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Competition Policy Analysis

An Integrated Approach

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I shall be telling this with a sigh.
Somewhere ages and ages hence:
Two roads diverged in a wood, and I –
I took the one less traveled by,
And that has made all the difference.

Robert Frost (1874-1963)
The Road Not Taken

Foreword

Competition policy is an integral and prominent part of economic policy-making in the European Union. The EU Treaty prescribes its member states to conduct economic policy 'in accordance with the principle of an open market economy with free competition'. More precisely, the goal of EU competition policy is "to defend and develop effective competition in the common market" (European Commission, 2000: 7). Under its Commissioners van Miert, Monti and, most recently, Kroes the EU Commission has stepped up its effort to pursue and achieve the aforementioned goal. A number of so-called hard-core cartels, such as the notorious "vitamin cartel" led by Roche, have been detected, tried in violation of Art. 81 of the Maastricht Accord and punished with severe fines. Also Microsoft was hit hard by the strong hand of the Commission having been severely fined for exploiting a dominant market position.

Economic analysis has been playing an increasingly significant role in the Commission's examination of competition law cases. This holds true in particular for merger control. Here, however, the Commission has had to accept some poignant defeats in court, such as the Court's reversals of Airtours-First Choice or GE-Honeywell. Among other things, the European Court of Justice found the economic analysis as conducted by the EU's Directorate General for Competition to be flawed and the conclusions drawn not to be convincing. These rejections by the courts have stirred up the scholarly debate on the conceptual foundations of European competition policy.

Against this background Kai Hüschelrath applies theoretical reasoning to conceptualize an economic analysis that may better serve the needs of competition policy. Hüschelrath claims that, in order to be coherent and consistent, competition policy needs "the design of a progression of compulsory analytical steps to effectively constrain the strategies available to firms aiming at maximising the total welfare contribution for a given enforcement budget". Therefore, in Chapter 2 he develops a three-layered integrated approach to competition analysis. As the first and fundamental layer, policymakers should clearly define the purpose, goals and instruments of competition policy by applying microeconomic reasoning. On the second layer, the strategic behaviour of firms should be carefully analysed using theoretical and empirical tools to evaluate potential welfare effects and effects of alternative measures of policy intervention. The third layer refers to the critical operational tasks, such as the delineation of the relevant market, both in principle and case-based, or the measurement of market power.

In applying his approach Hüschelrath focuses on the strategic behaviour of oligopolistic firms. Using game theory, Chapter 3 discusses the welfare effects of strategically acting incumbents when faced with potential entrants. The theoretical and simulation results show that the overall welfare effects of strategic firm behaviour are in fact indeterminate under most circumstances, in particular if the entrant is not facing an incumbent monopolist but an oligopoly market. To avoid negative welfare effects of strategic firm behaviour, Hüschelrath therefore suggests that competition policy pursue a rule-of-reason approach to rein in strategic firm behaviour rather than a per-se rule.

Predation is a type of an incumbent's strategic behaviour that has been extensively and controversially discussed in the literature. In Chapter 4 Hüschelrath provides a very balanced and highly stimulating review of the existing literature and concludes that predatory behaviour can indeed be rational and profitable, Selten's chain-store paradox notwithstanding. Hüschelrath continues with a theoretical analysis revealing that the welfare effects of predatory behaviour are highly likely to be exclusively negative. Competition policy should thus take a tough stance and intervene accordingly and appropriately. Based on his theoretical and simulation assessment of potential countermeasures, Hüschelrath suggests a predation enforcement framework which promises to be valuable for practical application.

In the concluding chapter Hüschelrath critically reflects on his findings and provides the reader with an outlook on the shape of things to come.

Summing up, this book not only provides a state-of-art discussion of contemporary competition policy analysis but offers a host of new insights – some may be controversial, pending real-life testing, but they are definitely challenging discussion. Competition Policy Analysis is an invaluable read for everybody interested in the theory and practice of competition policy.

Vallendar, April 2008

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Preface

In a recent working paper, Gregory Mankiw (2006) divided the family of macroeconomists into two classes: *Scientists* and *Engineers.* While the scientist tries to understand how the world works, the engineer tries to solve practical problems. According to Mankiw, the class of scientists currently has a substantially larger population than the class of engineers. As a consequence, when it comes to providing practical policy advice, this asymmetry might create substantial problems and intensifies the desire for a class of *Scienteers,* which internalises both views and is therefore able to give applicable scientific-based policy advice.

Applying Mankiw's taxonomy to microeconomics, this book follows a Scienteer approach by developing an integrated approach of competition policy analysis. Based on the assumption that the deterrence of anticompetitive behaviour is the fundamental aim of competition policy rules and their enforcement, three pivotal levels of such an integrated approach are identified: a fundamental level, a strategic level and an operational level. After developing the approach, it is then applied to three traditional areas of competition policy – hard core cartels, horizontal mergers and predation – to draw conclusions on how to ameliorate current competition policy. The innovative idea of the book is its coverage of the entire process of designing and implementing competition rules. Past research has largely concentrated on particular aspects of the integrated approach (such as investigations of welfare effects or the development of detection strategies), but these were at the expense of practicability issues. The book proposes ways in which this divergence can be narrowed.

The content of the book was accepted in September 2007 as a doctoral dissertation at the WHU Otto Beisheim School of Management in Vallendar, Germany. During the research and writing process I profited from the support of many people and would like to take this opportunity to acknowledge them. Among all contributors, my supervisor and mentor, Professor Dr. Jürgen Weigand, was certainly the most important. Apart from the very productive working environment at his Institute for Industrial Organization and countless discussions on various aspects of competition policy, the most formative influence was his continuous encouragement to participate in the activities the academic community has to offer. I am exceptionally grateful for these important experiences.

I am also deeply indebted to Professor Dr. Michael Frenkel, not only for his role as second supervisor of the thesis, but also for easing my integration into the WHU in those early days. The thesis definitely profited from the very productive research environment at WHU, and I would like to thank especially my colleagues Regine Braun, Dr. Alexandra Groß-Schuler, Ansgar Kirchheim, Claus Neuser,

Christian Steiner, Irene Delzer, Professor Dr. Ralf Fendel, Professor Dr. Wolf-Heimo Grieben, Dr. Günter Schmidt and Christoph Swonke for their contribution to this environment. Special thanks go to PD Dr. Georg Stadtmann not only for more than two years of companionship at the Institute for Industrial Organization but especially for creating constant pressure to take that last step and finally submit the thesis. Elisabeth Pirsch was always very helpful in guiding me through the administrative jungle.

A significant part of the study was written at the Centre for European Economic Research (ZEW), which I joined in October 2006. I am especially thankful to Professor Dr. Dr. h.c. mult. Wolfgang Franz not only for his agreement to publish the thesis in his series 'ZEW Economic Studies' but especially for creating and maintaining an unparalleled research environment at the ZEW. Furthermore, I am exceptionally thankful to Dr. Georg Licht for his support thoughout the important final months of the project. Special thanks go to Dr. Patrick Beschorner for very valuable comments on a draft version of the thesis and to my colleagues in the competition policy team at ZEW consisting of Martina Lauk, Dr. Nina Leheyda, Hannes Ullrich and Tobias Veith for their support. I am very grateful to Janine Micunek Fuchs for editing the manuscript. Romy Weiland was especially helpful in managing the publication process.

Furthermore, the project profited from a number of research stays, and I would like to thank Professor Dr. Alari Purju (Tallinn University of Technology), Lea Tonston (Estonian Competition Board), Professor Peter Møllgaard PhD (Copenhagen Business School), Professor Margaret Slade PhD (University of Warwick), and Adrian Raass (Swiss Competition Commission) for their hospitality and support. I am especially indebted to Professor Daniel Rubinfeld PhD (University of California at Berkeley) and Professor Thomas W. Ross PhD (University of British Columbia), not only for making exceptional research stays at two of the leading universities in North America possible but also for providing the opportunity to attend a couple of high-level graduate courses. Professor Norbert Schulz PhD from the University of Würzburg provided me with the necessary tools to undertake research in the area of competition policy and guided me in taking some first steps into the academic community. Special thanks go to Dr. Christian Köberlein, Professor Jürgen Müller PhD and Professor Dr. Hans-Martin Niemeier for their companionship and guidance throughout my academic development.

Last but certainly not least, I would like to thank my family for their continuous and overwhelming support. My girlfriend Diana was always supportive and motivating throughout the project and exceptionally generous in sacrificing countless weekends and holidays. Of all the support I received from my parents, my grandparents and my brother, probably the most valuable was the advice to concentrate on the important things in life and to follow each goal with maximum dedication.

Mannheim, August 2008 *Kai Hüschelrath*

Table of Contents

1 Introduction

> *There was a man of Sicily, who, having money deposited with him, bought up the iron from the iron mines; afterwards, when the merchants from their various markets came to buy, he was the only seller, and without much increasing the price he gained 200 per cent. Which when Dionysius heard, he told him that he might take away his money, but that he must not remain at Syracuse, for he thought that the man had discovered a way of making money which was injurious to his own interests.*
>
> Aristotle, Politica (347 BC), Part XI

1.1 Motivation and Objectives

The striving for a monopoly position is probably as old as civilised mankind. Like the man of Sicily, people at all times have tried to restrict competition and enjoy the best of all monopoly profits: A quiet life! (Hicks, 1935). And indeed, it is easy to imagine that the alternative to an iron monopoly – some form of competition between different iron mines and iron distributors – would not have been a quarter as nice for the man of Sicily. Challenged by vertically integrated iron mines as well as rival distributors with probably more efficient production possibilities, better quality products or more innovative ideas to market the products, he would have had to work hard in order to prevail and to make a living.

Although the personal situation of the man of Sicily would have been worse under competition, the people of Syracuse as a whole likely would have benefited from competing iron mines and iron distributors by paying lower prices for iron and iron products and by gaining the possibility to buy better quality and more innovative products. It is unclear whether Dionysius implicitly had these effects in mind when he ruled that the man of Sicily had to leave the country because of his (successful) attempt to monopolise the iron market in Syracuse.

Nothing substantial has changed during the almost 2400 years since the man of Sicily had to leave Syracuse. Nowadays, the (potential) men of Sicily are called Microsoft or E.ON; the role of Dionysius is taken over by the Antitrust Division of the US Department of Justice or the Bundeskartellamt; and the potential interventions reach from simple orders to terminate infringements, over significant fines, up to behavioural or even structural remedies. Admittedly, attempts to re-

strict competition nowadays are typically much more sophisticated and take place in much more complex environments; however, the basic motivation behind them remains the same: the striving for a monopoly position.

What certainly has changed over the last 230 years or so is the economic understanding and evaluation of competitive interactions (and the problems triggered by their absence). In today's terminology, the man of Sicily exercised market power because he was able to profitably raise (and maintain) a price above his marginal costs. As a consequence, his behaviour likely generated a Pareto inefficiency. The follow-up question whether such welfare-reducing firm behaviour nowadays should trigger some kind of state intervention is disputed among economists. While one group of economists probably would not see any reason to restrict economic freedom by some form of state intervention, another group would probably prefer to end a possible abuse of a dominant position by some kind of antitrust intervention[1] (such as imposing a behavioural remedy), with the aim of creating or restoring competition in the market for iron. A third group of economists might instead argue that permanent oversight and regulation of the activities of the man of Sicily would be the appropriate reaction to restrict his economic power. Such a claim could be based on the presumption that competition in the market for iron is either not workable or not socially desirable given the prevalent market demand and firm cost structure.

Generally speaking, an economically well-founded decision on the desirability of state interventions – and the choice of the appropriate policy option – eventually has to be based on the fundamental objectives of economic policy. From a normative perspective, the ultimate aim of economic policy is the promotion of the wealth of nations – as first described in detail in the seminal contribution of Adam Smith (1776). Although it is, from a theoretical perspective, not immediately clear that state interventions have this potential to promote the wealth of nations[2], the standard answer to the follow-up question of how this overarching aim can be reached typically includes *promoting economic efficiency* as one cornerstone in a collection of important intermediate aims of economic policy. Given this aim, extensive theoretical and empirical economic research has been able to prove a positive, strong and stable relationship between the degree of competition[3]

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1 The terms *antitrust intervention* and *competition policy intervention* and the terms *antitrust policy* and *competition policy* are used interchangeably. This especially means that speaking about antitrust policy does not intend to create an automatical reference to the competition policy of the United States (where the term *antitrust policy* originated).

2 The question whether state interventions can generally have the potential to increase welfare is assessed, among many others, by Coase (1960). He finds that only the existence of positive transaction costs creates room for welfare-improving state interventions.

3 It is not attempted in the main text to define competition but rather to concentrate on the description of its characteristics. However, von Weizsäcker (1995: 2730, translated by the author) provides a very general definition of competition: "Competition is a process of the choice of objects among alternatives with respect to the suitability

in a market, an industry or an economy and the correspondingly realised degrees of efficiency. As a consequence, promoting competition typically serves the overarching aim of promoting efficiency as well.[4]

Although the identified link between competition and efficiency is prevalent in most markets and industries, economic research has also identified circumstances in which competition either does not function at all or can be expected to realise suboptimal economic results. In such circumstances of so-called market failures or market imperfections, regulatory interventions or even some kind of permanent regulatory supervision may be a warrantable option to promote the overarching aim of economic efficiency. To put it differently, while there is no significant doubt that the most desirable way to reach and maintain a high level of economic efficiency is by promoting competition, regulatory interventions might be a second-best option to promote this overarching aim in case the first-best option is not available at all or can be expected to realise poor results.[5]

In addition to situations in which some form of regulatory intervention is necessary, the competition-efficiency link might also be endangered in essentially competitive industries by forms of anticompetitive firm behaviour which aim at restricting competition to the detriment of consumers and without realising significant positive effects for society as a whole. These threats to the institution of competition mark the basic rationale for introducing competition policy norms (and their respective enforcement) in market economies.[6] In the words of Geroski

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of the chosen object for the respective environment". See Kolaski (2004) for more practical answers to the question What is competition? and especially for differences in interpretation between the United States and Europe.

4 In other words, competition is not an end in itself, but "rather it is to be encouraged as a means to improving economic efficiency" (Hay, 1993: 2). However, it should be noted here that such an understanding of competition is based on so-called mainstream industrial organisation. As Hay explains in detail, specific economic schools of thought, such as the Neo-Austrian school, argue that competition in and of itself is the appropriate objective. Consequently, the process of competition and not the outcome of competition should be the motivation for public policy actions. See World Bank (1999: 1ff.) for a general overview of the objectives of competition policy and especially a discussion on possible conflicts among multiple objectives.

5 Furthermore, it is important to note that the provision of an appropriate form of regulation in industries with monopoly elements (such as a railway network) is pivotal to create and maintain competition in markets in which this is socially desirable (such as rail transportation services).

6 Following a recent survey article by Evenett (2005b: 7ff.), the historically dominant objectives for the introduction of competition policy norms were the protection of economic freedom as well as fairness considerations. Although many actual competition laws are still inspired and influenced by these motivations, the contemporary view is more that "the protection of competition and efficiency" (Posner, 1976) should be seen as the fundamental aim of competition policy. However, there is no doubt that real competition law provisions typically follow multiple aims with different weightings (and potential conflicts of aims). Mehta and Evenett (2005), for example, differ between objectives officially stated in the national competition law provi-

(2004: 4), unlike regulation, which typically establishes a continuous relationship to industries with structural competition problems, competition policy only "swings into operation when serious, egregious problems are believed to exist" in essentially competitive industries.

In an attempt to further characterise the relationship between competition policy and regulation, Rey (2002) identifies four important criteria which help to distinguish these policy options. The first criterion, *procedures and control rights,* refers to the fact that regulatory authorities typically have more power to actively constrain the behaviour of the respective firms in an industry (such as by regulating price, entry or investment) than antitrust authorities, who basically enforce the existing competition law provisions. The second criterion, *timing of oversight,* refers to the observation that antitrust policy typically takes place ex post – after a certain anticompetitive behaviour has occurred and been detected – while regulation typically involves ex ante interventions. The third criterion, *information intensiveness and continued relationship,* refers to the fact that a regulatory authority typically develops a profound knowledge of the regulated industry given the continuous and long-term nature of regulation; whereas an antitrust authority typically does not develop such a continued relationship with certain industries but rather only acquires the necessary knowledge of the industry in the event of a particular case. The fourth separation criterion, *relationship to political power,* refers to the general influence of politics (and interest groups) on the respective agencies. Generally, antitrust authorities tend to be more independent in their decisions than regulatory authorities. [7]

Although these categories are all important for characterising the relationship between competition policy and regulation, Joskow (2002: 98) argues that the truly essential difference between them is that "antitrust policy is primarily a deterrence system not a regulatory system".[8] In other words, while regulation satis-

sions and more practical reasons given especially by countries in the Asia-Pacific region which recently introduced competition law. The official reasons for introducing such provisions include economic efficiency, consumer welfare, fair trading and the prevention of excessive concentrations; the more practical reasons include concentration concerns, curbing state monopolies, improving other government policies, conditionality from major development institutions, commitments made under free trade agreements and the realisation that it is basically "good public policy" (see Mehta and Evenett, 2005: xxiii).

7 Although there is no doubt that Rey's classification covers important aspects of the distinction between competition and regulation, there is also no doubt that his classification is not perfectly selective. Merger control, for example, is a traditional antitrust activity which largely takes place ex ante. Furthermore, competition authorities can also try to build a constant relationship with the respective industries by simply choosing a suitable organisational structure of the authority (based on industries).

8 It should be noted here that Joskow's (2002) quote refers to US antitrust policy. However, there is no doubt that also other legislations (such as that of the European Union) have implemented a deterrence-based system and not a regulatory system. With respect to cartel enforcement, Neelie Kroes, the current European commissioner responsible for competition policy, said recently that generally "[p]revention is better

fies the need for continuous supervision and intervention in industries with structural competition problems, antitrust policy should aim at creating a deterrence effect by combining "the prospect of being subject to reasonable (and unpleasant) penalties and the serious likelihood of being caught while engaged in the illegal activity" (Baker, 2003: 713). The creation and maintenance of such a deterrence effect, however, depends fundamentally on the design *and* implementation of appropriate antitrust rules (which concretise the kind of activities that are deemed illegal) – and antitrust institutions, which have the power to achieve compliance with these rules.

It is pivotal for antitrust policy to develop a set of clear and understandable antitrust rules, because "firms must be able to operate within a set of rules for competition that enable them to identify what strategies are likely to attract scrutiny, and what strategies they can pursue without hindrance" (Hay, 1993: 12). In other words, the design of antitrust rules needs to consider the trade-off between economic exactness on the one hand and providing clear signals to firms about what is allowed and what is not allowed on the other hand. In the words of Carlton (2003a: 2),

> [e]conomics can make sure that antitrust is grounded in logical analysis, but antitrust policy can use economic concepts and insights only if they are practical and capable of being implemented. This demand for practicality provides a discipline on economics that forces it to be relevant.

Notwithstanding the importance of an appropriate design of antitrust rules for antitrust policy, it is equally critical to understand that even the cleverest set of rules remains an academic mind game if it is not implemented and enforced by the responsible institutions. In addition to the mere existence of a public institution "that is empowered to seek out and to evaluate possible failures of competition (including powers to collect evidence)" (Hay, 1993: 14), antitrust enforcement essentially means to send clear signals to firms that breaches of antitrust rules are likely to cause antitrust interventions. These essential additional preconditions for achieving a deterrence effect are expressed very clearly by Everett (2005b: 10):

> Firms being rational decision makers will trade off the benefits of engaging in anticompetitive acts against the likelihood of enforcement action and any resulting punishments, be they fines or otherwise. The deterrent effect, therefore, of a competition law depends on firms' perception of the effectiveness of the implementation of competition law. Enactment of such laws is not enough; what matters is judicious and efficient implementation.[9]

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than cure … [however] sometimes a substantial fine is quite a direct way to really drive our deterrent message home!" (Kroes, 2006: 2).

[9] As confirmed by Rey (2002: 2), "little work has been done to account for implementation issues in the area of antitrust policy … no one asks the question: is this policy implication useful for competition agencies?" Following OECD (2007: 7), "[h]ow to craft appropriate and effective remedies and sanctions is a subject that is just as important as how to define dominance or identify abusive conduct, but it has received substantially less attention".

Based on these essential categories of a deterrence-based antitrust policy, it is the aim of the following chapters to contribute to the design and implementation of an *efficient* antitrust policy. An efficient antitrust policy consists of a set of effectively enforced rules that constrain the firms' competitive strategies aiming at maximising the total welfare contribution for a given enforcement budget. In order to reach this aim, an integrated approach of antitrust analysis is developed (and subsequently applied), which separates the antitrust policy process into three subsequent stages: a fundamental level, a strategic level and an operational level. The basic structure of this approach and the subsequent business conduct applications are sketched in the following section.

1.2 Structure

The present work is organised into six chapters. The first chapter introduces the motivations and objectives of the work and outlines the structure of the following chapters. The second chapter develops an integrated approach of antitrust analysis. The approach involves three different levels, as shown in Figure 1.

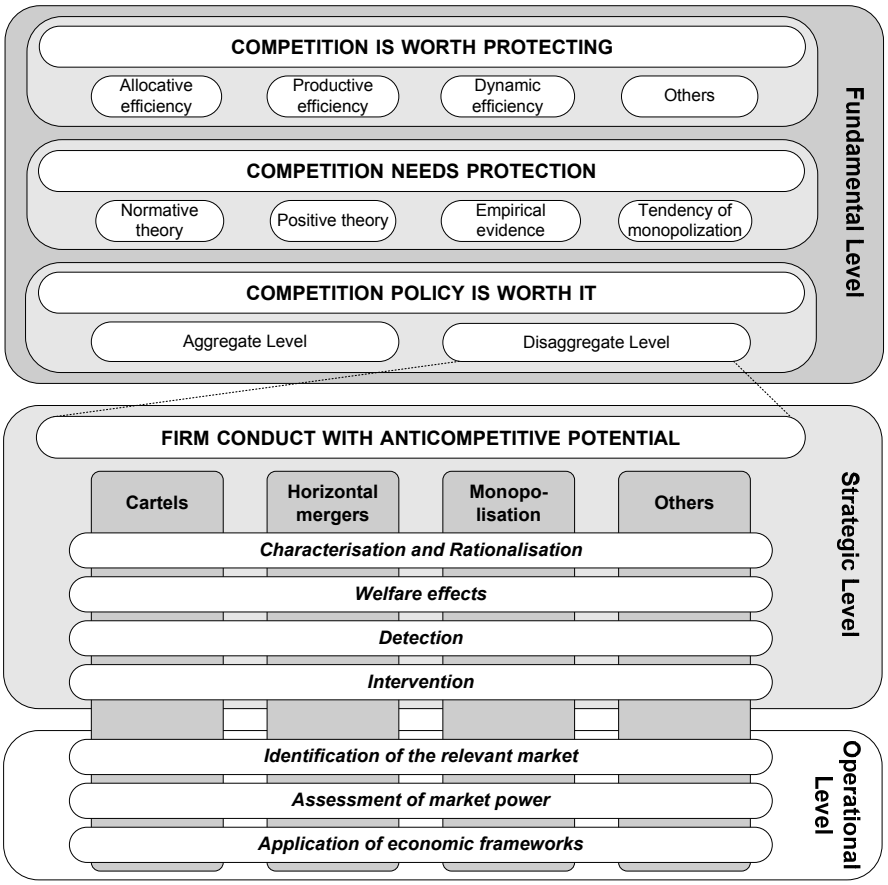
The *fundamental level* aims at answering existential questions of competition and competition policy. In particular, it assesses whether competition is worth protecting, whether competition needs protection and whether competition policy is bringing more benefits than costs to society. Such an assessment of the costs and benefits of antitrust enforcement for selected countries (on an aggregate and disaggregate level) is possible and sensible, because most countries have already implemented some kind of competition law. The consequential question is thus not whether it is welfare-increasing to introduce competition policy but rather whether (and how) it is possible to ameliorate it.

The *strategic level* aims at developing a progression of necessary steps to assess whether and how certain business conducts should be subject to antitrust policy. In addition to an initial delineation and characterisation of the business conduct, a welfare assessment and a concept of detection and intervention needs to be developed to ensure an integrated approach of antitrust analysis, which in turn ensures the creation of the desired deterrence effect. It is important to note that the strategic level aims at developing necessary analytical steps entirely from the viewpoint of (applied) microeconomics and antitrust economics. Existing law provisions are only referred to by way of example to underpin the theoretical arguments.

Whereas the strategic level aims at constructing investigation frameworks from a largely normative economic perspective, the *operational level* focuses on the question of how an antitrust authority should implement these recommendations in a world confined by resource constraints and asymmetric information. Generally, resource constraints lead to the problem that the antitrust authority cannot investigate every case of possible anticompetitive behaviour but has to find routines to identify those cases which promise to maximise the welfare contribution of antitrust policy for a given enforcement budget. The standard elements of such a rou-

tine are the delineation of the relevant market and the assessment of market power (consisting of concentration analysis and entry analysis). The second fundamental problem faced by an antitrust authority and therefore discussed on the operational level is asymmetric information. Asymmetric information generally leads to the danger of wrong and hence welfare-reducing case decisions by the antitrust authority and should therefore also be considered in the development of an efficient antitrust policy. Given the existence of resource constraints and asymmetric information, the insights derived on the strategic level need to be reassessed against this new background to guarantee an integrated approach of antitrust analysis. Consequently, the last stage on the operational level aims at providing recommendations for the design of practical frameworks for antitrust analysis. These theoretically derived proposals are in turn compared to the practical approaches currently followed by the antitrust policies of the European Union and the United States to identify improvement potential for current antitrust policy.

Fig. 1. The integrated approach



Based on the development of the integrated framework in the second chapter, the third chapter aims at applying parts of this framework to strategic behaviour. After generally characterising what is understood by strategic behaviour (from an economic perspective), the rationality of strategic behaviour is assessed in more detail. Subsequently, the welfare effects of strategic behaviour are investigated, essentially by comparing them to the competitive benchmark of Cournot competition. Based on the finding that strategic behaviour contains a multitude of different strategies with diverse welfare implications, three different antitrust enforcement options to cope with such conducts are discussed: a no-rule or do-nothing approach, a per-se-rule approach and a rule-of-reason approach. This section aims at providing a high-level discussion of these basic tools without making specific policy recommendations for strategic behaviour in general or certain forms of strategic behaviour in particular.

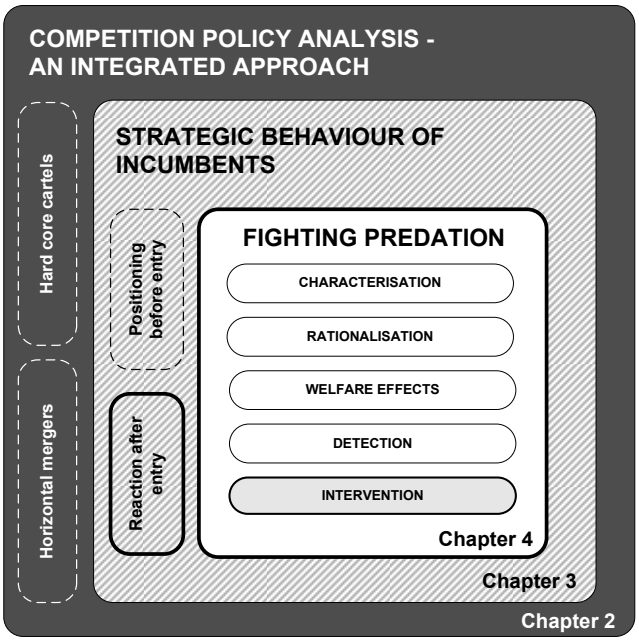
An in-depth antitrust analysis of one particular form of strategic behaviour – namely, predation – is the focus of the fourth chapter. After briefly reviewing research on an appropriate characterisation of predation and addressing the basic rationality behind predation strategies, the welfare effects of predation strategies are assessed. Based on the finding that predation strategies typically cause negative welfare effects, research on how to detect predation is reviewed next. The fourth chapter takes the analyses of the preceding levels for granted and analyses the complementary question of how predators should be fought. Although such an intervention phase is a compulsory part of the integrated approach for creating a deterrence effect, almost no sources have been devoted to finding appropriate answers to this question. After proving the practical relevance of the question with a discussion of recently decided predation cases in various jurisdictions, a Cournot oligopoly model is developed and applied to study the problem of predation enforcement. The model approach, which takes into account efficiency advantages of the entrant, allows analysing welfare effects of the various enforcement options mentioned above. Specific demand and cost functions which allow a quantification and easier interpretation of the (applied) results are then introduced, delivering further insights into optimal predation enforcement. The results of the formal approach are subsequently incorporated into the development of a predation enforcement framework which aims at increasing the deterrence effect for predation strategies; without, however, biasing the fundamentally important incentives for procompetitive price decreases.

The fifth chapter summarises the results of the preceding chapters and derives several general conclusions for implementing and maintaining an efficient antitrust policy. An overview of the research results with the strategic and operational levels is presented in an easy-to-read table. An annex chapter contains several smaller essays which feed into discussions in the main text. These essays include estimations of the welfare effects of a hard core cartel in the United States and a remedied merger in the Netherlands, an assessment of the antitrust implications of franchise agreements, a presentation of the specifics of so-called critical loss analyses in market definition and merger control and a description of the *Lufthansa-Germania* (2002) predation case. The annex further contains a section with

mathematical proofs, as well as a section which provides data tables for graphs presented in the main text.

Figure 2 depicts the general structure of the thesis. As shown, the second chapter not only aims at developing the integrated approach of antitrust analysis but also provides applications of the general framework to hard core cartel enforcement and to horizontal merger control. Such a procedure is important not only because it provides a test bed for the universal applicability of the developed framework, but also because it allows the derivation of specific proposals on ameliorating key activities of current antitrust policy.

Fig. 2. The chapters



2 Competition Policy Analysis – An Integrated Approach

You're gouging on your prices if you charge more than the rest. But it's unfair competition if you think you can charge less. A second point that we would make to help avoid confusion: Don't try to charge the same amount – that would be collusion.

Richard W. Grant (1963)

2.1 Introduction

In this chapter, an integrated approach of competition policy analysis is developed. This approach comprises a progression of compulsory analytical steps toward creating and maintaining an efficient antitrust policy. An efficient antitrust policy consists of a set of effectively enforced rules that constrain the firms' competitive strategies aiming at maximising the total welfare contribution for a given enforcement budget. To put it differently, this chapter focuses on proposing ways of assuring that the introductory quote by Richard Grant stays a provocative poem, a far cry from reality, rather than a realistic description of contemporary antitrust policy.

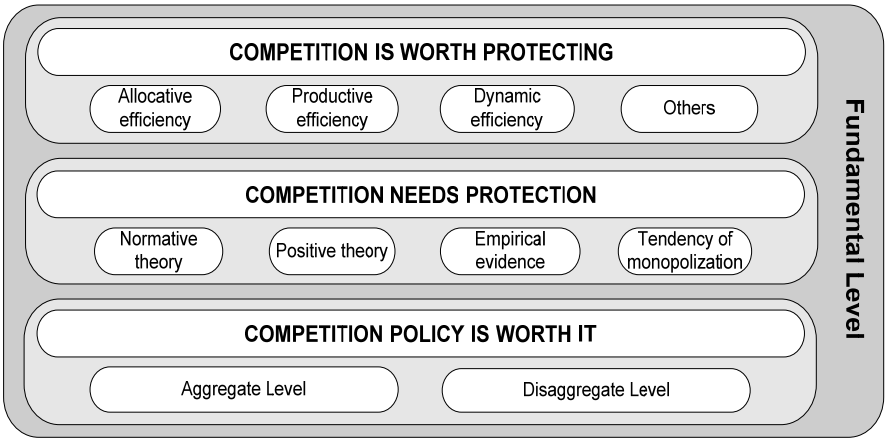
Three levels of investigation are analysed here. The *fundamental level* deals with existential questions of competition and competition policy. In particular, it assesses whether competition is worth protecting, whether competition needs protection and whether competition policy is bringing more benefits than costs to society. Subsequently, the *strategic level* develops a simple progression of necessary steps for – normatively – assessing whether and how certain conducts should be subject to antitrust policy. In addition to an initial characterisation of the business conduct, a welfare assessment and a concept of detection and intervention need to be developed to ensure an integrated approach of antitrust analysis. The third level, the *operational level,* aims at implementing the concepts developed on the strategic level in a world in which the antitrust authority faces resource constraints and imperfect information. This level therefore deals with approximation techniques such as the identification of the relevant market, the assessment of market power and the application of economic frameworks for deriving appropriate conclusions about the likelihood and the severity of anticompetitive effects in the cases at hand. In order to assure the universal applicability of the chosen inte-

grated approach, it is applied to hard core cartel enforcement and merger control on all three levels. Chapters 3 and 4 also build on the integrated approach and will focus on strategic behaviour in general and predation in particular.

2.2 Fundamental Level

The fundamental level of the integrated approach covers existential questions of competition and competition policy. In particular, it assesses whether competition is worth protecting, whether competition needs protection and whether competition policy is bringing more benefits than costs to society. Figure 3 summarises the analytical structure of the fundamental level.

Fig. 3. The fundamental level



As shown in Figure 3, one task of the fundamental level is to assess the costs and benefits of antitrust enforcement. In order to allow such comparisons on an aggregate as well as on a disaggregate level, the following sections will focus on possible quantifications of especially the benefits of competition and competition policy.

2.2.1 Competition Is Worth Protecting

Economists and philosophers have both studied competition and the benefits of competition in a multitude of ways. Notwithstanding the potential relevance of any of these efforts – some of which having been very influential, such as Adam Smith's 'invisible hand' or Friedrich August von Hayek's 'competition as a discovery procedure' – the most fundamental result of all these research efforts is probably the insight that competitive markets allocate resources efficiently be-

cause they provide products to all customers willing to pay the opportunity cost of production (see, for example, Debreu, 1959).

Market power is generally defined as a deviation from this competitive benchmark. If a company can profitably raise and maintain a price above its marginal cost (i.e., the market price under perfect competition), then it possesses some degree of market power. The degree of market power is maximised in a monopoly, as the company can set the profit-maximising market price absent of other firms.[10] Although both monopoly and perfect competition are typically artificial constructs, a comparison of both extremes is a fruitful way to derive an upper bound for the benefits of competition.

From a static perspective, the presence of monopoly leads to a welfare loss that results from the absence of customers who derive a value that is lower than the price of the product but greater than the marginal cost of production (see Chart 1a in Figure 4). The size of the welfare loss can be expressed as a function of the price-cost margin, industry revenue (a measure of market size) and the industry elasticity of demand (see Annex 6.6.1 for the proof):

$$DWL = \frac{1}{2} M^2 \cdot R^M \cdot \varepsilon_D . \tag{1}$$

Harberger (1954) undertook one of the first attempts to estimate the deadweight loss for 73 US manufacturing industries from 1924 to 1928. His estimations, based on Equation (1), led to a monopoly welfare loss of around 0,1%[11] of the Gross Domestic Product (GDP). Surprised by this (seemingly) small size of the welfare loss, Harberger concluded that "we can neglect monopoly elements and still gain a very good understanding of how our economic process works" (1954: 87). In response to Harberger's analysis and conclusion, economists undertook numerous attempts to recalculate the welfare triangle loss by replacing some of his oversimplifying assumptions and/or using different data sets (see, for example, Schwartzman, 1960; Kamerschen, 1960). Furthermore, scholars increasingly investigated the follow-up question, "If the conventional loss is so small, are there other, more significant losses?" (Farrell, 1983: 1).

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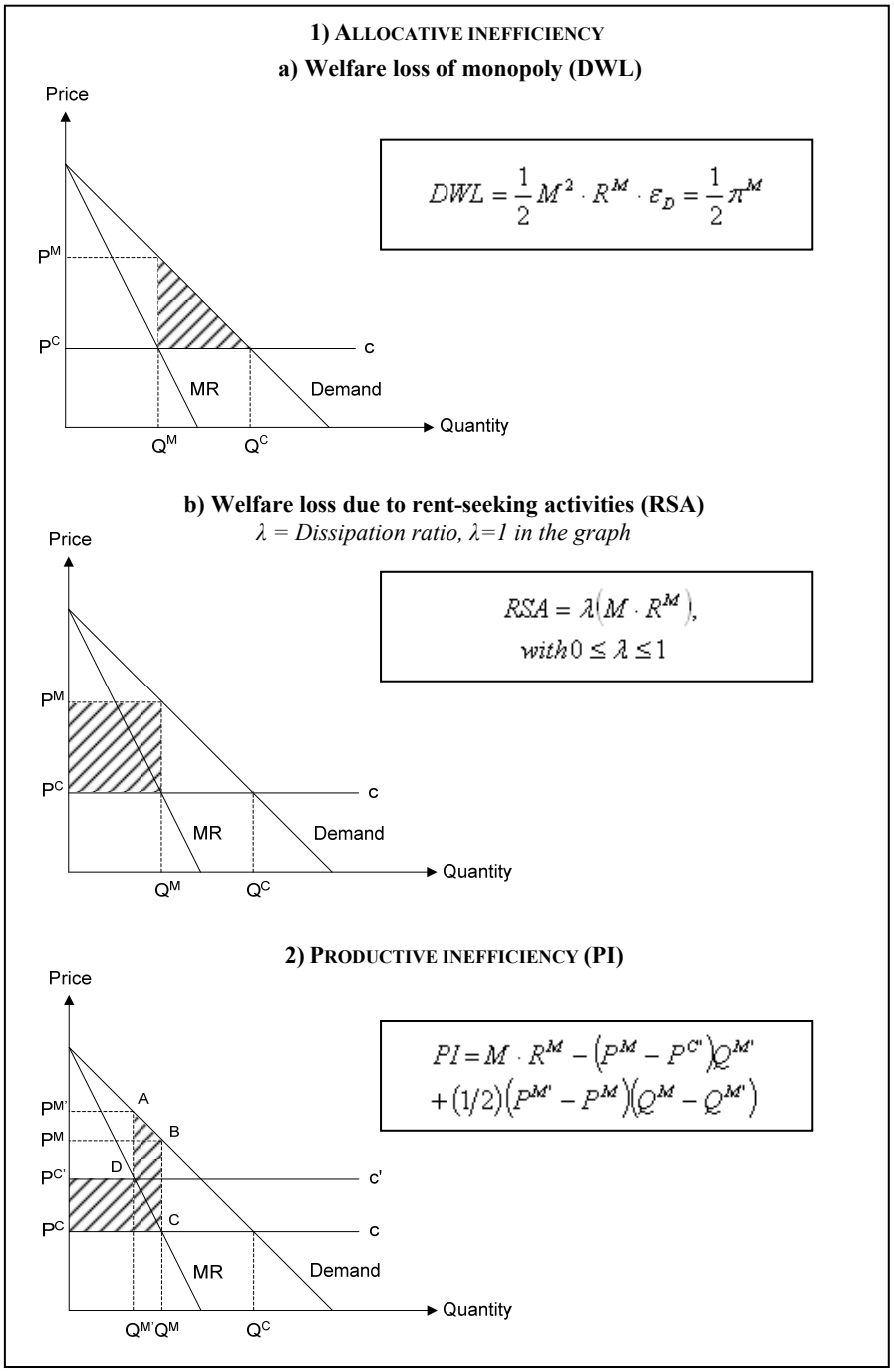
10 Although monopolists do not face constraints of direct competitors in their price-quantity decision, they cannot act independently. They maximise profits subject to demand conditions.

11 Please note that in order to comply with the graphs, which were created with German-language software packages, the comma is used in place of the decimal point (i.e., 2,0% instead of 2.0%) and the full stop in place of the comma (i.e., 5.000€ instead of 5,000€).

Fig. 4. Inefficiencies caused by the exercise of market power



One possible additional loss of monopoly was traced out by Tullock (1967). He pointed out that if firms compete to gain and to preserve market power, these resources diverted to unproductive activities must be added to the welfare loss of monopoly, and the overall loss therefore has the geometrical form of a trapezoid rather than a triangle. Referring to Chart 1b) in Figure 4, the additional welfare loss due to so-called rent-seeking activities is determined by the dissipation ratio λ (i.e., the percentage of the total rent dissipated by rent-seeking activities), the price-cost margin *M* and the monopoly revenue R^M:[12]

$$RSA = \lambda\left(M \cdot R^M\right) with\, 0 \le \lambda \le 1\,. \tag{2}$$

Although rent-seeking expenses are typically viewed as a welfare loss of monopoly, Neumann (2000: 107) points out that such a classification of rent-seeking activities already involves a value judgment. This is because the expenses for rent-seeking activities are not lost surplus (as the deadweight loss discussed above) but rather income of other individuals and therefore not a loss of total welfare. Therefore, classifying rent-seeking activities as welfare loss depends on a value judgment that these expenses and the resulting incomes are of lower value than other incomes.

Posner (1975) was one of the first scholars who actually incorporated rent-seeking into a measure of *overall* welfare loss due to monopoly power. He studied the relative size of the deadweight loss and the resources wasted on competition to acquire and maintain monopoly profits and showed that the deadweight loss *DWL* relative to the rent-seeking loss *RSA* is given by

$$\frac{DWL}{RSA} = \frac{U^C}{2\left(1/\varepsilon_D - U^C\right)}, \tag{3}$$

with $U^C = \Delta P/P^C$ (price-cost markup). Equation (3) shows that the RSA is large relative to the DWL when U^C is small. For instance, if $\varepsilon_D = 1$ and the price-cost

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12 Tullock (1980) himself studied the determinants of the size of the dissipation ratio. He shows in a basic rent-seeking game that the expenditure on rent-seeking κ by each of the *n* individual rent seekers is given by $\kappa = \left((n-1)/n^2\right)\left(M \cdot R^M\right)$. This means that if the rent to win (i.e., the monopoly profit) is given by 50 and there are 7 firms in the contest, each firm will spend about 6,12 in the contest. This would lead to an overall investment in the contest of 7*6,12 = 42,84 and a dissipation ratio of (42,84/50) = 85,7%. Hazlett and Michaels (1993) studied lotteries conducted by the US Federal Communications Commission to award cellular telephone licenses. There were 643 licenses available, and almost everybody was (seemingly) allowed to participate in the lottery (i.e., no barriers to entry were initially noticed). In such an environment, Hazlett and Michaels would have expected total rent dissipation (as *n* is large, in fact about 320.000). However, their empirical results show that overall costs were $325 million, while the rents were estimated to about $611 million, leading to an (average) dissipation ratio of about 0,53. Hazlett and Michaels explain this result with the existence of entry barriers in the application process (such as a factual entry fee of nearly $3.500 per application due to general fees and attorney fees).

markup is given by 0,2, the loss due to rent-seeking activities is about 8 times larger than the deadweight loss. Using Harberger's data and estimate of the DWL, Posner estimated that, while the deadweight loss is 0,1% of GDP, rent-seeking activities account for about 3,3% of GDP, leading to an aggregated welfare loss due to monopoly of about 3,4% of GDP for the United States.

Cowling and Mueller (1978) also extended Harberger's work by changing several assumptions. For instance, instead of using unity elasticity, they applied the (inverse) Lerner index $(P^M/(P^M-MC))=\varepsilon$ and showed that the deadweight loss is then equal to half of the monopoly profits (see Annex 6.6.1 for the proof):[13]

$$DWL = \frac{1}{2} M \cdot R^M = \frac{1}{2}\left(P^M - MC\right)Q^M = \frac{1}{2}\pi^M . \quad (4)$$

By using this estimate, Cowling and Mueller avoided using separate estimates of the price markup and the demand elasticity (and therefore considered the interdependence of the observed price-cost ratios and of the value of the elasticity of demand; see, e.g., Clarke, 1985: 234). Furthermore, Cowling and Mueller also incorporated the cost of reaching and maintaining a monopoly by extending their study with several combined measures of deadweight loss and advertising expenses (as a measure for rent-seeking activities; see Table 1 for an overview of their measures). Their results show, depending on the used measure, aggregated welfare losses ranging from 3,96% to 13,14% for the United States and ranging from 3,86% to 7,20% of the Gross Corporate Product (GCP) or equivalent for the United Kingdom. An overview of influential studies on monopoly welfare losses is presented in Table 1.

Masson and Shaanan (1984) present a methodology for estimating welfare losses caused by market power which departs from the studies discussed thus far, because they explicitly take different levels of market power into account. The authors provide estimates for the actual social costs arising from existing market structures and the expected monopoly social costs that would occur if there were no competition. They define the difference between actual and monopoly welfare losses as the *value of competition* in existing markets. Masson and Shaanan find that the actual *oligopoly* deadweight loss averages 2,9% of the value of shipments for a sample of 37 US manufacturing industries from 1950 to 1966. Furthermore, they estimate a potential (average) monopoly deadweight loss of 11,6%, leading to a value of competition of 8,7% of the value of shipments.

[13] Cowling and Mueller's results, however, hold only in the absence of fixed costs.

Table 1. Monopoly welfare loss estimates

Study	Country	Measure	Welfare loss	Scope	Assumptions / Remarks
STUDIES FOCUSING SOLELY ON DEADWEIGHT LOSS					
Harberger (1954)	US	$0{,}5*M^2*R^M*\varepsilon_D$	0,1	2.046 firms in 73 US manufacturing industries from 1924 to 1928;	Unity elasticity, competitive rates of return given by average rate of return in sample
Schwartzman (1960)	US CAN	$0{,}5*(P^M-P^C)*z\pi$	<0,1	Sample of Canadian and US industries in 1954	Used direct price-cost margins data; allowed elasticities up to 2
Kamerschen (1960)	US	Similar to Harberger	1,9	US industry from 1956/7 to 1960/1	Inclusion of other non-manufacturing and non-corporate sectors
Worchester (1973)	US	General equilibrium model of welfare loss	0,43-0,73	Data on 500 largest industrial individual firms from 1956 to 1969	Used firm-level instead of industry-level data
STUDIES FOCUSING ON DEADWEIGHT LOSS AND RENT-SEEKING EXPENSES					
Posner (1975)	US	$DWL/RSA=(U^C/(2(1/\varepsilon_D-U^C)))$	3,4	Uses Harberger data	Assumed that resources committed to rent-seeking equal revenues obtainable
Cowling/Mueller (1978)	US	$\pi/2$	3,96	734 large US firms from 1963 to 1969	Used half monopoly profit rather than separate estimates for price-cost margins and elasticities; used independent estimate of the competitive rate of return; used firm-level monopoly profits; used advertising as estimates of rent-seeking expenditures
	US	$(\pi+A)/2$	6,52		
	US	$A+(\pi+A)/2$	12,27		
	US	$\pi'+A+(\pi+A)/2$	13,14		
Cowling/Mueller (1978)	UK	$\pi/2$	3,86	Largest 103 UK firms from 1968 to 1969	
	UK	$(\pi+A)/2$	4,36		
	UK	$A+(\pi+A)/2$	5,39		
	UK	$\pi'+A+(\pi+A)/2$	7,20		

Welfare loss is in % of GNP or equivalent; C&M use gross corporate product; *z* is arc elasticity of demand; *A* is advertising; and π and π' are pre- and post-tax profits (see Clarke 1985: 235).

Davies and Majumdar (2002: 30ff.) express their concern about the general value of measuring deadweight losses of monopoly for large parts of economies because of the oversimplifications which are necessary for such a quantification (such as an average demand elasticity and an average price-cost margin for large parts of an economy). However, in aiming at showing the sensitivity of such models, they adopt the methodology of Cowling and Mueller (1978) and apply the well-known relationship in a homogenous Cournot model that the price-cost margin equals the Herfindahl-Hirschman concentration index (HHI) divided by the market demand elasticity. Making use of this relationship by inserting it into the general deadweight loss formula derived above leads to the following estimate for the deadweight loss (see Annex 6.6.1 for the proof):

$$DWL = \frac{1}{2} HHI \cdot M \cdot R^M \,. \tag{5}$$

As Equation (5) shows, the DWL now depends on a measure of market concentration, namely the Herfindahl-Hirschman index, which is somehow easier to estimate than market demand elasticity (as a lot of countries have statistics at least for major industries). In the following, Davies and Majumdar (2002: 31) attempt to calibrate Equation (5) for the UK. For the average price-cost margin, they decide to use a value of 0,1 as a defensive estimate, compared to a value of 0,08 used by Cowling and Mueller and a broader survey by Scherer and Ross (1990), which found price-cost margins between 0,1 and 0,2. In terms of HHI, they assume a value of 0,1 (in a properly defined market), largely based on rough approximations due to the fact that the UK only publishes data on concentration ratios.[14] Inserting the *M* and *HHI* values in Equation (5) leads to an aggregated welfare loss of 0,5% of GDP.

A third kind of possible loss due to monopoly is the loss in productive efficiency if a monopoly slacks off and prefers 'the quiet life' to profit maximisation. As shown in Chart 2 in Figure 4, such inefficiencies lead to a higher marginal cost level and a corresponding welfare loss given by[15] (see Annex 6.6.1 for the proof):

$$\mathrm{PI} = \mathrm{M} \cdot \mathrm{R}^{\mathrm{M}} - \left(\mathrm{P}^{\mathrm{M}} - \mathrm{P}^{\mathrm{C'}}\right)\mathrm{Q}^{\mathrm{M'}} + \frac{1}{2}\left(\mathrm{P}^{\mathrm{M'}} - \mathrm{P}^{\mathrm{M}}\right)\left(\mathrm{Q}^{\mathrm{M}} - \mathrm{Q}^{\mathrm{M'}}\right). \tag{6}$$

At first glance, it seems implausible why the shareholders of a monopoly firm would be less willing to keep costs down (and let slacking happen) than those of a competitive firm (see Rasmusen, 2000: pt. VII, no. 33). To the question "Why

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14 For the United States, data on the Herfindahl-Hirschman indices for 443 US manufacturing industries (four-digit SIC) for the year 1992 is available (see www.census.gov/ epcd/www/concentration.html). The average HHI for the US for these industries in 1992 can be calculated to 725,49.

15 In the same way as explained for the case of rent-seeking activities, a value judgment stating that society values the distribution of pecuniary and non-pecuniary rents in a quiet-life monopoly state less than the results that competition would bring is needed in order to interpret the entire hatched area in the third chart in Figure 4 as a welfare loss due to monopoly (see also Neumann, 2000: 107).

would a monopolist spare efforts to reduce costs when it stands to reap all the incremental profits arising from the cost reduction (i.e., when it does not have to worry about the incremental profits being competed away)?" (Chen and Chen, 2005: 25), Farrell (1983) provides an intuitive explanation based on the separation of ownership and control. In a world of imperfect information, managers find it costly to search for better techniques. The firm itself cannot reliably tell when the manager is searching, and so cannot reimburse him for these costs. The firm also cannot reliably tell by results whether or not the manager has been diligent partly due to missing comparator firms. The best the shareholders can do is to provide a contract with some incentive to increase profits; however, the manager's risk aversion limits the effectiveness of such contracts.[16] According to Farrell (1983: 1), "[t]he inefficiency which results is ameliorated if more information becomes available about the manager's activities; and, if there is a competing firm, the market interaction may convey such information" .[17]

Empirical evidence on productive inefficiencies is diverse but still fragmentary (see Davies and Majumdar, 2002: 35ff.). In probably the most influential paper, Nickell (1996) investigates the question whether competition improves corporate performance. His results based on an analysis of 670 UK companies largely support this view. Nickell finds that market power – captured by market share – generates reduced levels of productivity. More importantly, he presents evidence that competition is associated with a significantly higher rate of total factor productivity growth. Furthermore, a study by Jenny and Weber (1983) derive an estimate for productive inefficiencies in France of 5,18% of GDP for the years 1971 to 1974. Additionally, Ahn (2002: 53ff.) provides an overview of the main methods and main findings of further studies on the competition-productivity relationship in certain sectors or industries (see especially Bailey, 1993; Baily and Gersbach, 1995; Zitzewitz, 2003; Disney et al., 2000). The results mostly show that increases in product market competition led to increases in the overall levels of productive efficiency. In line with these findings, Scherer and Ross (1990: 672) conclude their survey on productive inefficiencies by expressing their belief that productive inefficiencies are "at least as large as the welfare losses from resource misallocation."

An alternative to the study of the general relationships between competition and productivity across different product markets is an analysis of recently liberalised sectors. In such environments, economic theory would expect significant productivity improvements after deregulation due to the correction of inefficiencies typically caused by economically largely obsolete regulation schemes (see

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16 Nalebuff and Stiglitz (1983: 281) argue in a comparable way by focusing on principal-agent problems and conclude that monopoly does not cause productive efficiency losses in an owner-managed firm.

17 As discussed in more detail in McAfee and McMillan (1996: 263ff.), 'revealing hidden information' is an important characteristic of competition from a game-theoretical point of view. Other important characteristics include: 'competition works better than bargaining', 'competition creates effort incentives' and 'competition mechanisms are robust'.

OFT, 2007). Certainly, the almost unanimous result of studies by Maher and Wise (2005), Ehrlich et al. (1994), Pilat (1996) and Griffith and Harrison (2004) is that deregulation in such industries as electricity, gas, water, airlines and road freight led to substantial increases in total factor productivity growth. An overview of the results of several studies focusing on improvements in productive efficiency (as well as consumer welfare) after regulatory reforms in the United States is presented in Table 2.

Table 2. Improvements in productive efficiency and consumer welfare after regulatory reforms in the United States

Industry	Studies	Improvements in productive efficiency	Improvements in consumer welfare
Airlines	Morrison and Winston (1998)	Average industry load factors have increased from roughly 52% the decade preceding deregulation to roughly 62% since deregulation. Real costs per revenue ton-mile have declined at least 25% since deregulation. Industry profits have been very volatile during deregulation, although higher, on average, than they would have been under regulation.	Average fares are roughly 33% lower in real terms since deregulation, and service frequency has improved significantly.
Less-than-truckload trucking	Corsi (1996a)	Carriers have substantially reduced their empty miles since deregulation. Real operating costs per vehicle mile have fallen 35%, but operating profits are slightly lower than they would have been under regulation.	Average rates per vehicle mile have declined at least 35% in real terms since deregulation, and service times have improved significantly.
Truckload trucking	Corsi (1996b)	Carriers have substantially reduced their empty miles since deregulation. Real operating costs per vehicle mile have fallen at least 75%, but operating profits are slightly lower than they would have been under regulation.	Average rates per vehicle mile have declined at least 75% in real terms since deregulation, and, because of the emergence of advanced truckload carriers, service times have also improved significantly.
Railroads	Winston et al. (1990)	Railroads have abandoned one-third of their track miles since deregulation. Real operating costs per ton-mile have fallen 60%, and rail profits are much higher than they would have been under regulation.	Average rates per ton mile have declined more than 50% in real terms since deregulation, average transit time has fallen at least 20%, and the standard deviation of transit time has fallen even more than 20%.

Banking	Berger et al. (1995)	The real cost of an electronic deposit has fallen 80% since deregulation. Operating costs have declined 8% in the long run because of branch deregulation. Recent industry returns on equity exceed those just before deregulation.	Consumers have benefited from higher interest rates, better opportunities to manage risk, and more banking offices and automated teller machines.
Natural Gas	Henning et al. (1995); Costello and Duann (1996); Crandall and Ellig (1997)	Pipeline capacity has been much more efficiently utilised during peak and off-peak periods since deregulation. Real operating and maintenance expenses in transmission and distribution have fallen roughly 35%.	Average prices for residential customers have declined at least 30% in real terms since deregulation, and average prices for commercial and industrial customers have declined even more than 30%. In addition, service has been more reliable as shortages have been almost completely eliminated.

Source: Winston (1998).

In addition to the described efforts to estimate the *true* welfare losses due to monopoly[18], some scholars argue that the economic impact of even small welfare losses can be substantially larger if other factors are taken into account. Dickson (1982), for instance, shows that a small welfare loss in a monopolised market can cause multiple damages if the transmission of monopoly distortions though successive vertical stages is considered. Neumann (1999) contributes to the discussion by adding the intertemporal dimension. He uses a simple growth model to estimate the effect of a static welfare loss due to monopoly on the growth rate of the GDP and indeed finds that the long-run welfare loss due to monopoly typically dwarfs the static loss analysed above.[19] Kwoka (2003: 11) remarks that it is not the average deadweight loss (derived by an average demand elasticity and an average price-cost margin for large parts of an economy) that matters but rather its distribution. Losses are greater in several industries where competition does not reign, and the deadweight losses can be quite substantial in these industries (although relatively low on average).

Although the analysis thus far has drawn a solely negative picture of monopoly with respect to its (static) welfare effects, economic analysis has shown that this is not generally the case. Economies of scale, for example, are one prominent reason why a monopolistic market structure might occasionally be socially desirable. On

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18 The maximum welfare loss due to monopoly is given by $(1/2)\left(P^{M'} - P^{C}\right)\left(Q^{C} + Q^{M'}\right)$. See Annex 6.6.1 for the proof.

19 In a simplified example, Neumann (2000: 110f.) shows for a fixed interest rate and potential growth rate that a static welfare loss of 0,1% (the Harberger estimate) would lead to a yearly welfare loss of about 1%. A static welfare loss of 3% (one of the Cowling and Mueller estimates) would lead to a long-term welfare loss of about 26% per year.

the supply side, economies of scale can lead to situations in which a monopoly is able to supply the entire market at a lower unit cost than two or more firms. Technically, such *natural monopolies* exist if the demand curve intersects the average cost curve in its downward-sloping or subadditive part. On the demand side, economies of scale are reflected in the so-called network effects:[20] As the value of a network for an individual increases with the number of users,[21] the overall value is maximised in a monopoly network and a fragmentation would lead to consumer welfare losses.

In addition to a discussion of the largely static concepts of allocative and productive efficiency, a fundamental benefit of competition is seen in its ability to meet customer requirements *dynamically* and to ensure that old inferior products are replaced by superior new products. As stated by Kolasky and Dick (2002:6),

> Dynamic efficiency arises from market processes that encourage innovation to lower costs and develop new and improved products. Whereas allocative and productive efficiency can be viewed as static criteria – holding society's technological know-how constant – a more dynamic view of efficiency examines the conditions under which technological know-how and the set of feasible products optimally can be expanded over time through means such as learning by doing, research and development, and entrepreneurial creativity.

From such a dynamic point of view, it has been discussed extensively in the economic literature whether market power must be seen as an important precondition for technical progress and therefore, to a certain extent, as socially desirable.[22] Notwithstanding the existence of such a trade-off between static and dynamic efficiency, the empirical evidence by the majority shows that monopoly power is more likely to slow down the pace of innovative activity[23] (see, for ex-

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20 See Farrell and Klemperer (2006: 58f.) for a discussion as to why network effects are not always (positive) externalities. Generally, negative externalities (such as pollution caused by a production process) might be another reason to prefer monopoly over competition, simply because a monopoly reduces output and therefore reduces the negative externality. However, it is likely that an optimally regulated market in such a case would reach better performance levels than either monopoly or perfect competition.

21 If there are *n* people in a network and the value of the network to each of them is proportional to the number of other users, then the total value of the network to all the users is proportional to $n(n-1)=n^2-n$. For example, a tenfold increase in network size leads to a hundredfold increase in its value. This relationship is known as Metcalfe's Law (see Shapiro and Varian, 1999: 184). Given the functional form, it is obvious that demand-side economies of scale do not dissipate (as supply-side economies do when the market gets large enough).

22 See Evans and Schmalensee (2001) and Shapiro and Varian (1999) for overviews and discussions of implications for business strategy and public policy.

23 From a theoretical perspective, the relationship between market power and process innovations can be characterised by two conflicting effects. The *replacement effect* (Arrow, 1962) speaks for lower innovation incentives for a monopolist compared to a competitive industry (under the assumption that the respective firms are in each case the only firms who could implement the respective process innovation[s]). The basic

ample, Weigand, 1996; Audretsch, 1995; Geroski, 1990). However, recent discussions on 'very innovative industries' with winner-take-all markets suggest that although these firms might be dominant in their market, they face the constant threat of being replaced by firms seeking to develop better products. Following Schumpeter (1942), these monopolists competed vigorously, not necessarily in the market but for the market (see Veljanovski, 2006: 119f. and Geroski (2003) for round-ups). As a consequence, a (temporary) high level of market power in such markets might be socially desirable.

An acknowledgment of the importance of market power in keeping up innovation incentives can be seen in the existence of patent systems. As part of such a system, the state factually grants temporary monopolies to innovative firms in the form of patents. This is seen as a necessary instrument to allow these firms to recoup their investments in research and development by avoiding immediate imitation by rivals. A patent system is therefore a necessary public policy instrument to keep up the innovation incentives for firms and therefore ensure technological progress and economic development.

In addition to allocative, productive and (possibly) dynamic inefficiencies[24], the distributional effects of market power might be another reason to prefer competition over monopoly. As prices above marginal costs not only lead to net losses in overall welfare but also to a (total welfare-neutral) transfer of consumer surplus into producer surplus, market power also influences the process of wealth creation as well as the distribution of wealth in a society. Comanor and Smiley (1975) investigate the impact of enterprise monopoly profits on the distribution of household wealth in the United States between 1890 and 1962. They basically find that past and current monopoly has had a major impact on the current degree of inequality in the distribution of wealth. Creedy and Dixon (1998) estimated the relative burden of monopoly, measured as the static loss of consumer surplus for different household income levels, and find that the welfare loss associated with monopoly power is higher for low-income households compared with high-

reason for the lower incentives of the monopolist is that by being innovative he is just replacing an already high (monopoly) revenue stream with a revenue stream that is even a bit higher. The competitive firm, on the other hand, starts from a situation of zero profits and therefore has higher incentives to implement the process innovations. If it is, however, assumed that both the monopolist and a potential rival are able to implement a certain process innovation, the *efficiency effect* shows that a monopolist now has a higher incentive to be innovative than his rival from the competitive industry, because he is in danger of losing his high monopoly excess profits in case the rival firm implements the process innovation (Gilbert and Newbery, 1982).

[24] A fourth efficiency type which might be distorted by the presence of market power is the *transactional efficiency*. "The basic insight offered by the school of thought known as 'transaction cost economics' is that market participants design business practices, contracts, and organisational forms to minimise transaction costs and, in particular, to mitigate information costs and reduce their exposure to opportunistic behavior or 'hold-ups' … transactional efficiencies frequently facilitate firms' efforts to achieve allocative, productive, and dynamic efficiencies" (Kolasky and Dick, 2003: 249).

income households. However, as Martin (1994: 38) has pointed out, the decision whether this is considered a problem from a social point of view is a matter of politics rather than economics.

In a nutshell, this section has characterised several important economic arguments why monopolies are typically inferior to competition from a total welfare point of view. Although the striving for a monopoly position remains probably the most important individual motivation for undertaking business activities[25], the permanent (ab)use of such a position likely leads to welfare-reducing inefficiencies. Although empirical studies on deadweight and rent-seeking losses show that the performance differential between perfect competition and monopoly can be surprisingly small, a closer interpretation of these results show that the true losses are very likely significantly larger. Therefore, economists might still serve a more useful purpose in fighting monopolies instead of fires or termites.[26]

2.2.2 Competition Needs Protection

The finding that competition is typically worth protecting is a necessary but not sufficient condition to justify a need for some kind of competition policy. Although the desirability of competition is probably one of the few things most economists generally agree upon, different schools of thought arrive at quite different answers to the questions of whether protection is needed and what kind of protection is needed. The spectrum reaches from laissez-faire approaches with no or only skeletal antitrust rules to quite interfering approaches which plan to create an 'optimal competition intensity'.

Without wanting to enter into these debates in detail (see, for example, Kovacic and Shapiro, 2000; Mueller, 1996; and van den Berg and Camesasca, 2001, for overviews of US and EU antitrust policy history), the basic theoretical justification for some kind of antitrust policy is its potential to reduce the so-called deadweight welfare loss of market power and, consequently, to realise better market performances than without such a policy. If the aim of antitrust policy is simply to promote economic efficiency, then the additional allocative inefficiency caused by productive inefficiencies (trapezoid *ABCD* in the third chart in Figure 4) must

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25 The importance of (temporary) market power as a key element in market systems is expressed in great clarity by Justice Antonin Scalia in the US Supreme Court's Trinko (2004) decision: "The mere possession of monopoly power, and the concomitant charging of monopoly prices, is not only not unlawful; it is an important element of the free-market system. The opportunity to charge monopoly prices at least for a short period is what attracts business acumen in the first place; it induces risk taking that produces innovation and economic growth. To safeguard the incentive to innovate, the possession of monopoly power will not be found unlawful unless it is accompanied by an element of anticompetitive conduct" (Verizon Communications v. Law Offices of Curtis V. Trinko LLP, 540 U.S. 398, U.S., 2004).

26 The original quote stems from George Stigler (1966) who once stated that „economists might serve a more useful purpose if they fought fires or termites instead of monopoly".

be added to the deadweight loss to trace out the overall potential of antitrust policy to improve total welfare. The inclusion of rent-seeking activities and the fraction of productive inefficiencies without allocative distortions is only feasible if the underlying aims of competition policy are changed (for example, by adopting a consumer surplus standard) or extended (for example, by including the aim of promoting a fair income distribution).[27]

Antitrust policy, as opposed to regulation, is applied in markets in which the competitive process is viable in principle, and only occasionally endangered by actions of individual firms or groups of firms. Therefore, as Geroski (2004: 4) indicates, competition policy only "swings into operation when serious, egregious problems are believed to exist". Although most economists would probably still agree on the desirability of these selective and episodic swings in an artificial world of perfect information, a considerable group of scholars becomes sceptical about how to decide *when* to swing as well as about the accuracy of the swings in a world of imperfect and incomplete information, in which the antitrust authority has to judge on complex forms of business behaviour in complex markets with a multitude of knock-on effects. Especially in such environments, it is believed that market forces (at least in the long run) will automatically select the most efficient firms and lead to efficient market outcomes. Antitrust interventions, on the other hand, are believed to do more harm than good, especially because "economists … have not reached a consensus about the ultimate effects of various business practices ... [I]t seems likely that well-intentioned prosecutors and judges face ... some difficulty in distinguishing good from bad business practices" (Bittlingmayer, 1996: 371).

The so-called private interest theories of regulation (and antitrust) even go one step further and question the general existence of well-intentioned prosecutors. These theories are based on the disbelief that the responsible individuals really base their decisions on the public aim of promoting economic efficiency. Stigler (1971), for instance, argues that enforcers – as well as politicians – will get captured by interest groups, and that these groups will use their regulatory and coercive powers to shape laws and regulations in a way that is beneficial to them (see Hüschelrath, 2005: 192ff., for a general description of these theories in a regulatory context). These public versus private-interest explanations for the development and persistence of antitrust law and enforcement are investigated back to the passing of the Sherman Act in the United States in 1890[28] (see Box 1 for an overview and Rowley and Rathbone, 2004, for a survey).

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27 The economic literature discusses a multitude of aims of competition policy. Motta (2004: 177ff.), for instance, discusses welfare, consumer welfare, defense of smaller firms, promoting market integration, economic freedom, fighting inflation, fairness and equity, as well as other public policy factors effecting competition. See also Furse (1996) for a discussion on different aims of competition policies in the United States, the European Union and the United Kingdom.

28 Ghosal and Gallo (2001) study the cyclical behaviour of the US Department of Justice's antitrust enforcement activity between 1955 and 1994. They find that case activity is countercyclical; i.e., in an economic downturn, antitrust enforcement activity

Box 1. Congressional intent on passing the Sherman Act

The motivations of the US Congress on passing the Sherman Act in 1890 has been the subject of several economic studies (see, for example, DeLorme et al., 1997). In general, two types of economic explanations are offered. The first type is based on a *public interest theory* of antitrust and assumes that government interventions are motivated by correcting market inefficiencies resulting from monopolies. From that perspective, antitrust laws were initially designed to prevent higher prices and consequently to reduce wealth transfers from consumers to producers (see, for example, Bork, 1966). The second type is based on a *private interest group theory* and assumes that special interest groups pressure legislators to create regulations that promote market inefficiencies. In other words, these approaches argue that US antitrust laws were designed to generate higher prices and lower outputs, protecting some special-interest groups rather than consumers (see, for example, DiLorenzo, 1985; Shughart and Tollison, 1991; Shughart, 1996).

In addition to opportunistic behaviour of captured politicians and enforcers, the companies themselves might strategically (ab)use antitrust policy for their own purposes. Baumol and Ordover (1985: 263) identified that such rent-seeking behaviour by competitors is widespread (and costly to the economy) and consequently asked for easy and costless remedies for such abuses of antitrust "by those who use it for protection from competition". McAfee and Vakkur (2004) developed a taxonomy of strategic uses of antitrust laws.[29] They identified the following seven strategic (ab)uses: 1) Extort funds from successful rival; 2) change the terms of the contract; 3) punish non-cooperative behaviour; 4) respond to an existing lawsuit; 5) prevent a hostile takeover; 6) discourage the entry of a rival; and 7) prevent a successful firm from competing vigorously. Without wanting to go though the whole taxonomy (see McAfee and Vakkur, 2004: 4ff.), a prominent example of a misuse of antitrust law (reflected in points 1 and 2 of the taxonomy) is to extort funds of a successful rival by saying, Give me something (cash, better contract terms) and I will not expose your vulnerability to an antitrust lawsuit. Another typical misuse (reflected in point 3) exploits the expensive nature of anti-

increases, and vice versa. Based on this empirical finding, the authors conclude that private interest group theories of antitrust enforcement are not supported, as they would expect increases in producer protection in economic downturns (i.e., procyclical enforcement). One possible explanation for the identified countercyclical pattern of antitrust enforcement activity is that the number of antitrust violations increases in economic downturns.

29 It is important to remark that the literature on the strategic abuse of antitrust law concentrates on a system of private antitrust enforcement which is predicated on the idea that firms can sue firms. It is straightforward to see that such a system (as applied in the US) opens more possibilities for strategic behaviour than a system of public enforcement (such as currently dominant in the EU), in which the firms can only inform the antitrust authority about possible breaches of competition law but typically cannot directly bring a suit against a competitor. Such a system is likely to provide fewer opportunities for the strategic abuse of antitrust laws.

trust lawsuits and the fact that it is typically cheaper to bring a lawsuit than to defend against one.[30] This opens possibilities, for instance, to use antitrust law as a (threat of) punishment for the purpose of enforcing collusive agreements. In line with this argumentation, Yao (1998: 355ff.), in his survey on antitrust restrictions of competitive strategies, differentiates between strategies that simply include antitrust restrictions in business decisions defensively[31] and strategies that use antitrust as an aggressive strategic weapon; for instance, to reach a ban for a certain merger which might threaten the own market position.

From an empirical perspective, one way to investigate the necessity of competition policy is to analyse historic episodes with no or only lax antitrust enforcement. In the United Kingdom, Adam Smith (1776) already used this approach in his *An Inquiry into the Nature and Causes of the Wealth of Nations* and observed a general 'tendency for collusion'. In Germany, Walter Eucken, amongst others, analysed historical experiences and found a 'tendency of monopolisation'[32] (1952: 31). He concludes that competition policy is necessary to secure competitive market structures in the medium and long term and generally to preserve freedom and organisation of the economic system (*Wirtschaftsordnung*).

More recently, Baker (2003: 42) concluded that "[c]ompetition does not invariably happen by itself", as firms have incentives to restrict competition either

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30 Bizjak and Coles (1995) study the implications for shareholder wealth of inter-firm (so-called private) antitrust litigation and find that the average defendant loses more than the average plaintiff gains. The average wealth loss for defendants is a statistically significant 0,6% of the equity value, or an average of $4 million. Given the fact that managerial compensations are often linked to performance, the negative price reaction for the defendant upon a filing suggests that lawsuits can provide significant incentives for firms to comply with antitrust laws. The average wealth gain for a plaintiff was estimated at approximately 1,2% of the equity value of the firm, or equivalently an average gain of $3 million.

31 The relevance of so-called antitrust compliance programs as an integral part of a firm's business strategy is shown by Yoffie and Kwak (2001). They explain how Intel avoids antitrust litigation while Microsoft has to cope with multiple antitrust suits. "Intel's success is not a matter of luck. It's a matter of painstaking planning and intense effort. The company's antitrust compliance program, refined over many years, may not receive a lot of attention from the press and the public, but it's been an integral element in the chip maker's business strategy. In an age increasingly characterised by global markets that are dominated by a few huge companies, Intel's approach to compliance provides a valuable model for any enterprise that may come under regulators' scrutiny" (Yoffie and Kwak, 2001: 120). In the past, Michael Porter had been criticised for not considering antitrust violations in his books on *Competitive Strategy* and *Competitive Advantage* (see especially Fried and Oviatt, 1989).

32 "Anbieter und Nachfrager suchen stets – wo immer es möglich ist – Konkurrenz zu vermeiden und monopolistische Stellungen zu erwerben oder zu behaupten. Ein tiefer Trieb zur Beseitigung der Konkurrenz und zur Erwerbung von Monopolstellungen ist überall und zu allen Zeiten lebendig. … Universal besteht der 'Hang zur Monopolbildung' – ein Faktum, mit der alle Wirtschaftspolitik zu rechnen hat." (Eucken, 1952: 31).

collusively or exclusively. He substantiates his view (pp. 36ff) by evaluating evidence from four episodes of no or lax antitrust enforcement in the United States:

- *Industry performance before and shortly after the enactment of the Sherman Act (1890)*
  Studies of major industries during that period show successful though imperfect collusion in steel (Scherer, 1996), bromine (Levenstein, 1997), railroads (Elli son, 1994; Porter, 1983) and petroleum refining (Granitz and Klein, 1996). The activities of Standard Oil and American Tobacco also illustrated harmful exclusionary behaviour and showed the effects of anticompetitive mergers (see Granitz and Klein, 1996; Burns, 1986; Lamoreaux, 1985).
- *Industry performance in sectors in which the United States has successfully repealed the antitrust laws as they apply to export cartels (since 1918)*
  Dick (1996) conducted a study on 111 cartel episodes covering 93 industries during the years 1918 to 1965 and found many examples of long-lived export agreements motivated by price-fixing; he also found, however, examples of cartels undermined by price wars and fringe competition.
- *Industry performance during the National Industrial Recovery Act (mid-1930s) which allowed industries to develop the Codes of Fair Competition*
  Several industries used the Codes as a vehicle for price-fixing through various methods. Studies by McGahan (1995), focusing on breweries, and Baker (1989), analysing steel producers, show that at least these industries exploited the opportunity to collude and even managed to stabilise agreements for years after the Codes were declared unconstitutional.
- *Industry performance during the second term of the Reagan administration (mid-1980)*
  The second period of the Reagan administration was a period of relaxed antitrust enforcement (see Box 2 for some empirical evidence), during which the antitrust authorities wanted to prevent certain likely anticompetitive mergers, but the transactions were nevertheless later permitted (e.g., by the Department of Transportation). In particular, the acquisitions of Republic Airlines by Northwest Airlines and the purchase of Ozark Air Lines by Trans World Airlines were both characterised by substantially overlapping route networks of the merging parties. A study by Peters (2006), among others, shows that these mergers indeed led to higher fares (as well as a decrease in service quality) in some markets with estimated average price increases of at least 5-10% in city pairs where the two carriers had previously competed (see Pautler, 2003: 167ff., for an overview). Hüschelrath (1998b: 347ff.) shows that the belief that airline markets are ‘perfectly contestable’ in the sense of the theory of Baumol, Panzar and Willig (1982) led to the approval of these mergers.

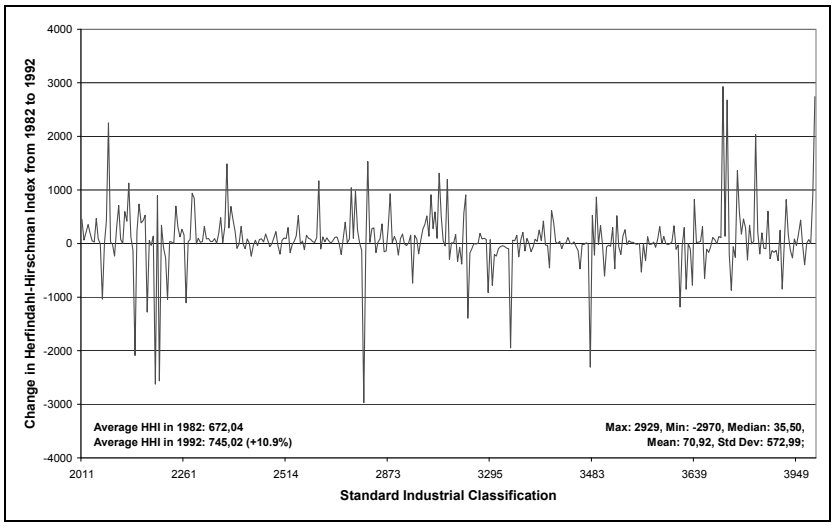
An alternative way to study the effects of antitrust policy is to look at cross-national studies. In a recent working paper, Krakowski (2005), for instance, explores the relationship between competition policy, experience in the application of competition policy, the intensity of local competition and the standard of living. He finds that the effectiveness of antitrust policy has a significant influence on the intensity of local competition. Furthermore, his results show that in coun-

tries with a high intensity of local competition, the standard of living is higher than in countries with a low intensity of local competition.

Box 2. Did lax antitrust enforcement in the 1980s increase concentration?

In the United States, the 1980s were characterised by a lax antitrust enforcement, partly due to the influence of the Chicago School of Antitrust. In such a state, one would expect an increase in concentration due to anticompetitive mergers and successful monopolisation strategies. Based on a data set of concentration measures for 360 US manufacturing industries, the graph below shows the changes in the Herfindahl-Hirschman index from 1982 (the beginning of the lax period) to 1992 (after the end of the lax period).

Fig. 5. Change in Herfindahl-Hirschman index from 1982 to 1992



Source: Own calculations based on data from US Census of Manufactures, Concentration ratios in manufacturing 1982 and 1992 (www.census.gov/epcd/www/concentration.html). Herfindahl-Hirschman index changes may partly be influenced by changes in the SIC structure from 1982 to 1992.

The graph as well as the calculated averages show that industrial concentration indeed increased in these ten years by about 10% on average. Although causality between this development and lax antitrust enforcement cannot be substantiated with the data at hand, it is especially interesting to see that the concentration in several industries increased dramatically, while others experienced a deconcentration process. This indicates that studying industry averages alone might say little about concentration effects of lax antitrust enforcement. Additionally, it has to be kept in mind that the graphs only show manufacturing industries and therefore miss important industries (such as the airline industry) in which concentration effects due to lax antitrust enforcement can be expected to be substantial (see Baker, 2003: 38).

Baker (2003) summarises studies which seek to understand why some nations have grown wealthy and others have not. These studies find almost unanimously that impediments to competition impede innovation, growth and prosperity (see, for example, Baumol, 2002; Shleifer and Vishny, 1998; Olson, 1982). Similarly, studies by business economists (see, for example, Porter, 1990) allow drawing the conclusion that differences in the power of competition across developed countries have been an important factor in explaining the difference in the performances of major industries across economies.

Although the historical review so far corroborates the need for some kind of antitrust policy, there is also oppositional evidence. Crandall and Winston (2003) collected historical evidence to underpin the view that antitrust policy was not successful in the past in terms of maximising consumer welfare. Their study, however, was heavily criticised – partly for its selective choice of empirical studies – by antitrust experts such as Connor[33] (2004), Kwoka (2003) and Werden (2003).

Bittlingmayer (2001) investigates the detrimental effects of antitrust enforcement on investment behaviour and industry structure. He uses antitrust case filings as a measure of regulatory uncertainty aiming at explaining some of the variation in industry investment by appealing to political or regulatory uncertainty. His results imply that the low investment level of the late 1950s and early 1960s in the United States was due at least in part to a resurgence of aggressive antitrust and related initiatives. He concludes that "whatever the ability of antitrust to lower prices and increase output in theory or in isolated circumstances, one actual effect of antitrust in practice may have been to curtail investment" (Blittlingmayer, 2001: 322).

Shleifer and Vishny (1991) argue that while lax enforcement may lead to monopoly, tough enforcement could lead to an even worse industry structure: namely one dominated by conglomerates (see Box 3). Therefore, the authors vote for a lax merger enforcement standard.

In a nutshell, it was shown that mainstream theoretical analysis – as well as the majority of empirical studies – comes to the conclusion that competition needs protection and – more importantly – that evidence has shown that competition policy actually helped to improve market performance, industry performance and the performance of the whole economy. However, it is important not to disregard the sceptical views on antitrust but to interpret them as a cornerstone of the continuous improvement of antitrust enforcement. Antitrust interventions have to be aware of enforcement's significant influence on manager's decisions, market behaviour and industry structure. In order to minimise uncertainty caused by antitrust enforcement, it must be the aim to develop, as clearly as possible, rules which are based on sound economic theories but understandable and applicable for people with academic backgrounds other than economics.

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33 Connor (2004: 1), for instance, writes: "This paper is an oddly slap-dash product far below the usual standards of the Journal of Economic Perspectives."

Box 3. Monopolies or conglomerates?

Shleifer and Vishny (1991) review evidence on takeover waves in the 1960s and 1980s in the United States and discuss the implications of this evidence for corporate strategy, agency theory, capital market efficiency and antitrust policy. With respect to antitrust policy they generally find that it played an important role in the two takeover waves. "The extremely strict antitrust enforcement in the '60s made most related acquisitions infeasible, or at least costly, and so forced firms determined to make acquisitions to diversify" (Shleifer and Vishny, 1991: 58; see Matsusaka, 1996, for antithetic evidence). In other words, antitrust policy was at least partly responsible for the diversification wave at that time. In direct comparison to that, the authors argue that even if one sees some problems with the takeover wave (made possible due to lax antitrust enforcement) in the 1980s, it is hard to believe that they will turn out as bad as diversification in the 1960s. Consequently, Shleifer and Vishny (1991: 58) conclude that "[i]n a first best world, aggressive antitrust may be a good idea. But, in the world where corporations are committed to growth though acquisitions, antitrust policy of the '60s … had inadvertent effects much more damaging than the benefits it created. … There's no question that … lax [antitrust] policy has led to some anticompetitive mergers, such as those in the airline industry, but it is better to have a few monopolies than a lot of conglomerates."

2.2.3 Competition Policy Is Worth It

Even after concluding that competition is worth protecting and also (regularly) needs protection, the case for antitrust enforcement is still not closed. In a third step it has to be shown that the benefits of antitrust enforcement likely exceed its costs. In the words of Geroski (2004), the question Is competition policy worth it? has to be answered.

In general, there are two ways to approach such a question. On an *aggregate level*, it can be assessed whether competition policy as a whole brings more benefits to society than it costs.[34] On a *disaggregate level*, it can be investigated

[34] As argued by Kee and Hoekman (2003), the benefit of competition policy needs to be compared with the potential benefit of other policy options which could foster competition. Based on an empirical study of an international data set consisting of 28 industries in 42 developed and developing countries from 1981 to 1998, the authors indeed conclude that reducing trade barriers and government regulations (as two major restrictions of domestic competition by impeding entry and exit of firms) would likely generate a higher rate of return than the adoption and enforcement of competition law. However, the increased significance of especially international cartels, despite shrinking trade barriers, suggests that reductions in trade barriers and government regulations are complements rather than substitutes to competition policy norms. In other words, although trade liberalisation and reductions of government regulations are typically worth promoting from an economic perspective, they do not make competition policy norms obsolete.

whether and to what extent certain sub-activities of the antitrust authorities – such as cartel or merger enforcement – contribute to the overall benefits of antitrust policy.

2.2.3.1 Aggregate Level

In the following sections, the aggregated costs and benefits of antitrust enforcement for two countries are investigated further: the United States and the Netherlands. These two countries were basically chosen for two reasons. On the one hand, both countries are quite distinctive with respect to size: the United States had a GDP of about $12.970 billion in 2004 (at current prices), and the Netherlands had a GDP of about $629.900 million in 2004 (at current prices, see IMF World Economic Outlook 2004). On the other hand, both countries are quite distinctive with respect to their history of antitrust law: the United States enacted their first antitrust law in 1890, and the Netherlands did not reform their rudimentary competition law (from 1956) until January 1998 (see Konings et al., 2001: 845).

Costs and benefits of antitrust enforcement in the United States

On an aggregate level, some of the cost-side components of antitrust enforcement can be quantified relatively easily. The direct governmental costs in the United States are basically given by the budgets of the two enforcement agencies: the Federal Trade Commission (FTC) and the Antitrust Division (AD) of the US Department of Justice (DOJ). The FTC (2004) splits its 2005 budget into two fractions: 'consumer protection', with roughly $118 million, and 'maintaining competition', with roughly $87 million. Only the latter is interpreted as part of the governmental costs of antitrust enforcement. The Antitrust Division (2006) is solely working on 'maintaining competition' and had an annual budget in 2006 of roughly $139 million, leading to total governmental enforcement costs of about $226 million.

In addition to the direct governmental costs, firms also generate costs caused by antitrust enforcement. These can be subdivided into two fractions: 'costs by responding to government investigations' and 'costs of private antitrust litigation'. Baker (2003) estimates that the former cost block sums up to roughly $500 million annually. He derives this estimate by using an average value of an antitrust case of $2,5 million (covering filing fees, lawyers and economic consultants; see Global Competition Review, 2003, as well as Box 4 for comparable evidence from the *Airtours* case in the European Union) and multiplying it by the number of second-request cases (roughly 200) in 2002 in the United States. The estimate for private antitrust litigation is taken from Salop and White (1986), adjusted for inflation, and adds up to about $400 million annually. Overall, the direct costs of antitrust enforcement add up to about $1.126 million.[35]

[35] In a survey, PriceWaterhouseCoopers (2003) investigated whether the time and costs of business devoted to multi-jurisdictional merger reviews has the effect of a factual

Box 4. Legal and economic fees in *Airtours* case (1999)

Neven (2005: 10) discusses evidence on the relative importance of economic and legal fees gathered from the records of the *Airtours* case (1999). Airtours attempted to acquire First Choice; however, the European Commission banned the proposed acquisition. Nevertheless, Airtours succeeded in its appeal in the Court of First Instance (CFI). As a consequence, the Commission was ordered to pay the cost that Airtours had incurred in the procedure. These costs are shown in Table 3.

Table 3. Legal and economic fees in *Airtours* case (1999)

	Claimed by AT		Accepted by CFI		
	In €	in %	in €	in %	in % of claimed
Barrister	424.105	19%	258.068	36%	61%
Solicitors	1.290.342	58%	379.512	53%	29%
Solicitors (expenses)	29.616	1%	0	0%	0%
Economic consultancy	426.650	19%	45.541	6%	11%
Academic economists	51.440	2%	29.579	4%	58%
Legal fees in Luxembourg	941	0%	0	0%	0%
Total	2.223.094	100%	712.702	100%	32%

Underlying £-€ exchange rate: 1,52 (1999 average).

As shown in Table 3, the fees claimed by Airtours add up to more than €2,2 million overall with about 80% of these fees referring to the work of lawyers and the remaining 20% to the work of economists. Interestingly, the Commission refused to pay the amounts Airtours requested, claiming that they were exaggerated. In the end, the CFI had to rule on the amount, and the Commission was ordered to repay about 32% of the costs claimed by Airtours.

In addition to the direct costs of antitrust enforcement, indirect costs, which are somewhat more difficult to delineate and estimate, must be taken into account. Baker (2003) considers the opportunity cost of management time devoted to antitrust compliance and litigation as well as any lost efficiencies if beneficial activi-

tax on mergers. The study finds that, although such a tax exists, it is on average clearly below 1% of the overall value of the merger deals. The study further finds that the typical multi-jurisdictional merger deal requires 8 completed or considered filings and generates on average €3,3 million in external merger review costs; 65% of these costs are legal fees, 19% are filing fees and 14% are fees for other advisers. The survey shows further that a few major deals with at least one in-depth review by an antitrust authority incurred costs of more than €10 million. Taking internal and external costs together, deals involving an in-depth review are eight to ten times more expensive than those subject only to an initial review (see PriceWaterhouseCoopers, 2003: 4f.).

ties are deterred by the prospect of antitrust enforcement[36] (see also Crandall and Winston, 2003: 5f.).[37] Baker (2003) assumes that the indirect costs are roughly equal to the direct costs, leading to total annual costs of antitrust enforcement in the United States of about $2.126 million (see Table 4).

Table 4. Direct and indirect costs of US antitrust enforcement

		million USD
DIRECT COSTS		1.126
Direct governmental costs	Federal Trade Commission	87
	Antitrust Division	139
Direct private costs	Costs responding to government investigations	500
	Costs of private litigation	400
INDIRECT COSTS		1.000
Opportunity costs of management time (Compliance and litigation)		n.a.
Deterrence of beneficial activities by antitrust rules		n.a.
OVERALL COSTS		2.126

Sources: FTC (2004); DOJ-AD (2005); Baker (2003); GCR (2003); Salop & White (1986).

On the benefits side of antitrust enforcement, the first quantification efforts were estimations of the sizes of the deadweight loss triangles discussed in section 2.2.1. Applying the basic equation for the deadweight loss (see Equation 1), it is

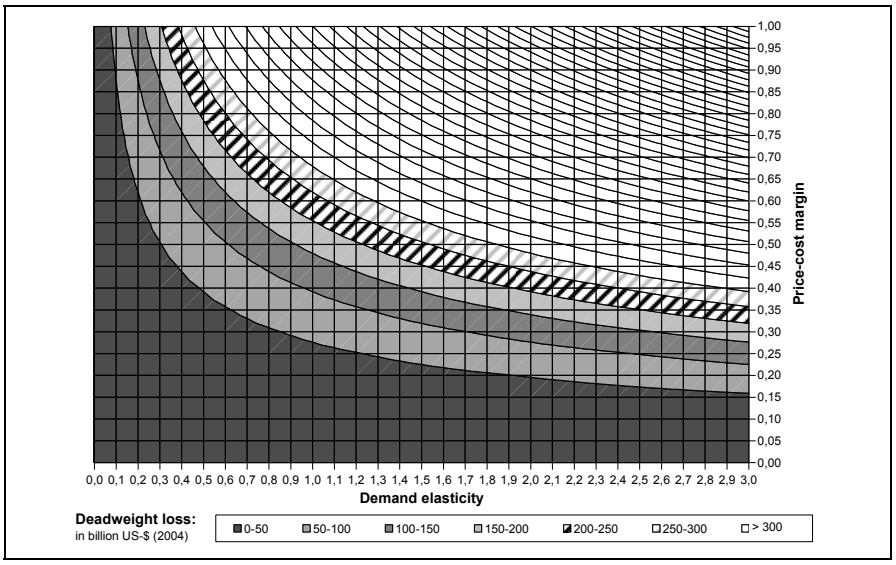
[36] Generally, the magnitude of especially the indirect costs of deterring beneficial activities by the design and enforcement of suboptimal antitrust rules is disputed among antitrust scholars. While some argue that Baker's estimate could be a realistic ballpark figure, others are of the opinion that these costs are substantially larger and typically dwarf any other costs of antitrust enforcement discussed above. I would like to thank Michael Waldman for pointing this out to me.

[37] Bittlingmayer and Hazlett (2000) analyse whether antitrust actions against Microsoft have created value in the computer industry. They hypothesise that a large number of computer firms which have products that are tied to the success of the allegedly monopolised Microsoft product (Disk Operating Systems) should prosper if actions are taken (by Microsoft or the DOJ) to make these operating systems costless, function better, or provide a more convenient platform for popular products. Policy actions that are expected to constrain Microsoft's market power effectively should simultaneously increase efficiency and improve profitability of firms throughout the sector. Bittlingmayer and Hazlett examine share price reactions for both Microsoft and a portfolio of 159 other computer firms around 54 antitrust enforcement announcements involving Microsoft over the seven years from 1991 to 1997. They find that antitrust action against Microsoft appears to inflict capital losses on the computer sector as a whole. Each enforcement action lowered Microsoft's stock by 1,2%, roughly $3 billion at May 1998 share prices. Furthermore, each enforcement action decreased a broad index of other computer stocks by 0,7%, equivalent to an additional loss of $5 billion in May 1998.

indeed straightforward to derive a first back-of-the-envelope estimate of the (potential) benefits of antitrust enforcement: Suppose that 10% of a country's national output is produced in monopolised industries, that the average price-cost margin is 0,2 and that the average market demand elasticity is 1,5 (see Leibenstein, 1966, and Rowley and Rathbone, 2004, for comparable calculations.) Using Equation (1) above then leads to a deadweight loss of 1,5% of the total GDP (see Annex 6.7 for a full table). Using the actual GDP figure for the United States in 2004 (about $12.970 billion), Figure 6 plots the corresponding deadweight losses for varying elasticities and price-cost margins.

As shown in Figure 6, with an average market demand elasticity of 1,5 and an average price-cost margin of 0,4, the corresponding deadweight loss lies in the range of $150-200 billion (the exact value is $156 billion as shown in Table 46 in Annex 6.7). Even with a substantially smaller price-cost margin of 0,1 and an average market demand elasticity of 1,0, the deadweight loss would still be around $6 billion and therefore about three times larger than the estimated costs of antitrust enforcement.

Fig. 6. Deadweight loss (in billion USD) against demand elasticity and price-cost margin (10% of US industry monopolised)



Although the benefits of antitrust enforcement shown in Figure 6 typically dwarf the generated costs, it is obvious that these estimates are very rough. In addition to the general criticism of deadweight loss studies (largely based on their assumptions and data-sets used; see section 2.2.1), Posner (2001: 17ff.) argues that neither of these studies can properly be used to measure the gains from having antitrust laws. "They measure the costs of monopoly given the existence of those laws, not the costs of monopoly that could be expected in the absence of

such laws. In a sense they measure the degree to which the antitrust rules have failed"[38].

An alternative way to measure the benefits of antitrust enforcement is to argue that antitrust interventions eventually lead to a decline in the price-cost margin. The benefits of antitrust policy can then be expressed by the deadweight loss differential between the before-enforcement and after-enforcement values of the (average) price-cost margin.[39] Figure 7 shows these differentials (i.e., the reductions in deadweight loss) for the United States (again based on 2004 GDP data) against the demand elasticity and the changes of the price-cost margin (in 0,1 steps).

As shown in Figure 7, a reduction in the price-cost margin from 0,4 to 0,3 at an average demand elasticity of 1,5 would lead to reductions in the deadweight loss in a range of $50-$75 billion (the exact value is $68 billion; see Table 47 in Annex 6.7). For a demand elasticity of 1,0, the reduction of the deadweight loss would still be in the range of $25-50 billion (the exact value is $45 billion; see Table 47 in Annex 6.7). In both cases, the benefits of antitrust enforcement still dwarf the cost estimate derived above.

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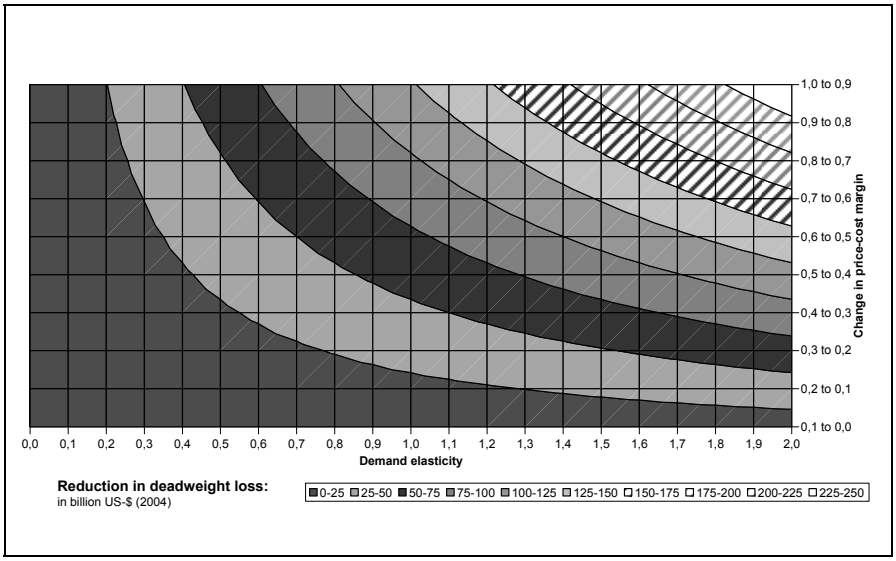
38 Baker (2003: 45) agrees with Posner's argument, adding, however, that such a "minimum estimate of the potential gains from additional antitrust enforcement provides a benchmark for assessing the benefits of current enforcement activity, under the plausible assumption that the efficiency gains achieved by preventing anticompetitive conduct – the deterrence benefits of antitrust – are at least as large as the potential gains from additional enforcement, which the Harberger framework measures".

39 In a recent paper, Boone (2006) argues why the price-cost margin is not a measure of success for competition policy for an antitrust authority that aims at maximising consumer welfare. Warzynski (2001) tests whether antitrust policy had an impact on the price-cost margins in the US manufacturing industry. His results indicate the presence of market power in many industries but also substantial heterogeneity of behaviour, across both time and industries. However, he concludes that price-cost margins were significantly lower when the antitrust policy was very tough. Konings et al. (2001) investigate the impact of competition policy on the level and the dynamics of firm price-cost margins in the Belgian and Dutch manufacturing industries. Belgium significantly strengthened their competition law in 1993, while the Netherlands followed a more lenient approach until the very end of the last century. The empirical results show that the reform of competition policy in Belgium did not have any significant effect on the price-cost margins in Belgium. However, a comparison between Belgium and the Netherlands revealed that price-cost margins in the Netherlands were significantly higher than those in Belgium. Additionally, Kee and Hoekman (2003) found for an international data set consisting of 28 industries in 42 developed and developing countries from 1981 to 1998 that the direct effect of antitrust law on industry price-cost margins is not significant for a sample consisting of all countries. However, the effect of antitrust law on industry price-cost margins increases with the size of the economy, indicating that antitrust policy may be more important for larger countries.

Fig. 7. Reduction in deadweight loss (in billion USD) against demand elasticity and changes in price-cost margin (10% of US industry monopolised)



In addition to the analysis so far, there are basically two major reasons why the true benefits of antitrust enforcement are substantially larger than stated so far: additional losses of monopoly and the deterrence effect of existing antitrust laws. With respect to the former, section 2.2.1 already showed that rent-seeking activities and productive inefficiencies can be interpreted as such additional losses of monopoly. If conservative estimates of these losses are also taken into account (DWL: 0,1%, RSA: 1,0%, PI: 1,0% of GDP) and applied to the GDP figure of $12.970 billion for the United States in the year 2004, the (potential) benefits of antitrust enforcement add up to roughly $272,4 billion ($13,0 billion DWL + $129,7 billion RSA + $129,7 billion PI).

The second argument which speaks for a too-low estimate (in Figure 6) is the deterrence effect of antitrust rules. *Deterrence* basically means that existing antitrust rules (and their enforcement) encourage firms not to behave in anticompetitive ways which would have lead to negative welfare effects in the absence of such rules. This 'encouragement' can be based either on a general attitude to respect the law and/or on the fear of antitrust investigations and fines. Although the existence of such a deterrence effect is beyond controversy, its quantification is surely a very challenging task.[40] Baker (2003: 40) and Geroski (2004: 8) simply

40 At first sight, the results of Masson and Shannan (1984), presented in section 2.2.1, might answer this question. However, although Masson and Shannan estimate that the gains from competition are 8.7%, this value cannot be interpreted as a gain of antitrust policy, as even in the absence of any kind of antitrust law competition would likely prevail in many industries.

have the feeling that the deterrence effect very likely delivers more benefits alone than all the other benefits (discussed above) together.

In a nutshell, although several benefits and cost components are hard or almost impossible to estimate, it is likely that on an aggregate level for the United States, antitrust policy as a whole brings more benefits than costs to society.

Costs and benefits of antitrust enforcement in the Netherlands

In a study on behalf of the Dutch Ministry of Economic Affairs, Oxera (2004a; 2004b) develops a conceptual framework to assess the costs and benefits of market regulators (Oxera, 2004a) and applies it in the second part of the report to the respective institutions in the Netherlands.[41] The conceptual framework distinguishes between two possible counterfactuals to the present antitrust enforcement regime: 1.) no competition law and no Dutch competition authority (Nederlandse Mededingingsautoriteit, hereafter referred to as NMa) and 2.) private enforcement of competition law[42] and no NMa. While the first counterfactual would lead to an analysis of the costs and benefits of both competition law and competition policy, the second alternative would allow a comparison of the costs and benefits of having the NMa as an institution (see Oxera, 2004a: 7). Oxera concentrates their study on the latter counterfactual. Their (qualitative) results are summed up in Table 5.

As Table 5 shows, the cost side of antitrust enforcement by the NMa (compared to the counterfactual of private litigation under existing competition law) is structured into four sections: the direct costs of the running the NMa, the direct costs of the regulated firms, economic costs to the investigated markets (e.g., by making enforcement mistakes) and indirect regulatory costs created by regulatory uncertainty among firms. On the benefits side, Oxera identifies economic benefits to the markets in question (essentially by increasing allocative, productive and dynamic efficiency) as well as indirect regulatory benefits, such as deterrence effects of existing antitrust laws (and their enforcement).

Based on the arguments shown in Table 5, Oxera (2004b: 1ff.) continues in the second part of the report with the quantification of especially the cost part of their conceptual framework. The direct governmental costs are given by the budget of

41 The market regulators in the Netherlands are the Competition Authority (NMa), the Post and Telecommunications Authority (OPTA), the Financial Markets Authority (FMA), the Office of Energy Regulation (DTe), the Transport Chamber and the Healthcare Authority (NZa) (see Oxera, 2004a: 1).

42 *Private antitrust enforcement* basically means that existing competition laws are not enforced by an antitrust authority but rather through private litigation by especially competitors, suppliers and customers. In the United States, for instance, around 90% of all federal antitrust cases originate from private cases. See Jones (1999) and Oxera (2004a: 22ff.) for further discussions.

Table 5. Costs and benefits of the NMa against the counterfactual of private litigation under existing competition law

Costs	Benefits
Direct costs of the NMa – Total administrative costs of the NMa – Minus administrative costs of the judiciary system dealing with private litigation	
Direct costs of regulated firms – Total costs incurred by firms to comply with competition law and in relation to specific competition law proceedings – Minus costs incurred in private litigation cases	
Economic costs to the markets in question – Allocative, productive and dynamic inefficiency may result from unintended mistakes by NMa (e.g., excessive intervention or prohibition of efficient (and hence welfare-enhancing) practices) – Minus any such costs caused by decisions of judiciary system	*Economic benefits to the markets in question* – Allocative, productive and dynamic efficiency achieved through prevention of cartel and other anticompetitive behaviour that would not be challenged under private litigation – Enhanced product/service quality and innovation achieved through promotion of a competitive market environment
Indirect regulatory costs – Regulatory uncertainty among firms due to open-ended nature of competition law prohibitions (may be mitigated through clear guidance by the NMa and case law over time) – Minus any such uncertainty caused under private litigation	*Indirect regulatory benefits* – Active enforcement of prohibition in competition law has deterrent effects on cartels and other anticompetitive behaviour that would not be challenged under private litigation – Active stance of the NMa contributes to overall government objective of achieving a competitive culture, away from previous 'cartel paradise' culture in the Dutch economy

Source: Oxera (2004a: 28).

the NMa, which was about €22 million in 2003. In terms of administrative costs of firms in relation to Dutch competition law (e.g., filling in notification forms, dealing with information requests), Oxera uses a measure derived by a survey from the Dutch Ministry of Economic Affairs (MEA), which estimates these costs at €2,38 million per year (in 2002). However, these administrative costs are likely to underestimate the true costs for the firms, especially if in-depth analyses of

merger cases are considered. A survey by PriceWaterhouseCoopers (2003: 4) found that a typical multi-jurisdictional merger deal generates on average €3,3 million in external merger review costs. However, the survey shows further that a few major deals with at least one in-depth review by an antitrust authority incurred costs of more than €10 million.

Based on the PWC survey results, Oxera (2004b: 2) estimates the typical costs of a firm in a single EU jurisdiction. The internal costs of a first-stage merger were estimated to fall into a range of €20.000-€40.000 and €80.000-€120.000 for an in-depth merger review. In terms of external cost to firms, Oxera estimates a range from €110.000 to €160.000 for a first-stage merger and €600.000 to €900.000 for an in-depth merger review. Taking a subset of the average number of cases the NMa has dealt with in each year, the following rough approximation of the cost of firms due to antitrust enforcement can be obtained.

Table 6. Annual costs to firms due to a subset antitrust enforcement by the NMa

Type of case	Number of cases dealt with by NMa (average p.a. over period 2001-03)	Estimated cost per case (€)	Total costs (€ million)
Notifications of agreements	84	130.000 - 200.000	10,9 - 16,8
Notifications of mergers	95	130.000 - 200.000	12,4 - 19,0
Reports based on reasonable suspicion of contravention of competition law (in-depth)	9	680.000 - 1.120.000	6,1 - 10,1
In-depth merger reviews	2	680.000 - 1.120.000	1,4 – 2,2
Total			30,8 - 48,1

Source: Oxera (2004b: 2).

The estimates presented in Table 6 do not take costs of other proceedings (e.g., complaints or appeals) or general compliance costs incurred by firms into account. Overall, the costs of the private sector together with the direct governmental cost of about €22 million lead to a cost estimate between €52 million to €70 million (Oxera, 2004b: 22). Oxera undertakes no attempt to quantify the aggregate benefits of antitrust enforcement in the Netherlands; however, they estimate the welfare effects of three antitrust cases in more detail. One of these cases is presented in the discussion of the disaggregate level in the following section.

2.2.3.2 Disaggregate Level

The analysis of the costs and benefits on an aggregate level basically give an indication that the sign of the net welfare effect of antitrust policy is likely to be positive. Although this is surely important information, it only presents half of the story, because it masks the partial contributions of the different areas of antitrust enforcement to the overall success of antitrust enforcement. In the words of Rowley and Rathbone (2004: 17),

> economists cannot confidently rely on deadweight cost arguments to justify on efficiency grounds a per-se policy of antitrust intervention … In principle, it is clear that a very detailed case-by-case study is required to determine whether or not specific instances of monopoly, whether induced by conspiracy, by merger or by internal expansion, is justified in terms of economic criteria.

It is beyond the scope of this section to try to derive or collect separate estimates for the contribution of every area of antitrust policy. However, what can be done is analysing single cases of antitrust enforcement and show whether their contribution to the benefits of antitrust enforcement alone was significant compared to the overall enforcement costs derived above. Geroski (2004) followed such an approach for selected cases in the United Kingdom and from his viewpoint as the chairman of the Competition Commission (who regularly has to justify the budgets for his authority). Following Geroski's approach, two case studies are presented in the Annexes 6.1 and 6.2: the *lysine* case*,* focusing on cartel enforcement in the United States, and the *Nuon-Reliant* case*,* focusing on merger enforcement in the Netherlands. Both case studies allow a quantification of the benefits of antitrust enforcement.

The quantitative results of the two case studies on cartels and mergers both show substantial contributions to the benefits of antitrust enforcement. In the US *lysine cartel* case, it is found that the overcharge (excluding the price war) adds up to about $113 million in total, which can be translated into an average overcharge of 22,82% of sales (in a range from 13,48% to 36,92%). The deadweight loss was assumed to be at 10% of the overcharge and therefore is about $11 million for the whole cartel period.[43] In the Dutch *Nuon-Reliant* merger case, the redistribution effect (per year) appears to be substantial across the board (between 5,57%, or about €280 million, and 11,72%, or about €612 million, of post-merger sales), while the deadweight losses are, because of the typically low demand elasticity in electricity markets, relatively small (between 0,60%, or about €1,7 million, and 1,36%, or about €8,2 million, of the redistribution effect). To a certain extent, the results of the two case studies confirm the results of the aggregate approach: The redistribution effects of increases in market power seem to be significantly larger

[43] One possibility to underpin this allegation is to argue that without successful cartel enforcement, the respective cartel would have continued to exist, causing welfare losses. In other words, the direct benefits of detecting a cartel can be approximated by the net present value of the yearly benefits in the future. See Annex 6.1 for a more detailed discussion on the occasion of the assessment of the customer losses caused by the lysine cartel in the United States.

than the actual deadweight loss – which is the primary aim of an efficiency-oriented competition policy.

An underpinning of this finding can be achieved by casting an eye on studies which try to aggregate the (costs and) benefits of cartel and merger enforcement. Connor and Helmers (2006), for instance, present a study in which they analysed a large dataset of 283 private international cartels that existed between 1990 and 2005. They provide estimates of the overcharges for all of these cartels for the United States, Canada, the European Union and other regions. Furthermore, they estimate that the deadweight loss adds between 10% and 30% of the overcharges to receive an estimate of the overall customer losses (see Connor and Helmers, 2006: 21). Using 10% as a defensive estimate of the deadweight loss and 30% as an aggressive estimate, it is possible to estimate the overall customer losses of 283 private international cartels between 1990 and 2005. The results are presented in Table 7 (see Tables 49 to 52 in Annex 6.7 for the full data tables and the spreadsheet calculations).

Table 7. Customer losses due to 283 cartels operating between 1990 and 2005

	Overcharges	Defensive DWL estimate (10%)	Aggressive DWL estimate (30%)	Total customer losses (defensive estimate)
Overall		*Million Real 2005 US Dollars*		
United States	54.001	5.400	16.200	59.402
Canada	975	97	292	1.072
European Union	99.459	9.946	29.838	109.405
Other regions	21.137	2.114	6.341	23.251
All countries	175.573	17.557	52.672	193.130
Yearly average		*Million Real 2005 US Dollars*		
United States	3.375	338	1.013	3.713
Canada	61	6	18	67
European Union	6.216	622	1.865	6.838
Other regions	1.321	132	396	1.453

Source: Calculations are based on data from Connor and Helmers (2006: 49ff.).

As shown in Table 7, aggregate cartel overcharges for the four regions add up to more than $175 billion for the period from 1990 to 2005. A defensive estimate of the deadweight loss of 10% of the overcharges adds almost $18 billion to the overall customer losses caused by these cartels of more than $193 billion. Focusing only on the data for the United States shows overcharges of $54 billion and a defensive estimate of the deadweight loss of $5,4 billion for the period from 1990 to 2005.

In terms of the overall benefits of merger enforcement in the United States, the Government Performance and Result Act requires agencies to monitor their performance. In order to meet these requirements, the FTC and the AD of the DOJ

quantify 'the dollar savings for consumers resulting from agencies' actions stopping anticompetitive merger activity' and 'non-merger activity' as part of their annual performance measures. For the fiscal year 2001, for instance, the FTC calculated consumer savings of $2,5 billion resulting from merger activities and further $157 million savings for consumers resulting from non-merger activities.[44] The DOJ reported to Congress that the AD merger enforcement efforts saved consumers at least $4,094 billion in the fiscal year 1998 and $2,551 billion in the fiscal year 1999 (see Nelson and Sun, 2001: 927).

In terms of methodology used to come to these estimates, both agencies use a consumer savings estimate constructed by multiplying an estimate of the price increase that would have occurred by the volume of commerce in the respective relevant market affected. For the derivation of the price increase estimates, two different approaches are used. For homogenous product markets the following formula derived from a standard Cournot model is used (see section 2.4.2.1 for a discussion and Annex 6.6.10 for the proof):

$$\frac{\Delta p}{p} = \frac{\Delta HHI}{\varepsilon_D^m - HHI_{postmerger}} \tag{7}$$

with *(Δp/p)* representing the percentage increase in price that would have resulted if the merger had been allowed to proceed, *ΔHHI* representing the change in the *HHI* that would have resulted and $HHI_{postmerger}$ representing the corresponding post-merger *HHI*. Following the example of Nelson and Sun (2001: 929f.), if an industry has 5 firms that each have a market share of 20% pre-merger and the market demand elasticity is equal to 1,0, a 2-firm merger would lead to an increase in the *HHI* of 0,08 and the equation above would therefore predict an 11,1% increase in price.

The second approach to estimate the price increase that would have resulted if the antitrust authorities had not stopped the merger is used for mergers which involve differentiated products. In such cases, merger simulations are run to estimate the percentage change in price. As explained by Nelson and Sun (2001: 931), the simulation models are based on the Bertrand assumption that a firm chooses a profit-maximising price assuming that competitors will maintain their current prices. For both approaches, Nelson and Sun extensively discuss the underlying assumptions and therefore the limitations of the significance of consumer savings figures which are derived by these techniques.[45]

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44 The values for FY 2002/FY 2003 were $726 million/$292 million (merger) and $86 million/$211 million (non-merger); see FTC (2006: 20). Starting with the fiscal year 2004, the FTC discontinued the savings measure and replaced it by an estimate of the dollar volume of commerce in markets in which FTC took action to prevent anticompetitive mergers and other competitive conduct (see FTC, 2006: 20).

45 For the homogenous goods approach the somewhat critical assumptions are: (1) all firms have constant marginal costs, (2) the merger does not change the cost structure of the firm, (3) the merger does not change the behaviour of the firms, (4) the post-merger market share of the firms is equal to the sum of their pre-merger market shares, (5) the elasticity of demand is constant over the relevant range of sales levels

Box 5. Effects of competition enforcement work conducted by the Office of Fair Trading in the United Kingdom (2000-2005)

In December 2005, the Office of Fair Trading, one of the two competition enforcement agencies in the United Kingdom, published an initial evaluation of the effects of its competition enforcement work between 2000 and 2005 (all values are in 2005 prices). In terms of costs, the OFT's competition enforcement division spent about £71 million: £7,2 million on merger investigations; £27,3 million on Competition Act 1998 (CA98) investigations (which basically refers to anticompetitive practices such as price-fixing, bid-rigging, predatory pricing, margin squeezes and other abuses of dominant positions); and £37,2 million on policy formulation, quality control, administrative overhead and indirect costs. On the benefits side, the OFT estimated that at least £750 million have been saved by consumers from competition enforcement market interventions: £640 million as a result of anticompetitive mergers blocked or remedied and about £110 million from market interventions following CA98 infringement decisions (OFT, 2005: 18ff.).

For the Netherlands, Postema et al. (2006) try to measure the costs and benefits of merger control by using merger simulation tools. The authors compare the hypothetical situation in which all mergers would have been approved (the counterfactual) to the actual situation of merger control in which mergers with clear anticompetitive effects were prohibited or remedied by the NMa. For the period between 1998 and 2002, eleven rejected mergers were identified; however, data availability and data confidentiality issues finally allow the authors to study four mergers in more detail. With these four mergers/markets, four sensitivity analyses were run using four different demand models suitable for merger simulation.[46] It turned out that only the linear and log-linear demand functions produced sensible results which were then used to estimate the prevented price increases due to merger control. The results show that, for the four markets, price increases between 4,0% and 21,7% would have resulted in the absence of merger control leading to a weighted average price increase of about 14%. Applying this figure to the nine relevant cases[47] in which a merger was prohibited (or later allowed subject to 'healing remedies') led to a welfare gain of merger enforcement in the Netherlands between 1998 and 2002 of roughly €770 million. On the cost side, Postema et al. (2006) basically uses the estimates derived in the Oxera study presented

and (6) there is no entry. For the differentiated goods approach, especially the assumptions about the underlying demand system are added to the general problems named for the homogenous goods approach (see Nelson and Sun, 2001: 935ff.).

46 The four basic approaches to model the demand side in a merger simulation are linear demand, log-linear demand, logit demand and the almost ideal demand system.

47 From the total of eleven cases, the authors exclude two cases in the electricity industry because these markets are typically characterised best by Cournot competition and therefore conflict with the author's modelling assumption of Bertrand competition (see Postema et al., 2006: 94).

above, which led to an estimate for the overall costs of antitrust enforcement of at most €120 million. The net welfare effect of merger control can therefore be quantified at about €100 million per year.

In a nutshell, the analysis of competition and competition policy on the fundamental level showed, first, that competition is typically desirable. Second, it was argued that without antitrust policy, firms could and would (permanently) exercise market power, to the detriment of overall welfare as well as consumer welfare. However, although antitrust matters, it has to be used cautiously in order to avoid business distortions causing more harm than good. Finally, an assessment of the costs and benefits of antitrust enforcement suggest – at least for the United States and the Netherlands – that the realised benefits overtop the realised costs by far as long as overcharges/redistribution effects *and* deadweight losses are considered as welfare loss (see Box 5 for evidence from the United Kingdom). However, under a total welfare approach, only the avoidance of deadweight losses can be considered as a benefit of antitrust policy, and then the benefits estimate for cartel and merger enforcement under a disaggregate approach cannot cover the derived cost estimate for the United States and the Netherlands.[48] However, it should be kept in mind that the deterrence effect as an important benefit of antitrust laws and enforcement has not entered the quantification. Generally, it has to be reminded that some cost and benefit components can hardly be measured with satisfactory accuracy.

2.3 Strategic Level

The focus of the preceding section basically was to highlight the benefits of competition and competition policy. On an aggregate level, it was shown that antitrust policy as a whole likely increased overall welfare compared to the counterfactual of no antitrust policy. On a disaggregate level, estimations of the welfare implica-

[48] For the United States, costs of about $2,1 billion p.a. were estimated. While the aggregate approach resulted in a benefits estimate of about $6,0 billion p.a., the disaggregate approach result in savings of about $3,38 billion p.a. (overcharges) and about $0,34 billion p.a. (deadweight loss) on average for cartel enforcement. The lysine case study showed an overall overcharge of about $113 million during the entire cartel period of 23 months; however, only a deadweight loss saving of about $11,3 million over the whole cartel period. It can be seen that the deadweight loss savings alone cannot cover the overall costs of antitrust enforcement. The same conclusion is basically true for the Netherlands, where the cost estimate was about €61,5 million p.a. The benefits assessment of Postema et al. (2006) led to an estimate of about €154 million p.a. from merger enforcement alone (focusing on deadweight losses and redistribution effects). The case study of the Nuon-Reliant case again showed that the redistribution loss of about €280 million p.a. could cover the enforcement costs for the entire Dutch antitrust system. However, again, the deadweight losses alone are relatively small (about €1,7 million p.a.) and cannot cover the costs of antitrust enforcement.

tions of selected antitrust cases showed substantial contributions of these single decisions alone to the coverage of the overall cost of antitrust enforcement.

Although the existence of such a positive sign in terms of the overall welfare effect of antitrust policy is an encouraging signal, it hardly contains sufficient information to judge on the efficiency of antitrust policy. To give an example, suppose that an (budgetary well-equipped) antitrust authority follows an ill-equipped approach to detect anticompetitive mergers and – as a consequence – only detects one out of five anticompetitive mergers in a certain business year. In such a case, few commentators would speak of an efficient antitrust policy – even if the welfare gains (or consumer gains respectively) of prohibiting the single anticompetitive merger may already cover the whole costs of antitrust enforcement in the respective year.

From an economic perspective, the key to the maximisation of the positive impact of antitrust policy on overall welfare (i.e., an *efficient* antitrust policy) lies in the stringent development and application of *contemporary* economic concepts[49] embedded into an integrated general concept of antitrust enforcement. Such an integrated approach must consist of four necessary steps on the strategic level:

1. Characterisation and rationalisation of business conduct suspicious of causing anticompetitive effects;
2. Assessment of the welfare effects of such conduct;
3. Derivation of rules on how to detect such harmful conduct; and
4. Derivation of rules on how to intervene against such harmful conduct.

The following sections aim at explaining, largely from a *normative* point of view, why and how these four steps are essential for an integrated approach of antitrust policy. Before such an in-depth assessment is commenced, it is pivotal to clarify further the importance of the openness of the entire antitrust policy process for continually adopting new economic insights and new forms of potentially anticompetitive business conduct, thus maximising dynamically the contribution of antitrust policy to social welfare. In this respect, Kovacic (1992) studied the influence of economics on antitrust law by explicitly discussing the institutional structures necessary in order to secure the openness of the antitrust system for creation and adoption of new economic ideas. He basically concludes that the future influence of economics upon antitrust policy will critically depend upon how successfully economists and attorneys are working together in order to translate new economic ideas into cases.

The practical relevance and actuality of these questions is confirmed by a recent survey on European antitrust policy by Neven (2005: 6), who asks whether something can be said

> about observed developments relative to what would an 'efficient' use of economic analysis [be]; for instance, can we evaluate whether economic analysis

[49] However, as reminded by Carlton (2003b: 1), "using only the latest research tools to analyse competition is a mistake. The recent advances in both theory and empirical work should definitely improve our ability to understand the competitive process but should be viewed as a complement and not as a substitute for the more traditional studies."

> has improved the quality of decision making in terms of reducing the frequency of errors? Could economics have been used more efficiently, and do we understand why it has not fully developed its effects?

Although it cannot be the aim of this section to provide complete answers to the questions raised, the general importance and significance of adopting new economic insights on the strategic level should be underpinned by several examples.

On a very general level, the application of concepts borrowed from game theory is probably the most substantial example of the significance of new economic insights for antitrust policy. Although it is relatively undisputed that "game theory alone is unlikely to produce insights that are sufficiently robust that they can provide a clear guide to the implementation of antitrust policy"[50] (Carlton, 2003b: 4), it is equally undisputed that the general influence of game theory on the understanding of various forms of business conduct, such as collusion (see, e.g., Yao and DeSanti, 1993), predatory pricing (see, e.g., Bolton et al., 2000) and the appropriate design of antitrust rules, has been substantial in the last couple of decades.[51]

Another prominent example of the emergence and significance of new economic insights is the field of network economics, which certainly improved the economic understanding of firm strategies and market structures in industries characterised by substantial network effects[52] (see Koski and Kretschmer, 2004,

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50 One prominent argument against an extensive use of game-theoretic reasoning in antitrust policy is partly reflected in the so-called 'explaining everything, explaining nothing?' debate (see Sutton, 1990; Fisher, 1989) which refers (among other things) to the problem that game-theoretic models offer a rich menu of candidate explanations. "Indeed, in some settings, almost any pricing outcome, from pure competition to monopoly, can be the equilibrium outcome of oligopoly behaviour. This indeterminacy has lead to much criticism of the value of game theory" (Carlton, 2003b: 2). Additionally, game-theoretic models are often relatively sensitive to changes in assumptions and parameters and therefore may run into clarity problems when such insights should be used for antitrust policy (see Carlton, 2003b, for a detailed discussion). Elzinga and Mills (2001: 21f.), for example, see the game-theoretic theories of predatory pricing as "pristine theoretical existence proofs. Their value lies in identifying sufficient theoretical conditions for predatory pricing to arise as an equilibrium outcome. … To implement these theories in antitrust responsibly, however, requires more factual support … Factual support is crucial because strategic theories are so fragile."

51 However, as shown by Neven (2005), the adoption process is still not finished yet, as at least in certain areas of antitrust policy, antitrust authorities and the courts have not adopted key insights of game-theoretic research so far. This also shows that economists have an obligation to communicate their thoughts in an appealing way, so that the basic insights can be understood and possibly applied by non-economists (see a longer discussion below as part of the analysis on the operational level).

52 On a more general level, characteristics of so-called new-economy industries recently played an increasing role in antitrust policy (see OFT, 2002, for instance, for an extensive discussion). Those characteristics include R&D and intellectual property,

for a survey and Shy, 2001). From an antitrust policy perspective, the consideration of these insights in antitrust decisions very likely led to a substantial improvement in the quality of antitrust decisions in network industries (see Regibeau, 2004, for a simple competition policy algorithm to assess the significance of network effects for antitrust policy[53]).

A more recent example for the significance of adopting new economic insights into antitrust economics and antitrust policy is the emergence of research in so-called two-sided markets. Generally, a market is called *two-sided* when firms necessarily have to attract two or more groups of customers to be successful. A straightforward example for such a market is a heterosexual dating club, which has to attract both men and women to operate profitably. Another example is the credit card industry, in which the respective card-issuing firms need to attract both customers who own the card as well as shops who actually accept the card as a form of payment. The general structure of a two-sided market is depicted in Figure 8.

Given the specifics of two-sided markets, it is essential for the firm (i.e., the platform in Figure 8) to get both sides on board and therefore internalise the positive (so-called cross-group) externalities (see Armstrong, 2006). One general possibility for the platform to achieve such an optimal mix of customers is to set not only a price level, but also an entire price structure consisting of a fixed fee and a usage fee for customer groups 1 and 2 (see Tirole, 2004). Given the specifics of the market (for example, the relative sizes of cross-group externalities), it might be rational for the platform (and also in the interest of the customers) to price below costs for one customer group (e.g., to attract women in a dating club) and collect prices above competitive levels from the other customer group (e.g., men in a dating club). In such an environment, antitrust investigations based on the traditional predatory pricing argument might therefore lead to wrong conclusions, simply because the respective price (although below cost) does not reflect an attempt to behave anticompetitively but is rather part of the competitive process in the industry (see Armstrong, 2006, and Rochet and Tirole, 2003, for formal treatments). Other examples of two-sided markets include stock exchanges, newspapers, yellow pages and shopping malls.

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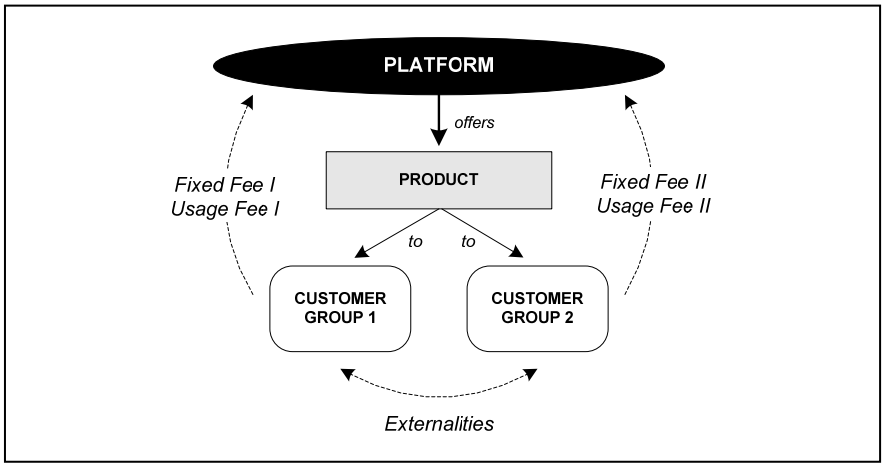
network effects, high fixed/sunk costs and low marginal costs, technical complexity, compatibility and standards.

53 The *competition policy algorithm* of Regibeau (2004) contains two stages: 1) Gauging likely network effects and 2) Detailed assessment of the role of network effects. With respect to the first stage, Regibeau (2004) proposes a) to identify the mechanism involved, b) to assess the extent of incompatibility and the terms of access, c) to judge the extent of double purchase or multi-homing and d) to provide a rough estimate of the size of the network effects. Only if a) a mechanism is found, b) cheap access is not available, c) the extent is not extensive and d) network effects are likely to be substantial, then Regibeau proposes to enter the second stage of the algorithm which focuses on a detailed assessment of the role of network effects with respect to the competition policy problem at hand (such as a merger or the abuse of a dominant position).

Fig. 8. A two-sided market



In addition to an evaluation of an existing portfolio of suspicious conduct with new tools and concepts, antitrust policy also has to consider extensions of the portfolio by identifying new forms of business behaviour with possibly anticompetitive potential. A historical example of such new forms of business behaviour is the introduction of best-price clauses, which include so-called most-favoured-customer clauses and meet-or-release clauses. The former basically guarantees a rebate on the original price if the seller offers lower prices to other customers thereafter; whereas the latter promises a rebate (or alternatively a release from the contract) if the purchase price is undercut by competing sellers later on (see Schnitzer, 1994: 186). Although both clauses look consumer-friendly at first sight[54], economic analysis has shown that both clauses can be problematic from an antitrust point of view, as they can serve as collusion-facilitating devices (see Phlips, 1995: 89ff.; Schulz, 2003: 83f.). For example, as argued in Schulz (2003: 83f.), meet-or-release clauses have a potential to stabilise collusive price levels, because the deviation of a firm from this price level is followed by significant claims of reimbursement by the customers.[55] This threat of reimbursement can eliminate the incentives to deviate from the collusive agreement. In fact, Schnitzer (1994) shows that monopoly prices can be maintained with such clauses.

Another example of a form of business behaviour relatively recently discovered to have potential antitrust relevance is so-called slotting fees. In general, *slotting fees* can be defined as "fixed per-unit time payments from manufacturers to

54 However, a possible advantage of such clauses from the viewpoint of the customer is a reduction in transaction cost, which must – in theory – be traded off against the welfare losses due to the stabilisation of the collusive outcome.

55 At the same time, meet-or-release clauses are helpful in detecting deviations from collusive prices, as the customers will typically report price drops in order to claim the reimbursement.

retailers in exchange for some allocation of shelf space"[56] (Shotlander, 2006: 1273). As shelf space is scarce in supermarkets and manufacturers depend on retailer shelf space, retailers are often in the position to charge such slotting fees from manufacturers. However, the exact business motivations for charging slotting fees as well as the question whether slotting fees have an anticompetitive potential (i.e., whether they would lead to higher retail prices for the respective products) is subject to an ongoing discussion (see Shotlander, 2006; Klein and Wright, 2006a, 2006b; Wright, 2006). Some authors see competition for shelf space – and correspondingly slotting fees – as an essential element of the competitive process without any need for antitrust rules or interventions (see Klein and Wright, 2006a, 2006b). Other commentators are of the opinion that either retail market power of the manufacturers drive slotting fees (see Shotlander, 2006: 1279ff.), or that slotting fees are an instrument for retailers to reduce competition at the retail level (Shaffer, 1991). Rey et al. (2006) find that slotting allowances, on the one hand, ensure that no efficient retailer is excluded. On the other hand, they allow firms to maintain monopoly prices in a common agency situation. Simulations undertaken by the authors suggest that the latter effect is more significant than the former. Additionally, Salop (2000) investigates slotting fees as an instrument of manufacturers to exclude rivals from entering the shelves by simply buying surplus shelf space from the retailers. Future research will have to identify conditions under which slotting fees might have a largely anticompetitive motivation and might therefore be of interest for antitrust policy.

Having emphasised the importance of an adoption of new economic insights and new firm conduct for an efficient antitrust policy, Figure 9 reminds of the four-stage structure of the strategic level which will be assessed in the following sections.

To assure the universal applicability of the approach, the following paragraphs apply the general reasoning to hard core cartel enforcement and merger control, two of the most common and traditional areas of antitrust policy. It will be applied to forms of strategic behaviour in the remaining chapters.

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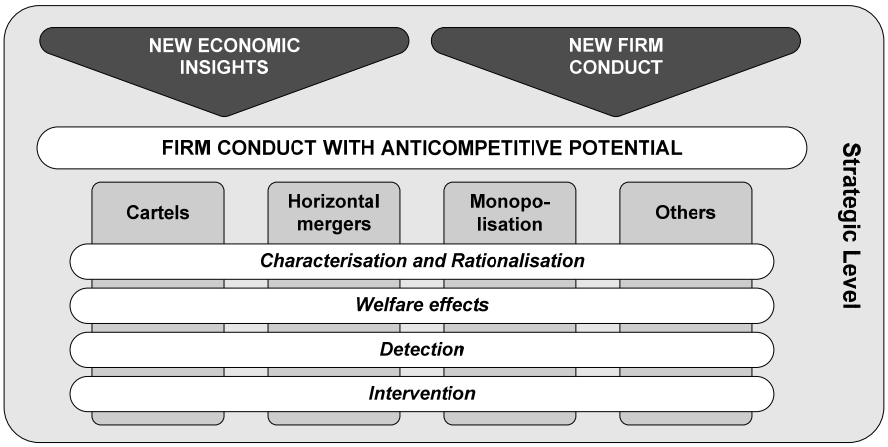
[56] A closely related business practice which recently attracted attention from antitrust economists is *category management*. Klein and Wright (2006b: 4) define this term as a business practice "whereby a retailer designates a manufacturer as a category manager or captain and gives the designated manufacturer authority concerning retail shelf space allocation within a product category. In return for shifting brand stocking decisions [as well as promotion, product assortment, and inventory decisions] to the designated manufacturer, the retailer receives a lower wholesale price or a per-unit time payment from the manufacturer."

Fig. 9. The strategic level



2.3.1 Characterisation and Rationalisation

The first step on the strategic level is devoted to the characterisation of forms of business conduct that are potentially relevant for antitrust policy. Such a characterisation basically aims at defining and delineating the respective business conduct as well as developing an understanding of its underlying business motivations. Subsequently, the welfare effects of a well-defined and delineated business conduct have to be assessed in order to decide whether it could be of interest for antitrust policy.

The characterisation of potentially relevant business conduct has to start with a decision about the level of disaggregation from which the analysis is conducted. For example, aiming at characterising and studying the business motivations and welfare effects of cooperation between firms would be considered a low level of disaggregation, as the types of conduct that would belong to such a category – such as cartels, mergers and joint ventures – are quite diverse. Even one level underneath – a category called 'mergers', for example – would still be considered as a relatively broad category, because horizontal, vertical and conglomerate mergers often underlie different business motivations and typically lead to quite different potential antitrust problems. Another level underneath could subdivide the category of horizontal mergers further by differentiating between mergers in homogenous product markets and mergers in heterogeneous product markets. Further subclassifications might focus on special industry characteristics, such as network markets or two-sided markets.

Given such a 'tree structure' of related business conducts, the choice of the right level of disaggregation depends on the motivation behind doing such an exercise. If a characterisation of fundamental relationships and broad general welfare assessments are of interest, a high-level analysis (i.e., a low level of disaggre-

gation) of a bunch of (different but related) business conducts (such as a category 'mergers') can create value. This is especially true for considerations such as the development of antitrust policy frameworks, which by definition have to abstract from subtleties (see chapter 3, which investigates the antitrust implications of strategic behaviour). It is, however, likely that the business motivations and the welfare effects on such a high level are simply too diverse to produce clear and applicable results which are usable for the subsequent stages of the integrated approach (i.e., the development of detection and intervention rules). In such a case, the level of disaggregation simply has to be increased, and the assessments of business motivations and welfare effects have to be redone (e.g., horizontal mergers in homogenous product markets).

The identification of potentially suspicious business conduct must be followed by an assessment from a business economics perspective investigating why companies are actually applying the identified conduct. The exact way of conducting such an exercise strongly depends on the specifics of the conduct at hand. In any case, profound business (economics) knowledge is of paramount importance during such an assessment, especially in cases in which the suspicious conduct is only one component of a complex set of interdependent forms of conduct. Having in mind the subsequent steps of the integrated approach of antitrust analysis, it is especially important to understand whether alternative business conducts would be available which could reach the same economic effect (from a business perspective) but which might cause fewer anticompetitive effects. An example for such an analysis is given as part of Annex 6.3, which generally discusses the antitrust implications of franchise agreements.

Application A-1: Characterisation and rationalisation of hard core cartels

The first exemplary application of the two introductory steps on the strategic level focuses on cartels. As part of an initial characterisation of this form of business conduct, it is helpful to compare several definitions of *cartel* provided by leading industrial organisation textbooks:

Definition 1: "An association of firms that explicitly agrees to coordinate its activities is called a cartel."(Carlton and Perloff, 2000:121)

Definition 2: "Cartels are associations of independent firms in the same industry that are formed to increase their joint profits by restricting their competitive activities." (Lipczynski and Wilson, 2001: 59)

Definition 3: "A cartel is a group of firms who have agreed explicitly among themselves to coordinate their activities in order to raise market price – that is, they have entered into some form of price-fixing agreement." (Pepall et al., 1999: 345)

A comparison of the three definitions shows significant differences, but also some important similarities. The first definition surely is the broadest of the three, as it delineates *cartel* as every kind of explicit coordination of activities by an association of firms. For antitrust purposes, this definition is likely too broad and unspecific, as it would, in principle, also consider the foundation of a joint foot-

ball club by several competing firms as a cartel. However, the mentioned explicitness of a cartel agreement – typically met by the existence of some form of written or verbal contract – separates cartels from various forms of so-called tacit collusion which are not analysed further (see Ivaldi et al., 2003; Kovacic, 2006: 817ff.; and Phlips, 1995: 79ff. for overviews).

The second definition is closely related to the first one, but it concretises the basic motivation of cartels (i.e., increasing joint profits) and also specifies the modus operandi (restricting *competitive* activities). Both criteria help to rule out the foundation of a joint football club as a cartel and therefore can be considered as a step forward in the search for an appropriate definition of *cartel* for antitrust purposes. However, also the second definition still falls short of a necessary substantiation of what is considered *competitive activity*. Firms can agree on many competitive activities, such as prices, quantities, customers, territories, marketing plans, procurement of input goods, R&D investments, general business terms and conditions, rebates, standardisation plans and so on; however, it is rather unlikely that a cartelisation of either of these competitive activities should be of equal concern for antitrust policy (see Neven et al., 1998, for a comprehensive overview of European competition policy and agreements between firms).[57]

The third definition is relatively precise in this respect, as it characterises a cartel as an explicit agreement between firms *aiming to raise the market price*. As raising and maintaining the market price surely is of relevance for antitrust policy, the third definition can act as an appropriate working definition of *cartel*. However, what still needs to be done is identifying explicit agreements that have the potential to increase market price. The OECD refers to such cartels as *hard core cartels*, and, following Crampton (2003: 5), subsume the following agreements under this term: price fixing, bid-rigging (collusive tenders), output restrictions

[57] To give a practical example, the German Act against Restraints of Competition (ARC), codifies in §2 that "[a]greements between undertakings, decisions by associations of undertakings or concerted practices, which, while allowing consumers a fair share of the resulting benefit, contribute to improving the production or distribution of goods or to promoting technical or economic progress, and which do not 1) impose on the undertakings concerned restrictions which are not indispensable to the attainment of these objectives, or 2) afford such undertakings the possibility of eliminating competition with respect to a substantial part of the products in question shall be exempted from the prohibition of § 1." §1 basically prohibits "[a]greements between undertakings, decisions by associations of undertakings and concerted practices, which have as their object or effect the prevention, restriction or distortion of competition." In §3, the ARC explicitly allows cartels of small or medium-sized enterprises under certain conditions. Furthermore, in older versions of the ARC, §3 to §7 specified further types of cartels which were generally allowed or may be allowed by the antitrust authority. Cartel types especially mentioned were cartels which aimed at agreeing on general terms and conditions, rebates, rationalisation efforts and export or import (see Schmidt, 1996: 172ff. for an overview).

and quotas, allocation of customers, suppliers, territories and lines of commerce.[58] Only these hard core cartels will be assessed in the following.

From a business perspective, firms have an incentive to form hard core cartels because coordinating the respective competitive activities leads to greater profits than acting independently. The basic rationale for this allegation lies in the internalisation of a negative externality. In a competitive market, a firm is simply interested in how much a reduction in its own output benefits itself, while it ignores the (positive) effect that a reduction in output has on the profits of the other firms in the market (via the reduction in total market output and the corresponding increase in price). A cartel internalises this effect by taking into account how changes in the output level of each firm affect joint cartel profits (see Carlton and Perloff, 2000: 122ff. for a detailed treatment). As a consequence, it pays for the cartel to reduce total output below the competitive level and thereby increases joint profits.

Although economic research has identified numerous cases in which cartels have aimed at raising joint profits by exploiting customers (see, for instance, the *lysine cartel* case study presented in Annex 6.1), empirical studies do not generally support this presumption. In particular, a seminal empirical paper by Asch and Seneca (1976) investigates whether the profit rates of colluding firms differ from those of non-colluding firms and whether the incidence of collusion can itself be explained on the basis of the structure and performance patterns of affected firms and markets. The results of Asch and Seneca (1976) show that colluding firms are consistently less profitable than non-colluding firms and that important structural differences exist between the two groups. Somehow puzzled by especially the first result, Asch and Seneca (1976) nevertheless doubt that collusion really consistently leads to lower profitability and explain their results by the possibility that antitrust prosecution centers largely on the unsuccessful manifestations and leaves the truly successful cartels undetected (see also Shughart and Tollison, 1998: 367ff.).

Another explanation discussed by Asch and Seneca (1976) is the possibility that unsatisfactory performance may motivate firms to collude (under conditions which are not favourable to create stable cartel agreements). Historically, such an argument has been based on the hypothesis that cartels might be 'knights in shining armour', meaning that cartels are formed in difficult economic times within an industry (or a whole economy) characterised by unsatisfactory performance as well as high risk and uncertainty, which is mirrored in cut-throat competition and price warfare. Following Lipczynski and Wilson (2001: 50ff.),

> [c]ollusion is seen as a way of easing the pressures of competition by unified action rather than just a strategy to maximise joint profits … evidence shows that firms enter cartel-type agreements to protect themselves rather than be-

[58] The choice between these different ways of forming a cartel largely depends on the circumstances in the market. While in fairly simple markets with standardised products agreements might focus on price, more complex markets make it often necessary to apply other forms of agreement, such as the delineation of exclusive territories or customer groups (see Hay, 1993: 7).

> cause of a desire to exploit the market. Agreements tend … to keep out or keep under control potential entrants and new products that could threaten the stability of existing firms.

From a historical perspective, Neumann (2000: 28 ff.) argues that fundamental changes in production technology in the second half of the nineteenth century led – partly via the corresponding changes in the cost structures of firms – to large cooperations which, because of the typically high share of fixed costs, were especially vulnerable in economic downturns. Following Bittlingmayer (1992), especially the combination of high fixed costs facing volatile demand indeed may have caused periods in which the market price dropped below average costs. From that perspective, cartels at that time could be seen as an instrument to fight these price drops and therefore might have been in the public interest (see Neumann, 2000: 28ff., and Richardson, 1965, for more detailed assessments).

Although some of these arguments have had played important roles in the toleration of cartels in several European countries in the nineteenth and the early twentieth centuries (see Resch, 2005, for an historical overview), contemporary economic research tends not to support the view that cartels nowadays are merely firm reactions to 'tough times'. Apart from general objections against such arguments – which could, for instance, remind of the fact that the pressures of competition play an indispensable role in every market economy (and are typically in the interest of society) – a theoretical assessment by Haltiwanger and Harrington (1991) and empirical studies by Dick (1996) and Bagwell and Staiger (1997) imply that cartels are in danger of breaking apart in recessions (see Neumann, 2000: 31f.). Such findings are somewhat contradictory to the knight-in-shining-armour motivation to form cartels mentioned above.

In addition to the 'profit-maximisation' and 'tough times' arguments, which have been the focus of academic research on the motivation to form cartels, an alternative way to assess this question is to look at the justifications brought forward by detected cartels themselves. Although it is fairly obvious that these arguments do not necessarily have to reflect the true motivations for cartel formation – but might in fact have been developed ex post as part of a defense strategy in court - they nevertheless have to make use of logically sound lines of economic reasoning. In a detailed assessment of these justifications for cartels, the World Bank (1999: 24ff.) identifies four frequently applied arguments: the industry cannot function with competition; the industry competes on service and quality; safety and quality will decline without the cartel; and the cartel is necessary to stop unfair and unethical competition. These arguments all have in common that they are built on the belief that competition is not working in the industry (from the perspective of the cartel firms), and therefore that a concerted action by the industry – which might lead to elevated prices but which also produces benefits for the consumers (by maintaining a high level of service and quality as well as safety) – is justified. Without wanting to enter into a detailed economic assessment of these 'excuses' for cartel formation (see World Bank, 1999: 24f.), one simple but disarming counterargument would be that it is not the industry that has to decide whether competition is unworkable. Economic research and practical experiences in the majority of cases show that competition is typically socially

desirable and it is up to the respective state bodies to decide whether some form of regulatory intervention is necessary, for example, to secure a high level of safety or to water down the consequences of unethical competition.

Application B-1: Characterisation and rationalisation of horizontal mergers

Compared to cartels, the characterisation of a merger is relatively straightforward. A *merger* is generally defined as the act (or alternatively process)[59] of combining two or more existing companies into one new company. More specifically, mergers are typically categorised with respect to the position of the merging companies in the value-creation chain (i.e., the production and distribution chain) of a certain product or service. Applying this logic, a *horizontal merger* takes place between two or more parties operating at the same level of the value-creation chain for a certain product, such as, for example, a merger between two producers of televisions. In other words, horizontal mergers take place between producers of goods or services with a high potential for substitution. A *vertical merger*, however, involves companies from different levels of the supply chain of a certain product or service, such as the combination of a producer of televisions with a supplier of input goods for television production (upward vertical integration) or alternatively with a retail chain (downward vertical integration). The third and final category of mergers is the *conglomerate merger*, which involves two or more firms operating in different value creation chains, such as a producer of televisions and a producer of flour (see ICN, 2006: 10ff., for a detailed discussion).

From an antitrust perspective, there is no need to differentiate between mergers and acquisitions in terms of the competitive analysis – although both concentration processes have slightly different meanings from a finance or corporate strategy point of view.[60] From an antitrust perspective, all that counts is the possibility

[59] A merger is, for instance, considered as an act from a law perspective but as a process of integration of two companies from a management perspective.

[60] From the viewpoint of finance theory as well as that of corporate strategy, there seems to be no definition of mergers and acquisitions that researchers and practioners would totally agree on (see Grimpe, 2007: 3ff. for a discussion). However, a popular differentiation of both terms is given as such: "A merger involves the mutual decision of two companies to combine and to become one entity; it can be seen as a decision made by two 'equals'. … A typical merger, in other words, involves two relatively equal companies which combine to become one legal entity with the goal of producing a company that is worth more than the sum of its parts. In a merger of two corporations, the shareholders usually have their shares in the old company exchanged for an equal number of shares in the merged entity. A takeover, or acquisition, on the other hand, is characterised the purchase of a smaller company by a much larger one. This combination of 'unequals' can produce the same benefits as a merger, but it does not necessarily have to be a mutual decision. A larger company can initiate a hostile takeover of a smaller firm, which essentially amounts to buying the company in the face of resistance from the smaller company's management. Unlike in a merger, in an acquisition, the acquiring firm usually offers a cash price per share to the target firm's shareholders or the acquiring firm's share's to

of exercising decisive influence on an undertaking by controlling a substantial part of its assets (and the corresponding voting rights). While a merger certainly fits into that category, the effect of an acquisition depends on the respective scope of investment.[61]

Although these general provisions are applicable for every merger type – horizontal, vertical or conglomerate – the business motivations and the welfare effects can differ substantially between these merger types (see, for example, Mueller, 2004: 66ff.). Consequently, the competitive assessments of these types of mergers often have different emphases on different stages of the analysis, which justifies a separation for an in-depth antitrust analysis. The following paragraphs concentrate solely on the study of horizontal mergers[62]; albeit some of the empirical evidence presented below only refers to mergers and does not allow to extract specific results for horizontal mergers.

The literature studying the business motivations of horizontal mergers has grown to an impressive size – partly reflecting the constant changes of the business landscape and the general innovativeness of private companies to justify their merger plans. Notwithstanding the potential relevance of any of these motivations (see Tichy, 1990, 2001, and DePamphilis, 2003: 19ff. for surveys), the most fundamental and straightforward reason to merge is the expectation to increase profits in some way. The channels of how a merger can lead to such profit increases are again diverse, reaching from an increase in market power (which would allow price increases) via the realisation of cost efficiencies (which would lead to lower production costs and therefore competitive advantages), up to a reduction of management inefficiencies via a market for corporate control[63] (which would lead to the acquisition and restructuring of suboptimally managed firms). Further merger motivations include financial distress, retirement or the realisation of tax advantages (see Viscusi et al., 1997: 202).

From the viewpoint of business economics, the profitability (and therefore the rationality) of a horizontal merger in a simple oligopolistic framework is not as straightforward to prove as economic intuition might suggest. In their seminal work, Salant et al. (1983) studied horizontal mergers in a basic *n*-firm Cournot

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the shareholders of the target firm according to a specified conversion ratio. Either way, the purchasing company essentially finances the purchase of the target company, buying it outright for its shareholders" (Investopedia, 2006: 1).

61 A proposal of what can be considered as a definition of a *substantial part* is given by the German ARC, which defines in §37 Section 1 No. 3 ARC an antitrust relevant concentration as "acquisition of shares in another undertaking if the shares, either separately or in combination with other shares already held by the undertaking, reach a) 50% or b) 25% of the capital or the voting rights of the other undertaking".

62 See RBB Economics (2005b) for a recent report on efficiency-enhancing effects of non-horizontal mergers.

63 Jensen (1988: 23) defines the *market for corporate control* as "the arena in which alternative management teams compete for the rights to manage corporate resources." It is "a healthy market in operation, on both the takeover side and the divestiture side, and it is playing an important role in helping the American economy adjust to major changes in competition and regulation of the past decade."

framework. In such a model, the profits per firm are given by (see section 3.4.1 for the proof):

$$\pi_i^{\text{Premerger}} = \left(\frac{a-c}{n+1}\right)^2 \left(\frac{1}{b}\right). \tag{8}$$

If it is now assumed that *m* of the *n* firms in the industry merge, the industry would consist of (n-m+1) firms post-merger with a profit per firm of

$$\pi_i^{\text{Postmerger}} = \left(\frac{a-c}{n-m+2}\right)^2 \left(\frac{1}{b}\right). \tag{9}$$

A horizontal merger of *m* firms is profitable as long as

$$\left(\frac{a-c}{n-m+2}\right)^2 \left(\frac{1}{b}\right) > m \left(\frac{a-c}{n+1}\right)^2 \left(\frac{1}{b}\right), \tag{10}$$

which leads to the following condition for profitable horizontal mergers in such a basic Cournot world (see also Pepall et al., 2001: 409):

$$(n+1)^2 > m(n-m+2)^2 . \tag{11}$$

Inequality (11) implies that horizontal mergers are not profitable for the merging firms unless the majority of the firms in an industry merge. For instance, if *n*=7 and *m*=4, the merger would not be profitable (64>100, false). The same conclusion is true for *m*=5 (64>80, false). If *m*=6, that is, 6 out of 7 firms in the industry merge, then the merger would be profitable (64>54, true). The economic intuition behind this result is a free-rider effect. Although the decrease in the number of firms raises industry profit and per-firm profit, the merged entity gets a relatively smaller share of the industry. The incentive to merge in this model is solely driven by the achieved reduction in the number of competitors (and therefore competition); however, this advantage is not exclusive to the merging firms but also enjoyed by the non-merging firms in the market. Consequently, only a merger including most firms in the market sufficiently internalises this effect to make a merger profitable. Methodologically, Salant et al.'s basic result constituted a so-called *merger paradox*, suggesting that most horizontal mergers are typically unprofitable. They are nevertheless frequently observed in reality.

In the aftermath of this study, substantial resources were invested into follow-up research on the rationality of horizontal mergers and the demystification of the merger paradox. The most immediate way of resolving the paradox in general is to replace one or more of the critical assumptions of the basic model. Pepall et al. (2001: 413ff.), for instance, show that the merger paradox can be resolved by assuming that the merged company acts as a Stackelberg leader. However, such a model creates a second merger paradox, as now all two-firm mergers lead to lower prices for consumers and consequently would make two-firm merger control obsolete. However, as Pepall et al. show, this second paradox can be resolved by introducing several industry leaders and several followers. In such a model, prices to consumers will fall post-merger as long as $L<N/3-1$, where L stands for the number of leaders and N for the number of firms in the market.

In addition to the changes in the model type (i.e., from Cournot to Stackelberg models), Huck et al. (2005) find that relaxing other assumptions of Salant et al. (1983), such as quantity competition (Deneckere and Davidson, 1985), linear demand (Cheung, 1992), complete information (Amir et al., 2004) or mere profit maximisation (Huck et al., 2004) can also explain why horizontal mergers can be profitable and therefore solve the merger paradox.[64]

Complementary to these research efforts within the world of horizontal mergers without cost advantages, there are at least two additional research strands which contribute to the question of possible business motivations for horizontal mergers. The first strand analyses horizontal mergers with cost efficiencies. Given the fact that mergers can be profitable even without generating any cost efficiencies, no further discussion is needed to conclude that mergers *with* such cost efficiencies can also have this potential to increase profits for the merging firms (see section 2.3.2 for a welfare assessment).[65]

The second additional strand of research on the motives for mergers deviates from the assumption that mergers aim at maximising profits and instead explains merger activity by behavioural theories. Tichy (2001: 368) differentiates this group of merger explanations into approaches in which the manager incorrectly believes to be better able to manage the target (hubris hypothesis); the manager believes in the superior quality of management's investment decisions relative to those of the shareholders (free cash flow hypothesis); and the manager acts to get personal advantages (empire-building hypothesis).

Although the information problems caused by the separation of ownership and control can indeed provide managers with some flexibility in following their own personal interests, Fauli-Oller and Motta (1996) show that the owner's side may also have incentives to remunerate managers not only with respect to increases in profits but also with respect to increases in firm size. If the manager is confronted with such an incentive scheme, he may promote even unprofitable mergers, because such mergers still lead to increases in firm size and may therefore be profitable for the manager individually.

Although the behavioural theories on why mergers occur have been quite successful in explaining M&A activity (see Shleifer and Vishny, 2003; Gugler et al., 2005), their antitrust relevance is rather limited. It is not particularly interesting for antitrust policy whether a proposed merger is probably unprofitable and

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64 Huck et al. (2005: 14) conclude that "many strategic interactions other than the one considered in the quantity-setting Cournot game are profit relevant, like the role of the internal organisation of the firm or strategic interaction with other players such as governments or input suppliers, can render merger profitable in the absence of synergies or production efficiency effects. It is important for competition policy to take these factors into consideration, as, unlike cost savings or synergies, these profitability-increasing factors are less straightforward to evaluate from a welfare point of view."

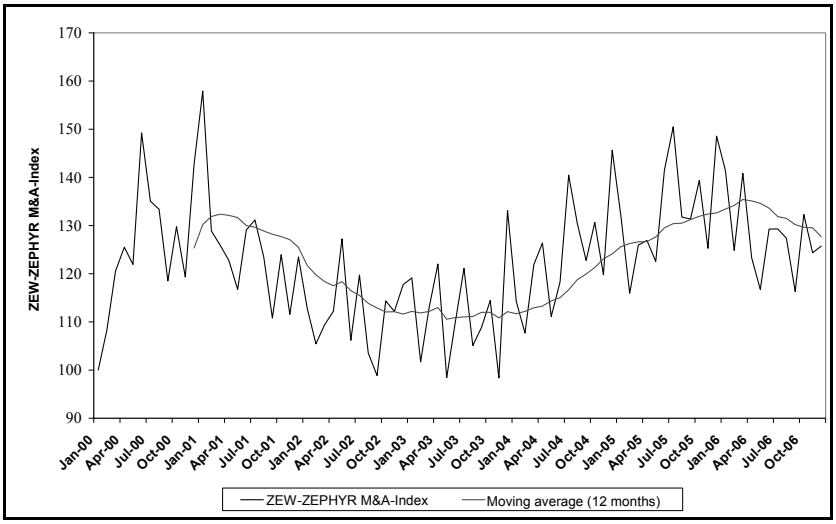
65 An answer to the question of how these cost advantages are translated into profits depends on the intensity of competition in the market (measured, for example, by demand and supply elasticities) and the sustainability of the respective cost advantages.

largely driven by managerial discretion or managerial hubris; all that counts for an antitrust assessment are the competitive effects and the corresponding welfare implications of a proposed merger.[66] Nevertheless, although these alternative merger motives might not be of substantial relevance for strategic antitrust considerations (or actual case work), the well-proven theoretical and empirical fact that they play a significant role in the development of merger waves (see Box 6) make them an important indicator for corresponding 'waves of antitrust enforcement' and therefore help the antitrust authority to estimate the expected workload and resources needed.

Box 6. The existence and determinants of merger waves

The phenomenon of *merger waves* – periods of low M&A activity followed by periods of high M&A activity – can be observed for more than a century now. Bittlingmayer (1985) and Banerjee and Eckhard (1998), for example, studied the first big merger wave in the United States from 1897 to 1903. The general phenomenon of merger waves, however, is also reflected in more recent data. Figure 10 shows the worldwide ZEW-ZEPHYR Mergers & Acquisitions index from January 2000 to December 2006.

Fig. 10. Worldwide ZEW-ZEPHYR M&A index (2000-2006)



Source: ZEPHYR-Database, Bureau van Dijk Electronic Publishing (BvDEP), ZEW calculations. The index is calculated on the basis of both the number and the volume of mergers and acquisitions concluded worldwide, as recorded in BvDEP's ZEPHYR Database. The index uses the monthly rates of change of both the number

66 However, when it comes to the investigation of merger efficiencies in a case, knowledge on the real motivation of the merging parties might help to investigate efficiencies more closely.

and volume of M&A transactions, combined and adjusted for volatility (see Grimpe, 2007, for a detailed documentation of the index).

As shown in Figure 10, M&A activity peaked in 2000 and early 2001, then experienced a downturn until mid-2003, followed again by an increase in M&A activity until early 2006. The economic determinants of such merger waves were recently investigated empirically by Gugler et al. (2005). The authors basically test four hypotheses to explain merger waves, two neoclassical – namely, 'industry shock theory' and '*q*-theory', which are based on typical assumptions, such as managers maximising profits, mergers creating wealth and efficient capital markets; and two behavioural – namely, 'overvaluation' and 'managerial discretion', which both relax the neoclassical assumptions in a number of ways. Although Gugler et al. (2005) find some support for each of the four hypotheses, most of the evidence favours the two behavioural hypotheses as explanations of why merger waves occur.

In addition to the described theoretical research on the business motivations of horizontal mergers, a huge number of empirical studies aim at investigating this relationship. Mueller (1996) provides a survey of the literature and differentiates between the effects of mergers on profitability, market share and growth, as well as share prices (see also Pautler, 2003, for an alternative review of the empirical literature). As explained above, from a neoclassical perspective, mergers are expected to raise the merged firms' profits, either through increased market power or by superior efficiency. As a consequence, successful mergers should result in market share growth, firm growth and increases in share prices. Share prices do not only reflect current profits but also include future profit expectations. Consequently, a merger that is considered as successful by the market should coincide with increasing share prices (while the share prices of direct competitors are expected to experience a decline).

Following the literature review by Mueller (1996: 432ff.), empirical evidence cannot provide clear support for one of the effects predicted by the neoclassical theories. The effect of mergers on *profitability* were found to be negative for the United States (see Ravenscraft and Scherer, 1987), the United Kingdom (see Meeks, 1977), the Netherlands (see Peer, 1980) and Sweden (see Ryden and Edberg, 1980), while a positive relationship was found for Japan (see Ikeda and Doi, 1983) and Canada (see Baldwin, 1991).

In terms of the effect of mergers on *market growth*, studies for Australia (see McDougall and Round, 1986), Belgium (see Kumps and Wtterwulghe, 1980), France (see Jenny and Weber, 1980), Germany (see Cable et al., 1980), Sweden (see Ryden and Edberg, 1980) and the United Kingdom (see Cosh et al., 1980) show no significant effect, while studies for the United States (see Mueller, 1980) and the Netherlands (see Peer, 1980) even show a significant decline in market growth post-merger. In terms of *market shares*, the empirical results find almost unanimously that market shares of the merging firms decrease post-merger (see Mueller, 1985; Baldwin and Gorecki, 1990; Stewart and Kim, 1993). [67]

[67] The message of most of the empirical studies on the effect of mergers coincide with the practical experience of Luke Froeb, a former antitrust enforcer at the US Federal Trade Commission: "In some mergers the value created is obvious and well docu-

Finally, studies on the effect of mergers on *share prices* have to be considered as part of an overview of empirical studies. The typically found pattern shows that the acquiring firm's share price declines and the acquired firm's share price rises after the merger plan has been announced and completed. One economic explanation for such a finding is that the share prices of both companies reflect the premium that the acquiring firm usually pays to the shareholders of the acquired firm. Mueller (1996) finds that, because acquiring firms are typically much larger than acquired firms, the relative sizes of the two diametric effects differ. In particular, the acquired firm shareholders were able to fully offset the loss realised by the acquiring firm shareholders, leading to the conclusion that mergers produce a net increase in wealth (see Mueller, 1996: 434; Mueller, 1980). In a more recent survey article, Andrade et al. (2001: 109ff.) confirm the basic result of Mueller. They find that, based on a data set of 1864 US mergers from 1990 to 1998, the acquiring firms experienced abnormally negative returns (about 1,0% during a three-day window around the announcement, and about 3,9% during a longer window, from twenty days prior to the announcement through the closing of the merger deal). The target firms, in contrast, showed an abnormally positive return of about 15,9% during the three-day window and 23,3% during the longer window, leading to combined firms' gains of about 1,4% over the short window and about 1,6% over the long window (see also Kaplow and Shapiro, 2007: 75f., for a general overview).

2.3.2 Welfare Effects

After delineating the business conduct and assessing its business motivations, the consequential next step is to evaluate the respective conduct from a welfare perspective. An important precondition for such an assessment is the definition of a welfare standard (see Carlton, 2007; Farrell and Katz, 2006; Heyer, 2006; Salop, 2005; Schmidtchen, 2005). In antitrust policy there is typically a choice between two 'pure'[68] welfare standards: the total welfare standard and the consumer welfare standard. The total welfare standard evaluates a conduct simply by its efficiency effect on the sum of producer and consumer surplus. As a consequence,

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mented, but for a surprising number the analysis is nothing more than a litany of excuses copied out of a corporate strategy textbook to justify the deal to the board of directors" (Froeb, 2006: 1).

[68] The word *pure* indicates that also *weighted* welfare standards could be applied in practice. For example, Ross and Winter (2005: 487ff.) report that in the Superior Propane (2000) case in Canada (see Box 8 below for a short general case description), the Court of Appeals demanded a balancing weights approach for merger decisions. Following Ross and Winter (2005: 488), this approach first determines the change in consumer surplus ΔCS caused by the merger and the change in profits ΔPS. In the next step, the weight w that would lead to a zero weighted average of the change in surplus, $w*\Delta CS+(1-w)*\Delta PS$, must be calculated. In the last step, it has to be decided whether the resulting w is greater or less than a critical value w'.

such a standard is *consciously* blind with respect to the distribution of the overall surplus between producers and consumers (see Motta, 2004: 18). That is, even if a certain conduct would cause substantial losses in consumer surplus[69], an antitrust authority which follows a total surplus standard should not intervene as long as the corresponding increase in producer surplus can be expected to compensate or overtop the losses of the consumers and therefore lead to the same or a higher overall welfare level. However, it is important to remark in this respect that promoting a total welfare standard by no means justifies the conclusion that economists generally do not care about distributional issues. It is more that most economists believe that "there is a natural division of labor between efficiency-oriented policies and policies aimed at improving the distribution of income … A number of reasons suggest that antitrust policy is poorly suited as a redistribution vehicle in comparison with various tax and subsidy schemes" (Farrell and Katz, 2006: 11). If antitrust policy focuses on overall surplus, then other public policy can follow the aim of redistributing that surplus (see Kaplow and Shavell, 1994, for a detailed assessment).

On the other hand, if antitrust policy follows a consumer welfare standard, the antitrust authority would have to intervene against any conduct that leads to a reduction in consumer surplus. This would, for instance, result in the prohibition of every horizontal merger that is expected to lead to an increase in price. From a static perspective, an antitrust authority which aims at minimising the deadweight loss indeed has a reason to focus on consumer welfare, as the maximisation of consumer welfare coincides with a minimisation of the deadweight loss (see Canoy et al., 2004: 211). However, apart from obvious objections against such a standard, such as its disregard of fixed costs, Motta (2004: 21) argues that from a dynamic perspective, the producer surplus is just another form of consumer surplus, and therefore a total surplus approach would be the appropriate standard for antitrust policy. In the words of Kaplow and Shapiro (2007: 88), "[p]roducers have owners who are people, just like final customers". And although for many types of business conduct, a change in the welfare standard would not change the welfare (and policy) conclusions fundamentally (see Schmidtchen, 2005: 15; Carlton, 2007: 4), a pure consumer welfare standard has to accept its potential to harm overall welfare, for example, by banning any price-increasing horizontal mergers although the merging parties would have been able to compensate the consumers with their merger-induced gains in productive efficiency.[70] Further-

[69] The standard textbook example considers a monopolist who is able to introduce perfect price discrimination; that is, every customer pays exactly its reservation price for the good. As a consequence, the consumer surplus is zero while the producer surplus is maximised. However – as the monopolist serves every customer who is willing to pay at least the opportunity cost of production – perfect price discrimination reaches the same market performance level as perfect competition. Both market results simply differ in the distribution of rents between consumers and producers.

[70] Following the basic idea of the Kaldor-Hicks criterion, a certain action is desirable if it would be possible (and profitable) for the winners (e.g., the producers) to compensate the losers (e.g., the consumers).

more, as sketched in Box 7, focusing on consumer surplus at the antitrust authority level may indirectly still serve the ultimate antitrust goal of maximising total surplus.

Box 7. How focusing on consumer surplus may help to maximise total surplus

Farrell and Katz (2006) propose to assess the question of the appropriate welfare standard by focusing on basically two questions: First, what should be antitrust policy's ultimate goal? And second, what objectives should specific agents such as the antitrust authorities and the courts apply in their enforcement decisions? They conclude that although the total welfare standard is the appropriate ultimate goal for antitrust policy, the case for basing enforcement decisions on an analysis of total surplus is far less clear. The authors argue that the antitrust enforcement process contains multiple steps with multiple decision makers, and therefore "a full discussion of what standard is or should be applied must specify by whom and how it fits in the overall process. For several reasons … it may be optimal to have specific agents within the broader system act to maximise a different objective (e.g., consumer surplus), even when the ultimate goal of antitrust policy is to maximise total surplus" (p. 2). One essential argument to back up this finding is that the tougher consumer welfare standard can act as a counterweight to the firm's informational advantages and lobbying activities during the merger control procedure (see also Besanko and Spulber, 1993; Neven and Röller, 2006).

In the remainder of this work, a total welfare standard is primarily applied. However, whenever it can be expected that the welfare standard is crucial for policy conclusions – such as in the evaluation of horizontal mergers and predation – interpretations from the point of view of consumer welfare standard will be provided as well.

After clarifying the applied welfare standard, the respective business conducts can be evaluated for their effects on total welfare. In particular, theoretical as well as empirical evidence has to be collected in order to come to conclusions whether the business conduct at hand has:

- Generally anticompetitive potential, which would speak for per se prohibition;
- Probably anticompetitive potential, which would speak for the development of criteria which allow differentiating between pro- and anticompetitive effects; or
- Likely no anticompetitive potential, which would speak for per se legality.

This broad delineation – derived by characterising and evaluating forms of business conduct – is of paramount importance for the further proceedings within the integrated approach.[71] On the one hand, in the case of per se prohibitions, it is

[71] Whinston (2006: 19) confirms this importance: "While a per-se rule simplifies judicial administration, legal complexities still arise whenever the courts are called upon to decide whether a novel set of facts should in fact be called "price fixing". Historically, this categorisation process has seemed in many cases to take on a particularly semantic nature (as in, do the words "price fixing" describe this behaviour?). The real issue is whether the practice seems to be one for which a per-se approach seems ap-

extremely important to delineate and to characterise the respective business conduct as clearly as possible to give clear signals to firms what kind of conduct is banned and what happens if firms do not comply with these rules. For the antitrust authority the basic challenge will be to detect offences against per se prohibitions. On the other hand, if a business conduct has diverse welfare effects, then it is especially important to provide a basic framework of analysis which sets up the necessary investigation steps in order to come to a conclusion whether the pro- or anticompetitive effects are dominant in the case at hand. For the antitrust authority, such an approach creates considerable complexity and administrative discretion in the development of antitrust decisions. As a consequence, the firms have to cope with a considerable uncertainty about the legality of their business plans.

Application A-2: Welfare effects of hard core cartels

Given the assessment of the business motivations for hard core cartels in section 2.3.1, an assessment of the welfare effects seems to be obvious: A perfectly functioning hard core cartel (involving all firms in the market) leads to the same market outcome as a monopoly and therefore causes similar types and degrees of allocative, productive and dynamic inefficiencies (see section 2.2.1 for a general discussion). Additionally, hard core cartels usually[72] do not create any kind of benefits to society which could be traded-off against the anticompetitive effects from an antitrust perspective.[73] As a consequence, contemporary hard core cartels

propriate. Of course, for this, a least a quick look at the underlying economic facts is necessary".

72 One argument against the allegation could be that cartels have an incentive to shift production to the firm with the lowest production costs and probably to close inefficient plants (see Whinston, 2006: 25). Although correct from a theoretical perspective, there appears to be no significant evidence that such a practice is actually exercised within real hard core cartels. On the contrary, quota systems applied by cartels often hinder more efficient producers to expand their production, and a cartel is therefore likely to cause productive inefficiencies. As a consequence, dynamic inefficiencies would likely arise given the interfered process of replacing old technologies by new technologies.

73 This is an essential difference between hard core cartels and joint ventures. Although both types of agreement can be interpreted as cartels following the broad definition of Carlton and Perloff (Definition 1 above), joint ventures typically bring benefits to society, for example in the form of developing superior products (at lower cost) by pooling research and development efforts. Furthermore, because joint ventures are often founded in the research and development phase of a product, there is not yet a product market in which the joint venture could increase market price; hence there is no immediate harm as diagnosed in case of hard core cartels. If, however, joint ventures are planned in already existing product markets, for example, by founding some kind of marketing joint venture, then hard core cartels and joint ventures become similar, and consequently also joint ventures might raise similar competitive concerns (see Schulz, 2003: 137ff.; Werden, 1998b).

are a prime example for a per se prohibition irrespective of the particular characteristics of the industry, product or type of agreement.

Despite this clear statement with respect to the welfare effects of hard core cartels, a simple game-theoretic reasoning suggests that antitrust bans (and antitrust enforcement) against such cartels may be unnecessary, because firms will typically fail to stabilise cartel agreements and, hence, the negative welfare consequences predicted above would not materialise. The basic argumentation is exemplified in Table 8 for a simple duopoly model.

Table 8. Payoffs to cartelisation and competition in a duopoly game

		Strategy of firm 2	
		Cartelisation	Competition
Strategy of firm 1	Cartelisation	$\frac{(a-c)^2}{8b}, \frac{(a-c)^2}{8b}$	$\frac{3(a-c)^2}{32b}, \underline{\frac{9(a-c)^2}{64b}}$
	Competition	$\underline{\frac{9(a-c)^2}{64b}}, \frac{3(a-c)^2}{32b}$	$\underline{\frac{(a-c)^2}{9b}}, \underline{\frac{(a-c)^2}{9b}}$

Table 8 shows the payoffs (i.e., profits) to cartelisation and competition in a simple duopoly game (see Annex 6.6.2 for the proofs). A comparison of the respective payoffs in the four possible states reveals that competition is the dominant strategy for both firms. Although both firms realise that they would achieve a higher profit in the cartelisation state, they also realise that the rival firm has a substantial profit incentive to cheat on such a collusive agreement. As both firms anticipate this possibility (as well as the negative consequences for their own profit), it is the dominant strategy for both firms not to cooperate. The subsequent policy conclusion would be that, although cartel agreements in theory harm social welfare, it is not necessary to consider antitrust bans or even antitrust actions against them, as firms typically fail to stabilise such agreements anyway.

The diagnosed chronic instability of cartels in one-shot games is basically caused by a lack of trust between the two companies. Although it is admittedly hard to establish trust in one-shot games, it is also hard to believe that one-shot games are a suitable description of real markets. Typically, firms meet regularly in markets (or even in a couple of markets) and this repeated interaction creates possibilities to stabilise cartel agreements.

Although it cannot be the aim of this section to give a comprehensive overview of possible strategies to stabilise cartels (see, e.g., Schulz, 2003, and Feuerstein, 2005, for surveys), it is straightforward to characterise the consequences of repeated interaction generally (with an indefinite time horizon or unknown end of

the market). Imagine that the duopoly game characterised above is played infinitely. It is then possible to show that the incentive to cheat depends on the discount factor δ (see Annex 6.6.3 for the proof):

$$\delta \geq \frac{\pi^{\text{Defect}} - \pi^{\text{Cooperation}}}{\pi^{\text{Defect}} - \pi^{\text{Non-Cooperation}}}. \quad (12)$$

For example, inserting the payoffs of the simple duopoly model above leads to a critical discount factor of about 0,53 which must be met to stabilise the cartel agreement (see Annex 6.6.3 for the proof).[74] In other words, as long as the discount factor is sufficiently high (i.e., the firms are sufficiently patient and value future profits to a sufficient extent), deviation does not pay for either firm and the agreement is therefore stable. Furthermore, repeated interaction gives cartel members the opportunity to implement effective punishment strategies for cheaters which also reduce the incentives to deviate and therefore stabilise the cartel.

An additional theoretical argument why cartels could be doomed to fail refers to the harmed customers of the cartel members and basically asks why this group does not react to the formation of a cartel with the formation of a coalition which aims at prompting the cartel members to end their agreement. Although the customers typically have incentives to form such a coalition, the existence of transaction costs often forecloses its actual formation. Especially the often huge number of customers of a cartel – with diverging interests and substantial free-rider problems – speaks against the practicability of such proposals as an effective deterrent against cartelisation (see von Weizsäcker, 1995: 2736f.) and for the use of the transaction-cost advantages of (antitrust) interventions by the state.

In addition to theoretical research, empirical studies have shown that firms can indeed manage to form and to stabilise cartels for relatively long periods. In addition to the cases already sketched in section 2.2.3.2 and Annex 6.1, Table 9 provides case study evidence of several successful cartels across different industries.

As shown in Table 9, cartels can not only be successful in maintaining their agreements over long time periods but often also manage to overcome cartel crises, such as market entry of new firms or the emergence of dispute among existing cartel members (see Levenstein and Suslow, 2004, for a comprehensive overview).

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74 Although the supergame analysis assumes an indefinite time horizon, it is possible to show that uncertainty about the duration of the market leads to the same results. If the future of the market is uncertain, the discount factor is relatively low leading to fewer cartels. In mature markets with a clearly defined future potential, the discount factor is relatively high leading to more cartels.

Table 9. Cartel duration – Selected case studies

Industry	First year of cartel	Average length of cooperation in industry (in years)	Number of distinct episodes of cooperation	Maximum length of cooperation (in years)	Minimum length of cooperation (in years)
Beer	1933	9	1	9	9
Bromine	1885	6,5	4	10	3
Cement	1922	40	1	40	40
Diamonds	1870s	60	2	100	20
Electrical Equip.	1950	8	1	8	8
Mercury	1928	25	2	28	22
Ocean shipping	1870s	51	3	54	50
Oil	1871	2	3	3	1
Parcel Post	1851	28,5	2	40	17
Potash	1877	9,4	8	20	1
Railroad	1875	3,8	6	8	1
Railroad Oil	1871	7	5	30	0
Rayon	1932	8	1	8	8
Steel	1926	7,25	4	13	4
Sugar	1887	6,75	4	10	2
Tea	1929	3,5	2	6	1

Source: Levenstein and Suslow (2004: 61).

Although cartels typically fail to reach the outcomes of a hypothetical single monopolist – given the existence of cartel outsiders or remaining forms of non-price competition (which keep up some competition) – they often manage to raise prices significantly above competitive levels. Audretsch (1989), for instance, found significantly elevated market prices for a sample of cartels in Western Germany. Connor and Lande (2006) collected average overcharges of six economic surveys consisting of more than 100 cartels (in sum) which are presented in Table 10.

As shown in Table 10, the average cartel overcharges differ considerably among the different empirical studies. Levenstein and Suslow (2004), for instance, calculate an average overcharge (mean) of 43%, while Werden (2003) finds 21% and the OECD (2003) 15,75% for the average overcharge (mean). The total average of all studies shows a mean of 30,7%. As already mentioned in section 2.2.3.2, the deadweight losses caused by cartels typically adds between 10% and 30% of the overcharges in order to receive the total customer losses due to cartelisation. Although these customer losses are significant and therefore provide a sound basis for antitrust actions against cartels, it has to be kept in mind that a pure total welfare standard is not interested in the higher prices paid by customers but only in those customers who refrain from buying the good at the elevated price and would have bought it at the competitive price.

Table 10. Summary of six economic surveys on cartel overcharges

Reference	Number of cartels	Average overcharge	
		Mean (%)	Median (%)
Cohen and Scheffman (1989)	5-7	7,7-10,8	7,8-14,0
Werden (2003)	13	21,0	18,0
Posner (2001)	12	49,0	38,0
Levenstein and Suslow (2004)	22	43,0	44,5
Griffin (1989)	38	46,0	44,0
OECD (2002)	12	15,8	12,75
Total (simple average)	*102-104*	*30,7*	*28,1*
Total (weighted average)	*102-104*	*36,7*	*34,6*

Source: Connor and Lande (2006: 1004).

Application B-2: Welfare effects of horizontal mergers

From a welfare perspective, at first sight, there seems to be no fundamental difference between cartels and mergers. Whether two firms in a three-firm industry form a cartel or merge seem to make, ceteris paribus, no fundamental difference from a welfare point of view.[75] However, there are at least two basic justifications why mergers should be treated differently. First, from an economy and industry-level perspective, mergers and acquisitions are an important instrument[76] for facilitating changes in industry structures, which may have become necessary because of technological changes, globalisation, commoditisation, low or high growth, chronic excess capacity, fragmentation, price volatility, demand shifts, new entries or deregulation (see Weston, 2001: 397, for the complete list as well as industry examples). Second, from a product market perspective, mergers differ from cartels because mergers *regularly* contain the possibility of increasing welfare by the realisation of so-called merger efficiencies. As discussed in more detail in section 2.3.3.1, one prominent way to realise such efficiencies by a horizontal merger is generally through cost efficiencies, such as economies of scale or economies of scope, which allow the merged company to produce the product(s)

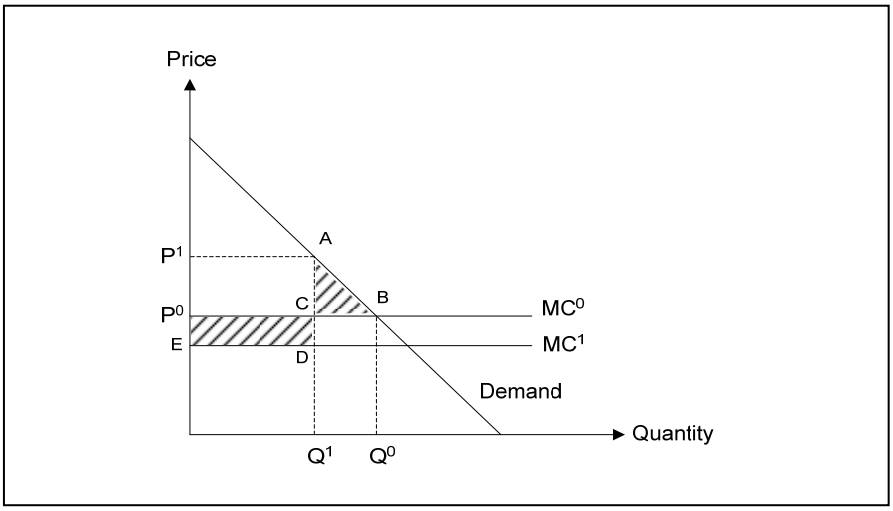
75 From a business perspective, the merger would probably be the preferred option as it would solve the stability problems faced by cartel agreements. Historically, the prohibition of cartels in the United States by the Sherman Act in 1890 led to a first big merger wave, indicating that mergers were considered as the next-best alternative to cartels. See section 2.2.2 as well as Evans (2005: 5).

76 Following Weston (2001: 399f.), it would be myopic to view mergers as the only adjustment process. Weston identifies three general methods for value growth, namely expansion (such as merger, tender offer, joint ventures, alliances, investments and licensing), restructuring and reorganisation (such as divestitures, equity carve-outs, spin-offs, tracking stock, changing of organisation structure and reformulation of value-based management system) and financial engineering and governance strategies (such as write-offs, exchange offer, share repurchases, leveraged buyouts, employee stock ownership plans and takeover defenses).

cheaper than before the merger. An alternative source of such efficiencies may be realised via the combination of R&D assets, which allows an easier knowledge transfer and greater research output (probably combined with a reduction in fixed costs).

Taking such efficiencies into account leaves a horizontal merger with basically two opposite potential welfare effects: On the one hand, the inevitable increase in market concentration contains the imminent danger of making post-merger price increases profitable. If the underlying welfare standard is consumer surplus, such a price increase post-merger would allow the conclusion that the merger is reducing welfare. On the other hand, the creation of merger-specific efficiencies would allow the merged entity to reduce costs and to increase their profits. If the underlying welfare standard is total welfare, such an increase in producer surplus realised by the reduction in marginal costs has to be traded off with the (deadweight) welfare losses caused by the increase in price. This so-called 'Williamson trade-off' is sketched in Figure 11.

Fig. 11. 'Trading off' price increases with production cost reductions



Starting from a competitive pre-merger situation where price equals marginal costs, it is assumed that a merger in the respective market would allow a price increase from P^0 to P^1, causing the typical deadweight loss triangle ABC and the shifting of a fraction of consumer surplus to producer surplus (rectangle P^1ACP^0). However, if the merger would also allow the merging parties to reduce the marginal costs from MC^0 to MC^1, the welfare triangle loss has to be compared with the rectangle gain of a more efficient production. As long as the rectangle is larger than the triangle, a merger would raise total welfare even though the consumers have to pay a higher price. To put it differently, even if the merged entity raises the price post-merger it is still possible that such a merger increases total welfare as long as the realised efficiencies are large enough.

The specification 'large enough' can be derived directly from the simple Williamson trade-off argument represented in Figure 11. In this setting, a merger is not harming social welfare as long as the merger-induced gain of efficiency (rectangle A_2: P^0CDE) is at least as big as the merger-induced allocative inefficiency (triangle A_1: ABC). This trade-off can be expressed formally as follows (see Williamson, 1968: 21ff.; Viscusi et al., 1997: 222f.): The size of the triangle is given by $A_1 = 1/2(\Delta P)(\Delta Q)$, with $\Delta P = P^1 - P^0$ and $\Delta Q = Q^0 - Q^1$. The size of the rectangle is given by $A_2 = (\Delta AC)Q^1$, with $\Delta AC = P^0 - E$. Using the general definition for the demand elasticity ε_D and some algebraic manipulations leads to the following expression for triangle A_1:

$$A_1 = \frac{1}{2}\frac{(\Delta P)(\varepsilon_D Q_0 \Delta P)}{P^0}. \tag{13}$$

Setting $A_1=A_2$ immediately leads to

$$(\Delta AC)Q^1 = \frac{1}{2}\frac{(\Delta P)(\varepsilon_D Q_0 \Delta P)}{P^0}. \tag{14}$$

As $AC^0=P^0$, dividing the left side by $(AC^0)Q^1$ and the right side by P^0Q^1 leads to

$$\frac{\Delta AC}{AC^0} = \frac{1}{2}\varepsilon_D\left(\frac{Q^0}{Q^1}\right)\left(\frac{\Delta P}{P^0}\right)^2. \tag{15}$$

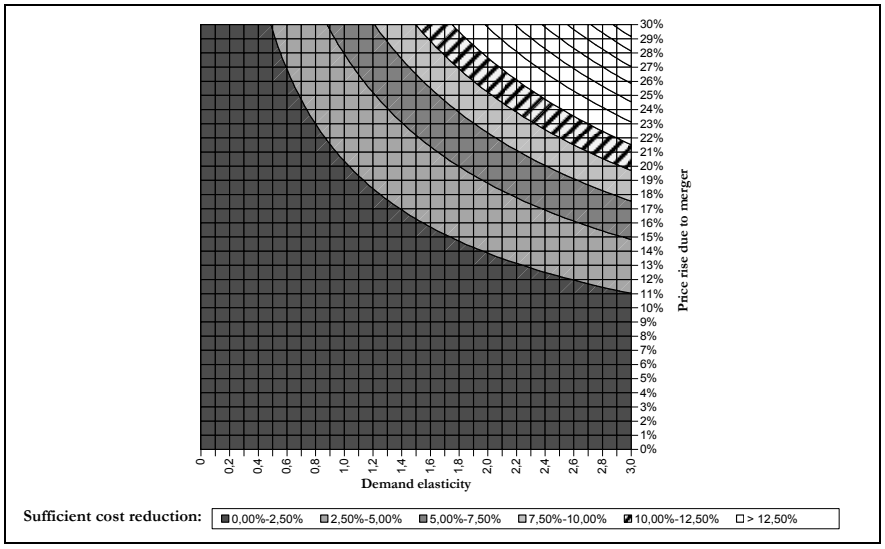
Assuming a constant-elasticity demand curve leads to the following equation for $\left(\frac{Q^0}{Q^1}\right)$:

$$\left(\frac{Q^0}{Q^1}\right) = \left(\frac{1}{1+\frac{\Delta P}{P^0}}\right)^{\varepsilon_D}. \tag{16}$$

Using Equation (16), for ε_D=-1,0, $(\Delta P/P)$=0,2, we get (Q^0/Q^1)=1,2 and therefore $(\Delta AC/AC^0)$=0,024 by inserting into Equation (15). The results for variable values of price increases and demand elasticities are depicted in Figure 12 (and in Table 48 of Annex 6.7).

As shown in Figure 12, the sufficient cost reduction for price increases of up to 11% lies between 0,00% and 2,50%. However, a price increase of, for instance, 20% at a demand elasticity of 2,0 can be compensated by a cost reduction in the range of 5,00% to 7,50% (the exact value is 5,76%; see Table 48 in Annex 6.7). In general, Figure 12 indicates that relatively small cost reductions can compensate for the allocative inefficiency caused by higher prices. However, as it will be shown in section 2.3.3.1, the 'sufficient percentage cost reduction' can increase substantially if other forms of demand are analysed.

Fig. 12. Sufficient percentage cost reduction to offset a merger-induced percentage price increase for different demand elasticities



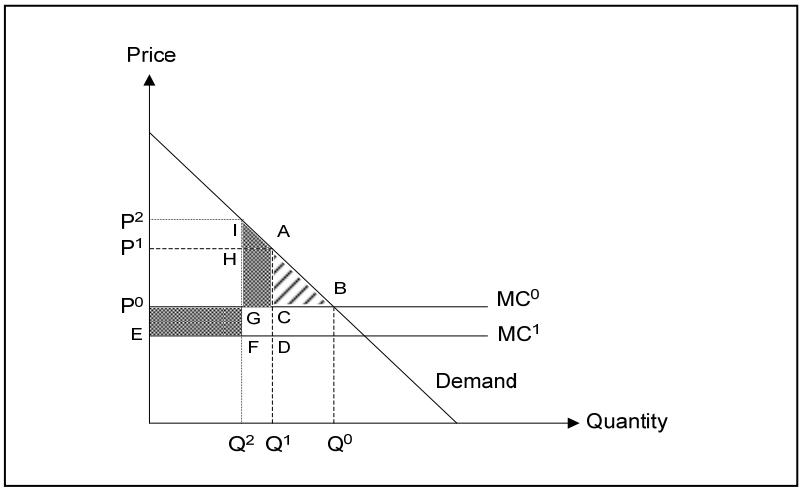
Given the simplicity of the basic trade-off analysis, it is not surprising that the generality of its results has been questioned. Apart from somehow natural assumptions, such as a total welfare standard or the concentration of post-merger price changes (while ignoring other potentially relevant competition variables such as capacity investment, R&D or product quality), Whinston (2006: 60ff.) identifies additional more profound assumptions in Williamson's model set-up, which may become critical with respect to the results and therefore to policy conclusions. First, Williamson's analysis is based on the assumption that the pre-merger price is competitive. If, however, the pre-merger price already exceeds marginal cost, the deadweight welfare loss is significantly larger. The policy consequences of not considering these differences are shown in Box 8 for a merger-to-monopoly in Canada. Second, the basic trade-off analysis does not take account of differences in marginal costs between firms. Such an assumption is likely critical as it ignores the welfare implications of shifting production between firms with different marginal costs. In this respect, the basic trade-off analysis simply compares the isolated effect of a price increase with the isolated effect of a productivity increase and thereby ignores the possibility that the realisation of merger-specific efficiencies typically provides incentives for the merged entity to reduce post-merger quantities to a lesser extent than initially assumed. As will be shown in section 2.3.3.1, if the merger efficiencies are sufficiently large, the merged entity even has incentives to increase post-merger production leading to a decrease in post-merger prices.

Box 8. Miscalculation of deadweight loss in Superior Propane (2000)

One critical assumption of the basic welfare trade-off argument is that the pre-merger price equals marginal cost (i.e., the merger takes place in a perfectly competitive industry). However, as discussed for example in Whinston (2006: 60ff.), if the pre-merger price exceeds marginal cost, the deadweight loss caused by the merger becomes significantly larger, as shown in Figure 13.

The figure shows that the basic welfare trade-off argument – applied from the pre-merger price P^1 – would compare the increase in productive efficiency (rectangle P^0GFE) with the increase in allocative inefficiency (triangle AHI). However, given the fact that the pre-merger price P^1 was already above the competitive price P^0, the rectangle ACGH is also part of the allocative inefficiency caused by a price increase post-merger from P^1 to P^2 and must – together with triangle AHI – be traded-off against the increase in productive efficiency given by the rectangle P^0GFE.

Fig. 13. Williamson's welfare trade-off when pre-merger price exceeds marginal cost



According to Ross and Winter (2005), the *Superior Propane* case in Canada (*Commissioner of Competition v. Superior Propane Inc*., [2000] C.C.T.D. No. 1) provides an excellent opportunity to show that estimates of pre-merger market power are of paramount importance for the estimation of the welfare impact of a merger. In 1998, Superior Propane announced its intent to buy all shares of the Chancellor Holdings Cooperation, the owner of ICG Propane. An initial antitrust assessment signalled that the merger would result in a merger-to-monopoly in many regional markets for the distribution of propane in Canada. However, during the investigations on the case, evidence was accepted by the court which showed that the merger would lead to cost savings of $29 million per year over a ten-year horizon, while the deadweight loss (caused by an estimated price increase of 9%) was estimated to only $3 million per year. Consequently, following a total surplus standard, the merger would enhance welfare and should be approved.

However, as explained by Ross and Winter (2005: 495ff.), the relatively small deadweight loss estimate of $3 million per year applied in the calculation only considered the small triangle AHI in Figure 13 and missed out including the additional deadweight loss represented by rectangle ACGH. Following an estimation by Ross and Winter (based on an absolute market demand elasticity of 1,5, absolute individual firm demand elasticities of 3 and a post-merger price increase of 9%), the correct deadweight loss would have been 8,5 times larger than the actual estimate of $3 million used in the trial. In other words, the correct measurement of the deadweight loss probably would have led to the immediate conclusion that the merger is likely to be anticompetitive (as $3 million x 8,5= $25,5 million comes close to the estimated cost savings of $29 million per year). However, given the initial results in favour of the merger-to-monopoly, the case caused a remarkable discussion of the appropriate role of efficiencies / welfare standard in merger control which has not yet come to an end.

Partly based on the criticism of the basic welfare trade-off model, scholars have investigated the 'market power-efficiency trade-off' of horizontal mergers in oligopoly models. Probably the most influential contribution is by Farrell and Shapiro (1990), who analyse the effects of horizontal mergers on consumer welfare and total welfare in a Cournot model with cost asymmetries.

With respect to the effects of a horizontal merger on *market prices* (i.e., consumer welfare), Farrell and Shapiro (1990) find that in the absence of synergies, horizontal mergers necessarily lead to an increase in price even if the reallocation of production from less efficient to more efficient production facilities within the merged entity is taken into account. Furthermore, even if merger-specific synergies exist (which lead to a downward shift of the cost curve), the model shows that the post-merger firm's marginal cost must fall substantially in order to lead to price decreases post-merger (see section 2.3.3.1 for a quantification).

In order to study the *total* welfare effects of horizontal mergers, Farrell and Shapiro (1990) develop the concept of the *net external effect*. The concept assumes that the impact of a horizontal merger on total welfare (TW) is determined by its effect on consumer welfare (CS), the profits of the merging parties (PS^M) as well as the profits of the firms that remain independent (PS^O): $\Delta TW=\Delta CS+\Delta PS^M+\Delta PS^O$. Under the assumption that a merger is only proposed as long as it is expected to raise the profits of the merging firms (i.e.. $\Delta PS^M>0$), a merger necessarily increases net welfare (i.e., $\Delta TW>0$) as long as $\Delta CS+\Delta PS^O>0$. Following the interpretation of Padilla (2005), this so-called 'net external effect' ($NEE=\Delta CS+\Delta PS^O$) can be used to develop a taxonomy of the total welfare effect of horizontal mergers (see Box 9).

Furthermore, with respect to the relationship between horizontal mergers, industry concentration and welfare, Farrell and Shapiro (1990) show that the change in overall welfare caused by a horizontal merger depends on the change in the Herfindahl-Hirschman index and the change in output

$$\operatorname{sign}(\mathrm{dTW}) = \operatorname{sign}\left(\frac{1}{2}\frac{\mathrm{dHHI}}{\mathrm{HHI}} + \frac{\mathrm{dQ}}{\mathrm{Q}}\right). \tag{17}$$

Equation (17) implies, first, that mergers which increase output are, ceteris paribus, more likely to increase welfare. Second, Equation (17) shows that merg-

ers that increase the Herfindahl-Hirschman index are also more likely to, ceteris paribus, increase total welfare. At first sight, the second conclusion of Equation (17) seems to be surprising, as an increase in concentration leads to an increase in total welfare. However, the result can be explained by the cost asymmetries between firms assumed in Farrell and Shapiro's model. In such a model world, firms with low shares have these low shares because their marginal costs are high. Consequently, an increase in the share of the firm with the lowest marginal costs (i.e., an increase in concentration) raises overall welfare.[77] With respect to the antitrust implications, Equation (17) basically says that an increase in concentration cannot be used as a general proxy for a decrease in total welfare (see also Kaplow and Shapiro, 2007: 64).

Although Farrell and Shapiro's model has been influential on the economic thinking about horizontal mergers, it has important limitations. One obvious limitation is the assumption of quantity competition which is not necessarily a good approximation of competitive interaction in every market. Deneckere and Davidson (1985), for example, studied the effects of a horizontal merger in a Bertrand model with differentiated goods and demonstrated that although horizontal mergers are profitable for the merging parties, the outsider firms in the industry gain more from the merger than the insiders.[78] From a welfare perspective, any horizontal merger (which generates no cost efficiencies) would lead to price increases for the products of the merging firms and would also provide an incentive to the outsider firms in the market to increase prices for their products. Such a merger would therefore necessarily reduce consumer surplus. If, however, the merger generates sufficient marginal cost reductions (for the merging firms), the post-merger equilibrium prices can even undercut the pre-merger equilibrium prices (see section 2.3.3.1 for a quantification).

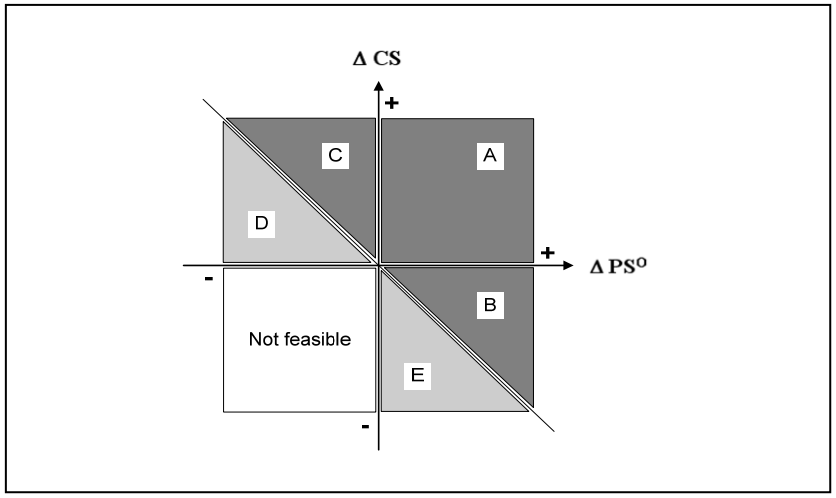
Box 9. A taxonomy of the net external effect of a horizontal merger

The impact of a horizontal merger on total welfare (TW) is determined by its effect on consumer welfare (CS), the profits of the merging parties (PS^M) and the profits of the firms that remain independent (PS^O): $\Delta TW=\Delta CS+\Delta PS^M+\Delta PS^O$. Under the assumption that a merger is only proposed as long as it is expected to raise the profits of the merging firms (i.e., $\Delta PS^M>0$), a merger necessarily increases net welfare (i.e., $\Delta TW>0$) as long as $\Delta CS+\Delta PS^O>0$. Following Padilla (2005), this 'net external effect' ($NEE=\Delta CS+\Delta PS^O$) can be used to develop a taxonomy of the total welfare effect of horizontal mergers. The taxonomy is sketched in Figure 14. (The figure is adopted from Padilla, 2005: 19; the general concept stems from Farrell and Shapiro, 1990.)

77 Please note that this is a similar argument to the one mentioned in section 2.3.2 (Application A-2), arguing why cartels are not always welfare-decreasing.

78 The intuitive reason for this result is that the price increase of the products of the merged entity leads to an increase in the demand of the products of the outsider firms.

Fig. 14. A taxonomy of net external effect



Source: Padilla (2005: 19) based on Farrell and Shapiro (1990).

The dark-shaded areas A, B and C in Figure 14 represent a positive NEE; that is, every merger which is located in these areas leads to an increase in total welfare. Area A is the clearest possible case in which a merger leads to consumer surplus increases as well as producer surplus increases for the outsiders. Following Padilla (2005: 19), a typical example would be a merger that increases price (and therefore benefits the outsiders) but also results in significant demand-side efficiencies (and therefore benefits the consumers). Areas B and E represent cases in which the change in consumer welfare is negative; however, the effect on outsider profits is positive. As long as the outsider profit can compensate for the consumer welfare losses (i.e.. Area B), the net effect is positive; otherwise it is negative (i.e., Area E). As argued by Padilla, from a theoretical perspective, it is more likely that mergers fall into area E, because mergers with no cost efficiencies typically lead to a greater reduction in consumer surplus than increases in outsider producer surplus. Areas C and D represent cases in which the consumer surplus increases post-merger but the profits of the outsiders shrink. Again following Padilla, economic theory suggests that mergers producing significant cost and demand efficiencies are likely to cause such welfare effects. However, the question of which factor is dominant (leading to either a positive or a negative NEE) depends on the size of the efficiencies as well as the actual impact of a reduction in volume on the profits of the outsiders. In short, all mergers falling into areas A, B or C increase total welfare. However, it is important to note that a positive NEE is a sufficient albeit unnecessary condition for a positive total welfare effect of a merger. It may still be the case that the profit increases of the merging parties, ΔPS^M, offset the negative NEE, leading to $\Delta TW>0$.

Whinston (2006: 71ff.) especially focuses on the static nature of the model by Farrell and Shapiro (1990) and discusses the implications of 'dynamic extensions', such as repeated interaction (reflected in the so-called coordinated effects theory), durable goods, entry, endogenous mergers, multimarket contact and sev-

eral long-run competition variables, such as capacity investment, R&D and new product development. Padilla (2005: 3) adds another dimension by focusing on the effect of a horizontal merger on product variety. He argues that horizontal mergers may lead to a reduction in product variety, as the merged firm may find it profitable to phase out some of the products the merging parties offered before the merger. The net welfare effect of such a reduction in product variety is, however, undetermined ex ante, as the loss of variety to consumers has to be traded off against possible fixed-cost saving on the side of the merged firm. Additionally, Gandhi et al. (2006) study the effects of product repositioning post-merger. In a model in which firms compete by simultaneously choosing price and location, they find that products combined by a merger are repositioned away from each other to reduce cannibalisation, and that non-merging substitutes are, in response, repositioned between the merged products. This repositioning can substantially reduce the merged firm's incentive to raise prices and thus can substantially mitigate the welfare-reducing effects of the merger.

Finally, Padilla (2005: 3) discusses the possibility that a horizontal merger – via the assumed increase in market power – may reduce the incentives to invest in process innovations and may therefore facilitate the development of productive inefficiencies as described in section 2.2.1.[79] However, studying the respective theoretical and empirical literature on competition and innovation leaves the impression that there is no clear mono-directional relationship between the degree of competition, the incentives to innovate and overall welfare (see the opposing views of Arrow, 1962, and Schumpeter, 1942, sketched in note 24). Belleflamme and Vergari (2006), for instance, find from a theoretical perspective that it crucially depends on the characteristics of the industry whether the highest innovation incentives are reached by a competitive firm (Arrow, 1962), a monopolistic firm (Schumpeter, 1942), or by an intermediate form of competition[80] (Kamien and Schwartz, 1975).

Gilbert (2007) provides an in-depth study of the theoretical contributions to the questions of R&D incentives in different market structures. Based on this review he concludes that competition is more likely to provide greater innovation incentives if the following conditions apply: 1) Competition in the old product is intense; 2) The innovation is a major improvement; 3) The innovation does not increase the ability of the monopolist to discriminate with prices among consumers; and 4.) Market conditions make preemption unlikely.[81]

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79 From a long-term perspective, there is little doubt that innovation is the most important driver of sustainable economic growth. Consequently, it would be worth putting more emphasis on studying the effects of a merger on innovation rather than the effects on market price, which may be relatively short-lived.

80 The recent work of Aghion et al. (2005) suggests that the relationship between competition and innovation is best characterised by an inverted *U*, indicating that either very high or very low levels of product market competition provide lower incentives to innovation than middle levels of product market competition.

81 Alternatively, Baker (2007: 6ff.) identifies four important principles relating competition and innovation: 1) Competition in innovation itself – that is, competition

With respect to the specific effects of a horizontal merger on innovation incentives, Carlton and Gertner (2003: 13f.) remark that

> [s]ince competing R&D expenditures may be duplicative, a merger that eliminates redundancy may lead to the same knowledge produced at lower costs, or even greater knowledge at lower cost … [i]t is incorrect to conclude that any reduction in R&D is necessarily bad for consumers.

Kleer (2006) finds in a Cournot oligopoly context that a merger increases the incentives for innovative activity of the merging parties as long as there are no organisational problems caused by the merger. The effect on the innovative activity of the rivals depends on the strength of the merged entity: If the merged entity has a low strength, then rivals have an incentive to increase their innovative activity, and a substantial strength of the merged entity leads to a reduction of the innovative activities of the rivals.[82]

In terms of empirical evidence on the welfare effects of (horizontal) mergers, the empirical studies on the profitability of mergers reviewed in section 2.3.1 are complemented by studies which explicitly aim at investigating the welfare effects of mergers. Following Pautler (2003: 145ff.), these studies can be subdivided into multi-industry studies, industry studies and case studies of specific mergers in specific industries.

An extensive *multi-industry study* is presented by Gugler et al. (2003); it compares the effects of mergers on profits and total sales on an international level. The full sample consists of 2.753 mergers which took place from 1981 to 1998. About 42% of the mergers in the sample were horizontal mergers, about 54% were conglomerate mergers and only about 4% were vertical mergers (see Gugler et al., 2003, for further descriptions of the data set and results by country and continent). The applied classification and the basic empirical results are outlined in Table 11.

Table 11 is subdivided into sections (1) to (4), representing the predictions and the respective empirical results for a reduced sample of 1.250 mergers for which t+5 data was available. For every prediction, the empirical results are presented as an average percentage (All) as well as respective percentage values for small and large firms.[83] Prediction (1) refers to the situation of profit increases and sales increases post-merger (compared to the prediction on the basis of the changes in

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among firms seeking to develop the same new product or process encourages innovation; 2) Competition among rivals producing an existing product encourages those firms to find ways to lower costs, improve quality, or develop better products; 3) Firms that expect to face more product market competition after innovating have less incentive to invest in R&D; and 4) A firm will have an extra incentive to innovate if in doing so it can discourage potential rivals from investing in R&D.

82 However, once organisational problems of a merger are accounted for, even the clear picture of increased innovation incentives for the merging parties disappears in Kleer's model.

83 *Small firms* are defined as those having total sales less than the median in the sample in year t-1; *large firms* are defined as those having total sales more than the median in year t-1.

profits and sales of the median firms in their industries). Such a specification represents mergers which created substantial efficiencies for the merging companies. As shown in the table, this was found to be the case for 29,1% of the mergers, with mergers involving small firms being somewhat more successful in realising efficiencies than mergers involving large firms. Prediction (2) refers to the situation of profit increases and sales decreases post-merger. Such a specification represents mergers which increased market power without offsetting efficiencies. This turns out to be the case for about 28% of the mergers in the sample; this time, however, with the large firms being more successful in realising market power compared to the small firms. Prediction (3) refers to the somewhat puzzling situation of profit decreases and sales increases post-merger. Gugler et al. (2003) name the category 'market power decrease', expressing, however, their uncomfortableness with this categorisation. One sensible explanation for the prediction could be that the managers' incentive was sales maximisation rather than profit maximisation. Nevertheless, more than 15% of the mergers in the sample fall into that category. Finally, Prediction (4) refers to the situation of profit decreases and sales decreases. Such a specification represents unsuccessful mergers which caused a decline in efficiency post-merger. This turns out to be the case for on average 28,2% of all mergers in the sample, this time with only minor differences with respect to firm size. Summing up the results presented in Table 11, as long as it is accepted that the mergers which fall into the categories (2) and (4) harm total welfare, the study of Gugler et al. allows to draw the conclusion that at least 27,6% + 28,2% = 55,8% of all mergers in the sample had negative effects on total welfare.

Table 11. Classification of mergers by firm size in year t+5

		$\Delta \Pi > 0$	$\Delta \Pi < 0$
		(1) Efficiency increase	(3) Market power reduction
$\Delta S > 0$	Small	34,7%	17,5%
	Large	23,4%	12,7%
	All	29,1%	15,1%
		(2) Market power increase	(4) Efficiency decline
$\Delta S < 0$	Small	20,4%	27,4%
	Large	34,8%	29,1%
	All	27,6%	28,2%

Source: Content follows Gugler et al. (2003: 628, 650).

Direct evidence on the question whether mergers have led to an increase in plant-level efficiency is presented by McGuckin and Nguyen (1995), who conducted a multi-industry study on the influences of changes in ownership structure on productivity in 28.000 manufacturing plants in the United States from 1977 to 1987. Their results show that plant-level productivity typically increased after changes in the ownership structure, suggesting that merger efficiencies do play a role in merger motivation. In a comparable earlier study, Lichtenberg and Siegel

(1987) also found plant-level productivity gains triggered by changes in the ownership structure. However, a considerable disadvantage of both studies is that they focuse on all types of mergers and therefore cannot lead to conclusions on the efficiency effect of specifically horizontal mergers (see Whinston, 2006: 127ff., for a detailed discussion).

In addition to empirical evidence based on multi-industry data, a relatively small number of *industry studies* are available. Pautler (2003: 154ff.) identified and reviewed especially studies with a focus on banking markets (see especially Rhoades, 1993; Berger and Humphrey, 1992; Prager and Hannan, 1998; Peristiani, 1997) and hospital markets (see especially Sinay, 1998; Connor et al., 1998; Spang et al., 2001). The results of these multi-merger studies in banking and hospital markets are mixed. With respect to banking, the results suggest that mergers produce some gains with respect to shifts in the product mix; however, the effects on either post-merger price or productive efficiencies are typically found to be small. With respect to hospital mergers, the studies suggest that mergers on the one hand typically lead to a reduction in costs but on the other hand may also cause significant increases in price (dependent on post-merger market concentration).

The last group of empirical studies which allows insights into the welfare effects of mergers is *case studies* of mergers in particular industries. Kaplow and Shapiro (2007: 76ff.), Whinston (2006: 110ff.) and Kaplan (2000) provide overviews of such case studies for a diverse set of industries, such as airlines (see Borenstein, 1990; Kim and Singal, 1993), banking (see Prager and Hannan, 1998), hospital markets (see Pautler, 2003: 172ff.), and various other industries, such as microfilms, telecommunications, computers, railroads, cement and tires (see Pautler, 2003: 179ff.). Again, the results of the different studies are mixed. Mergers often lead to significant price increases and reductions in service quality, although there is also evidence showing decreasing prices post-merger. In this respect, the empirical evidence backs the theoretically identified ambiguity of the effects of horizontal mergers on welfare.

2.3.3 Enforcement

After delineating and characterising the respective business conduct and collecting evidence on its potential to cause anticompetitive effects, economists have to identify ways of how to detect and possibly to intervene against such conduct. Such an antitrust enforcement process aims at creating "a more competitive environment … through the prohibition of certain practices deemed illegal" (Harrington, 2005b: 1).

An important precondition for achieving an efficient antitrust enforcement is the presence of several fundamental institutional factors. Based on significant practical experience in the design of competition law institutions, Kovacic (1997: 406ff.) identifies the following eight fundamental institutional factors:

1. Substantial resources
2. Academic infrastructure

3. Access to information networks
4. Professional associations
5. Sound judicial system
6. Legal process safeguards
7. Access to business records
8. Positive political environment

Although it can be assumed that most of these factors have been recognised and implemented in countries with a considerable antitrust enforcement history, the recent introduction of competition laws in many transition economies reminded of the importance of these institutional foundations and the problems created by their absence. Evenett (2005b), for instance, extensively studied the mixed experiences with the introduction of competition law in Thailand. He finds that

> the noble intentions of policy makers in enacting the 1999 competition law have been undermined by a combination of the following six factors: interference by government ministers, officials, and other politicians; lobbying by interest groups; legal loopholes; a lack of transparency in decision making; lack of human capacity; and, relatedly, a lack of funding (p. 11).

This report of the Thai experience could be complemented by comparable recent experiences with the introduction of competition law in many Latin American countries as discussed in detail by Owen (2003). The general message from these case studies is an important (albeit trivial) one: Even the best competition law provisions – motivated by entirely noble intentions – are worthless if essential institutional factors which are needed to run the system are not present. This is especially true for the creation of the desired deterrence effect of competition law as it will be discussed in more detail in section 2.3.3.2.

Assuming the presence of these fundamental institutional factors, the concrete design of competition law institutions offers several degrees of freedom. Trebilcock and Iacobucci (2002), for example, discuss general options to organise the competition law enforcement system from a theoretical perspective.[84] As part of such a set-up, policy makers can basically choose from three genuine antitrust enforcement systems: no enforcement, public enforcement and private enforcement. Leaving aside the system of no enforcement for the time being, *public enforcement* basically means that antitrust rules are enforced by state authorities (typically the antitrust authorities on a federal as well as a state level), while *private enforcement* is based on the actions of private parties (such as competitors, suppliers or consumers) who can bring antitrust lawsuits. The private system has the central advantage that private enforcers often have greater incentives, information

[84] One theoretical question that needs to be addressed can be derived out of the practical observation that several countries, such as the United States and the United Kingdom, have two antitrust enforcement agencies, while most other countries concentrate the respective powers into one authority (see especially Kovacic, 1996, for a practical discussion whether dual antitrust enforcement in the United States should be ended). Furthermore, the recent past has seen significant research on the general necessity and possible ways to institutionalise international cooperations between antitrust authorities (see Budzinski, 2002 and 2004, for overviews).

and resources to take enforcement actions compared to public enforcers. As McAfee et al. (2006: 2) argue, this might lead to additional benefits for society through additional deterrence. However, the downside is – in addition to the general costs incurred by an additional private system – that private enforcers also have greater incentives to (ab)use antitrust rules strategically and might therefore cause harm to society (see McAfee and Vakkur, 2004, and section 2.2.2).[85] As a consequence, the cost of innocent firms to prove their innocence may rise, and that needs to be traded off against the additional deterrence effects (see Bourjade et al., 2007). Furthermore, Rubinfeld (2006a: 143) argues that it is important to harmonise the systems of public and private enforcement in order to avoid problems of under- or overdeterrence. Basically for reasons of simplicity, the remainder of the chapter will concentrate on a system of public enforcement.[86]

Within the system of public enforcement, an important precondition for achieving an efficient antitrust enforcement is an appropriate design of the competition policy institutions, first and foremost of the antitrust authorities. In direct connection to the institutional foundations of competition policy on a macro level presented above, Kovacic (2005: 512ff.) developed the following set of practices for the better design of competition authorities on a micro-level:

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85 Comparing both options in a strategic model of antitrust violation and lawsuit, McAfee et al. (2006: 21f.) show that while pure private enforcement is never optimal, a public system and combinations of both systems can reach the social optimum. This finding is in line with practical experiences which do not show pure public or private enforcement systems but rather combinations of both systems with different focal points. For instance, while the US system is dominated by private enforcement (but also has public enforcement), the European system is based on a system of public enforcement (with current discussions on whether to increase possibilities for private enforcement).

86 The choice of the optimal enforcement system is further dependent on the size of the country. Historically, large countries have adopted competition policy norms earlier than small countries. Forslid et al. (2005) study this phenomenon in a simple two-country Cournot model and indeed find that large countries typically have the strongest incentives to introduce competition policy when trade costs are high (as in such a state, intra-state competition is important). Consumers benefit most from competition policy, which makes this 'somewhat isolated' market more competitive. Small countries only have an incentive to follow the large countries with the introduction of competition policy once trade costs have come down. As the trade costs indeed came down during the twentieth century, this would explain the increased adoption of competition laws by small countries. Related to this finding, Owen (2003: 7ff.) remarks that a US-style antitrust policy can hardly be an archetype for smaller countries, basically because these countries do not have the body of well-trained experts which are required for such a system. Furthermore, it is questionable whether it is economically sensible to build such knowledge in small economies. Owen (2003) supposes that the most effective way to introduce the benefits of competition in small countries is to lower trade barriers rather than to promote competition among local suppliers (see Gal, 2001, for an extensive study of the effects of market size on optimal competition policy).

1. Periodic reviews
2. Ex post evaluation
3. Enhancement of databases
4. Explanation of actions taken
5. Assessment of human capital
6. Investment in antitrust R&D
7. Interdependencies to policy-making
8. Comparative studies

The enumeration clarifies that an antitrust authority has several possibilities to improve its practices continuously. Without wanting to go through all the (largely self-explanatory) practices, the investment in antitrust R&D is of particular importance in the sense that an antitrust authority has to expand its knowledge base constantly in order to guarantee an effective antitrust policy (see section 2.3 for examples of the importance of considering new economic insights and new forms of business conduct).

The antitrust enforcement process within a system of public enforcement consists of basically three steps: detection, prosecution and penalisation. Although there may be important practical differences between detection and prosecution – having in mind the fundamental difference between having knowledge of a certain conduct and being able to prove it from a legal perspective – both complexes are taken together for the following economic analysis, leading to a differentiation between a detection stage and a complementary intervention stage.

2.3.3.1 Detection

The fundamental result of the analysis of the preceding two stages of the integrated approach is a collection of well-defined business conducts which are characterised by either clear anticompetitive effects or possibly dominant anticompetitive effects. In the detection stage, the basic task for an antitrust authority is to separate these forms of suspicious conduct from the majority of procompetitive business conducts.

In general, there are two fundamental answers to the problem of detection: Per se rules and the rule of reason. A *per-se-rule* approach prohibits a certain behaviour generally. Accordingly, the antitrust authority only has to answer the question Did the incumbent engage in the proscribed practice? If the answer is Yes, the antitrust authority and afterwards the courts are committed to suppress the behaviour and eventually to fine the respective firm, independent of the question whether there has been an injury to competition or not (see Calvani, 2001: 201ff.; Wood, 1993: 887ff.). The central characteristics of the per se rule predestine the approach for types of behaviour that are clearly identifiable (for the firms and the antitrust authority) and have clear (and almost certain) negative welfare consequences (see Carlton et al., 1997: 423ff.).

If these preconditions are not met, some kind of rule-of-reason approach is applicable. The *rule of reason* accommodates the more frequent case that the procompetitive effects of a certain behaviour have to be compared with the anticompetitive effects. Such an approach therefore stands for a case-by-case analysis of

suspicious business conduct. Consequently, from a procedural point of view, the rule-of-reason approach gives the antitrust authority considerable administrative discretion and at the same time creates a considerable amount of uncertainty among the firms about the conformity of their business conducts with antitrust rules. Furthermore, compared to the per se rule, the rule-of-reason approach is typically more expensive to administer, as pro- and anticompetitive effects have to be assessed and compared. As a consequence, the antitrust authority has to separate the potentially harmful cases from the potentially less harmful cases as soon as possible (see section 2.4 for a discussion of ways to reach such a selection).

In addition to the choice between two types of control strategies – per se versus rule of reason – the antitrust authority further has to decide when to use a certain control strategy, namely before an infringement actually takes place (ex ante) or after an infringement occurred (ex post). This choice in the timing of control together with the different control strategies leads to the following detection options presented in Table 12.

Table 12. Detecting options

		Control strategy		
		per se	rule of reason	no rule
Timing of control	ex ante	I	II	n.a.
	ex post	III	IV	n.a.

At first glance, it might be surprising to consider ex ante control (options I and II) as antitrust options, because the timing of control criterion is frequently used to separate regulation (ex ante) from antitrust interventions (ex post). However, for certain business conducts, an ex ante assessment – sometimes also referred to as *pre-screening* (see Wils, 2002: 88ff.) – has certain fundamental advantages, such as a reduction of firms' uncertainty about the legality of their plans before they are implemented and hard to reverse.[87] The following applications of the detection stage to hard core cartels and horizontal mergers will reveal how the detection stage differs between a per se, ex post approach (hard core cartels) and an ex ante, rule-of-reason approach (horizontal mergers).

[87] However, the performance of an ex ante approach heavily depends on a good informational situation, as well as good analysing capabilities within the antitrust authority (as it has to assess the likely competitive effects of a merger in the future).

Application A-3: Detection of hard core cartels

Following the theoretical and empirical evidence discussed on the previous level of the integrated approach, hard core cartels are a prime candidate for a per se prohibition. Such a conclusion does not necessarily preclude the possibility that there might occasionally be hard core cartels which would have risen overall welfare; however, such occurrences are considered so rare that a per se ban remains the appropriate antitrust reaction[88] (see also Whinston, 2006: 15ff., and the analysis on the operational level below).

Assuming that such a per se ban of hard core cartels is codified, the questions occur how an antitrust authority (together with the complementary court system) can reduce the formation of cartels and how it can detect existing cartels. With respect to the first question, the antitrust authority can apply certain ex ante instruments which aim at preventing the formation of cartels in the first place. With respect to the second question, the antitrust authority can revert to several ex post instruments which focus on detecting cartels in the literal sense[89] (see Motta, 2004: 190ff.).

A typical example of an ex-ante instrument of cartel enforcement is the development and publication of blacklists which specify the types of conduct that belong to the category called 'hard core cartels'. The importance of such clear signals for firms – and consequently for an efficient antitrust policy – was already discussed in section 2.3.1 as part of the characterisation of the business conduct. The potential of blacklists to reduce cartelisation is, however, limited to cases in which firms are uncertain (or ignorant) about the illegality of their planned conduct and only decide to refrain from applying it after studying the respective blacklist. Given this inherently informative character of blacklists, they are of exceptional importance in countries where competition policy has been introduced recently[90] (and hence where firms might simply be unaware of the exact content

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88 In fact, Whinston (2006: 16f.) constructs a simple model and argues that the prospect of building a cartel may – under certain special conditions, such as the impossibility of perfect collusion – act as an inducement to entry and might therefore help to reach a socially optimal number of firms in the market (and might therefore raise overall welfare). Whinston refers to a case from the US railroad industry for which such an argument – based on a theory of ruinous competition – was in fact (unsuccessfully) made in front of a court. "[T]he railroads had argued that their agreement [to set reasonable railroad rates] was not illegal because their rates were reasonable and, absent the agreement, ruinous competition would ultimately lead to monopoly and consequently higher prices" (Whinston, 2006: 16). Additionally, Salin (1996: 29ff.) investigates cartels from an Austrian economics perspective and collects arguments why cartels can be efficient, value-producing, productive structures.

89 The differentiation between ex ante and ex post methods reveals that it is difficult to measure the success of cartel enforcement, basically because functioning ex ante tools automatically lead to a reduction in detection possibilities ex post.

90 In Estonia during the late 1990s, for instance, several cartel cases were reported in which the involved companies simply did not realise that their agreements were

and meaning of antitrust rules) and for companies which operate in foreign countries and have to comply with the interpretation of antitrust law in these countries.

Kühn (2001) develops a second way to prevent the formation of cartels and collusion. He identifies types of communication between competitors that indicate an attempt to form a cartel (or tacitly collude) and that therefore should be put on some kind of blacklist. These types of communication are also unlikely to improve social welfare by enabling some kind of exchange about procompetitive information. The following forms of communication should be banned in particular: any private discussion of future output prices or production plans, individualised information exchanges about past prices and quantities and (probably) the exchange of individualised cost and demand data (p. 195ff.). According to Kühn, banning these forms of communication could "significantly improve competition policy towards collusive practices" (p. 196). Without wanting to discuss the practicability or the discriminatory power of Kühn's proposal, it certainly – from a methodological point of view – corroborates the importance of specifying the term *hard core cartel* by listing the types of practices that are comprised under such an expression (see also section 2.3.1 for a discussion).

A third type of ex ante instrument for preventing the formation of cartels is adjustments in market designs (see Motta, 2004: 191f.). The application of contemporary auction theory, for example, can help in designing auction mechanisms which offer fewer possibilities for bid-rigging than standard auction types (see Klemperer, 2004, for an overview of auction theory and Hüschelrath, 1998a: 289ff., for an application to landing rights [slot auctions] at crowded airports). [91]

A somewhat related fourth ex ante tool to reduce cartel formation is the *coordinated effects analysis,* which is a compulsory part of the horizontal merger control procedure (see Motta, 2004: 192). Such an analysis investigates whether a proposed merger would create a post-merger environment in which collusion is more likely than in the pre-merger environment. Hypothetically, suppose an aggressive firm (a so-called maverick firm[92]) manages to enter a mature industry with high entry barriers and several episodes of cartelisation in the past. If now one of the three incumbent firms tries to get rid of the 'troublemaker' by simply acquiring it, merger control would probably impede such an attempt by arguing that the post-merger environment (again consisting of the three incumbents) would ease coordination among the incumbents.[93]

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breaking new Estonian competition law. See, for instance, Konkurentsiamet (1999: 8ff.) for an example from the taxi services market in Pärnu.

91 However, from a practical perspective, it seems rather unlikely that an antitrust authority has a big influence on the design of such auctions.

92 See Baker (2002) for a detailed characterisation of the role of maverick firms in an assessment of coordinated competitive effects.

93 Although it cannot be assessed here in detail, it is also thinkable that the acquisition does not raise concerns from a coordinated effects point of view, as the acquisition of the maverick firm creates an unequal market share distribution among the remaining three incumbents. Such inequalities typically make it harder to stabilise a cartel agreement. However, apart from coordinated effects, a 4-to-3 merger, including a

Although ex-ante instruments are certainly useful in reducing the number of cartels in an economy, it is unlikely that these instruments alone will deter cartelisation to an economically optimal degree (i.e., the marginal costs of deterrence is equal to the marginal gains of deterrence).[94] Consequently, from an ex post perspective, the antitrust authority's fundamental challenge is to detect hard core cartels. As cartel members are typically aware of the illegality of their agreements, they have a strong motive to keep them secret. As a consequence, a key action for an antitrust authority lies in the identification of such illegal agreements (detection in a narrower sense) and the collection of sufficient evidence to prevail in possible court examinations (detection in a broader sense).

Against this background, the following three-step procedure is proposed to guide the antitrust authority in actively detecting cartels:

1. Structural assessment of all industries in an economy
2. Behavioural assessment of suspicious industries
3. Collection of hard evidence

In the first step, a structural assessment of all industries in an economy is undertaken, followed by an in-depth behavioural study of those industries which where identified as 'suspicious' by the initial structural assessment. If sufficient behavioural evidence is found, the antitrust authority may – in a third step – successfully apply a leniency program and/or may be allowed to execute dawn raids with the aim of collecting written proof for the existence of conspiracies. Such hard evidence is needed in most jurisdictions to prove the existence of a cartel agreement in court. The three necessary steps to actively detect a cartel will be sketched below. As indicated by the discussion in Box 10, such methods to detect cartel agreements actively by an antitrust authority only played a minor role in the actual method of cartel detection so far – at least in the United States of the 1960s and early 1970s. These findings imply that the active detection of cartels by the antitrust authority must be complemented by programs, for instance, to encourage employees of cartel participants to come forward with hard evidence of a conspiracy (see Kovacic, 2006: 816) in order to optimise the probability to detect a cartel.

1. Structural assessment of all industries in an economy

Within an antitrust framework to actively detect cartels, the first step is a structural assessment of industries. Such a structural assessment reverts to the stability problems cartel agreements typically face. As mentioned in section 2.3.1, although firms have developed various incentive schemes to stabilise cartel agreements, these schemes typically cannot be applied profitably in every market environment. The underlying economic reasons are twofold. On the one hand, the profit differential between the cartel profit and the competitive profit – i.e., "the

maverick firm, would surely also raise concerns with respect to the unilateral effects of such a proposed transaction.

94 In general, the theory of law and economics shows that it is typically not optimal to deter behaviour completely, but to find the optimal degree of enforcement based on assessments of costs and benefits (see Cooter and Ulen, 2000: 427ff.).

difference between the most profitable outcome possible for the firms (the best possible Nash equilibrium) and the worst" (Whinston, 2006: 40) – depends on the specifics of the market and market interaction. On the other hand, the costs of operating a cartel – i.e., reaching and monitoring[95] cartel agreements, and possible antitrust fines and damages – also depend on the specifics of the market and market interaction and might become prohibitive in certain constellations. To give a simple example, consider a market with 10 firms and a market with 3 firms. Ceteris paribus, it can be expected that it is more costly to reach and maintain a cartel agreement in a market with 10 firms than in a market with only 3 firms, simply because negotiations (and the subsequent monitoring) among 10 parties is typically more complex and expensive than negotiations among only 3 parties. As a consequence of this reasoning, it would make more sense for an antitrust authority to investigate more closely the 3-firm market rather than the 10-firm market, simply because, ceteris paribus, a cartel in the 3-firm market is more likely than in a 10-firm market.[96]

Box 10. Methods of cartel detection in the United States (1963-1972)

Although economic theory and econometrics provide plenty of possibilities for antitrust authorities to actively detect cartels, empirical evidence on the methods actually applied by antitrust authorities suggests that neither of these methods have played a significant role thus far. Table 13 provides evidence for the United States by displaying the actual methods used to detect 49 cartels between 1963 and 1972.

As shown in Table 13, only a very small proportion of cartels – in fact only about 4% in the sample above – were detected by an investigation of conduct or performance initiated by the Antitrust Division. A considerable amount of the cartels represented in the table were detected 'by accident'; another large percentage refers to complaints by competitors or customers (which were harmed by the cartel agreement). Although the data shown in the table is outdated – and refers to a time in which the discussed structural and behavioural methods were not that easy to apply – there is no clear indication that the use of these methods has been increased dramatically since then. Only in the very recent past have competition authorities made first efforts to actively detect cartels by studying market structure and market behaviour. The Office of Fair Trading in the UK commissioned a study on structural methods to

95 In general, the stronger, the swifter, or the more certain punishment, the more likely a collusive agreement is sustainable, or alternatively, the closer to joint profit maximising is the industry equilibrium.

96 Following a seminal paper by Selten (1973), cartelisation pays for all firms in the market as long as this number is sufficiently small. However, if the number of firms exceeds a threshold level – 5 firms in Selten's model – then it becomes more profitable to become a cartel outsider (which reduces profits for the cartel). See Schulz (2003: 64ff.) for a model studying the effects of fringe firms on the stability of the cartel agreement. He shows that fringe firms by no means have to cause the breakdown of the cartel but can even have a stabilising influence. A cartel is found to be stable as long as $f+3 \geq k \geq f+2$, with f being the number of fringe firms and k the number of firms in the cartel. As $f+k=n$, the above expression can be rearranged and expressed as follows: $(n+1)/2+1 \geq k \geq (n/2)+1$.

predict cartels (see Grout and Sonderegger, 2005), while the Dutch Competition Authority was able to uncover a shrimp cartel by studying structural and behavioural specifics of the market (see Oxera, 2004b, and Harrington, 2006b, for descriptions).

Table 13. Methods of cartel detection in the United States (1963-1972)

Method	Number of cases	Percentage of all cases
Grand Jury investigation in another case	12	24%
Complaint by competitor	10	20%
Complaint by customer	7	14%
Complaint by local, state or federal agency	6	12%
Complaint by current or former employees	3	6%
Complaint by trade association official	2	4%
Investigation of conduct or performance initiated by Antitrust Division	2	4%
Newspaper account	2	4%
Referred to Antitrust Division by the Federal Trade Commission	2	4%
Complaint by anonymous informant	1	2%
Merger investigation	1	2%
Private suit	1	2%
Total	49	100%

Source: Hay and Kelley (1974).

In addition to this simple structural example focusing on the number of firms in a market, theoretical research has identified an ample number of additional factors which have the potential to influence the potential gains and costs – and therefore the rationality and stability – of cartels and collusion. Rey (2006) – in accordance with many other commentators on the topic – subdivides these factors into structural, supply-related and demand-related factors. Structural factors that ease collusion include a low number of competitors (as discussed above), high entry barriers, frequent interaction between firms and market transparency. Demand-related factors include market growth, absence of significant fluctuations or business cycles, low demand elasticity, buying power and the absence of club and network effects. Finally, supply-related factors which ease collusive agreements include mature industries (with stable technologies), symmetric costs, symmetric capacities, product homogeneity, multi-market contact, structural links and cooperations and other contractual agreements. The theoretical reasoning upon which these dif-

ferent collusion factors are based can be found, for instance, in Rey (2006), Motta (2004), Ivaldi et al. (2003) and Grout and Sonderegger (2005).[97]

Given this collection of collusion factors, it is important to remark that such an analysis of collusion factors is by no means deterministic with respect to the detection of cartels. The presence of one or more structural factors in a market simply makes it more likely to find a cartel in such an industry than in an industry with, for example, 'inverted' characteristics. However, there is neither a guarantee of finding a cartel nor a guarantee that cartels do not exist in industries with different structural characteristics. In the words of Fraas and Greer (1977: 21):

> To a large degree, none of these factors taken singly appears to be a sufficient condition nor, with the possible exception of the number of participants, even a necessary condition for effective collusion; instead, the emergence of an effective coalition seems to depend on some broad combination of these conditions.[98]

Harrington (2005a: 3) therefore concludes that structural assessments may not be too helpful a screening device, as the output of such a screening procedure is simply a large amount of markets which all have a cartel potential, although it is quite likely that the majority of them is in fact not cartelised. In other words, structural assessments are likely too inexact to really deliver a selection of markets in which in-depth investigations are worthwhile. Additionally, empirical evidence on structural factors – shown in Table 14 – confirms the indefiniteness of some structural factors with respect to their effect on the likelihood of collusion.

As shown in Table 14, although most empirical studies confirm the underlying theoretical reasoning, antithetic evidence has been found with respect to the effect of demand growth as well as seller concentration on the stability of collusion. Additionally, extensive case study evidence collected by Levenstein and Suslow (2004) also suggest that although many structural factors are approved by the case studies, there are always exceptions (which, however, might prove the rule).

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97 The economic literature also identifies collusion factors with ex-ante unclear direction. The classical example is production capacity. On the one hand, binding capacity constraints reduce the possibilities to deviate from a collusive agreement. On the other hand, spare capacity might be necessary to punish deviations from the cartel agreement by other cartel members. If such production increases are not possible in the short run, this tends to make deviations from the cartel more likely. As a consequence, the production capacity situation has an ambiguous impact on the stability of collusion.

98 In an empirical study, Dick (2005) aims at identifying whether the structural characteristics of cartels provide a reliable basis to screen industries for potential cartels. He concludes in this respect that "[w]hile readily observable industry characteristics are statistically correlated with cartel activity, the economic magnitudes of these correlations are sufficiently small as to be likely undetectable in practice when industry conditions are measured with noise" (p. 169).

Table 14. Empirical evidence on factors affecting the likelihood of collusion

Factors		Evidence that factor lowers likelihood of coordinated behaviour	Evidence that factor raises likelihood of coordinated behaviour
Demand factors	Elastic demand at competitive prices	Eckbo (1976), Marquez (1992)	
	Large and sophisticated buyers	Dick (1996, 1997)	
	Differentiated products	Hay and Kelley (1974), Dick (1996, 1997), Asch and Seneca (1975), Jacquemin et al. (1981), Fraas and Greer (1977)	
	Lumpy purchase	Hay and Kelley (1974)	
	Volatile demand	Suslow (1988), Dick (1996)	
	Anticipated demand growth	Jacquemin et al. (1981), Palmer (1972)	Dick (1996, 2000), Suslow (1988)
Supply factors	Low seller concentration	Hay and Kelley (1974), Dick (1997), Eckbo (1976), Marquez (1976, 1992), Palmer (1972), Fraas and Greer (1977)	Posner (1970), Asch and Seneca (1975), Jacquemin et al. (1981)
	Competitive fringe with elastic supply	Eckbo (1976), Griffin (1999)	
	Ease of entry	Dick (1997), Eckbo (1976), Asch and Seneca (1975)	
	Cost symmetries		Eckbo (1976), Fraas and Greer (1977)
Other factors	History of prior collusion		Dick (2000)
	One shot equilibrium	Asch and Seneca (1975)	

Source: Europe Economics (2001: 67) based on Knight and Dick (1998).

One fundamental problem with the application of general collusion factors for the detection of cartels is that such an approach treats both collusion strategies, explicit collusion (cartelisation) and tacit collusion, as equal. However, if tacit collusion and cartelisation would be equally applicable, would be driven by the exact same factors and would lead to identical profits, it would be irrational to form cartels and take the risk of being caught if tacit collusion is available as an identical strategy but with almost no chance for the antitrust authority to prove it. In other words, the conscious choice of forming a cartel must have certain advantages over tacit collusion that are not picked up by the general application of collusion factors. Consequently, in order to develop powerful strategies to detect cartels, it would be of great importance to extract such cartel-specific factors out of the pool of factors that affect the likelihood of collusion. Whinston (2006: 41) de-

scribes this problem as follows: "What determines how a given factor affects the incentive to engage in price fixing is the extent to which it makes coordination relatively easier when firms talk than when they do not". As a consequence, following Grout and Sonderegger (2005: 36), firms might only be willing to engage in explicit cartel agreements in circumstances that are predicted by the theory as being adverse to collusion.

Despite these restrictive remarks on the accuracy of structural assessments, Grout and Sonderegger (2005) developed an operational framework to predict cartels in the United Kingdom. Based on the 3-digit standard industrial classification – which they considered as the right level of disaggregation between industries and markets to conduct such a study – they first collect and apply existing evidence on detected cartels to identify structural characteristics that seem to be important for the formation of (formerly workable) cartels. Second, they use an economic model to compare the structural characteristics of detected cartels with the structural characteristics of each of the industries which belong to the 3-digit SIC in the United Kingdom aiming at providing predictions of the probability of cartels within these industries. Their results show that in 8 industries, the probability of the existence of at least 1 cartel lies above 50%. These industries are: telecommunications; manufacture of aircraft and spacecraft; manufacture of grain mill products, starches and starch products; legal, accounting, bookkeeping and auditing activities; tax consultancy; market research and public opinion polling; business and management consultancy; and cargo handling and storage.

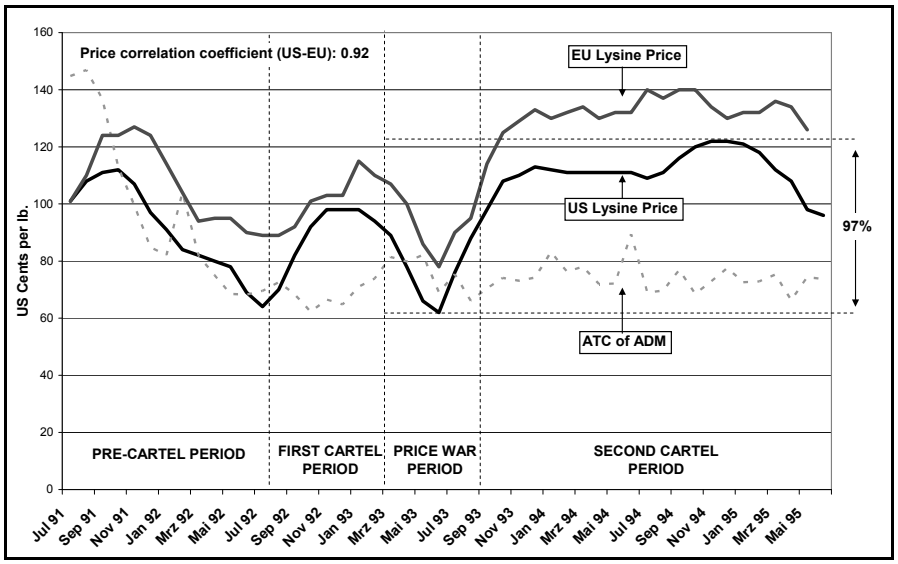
The potential value of a structural assessment of markets can be exemplified by the US lysine industry (see Annex 6.1 for a general description of the product and industry history). Lysine (an essential amino acid) is a homogenous product with inelastic demand, produced in an industry with only a few firms operating and with relatively symmetric costs. Additionally, the whole industry has seen long periods of cartelisation before, basically because two major producers are based in Japan, which traditionally followed a more lenient approach to cartel enforcement. These structural factors make the lysine industry a possible candidate for the creation or existence of cartel agreements.

2. Behavioural assessment of 'suspicious' industries

Subsequent to a study of the structural characteristics of industries, suspicious industries should be investigated further by a behavioural assessment, which focuses on signs in actual market behaviour that may signal the existence of cartel agreements. Such a behavioural assessment, according to Harrington (2006b: 3), "focuses on the market impact of that coordination; suspicions may emanate from the pattern of firms' prices or quantities or some other aspect of market behaviour". Typically, a behavioural analysis focuses on structural breaks (e.g., caused by cartel price wars) and exogenous shocks (e.g., caused by changes in input costs). It aims at investigating whether the firm's (re)actions to the observable breaks or shocks are consistent with competitive behaviour or whether it might better be explained by some kind of collusive model (see, for instance, de Roos, 2006).

In order to illustrate the basic idea behind behavioural assessments, consider again the US lysine industry (from which it is known that a cartel agreement was in place during the 1990s). Figure 15 shows the average monthly lysine prices for the United States and the European Union between July 1991 and June 1995.

Fig. 15. Average monthly lysine prices in the United States and the European Union between July 1991 and June 1995



As shown in Figure 15, the lysine market history between July 1991 and June 1995 can be separated into four periods (which were disputed but nevertheless identified during the criminal lysine price-fixing trials): A pre-cartel period, a first cartel period from August 1992 to February 1993, a price war period from March 1993 to August 1993 and a second cartel period from September 1993 to June 1995.[99] The pre-cartel period was characterised by the large-scale market entry of ADM and a smaller-scale market entry by a Korean firm and shows the expected downward reaction in price that would be expected in a competitive market. As a consequence of the implementation of the cartel agreement in August 1992, a structural break can be identified, characterised by a steady increase in the market

[99] In addition to the US and EU market prices of lysine, Figure 15 also shows the time series of the average total costs of Archer Daniels Midland, the US firm which participated in the cartel. Although a comparison of average total costs with the market price might also allow some conclusions on the existence of a cartel, such information typically cannot be used in a behavioural approach, as it is typically confidential ex ante and cannot be monitored by the antitrust authority. However, it may be possible to use cost data – collected for other antitrust purposes such as a predatory pricing allegation – to see whether cartelisation could also have been an issue in the markets at hand.

prices for lysine over a couple of months. The price increase was interrupted and was reversed by a price war from March 1993 to August 1993, which is reflected by two additional structural breaks in the market price for lysine. The first break is caused by the beginning of the price war and the corresponding substantial price decreases, while the second break is characterised by the reinstatement of the cartel agreement after resolving the price war. The post price war period can be characterised by steady increases in market price and especially the maintenance of the elevated price level – with only minor variations in price – until the FBI cracked the cartel in June 1995. In a nutshell, studying the market prices for the US lysine industry prior to and during the cartel suggests that especially during the transition from the pre-cartel state to the cartel state, possible price wars and longer periods of stationary prices with low variance might be considered as typical patterns of price-fixing conspiracies.

Based on factual evidence of 20 EU cartel cases between 2000 and 2004, Harrington (2006a, 2006b) affirms the identified specifics as part of a broader behavioural screening, but he adds several additional *collusion markers*, which can be used to distinguish between collusive market behaviour and competitive market behaviour. Table 15 provides an overview of the markers.

As shown in Table 15, next to an analysis of market prices over time, a complementary analysis of quantity data might add value to a behavioural assessment. It is, however, beyond the scope of this section to discuss all the collusion markers sketched in Table 15 (see Harrington, 2006a, for a complete assessment). A good example for a recently applied – and apparently working – collusion marker is low price variance. From a theoretical perspective, such a marker is justified by the expectation that price variance is reduced during a conspiracy because, for example, frequent adjustments of cartel agreements are costly. Or alternatively, if individual adjustments by cartel members were allowed, that would make it harder to detect deviations from the cartel agreement. Hence, it can be expected that the transition from a cartel state to a non-cartel state is characterised by an increase in price variance. Furthermore, it can be expected that prices become more responsive to cost after a cartel breakdown.

Recent empirical research supports this theoretical reasoning. Abrantes-Metz et al. (2006) (re)investigate price movements over time around the collapse of a bid-rigging conspiracy among seafood processors in the United States (with respect to supplying seafood to military installations). The authors find that in the case of frozen perch fillets, the average weekly price decreased by about 16% after the collapse of the cartel, while the standard deviation of price increased by 263%. Furthermore, Esposito and Ferrero (2006) investigate data of two Italian cartel cases with respect to the question whether a variance screen would have successfully detected the conspiracies. The authors conclude that in both cases – motor fuel and baby food products – such a screen would have detected the conspiracies. Finally, Bolotova et al. (2005: 10) found for the lysine price-fixing conspiracy that the price variance decreases significantly during the cartel period.

Table 15. Collusive markers for behavioural screening

Type of collusive marker		Description
Price	1	A higher list (or regular) price and reduced variation in prices across customers
	2	A series of steady price increases is preceeded by steep price declines
	3	Price rises and imports decline
	4	Firms' prices are strongly positively related
	5	A high degree of uniformity across firms in product price and other dimensions including the prices for ancillary services
	6	Low price variance
	7	Price is subject to regime switches
Quantity	8	Market shares are highly stable over time
	9	There is a subset of firms for which each firm's share of total supply for that subset of firms is highly stable over time
	10	A firm's market share is negatively correlated over time

Source: Content follows Harrington (2006a: 4ff.)

3. Collection of hard evidence

After applying structural and behavioural screens, the third step in the ex post detection of cartels is dawn raids. *Dawn raids* are unannounced visits at the cartel firm(s') headquarters by state officials with a search warranty seeking written proof of the alleged cartel agreement. Alternatively, the antitrust authority can motivate the cartel members to come forward with proofs of their cartel agreement in exchange for a reduction or an exemption of fines. However, because these so-called leniency programs factually lead to a reduction in fines, they will be assessed in the intervention section below.[100]

In any case, hard evidence is essential in order to prove the cartel allegation in the courtroom. In the case of the lysine cartel, a senior manager of ADM, Mark Whitacre, became an undercover informant of the FBI in November 1992 and supplied several audio tapes of conversations among lysine managers and of several meetings of the lysine producers. Due to the help of Whitacre, the FBI was

[100] Friederiszick and Maier-Rigaud (2006) develop a two-step framework for initiating ex-officio cartel investigations. In the first step, an industry analysis – equivalent to the structural step in the framework above – focuses on price-related indicators, transparency-related indicators, content-related indicators and entry-related indicators. In order to decide which industries should be investigated further, Friederiszick and Maier-Rigaud propose a simple scoring method. The structural indicators are given a scoring value dependent on the assumed importance. The values for every industry are added up and every industry above a certain threshold will be subject to a closer investigation. In the second step of the framework, market behaviour in the selected suspicious industries is more closely investigated by screening for critical events (exogenous shocks and structural breaks).

even able to make videotapes of some of the meetings.[101] Finally, by the end of June 1995, the FBI raided offices in the ADM headquarters to gather additional documents, which proved the conspiracy (see White, 1999a, for a detailed description).

Application B-3: Detection of anticompetitive horizontal mergers

In the case of horizontal mergers, *detection* refers to the identification of anticompetitive mergers. Compared to the detection of cartels, the basic challenge is typically not to detect the conduct of merger as such but rather to assess whether a notified merger would cause anticompetitive effects. While cartel enforcement can revert on ex-ante as well as ex-post methods, merger control typically takes place ex-ante (see Box 11 for several exceptions). As a consequence, while cartel enforcement (as well as most other areas of antitrust policy) is largely backwards-oriented aiming at detecting and proving a breach of the cartel ban, merger control needs to look into the future and must develop a picture of the likely competitive effects in case the proposed merger would be allowed.[102] It is obvious that such an exercise is more diverse and offers more degrees of freedom during the analysis.

The characterisation of the potential welfare effects of a horizontal merger in section 2.3.2 has already indicated that the detection of anticompetitive mergers is a multidimensional problem. First and foremost, a horizontal merger inevitably leads to the loss of a direct competitor in a market and is therefore suspicious of leading to price increases. From an economic perspective, there are basically two strands of argument which both explain such post-merger price increases. On the one hand, the merged entity unilaterally might have incentives to decrease output and increase price given an increase in market power post-merger. Although the non-merging firms in the industry typically respond to such a move with an increase in output, Farrell and Shapiro (1990) have shown that the former effect is typically stronger than the latter leading to an increase in price and a corresponding reduction in consumer surplus. On the other hand, post-merger prices may be higher than pre-merger prices because the firms in the post-merger market find it easier to collude tacitly or overtly. These effects are covered by the so-called coordinated effects analysis, which is not considered further below.[103] In addition to

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101 For example, Whitacre convinced the Japanese cartel members to meet in Hawaii, where the FBI was allowed to follow him, rather than in cartel-friendly Japan, where these meetings usually took place.

102 In principle, an alternative policy option would be to abandon merger control completely and correct possible dominant positions ex post by some form of 'monopolisation control'. However, in practice, such a solution has not played a considerable role, basically because of the uncertainty among firms created by such an option. I would like to thank Wernhard Möschel for pointing this out to me.

103 The theory of coordinated effects is largely based on the theory of repeated games and basically uses the same screens as developed in the previous section on hard core cartel detection (see Kaplow and Shapiro, 2007: 71ff., for a short overview. Essentially, unilateral and coordinated effects theories aim at investigating the potentials for price increases post-merger. While the unilateral effects assessment basically fo-

the effect on price, section 2.3.2 has shown that horizontal mergers may influence welfare through several other channels, such as especially merger-specific efficiencies, product repositioning, product variety and the incentives to innovate.[104]

Box 11. Ex-post merger enforcement

Although merger control typically takes place ex-ante, antitrust authorities occasionally have to enforce anticompetitive mergers ex-post. As merger control is typically based on a notification system, that is, the respective companies have to come forward and announce their merger plans to the authority, it is possible that merging firms – accidentally or intentionally – do not report their merger plans to the authority. Alternatively, firms can wrongly be of the opinion that their planned merger lies below a certain threshold level (e.g., revenue of €15 million per year in German antitrust law) which releases the companies from the responsibility to report their merger plans to the authority (see Bundeskartellamt, 2007). In any event, if the antitrust authority learns about a completed merger that likely would have been prohibited or remedied at the time of its completion, it has to consider ex-post merger enforcement in the sense that competition may be restored to pre-merger levels by forced divestitures.

In the United States, for instance, in 2001, Chicago Bridge and Iron Company (CB&I) acquired certain assets of Pitt-Des Moines, Inc (PDM) in contravention of US antitrust laws. The FTC received knowledge of the acquisition, investigated the case and finally in 2005 ordered a divestiture of both assets - more than four years after the transaction was factually completed (see Freshfields Bruckhaus Deringer, 2005).

In Germany, the Bundeskartellamt (BKartA) discovered the takeover of Landré by Herlitz by chance years after its factual completion and retroactively forbid the takeover because of a dominant market position of the merged entity at the time of the merger (Beschluß v. 6.2.1997-B10-21231-U-54/96). Additionally, the BKartA imposed fines of €227.000 overall for the failure to notify the antitrust authority about the merger plans.

Given these problem specifications and having in mind the possibilities to detect cartels actively in the preceding section, the question arises whether comparable markers are available that can detect anticompetitive mergers. Based on the seminal work of Eckbo (1983), Eckbo and Wier (1985) and Stillman (1983), the event-study approach may provide such a possibility. The simple idea behind such a study is that a merger that will increase market power of the merging firms is also 'pleasant' for the rival firms in the market. If, however, the merger creates significant efficiencies and provides an incentive for the merged entity to lower

cuses on the possibilities of the merged entity to increase price, the coordinated effects assessment focuses on the increased possibilities of all firms or a group of firms to overtly or tacitly collude post-merger, thereby increasing the post-merger market price.

104 As noted by Kaplow and Shapiro (2007), a price increase can also serve as a proxy for other possible anticompetitive effects, such as a reduction in product quality or service or a decrease in the pace of innovation.

prices post-merger, that can be considered as 'unpleasant' for the rival firms in the market. As a consequence, analysing the stock-price reactions of the rival firms to the announcement of a merger proposal can be helpful in distinguishing between mergers motivated by increases in market power (positive price reaction of rivals' stocks) and mergers motivated by the realisation of efficiencies (negative price reaction of rivals' stocks). The respective hypotheses are outlined in Table 16.

Table 16. Abnormal returns to the merging firms and their rivals

	Abnormal returns to merging firms	Abnormal returns to rival firms
A. Merger proposal		
Market power: Collusion or Cournot	Positive (Monopoly rents)	Positive (Monopoly rents)
Economic efficiency: Productivity increases	Positive (Cost savings)	Negative (Competitive disadvantage)
B. Antitrust complaint		
Market power: Collusion or Cournot	Negative (Loss of monopoly rents)	Negative (Loss of monopoly rents)
Economic efficiency: Productivity increases	Negative (Loss of cost savings)	Positive (Avoiding competitive disadvantage)

Source: Content follows Eckbo and Wier (1985: 124).

As shown in Table 16, in addition to focusing on rivals' stock price reactions at the time of the announcement of the merger, the reactions to the announcement of an antitrust complaint may disclose additional evidence on the pro- or anticompetitiveness of the respective merger.

Although the event-study method looks like a relatively easy way to detect anticompetitive mergers – and several empirical studies have shown that they can indeed be helpful for the detection of anticompetitive mergers – the concept has to cope with substantial drawbacks. First of all, the event study approach is only applicable for firms with publicly traded shares. This precondition may already exclude many acquisitions of small- and medium-sized firms from an event-study analysis.[105] Furthermore, as argued by McAfee and Williams (1988: 199ff.), firms often derive only a small fraction of their revenues from the markets affected by the merger, and consequently the power of event studies to detect anticompetitive mergers is rather limited. A test of the event study approach with a known anticompetitive merger[106] showed that the event study approach would have failed to

[105] A counterargument could be that these mergers are typically unproblematic from an antitrust perspective and consequentially there is no need to conduct an event study anyway.

[106] McAfee and Williams (1988) use the 1979 merger of Xidex Corporation with Kalvar Corporation. Both firms produced non-silver duplicate microfilms. Post-merger,

detect that merger (see McAfee and Williams, 1988. 200ff.). Whinston (2006: 111) discusses 'precedent effects' as another potential pitfall of event studies. He argues that the announcement of a merger may convey information about market conditions more generally – such as the likelihood of further mergers as a reaction to the announcement of an efficiency-enhancing merger in the industry – and therefore may lead to 'diametric' stock price reactions, such as increases in rivals' stock prices following the announcement of an efficiency-enhancing merger.

Given the substantial problems in the application of the event study approach, the development of an indirect but generally applicable framework to detect anti-competitive mergers is necessary. The following four-step approach is proposed to guide such an analysis:

1. Estimation of the post-merger price increase
2. Consideration of evidence whether such a price increase would be sustainable
3. Estimation of the effect of possible merger efficiencies on the post-merger price
4. Consideration of the effects of the merger on competition variables other than price (such as product variety or the incentives to innovate).

The *first step* of the framework needs to develop an estimate of the impact of a horizontal merger on the market price(s). Such an estimate can be achieved either by applying econometric techniques or by applying simulation techniques based on theoretical models.

The *second step* of the framework has to assess whether the price increase predicted in the first stage would be sustainable post-merger. As econometric and simulation tools typically need to abstract from important factors – such as entry or product-repositioning of existing rivals – these factors have to be assessed quantitatively (or at least qualitatively) with a conclusion whether these factors make it likely or unlikely that the merged entity would be able to actually impose the estimated price increase post-merger.

The *third step* of the framework needs to assess, first, whether the merger efficiencies claimed by the merging parties are existent, merger-specific and likely to materialise post-merger. Second, it needs to estimate whether the accepted efficiencies are strong enough at least hold to the pre-merger price level.

The *fourth step* of the framework needs to consider the effects of a horizontal merger on other competition variables such as product variety, marketing and R&D post-merger, which might influence the overall welfare effects of a merger.

The four-step approach will be applied next to horizontal mergers for two types of models: a homogenous Cournot model and a differentiated Bertrand model. Generally, standard Cournot models are a good approximation in homogenous good industries in which competition is accurately modelled by a (one-shot) quantity-setting game – or alternatively as a capacity-setting game with subsequent price competition (see Kreps and Scheinkman, 1983). If, however, a horizontal merger in a differentiated branded-products market has to be assessed, a differen-

Xidex closed down the production facility of Kalvar, fired all employees and raised prices substantially for their own remaining products.

tiated Bertrand model typically delivers the better approximation of competitive interaction (see Kaplow and Shapiro, 2007: 59ff.).

1. Estimation of the post-merger price increase

The first step of the framework assesses the standard competitive concern raised by most horizontal mergers: their potential to increase prices post-merger. Based on a specification of pre-merger market conditions and assumptions on the behaviour of firms in the market, economic models can be applied to estimate post-merger price increases (see Epstein and Rubinfeld, 2001: 886ff., for a detailed description).

Starting with an assessment in a homogenous market in which market interaction is best described by quantity competition, Dansby and Willig (1979) derive the following simple relationship between the Lerner index of market power and the Herfindahl-Hirschman index:

$$L = \sum_i \frac{m_i^2}{\varepsilon_D^m} = \frac{HHI}{\varepsilon_D^m}. \tag{18}$$

Equation (18) shows that the Lerner index for an industry is given by its HHI divided by the market demand elasticity (see Annex 6.6.10 for a detailed discussion and the proof). Market power is increasing with the concentration in a market and decreasing with the market demand elasticity. In order to receive a simple, back-of-the-envelope estimate of the price increase following a horizontal merger, Equation (18) can be rearranged to receive the following expression for the price increase following a horizontal merger (see Annex 6.6.10 for the proof):

$$\frac{\Delta p}{p} = \frac{\Delta HHI}{\varepsilon_D^m - HHI_{postmerger}}. \tag{19}$$

As shown by Equation (19), the percentage price increase following a merger is given by the change in the HHI divided by the market demand elasticity minus the HHI in the post-merger state. Alternatively, Equation (19) can be expressed in market shares

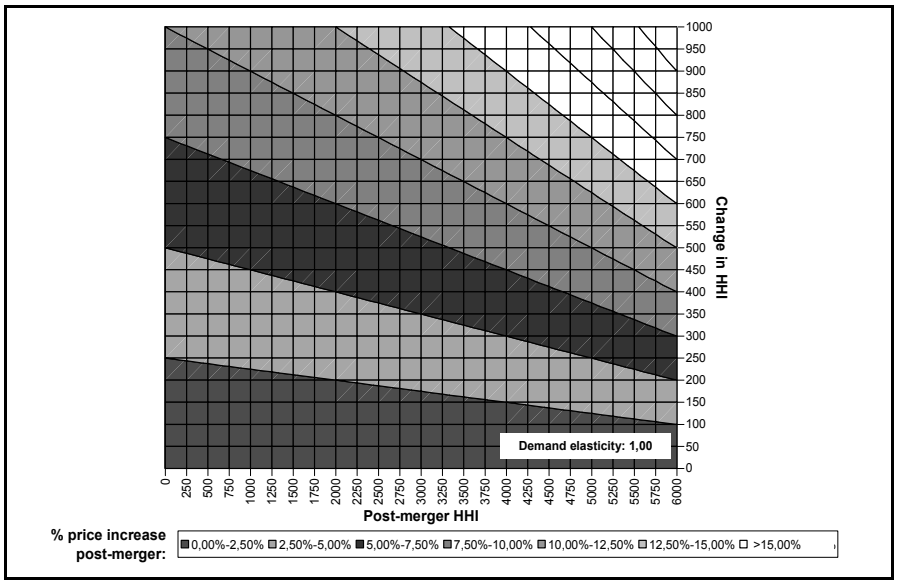
$$\frac{\Delta p}{p} = \frac{\Delta HHI}{\varepsilon_D^m - HHI_{postmerger}} = \frac{2s_1s_2}{\varepsilon_D^m - \left(\sum_i (s_i)^2 + 2s_1s_2\right)} \tag{20}$$

with s_1 and s_2 indicating the market shares of the merging companies. Figure 16 plots Equation (19) based on unity market demand elasticity.

Figure 16 shows the percentage price increase post-merger for various combinations of post-merger HHI and the merger-induced change of the HHI. For example, a post-merger HHI of 3000 and a corresponding change in the HHI of 450 would forecast a price increase between 5,00%-7,50% (the exact value is 6,43%; see Table 61 in Annex 6.7). However, for a demand elasticity of 1,5, the predicted price increase would drop to 3,75% (see Table 62 in Annex 6.7). This example al-

ready indicates the sensitivity of the results with respect to the underlying market demand elasticity, which will be studied further below.

Fig. 16. Percentage price increase due to a merger in a homogenous Cournot model



Furthermore, as assessed in more detail in Nelson and Sun (2001: 935ff.), Equation (19) and the corresponding Figure 16 are based on several assumptions which might become critical in the sense that they are not met in the market being investigated. Apart from obvious assumptions such as (1) quantity competition or (2) the presence of homogenous goods, other less obvious but nevertheless potentially critical assumptions include that (3) all firms are assumed to have constant marginal costs, (4) the merger does not change the cost structure of the firm, (5) the merger does not change the behaviour of the firms, (6) the post-merger market share of the firms is equal to the sum of their pre-merger market shares, (7) the elasticity of demand is constant over the relevant range of sales levels and (8) there is no entry. Werden and Froeb (2007: 7) consider assumptions (3) and (6) as especially critical, which reduces the significance of price-increase estimates derived by the above formula. Merger simulations – as sketched below for a differentiated products market – can typically help to relax at least some of the critical assumptions of simple, back-of-the-envelope formulas.

In a world of differentiated branded products, a Bertrand model is typically an appropriate approximation of competitive interaction. In general, product differentiation lessens competition, as an increase in price by one firm does not imme-

diately lead to the loss of all customers for that firm.[107] The basic reason for this finding – first reflected in the theory of monopolistic competition by Chamberlin (1933) as well as the theory of imperfect competition by Robinson (1933) – is that products are not perfect substitutes for each other any more, with the direct effect that a fraction of customers would still buy the product in the event of a price increase. The first chart in Figure 17 explains this fundamental characteristic of differentiated product markets.[108]

Figure 17 shows four products (A, B, C and D) which are located at different places among a line representing consumer preferences. In the initial stage, it is assumed that the prices for all products are the same. The substitutability between different products (from the consumer perspective) is expressed by the slope of the umbrellas originating in the respective basis product prices. Given this set-up, Chart 1 in Figure 17 shows the consequences of a price rise of firm C from Pc to Pc'. Although company C would loose all customers located in the areas cd-c'd and bc-bc' to products D and B, it would still keep the customers between c'd and bc'. It will simply have to trade off the margin increase of the remaining customers with the loss in customers to decide whether a price increase is profitable or not.[109]

Now imagine that the producers of products B and C in Figure 17 consider merging. In such a case, the second chart in Figure 17 shows that it becomes – ceteris paribus – more likely that the price increase for products B and C (the merged entity) is profitable, as the customers located between products B and C simply lose their respective switiching possibilities and just have to pay the higher price (see Willig, 1991, for a detailed assessment). On a more general level, the analysis suggests that an evaluation of mergers in differentiated product markets needs to assess not only how many customers a firm would loose following a price rise but also whom these customers switch to. The so-called diversion ratio satisfies this demand.

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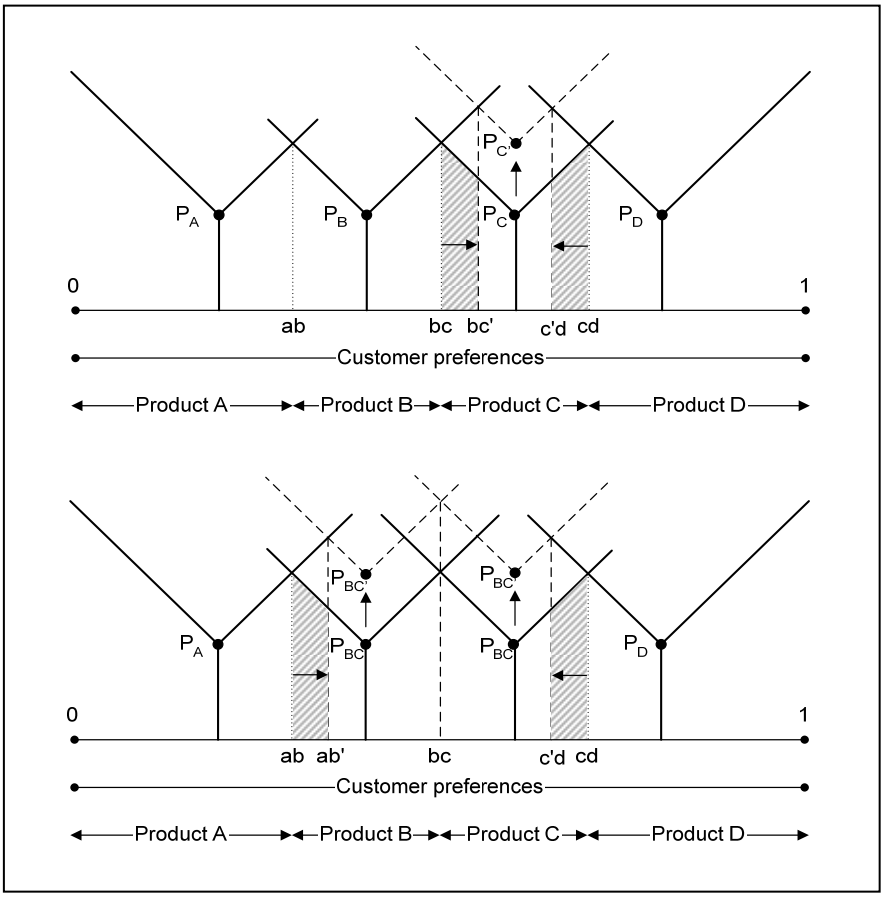
107 While horizontal differentiation leads to different features of products (valued by the consumers), vertical differentiation relates to differences in quality levels (of the same features).

108 Inspired by comparable graphs in Bishop and Walker (2002: 71) and Baker and Bresnahan (1985: 429). Although the aim of Figure 17 is purely presentational, without having in mind any specific model, the general set-up is equal to a typical Hotelling location model with Bertrand competition. D'Aspremont et al. (1979) showed that as long as the (two) firms can change their prices and location costless, no equilibrium exists in such a model. However, modifications of the model can prove the existence of an equilibrium (see Carton and Perloff, 2000: 217ff.).

109 Although Figure 17 assumes that the horizontal 0-1 line represents the spectrum of customer preferences, it is also possible to interpret the horizontal 0-1 line in a spatial sense. The umbrellas would then mirror the transportation costs, which determine the intensity of competition between different locations. In other words, the graph can refer to both types of differentiated products: branded consumer products and physical facilities that distribute goods where differentiation is based on location, such as supermarkets or hospitals (see Shapiro, 1995: 2f.).

Fig. 17. Competition between horizontally differentiated products



The *diversion ratio* is a measure of how close two products are in the product space and therefore how intense competition is between these two products. Shapiro (1996) defines the diversion ratio as "the fraction of sales lost by [product C] that are captured by [product] B in case the price for [product C] is increased by a certain percentage rate."[110] Table 17 explains the concept in a hypothetical four-product market.

As shown in Table 17, it is assumed that the price for product C is raised by 5%, which leads to a reduction in its sales of 50% (i.e., 1000 units). Then 600 units of the 1000 units in sales switch to product D, while the remaining 400 units

[110] Technically, the diversion ratio from A to B is the ratio of the cross-price elasticity of demand for A with respect to the price of B over the own elasticity of demand for A. In a logit model, the market diversion ratio between products 1 and 2 is given by the market share of product 2 divided by 1 minus the market share of product 1.

switch to product B, leading to diversion ratios of 0,6 for products C and D and 0,4 for products C and B. Product A does not gain any additional sales from the price increase of product C, leading to a diversion ratio of 0,0 between product C and A. If, however, products B and C belong to one firm, a price increase in product B would probably lead to a loss of some customers to product A, but the loss to product C stays within the firm. Hence the loss of revenue is less and price rises are more likely to be profitable. As a consequence, firms which control a larger product portfolio (i.e., have a high market share) will charge higher prices than firms with a smaller product portfolio.

Table 17. Calculating diversion ratios

	Initial Sales (volume)	Sales after 5% price rise of C	Diversion in volume	Diversion ratio
Product A	5000	5000	0	0,0
Product B	3500	3900	400	0,4
Product C	2000	1000	-1000	
Product D	1000	1600	600	0,6
Total	*11500*	*11500*	*0*	*1,0*

A very helpful characteristic of diversion ratios is that they can be incorporated into a differentiated Bertrand model to derive an estimate of the post-merger price increase in a differentiated products industry. As shown in Annex 6.6.7, if the demand function is linear, the percentage price increase triggered by the merger can be derived by the following expression:

$$\frac{\left(P^{\text{Post-Merger}} - P^{\text{Pre-Merger}}\right)}{P^{\text{Pre-Merger}}} = \frac{MD}{2(1-D)}. \tag{21}$$

Equation (21) basically shows that the post-merger percentage price increase is a function of the pre-merger price-cost margin as well as the diversion ratio between the two brands merging. Generally, higher margins result from greater product differentiation, while a higher diversion ratio, as explained above, reflects more intense competition between the products (see Werden, 1996). Plotting Equation (21) for various combinations of pre-merger price-cost margin and diversion ratios leads to Figure 18.

As shown in Figure 18, for diversion ratios below 0,2, the percentage price increase post-merger is estimated to be below 10% (the exact value for M=0,4 and D=0,2, e.g., is 5,00%; see Table 53 in Annex 6.7 for the corresponding data matrix). Generally, the percentage price increase post-merger rises with the pre-merger price-cost margin and the diversion ratio. This is in line with the general interpretation of the diversion ratio provided above.

However, it is important to remark that Equation (21) is only valid as long as the two merging firms are identical before the merger, they both produce a single product pre-merger and both face a linear demand curve. As argued by Bishop and Walker (2002: 374), all three assumptions can be critical, leading to wrong

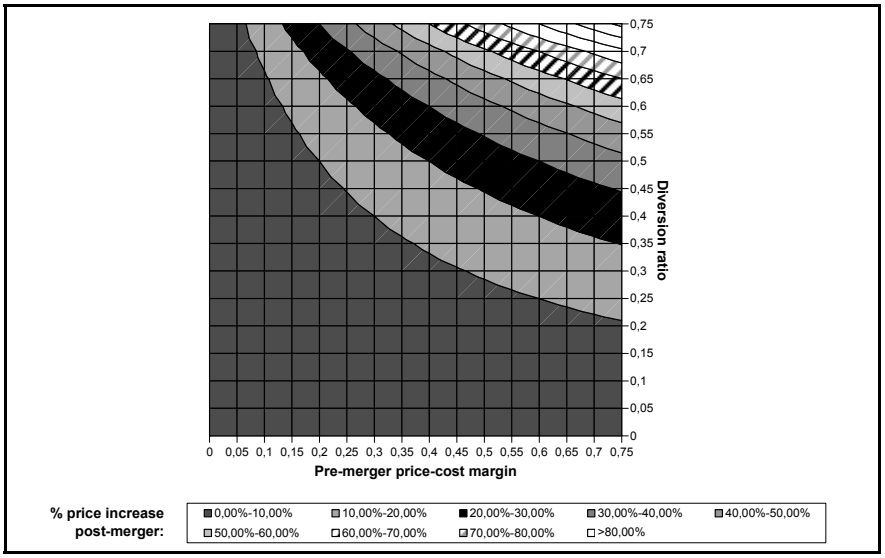
conclusions if Equation (21) is just applied mechanically without studying the suitability of the underlying assumptions up front. As shown in Annex 6.6.7, if the demand curve is assumed to be iso-elastic instead of linear, Equation (21) changes to

$$\frac{\left(P^{Post-Merger} - P^{Pre-Merger}\right)}{P^{Pre-Merger}} = \frac{MD}{(1 - M - D)} \tag{22}$$

leading to significant changes in the price predictions as well as the range of economically interpretable results.[111] Furthermore, if the assumption of symmetric firms is released, then the respective equation to estimate the price increase loses some of its 'applicability charme' (see Bishop and Walker, 2002: 378f.).

On a more general level, Hausman and Leonard (1997) fundamentally criticise the use of such back-of-the-envelope formulas. Following the fallacy that 'some number is better than no number' discussed in Diamond and Hausman (1994), they argue that it would be preferable to rely entirely on qualitative analysis – in case the data (and/or time) for a sophisticated estimation of a demand model (see Hausman et al., 1994, for an overview) is not available – rather than applying simple simulation techniques, such as diversion ratio analysis. Werden (2004: 4), however, takes the counterargument by remarking that "price-increase predictions are only rough estimates, but that is better than none at all".

Fig. 18. Percentage post-merger price increases against pre-merger price-cost margin and diversion ratio



111 As (1-M-D)>0, D must be larger than (1-M) to deliver interpretable economic results (which delineates a relatively small range of sensible price predictions).

In line with the reasoning in Werden (2006), diversion ratios and corresponding estimates of post-merger price increases can provide useful back-of-the-envelope results for differentiated product mergers in which a) market interaction is adequately described by Bertrand competition, b) the mentioned assumptions are met to an acceptable degree, and c) the existing data and the budget or skills in the antitrust authority do not allow a more sophisticated analysis, such as the estimation of demand systems[112] (see Hausman et al., 1994, for an overview). In any case, such simple simulation results – as well as the results of more sophisticated techniques – should be viewed as one piece of evidence and should by no means replace a qualitative assessment of the case based on documents, interviews with customers and competitors and institutional details.[113]

As an alternative to the application of back-of-the-envelope formulas, economists have developed more sophisticated 'merger simulation tools' to come to conclusions on the likely effects of a horizontal merger on market price (see Werden and Froeb, 2007: 31ff. and ABA, 2005: 269ff. for more detailed overviews). In general, these tools use a model of consumer demand and a model of competitive interaction to predict the price effects of a merger (see Hausman and Leonard, 1997). In order to be able to apply such tools, market information, such as market shares and market demand elasticities, needs to be estimated as data input for the simulation of the effect of a merger-induced change in the ownership structure on market price. Box 12 characterises an example of a merger simulation tool which has been frequently applied in practice by both antitrust authorities and private parties.

Box 12. Simulating horizontal mergers

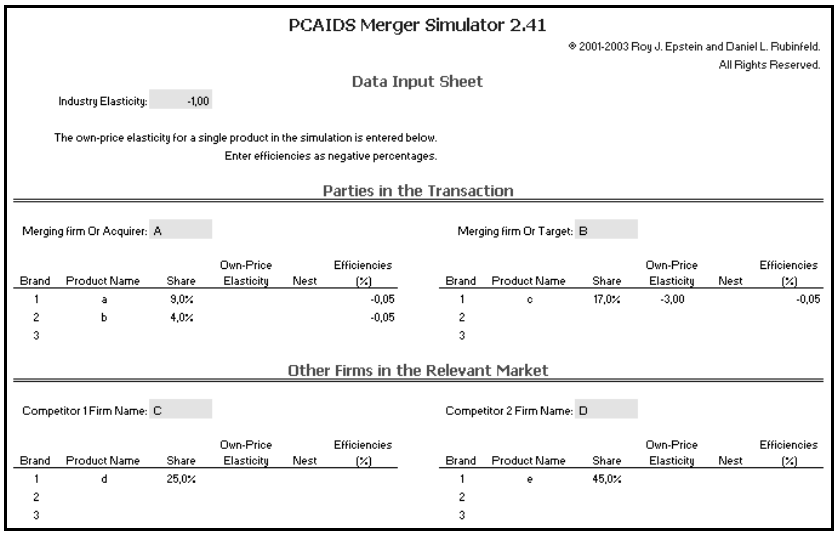
One frequently applied merger simulation tool to estimate post-merger price increases is the PCAIDS Merger Simulator developed by Roy Epstein and Daniel Rubinfeld. The simulator is a simple spreadsheet add-in and provides the user with a data input sheet shown in Figure 19.

The data input sheet shown in Figure 19 already contains data on a hypothetical merger between firms A and B. Firm A sells two brands (*a* and *b*) with market shares of 9% and 4% respectively. Firm B has only one brand c with a market share of 17%. Furthermore, there are two 'outsider' firms in the market: Firm C sells brand *d* and has a market share of 25%, and firm D offers brand *e* and has a market share of 45%. The industry demand elasticity is assumed to be -1,0 and the individual demand elasticity for firm B is -3.0 (see Epstein, 2002: 3ff.).

112 Scanner data from supermarkets is an example of 'good data' which technically allows the application of more sophisticated approaches. However, time limitations or missing skills in the technicalities of such forms of analysis may hinder its application on the side of the antitrust authority.

113 Although merger simulation focuses on a quantification of the unilateral effects of a merger, Davis (2006) provides an application focusing on coordinated effects.

Fig. 19. Data input sheet of the PCAIDS merger simulation tool



PCAIDS Merger Simulator 2.41

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Data Input Sheet

Industry Elasticity: -1,00

The own-price elasticity for a single product in the simulation is entered below.
Enter efficiencies as negative percentages.

Parties in the Transaction

Merging firm Or Acquirer: A

Brand	Product Name	Share	Own-Price Elasticity	Nest	Efficiencies (%)
1	a	9,0%			-0,05
2	b	4,0%			-0,05
3					

Merging firm Or Target: B

Brand	Product Name	Share	Own-Price Elasticity	Nest	Efficiencies (%)
1	c	17,0%	-3,00		-0,05
2					
3					

Other Firms in the Relevant Market

Competitor 1 Firm Name: C

Brand	Product Name	Share	Own-Price Elasticity	Nest	Efficiencies (%)
1	d	25,0%			
2					
3					

Competitor 2 Firm Name: D

Brand	Product Name	Share	Own-Price Elasticity	Nest	Efficiencies (%)
1	e	45,0%			
2					
3					

Source: Screenshot of Epstein and Rubinfeld (2003) also documented in (2004).

As explained in more detail in Epstein and Rubinfeld (2001: 893ff.), this information is sufficient to simulate the merger and receive 'reasonable' predicted price increases. Without considering efficiencies, the simulation predicts price increases of 5,1% for the brands produced by firm A and a 4,2% price increase for the brand of firm B, leading to an average price increase for the merged entity of 4,6%. If, however, merger efficiencies of 5% per brand are considered, the simulated price increase drops to 1,6% for firm A and 0,6% for firm B. Furthermore, merger simulation can quantify the effects of divestitures on the post-merger prices. If it is assumed, for instance, that firm A – in order to get the merger through – proposes to sell brand *b* to firm C, the simulated price increase is 0,7% for firm A and -0,3% for firm B respectively (under the assumption that the claimed efficiencies for brands *a* and *c* – but not for the divested brand *b* – are still realised). Alternatively, the sale of brand *b* to an independent company would predict a price increase of 0,2% for firm A and -0,7% for firm B respectively. As this small example shows, merger efficiencies and divestitures can reduce or even eliminate the potentials for the merged entity to increase price post-merger. It is further worth remarking that the application of the back-of-the-envelope formula for a homogenous Cournot oligopoly derived above would predict a price increase of 6,9% (when assuming 'one brand per firm' based on a market demand elasticity of -1,0 and an increase in the HHI from 3.108 to 3.550 caused by the merger).

An especially helpful feature of merger simulation tools is that they allow simulating not only the post-merger prices but can also take account of changes in the cost structure (the so-called merger efficiencies) and antitrust-induced changes in the ownership structure (the so-called [structural] merger remedies). However, despite an increasing adoption of merger simulation tools in antitrust authorities and economic consultancies, the general suitability of such techniques is ques-

tioned by academics and practioners. Walker (2005: 27), for example, remarks that "merger simulation models do not allow investigators to avoid much of the competitive effects analysis relating to the relevant economic market, nor do they necessarily provide more precision to merger control." He adds that problems are predestined if 'off-the-shelf models' are applied for a certain case rather than 'bespoke models', which take account of relevant specifics of the market and industry at hand.[114] Werden and Froeb (2007: 58) show, with data collected for a competitive effects assessment of the WorldCom-Sprint merger in the United States, that the estimated price increases post-merger heavily depend on the underlying demand form. With linear demand, the merger simulation led to a price increase of 2,3%, while an iso-elastic demand would lead to an estimate of 16,4%. However, in case of AIDS, an estimate of 13,8% was obtained. This simple practical example underpins the general sensitivity of these models and the importance of getting the model input (such as the demand form) right in order to receive meaningful estimates of the post-merger price increase. This caveat is confirmed by Whinston (2006: 101f.), who identifies the following important caveats of merger simulation: 1) The quality of the predictions depends on the correct estimation of demand; 2) The choice of the post-merger behavioural model of the industry is key, as firm's may change their behaviour as a result of the merger; and 3) Pricing is only one of several important competition variables such as entry or R&D, and merger simulation tools so far have failed to include them.

Given the potential problems of merger simulations, Carlton (2003a: 7ff.) views these tools as a useful substitute for the more direct 'traditional' approaches for merger analysis, which basically build on 'natural experiments' aiming at answering the question, What happens to price when the number of competitors diminishes by one? Carlton himself provides an example of such a natural experiment (Carlton, 2003a: 11):

> [S]uppose that there are 5 firms in most areas of the country, but only 4 in one area. Well, the difference in price between the two areas may be a good predictor of the effect of a merger if the regions are otherwise similar. By identifying such 'natural experiments', one can try to assess the effect on price of having one less firm. This type of analysis is called 'reduced' form analysis, in contrast to structural [such as merger simulation] because unlike structural analysis, the reason for the observed relationship between price and number of firms (e.g., the presence of demand substitutes) is not spelled out.

Generally, the evidence created by such natural experiments is extensively used by economic consultancies in their merger assessments.

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114 Slade (2006: 21) also criticises simple merger simulation tools because "the predictions about markups and merger effects that can be obtained from simple models are often very misleading. Unfortunately, however, a number of economists have attempted to convince competition authorities that user-friendly canned programs can provide reasonable predictions." However, later on, Slade agrees that back-of-the-envelope calculations can be useful "as long as everyone understands the assumptions that underlie those calculations and no spurious claims of accuracy are made … However, we should eschew generic, one-size-fits-all merger models and numbers that come out of black boxes" (p. 23).

2. Consideration of evidence whether such a price increase would be sustainable

The second step of the detection framework for anticompetitive mergers is entered by cases which are suspicious of significantly increasing market prices post-merger. As simulation tools typically abstract from important factors – such as the potential role of entry or product repositioning of existing competitors – these factors have to be assessed qualitatively and have to be incorporated into a conclusion whether the estimated price increase would actually materialise in the post-merger world.[115] A central focus of such an investigation lies on the role of entry barriers in the respective market, because even in the case that a merger simulation predicts a significant price increase post-merger, low-entry barriers in the respective market would likely make such a price increase unsustainable. Following the theory of contestable markets, even a monopolist has no choice other than to price at marginal cost if 'hit-and-run' entrants are waiting to enter the market as soon as it raises the price above competitive levels. The generally important role of entry barriers within an antitrust assessment will be discussed in more detail on the operational level in section 2.4.2.2.

A second focus of an assessment on the sustainability of a simulated price increase could be buyer power. In general, the existence of a significant countervailing power of customers typically reduces the ability of the merging parties to increase price post-merger. "Empirical studies have shown that the stronger and more concentrated the buyers' side of the market is, the less is any ability of sellers to elevate their prices"[116] (ABA, 2005: 29). One central explanation for this finding is that collusion becomes harder to sustain because, on the one hand, deviation incentives are larger and, on the other hand, the buyers typically have incentives to monitor the transactions closely and are typically in a good position to question price increases (or might even use competitive bidding procedures to promote competition). Furthermore, large buyers often also have the possibility to sponsor entry into the supplier's market in order to increase competitive pressures (see ABA, 2005: 29).

3. Estimation of the effect of possible merger efficiencies on the post-merger price

The third step in the detection approach for anticompetitive horizontal mergers considers merger efficiencies. As already explained in section 2.3.2, merger-specific efficiencies are of interest because they have the potential to offset the merged firms' incentives to increase price post-merger. In other words, even if the first two stages of the detection framework come to the conclusion that the merged entity would have the incentive and the possibility to increase price, the

115 Following ICN (2006: 41ff.), factors which help to understand the competitive constraints existent in the market include low barriers to entry or expansion, buyer power, the nature of competition in the market, responsiveness of competitors, existence of alternative suppliers or the elimination of a potential competitor.

116 See Scherer and Ross (1990: 533ff.) and Schumacher (1991) for supporting empirical evidence of the seller market power-reducing effect of countervailing buying power.

existence of merger-specific efficiencies could offset this increase or could even create incentives for the merged entity to increase production post-merger.

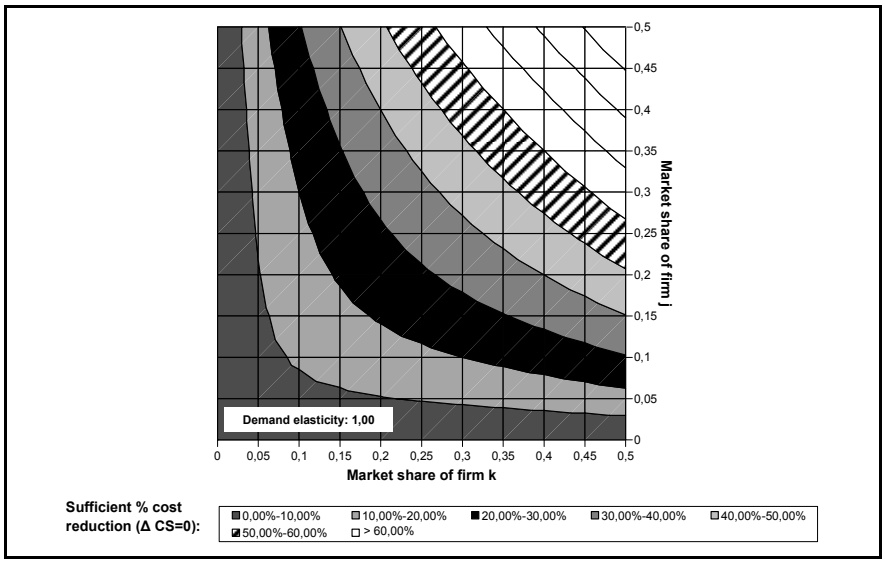
The follow-up question of what degree of merger efficiencies is sufficient to restore pre-merger prices can again be estimated by rather simple formulas. In a homogenous Cournot world, the sufficient percentage cost reduction to restore pre-merger prices, $\overline{c}$, can be expressed as a function of the merging firms' market shares and the market demand elasticity (see Annex 6.6.8 for the proof):

$$\overline{c} = \frac{2s_j s_k}{\varepsilon_D^m (s_j + s_k) - (s_j^2 + s_k^2)}, \tag{24}$$

with s_j and s_k representing the output-based market shares of the two merging firms.[117] Plotting Equation (24) for the purpose of an easier interpretation leads to Figure 20.

As shown in Figure 20, the sufficient percentage cost reduction rises with the market shares of the two merging firms. In general, even mergers between firms with relatively low market shares have to realise substantial efficiencies in order to restore pre-merger prices. For example, if both firms have a market share of 10%, the respective sufficient cost reduction would be in a range between 10,00% and 20,00% (the exact value is 11,11%; see Table 55 in Annex 6.7).

Fig. 20. Sufficient percentage cost reduction to restore pre-merger prices in a homogenous product merger



117 In case of symmetric market shares, $s_j=s_k=s$, (24) above simplifies to

$$\overline{c} = \frac{2s^2}{\varepsilon_D^m \cdot 2s - 2s^2} = \frac{s}{\varepsilon_D^m - s}.$$

However, it has to be kept in mind that Figure 20 is based on unity market demand elasticity. The sensitivity of the sufficient percentage cost reduction with respect to the market demand elasticity is clarified by Table 18.

Table 18. Percentage marginal cost reduction that restores pre-merger price dependent on the change in HHI and demand elasticity

Market shares of merging firms		`Delta`	Elasticity		
s_j	s_k	ΔHHI	1	2	3
0,05	0,05	50	5,26%	2,56%	1,69%
0,05	0,1	100	7,27%	3,48%	2,29%
0,1	0,1	200	11,11%	5,26%	3,45%
0,1	0,15	300	13,79%	6,42%	4,18%
0,15	0,15	450	17,65%	8,11%	5,26%
0,2	0,2	800	25,00%	11,11%	7,14%
0,3	0,3	1800	42,86%	17,65%	11,11%
0,35	0,3	2100	48,00%	19,31%	12,09%
0,4	0,4	3200	66,67%	25,00%	15,38%
0,5	0,5	5000	100,00%	33,33%	20,00%

Source: Inspired by a comparable table in Froeb and Werden (1998: 269).

As shown in Table 18, estimating the correct market demand elasticity is crucial with respect to the choice of the appropriate marginal cost reduction. A merger between two firms with a 10% pre-merger market share would demand a percentage marginal cost reduction of 11,11% for a demand elasticity of 1, but only a reduction of 5,26% if the demand elasticity is 2. Table 18 further shows the respective change in the HHI (or 'delta') value, which can be calculated by doubling the product of the market shares of the two merging companies and multiplying in with 10.000 (see section 2.4.2.1 for the proof). For example, a merger which leads to a delta of 50 needs to realise a marginal cost reduction of 5,26% (if unity elasticity is assumed) in order to restore pre-merger prices.

For the case of a differentiated Bertrand model, it is also possible to derive the complementary back-of-the-envelope formula to estimate the sufficient percentage cost reduction which restores pre-merger prices (see Annex 6.6.9 for the proof):

$$\bar{c}_i = \frac{M_i D_{ij} D_{ji} + M_j D_{ji} p_j / p_i}{(1 - M_i)(1 - D_{ij} D_{ji})}. \tag{25}$$

For the symmetric case, $M_i = M_j = M$ and $D_i = D_j = D$, Equation (25) simplifies to[118]

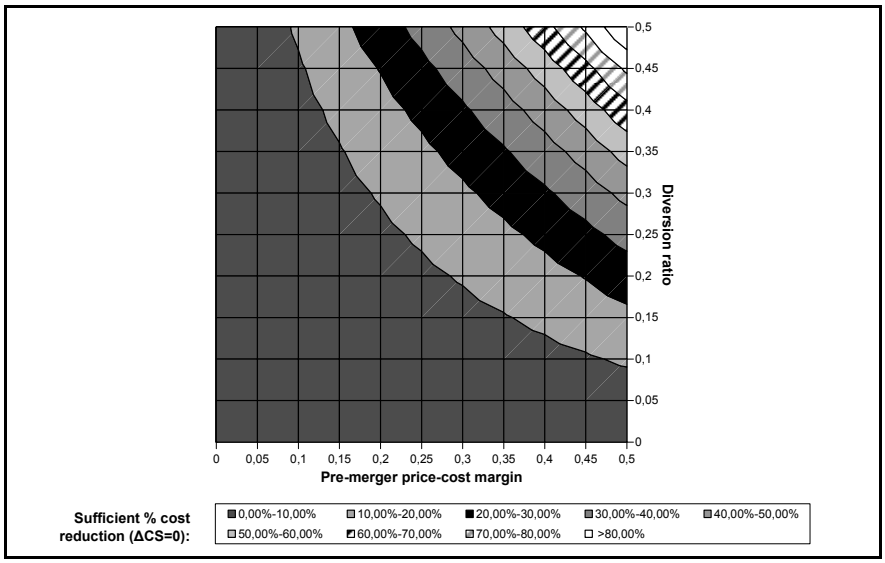
[118] As shown by Werden and Froeb (2007: 15), Equation (26) can also be expressed as a proportion of pre-merger price leading to MD/(1-D).

$$\bar{c} = \frac{M}{1-M}\frac{D}{1-D}. \tag{26}$$

As shown by Equation (26), estimates of the pre-merger price-cost margin and the diversion ratio are enough to receive an estimate of the sufficient percentage cost reduction. Plotting Equation (26) for the purpose of easier interpretation leads to Figure 21.

As reflected in Figure 21 and also stressed by Werden (1996), if the products are relatively differentiated (i.e., M is high) and the merging firms compete intensively (i.e., D is high), large cost reductions are necessary to restore pre-merger prices. As shown in Figure 21, if the pre-merger price-cost margin is 0,45 and the diversion ratio is 0,3, the sufficient percentage cost reduction lies between 30,00% and 40,00% (the exact value is 35,06%; see Table 56 in Annex 6.7).

Fig. 21. Sufficient percentage cost reduction to restore pre-merger prices in a differentiated products merger



Although the calculation of sufficient percentage cost reductions can be a helpful quantitative tool in assessing merger efficiencies, it masks several important conceptual challenges of merger efficiencies. One general aspect refers to the fact that merger efficiencies do not necessarily have to cause a measurable reduction in marginal cost as it was assumed so far. In practice, merger efficiencies can take many forms, and it is with the antitrust authority to decide which efficiencies are accepted and which are not. Ivaldi et al. (2003: 63), for instance, differentiate between efficiencies generated by a better exploitation of tangible assets (such as rationalisation through the reallocation of the production, exploitation of economies of scale and scope or investment) and those by a better exploitation of intangible

assets (such as sharing of know-how, management, R&D and innovation, product-line redefinition or purchasing power).[119]

Given this enumeration, it is obvious that some efficiencies may translate directly into marginal cost reductions (e.g., economies of scale) while others rather lead to a reduction in fixed costs (e.g., R&D expenditures). The question whether only the former or both types of efficiencies are considered within a merger efficiencies assessment finally depends on the underlying welfare approach followed by the respective antitrust authority.[120] Additionally, the mentioned efficiencies differ with respect to the time window in which they are scheduled to materialise. For example, while a re-allocation of production can be accomplished fairly quickly, efficiencies in R&D might only materialise in the medium or long term by, for instance, improving new product development. However, as shown in Box 13, it is in principle possible to weight all these pro- and anticompetitive aspects by a simple calculation of the net present value of the likely benefits and harms of a proposed merger.

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119 Evans and Padilla (2003) point out that every merger efficiencies assessment has to consider supply-side efficiencies (referring to the cheaper production of existing products) and demand-side efficiencies (referring to new or better products, such as increased network size or product quality), both which may be realised by a horizontal merger. Kolaski and Dick (2002) provide a taxonomy of possible efficiencies based on the traditional differentiation between allocative efficiencies, productive efficiencies, dynamic efficiencies and transactional efficiencies. As assessed in more detail in Röller et al. (2001: 42ff.), several alternative typologies exist. They differentiate between a typology based on the concept of the production function (rationalisation, economies of scale, technological progress, purchasing economies and slack) and another typology based on the alternate distinctions of real cost savings vs. redistributive (or pecuniary) cost savings, fixed costs vs. variable costs, firm-level efficiencies vs. industry-level efficiencies and, finally, efficiencies in the relevant market vs. efficiencies in other markets.

120 In general, microeconomic theory suggests that marginal cost savings have a direct influence on short-term pricing behaviour, while fixed cost savings do not have this influence and would therefore not be considered as efficiencies. However, as virtually all fixed costs become variable by simply increasing the time horizon, this distinction is often not easy to make in terms of efficiencies (see also Carlton, 2007, who argues that many fixed costs are recurring and respective savings can therefore very well translate into lower future costs – which eventually benefit consumers through lower prices). Furthermore, a total welfare standard would still allow taking account of fixed cost savings. Additionally, as remarked by Everett and Ross (2002: 20ff), the often assumed equality of a price standard and a consumer welfare standard is not correct from a theoretical point of view. While a pure price standard would just concentrate on the post-merger price, a consumer welfare standard would also consider non-price influences of the merger such as effects on product choice or product quality.

Box 13. Weighting pro- and anticompetitive effects of a merger

A practical way to trade-off price increases with possible efficiencies is proposed by Simons (2004). He takes a potential merger of two widget producers and assumes that the market investigations of the antitrust authority have revealed the following: the market is widgets with a 80% probability; entry will not occur for 2 years with a 80% probability; the anticompetitive effect of the merger is a 10% price rise for 2 years with a 80% probability; marginal cost will decline and impact price by 2% with 70% probability beginning in year 2 and continuing though year 5; pecuniary costs will decline and impact price by 1% with 70% probability beginning in year and continuing through year 5; and fixed costs will decline and impact price by 1% with 70% probability beginning in year 3 through year 5. Based on these assumptions, it is possible to calculate the net present value resulting from the proposed merger. This schedule is shown in Table 19.
As shown in the simple spreadsheet calculation above, although the hypothetical merger causes a price increase of 10% for two years, the net effect of the merger on consumer welfare is positive. It further shows that efficiencies realised years after the completion of the merger can contribute substantially to the procompetitive effects of a merger.

Table 19. Calculating the consumer welfare net present value

	Probability	Harm or Benefit	Risk adjustment	Years				
				1	2	3	4	5
Competitive effects								
Market definition	0,8							
Entry	0,8							
Anticompetitive effects	0,8	-10,0						
Total	0,51	-10,0	-5,1	-5,1	-5,1	0	0	0
Efficiencies								
Marginal cost	0,7	2,0	1,4	0	1,4	1,4	1,4	1,4
Pecuniary benefits	0,7	1,0	0,7	0,7	0,7	0,7	0,7	0,7
Fixed cost benefit	0,7	2,0	1,4	0	0	1,4	1,4	1,4
Total effect				-4,4	-3,0	3,5	3,5	3,5
Net present value @ 10% rate	*0,71*							

Source: Content follows Simons (2004: 3).

Against this background, the major problem for an antitrust authority with respect to merger efficiencies is to check their plausibility, their likelihood of realisation and their likely effects on post-merger competition.[121] From a microeco-

[121] Ivaldi et al. (2003: 64f.) consider ex post reviews of efficiency gains as a way to secure them for the consumers. Although theoretically appealing, they conclude that it

nomic perspective, it is straightforward to identify substantial informational advantages on the side of the merging firms about the existence and size of merger efficiencies. Amir et al. (2004) manage to show in a Cournot oligopoly context that firms have an incentive to 'overestimate' the efficiencies achieved by the merger with respect to both the antitrust authority (in order to get the merger through) and rivals (in order to influence their beliefs on the competitiveness of the new merged entity). They therefore conclude that antitrust authorities should be reluctant to accept cost-reducing arguments, as there is a high probability that the estimated efficiencies are smaller or even non-existent, leading to higher prices in the post-merger world. The empirical results – presented in section 2.3.1 – which showed a very moderate successfulness of horizontal mergers would also (indirectly) support such an argument. As a consequence, antitrust scholars such as Farrell and Katz (2006) have argued that it may be optimal to follow a pure consumer welfare approach in merger control as some kind of counterweight to the firm's informational advantages and to possible lobbying activities during the merger control procedure (see Neven and Röller, 2006). Kaplow and Shapiro (2007: 89) add a dynamic perspective, remarking that

> if the process of competition itself … is of some value, but this value is difficult to measure, it makes sense to tilt the balance against concentration. This might be done by making the threshold for challenge lower … or through other means, such as being less generous in considering efficiencies in justifying otherwise problematic mergers.

The question of an appropriate standard for 'acceptable' merger efficiencies is – among others – assessed by Farrell and Shapiro (2001). Having in mind their own theoretical finding that not just a reallocation of production but real merger *synergies* – that is, the integration of specific and hard-to-trade assets which create output/cost configurations which would not be feasible otherwise – are necessary[122] to avoid welfare-reducing horizontal mergers, they propose a simple, three-step decision tree to extract merger-specific synergies. The first stage of the framework investigates whether the merged entity would likely achieve the claimed efficiencies. Given the fact that every merger purports to be motivated by substantial efficiencies, an antitrust investigation has to assess whether such calculations are sound and plausible. If this is found to be the case, the second step asks whether the merging firms *would* likely achieve the efficiencies unilaterally.

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seems illusory to believe that such interventions could be a realistic option for antitrust policy. Davies et al. (2007: IX) report that firms have actually tried in merger control cases to get the merger through by signing a guarantee that prices will be reduced post-merger. However, the antitrust authorities have been hesitant to accept such behavioural commitments basically because of the monitoring obligations and the implementation of a reporting system post-merger (see section 2.3.3.2 below for a more detailed discussion of merger remedies).

122 The availability of non-synergic efficiencies may be largest in cases of high pre-merger market power and therefore the greatest prospect of further increasing that power. However, intensive competition can be an obstacle in the realisation of particular types of efficiencies (see Farrell and Shapiro, 2001: 709).

This question tries to find out whether the efficiencies are merger-specific or not. If this is found to be the case, it is asked in a third step whether the efficiencies *could* be achieved unilaterally. Only if such a question is denied, then the merger-specific efficiencies are synergies and therefore relevant for an antitrust assessment following the Farrell-Shapiro approach.[123] Applying the framework would, for instance, allow the conclusion that economies of scale are typically not accepted as synergies, because they can be achieved unilaterally by 'simply' extending the production capacities[124] (see Farrell and Shapiro, 2001, for a discussion of additional implications).

Based on these general theoretical considerations and on practical experiences (see especially Everett and Ross, 2002, for an overview), three conditions for 'acceptable' merger efficiencies have been identified (see ICN, 2006: 64):

1. *Verifiability* – Only those efficiencies will be taken into account which have a high probability of realisation within a reasonably short period after completion of the merger.[125]
2. *Benefit to consumers* – Some share of the expected benefits of the merger efficiencies are likely to be passed on to consumers in the form of lower prices.[126]

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123 See European Commission (2001) as well as de la Mano (2002) for an extensive discussion of the efficiency defense and the European system of merger control, as well as Copenhagen Economics (2006) for a discussion of practical methods to assess efficiency gains.

124 As argued by Slade (2006: 23), merger-related efficiencies are often exaggerated, as most economies of scale and scope in manufacturing occur at plant level and economies in distribution are often tiny, as they typically do not represent a large fraction of total costs. However, Kolaski and Dick (2003: 245) identify three practical reasons why internal expansion can be more costly than a merger. First, firms can often expand their scale faster by a merger than by internal expansion. Second, adding new capacity in a market with constant or declining demand may also create pressures on price, which could make internal expansion unprofitable. Third, the construction of new capacity may create social waste in the form of first duplicating resources and later (probably) closing down capacity.

125 As discussed in more detail in Davies et al. (2007: VIIIf.), the following types of evidence may be helpful in demonstrating efficiencies to the antitrust authority: detailed analysis of the extent and type of cost savings (e.g., on the basis of a business plan and supporting evidence that justifies the planning methods and shows the reasonableness of the applied assumptions), plant- and firm-level accounting statements, internal studies (using recent cost records and other pertinent objective data), strategic plans, data and analysis of past experience, statements of knowledgeable company personnel, bespoke research into customer preferences, market studies regarding future trends and innovation obstacles, management consulting studies or analysis prepared by antitrust-specialised economic consultants and merger simulation.

126 Werden et al. (2005: 4ff.) identify three channels of how merger efficiencies can affect market prices post-merger (the so-called pass-though effect) in differentiated product markets. The most important channel is the direct effect of the reduction in a product's marginal cost on its own price: "A reduction in the marginal cost of any of the merged firm's products causes a reduction in its price by an amount largely de-

Factually, this condition rules out a pure total welfare standard as appropriate for merger control.

3. *Merger specificity* – The efficiency gains must be merger-specific, that is, they are unlikely to be produced or available absent the merger.

Only efficiencies which satisfy all three conditions should be considered during (or alternatively following) the competitive assessment of a proposed horizontal merger. However, as reported by Scheffman (2004) for the United States, the practical role of efficiencies is more understood as a sort of 'sliding scale', in which the stronger the anticompetitive case, the less weight is given to efficiencies. In other words, there seems to be no weighting of the magnitude of efficiencies against the magnitude of anticompetitive effects as shown in the spreadsheet in Box 13. This finding – together with the three conditions for acceptable merger efficiencies – can be exemplified by the *Heinz-Beech Nut* merger case (2001), which is sketched in Box 14.

Box 14. The role of merger efficiencies in *Heinz-Beech Nut* (2001)

In the year 2000, the market for jarred baby food in the United States was dominated by three companies (see Baker, 2004: 150ff., for the following): Gerber, the market leader, with a market share of more than 65% of nationwide sales; Heinz, the second-largest player, with a market share of about 17%; followed by Beech-Nut, with a market share of about 15%. Gerber and Beech-Nut are premium brands, while Heinz is a 'value' or so-called private label brand.

In February 2000, Heinz agreed to acquire Beech-Nut. In July 2000, the FTC decided to challenge the merger, because it would have reduced the number of players in the jarred baby food market from 3 to 2 and would thereby have caused an increase in the HHI by 510 points to 5.285. In the economic reasoning of the FTC, the loss of wholesale competition between Heinz and Beech-Nut for shelf space in supermarkets (supermarkets typically provide space for only two out of the three brands) was a cornerstone in the conclusion that the merger would create possibilities to unilaterally increase prices post-merger. Additionally, the FTC found that the post-merger market structure would make tacit collusion more likely than in the pre-merger state. Finally, an analysis of the recent industry history revealed no successful entry attempt, and the FTC assumed – given the importance of having a brand name for successful entry – that this is unlikely to change post-merger in the foreseeable future.

Although the case admittedly looks like a crystal clear example of an anticompetitive merger, the merging parties developed a somewhat convincing story line in favour of

termined by the curvature of that product's demand curve. The other two ways in which marginal-cost reductions affect consumer prices relate to the nature of the competitive interaction among differentiated products. When a reduction in the marginal cost of one of the merged firm's products causes a reduction in that product's price, the price reduction causes a shift in the demand curves of the merged firm's other competing products. Consequently, the merged firm adjusts the prices of all the competing products it sells in response to a reduction in marginal cost for any one of those products. In addition, non-merging sellers of competing products adjust their prices in response to the price changes of the merged firm" (Werden et al., 2005: 4).

the merger. With respect to the tacit collusion allegation, for example, they argued that the merger would in fact make tacit collusion less likely, as the merged entity would have the economic power and incentives to challenge Gerber's position in the market. One central point of the defense – which backed up the story of 'having incentives to challenge Gerber' – was the extraordinary merger-specific efficiencies that would have been realised in the event of the merger. In fact, estimations showed that the variable cost of the Beech-Nut product line would fall by about 43% and the variable costs of all production and distribution activities would decline by about 15%. The basic reason for the substantial cost efficiencies was that Beech-Nut manufactured its products in an old, high-cost production facility while Heinz had just opened a new production facility with so much excess capacity that it could absorb the whole yearly production of Beech-Nut without reaching capacity limitations. Heinz alone, as it was argued, would not be able to increase production (or sales, respectively) significantly, as the attractiveness of their 'value' brand is limited compared to the 'premium' products of Gerber and Beech-Nut.

Although the claimed efficiencies would have passed two conditions of acceptable merger efficiencies derived above – verifiability and specificity – the FTC blocked the merger based on the sketched unilateral and coordinated effects theories (which ultimately doubt that sufficient efficiencies would be passed on to consumers). The district court, however, sided with the merging firms. It argued that the extraordinary efficiencies would indeed create the possibility for the merged entity to provide a seriously challenge to Gerber's position. The FTC appealed and the appeals court reversed the district court by arguing that the efficiencies evidence accepted by the district court was insufficient: "The appeals court pointed out three main problems with the district court's factual findings on efficiencies. First, the district court should have considered the reduction in total variable cost, rather than merely the reduction in the variable costs of manufacturing. Second, the district court should have analysed the magnitude of the cost reductions over the merged firms' combined output, rather than with respect to Beech-Nut alone. Third, the district court did not satisfactorily explain why the efficiencies could not be achieved through reasonable and practical alternative means, with less competitive risk than would arise from merger" (Baker, 2004: 166). Finally, the appellate court also rejected the district court's opinion, basically because of a general scepticism about the applicability of the efficiency defense in markets that would be highly concentrated post-merger. The appellate court's decision in favour of the argumentation of the FTC ended Heinz's attempt to acquire Beech-Nut.

4. Consideration of the effects of the merger on other competition variables

The fourth step of the detection framework has to consider the effects of the merger on competition variables other than price and quantity in order to allow an integrated assessment of the pro- or anticompetitiveness of a specific merger. The importance of such an assessment is expressed by several antitrust scholars, who argue that the traditional focus of antitrust analysis on the effects of a merger on market price is entirely static and too simple to understand the true economic motivations and effects behind a certain merger.[127] Following Scheffman (1996: 247),

[127] On a more general level, characteristics of so-called new-economy industries need to be considered in competition policy assessments (see, for instance, OFT, 2002).

> [t]he standard industrial organisation analysis of a merger boils the merger down to potential shifts in static cost and demand curves and concentrates on the effects of the merger on short run pricing dynamics. This approach misses the essence of what business strategy, and mergers, in particular, are about.

Hofer and Williams (2005b) agree with the general argument, especially with respect to so-called fast-moving consumer goods (FMCG) markets (such as soft drinks, tobacco or mobile phones), in which the fundamental dimension of competition is not price but marketing and branding. A reduction in competition due to a merger in such industries could therefore take the form of lower levels of marketing expenditure rather than increases in price.[128]

With respect to the role of innovation, Hofer and Williams (2005b) argue that many of the biggest gains to consumers in markets arise from innovation and dynamic aspects of market competition, "and if reductions in competition lead to reductions in innovation, the consequences for consumers can potentially be at least as serious than the effect of a five to ten percent increase in price" (p. 7). In other words, the role of advertising in creating new demand and the role of R&D in creating new technological competition can be critical dimensions of competition and need to be considered as a compulsory part of any competition assessment.[129]

With respect to the role of innovation in merger control, Katz and Shelanski (2006) recently presented an integrated approach of this multifaceted relationship by studying the implications of innovation in the complete merger control procedure consisting of market definition, analysis of competitive effects, consideration of efficiencies and remedies. The authors base their assessment on the separation of two effects which need to be considered as part of an extended merger control procedure: An *innovation impact* criterion – which takes account of the fact that innovation can affect the relationship between the pre-merger marketplace and the

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Those characteristics include R&D and intellectual property, network effects, high fixed/sunk costs and low marginal costs, technical complexity, compatibility and standards.

128 As noted by Hofer and Williams, such a reduction in marketing competition is difficult to evaluate from a welfare perspective, basically because economists have not come to final conclusions on the general role of marketing. While some argue that marketing is procompetitive and provides the consumers with relevant information on the respective products, others are of the opinion that marketing is just a mechanism for redistributing rents. "Accordingly, a reduction in marketing expenditures could simply be seen as an efficiency of a merger. However, to the extent that marketing expenditures expand market demand and consumer valuation, then a reduction in marketing expenditures could reduce consumer welfare" (Hofer and Williams, 2005b: 6).

129 The increasing importance of innovation concerns in antitrust policy is underpinned by Gilbert (2007: 2ff.). He analysed the mergers challenged by the US antitrust authorities in three periods: 1990 to 1994, 1995 to 1999 and 2000 to 2003. In these periods the authorities challenged 135, 269 and 108, mergers respectively, of which 4, 47, and 41 respectively mentioned 'innovation' as a reason for the challenge. Expressed in percentages, the importance of innovation effects rose from about 3% in the first period to about 18% in the second period, up to 38% in the third period.

post-merger marketplace – and an *innovation incentives* criterion, which takes account of the fact that innovation itself can be an important dimension of market performance that could be affected by a merger. "To examine the innovation incentives effect, one asks how the change in market structure and competition brought about by a merger will likely affect consumer welfare through effects on the pace or nature of innovation that might reduce costs or that brings new products to market. To examine the innovation impact effect, the situation is reversed. It refers not to how market structure will affect innovation but to how innovation will affect the evolution of market structure and competition. Innovation is a force that could make static measures of market structure unreliable or irrelevant, and the effects of innovation may be highly relevant to whether a merger should be challenged and to the kind of remedy antitrust authorities choose to adopt" (Katz and Shelanski, 2006: 14).

From a practical perspective, there are at least two ways in which innovation incentives have played a role in merger control. First, as part of a merger which involves actually existing product markets in which R&D is one important competition variable such as, for instance, the software industry. Second, alternatively, a merger can take place between companies who are both solely focusing on R&D and consequently do not sell any product on a product market at the time of the merger. In such a case, the question arises whether the traditional merger control procedure is applicable at all (see Box 15 for a case example from the United States). Focusing on the first group of cases, Gilbert and Sunshine (1995: 595ff.) suggest the following five-step framework to study the effects of a merger on market power in an innovation market: 1) Identify the overlapping R&D activities of the merging firms; 2) Identify alternative sources of R&D; 3) Evaluate actual and potential competition from downstream products; 4) Assess the increase in concentration in R&D and competitive effects on investment in R&D and 5) Assess R&D efficiencies.

In a nutshell, given the ex ante indefiniteness of an increase in concentration on the scope and pace of R&D, it is unlikely that R&D can be evaluated by the same instruments as the effects of mergers on price. The consideration of innovation markets necessarily has to be approached by some kind of rule-of-reason approach, such as the proposal by Gilbert and Sunshine. In any case such an assessment is affected by its forward-looking and hypothetical character.

In a nutshell, this section proposed a four-step framework to detect anticompetitive mergers. It has become apparent that substantial resources have to be invested to come to appropriate conclusions at every stage of the framework. It is therefore important that only those cases are investigated further in which the likelihood of substantial anticompetitive effects is sufficiently high. The operational level in section 2.4 will discuss these implications in more detail.

Box 15. Innovation market analysis in *Genzyme-Novazyme* (2004)

In 2004, the FTC decided – by split decision – to close its investigation of the proposed $120 million acquisition of Novazyme Pharmaceuticals, Inc. by Genzyme Corp. The acquisition, announced back in 2001, was remarkable from an antitrust

perspective because it did not involve any existing product market but solely combined two research programs which aimed at finding a treatment for the often fatal Pompe disease. As Genzyme and Novazyme were the only companies with such research programs in the United States, the transaction would lead to a 'merger to monopoly'. Genzyme's plan, however, was not to merge the two research programs post-merger but to continue research in both programs separately (see Balto and Sher, 2004).

Given this short description of the case background, an application of the standard US horizontal merger guidelines (HMG) very likely would have led to the prohibition of the merger, given a 100% market share post-merger. However, the FTC acknowledged during its assessment that "economic theory and empirical investigations have not established a general causal relationship between innovation and competition" (FTC, 2004: 1). In other words, while concentration is believed to provide guidance for antitrust decisions in existing product markets (i.e., a higher concentration typically leads to harmful price increases), the role of concentration in innovation markets is largely undetermined ex ante. On the one hand – following Arrow (1962) – monopoly power can lead to a reduction in the incentives to innovate, while on the other hand – following Schumpeter (1942) – monopoly power creates possibilities to shoulder substantial R&D investments. Given these diverging views on the role of market power in innovation markets, the FTC deviated from the HMG procedure and especially focused in their assessment on the question whether the Genzyme-Novazyme acquisition would cause a socially harmful slow-down in the speed of the innovation processes of the two research programs.

The majority of the commissioners concluded that Genzyme had no incentives to slow down either its own or the research program of Novazyme post-merger. Two commissioners, however, had doubts that the merger was entirely procompetitive, basically because the merger extinguished the race-to-market between Genzyme and Novazyme which can be expected to increase competition. Furthermore, as both research programs were planned to be continued in the merged entity, there were no efficiencies in the sense of fixed costs savings. Additionally, it was doubted whether the claimed merger efficiencies – such as the possibility of comparative experiments and general synergies between the two programs – were merger-specific (as typically demanded by the US antitrust authorities). However, the majority of the FTC commissioners decided that the evidence collected did not allow the conclusion that the acquisition is anticompetitive and therefore cleared the merger. In the aftermath of the decision, the academic discussion about the antitrust treatment of innovation markets reached its second hype (see, for example, Balto and Sher, 2004; Davis, 2003; Rapp, 2004; Wald and Feinstein, 2004) after the first accummulation of research papers by the mid-1990s (see, for example, Gilbert and Sunshine, 1995; Hoerner, 1995; Dahdouh and Mongoven, 1996; Widnell, 1996).

2.3.3.2 Intervention

Detecting is a necessary but not sufficient condition for *enforcing*. Even the cleverest detection rule stays an academic mind game if it is not applied in the sense that possible infringements are pursued and eventually intervened against. As reflected in the integrated approach of antitrust analysis, only the appropriate characterisation and rationalisation, the assessment of the respective business conduct with respect to its anticompetitive effects, the subsequent design of appropriate

antitrust rules *and* appropriate interventions against detected breaches of these rules *together* can create an efficient antitrust policy.

From the viewpoint of an antitrust authority, the intervention stage adds a third powerful decisions variable to the already identified choices of the control strategy and the timing of control: the type of intervention. In general, three types of intervention are available for an antitrust authority: fines, behavioural remedies and structural remedies. A *fine* is commonly understood as imprisonment or an amount of money which must be paid for a proved misdemeanour or felony. A *remedy* comprises all other possible (non-pecuniary) interventions with either a behavioural or a structural focus.[130] Conceptually, fines and remedies differ considerably; "[r]emedies cure, correct, or prevent unlawful conduct, whereas sanctions penalise or punish it" (OECD, 2007: 7). Table 20 shows the resulting intervention options determined by the type of intervention and the timing of control.

Table 20. Intervention options

		Type of intervention		
		Fine (€)	Behavioural remedies	Structural remedies
Timing of control	ex ante	n.a.	A	B
	ex post	C	D	E

The choice of the appropriate intervention depends on the type of conduct it refers to. If an ex ante approach is applied, fines are generally inappropriate, as – by definition – no anticompetitive (harmful) effect has occurred yet which would justify that. Behavioural and structural remedies, however, might very well be considered as appropriate ex ante tools, for example, if it is likely that future market

130 Lévêque (2000: 3) provides a classification of possible ways to intervene. He defines the following general targets as a firm's environment (e.g., optimal fines), a firm's outputs (e.g., regulations of price, quantity or quality) and a firm's frontiers (e.g., break-up of an undertaking). A good example for target (1) would be antitrust fines. Point (2) mainly refers to what is called behavioural remedies, such as regulations of price, quantity or quality; while (3) stands for structural remedies, such as the break-up of an undertaking in order to end persistent abuse of a dominant position. Gavil et al. (2002) remark that "[i]n antitrust systems with criminal sanctions, criminal punishment ordinarily is reserved for well-defined categories of pernicious conduct such as price-fixing by competitors or bid-rigging. The more common remedies are civil sanctions. These include civil monetary penalties, such as fines and damages, limits on behavior, mandatory licensing of intellectual property, and the divestiture of assets" (Gavil et al., 2002: 57).

structures would be more vulnerable to forms of anticompetitive behaviour. An ex post approach can revert to the full toolbox of interventions reaching from the imposition of fines via behavioural remedies up to structural remedies such as divestitures. Given these general differences, the particularities of both approaches will be assessed in more detail below in the application of the intervention stage to hard core cartels (largely ex post intervention) as well as horizontal mergers (largely ex ante intervention). Furthermore, chapter 4 will extend the analysis to predation as a monopolisation strategy which can be fought by intervening either ex ante or ex post.

Before a discussion of these applications is developed, it is crucial to focus on a somewhat indirect effect of actual interventions which nevertheless lies at the heart of contemporary antitrust policy: the deterrence effect of interventions. Notwithstanding the punitive and/or compensatory roles of actual fines for the offender and the victims[131], the probably most important effect of actual fines are their spillover effects on other firms (in the same or other markets), signalling that the antitrust authority is able and willing to intervene against breaches of the specific competition rule and probably also against breaches of other competition rules. In other words, actual interventions must be interpreted as an investment in the credibility of the antitrust authority. As argued by Acutt and Elliott (2001), in a perfect world without resource constraints and perfect information, such a 'threat-based competition policy' basically has the same disciplining effect on the incumbent firm(s) as a so-called hit-and-run entrant in the theory of contestable markets. If the antitrust authority punishes every deviation of the incumbent from the competitive benchmark with an optimal fine, it is the dominant strategy for the incumbent to produce the competitive output. Although the argument is purely theoretical, it shows the potential power of a tough reputation of an antitrust authority with respect to the deterrence of particular types of behaviour.

In general, a deterrence effect is created by a combination of the prospect of being subject to reasonable (and unpleasant) penalties and the serious likelihood of being caught while engaged in the illegal activity (see Baker (2001: 713). From a practical perspective, there is only little doubt that contemporary antitrust policy

[131] Following Easterbrook (1981: 319), "[d]eterrence is thus the first, and probably the only, goal of antitrust penalties. If awarding damages to an injured party also compensates him, that is just a pleasant by-product". In more general terms, the OECD (2007: 7f) identifies a diversity of opinion regarding the objectives that should be pursued when designing remedies and sanctions: "[d]eterring future anticompetitive conduct, restoring competition, compensating victims, and simply putting an end to the unlawful conduct". In the remainder of this work, deterrence and restoring competition are viewed as the central aims of the imposition of fines and remedies. While fines as well as remedies can contribute to the creation of a deterrence effect, fines typically contribute less to the problem of restoring competition. As a consequence, this problem has to be tackled by the design and implementation of suitable remedies. Compensation issues are assumed to be decided in separate private antitrust lawsuits and are not considered further.

– at least in the United States and the European Union – is fundamentally based on the deterrence idea. Paul Joskow (2002: 98) makes this very clear:

> U.S. antitrust policy is primarily a deterrence system not a regulatory system. That is, antitrust policy and the associated enforcement hierarchy are not, in general, designed broadly to scrutinise, screen, or approve firm behaviour or market structures throughout the economy. Instead, antitrust policy relies on administrative and case law developed through public and private antitrust enforcement actions to develop a set of 'antitrust legal rules' which businesses are expected to internalise into their decisions.

Supporting this point of view, Easterbrook (1981: 319) argues that "[d]eterrence is thus the first, and probably the only, goal of antitrust penalties".

In his new edition of *Antitrust Law*, Richard Posner (2001) provides further insights into antitrust enforcement in the United States. In particular, he collects a time series of the antitrust fines imposed in the United States from 1890 to 1999, which is presented in Table 21.

Table 21. Antitrust fines imposed in the United States from 1890 and 1999

Period when case was filed	Number of cases in which fine was imposed		Average fine per case in which fine was imposed		Total fines	
	No.	%-change	'000 USD	%-change	'000 USD	%-change
1890-1899	-	-	-	-	-	-
1900-1909	11	-	20	-	220	-
1910-1919	24	118%	20	0%	480	118%
1920-1929	15	-38%	98	390%	1.470	206%
1930-1939	18	20%	61	-38%	1.098	-25%
1940-1949	149	728%	52	-15%	7.748	606%
1950-1959	121	-19%	40	-23%	4.840	-38%
1960-1969	103	-15%	131	228%	13.493	179%
1970-1979	156	51%	301	130%	46.956	248%
1980-1989	513	229%	368	22%	188.784	302%
1990-1999	324	-37%	4.778	1198%	1.548.072	720%

Source: Posner (2001: 44ff.).

As shown in Table 21, the average fine per case (in which a fine was imposed) underlies significant changes between the different periods. However, the experienced substantial increase in the average fine – in fact by almost 1200% – from the 1980-1989 enforcement period to the 1990-1999 enforcement period is without precedent in the history of antitrust enforcement in the United States. One possible interpretation of these figures is that US antitrust policy recently increased actual fines in order to foster the deterrence effect of antitrust enforcement.

For the European Union or the United Kingdom, Calvino (2006), Acutt and Elliott (2001) and Geroski (2004) provide general discussions which emphasise the crucial role of the deterrence effect for an efficient antitrust policy. With re-

spect to cartel enforcement, Neelie Kroes, the European commissioner responsible for competition policy, recently said that generally "[p]revention is better than cure … [however] sometimes a substantial fine is quite a direct way to really drive our deterrent message home!" (Kroes, 2006: 2). Furthermore, Box 16 presents quantitative evidence on the growing importance of fines in the European Union, which can be interpreted as an indicator for the attempt of European antitrust policy also to increase the deterrence effect of antitrust enforcement.

As discussed in more detail by Wils (2002: 16ff.), deterrence is almost doomed to be the antitrust enforcement approach, simply because the alternatives, such as prevention or stimulation by moral commitment, might be able to add value as additional approaches within the system of public enforcement but are, however, simply too expensive to administer in order to constitute a perfect substitute for the deterrence-based approach.

An additional indicator for an increased deterrence effect could be seen in a diagnosed increase in the implementation of so-called competition law compliance programs on the firm level. Generally speaking, *antitrust compliance programs* aim at assuring that employees of a company are aware of antitrust laws and that they comply with the existing rules. Compulsory parts of antitrust compliance programs are the issuing of an antitrust compliance handbook, active training of the senior company staff and a reoccurring evaluation of the program. An increase in the adoption of such programs could therefore be interpreted as a (profitable) investment of firms into the avoidance of antitrust infringements and the resulting fines. Interestingly, Rodger (2005) investigated whether the reform of UK competition policy in the late 1990s – which introduced significant increases in investigatory and fining powers of the competition authorities – led to increased compliance efforts in the UK industry. He assessed the competition law compliance programs of three major UK companies and found limited evidence to support the theoretical argument that an increase in the expected sanctions for cartel breaches leads to an increase in compliance efforts (see Beckenstein and Gabel, 1986, for an economic perspective of antitrust compliance for the law enforcement system of the United States).

In direct connection to the general discussion in section 2.3.3 on important institutional foundations of competition policy, experiences from countries that recently introduced competition law provisions can exemplify the importance of a deterrence effect for an efficient antitrust policy. Owen (2003: 2) shows for several countries in Latin America that competition laws without enforcement can hardly have an influence on the creation of a competitive culture:

> There are common obstacles to effective competition policy in the region. First, both Latin American courts and Latin American governments have difficulty making credible commitments upon which firms and markets can base a stable set of expectations. While this is a problem whose effects are felt throughout the economy, not just in antitrust, it greatly hinders the use of the deterrence mechanism to guide economic behavior.

Notwithstanding the importance and desirability of creating a deterrence effect, it cannot be overemphasised that it is in any case crucial to consider not only the potentially positive effects of expected interventions on firms' behaviour but also

potentially negative effects caused by suboptimal antitrust rules and their enforcement (see also Kaplow and Shapiro, 2007: 59). Following Carlton and Perloff (2000: 361), thoughtful answers to the intervention question are essential, as generally "[t]oo little enforcement leads to bad behavior and monopoly power, whereas too vigorous enforcement may deter firms from pursuing desirable forms of competition for fear that this competition will be misinterpreted". In other words, although the creation of a deterrence effect is principally desirable and necessary, the implementation of such a deterrence effect always contains the danger of deterring procompetitive behaviour. To be more specific, it is the aim of antitrust policy to create a deterrence effect with respect to hard core cartels but not with respect to any kind of cooperation between firms; it is further the aim of antitrust policy to deter anticompetitive mergers but not to discourage procompetitive mergers; finally, it is the aim of antitrust policy to deter anticompetitive decreases in price but not to affect the incentives of firms to introduce procompetitive price decreases.

Box 16. The growing importance of antitrust fines in the European Union (1964-2002)

The growing importance of antitrust fines – as part of a deterrence-based competition policy – can be underpinned by analysing the average fine levels per case imposed by the European Commission over time. Schinkel et al. (2006) assembled a dataset which includes all antitrust decisions (except for merger control and state aid decisions) of the European Commission between 1964 and 2002. The descriptive results for the change in fine levels are presented in Table 22.

Table 22. Economic rationale versus fine over time in the European Union

Period	Horizontal constraints		Abuse of dominance		Vertical restraints		Total	
Sum of fines /No.	m €	No.	m €	No.	m €	No.	m €	No.
1964-1976	10,7	25	1,3	5	0,3	8	12,3	38
1977-1989	177,0	49	23,3	14	15,5	28	216,0	91
1990-2002	3691,1	49	360,5	21	435,2	24	4487,0	94
Total	3879,0	123	385,1	40	451,1	60	4715,3	223
Average fine	m €		m €		m €		m €	
1964-1976	0,431		0,260		0,038		0,326	
1977-1989	3,614		1,666		0,557		2,374	
1990-2002	75,330		17,170		18,137		47,734	

Source: Raw data stems from Schinkel et al. (2006: 16); own calculations.

As shown in the table, the observation period is subdivided into three periods of 13 years each. Comparing the most recent period with its predecessor with respect to the sum of fines immediately reveals the huge increase in the amount of antitrust fines imposed for breaches of competition law. The greatest fine fraction can be assigned to horizontal constraints, which largely reflects the recent cartel enforcement record.

A comparison of the number of cases between the second and third periods further reveals that the overall fine increases are not driven by an increase in the number of cases but by a stiff increase in the average fine per case. Although it is unclear how much of the increase can be credited to an increasingly deterrence-based competition policy and how much to other factors, such as an increase in the trading volumes or the methods to calculate fines, it is nevertheless likely that the achievement of deterrence effects is an important explanatory variable. Furthermore, especially changes in the methods to calculate fines might just reflect the overarching aim of increasing the deterrence effect of antitrust enforcement.

What these examples show is that the respective antitrust rules and their enforcement need to be accurate and concerted – as suggested by the integrated approach – in order to give firms the possibility to incorporate these rules into their business decisions without unnecessarily constraining the set of strategies available to them. As it will be shown in the following applications of the intervention stage to hard core cartels and horizontal mergers, per se prohibitions are – by way of construction – better suited to provide these clear signals to firms than rule-of-reason assessments. While the success of the former stands and falls with a clear definition of the forbidden conduct, the latter can only provide some guidance on how a certain type of conduct would be evaluated. Although the signalling of these analytical steps is certainly important and helpful for firms in investigating their planned strategies with respect to their compliance with antitrust rules, the final outcome is typically less foreseeable given the considerable administrative discretion on the side of the antitrust authority which is necessary to decide whether the identified conduct is pro- or anticompetitive in the case at hand.

Application A-4: Intervening against hard core cartels

Interventions against hard core cartels are motivated by the belief that the imposition of fines discourages attempts by firms to form hard core cartels. Consequently, the fundamental purpose of antitrust fines is to create and keep up a deterrence effect by signalling to the companies that substantial fines will have to be paid if their conspiracy is detected. This basic allegation immediately demands economic answers to the question of how a deterrence-optimal fine should be derived.

In general, an ex ante deterrence effect is determined by especially two parameters: the severity of the sanction and the probability of detection (see Gal, 2000: 104ff., for a detailed assessment). In general, a certain behaviour is deterred if the fine is equal to the gain of the conduct (for the offender) divided by the probability of detection. For example, if the excess profit of a cartel agreement g is given by $g=200$ and the probability of detection p is given by $p=0,2$, the corresponding fine F to deter such behaviour can be calculated to $F=(200/0,2)=1000$.[132]

[132] The basic model was developed in a seminal paper by Gary S. Becker (1968), in which he focused on a utility maximisation problem for an individual who faces the introduction of a law enforcement regime. Translated into the cartel world, the ex-

Although the focus on the gain for the offender as the numerator in the deterrence-optimal fine calculation seems to be straightforward, research in law and economics identified an alternative numerator which refers to the 'net harm to others' caused by the offender. As shown by Polinsky and Shavell (2000: 50), if the net harm to others is given by *h* and the probability of detection is still *p*, then the optimal harm-based fine *F* is given by *F=h/p* (as long as individuals are risk-neutral[133]), which is equal to the policy conclusion that the expected fine has to equal the net harm to others caused by the offender in order to deter the harmful conduct.

Although it is still disputed in antitrust law and economics whether 'gain' or 'harm' provides the appropriate basis for antitrust fines, recent commentators tend to favour the harm-based approach (see Wils, 2006: 12ff., for a discussion). This trend is based on a seminal paper by William Landes (1983), in which he showed under fairly general conditions that "[t]he optimal penalty should equal the net harm to persons other than the offender, adjusted upward if the probability of apprehension and conviction is less than one. This sanction encourages efficient behavior" (p. 678). One fundamental advantage of the harm-based fine over the gain-based fine is that the former would not deter those types of efficient conduct which cause more gain to the offender than harm to society and should therefore not be deterred (but punished) from a welfare perspective (see chapter 4 for a detailed assessment of and practical criteria on how to set optimal antitrust fines).[134] As stated by Wils (2006: 13):

> The optimal fine thus set makes the offender internalise all the costs and benefits of the violation, thus leading the offender to commit the 'efficient violations' whose total benefits exceed the total costs while deterring 'inefficient violations' whose total costs exceed the total benefits.

With respect to cartel enforcement, Souam (2001) investigates two different regimes of pecuniary punishment in a theoretical model: a fine based on revenues of the respective industry and a fine which relates to the damage caused to customers. Given the fact that investigations are costly and have a declining social benefit, he generally found - in line with many other authors – that it is welfare-optimal in both systems to tolerate some degree of collusion. As long as the damage is less than the ex ante costs of deterrence, it is welfare-optimal not to intervene. With respect to the comparison of the two alternative fine bases, Souam's results show that both approaches are theoretically similar as they both reach

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pected profits of the cartel agreement are given by $E(G^c)=p(G^c-c-F)+(1-p)G^c=0$. It immediately follows that the deterrence-optimal fine is given by $F=(G^c/p)-c$, where *c* is used as a measure of costs incurred by the detection process (which is set to 0 for the time being).

133 An individual is risk-neutral if he or she is indifferent about an expected cost or value and its certain equivalent.

134 However, in case of hard core cartels, it is quite unlikely – as discussed as part of the welfare assessment above – that the gain will be bigger than the harm; i.e., gain-based fines would almost certainly deter cartelisation. However, this might not be true for other areas of antitrust policy (see Camilli, 2005: 6ff., for a discussion).

similar deterrence levels. However, in industries in which the likelihood of collusion is small, a revenue-based fine has certain advantages over a damages-based fine, while in industries with high possibilities of collusion, a damage-based fine reaches slightly better performances.

Assuming that harm is chosen as the generally appropriate basis for antitrust fines, the harm caused by a cartel is determined by market size, duration of the infringement and size of the price rise compared to the competitive level[135] (i.e., the overcharge). If such a fine is a credible threat to market participants – together with a probability of detection of one – cartel agreements would be completely deterred. However, as already indicated by Souam above, keeping up a probability of detection of one would be an extremely expensive task far away from practical implementation. For example, a study by Bryant and Eckard (1991) estimated that the probability of detection for cartel agreements in a twelve-month period is about 15% on average.[136] This still does not mean that a full deterrence effect cannot be reached, as it is theoretically possible to adjust the size of the fine upward to compensate for the reduction in the probability of detection. However, studies also have revealed that such a proposal is far off any practical applicability for general economic reasons, such as the social and economic costs of such high fines, as well as for practical reasons, such as the inability of firms to pay such fines[137] (see Wils, 2006: 18ff.). In other words, it is neither possible not economically desirable to completely deter cartelisation.

However, even if antitrust fines and the probability of detection are not high enough to deter cartelisation completely, they still benefit consumers. The basic economic rationale behind such an assertion is formalised by Block et al. (1981), who study the relationships between antitrust enforcement and optimal collusion in a simple theoretical framework. The authors assume that the cartel objective is to maximise profits; hence, in a world without an antitrust authority all firms in the industry collude and charge the monopoly price. If now an antitrust authority is introduced which monitors the price-cost markup and decides to investigate (and imposes fines) if the markup exceeds a threshold level, the price-cost markup now significantly affects the probability of detection – that is, the higher the price-

135 These three parameters also determine the damage caused by the cartel, which needs to be calculated in private damage claims. Although private enforcement is not the focus here, Annex 6.1 gives a broad overview of these issues as part of a case study of the US lysine price-fixing conspiracy.

136 In a recent study, Connor (2006: 9ff.) collected views on the probability of cartel detection and found that most evidence seems to suggest a 10-20% chance of detection.

137 This reminds of the general question why it is not optimal to introduce capital punishment for price fixers. Although such a step might come near to full deterrence, it would very likely cause the avoidance of any kind of procompetitive cooperation that could be interpreted as a cartel. As shown in section 2.3.1, the term *cartel* represents a relatively diverse set of business conducts. Additionally, managers threatened by capital punishment would have a huge incentive to invest in compliance systems or alternatively in ways to hide their criminal acts. Both types of investment are costly to society.

cost markup, the more likely is an investigation by the antitrust authority. In such a model setup, it is straightforward to show that a profit-maximising cartel will not set the monopoly price anymore; but it will, however, nevertheless charge a price above the competitive level. In fact, the price level is determined by both the size of the expected fine and the probability of detection (i.e., the enforcement efforts of the antitrust authority). In other words, the Block et al.'s model shows that an increase in either the size of the fine[138] or the probability of detection leads to a reduction in the price-cost markup by the cartel firms. This reduction in price is solely caused by the deterrent effect of antitrust enforcement (see Martin, 2000, for a similar model with similar results).[139]

A relatively recently (re-)discovered possibility to increase the probability of detection – and therefore to strengthen the deterrence effect – are leniency programs. Generally speaking, a *leniency program* adopted in cartel cases promises the first cartel member which reports its involvement in the cartel to the antitrust authority either partial or total leniency from any subsequent fines. However, as shown in Box 17 for the case of the United States, leniency programs in practice are much more complex, basically to assure that the program provides an appropriate incentive structure for corporations and individuals[140] to come forward with hard facts, while at the same time without giving them the possibility to abuse the program.

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138 With respect to the effects of an increase in fines, Whinston (2006: 45) generally remarks that such a step should, ceteris paribus, lead to an increase in the level of effectiveness at which firms find it worthwhile to cartelise. As a consequence, the price effects of detected cartels should be more fundamental (as indeed found by several studies sketched in section 2.3.2).

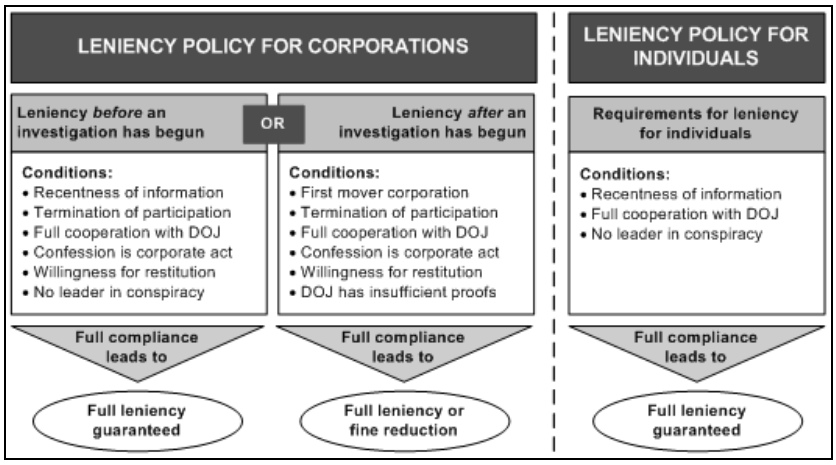
139 Cyrenne (1999) examines an antitrust enforcement policy which focuses on significant price changes in an industry as a sorting mechanism for the allocation of enforcement resources. He shows that such an enforcement strategy typically reduces the expected profits from the collusive agreement; however, it will be ineffective in reducing the frequency of collusion as long as the punishment is not large enough. Furthermore, Cyrenne suspects that firms can easily adjust their behaviour to such an enforcement policy so that the method would not be able to detect their conspiracy any more.

140 As price-fixing is a criminal offence in the United States, it is possible and common practice to convict leading cartel managers to jail terms of up to three years. Following Gallo et al. (2000), 53% of the convicted managers were sent to prison since 1970. This threat of incarceration might be an important incentive for managers to come forward without necessarily wanting to convince the whole company to apply for leniency as a corporate act. Hence, the consequential reaction to the situation in the United States was the implementation of a separate leniency program for individuals (see Werden and Simon, 1987, for a general assessment of why price-fixers should go to prison).

Box 17. The US leniency policy in cartel cases (1993/1994)

The first version of the US leniency policy was introduced in 1978. Under that program, only the first self-reporting firm was eligible to receive a complete pass from criminal prosecution if it reports before an investigation has begun. The policy makers aimed at initiating incentives for firms to race each other to the door of the Antitrust Division. Nevertheless, „[r]ather than a race, however, the policy produced a crawl“ (Kobayashi, 2002: 17). In 1993, the US Antitrust Division revised and expanded its amnesty program with the central aim of increasing the opportunities and raising the incentives for firms to report their cartel involvement. After this revision, the number of leniency applications rose from about one per year to two per month. Figure 22 gives an overview of the revised leniency program for corporations (1993) and individuals (1994).

Fig. 22. The US Leniency policy for corporations and individuals



Under the division's revised policy, leniency would be automatic for the first self-reporting firm if it reports before an investigation has begun and if it meets all six requirements mentioned above. Furthermore, the revised policy also allows full amnesty in cases where the antitrust authority has already initiated an investigation. In such a case, the revised policy requires the fulfilment of six slightly different requirements than in the former case. "Third, if a corporation qualifies for automatic amnesty, then all directors, officers, and employees who come forward with the corporation and agree to cooperate also receive automatic amnesty" (Hammond, 2000: 2). It is important to mention further that the US Amnesty Program for Corporations was complemented by a corresponding Amnesty Program for Individuals in 1994. This program grants leniency to a self-reporting decision maker of a cartel member even if his employer does not qualify for leniency. This might be of interest for the respective managers of the cartel firms, as US antitrust law allows pecuniary fines and incarceration for leading individuals of the conspiracy (see Hüschelrath, 2002: 146ff.).

From a theoretical perspective, the general idea behind leniency programs is that they "may destabilise organised crime by undermining internal trust with the increased risk that one of the involved parties unilaterally reports to enjoy the benefits of the leniency program" (Spagnolo, 2000: 3). In other words, leniency programs intend to reinforce the prisoner's dilemma situation, which exists in every cartel agreement.

The plausibility of this fundamental argument in favour of leniency programs as a way to destabilise collusion is disputed among economists. Ellis and Wilson (2001: 3), for instance, ask why cartel members should abandon their profitable cartel agreement in exchange for a reduction in fines. Intuitively, applying for leniency would only make a difference to them if the cartel is at the border of breaking apart anyway. In other words, firms will only apply for leniency when the cartel is already detected and the probability of punishment is sufficiently high. The influence of a leniency program on the probability of detection can therefore be expected to be minimal.

Aubert et al. (2005) developed a simple model to study the effects of leniency programs on collusive agreements. They suppose that two firms play an infinitely repeated game in which they have to choose at the beginning of each period whether they go for the collusive strategy or the competitive (i.e., deviation) strategy. It is further supposed that π^M is the profit per period and per firm if both firms decide to collude, π^D is the profit for a firm that deviates, π^S is the profit of the firm that decides to collude while the other firm deviates, and π^C is the profit if both firms compete in the market. It is reasonable to assume that firms gain from collusion and that the deviating firm benefits at the expense of the other firm, so $\pi^S<\pi^C<\pi^M<\pi^D$ as well as $\pi^S+\pi^D<2\pi^M$. It is further assumed that if one firm deviates, both firms play the competitive strategy in each of the coming (infinite) number of periods.

It is further assumed that an antitrust authority is overseeing the industry and can impose a maximal fine F which is not large enough to deter collusion, so $\pi^M-\pi^C>\omega F$. In order to detect collusion, the authority can either collect evidence by auditing the industry (this is assumed to take place with probability ω), or, if a leniency program is implemented, each firm can decide to inform the authority of the existence of the collusive agreement. Given this setup, Aubert et al. (2005) characterise the effects of both mechanisms on the sustainability of collusion as follows.

In the absence of a leniency program, the profits for the firms in every period are $\pi^M-\omega F$ in case both firms collude, $\pi^D-\omega F$ for a firm which competes while the other colludes (and therefore only realises a profit of $\pi^S-\omega F$) and simply π^C if both firms compete. As shown by Aubert et al. (2005), the most profitable collusive strategy is to collude in every period and punish deviations with returning to the competitive equilibrium. Collusion is sustainable if the gains realised when deviating are lower than the discounted gains from colluding:

$$\pi^{\mathrm{D}} - \omega\mathrm{F} + \frac{\delta}{1-\delta}\pi^{\mathrm{C}} \leq \frac{1}{1-\delta}\left[\pi^{\mathrm{M}} - \omega\mathrm{F}\right], \tag{27}$$

or equivalently

$$\pi^D - \pi^M \leq \frac{\delta}{1-\delta}\left[\left(\pi^M - \omega F\right) - \pi^C\right]. \tag{28}$$

If, however, the antitrust authority has implemented a leniency program with which it can reward reportings by firms with a reduction of the fine from *F* to *f*, a deviating firm will denounce its competitor if the reduced fine is lower than the expected fine it would have to pay if an audit takes place. In this case, collusion is sustainable if

$$\left(\pi^D - f\right) - \left(\pi^M - \omega F\right) \leq \frac{\delta}{1-\delta}\left[\left(\pi^M - \omega F\right) - \pi^C\right]. \tag{29}$$

It follows that a leniency program has a deterrence effect on collusion only if

$$\pi^D - \pi^M \leq \frac{\delta}{1-\delta}\left[\left(\pi^M - \omega F\right) - \pi^C\right] \leq \pi^D - \pi^M + \omega F - f\,. \tag{30}$$

In this model, leniency programs do not influence the profitability of collusion and affect its sustainability only by giving deviating firms the opportunity to avoid a fine in the case of investigations by the antitrust authority. "Leniency programs can therefore be effective only when the expected fine ... is large, that is, when collusion would already be fragile without any leniency program" (Aubert et al., 2005: 12). In other words, leniency programs likely raise the probability of punishment (as defecting firms have an incentive to apply for leniency and to provide hard evidence about the conspiracy), but likely have a very limited influence on the probability of detection.[141] However, a refinement of the basic model shows that leniency programs become a more powerful detection and deterrence tool as soon as the antitrust authority is allowed to pay rewards to reporting cartel members (or especially individuals) instead of just offering an exemption from fines.[142] Such an approach, however, might conflict with moral considerations, seeing a lawbreaker receiving rewards for cheating on an illegal agreement he himself profited from.

Motta and Polo (2003) present another modelling approach of leniency programs in which they analyse the effects of leniency programs on the incentives of firms to collude and to reveal information that helps the antitrust authority to prove illegal behaviour. One important result of their model is that leniency programs might induce firms to collude more often, as leniency programs reduce the

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141 The scepticism towards the role of leniency programs with respect to influencing the probability of detection is also shared by Harrington (2006b: 13): "[I]t is an open question … as to how effective leniency programs have been in discovering cartels. I am convinced by their role in prosecution as the evidence is much stronger when it is provided by one of the cartel members."

142 Spagnolo (2000) models another, more courageous form of leniency program which allows reporting firms to be rewarded. In this context, optimally designed leniency programs for undetected cartels can be a very powerful detection instrument. While the reporting firm receives rewards, the costs of the competitors are raised by the fines imposed.

expected fines in the event of detection. Consequently, preventing collusion by setting optimal fines is the first best option for an antitrust authority. However, if an optimal fines approach cannot be followed, the introduction of leniency programs may be optimal in a second-best perspective. "Fine reductions, inducing firms to reveal information once an investigation is opened, increase the probability of ex-post desistence and save resources of the antitrust authority, thereby raising welfare" (Motta and Polo, 2003: 26).

Although a significant influence of leniency programs on the probability of detection in the current design is unlikely, such programs can have important value for an overall strategy of the antitrust authority to detect and to prove hard core cartels. As described on the detection stage, the authority has structural and behavioural tools to screen industries. If something suspicious is found – i.e., the probability of detection increases significantly – cartel members might decide to come forward and apply for leniency. This step, in turn, typically provides the antitrust authority with the hard evidence it must have in order to prevail with the case in court. In the words of Harrington (2006b: 13): "the presence of an active leniency program makes the case for screening more, not less compelling because they are complements".

Having studied the theoretical motivations behind fines, a positive probability of detection and leniency programs, it is important to complement such an analysis with experiences from the actual implementation of these enforcement instruments. As already mentioned above, such a comparison is possible because most countries already implemented some kind of anti-cartel law as well as cartel enforcement and the consequential question is not whether it is welfare-increasing to introduce competition policy but rather whether (and how) it is possible to ameliorate it.

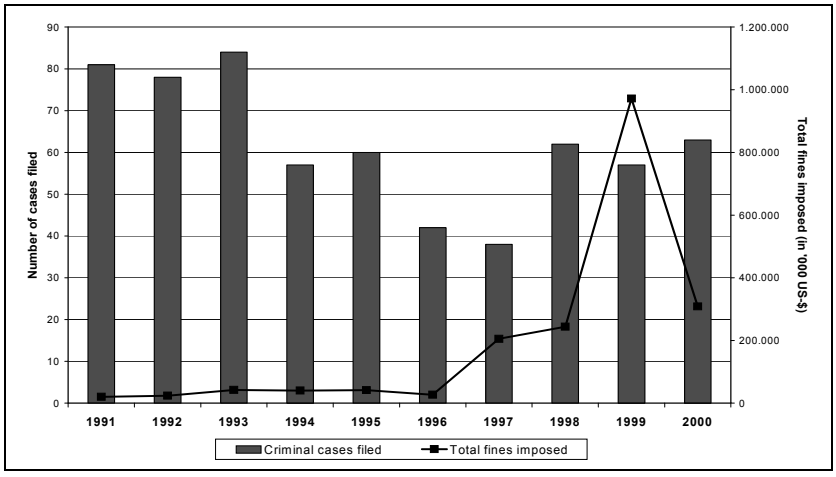
In general, an assessment of the successfulness of cartel enforcement faces an identification problem. If only a few cartels are detected, this could on the one hand be an indicator of a successful deterrence policy of the antitrust authority. On the other hand, however, an alternative interpretation of such an observation could be that the antitrust authority follows an ill-equipped approach to detect cartels or suffers from insufficient resources to exercise its duties conscientiously. Vice versa, an increase in the detection of cartels could on the one hand be an indicator that certain policy changes have been steps in the right direction. However, on the other hand, it could also indicate that only the number of cartels has risen and the antitrust authority was able to detect some of them more or less accidentally. Despite the identification problems, economists tend to accredit the recent success in the detection of especially big international cartels to a combination of policy improvements, including the ones discussed earlier in this section (see Box 18 for evidence from the United States).

Box 18. International cartels and competition policy: What's behind the recent success?

The last couple of years have seen an increasing detection and punishment record of several antitrust authorities with respect to mostly international cartels. Figure 23 (adopted from Litan and Shapiro, 2001: Annex) shows the development in number of criminal cases filed as well as total fines imposed for the United States between 1991 and 2000.

Economists have identified a couple of explanations for this cartel enforcement record. As argued in Hüschelrath (2002), it is likely that only a combination of several policy instruments together – which influence the probability of detection and/or the probability of punishment – can explain part of the observed enforcement record and can help to increase it further in the coming years. Starting from the simple equation for the deterrence-optimal fine, $F=(H/(p_d \cdot p_p))$, it is argued that deterrence-optimal fines (F) cannot be credibly set by the antitrust authority, as corporations might not be able to pay them. The leniency program in the current institutional design likely leads to an increase in the probability of punishment (p_P) (and saves some resources), but it is unlikely to influence the probability of detection (p_D). Consequently, high (but still credible) fines and leniency programs must be complemented by an increase in the probability of detection. This aim could be reached by a more effective and/or more efficient resource allocation by the antitrust authority, the implementation of pro-active detection strategies and by cooperation between different antitrust authorities. Again, only these instruments together assure a significant increase in the probability of detection, and again severe resource constraints, incomplete knowledge about cartel incentives and free-rider problems limit the effectiveness of these instruments. Moreover, by setting the parameters F, p_P and p_D, policy makers should take into account that the cartel gains and therefore the harm H might have risen due to the internationalisation of markets.

Fig. 23. Criminal cartel investigations and total fines in the United States (1991-2000)



A further indicator of the success of cartel enforcement focuses on the question whether the fines actually collected by the antitrust authorities come anywhere near to the theoretically derived optimal fines (and therefore signal firms that cartelisation does not pay). Veljanovski (2007a) collected data on duration, fines imposed, sales, overcharges, and consumer losses for several detected and prosecuted hard core cartels in the European Union. He further calculated the theoretically optimal fines – largely based on the respective cartel overcharge estimate (the measure for 'harm caused') as well as an (optimistic) probability of detection for cartels of 33%. An extract of his results is presented in Table 23.

As shown in Table 23, the fines collected by the European Commission largely under-deter price-fixing.[143] As shown by the multiplier in the last column, the optimal fine would have been between 1,6 and 115,5 times higher than the fines actually imposed. However, although these results on the surface speak for significant under-deterrence, it has to be kept in mind that the public fines presented in the table might be complemented by other costs, which can be interpreted as additional fines from the viewpoint of the cartel members. In addition to private damage claims, whose importance recently began to grow in the European Union, an additional cost is created by the lawsuit itself (and the respective fees for lawyers and economists; see, for example, OECD, 2007: 30).

An additional component of the fine package for cartelisation is stock market reactions triggered by the detection and prosecution of a cartel. Langus and Motta (2006) use an event-study approach to investigate the impact of various events of EU cartel enforcement on the respective firm's stock market value. Their results show that dawn raids reduced the firm's stock market value by 2,2% on average on the day of the raid. Furthermore, the formal decision of the European Commission (that a cartel was detected) led to another loss of 3,0% on average of the firm's stock market value. The authors conclude that these losses should be considered as another component in the fine package (consisting of public fines and private damages) that follows the prosecution of a cartel. As a consequence, losses in the firm's stock market value also contribute to the overall deterrence effect of antitrust laws. It thus has to remain undecided whether price-fixing in the European Union is really under-deterred.

Still aiming at assessing the successfulness of hard core cartel enforcement, another quantitative possibility is to analyse its effect on post-cartel prices. From a theoretical perspective, the breakdown of a cartel should be followed by price declines down to the non-collusive level. Empirical evidence, however, partly suggests that this price decline is often less significant. Feinberg (1984), for example, found a decline in average prices in four out of five investigated cartels between

143 In a recent paper, Connor (2006b) reaches the same conclusion albeit applying an alternative approach. He concludes that in order to "ensure optimal deterrence of global cartels, total financial sanctions should be four times the expected global cartel profits (the overcharge). In the case of followers, deterrence would require penalties in all geographic regions to be equal to eight times global cartel overcharges. Even in cases widely regarded as exemplary prosecutions, antitrust sanctions historically have failed to approach optimal levels" (p. 30).

6,6% and 11,4% which, however, partly diminished in the five years following the cartel detection (3,4%-8,9% lower prices due to deterrence). Sproul (1993) surveys 25 price-fixing cases between 1973 and 1984 with respect to the price levels four years after the breakdown. He finds an increase in prices of 7% on average for his sample. Thompson and Kaserman (2001) analyse the stock price movements 'after the fall' of 57 price-fixing cases with 127 firms involved. They find that within roughly one year of indictment, the stock prices of 85% of the firms in the sample had returned to their pre-indictment (collusive) values. Confronted with these results, they conclude that cartel enforcement has a very little lasting effect on market outcomes. "While it punishes individual offenders, it does not effectively deter collusion on any sort of sustained basis" (p. 334), basically because the cartel-adequate market structures remain unchanged after the conviction (and so the general incentives to re-build the cartel at a later point). In line with this finding, Harrington (2005a: 5) concludes from his review of the empirical research that cartel enforcement typically leads to price declines in the short run, however, that price increases are often experienced in the medium and long run. Taking a look at the price data over time for the US lysine cartel somehow corroborates this view (as shown in Figure 24).

Table 23. Estimates of consumer losses and optimal fines

Cartel	Duration	Fine	Sales	Overcharge	Consumer loss	Fine	Optimal fine	
	years	€m	€m	€m	€m		Fine €m	Multipl.
Lysine	4	110	164	121	181	61%	549	5,0
Vitamin A	9	132	150	275	413	32%	1.251	9,5
Vitamin E	9	203	250	459	688	30%	2.085	10,3
Vitamin C	5	114	120	112	168	68%	510	4,5
Vitamin D3	4	41	20	15	22	184%	67	1,6
Graphite Electr.	6	219	420	481	722	30%	2.188	10,0
Citric Acid	4	135	320	236	353	38%	1.071	7,9
Food Flavor Enh.	9	21	12	22	33	62%	100	4,9
Organic Peroxides	25	70	250	1.694	2.649	3%	8.029	115,5
Copper Plumbing	13	222	1.151	3.311	4.967	4%	15.052	67,7
Rubber Chemicals	5	76	200	188	282	27%	854	11,3

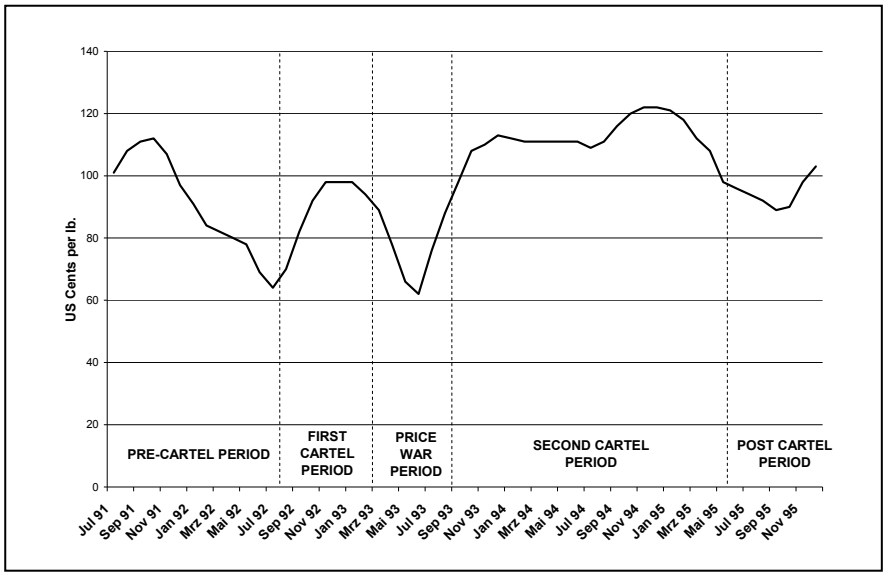
Remarks: Optimal fines calculations are based on a probability of detection of 0,33; 'Sales' refers to annual sales in preceding year.

Source: Table largely follows Veljanovski (2007a: 22); own calculations.

As shown in Figure 19, the price decline after the breakdown of the cartel was relatively small and – less than half a year later – the actual average lysine price

already overtook the price that existed at the end of the cartel.[144] One explanation for this observation could be that firms learned to collude tacitly and therefore managed to realise prices above the competitive level. In addition to the fact that the detection of a cartel does not change the collusion-friendly market structure of the industry (and therefore keep up the basic collusion incentives), the cartel members might have an additional incentive to avoid fierce price competition in the post-cartel period, as this would signal the court a higher harm caused by the cartel (probably causing the fixation of a lower 'but-for' price in the trials).

Fig. 24. Average monthly lysine prices in the United States between July 1991 and December 1995



From a policy perspective, these results suggest that antitrust authorities should continue to monitor the respective industries in order to make attempts to re-build the cartel more difficult. An alternative way of tackling the post-cartel phase problems would be the imposition of behavioural or even structural remedies. One possibility of a potentially suitable behavioural remedy would be to force each of the former cartel members to furnish a *compliance report*, in which the firms have to submit price data and report on the state of competition in the industry to the antitrust authority.

Despite this somewhat mixed empirical evidence on the effect of cartel enforcement, it is important to recall the significance of the deterrence effect of sanctioning cartels. Block et al. (1981), for example, test their theoretical model

144 A noticeable and a bit puzzling characteristic of the average monthly lysine prices shown in Figure 24 is the experienced substantial decline in the lysine price in the months prior to the dawn raids that cracked the cartel. One explanation could be the beginning of a second price war (which was ended by the dawn raids in June 1995).

described above and indeed find for the US bread industry that an increase in the DOJ's enforcement capacity or filing of a DOJ price-fixing complaint had a negative effect on the price markups. Furthermore, Block and Feinstein (1986) find evidence on the existence of a deterrence effect in highway construction procurement auctions. Clarke and Evenett (2003: 725f.) show for the case of the international vitamins cartel that the cartel reduced its overcharges in jurisdictions with tough cartel enforcement. For most European jurisdictions, this reduction in overcharges reached by the presence of tough cartel enforcement regimes was already large enough to cover a substantial proportion of the overall budgets of the respective antitrust authorities (including the budget of DG Competition at the European Commission). Finally, Symeonidis (2000) analyses the effect of the introduction of anti-cartel laws in the United Kingdom in 1956 and finds that price competition increased and led to lower margins in industries which had been previously cartelised.

Application B-4: Intervening against anticompetitive horizontal mergers

Interventions against horizontal mergers become relevant when the antitrust authority concludes its preliminary analysis on the detection stage with the finding that the anticompetitive effects of a merger dominate the procompetitive effects. In such cases, the most immediate intervention would be to prohibit the respective merger. However, as mergers often involve multiproduct companies which are active in many product markets, it would often be disproportionate to ban the entire merger because of competitive concerns in only one or a few relevant markets.[145] As a consequence, it is potentially welfare-improving to give the merging parties the possibility to offer so-called merger remedies to the antitrust authority. From the viewpoint of the merging parties, such remedies must have the potential to ('just') restore competition in the relevant market post-merger, however, subject to the conditions that neither the merger-induced efficiencies nor already realised pre-merger efficiencies are reduced or even destroyed by the respective remedies. From the viewpoint of the antitrust authority, the proposed remedies have to be effective in restoring competition[146] in the relevant market post-merger (see Papandropoulos and Tajana, 2006: 443ff.).

In general, two types of merger remedies can be distinguished: structural and behavioural. *Structural remedies* aim at changing the allocation of property rights and therefore create new firms, while *behavioural remedies* impose constraints on the merged firms' property rights (see Motta et al., 2002: 2).[147] Typical structural

145 As reported by Parker and Balto (2000), "the sheer size of the mergers and the number of markets involved is far greater than the past".

146 It is important to emphasise that the goal of setting merger remedies is never to sanction a violator but simply to restore competition. "The remedy must not impose unnecessary restrictions on the defendant, it may not be punitive, and courts may not impose penalties in the guise of preventing future violations" (see Gal, 2000: 100).

147 Although remedies will be discussed solely with respect to mergers, especially behavioural remedies can also be applied in monopolisation cases (see Tajana, 2005,

remedies are either full divestitures or partial divestitures of firm assets such as products, brands or production plants. Furthermore, the divestiture or licensing of intellectual property is typically considered as a structural remedy, might however also contain behavioural elements (such as, for instance, in licensing obligations, see ICN, 2005: 10). Behavioural remedies are often *regulatory-type interventions* which commit the merging parties to conduct business in certain ways, such as with guarantees for actual or potential competitors to have open access to essential facilities (see Rey, 2003). Figure 25 gives an overview of the merger remedies universe (see ICN, 2005, for explanations and case examples). The figure generally leaves the impression that behavioural remedies are much more diverse than structural remedies, reflecting the substantial differences in the market and in firm behaviour which demand a differentiation of behavioural remedies to make them effective.

Given this initial characterisation of merger remedies, the relative advantages and disadvantages of the two respective approaches become apparent. Following Tajana (2005: 7), key advantages of structural remedies are their direct effectiveness, their easiness to administer and their limited vulnerability to circumventions. On the downside of structural remedies, problems of incurring unnecessary transaction costs, potential damage caused to innocent third parties and reductions in the incentives to compete vigorously are typically mentioned. Furthermore, fixing structural remedies are regularly risky decisions, as they are largely irreversible once imposed (see Motta et al., 2002: 3). With respect to behavioural remedies, important advantages are their flexibility (which allow ex post fine-tuning) and their ability to take account of existing efficiencies which might be destroyed by a structural remedy. Furthermore, behavioural remedies can be a tool of last resort if, for instance, a structural remedy cannot be implemented; for instance in the case that no buyer for the respective assets can be found. However, high costs of implementation and constant monitoring efforts are additional characteristics of behavioural remedies which must be considered as potential disadvantages of this type of intervention. Given the fact that behavioural remedies are often regulatory-type interventions, the question must be assessed whether an antitrust authority has the necessary knowledge and resources to effectively implement such remedies.

Economic theory has only recently started to develop an interest for merger remedies, particularly structural ones. Among the few contributions, Motta et al. (2002) generally discuss fundamental problems caused by asymmetric information between the antitrust authority, the potential buyers and the merging companies, as well as the probable resulting discrepancy between theoretically effective but practically ineffective merger remedies. The sellers usually have strong incentives to sell assets to weak competitors, who are unlikely to challenge the market position of the merging firm, and they also may try to remove valuable assets (such has human capital) before the sale, leaving less valuable or even worthless assets for the buyer. The buyers, on the other hand, may often have different mo-

for an overview and a framework proposal). Chapter 4 below will discuss these possibilities for the case of predation enforcement.

tivations to buy the assets than those assumed by the antitrust authority in their competitive assessment. Furthermore, they also typically have limited incentives to start fierce competition with the merging firm. In the words of Farrell (2003: 1), "[a] strong argument can be made that the buyer is a teammate not of the agency but of the merging parties". As long as buyer and seller exercise joint market power, Farrell manages to show that they have, in fact, a common interest in limiting competition between each other.[148]

In addition to these general problems of the remedies negotiation process, specific aspects of structural remedies are investigated in more detail. Vasconcelos (2006) and Compte et al. (2005) argue that structural remedies run the risk of creating a post-merger environment which is more prone to collusion, simply because market shares tend to be more symmetric after the divestitures. Motta et al. (2002) add increased multi-market contact as another collusion-stabilising factor which might be positively influenced by divestitures. Cabral (2003) argues that asset sales and post-merger entry are substitutes in the sense that divestitures (i.e., sales of assets to competitors) may dissuade competitors from entering other markets. Cabral shows that this may cause effects detrimental to consumers.

Medvedev (2005) studies the effectiveness of structural remedies in a simple Cournot framework. He finds that the antitrust authority should play a more active role in choosing a suitable purchaser of the divested assets in order to maximise the probability that competition is restored in the post-merger world. In particular, he proposes that preference should be given to new entrants rather than to existing competitors in the respective market. Vasconcelos (2006) also studies the role of structural remedies in a Cournot model, where endogenous mergers are motivated by prospective efficiency gains. His results show that structural remedies are good in the sense that they increase consumer surplus compared to the counterfactual of no such remedies. With respect to policy conclusions he finds (p. 30), first, that the antitrust authority has a tendency to make the respective market more competitive than in the status quo industry structure (*over-fixing effect of remedies*). Second, this tendency to over-fix the remedies[149] may lead firms to refrain from proposing *pro*competitive mergers which would likely be challenged by the antitrust authority and may thus – as a form of negative deterrence effect – cause consumer surplus reductions compared to the counterfactual of the absence of structural remedies. However, contrary to this finding, the availability of structural remedies generally creates new merger opportunities for firms, as the absence of such possibilities to restore competition would lead to more general prohibitions of mergers (see Vasconcelos, 2006: 30).

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148 In other words, buyers have an incentive to accept weak ('ineffective') remedies because it will ease competition also for them in the post-divestiture world. Consequently, Farrell argues that not the buyers' ignorance or lack of bargaining power causes weak remedies but the buyers themselves together with the sellers.

149 Following Harker (2006), over-fixing can also be explained by the relative strength of bargaining power of the agencies compared to that of the merging parties.

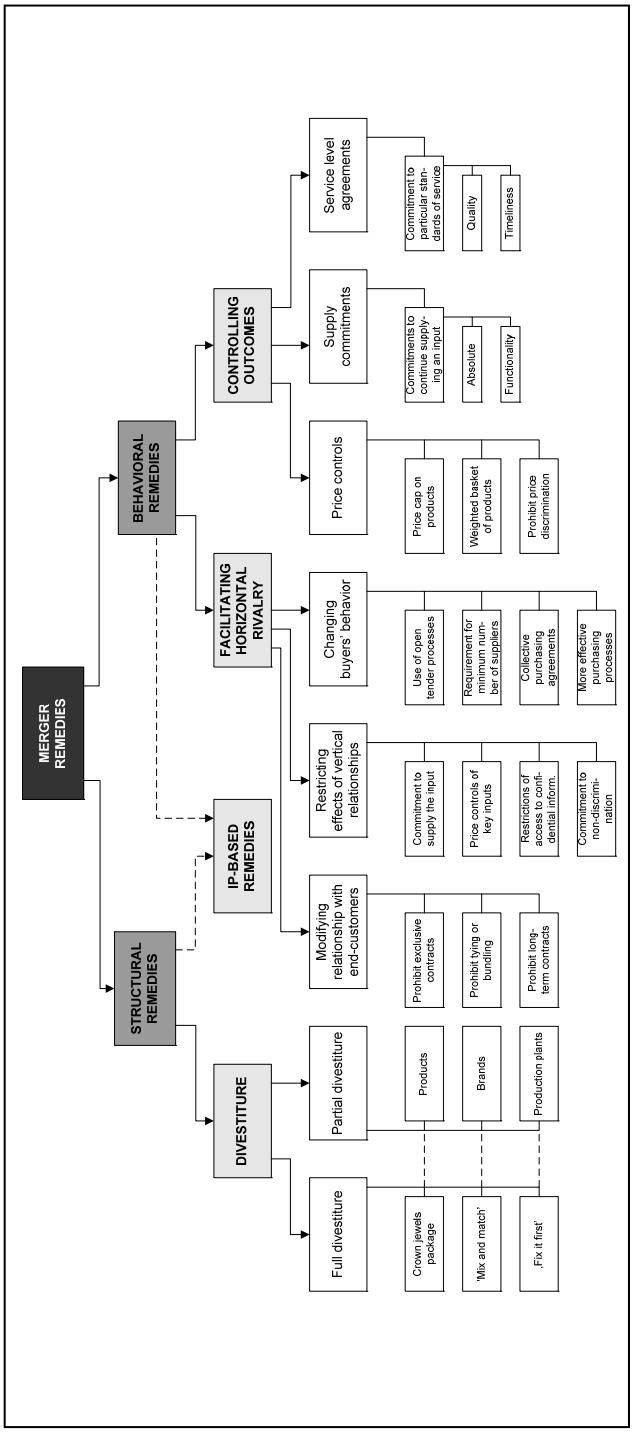

Fig. 25. The merger remedies universe

Remarks: Crown jewels are an alternative divested package that a competition authority may require merging parties to follow in the event that an initially agreed-upon package is not sold by an agreed date; Mix and Match is a divestiture package comprising assets from more than one of the merging parties; Fix it first is normally interpreted as a divestiture remedy in which completion of divestiture is required before a merger may proceed.

Source: Own figure largely following the content of ICN (2005).

Joskow (2002: 114ff.) studies merger remedies from the perspective of transaction cost economics. He argues that firms subject to structural remedies should be expected to behave strategically in the sense that they tend to look for marginally acceptable buyers and may also try to influence the success of the buyer negatively. Furthermore, buyers negotiating divestiture agreements act in an environment of asymmetric information with the danger of 'informational pitfalls' such as ex post hold-ups. Additionally, it can be expected that the divestiture of an ongoing business is on average more successful than the divestiture of assets that demand the creation of a new business organisation. Joskow recommends using divestitures very cautiously and only in conjunction with a careful consideration of transaction cost economics.[150]

Given these potential difficulties of structural remedies, several researchers have proposed to consider implementing more behavioural remedies instead of structural remedies. Rey (2003) argues that in a regulatory context, structural remedies are typically avoided as they are irreversible and often destroy efficiencies. Furthermore, he challenges the view that behavioural remedies are generally harder to enforce and are costly to monitor. Behavioural remedies, for instance, do not necessarily include monitoring-intensive price regulations, and many industries (especially the recently liberalised sectors) already have some kind of monitoring system operating, or such a monitoring effort can easily be shared with the market participants.[151] Generally, as behavioural remedies are often regulatory-type interventions, the economic theory of regulation provides plenty of advice on how to fix and monitor such remedies effectively (see Motta et al., 2002: 14ff., for a discussion).

In accordance with the request for more behavioural remedies, Werden et al. (2005) recently proposed the implementation of an *incentive contract* as a behavioural remedy. Such a contract – signed between the merging party and a third party (such as an auditor) – fixes a benchmark price and stipulates penalties or alternatively rewards paid by (or respectively to) the merged firm if they deviate from the agreed benchmark price post-merger. Although such a proposal would have the advantage of making price increases expensive for the merged firm, it would face the same problems as every kind of price regulation. In particular, the

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150 "Enforcement agencies and courts are unlikely to be in a good position to fashion or approve effective divestiture remedies, even in situations where firms make a 'voluntary' divestiture proposal. The knowledge base upon which we can draw is very limited. Until the enforcement agencies become more sophisticated in their understanding of the consequences of alternative governance arrangements for divested assets, I would be disinclined to expand their opportunities to rely on divestiture remedies" (Joskow, 2002: 114f.).

151 In a bulletin, Frontier Economics (2005) also proposes to consider behavioural remedies more often, especially in circumstances in which there is uncertainty about the effect of potential divestment packages, where jurisdictional issues may limit the range of divestments that can be considered, where the principle of proportionality points away from structural remedies and where the merger benefits would be greater with behavioural remedies.

practicality of such an approach is rather limited (at least within an antitrust policy system), as admitted by the authors themselves (see p. 10).

From an empirical perspective, commentators generally agree that "[t]he question of whether there is a remedy to an anticompetitive merger and what that remedy should be is perhaps the single most intriguing and complex issue faced by [an antitrust authority]" (Parker and Balto, 2000: 1). This view is underpinned by two major in-house studies on merger remedies, one by the US Federal Trade Commission (1999) and one by the European Commission (2005a), both of which shed light on the general effectiveness of merger remedies (also see Sullivan, 2003, for a comparison of practical antitrust remedies procedures in these two regions).[152]

The study of the US Federal Trade Commission (1999) only focuses on the divestiture process (i.e., structural remedies) and finds – based on a case-study assessment of past decisions of the FTC – that divestitures have been on average successful remedies for initially anticompetitive mergers. Nevertheless, the study identifies a number of problems which have impeded the remedies of becoming even more effective. Such obstacles were identified on the respondent's side (such as proposals of weak buyers, strategic behaviour to impede the success of the buyer or general pressure to limit divestiture packages) and on the buyer's side (such as lack of information, lack of bargaining power, lack of communication to the antitrust authority, diverging interests of the buyers and the Commission). In an attempt to overcome these obstacles, the study recommends increasing the respondent's incentives to achieve an effective divestiture, facilitate the success of buyers as well as a general facilitation of the transfer of business information.

The European Commission's study focuses on the effectiveness of both structural and behavioural remedies. The results show that while structural remedies are found to be slightly more effective than behavioural remedies, they are often not as effective as assumed at the time of implementation, especially due to composition risks, purchaser risks and asset risks (see also Papandropoulos and Tajana, 2006: 336ff., for an overview). The basic results of the EC study are wrapped up in Box 19.

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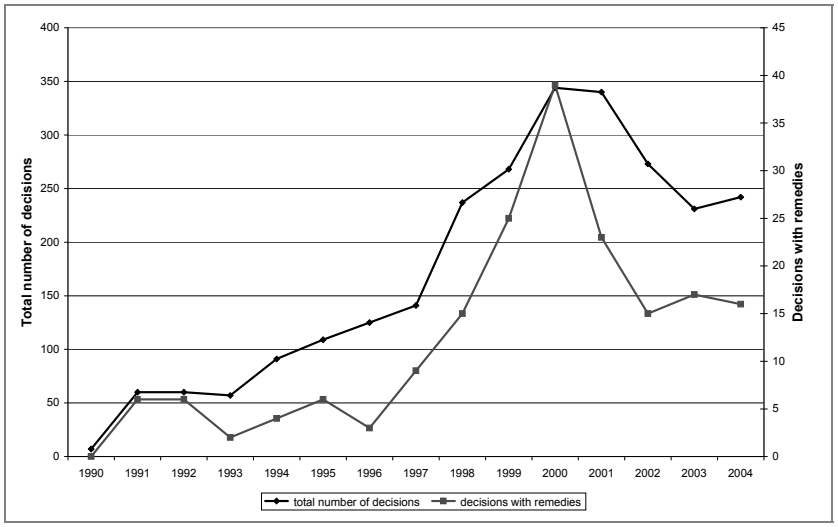
152 In 2007, the UK Competition Commission issued a report aiming at understanding past merger remedies. Based on desk research and on interviews with the parties involved in 14 remedied mergers investigated by the CC between 1999 and 2003, the case studies highlight "the importance of effective interim remedies, the need for parties to have appropriate incentives to implement remedies, and the friskiness of remedies that depend on third parties. Specifically in relation to divestiture remedies, they have shown: the need to be clear about the constituents of the divestiture package and ensure that it is maintained until the divestiture is complete, the importance of thorough assessment of potential purchasers, and the importance of including provision for sale of the package by divestiture trustees at no minimum price. Specifically in relation to behavioural remedies, they have shown that: behavioural remedies are more complex and resource-intensive than divestiture remedies but that they can work especially where the company has a compliance culture and where there are expert monitors, and that it is important for price controls to reflect the nature of the market (e.g. how the product is sold and what the cost drivers are)" (Competition Commission, 2007: 2).

In addition to the case studies conducted by major antitrust authorities themselves, there is also some econometric evidence with respect to the effectiveness of merger remedies. For the United States, Elzinga (1969), Rogowsky (1986), Ellert (1976) and Pfunder et al. (1972) contribute empirical studies which are summarised in Duso et al. (2006b). For the European Union, Duso et al. (2006b) study a sample of 167 mergers that were investigated by the European Commission from 1990 to 2002. Using an event-study approach, the authors find that, first, remedies were not always appropriately imposed in the sense that the Commission made mistakes it its evaluation when compared to the market's assessment of the competitive effects of a merger. Second, empirical results suggest that remedies on average do help to restore effective competition when correctly applied to anticompetitive mergers during the first phase of the merger investigation. However, if the remedies are applied after the second investigation phase, they turn out to be ineffective or even detrimental. Third, while the market seems to be able to predict a good prior to phase II clearances and prohibitions, this conclusion cannot be reached with respect to remedies. The authors explain this result with either measurement problems or increased merging firms' bargaining power in phase II of the merger control procedure.

Box 19. Merger remedies in the European Union – Are they effective?

In 2005, the European Commission (2005a) published a report on the effectiveness of merger remedies that it accepted between 1996 and 2000. As Figure 26 shows, this period is generally characterised by a steep increase in the total number of decisions as well as the number of decisions with remedies imposed.

Fig. 26. Merger decisions and merger remedies by the EC (1990-2004)

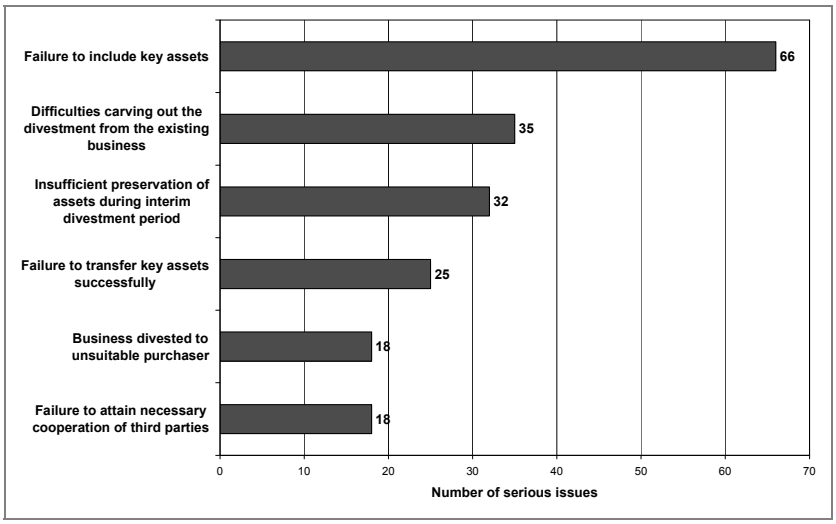


Source of Data: EC (2005a).

For the effectiveness analysis, the EC selected 44% of all merger decisions involving remedies between 1996 and 2000, leading to 40 mergers and 96 remedies to be investigated. Behavioural remedies were found to be slightly less successful than structural remedies. With respect to structural remedies, Figure 27 shows the main design and implementation issues identified by the EC.

As shown in Figure 27, a failure to include key assets in the divested business was the most prominent reason which led to the ineffectiveness of merger remedies. Frontier Economics (2006: 3) identifies the following typical problems in this respect: upstream and downstream links, geographical restrictions, insufficient size, product-cycle effects, lack of intellectual property rights, problems with carve-outs, commitments dependent on third parties and asset deterioration during the divestment process.

Fig. 27. Design and implementation issues of EC merger remedies (1996-2000)



Source: Frontier Economics (2006) based on EC (2005a).

In addition to studies on the effectiveness of merger remedies, some general empirical evidence on the accuracy of merger control decisions is available. Aktas et al. (2006) use an event-study approach to assess whether interventions by European merger control are more likely when European firms are harmed by increased competition. Their robust results show that the more harm suffered by European rival firms, the greater the likelihood of European regulatory interventions against a proposed combination. They therefore conclude that European merger control is largely driven by protectionist motivations and not by fostering competition.[153]

153 "Faced with the empirical facts, a cynical observer might doubt the good intentions of European regulators. If they are actually bent on protecting European firms from domestic competitive pressure and even more anxious to forestall competition from for-

Bergman et al. (2005) analyse the EU Commission's merger decisions from September 1990 to October 2002 empirically and find no indication that the Commission allows political aspects to influence its decisions. In particular, the authors found neither a significant effect of the nationality of the merging firms on the probability of a phase II investigation (or prohibition) nor a significant effect of the change of the commissioner in 1999. Nevertheless, they do find that the decisions of the European Commission appear to be influenced by variables that are, according to economic theory, related to the welfare effects of a merger. In particular, higher post-merger market shares increase the probability of a phase II investigation as well as the probability of the merger being prohibited. Furthermore, if the merger involves an industry leader and/or if entry barriers are high, they find that it is more likely that the merger will be prohibited.

Duso et al. (2006a) also investigate the determinants of EU merger control decisions. The authors consider again the sample of 167 mergers that were reviewed by the European Commission from 1990 to 2001 and collect additional evidence whether the stock market anticipated that these mergers were anticompetitive. The results of the study suggest that the Commission prohibited 4 out of 14 mergers (about 29%) that the stock market regarded as procompetitive.[154] Furthermore, in about 23% of the cases, the Commission erroneously cleared an anticompetitive merger without imposing any kind of remedy. With respect to the determinants of merger control, the authors find that the Commission's decisions cannot purely be explained by the motive of protecting consumer surplus. Although the data suggests that the Commission's decisions are not sensitive to firm interests, evidence does suggest that other factors, such as market definition, the length of the investigation as well as country and industry effects, play a significant role.

Given the fact that antitrust policy is based on the concept of deterrence, the question of the role of deterrence in merger control has to be addressed. At first sight, one might think that deterrence plays a minor or no role in merger control as there are no fines imposed, such as in cartel enforcement or other areas of antitrust enforcement. Furthermore, the different cases may be too diverse to draw any general conclusions for future antitrust decisions. Consequently, "there will always be a chance that the merging parties can persuade the authorities to clear an anticompetitive merger" (Davies and Majumdar, 2002: 134).

However, despite this scepticism, there is not much doubt among economists that also merger control builds on a deterrence effect. Geroski (2004: 8), for example, argues that behind every decision of the antitrust authority is a line of reasoning which is surely case-specific, but it often contains general implications for the activities of firms in other sectors. Furthermore, firms use past decisions to guide their choices whether to propose a merger or not. "And, to the extend that firms desist from particular forms of conduct or particular anticompetitive mergers

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eigners, they could not behave more appropriately. Their actions protect European firms and harm European consumers. They are de facto protectionists" (p. 30).

154 Of the four identified cases, two have been overturned on appeal – *Airtours-First Choice* and *Tetra Laval-Sidel* – and one case – *General Electric-Honeywell* – has been highly controversial.

without troubling the authorities, real resource savings are realised in both the private and the public sector" (Geroski, 2004: 8). Davies and Majumdar (2002: 134) confirm the existence of such an effect, but they prefer to call it 'demonstration effect' rather than 'deterrence effect' because it does not deter the respective conduct but encourage the parties to think about how to best overcome competition concerns raised by a certain merger plan.

In addition to such qualitative arguments, several empirical studies try to quantify the deterrence effect of merger policy tools. Stigler (1966), for example, explains the decline in horizontal merger activity (and a corresponding increase in vertical and conglomerate mergers) by a deterrence effect created by the implementation of an anti-merger amendment to the Clayton Act in 1950. Furthermore, a study by Eckbo (1989) concludes that while mergers are likely deterred by a more aggressive antitrust policy, it also runs the risk of deterring efficient mergers as well.[155]

Seldeslachts et al. (2006) find for an international sample of merger decisions in 28 antitrust jurisdictions from 1992 to 2003 that merger preventions lead to decreased merger notifications; however, remedies, abandonments and monitorings do not significantly affect future merger notifications. In other words, the Seldeslachts et al.'s results show that only merger preventions have a deterrence effect on future merger formation. For antitrust policy, these results provide a basis to think about preferring prohibitions over remedies, at least in close cases and at least if antitrust authorities would like to keep up a deterrence effect of merger control (and/or reduce the expected workload it causes).

Nevertheless, a measurement of the deterrence effects of merger control faces comparable challenges as already discussed in the section on cartel enforcement. Although it is likely that existing merger enforcement led to the abandonment of mergers with obvious anticompetitive effects, it is very difficult to estimate the absolute size of such an effect. Furthermore, it is largely unknown how many procompetitive mergers are deterred by antitrust rules and their enforcement.

2.4 Operational Level

While the strategic level basically aimed at deriving frameworks for identifying and assessing suspicious forms of business conduct, the operational level focuses on the application of these frameworks to actual cases. In a perfect world, this

155 As seen above, the tendency of the antitrust authority to over-fix remedies is a possible explanation why efficiency-enhancing mergers may not be brought forward due to antitrust law. Eckbo (1992) compares the relatively restrictive merger environment in the Untied States with the very lenient merger enforcement regime in Canada before the 1990s. Given the diametric institutional differences, one would expect that the probability of an anticompetitive horizontal merger is higher in Canada than in the United States. However, the parameters in cross-sectional regressions reject this hypothesis, leading to the conclusion that "there simply isn't much to deter" (p. 1028).

would mean that the economic insights of the strategic level must be applied to actual antitrust cases in order to maximise the benefits of antitrust policy. In an imperfect world, however, the antitrust authority has to operate in an environment characterised by resource constraints as well as imperfect (and incomplete) information.[156]

> Because resources are limited, the authorities cannot monitor all the markets and pursue all the firms which are suspected [of behaving anticompetitively]. The second problem is that markets are rarely transparent. The authorities do not perfectly observe the characteristics and behaviour of the firms. This asymmetry of information creates problems of adverse selection and moral hazard that reduce the efficiency and impact of public interventions (Souam, 2001: 2).

Based on this broad characterisation, the general consequences for antitrust policy operating in such an environment are sketched below.

Enforcement under resource constraints

In a perfect world without resource constraints, it is reasonable to assume that the antitrust authority would investigate every case of alleged anticompetitive behaviour by applying the appropriate framework. If anticompetitive behaviour is detected, the authority chooses a suitable form of remedy or sanction. However, in a world with resource constraints, it is quite likely that the number of cases with potentially anticompetitive concerns overtops the capacity of the respective antitrust authority. In microeconomic terms, the antitrust authority therefore faces a constrained optimisation problem. It has to maximise its objective function subject to (binding) resource constraints.

To study this optimisation problem further (see Martin, 2000: 165ff.; 2001: 441ff.), suppose that in a country there are only two industries (i=1,2). Net social welfare generated in both industries is given by the sum of consumer and producer surplus:

$$W_i(q_i) = \int_0^{q_i} [p_i(x_i) - c_i]dx_i \,. \tag{31}$$

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156 From a game-theoretic perspective, it is important to differentiate between the pairs of 'perfect and imperfect information' and 'complete and incomplete information' (see, for example, Fudenberg and Tirole, 1991, for an overview). In the former game types, all prior moves of the other players are either known (perfect information) or not known (imperfect information), but the structure of the game and the decision-relevant characteristics of the other players are known. In the latter game types, the players either know the structure of the game and the decision-relevant characteristics of the other players (complete information) or not (incomplete information). Based on such a delineation, chess would be a game of perfect and complete information. It is simply the size (i.e., the complexity) of the respective game tree that makes the chess game interesting (see Kreps, 1990: 399ff.). For the sake of the following discussion, it is assumed that the antitrust authority has to operate in a world of imperfect and incomplete information.

There is one monopolist per industry who aims at maximising profits. If there is no antitrust enforcement whatsoever, both monopolists just charge the monopoly price. However, suppose that an antitrust authority starts overseeing both industries and sets a threshold price level g_i for both industries. If the observed market price exceeds the threshold price level, the authority, with a certain probability, starts an investigation and, again with a certain probability, fines the monopolists for their monopolistic behaviour. In such a world, Martin (2000: 185ff.) shows that the profit-maximising firm chooses an output level at which the expected marginal revenue is less than marginal cost in order to reduce the probability of investigation τ_i and the expected value of fines.[157] The extent of the price adjustment downwards (i.e., the deterrence effect of antitrust policy) depends on the expected fine level (probability of punishment and fine level) and the threshold level chosen by the antitrust authority.[158]

From the viewpoint of the antitrust authority, the immediate solution to its enforcement problem is to fix the threshold levels at competitive prices and investigate every attempt to charge more than the competitive prices. However, if the antitrust authority faces positive investigation costs I_i (i=1,2) and is constrained by a budget B[159] with $B \geq \tau_1 I_1 + \tau_2 I_2$, it has to solve the following constrained optimisation problem to derive the equilibrium threshold levels for industries 1 and 2:

$$\max_{g_1, g_2} W_1(q_1) + W_2(q_2) - \tau_1 I_1 - \tau_2 I_2 \text{ s.t. } \tau_1 I_1 + \tau_2 I_2 \leq B. \tag{32}$$

The first-order conditions for the solution to the antitrust authority's constrained optimisation problem come from the Lagrangian (see Annex 6.6.4 for the derivation). The first-order conditions imply that the solution of the problem occurs at the tangency of an iso-welfare curve and an iso-budget curve (see Martin, 2000: 187ff.). This is sketched in the geometrical solution shown in Figure 28.

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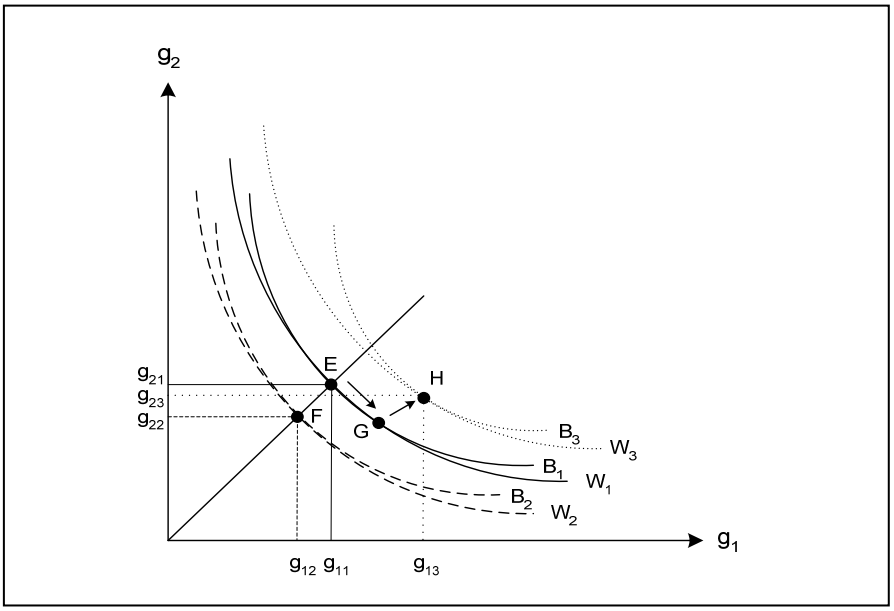
157 Following Martin (2000: 166ff.), τ_i is the probability that the realised price in the industry is above g_i leading to an investigation in the industry with $\tau_i = \Pr[p_i(q_i) + \varepsilon_i \geq g_i] = \Pr[\varepsilon_i \geq g_i - p_i(q_i)]$. The factor ε_i is a random element of demand.

158 For a constant threshold level, a greater output reduces the probability of investigation while a lower investigation threshold, holding output constant, increases the probability of investigation causing firms to typically increase quantities in order to reduce the expected fines.

159 In addition to the decision on the welfare-optimal allocation of a given budget B, the welfare-optimal size of the budget needs to be determined. From a theoretical perspective, the optimal size of the budget B is determined by the intersection of the marginal social benefit curve (downward-sloped) and the marginal social cost curve (upward-sloped). If the current budget is located left of this intersection, the budget of the antitrust authority should be increased (as the marginal benefits exceeds the marginal costs, and vice versa). However, in practice, such a point is typically difficult to identify (see Elzinga and Breit, 1976: 13ff., for a detailed discussion).

Fig. 28. Comparative statics of an antitrust authority's optimisation problem



Source: Inspired by a collection of separate graphs in Martin (2000: 175ff.).

Figure 28 shows different iso-welfare curves (W_1, W_2, W_3) and different iso-budget curves (B_1, B_2, B_3). The iso-welfare curves represent all combinations of g_1 and g_2 that yield a certain welfare level. Iso-welfare curves are downward sloping and convex, and curves closer to the origin correspond to higher levels of welfare (therefore $\overline{W}_2 > \overline{W}_1 > \overline{W}_3$). Iso-budget curves show all combinations of g_1 and g_2 that spend a given amount of total investigation cost. As shown by Martin (2000: 187ff.), iso-budget curves are also downward-sloping and convex (therefore $\overline{B}_2 > \overline{B}_1 > \overline{B}_3$); however, they are more sharply curved than iso-welfare curves.

As shown formally in Annex 6.6.4, the equilibrium investigation thresholds are determined by the point of tangency between the iso-budget curve and the iso-welfare curve that comes closest to the origin (see point E in Figure 28). An increase in the budget for the competition authority typically leads to a symmetric shift of the iso-budget curve downwards and results in lower investigation thresholds for both industries (and a correspondingly higher welfare level). An increase in the investigation cost for industry 1, for instance, makes the iso-budget curve steeper and the feasible set of thresholds retreats away from the origin (such as the shift from point E to point H in Figure 28), with the consequence that the old welfare level $\overline{W}_1$ is no longer reachable and instead the lower welfare level $\overline{W}_3$ is realised. In terms of equilibrium thresholds, Figure 28 shows that the equilibrium threshold for industry 1 rises (as this industry has become more expensive to investigate) while the investigation threshold for industry 2 is lowered (as it is now

relatively cheaper to investigate). If the government aims at keeping the old welfare level (that was realised before the increase in investigation cost), it has to increase the budget in order to reach the corresponding point on the old iso-welfare curve $\overline{W}_1$ (see point G in Figure 28).[160]

Although this simple model of the basic antitrust authority decision problem provides some important insights for the resource allocation of an antitrust authority, it surely leaves out multiple dimensions real decisions have to consider. For example, while the antitrust authority in the model only monitors one single signal of industry's performance, namely the market price, it will have to monitor multiple signals (such as customer complaints or quality indicators) in practice. It cannot be the aim of this section either to discuss or even to try to integrate these signals into an extended form of the model (see especially Besanko and Spulber, 1993, for an alternative model approach in a merger context). However, the important message to take along is that the antitrust authority faces a non-trivial problem of allocating its budget between different possible activities in order to maximise the positive impact of antitrust policy on overall welfare. As Souam (2001: 2) states,

> enforcement authorities face the same problem whatever their practical organisation. By devoting more resources to control activities, authorities can increase the probability of detecting collusion and gather the necessary evidence to condemn the firms involved in such activity. There is a trade-off between the number of interventions and their effectiveness. A smaller number of interventions can allow the authorities to devote more resources to each intervention, thereby increasing the probability of success of the interventions that are undertaken. But in doing so, they leave more markets without monitoring.

Enforcement under imperfect information

Apart from facing resource constraints, an antitrust authority typically has to cope with a second major challenge on the operational level of antitrust enforcement, namely the presence of imperfect information. The most immediate consequence of such an additional constraint is that the antitrust authority has to decide on complex cases without having all necessary information (such as firm costs, consumer demand, prices, sales or potential efficiency effects[161]) which it would theoretically need to decide with 100% accuracy about the welfare effects of a certain conduct. As a consequence, the antitrust authority is in danger of making wrong case decisions which eventually harm social welfare.

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160 In analogy to the comparative statics of the standard consumer choice model in microeconomic analysis, the total effect of an increase in investigation cost I (the move from point E to point H in Figure 28) can be split into a pure substitution effect (the move from point E to point G) and a pure budget effect (the move from point G to point H).

161 See Schinkel and Tuinstra (2006: 5ff.) for a detailed discussion of possible 'lacks of information' in a model context. Furthermore, the OFT (2006: 66ff.) provides an in-depth assessment of the role of imperfect information and imperfect knowledge during the application of per-se-rule and rule-of-reason approaches.

In general, decision theory provides a framework to guide the choice between alternative antitrust rules in a world of imperfect information (see Beckner and Salop, 1999, and Hylton and Salinger, 2004: 5ff., for surveys). On a very abstract level, a certain antitrust rule divides cases into two categories: those that are 'legal under the respective rule' and those that are 'illegal under the respective rule'. While in a world of certainty and perfect information, this categorisation is congruent with cases that are 'not harmful to society' and cases that are 'harmful to society'; in a world of imperfect information, this automatic link is lost. As the respective antitrust rule is inherently imperfect, the derived categorisation "is not identical to the distinction between the cases that are harmful and benign" (Hylton and Salinger, 2004: 55). The fundamental consequences for antitrust enforcement are shown in the resulting cross-classification scheme depicted in Table 24.

Table 24. Antitrust enforcement under imperfect information

	Harmful	Not harmful
Illegal	% of cases that both are harmful and violate the legal standard	% of cases that violate the legal standard even though they are not harmful (Type I error)
Legal	% of cases that are harmful even though they do not violate the legal standard (Type II error)	% of cases that are both benign and legal under the standard

Source: Hylton and Salinger (2004: 56).

As shown in Table 24, an imperfect world introduces two basic kinds of antitrust errors. On the one hand, an antitrust rule might detect an instance of harmful behaviour which in fact is not harmful (a so-called *type I error*). On the other hand, an antitrust rule might come to the conclusion that a certain behaviour is not harmful although it is in fact harmful (a so-called *type II error*).

In addition to these two prominent types of errors, antitrust decisions under imperfect information might cause an additional cost created by instances in which the antitrust authority correctly detects harmful behaviour but chooses suboptimal remedies which harm overall welfare (a so-called *type III error:* 'sub-optimal punishing of the guilty'). Furthermore, the general enforcement costs,[162] as well as costs incurred by firms using alternative strategies to achieve the same ends and costs due to procompetitive firms acting to avoid being mistaken for anticompeti-

[162] "The possibility of error in applying the legal standard to the facts of the case implicates another essential tradeoff. Process costs designed to reduce the incidence of error must be traded off against the costs that result from the occurrence of error. … Error costs also have to be traded off with those costs resulting from delay. The passage of time may decrease the likelihood of error by permitting a more extensive inquiry into disputed issues. The costs associated with delay, such as uncertainty over the outcome or the impairment of evidence, however, must be traded off with the associated reduction in error costs." (Schwartz, 1980: 1077).

tive firms, must also be taken into account when designing antitrust rules in an imperfect world[163] (see Easley et al., 1985: 445ff.).

Generally, antitrust errors harm social welfare *directly* by undertaking wrong enforcement decisions and *indirectly* via the consequential reduction in the deterrence effect of fines. As shown by Polinsky and Shavell (2000: 60), a positive probability of a type I error reduces the deterrence effect of fines because it lowers the expected fine for a violation, while a positive probability for a type II error lowers the deterrence effect of fines because it reduces the difference between the expected fine from violating the law and not violating the law.[164] As a consequence, in order to achieve the desired level of deterrence (in a world with positive probabilities of errors) it is necessary to increase the probability of detection or the amount of the fine in order to avoid a state of under-deterrence.

In order to take account of this essential effect, Buccirossi, Spagnolo and Vitale recently proposed to differentiate between ex post (or direct) costs and ex ante (or indirect) costs of erroneous antitrust decisions in an economic discussion paper on behalf of the OFT. "The ex post costs refer to a specific antitrust decision and they affect only the market(s) concerned with the behaviour judged by the competition authority. The ex ante costs, instead, affect all markets because they represent the welfare loss caused by the distortion that the expectation of the occurrence of errors imposes on the behaviour of all firms" (OFT, 2006: VI).

Given this initial description of the basic challenges of antitrust enforcement in a world with imperfect information, the question for the appropriate framework for deriving antitrust rules suggests itself. In general, elementary decision theory suggests that optimal antitrust decisions in an imperfect world should aim at minimising "the sum of the expected costs of error and the costs of implementation" (Joskow and Klevorick, 1979: 218). In this respect, the (ex post) error costs

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163 An immediate consequence of the existence of such positive costs of antitrust enforcement is that it is no longer socially optimal to aim at deterring all instances of anticompetitive behaviour but to identify the point where the marginal benefit of additional deterrence equals the marginal costs of additional deterrence. As a consequence, "the test of a good legal rule is not primarily whether it leads to the correct decision in a particular case, but rather whether it does a good job deterring anticompetitive behaviour throughout the economy given all of the relevant costs, benefits, and uncertainties associated with diagnosis and remedies" (Joskow, 2002: 99f.).

164 This is also an essential result of a recent theoretical model of imperfect competition law enforcement by Schinkel and Tuinstra (2006). The authors find that "[w]hen competition authorities and courts are fallible … the incidence of anticompetitive behaviour may increase in the enforcement error, essentially for two reasons. The first is that the expected punishment for law breaking decreases, due to the possibility of firms escaping without a penalty, even when prosecuted. The second reason is that firms that would otherwise behave as perfect competitors are induced to collude and abuse their dominant position as a precautionary measure when they face the risk of being unjustly punished when obeying the law. The overall conclusion, therefore, is that competition policy may be counterproductive, in that the imperfect way in which it is enforced stimulates the very behavior it intends to deter" (p. 21f.).

can basically be expressed by the following equation (see Evans and Schmalensee, 2001: 25):

$$\text{Error cost} = x_c(s) \cdot (1 - p) \cdot c_c + x_a(s) \cdot p \cdot c_a \,, \tag{33}$$

with p representing the probability that the challenged action is in fact anticompetitive, $x_c(s)$ the probability that innocent firm is falsely convicted, $x_a(s)$ the probability that the guilty firm gets away, c_c the costs to society of false convictions and c_a the cost to society of false acquittals. The first term stands for the costs of false convictions, the second term for the costs of false acquittals.

An operationalisation of the error cost Equation (33) basically needs to assess two key determinants of error costs: the likelihood of errors and the costs of errors. As discussed in more detail by Joskow and Klevorick (1979), the characteristics of both components greatly depend on factors such as the underlying theoretical model of competition, empirical guesses on market characteristics, the institutional competence of the antitrust authority and the underlying weights for the different evaluation factors. In any case, it is highly unlikely that one rule fits all. For example, if a certain type of conduct is assumed to be seldom applied in practice and to have only minor negative welfare effects, more defensive antitrust rules are in order than for a form of behaviour which is more commonly applied and regularly causes greater harm to society. In the first case, a tough antitrust enforcement runs a high risk of a costly type I error, while the costs of type II errors are expected to be small. In the second case, the characteristics are just inverted.[165] Therefore, as Joskow and Klevorick claim, "[t]he primary objective is to design an approach that makes the probability of a false positive error low when the cost of such an error is high and that makes the probability of a false negative error low when the cost of that type of error is high" (p. 243). Box 20 discusses some specifications of optimal antitrust rules under imperfect information in more detail.

Box 20. Optimal antitrust rules under imperfect information

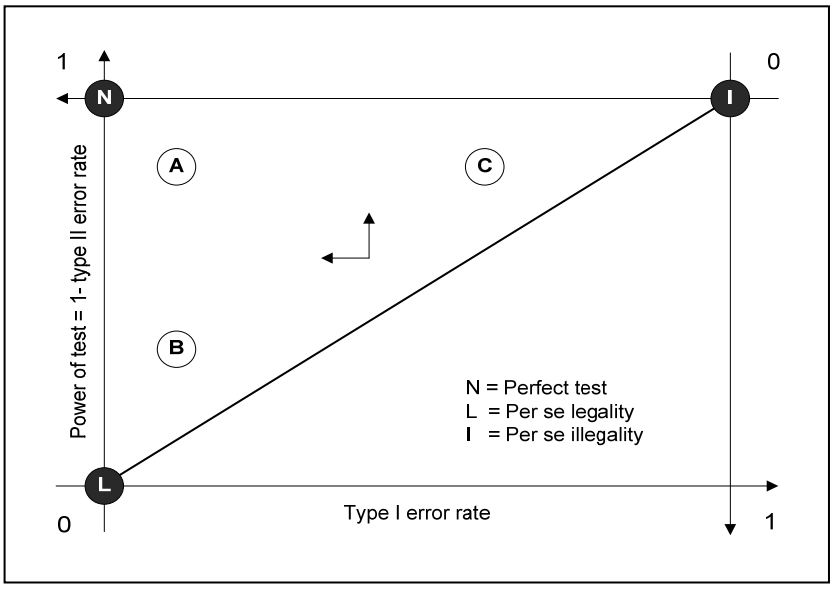
The choice of the optimal antitrust rule in a world of imperfect information basically depends on the frequency of the respective antitrust errors, the costs of respective antitrust errors and general enforcement costs. Guided by these key insights of decision theory, Kobayashi (2006) developed a simple way of illustrating the specifics of different antitrust rules under imperfect information.

The figure defines a space of possible antitrust rules which aim at detecting a certain type of conduct. On the horizontal axis, the type I error rate is plotted. On the vertical axis, the power of a particular rule is expressed by plotting '1 minus the type II error rate'. A perfect test – displayed by the black dot with the letter *N* – would have a type I/II error rate of zero and would therefore be located in the upper left corner of the space. This is the perfect-world state, which is typically too costly to re-

[165] Furthermore, as discussed in more detail in Evans and Padilla (2005), in dynamic industries in which investment and innovation are the main drivers of a firm's market share and profitability, type I errors are likely to be more serious. Type II errors, in contrast, can be expected to be costly when the price-cost margin is large and the elasticity of demand is high.

alise in a world of imperfect information. Per se legality – displayed by the black dot with the letter *L* – minimises the type I error rate but maximises the type II error rate and is therefore located in the lower left corner of the space. Such a rule is optimal for types of behaviour for which the costs of type I errors are considered to be high while the costs of type II errors are considered to be low. Per se illegality – represented by the black dot with the letter *I* – maximises the type I error rate but minimises the type II error rate. Such a rule should be chosen if the costs of type I errors are small but the costs of type II errors can be expected to be substantial.

Fig. 29. Antitrust rules and the likelihood of error



Source: Content follows Kobayashi (2006).

Based on the delineation of these extremal points, the optimal choice of the antitrust rule crucially depends on the beliefs about the relative costs of errors and enforcements. Actual predation enforcement (at least in the United States) might be located around circle *B* in the chart above, while hard core cartel enforcement might best be represented by circle *I*. In the case of predation, the doubts on the rationality of predation reduce the expected costs of type II errors relative to the likelihood of making type I errors that are considered to be large. However, in the case of hard core cartels, the costs of type I errors are considered to be low given the typical harmfulness of hard core cartels. At the same time, the costs of type II errors are also considered to be small due to the possible clear delineation of such practices.

Compared to the analysis on the strategic level, which focused on the development of frameworks for detection and intervention with respect to well-defined forms of business conduct from an economics point of view, the operational level focuses on what can be achieved by practical antitrust enforcement in a world characterised by resource constraints and imperfect information. Both limitations

– resources and information – create a need to simplify as well as a need to decide on where to invest scarce resources in order to maximise the return on investment of antitrust policy for society.[166]

In the words of Evans (2005: 15), optimal antitrust decisions should generally "involve forming prior beliefs based on imperfect information, assessing the likelihood of making the right decisions, estimating the cost of making the wrong decisions and choosing those decisions that maximise the present discounted value of the decision and minimise the expected cost of errors". For example, if resource constraints limit the activities of the antitrust authority and it cannot investigate every case of alleged anticompetitive behaviour, it is sensible to focus on cases which are most likely to cause the most significant welfare losses to society. As there is typically a close relationship between such cases and the presence of market power, it makes sense for operational antitrust policy to initially assess market power and to investigate further only cases in which the defendants are believed to have (or would gain) significant market power.

However, even within such a narrower group of alleged cases it might still not be economically feasible to investigate all cases with the latest economic/econometric techniques. For example, although it would often be possible to estimate market power directly by applying sophisticated econometric techniques, such analyses are often quite complex to undertake and correspondingly need a lot of resource input, such as high-quality data and time to analyse the data (see Stenborg, 2004, for a detailed discussion). As a consequence, it is unlikely to be socially optimal to spend large amounts of an antitrust authority's budget on state-of-the-art estimations of market power effects for a couple of merger cases while devoting only a suboptimally low resource input to other typical activities of antitrust authorities such as cartel enforcement. As a reaction to the described trade-offs, antitrust authorities should (and do) make use of approximation techniques, which still allow to study the relevant competitive interactions and still have a reasonably high probability to come to the correct conclusion.

In a nutshell, the operational level contains a progression of approximation techniques consisting of the delineation of the relevant market, an assessment of market power and the application of economic frameworks in cases where competitive concerns are likely to exist. Figure 30 gives a graphical overview of the operational level.

All three stages of the operational level will be described below. The aim can only be, however, as on the other levels before, to present a contemporary overview rather than a full assessment. In general, it is important to have in mind that the discussed techniques are 'second best' ways to study the competitive effects of certain forms of suspicious business conduct.

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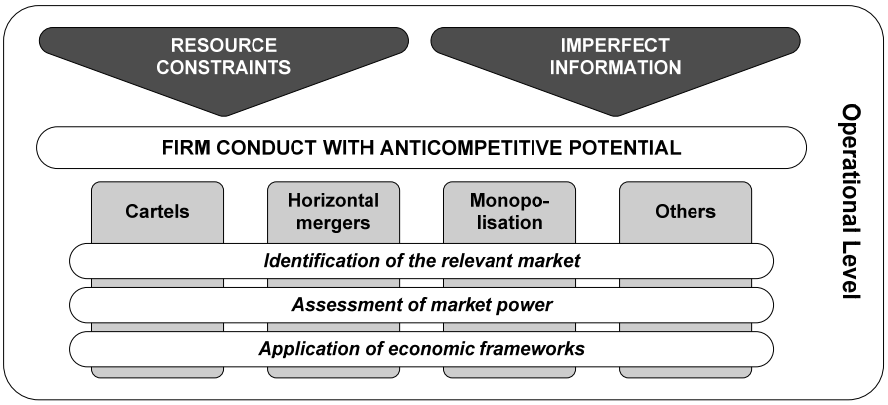
166 As shown by Besanko and Spulber (1989: 421f.), if the firms are uncertain about the antitrust authority's ability to commit, "it may be beneficial for the authority to create a reputation for toughness by prosecuting cases in which the social benefits from winning are relatively small" .

Fig. 30. The operational level



2.4.1 Identifying the Relevant Market

Identifying the relevant market is of paramount interest at the operational level of antitrust policy. The most obvious reason is simply that this exercise stands typically at the beginning of an antitrust case investigation, and its outcome often predetermines the further progression of the case. Following a famous example of Areeda and Kaplow (1988: 572f.), suppose that there are 99 producers of pleasure boats and 1 producer of canoes. If the relevant market is canoes, then the canoe producer has a 100% market share and certain types of conduct would likely raise competitive concerns. If the relevant market is 'all pleasure boats' (including canoes), then the canoe producer has a 1% market share and competitive concerns are rather unlikely, as the canoe producer is effectively constrained in its behaviour by the pleasure boats producers.

From a methodological perspective, defining markets is not about studying real phenomena but rather must be understood as an instrument to reduce the complexity of market interaction. In the words of Geroski (1998a: 678), "[m]arket definitions are a way of intellectually organising the way we think about the economic activity we observe, and are not inherent in the nature of things". Although there may be measurable relationships between a lot of different products (reflected in non-zero cross-price elasticities), identifying the relevant market is about identifying the most 'substantial' and 'relevant' of these relationships. It immediately follows from this that there cannot be an ultimate or predetermined way to delineate market boundaries. Choosing and applying a meaningful delineation methodology always depends on the underlying motivations behind such an exercise.[167]

From the viewpoint of competitive strategy, for instance, market definition and market analysis are integral parts of the strategic planning process which generally

[167] Geroski (1998a), for example, differentiates between three types of market: the strategic market, the trading market and the antitrust market.

aims at creating (and sustaining) competitive advantages (see Day, 1981: 281ff.; Geroski, 1998a, 1998b). As sketched in Figure 31, such a strategic planning process typically starts with the identification of relevant market dimensions, such as functions, technologies, customer groups, geography and time. Combinations of these market dimensions are then taken to delineate so-called market cells[168] (see Buzzell, 1987; Day, 1981). Based on such an initial categorisation of the 'basic needs', the company has to delineate 'competitive arenas' by answering the questions, Who are our customers and what are their needs? (i.e., assessing demand substitution) and Who are our competitors and what are their strengths and weaknesses? (i.e., assessing supply substitution).

Subsequently, the attractiveness of the competitive arenas, which are determined by arena structure and arena environment, needs to be assessed, based, for instance, on Porter's (1995: 26) five forces paradigm consisting of rivalry among existing firms, the threat of substitutes, buyer power, supplier power, and the threat of new entrants. Given this evaluation of attractiveness, the company subsequently has to make a choice on the actual markets (within the arenas) it would like to serve. Such an assessment typically includes evaluations of external attractiveness and internal firm capabilities and resources (see Day, 1998: 51ff.). Subsequently, customer segmentation and product positioning within the chosen markets are important operational tools to maximise profits.

Finally, the success of the chosen strategy needs to be evaluated constantly by focusing on changes in indicators such as the relative competitive position and the likely future growth potential. As markets underlie constant changes – driven, for instance, by changes in customer preferences and actions of rivals – it is pivotal for reaching a sustainable competitive advantage to constantly review and possibly redefine market dimensions, competitive arenas and supplied markets. Geroski (1998b) sees this 'redefinition of the market' by introducing new products or addressing the (new) needs of (new) customers as the 'key to strategic innovation'.[169]

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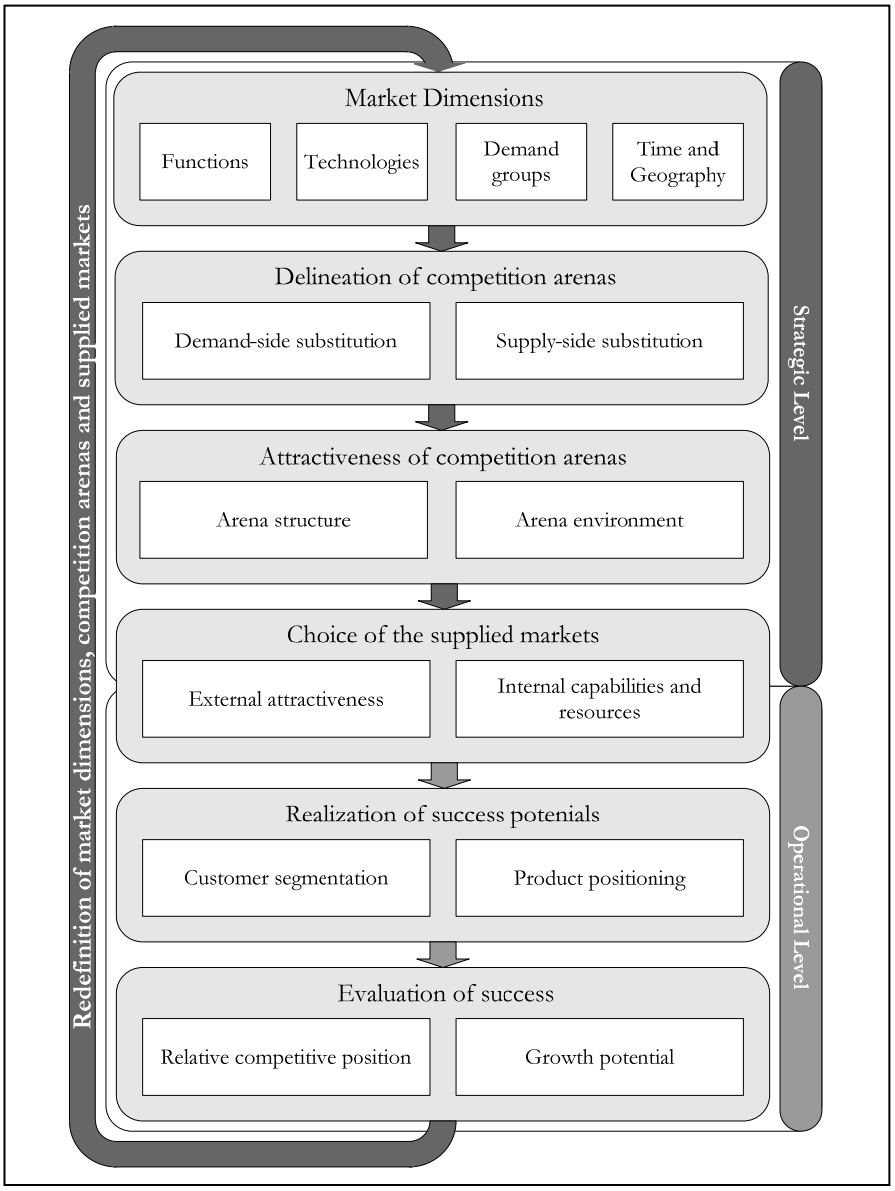
168 A possible characterisation of the packaging industry in terms of market dimensions could consist of demand groups (detergent producers, soft drink producers, and breweries), functions (packaging of definite substances, packaging of liquids, and packaging of powders) and technologies (aluminium, glass, and paper). Given this delineation, an example of a market cell would be aluminium cans for breweries for the packaging of liquids.

169 "Markets are complex, multidimensional arenas of competition composed of a myriad of niches and categories. The strategist seeking to understand a particular market is dealing with a moving target, for there is continuous change along each of the key market dimensions of function, technology, customer segmentation, and degree of integration. Barriers to competitive movement along these dimensions are constantly shifting, creating both threats and opportunities for protected market positions" (Day, 1981: 298).

Fig. 31. Identifying competitive arenas as part of the strategic process



The basic motivation for delineating markets in antitrust policy is different. Although an antitrust authority might also develop an interest for the likelihood of strategic innovation and other dynamic aspects of competition, such an interest would purely be motivated by the need to assess "the full set of competitive forces that operate in the market" (Geroski and Griffith, 2004: 26). The basic aim of the antitrust authority is not 'to create and sustain a competitive advantage' but to come to conclusions on the actual or likely future anticompetitiveness of certain suspicious conducts. Delineating the relevant market is typically a necessary precondition to allow such conclusions as it identifies the essential competitive constraints a firm or group of firms faces or would face. These boundaries are in turn needed to assess whether a firm or a group of firms enjoys (or would enjoy) economic power in relation to the goods or services it supplies (or would supply).

Under the assumption that economic power exercised by firms is typically transformed into elevated prices, the key for the derivation of antitrust markets lies in getting an understanding of what factors constrain the pricing behaviour of firms.[170] From a firm perspective, a price rise is profitable as long as the increased price charged on the new lower quantity Q_1 is greater than the lost margin on the decrease in quantity ΔQ (see Annex 6.6.5 for the proof):

$$\frac{\Delta P}{P_0} Q_1 > \frac{P_0 - C_0}{P_0} \Delta Q \,. \tag{34}$$

It follows that the decrease in quantity caused by a price increase is the basic constraint a firm faces. If the actual decrease in quantity is large following a small increase in price, it is likely that the 'lost margin' effect overcompensates the 'higher margin' effect and – as a consequence – the respective price increase would be unprofitable.[171]

The consequential follow-up question which needs to be investigated is what factors determine the decrease in quantity following a price increase? On the demand side, customers switching to alternative goods and customers looking for the same good in new geographic areas might lead to the unprofitability of a certain price rise. On the supply side, rivals starting to produce a substitute and rival firms looking for new geographic areas to sell their products in the event of a price rise constrain the price-setting behaviour of the firm (by providing switching alternatives to consumers).

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170 However, the European Commission Notice on the definition of the relevant market for the purposes of EC competition law (published in the Official Journal: OJ C 372 [1997]) implicitly chooses a broader definition of *economic power* when it speaks of market definition as a pre-requisite for identifying "those actual competitors of the undertakings involved that are capable of constraining their behaviour and preventing them from behaving independently of an effective competitive pressure".

171 This simple argument alone indicates that the own elasticity of demand a firm faces is key in determining the degree of market power it can exercise. The power to control price requires a low own-price elasticity of demand (see Scheffman, 1992: 901ff., for uses and abuses of this and other statistical measures of market power).

Based on this initial characterisation of the basic competitive constraints – supply and demand substitutability – the *small but significant non-transitory increase in price test* (the *SSNIP test*) has become the standard technique to identify the relevant antitrust market. The SSNIP test starts with a small candidate market containing one or a narrow set of products and asks whether a hypothetical monopolist controlling the product(s) in this hypothesised market could raise prices profitably and permanently (i.e., at least twelve months) by a significant amount (i.e., usually 5-10%). If the answer is Yes, the (set of) product(s) in the candidate market represent a well-defined market, because the constraints by other products on the price-setting behaviour of the hypothetical monopolist are too weak to make the price increase unprofitable. If, however, the hypothetical monopolist in the candidate market cannot raise the price (profitably and permanently) by, for example, 5%, this speaks for an effective constraint of its behaviour by the considered substitute, and it should therefore belong to the same relevant antitrust market. This procedure of adding potential substitutes (downward sorted by assumed substitution potential) has to be continued until a product is added which does not hinder the hypothetical monopolist to raise its price permanently and profitably by 5%. This product remains in the candidate market and the relevant market is constituted. Consequently, following this methodology of the SSNIP test, the relevant antitrust market is defined as the smallest collection of products with which a hypothetical monopolist could extract and maintain some degree of market power (here 5% above the competitive price). In the words of Bishop and Walker (2002: 89), a relevant antitrust market is "the smallest set of products worth monopolising."

The general usefulness of the SSNIP test for the delineation of antitrust markets is reflected in the adoption of this methodology by many antitrust authorities worldwide (see Bishop and Walker, 2002: 88, for an overview). Furthermore, the usefulness of the general framework can be exemplified by many practical examples (see Stenborg, 2004: 10ff.). One prominent area where the application of the SSNIP methodology helps to avoid flawed reasoning is the role of technical product characteristics in market delineation. While earlier antitrust decisions often applied such technical characteristics of products as a key guide for the delineation of markets (see Box 21 for a case example), the application of the SSNIP methodology immediately brings to light that technical product characteristics as such are of no immediate interest for antitrust market delineation.[172] The only relevant question that needs to be assessed is whether enough customers are 'marginal customers' in the sense that they would reduce or cut out their demand in the event of a significant price increase to make this price increase unprofitable. *Inframarginal customers,* those that do not adjust their demand as response to a price increase, are of no particular help for market delineation (Stenborg, 2004: 8f.).

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172 The same conclusion is true for the delineation of markets in business strategy where focusing simply on technical product characteristics is ill-equipped, because competition is about winning customers and the customer finally decides which products it views as interchangeable to satisfy a certain need (see Albach, 1978: 537).

Box 21. The toothless fallacy – Market definition in United Brands (1978)

The decision in *United Brands vs. European Commission* (Case 27/76, *United Brands v. E.C.* [1978] ECR 3461) gained notoriety due to a flawed argumentation in the delineation of the relevant market. With respect to product market delineation, the court had to decide whether bananas mark a separate relevant market or if they are part of a larger relevant market containing 'all fresh fruits'. The court decided to go for the narrow definition, arguing that "the banana has certain characteristics, appearance, taste, softness, seedlessness, easy handling, a constant level of production which enable it to satisfy the constant needs of an important section of the population consisting of the young, the old and the sick". Applying the basic principles of the SSNIP test immediately reveals that such an argumentation is flawed. The criterion of demand-side substitution does not require that whole customer groups would (have to) switch to other fresh fruits in case of an increase in the price of bananas. The crucial question is whether enough customers would switch following an increase in price to make this price increase unprofitable for the firm. The preferences of certain customer groups are of no particular interest for answering this question (see Bishop and Walker, 2002: 92; OFT 2001: 26f.).

From a theoretical perspective, the SSNIP test can be operationalised by estimating own-price elasticities and cross-price elasticities and by applying the formula for the price-cost margin for a differentiated good (see Annex 6.6.6 for the proof, which follows Neumann, 2000: 90f., and a slightly different approach developed in Schulz, 2003: 52):

$$\frac{p_i - c_i}{p_i} = \frac{1}{\varepsilon_i - \sum_{j \neq i} \mu_{ij} \varepsilon_{ij}}, \tag{35}$$

with μ_{ij} representing the conjectural elasticity[173], ε_i being the own-demand elasticity of product i and ε_{ij} representing the cross-price elasticity between products i and j. The SSNIP test aims at identifying the narrowest market for which a certain degree of market power – measured by an increase in the price-cost margin – can be profitably and permanently exercised.[174] If this increase in price is again set at 5% (starting from the competitive level), Equation (35) reveals that

[173] The conjectural elasticity reflects the expected percentage change of price p_j from producer i if he would increase the price of his product by 1%. The equation $\mu_{ij}=0$ applies in a homogenous Bertrand model, while $\mu_{ij}=1$ applies in case of perfect collusion.

[174] As explained in Neven (1993: 24), the question of the SSNIP test is an approximation of the ideal question, "which is whether such a price margin above marginal cost represents the profit-maximising margin for a firm that controlled the relevant market". In other words, while the SSNIP test asks, Is a 5% price rise just profitable? the ideal question would be, Is 5% the profit-maximising margin?

$$\varepsilon_i - \sum_{j \neq i} \mu_{ij} \varepsilon_{ij} < (1/0.05), \tag{36}$$

must apply in order to satisfy the SSNIP criterion and therefore to derive the relevant antitrust market. As the SSNIP test assumes a hypothetical monopolist, μ_{ij} can be set equal to 1. Subsequent, the own-demand elasticity of product i, ε_i must be estimated. If this elasticity is already smaller than (1/0,05)=20, the respective product alone already constitutes a relevant market. If the own-demand elasticity is larger or equal to 20, cross-price elasticities of potential substitutes have to be estimated, downward sorted with respect to size, and then iteratively subtracted from the own-demand elasticity (starting with the good with the highest cross-price elasticity) until the denominator is equal to or smaller than 20 and the relevant market is defined (see also Neven et al., 1993: 24).

Although data availability might foreclose the application of this theoretical approach in practice, it allows interesting insights into some specifics of the SSNIP test. For example, Equation (35) helps to understand the significance of fixing the percentage price increase for the resulting market boundaries. If, for example, a price rise of 10% would be assumed – instead of the 5% applied so far – the denominator of Equation (35) has to be smaller than or equal to 10 to constitute a relevant market. Ceteris paribus, such a market would be broader than under a 5% threshold. Furthermore, as described in more detail in Neumann (2000: 142), it is important to note that the 5% increase refers to the competitive price level; that is, the initial price-cost margin is zero. If, however, the initial product price is already above the competitive level, the underlying hypothetical price increase is correspondingly higher leading to broader market boundaries.[175] Furthermore, the

[175] As described by the so-called cellophane fallacy, the SSNIP test is in danger of leading to too broad markets when it is applied in monopolisation cases. The reason is simply that a firm with market power is expected to have raised prices already to the point where no further price increases are profitable (i.e., to the point where demand is elastic). Consequently, conducting the SSNIP test at prevailing prices would likely lead to the inclusion of products in the candidate market which would not have been part of it if the analysis had started at the competitive price level. Therefore, an application of the SSNIP test in monopolisation cases needs to identify the appropriate benchmark price against which to apply the hypothetical price increase (as shown by Gual, 2003, this is also one solution to the problem of applying the SSNIP test in markets with considerable fixed costs). Following Salop (1999: 14), the proper competitive benchmark for evaluating alleged anticompetitive restraints "is the price that would prevail in the absence of the alleged anticompetitive restraints or conduct". As the identification of such a benchmark price is typically problematic, some scholars have asked for the creation of a market definition paradigm solely for monopolisation cases (see White, 1999b, 2005), such as a SSNDP test which asks whether the preservation of the allegedly foreclosed competitor or group of competitors would have led to a small but significant nontransitory decrease in price (SSNDP) by the defendant (see Nelson and White, 2003). Other scholars, however, have instead argued that the SSNIP test is also of value in monopolisation cases and only seldom runs into problems such

theoretical concept of the SSNIP test simultaneously considers supply substitution[176] as well as the geographical dimension[177] of the relevant market, because all

as the cellophane fallacy (see Werden, 2000; NERA, 2001). Historically, the cellophane fallacy is much older than the SSNIP test. It was first reported in a landmark antitrust case, *United States vs. E.I. du Pont de Nemours & Co.* – (351 U.S. 377 [1956]), in which the Court erroneously concluded that the only producer of cellophane, Du Pont, did not have market power because it measured the demand elasticity at the monopoly level and not at the competitive level. In fact, other products were only considered as substitutes by the customers because of the elevated prices of cellophane charged by Du Pont.

176 It is disputed in the literature whether practical market definition should focus on demand substitution alone or should include the possibilities of both demand and supply substitution to delineate the relevant market. Neumann (2000: 139) favours an approach which only considers demand substitution for the delineation of the relevant market and proposes to study possibilities of supply-side substitution later in the investigation when entry possibilities are discussed. Traugott (1998) reports that this procedure is also common in German case law following the typically applied *Bedarfsmarktkonzept*. The same is true for the US Horizontal Merger Guidelines (Paragraph 1.0), which explicitly state that "[p]robable supply responses that require the entrant to incur significant sunk costs of entry and exit are not part of market measurement, but are included in the analysis of the significance of entry." However, Baker (2005) reports that US courts in several cases considered supply substitution already during the assessment of the relevant market. Furthermore, the EU Commission Notice on the definition of the relevant market explicitly considers supply substitutability (chapter II): "Supply-side substitutability may also be taken into account when defining markets in those situations in which its effects are equivalent to those of demand substitution in terms of effectiveness and immediacy. This requires that suppliers be able to switch production to the relevant products and market them in the short term without incurring significant additional costs or risks in response to small and permanent changes in relative prices." In line with this sample, ICN (2003: 12ff.) identifies remarkable differences in the consideration of supply substitutability in market definition guidelines across several countries. From a theoretical perspective, Neven et al. (1993: 24) and Gual (2003: 4ff.) remark that supply substitution is too seldom assessed as part of the delineation of the relevant market. Generally, considering demand and supply substitution leads to broader markets than just focusing on demand substitution.

177 The standard practical procedure is to carry out the SSNIP test sequentially by first focusing on the relevant product market and afterwards analysing the relevant geographical market. In an investigation of the relevant antitrust market for salmon, Haldrup et al. (2005) show that a sequential market delineation strategy would imply that Norwegian and Scottish salmon are separate products and that for each product France, Spain and Holland belong to the same geographical market. However, the simultaneous approach suggests that Norwegian and Scottish salmon belong to the same product and geographical market. From a theoretical perspective, the sequential approach might cause problems, as consumers who switch to alternative products might overlap with customers who switch to other geographic areas. Consequently, a

relevant substitution goods of actual or potential competitors (independent of their geographical location) are considered in the analysis. In that respect, it is important to remark that the SSNIP test basically analyses an increase in price of a product *i* while assuming that the prices of all other identified substitutes remain constant, that is, the supply elasticities are assumed as infinitely high. Neumann (2000: 143) remarks that such an assumption is seldom matched in real cases, especially if handicaps to trade between countries are considered.

Even if the data at hand does not allow deriving estimates of own demand elasticities as well as cross-price elasticities, the collection of other forms of quantitative evidence often allows sketching a reasonably good picture of supply- and demand-substitutability. Bishop and Walker (2002) and Lexecon (2004) identify inter alia price correlation analysis, stationary analysis, switching analysis and price-concentration analysis as simple quantitative techniques, which might be of use to assess the market definition problem. Without wanting to enter into an in-depth discussion of these empirical techniques and their possible contributions to market definition, Box 22 presents an exemplary application of simple price correlation analysis to the question of geographical market delineation in the European electricity industry.

An alternative, more recently developed, back-of-the-envelope tool to assess the question of the SSNIP test is critical loss analysis. Typically, critical loss analysis consists of three steps: calculation of the critical loss, estimation of the actual loss and comparing critical and actual loss. In the first step, the *critical loss* must be calculated, which is defined as the (percentage) decrease in sales resulting from a particular price increase that is just large enough so that a hypothetical monopolist would not impose a (percentage) price increase of at least that amount. Formally, the critical sales loss is straightforward to derive (see Annex 6.4 for the proof). If $\Delta P/P_0 = X$ and $((P_0 - c)/P_0) = M$, the critical loss formula (for a linear demand function) is given by[178]

$$-\frac{\Delta Q}{Q_0} = \frac{X}{X+M}. \tag{37}$$

sequential approach could lead to an overestimation of the extent of substitution and consequently to a too narrow definition of the relevant market.

178 Instead of calculating critical losses it is alternatively possible to derive critical demand elasticities (see Werden, 1998a). The corresponding 'critical demand elasticity equation' to the 'critical loss' Equation (37) can be calculated to (1/(M+X)). If *M* is set to 0, indicating that the initial price is the competitive price, the critical demand elasticity is given by (1/0,05)=20. This is the same result as derived above in the application of the price-cost margin for a differentiated good (Equation [35]) which aimed at characterising the SSNIP idea. This assessment assumed the competitive price as the initial price, so M=0.

Box 22. Geographical market delineation in the European electricity industry

Price correlation analysis is one common tool to get an idea of the relevant product and geographical market(s). The basic intuition is simple. If two products/regions are in the same market, one would expect that prices move together over time due to active demand and supply substitution. Due to the public availability of hourly electricity spot price data for most European countries, the often-proclaimed existence of a single European market for electricity can be reviewed by analysing correlation coefficients between different pairs of hourly spot prices of neighbouring countries. Table 25 shows such a matrix for five countries in Northern Europe.

Table 25. Correlation matrix of hourly spot prices for selected European countries (2001-2003)

	Denmark (West)	Norway	Sweden	Germany
Denmark (West)	1,000	0,525	0,568	0,359
Norway	0,525	1,000	0,970	0,137
Sweden	0,568	0,970	1,000	0,196
Germany	0,359	0,137	0,196	1,000

Source: Own calculations based on 26.280 observations; raw data stems from www.nordpool.com

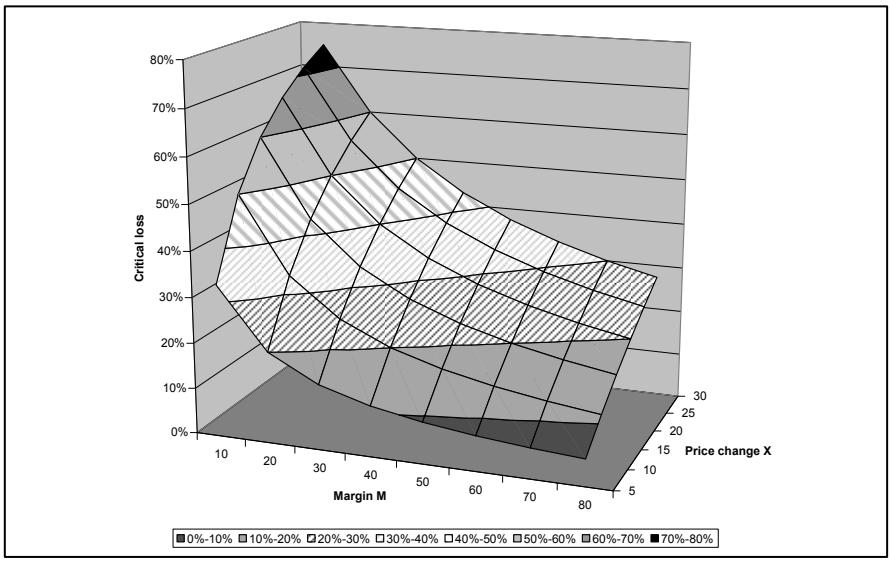
As the table shows, the correlation coefficients between Norway and Sweden are extremely high, indicating an integrated market for electricity. While the coefficients between Norway/Sweden and Denmark (West) are still around 0,5, the values for Germany and Denmark (West) are relatively low, leading to the conjecture of separate geographical markets for electricity. One explanation for the low correlation between both market prices could be insufficient trading possibilities caused by insufficient interconnector capacities and/or inefficient allocation mechanisms of existing interconnector capacities. From an econometric perspective, a test for stationarity of relative prices might be in order to avoid some potential problems of simple correlation matrices, such as a common cost factor which might lead to 'spurious correlation' (see Lexecon, 2004: 5ff.).

Equation (37) basically says that the critical percentage loss of units sold is determined by the percentage change in price (X) divided by the sum of the percentage change in price and the price-cost margin (M). For given values of X and M, it is therefore straightforward to derive the critical loss. If the percentage change in price is, for example, given by X=5% and the margin is assumed to be M=10%, the critical loss is 0,33 or 33%. This exercise can be replicated for other combinations of X and M values. Figure 32 plots the critical losses for price changes of 5% to 30% against margins of 10% to 80%.

Figure 32 basically shows that the critical loss increases with the price change X and decreases with the margin M. A margin of 10% and a price change of 30%, for example, would lead to a critical loss of more than 70% (see Table 69 in Annex 6.7). However, it is important to mention that the critical loss values can be

relatively sensitive to changes in the calculation method ('could' versus 'would'-approach) as well as the underlying demand function ('linear demand' versus 'iso-elastic demand'). These specifics of the critical loss are discussed in more detail in Annex 6.4.

Fig. 32. Critical losses plotted against different margins and different price changes



The derivation of the critical loss as such reveals how much substitution must occur as a consequence of a price rise to make that price rise unprofitable. In the second step, information must be collected to estimate whether such a substitution would actually take place in the case at hand. There are several ways to get an estimate of the size of the actual loss. Harkrider (2004: 3ff.), for example, differentiates between customer reactions to historical price changes, econometric evidence (as already sketched above), customer/industry expert interviews and affidavits as well as surveys. All these instruments might help to answer the question of how many customers would switch in response to an increase in price of a certain percentage.

After calculating the critical sales loss and estimating the actual sales loss, both have to be compared in a third step. Is the real loss in the market smaller than the critical loss, the increase in price would be profitable; otherwise it would not. Although critical loss analysis is typically seen as a useful tool to operationalise the SSNIP test, economic scholars recently raised significant concerns, especially with its mechanistic application experienced in several antitrust cases. Without wanting to enter these discussions in detail (see especially the interchange between Scheffman and Simons, 2003; Katz and Shapiro, 2003, 2004; O'Brien and Wickelgren, 2003, 2004), criticism refers to either the usefulness of the formula as such (e.g., its implicit assumption of constant marginal costs; see especially Coate and Williams, 2005) as well as its sometimes flawed interpretation (e.g., the

wrong conclusion that large initial margins as such indicate that the respective hypothetical monopolist has so much to lose that even small price increases are unprofitable and the market must be broadened[179]). Nevertheless, if conscientiously applied, critical/actual loss comparisons can be a useful back-of-the envelope tool for market delineation.[180]

In a nutshell, this section showed that market definition is typically an important analytical step in an antitrust investigation as it helps to identify the essential competitive constraints a firm or group of firms face or would face. However, it cannot be overemphasised that market delineation is not an end in itself but only a necessary precondition for the (indirect) assessment of market power (which in turn is key to the determination of whether a certain business conduct raises anticompetitive concerns).

In addition to views that interpret market definition as obsolete[181], other commentators, such as Fingleton (2000: 38 ff.), are worried that the focus on market definition and the corresponding analysis of concentration measures might hinder the often more fundamental analysis of the competitive effects of a certain suspicious conduct. Canoy and Weigand (2001) acknowledge that market definition is an important first step in an antitrust investigation; however, they also recommend concentrating on the study of relevant economic factors – such as entry barriers,

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179 The typical (correct) counterargument is that high margins indicate a relatively price-inelastic demand, hence the actual loss of demand following a certain price increase is expected to be small and therefore might very well be profitable leading to a relatively narrow relevant antitrust market (see, e.g., O'Brien and Wickelgren, 2003).

180 Critical loss analysis can also be used in merger control to assess the unilateral effects of a proposed horizontal merger. However, for such applications, it is necessary to adjust the critical loss formula, because some of the lost sales of firm A are recaptured by firm B and would therefore stay in the merged company A+B. In general, this effect increases the profitability of a price rise and consequently indicates that the critical loss in a unilateral effects assessment has to be larger than the critical loss for a market definition assessment. As also shown in Annex 6.4, the critical loss formula for unilateral effects assessments is given by the following expression (for a linear demand function):

$$\frac{X^A}{M^A + X^A - M^B \frac{P_0^B}{P_0^A} D_{AB}} \geq \frac{\Delta Q_A}{Q_0^A} .$$

with D_{AB} representing the so-called diversion ratio between products A and B. See section 2.3.3 for a definition and characterisation of the diversion ratio.

181 Stigler and Sherwin (1985: 583) pose the following provocative question in this respect: "Why the factual enquiry necessary under this 5 per cent approach – coupled with quantification of market shares and judgement concerning the level and changes in concentration - is any easier than asking directly whether the merger will result in an increased price (the question that is, after all, the one to be answered) is beyond us."

vertical and lateral links, dynamic considerations and business strategies – as it is often more important to study such areas intensively in order to develop an understanding of the competitive forces in the market, rather than devoting too many resources into 'getting market delineation exactly right'. This is also emphasized by Scheffman (2004), who reminds of the interrelationship of market definition and competitive effects analysis and the danger of fixing the relevant market first and only assessing competitive effects within these boundaries. Sometimes the competitive effects analysis reveals that the relevant market analysis was wrong. Salop (1999: 23) concludes his essay on 'The first principles approach to antitrust' by remarking that "[i]t will be clear that the first principles approach has become firmly established when the first analytical question antitrust practitioners ask themselves is no longer 'what is the relevant market', but instead 'what is the alleged anticompetitive effect?'"

2.4.2 Assessing Market Power

While the delineation of the relevant market consciously abstracted from intra-market rivalry by assuming a hypothetical monopolist, the assessment of market power basically has to release this assumption and aims at assessing actual or potential market power of firms or groups of firms within the relevant market boundaries. In general, it is no exaggeration to see the assessment of market power at the core of antitrust policy – simply because antitrust policy's main concern is the creation, exploitation and maintenance of market power. From a practical perspective, the concept of market power is of direct relevance in the definition and identification of monopoly as well as in the assessment of cartels and collusion. Furthermore, it is used in merger control as well as in the assessment of vertical restraints (see Fingleton, 2000; Hay, 1991). In particular, assessing market power is important because it is believed to play a fundamental role in determining 1) whether transactions will likely result in future anticompetitive effects; 2) whether ambiguous business practices could have resulted in anticompetitive effects; and 3) whether efficiencies have been or will be passed on to consumers (see McFalls, 1997).

The importance of market or monopoly power[182] for antitrust analysis is reflected in a multitude of definition and characterisation attempts by economists and lawyers (see, e.g., Fisher, 1979; Krattenmaker et al., 1987; Hay, 1991; Scheffman, 1992; Fingleton, 2000). A fairly general definition attempt specifies that a firm has market power if it can act (to a significant extent) independently of competitors, entrants, suppliers or customers (see Canoy and Weigand, 2001;

[182] Although the terms *market power* and *monopoly power* are mostly viewed as interchangeable, some scholars try to differentiate between them. As argued by Rubinfeld (2004: Section 3) and ABA (2005: 3ff.), monopoly power is typically understood as a 'stronger' form of market power characterised by high market shares, barriers to entry, a relatively high Lerner index and relatively high profitability. In the following, *market power* and *monopoly power* are used interchangeably.

Azevedo and Walker, 2002). Although this 'acting independently' is typically related to the possibility and profitability of price increases, market power might also be exercised if a firm is able to reduce product quality or restrict customer choice without losing enough sales to make such a downgrading unprofitable.

Daskin and Wu (2005) took a closer look at definitions of *market power* applied by US courts over the last couple of decades. The authors identify the following four influential definitions, each of which has different implications for antitrust policy:

Definition 1: "The power to control prices or exclude competition"[183]

Definition 2: "The ability of a single seller to raise price and restrict output"[184]

Definition 3: "The ability to raise prices above the levels that would be charged in a competitive market"[185]

Definition 4: "The ability of a firm or group of firms within a market to profitably charge prices above the competitive level for a sustained period of time"[186]

To a certain extent, the four definitions describe the evolution of the antitrust interpretation of *market power*. The first definition surely is the broadest of the four – likely too broad to act as a helpful guide for practical antitrust policy. Almost every firm has some control over price and might have the power to exclude some competition – without typically harming competition in a way that would justify antitrust interventions. The second definition somehow refines the first definition by focusing on price increases and output reductions. Although this definition comes closer to an applicable definition of market power, it especially lacks fixing a competitive benchmark that helps to distinguish between price increases due to cost increases and price increases due to market power[187] (see

183 *United States v. du Pont & Co*., 351 U.S. 377 (1956), *Aspen Skiing Co. v. Aspen Highlands Skiing Corp*., 472 U.S. 585 (1985).

184 *Eastman Kodak Co. v. Image Technical Services, Inc*., 504 U.S. 451 (1992), *Fortner Enterprises v. U.S. Steel,* 394 U.S. 495 (1969).

185 Jefferson Parish Hospital Dist. No. 2 v. Hyde, 466 U.S. 2 (1984).

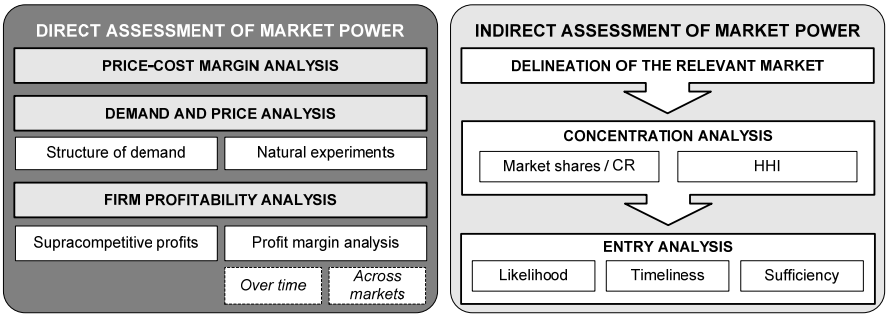
186 US DOJ / FTC Horizontal Merger Guidelines §0.1

187 However, it is important to note that the development from definition 1 to definition 2 loses an important facet of market power, namely 'the power to exclude competition'. In their influential paper on 'Monopoly power and market power in antitrust law', Krattenmaker, Landes and Salop (1987) identify this inconsistency and proposed to differentiate between two forms of market power: 'Stiglerian market power' and 'Bainian market power'. *Stiglerian market power* is basically the power of a firm or a group of firms to raise or maintain a price above the competitive level directly by restraining its own output ('the power to control price'). This is the kind of market power the evolution of the term *market power* concentrated on. However, in contrast, *Bainian market power* refers to situations in which a firm or a group of firms may raise prices above the competitive level by raising its rivals' costs and thereby causing them to restrain their output ('the power to exclude competition'; see Kratten-

Daskin and Wu, 2005: 53). The third definition is a refinement of definition two because it adds the competitive benchmark, however, without refining what might constitute such a competitive benchmark. Finally, the fourth definition – which is actually used in contemporary US antitrust policy – adds two important conditions to the definition: the price increase must be profitable (i.e., the firm must have an incentive to raise price) and the price increase must be sustainable for a long period of time (i.e., it is unlikely that the reactions of existing or new competitors will make the price increase unprofitable in the short or medium term; see Daskin and Wu, 2005: 57).

Based on this delineation of the term *market power*, the next step on the operational level is to think about possibilities to measure market power. In general, economists have developed direct and indirect approaches to assess and quantify market power. Both approaches are sketched in Figure 33.

Fig. 33. Direct and indirect assessment of market power



As shown in Figure 33, a direct assessment of market power can be carried out by (alternatively) analysing price-cost margins, demand and prices as well as firm profitability (see ABA, 2005: 147ff.). Typically, an application of these techniques (characterised further in the following paragraphs) makes high demand of the scope and quality of data which is needed to come to meaningful results and conclusions. If such data is not available or other reasons (such as time constraints or methodological issues) prevent the use of direct measures of market power, an indirect assessment of market power has to be pursued. Based on the delineation of the relevant market (discussed in the previous section), a concentration analysis of the relevant market is conducted followed by the study of the significance of entry barriers in the respective market. Such an assessment is 'indirect', because market power is inferred from the presence of high concentration figures and significant

maker et al., 1987: 248ff.). However, Bishop and Walker (2002: 73f.) somehow doubt whether there is a genuine distinction between pricing power and exclusionary power, basically because exercising exclusionary market power is a way of reducing the degree of competition and thereby allowing firms to raise prices.

entry barriers.[188] As the indirect approach is the standard technique to assess market power on the operational level, it will be discussed in more detail in the following sections.

Before providing such a more detailed assessment of the indirect approach, the above-mentioned direct approaches are worth characterising a little further. Given the definition of *market power* as 'a firm's ability to profitably raise and maintain prices above the competitive level', the Lerner index (or alternatively the price-cost margin) proposes the most immediate approach to measure market power by simply focusing on the differential of the firm's price and the competitive price (i.e., marginal cost under perfect competition) divided by the firm's price. Consequently, if a firm has no market power, the firm's price equals the competitive price and the Lerner index is 0. The Lerner index – and therefore market power – increases with the price-cost spread and approaches 1.

Although the Lerner index looks like a simple and practical instrument to measure market power directly, it has theoretical and practical drawbacks (see Elzinga, 1989: 25ff.). From a theoretical perspective, Hay (1991: 114) expresses the concern that focusing on the Lerner index could easily lead to a general condemnation of firms with a high Lerner index value irrespective of the fact that they might have 'deserved' their high margins by offering superior products and not by abusing their market power. Furthermore, an often-reported, related problem of the Lerner index refers to its reliance on perfect competition as the competitive benchmark. This assumption is typically critical in industries where 'substantial' fixed costs are incurred (for activities such as research and development in, for instance, pharmaceutical and software industries) and therefore 'substantial' price-cost margins are by no means a general indicator of market power but might simply be required to cover the substantial amounts of fixed costs[189] (see Elzinga, 1989: 27). In order to make the Lerner index a meaningful measure in such environments, an appropriate alternative competitive benchmark would need to be fixed in the first place to allow a differentiation between 'margins realised to cover fixed costs' and 'margins realised due to the abuse of market power'.

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188 Gavil et al. (2002: 811ff.) provide a detailed analysis of this issue and separate between 'single inference' and 'double inference' methodologies to assess anticompetitive effects. *Single inference methods* are methodologies which measure market power directly (by price-cost ratios, direct measures of demand elasticities or other types of econometric analysis) and infer anticompetitive effects from this analysis. *Double inference methods* measure market power indirectly by first diagnosing a high market share (based on the definition of the relevant market and market share calculations), which infers high market power, which in turn infers anticompetitive effects.

189 In general, fixed costs can be incorporated into the analysis. If the costs are given by $C(Q)=F+CQ$ the profits are given by $\pi=PQ-CQ-F$ and the condition that $\pi \geq 0$ can be written as $L \geq F/PQ$, that is in industries with positive fixed costs, the Lerner index must be at least as large as ratio of the fixed costs, *F*, and the firm's revenues *PQ* (see Kaplow and Shapiro, 2007: 4). See Cairns (1995) for several reflections of the Lerner index for various types of market, involving externalities, dynamics, increasing returns to scale, multiproduction, price discrimination and non-zero cross-elasticities of demand.

From a practical perspective, it is typically difficult to determine a firm's marginal cost of production at any given point in time, taking into account possible shifts in demand or the costs of inputs (see McFalls, 1997). Furthermore, even if it would be possible to derive an accurate measure of marginal cost, the Lerner index would likely overstate or understate the extent to which price exceeds the competitive level. The reason is simply that the marginal cost would be measured at the actual output level, which is typically different from the marginal cost measured at the competitive output level[190] (see Hylton, 2003: 235). Additionally, similar problems arise in many product markets with respect to the identification of 'the market price'. Such a single market price often turns out to be non-existent and replaced by a 'list of prices' reflecting, for instance, different brands, rebates, or simply different package sizes. "The result is a complex array of prices about which the Lerner index provides no selection criteria" (Elzinga, 1989: 26).

Given the identified problems of price-cost margins in a direct assessment of market power, it is worth considering alternative measures. Based on the well-known theoretical relationship that shows that the Lerner index $L = ((p - c)/p)$ is equal to the inverse of the firm's demand elasticity $1/\varepsilon_D^i$ [191], such an alternative measure is the firm's price elasticity of demand (see Fingleton, 2000: 29ff., and Motta, 2004: 124ff., for detailed overviews). Without wanting to enter into a detailed discussion, the estimation of the firm's price elasticity of demand is typically approached by constructing a full demand system for all interrelated products. As the available data typically does not allow the estimation of all own- and cross-price elasticities, econometric theory keeps ready several models to tackle this 'dimensionality problem' by way of introducing specific assumptions and restrictions. While a Logit approach factually assumes that elasticities are proportional to market shares, the almost ideal demand system (AIDS) involves a model in which products are 'nested' together in order to allow an estimation of the cross-price elasticities within these groups (see ABA, 2006, for an in-depth characterisation of the econometric techniques and Rubinfeld, 2000, for a practical application of the AIDS model to the breakfast cereal industry on the occasion of the Post-Nabisco cereal merger in the United States).[192]

A further possibility to directly assess market power is by conducting so-called *natural experiments* in the sense that prices (or alternative potential indicators) are

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190 As argued by Motta (2004: 116), high costs can be inherent to monopoly power. As a consequence, even a monopolistic firm might not show a high Lerner index simply because the firm is enjoying its 'quiet life' and produces at elevated costs (which in turn reduces the price-cost margin).

191 This relationship can be derived by simply rearranging a basic result of monopoly theory which shows that a firm with market power maximises profit when $p(1 - 1/\varepsilon_D^i) = c$.

192 A practical possibility to approximate the market power of a firm is an estimation of the elasticity of the residual demand function facing a single firm (see Baker and Bresnahan, 1988,and Motta, 2004: 125ff., for an overview). The *residual demand function* is the demand function a single firm faces once the supply responses of all other firms are taken into account.

compared between markets in question and comparable markets which are thought to perform competitively. Gavil et al. (2002: 813) explains further:

> These might be based upon different regions of the country, or a 'before and after' comparison with the same market at an earlier time, for example. When a competitive benchmark is available, this type of comparison constitutes a 'natural experiment' that can identify the presence or absence of market power.

However, important preconditions for a meaningful experiment are competitive benchmark markets as well as considerations whether the identified differences between the benchmark market and the market under review could have explanations other than market power, such as cost differences (see Gavil et al., 2002: 813ff., for a practical example of a natural experiment successfully applied in the 1997 *Staples-Office Depot* merger case).

A third possibility to directly assess market power is by undertaking some kind of firm profitability analysis. Based on an extensive treatment of these measures in ABA (2005: 147ff.), such indicators can be subdivided into assessments of supracompetitive profits generally and profit margin analysis[193] over time and/or across markets. Focusing on the role of supracompetitive profits as an indicator for market power, Hay (1991: 814) indeed proposed to extend the standard definition of *market power* by arguing that "market power for antitrust purposes should refer to a situation in which a firm or group of firms is able profitably to maintain prices significantly above the competitive level for a sustained period of time, thereby *earning supranormal economic profit*." Although the addition of supranormal economic profits as a condition for the presence of market power might indeed be helpful from a theoretical perspective – especially in industries with high fixed costs in which high margins do not necessarily mean high market power[194] – the practicality of such a proposal is rather limited given the possibilities of firms to hide economic profits in their accounts and the well-studied conceptual differences between *economic profits* and *accounting profits* (see Fisher and McGowan, 1983). Given these problems, profitability measures are rarely used in contemporary antitrust policy. In line with this finding, Daskin and Wu (2005: 55) remark that neither the prices approach nor the profits approach provides guidance on how high they must rise to constitute market power (see Fingleton, 2000: 29ff., and ABA, 2005: 147ff., for a discussion of various methodological problems).

Based on the challenges in measuring market power directly, an indirect assessment of market power is the standard procedure on the operational level of the

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193 The theoretical relationship between the Lerner index and the profit margin can simply be shown by multiplying the numerator and the denominator of the Lerner index L with the quantity q: $L = \left((p - c)/p\right) = \left((pq - cq)/pq\right) = \pi/R$.

194 Baumol and Swanson (2003: 661) argue in a comparable way: "We believe that a firm's profit record can be very helpful as one defensible indicator of market power, although it is hardly the one most commonly used. … The logic of our approach suggests that monopoly power can appropriately be defined as the ability to obtain monopoly earnings, rather than as the power to charge monopoly prices (or as the power to exclude competition)."

antitrust process.[195] In the following, the two key steps in an 'indirect' assessment of market power are analysed: concentration analysis and entry analysis. *Concentration analysis* is basically justified by theoretically and empirically discovered links between concentration levels and market power. *Entry analysis* basically aims at investigating whether a certain market concentration provides opportunities for abusing market power or if potential or actual entry possibilities (in the event of price rises) would restrict such possibilities.

2.4.2.1 Concentration Analysis

The logic behind market concentration analysis is the assertion that a concentrated market offers more possibilities for firms to behave anticompetitively – and consequently cause competitive harm – than an unconcentrated market. Economists have studied this field for more than a century now and have developed a couple of methods which allow measuring market concentration and which offer direct or indirect links to market power (see McFalls, 1997: 21ff.). In the following, market shares (in combination with concentration ratios) and the Herfindahl-Hirschman index are described as the three most commonly used concentration measures.

A typical measure of market concentration is *market share*, the percentage of sales or capacity that a firm controls in a relevant market. Typically, it can be expected that the larger the market share of a firm, the smaller is the fraction of lost sales in the event of a price increase above the competitive level (and the more likely it is that such a price increase is profitable). Although the calculation of market shares seems to be a straightforward exercise, Werden (2002c) shows that finding the correct denominator to calculate meaningful market shares can be quite challenging (see Box 23).

In a seminal paper, Landes and Posner (1981) study the theoretical relationship between market shares and the Lerner index.[196] Given the 'Lerner index - elasticity' relationship of $((p-c)/p) = 1/\varepsilon_D^i$, Landes and Posner assume that there is one dominant firm i with a large market share s_i in the market and a so-called competitive fringe denoted by the subscript j. In such a framework, the authors show that the firm's demand elasticity ε_D^i can be expressed as a function of the market share of the dominant firm s_i, the market demand elasticity ε_D^m and the fringe supply elasticity ε_S^j (see Annex 6.6.10 for the proof):

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195 It should be remarked that direct approaches to measure market power can also be used as evidence in an indirect assessment of market power. Generally, even if the data situation is sufficiently good in a certain case to conduct the direct approach, some idea on market concentration and the role of entry barriers would typically be needed in order to assess the competitive effects of a merger.

196 Landes and Posner (1981) were motivated to derive the above formula by the practical problem that firm-specific demand elasticities used in the Lerner index are often hard to measure. The formula above therefore tries to approximate these values by using market demand elasticity and market share (see McFalls, 1997: 2).

$$\varepsilon_D^i = \frac{\varepsilon_D^m}{s_i} + \left(\frac{\varepsilon_S^j (1 - s_i)}{s_i} \right). \tag{38}$$

Box 23. Assigning market shares

The calculation of market shares aims at describing the relative sizes of competitors in the relevant market. To serve this purpose, "market shares should be shares of some real and measurable industry quantity that reasonably serves as a common denominator for the array of products in the relevant market" (Werden, 2002c: 104). Werden identifies, among others, the following common denominators for assigning market shares:

- *Output-based shares* (such as weight or volume) have difficulties in handling heterogeneities in products, such as different package sizes (e.g., toilet paper) or different product performances (e.g., sugar and artificial sugar);
- *Revenue-based shares* have difficulties in differentiated product markets when relatively cheap (but technically identical) private labels compete against high-priced premium brands. Consequently, revenue-based market shares for premium brand producers are typically substantially higher than output-based shares;
- *Capacity-based shares* are typically used in process industries that produce homogenous goods using equipment for which there is a rated capacity (e.g., electricity generation).

The choice of the suitable denominator depends on the market power concern as well as the respective product(s). It is common practice in practical antitrust analysis to calculate market shares using various denominators (such as output and revenue) in order to identify and interpret differences.

Applying the relationship between the Lerner index and the firm's own demand elasticity, it directly follows that

$$\frac{(p - c)}{p} = \left(\frac{s_i}{\left(\varepsilon_D^m + \varepsilon_S^j (1 - s_i) \right)} \right). \tag{39}$$

Equation (39) shows that the level of market power (measured by the Lerner index) depends on basically three factors: market share, market demand elasticity and supply elasticity of the competitive fringe.[197] Figure 34 plots the level of market power for two different market shares of the dominant firm (40% and 80%) against variable values for the market demand elasticity and the supply elasticity of the competitive fringe.

[197] Please note that if there is only one firm in the market, Equation (39) simplifies to the standard monopoly formula $L = (p - c)/p = 1/\varepsilon_D^m$.

Fig. 34. Market power as a function of market share, supply elasticity and demand elasticity

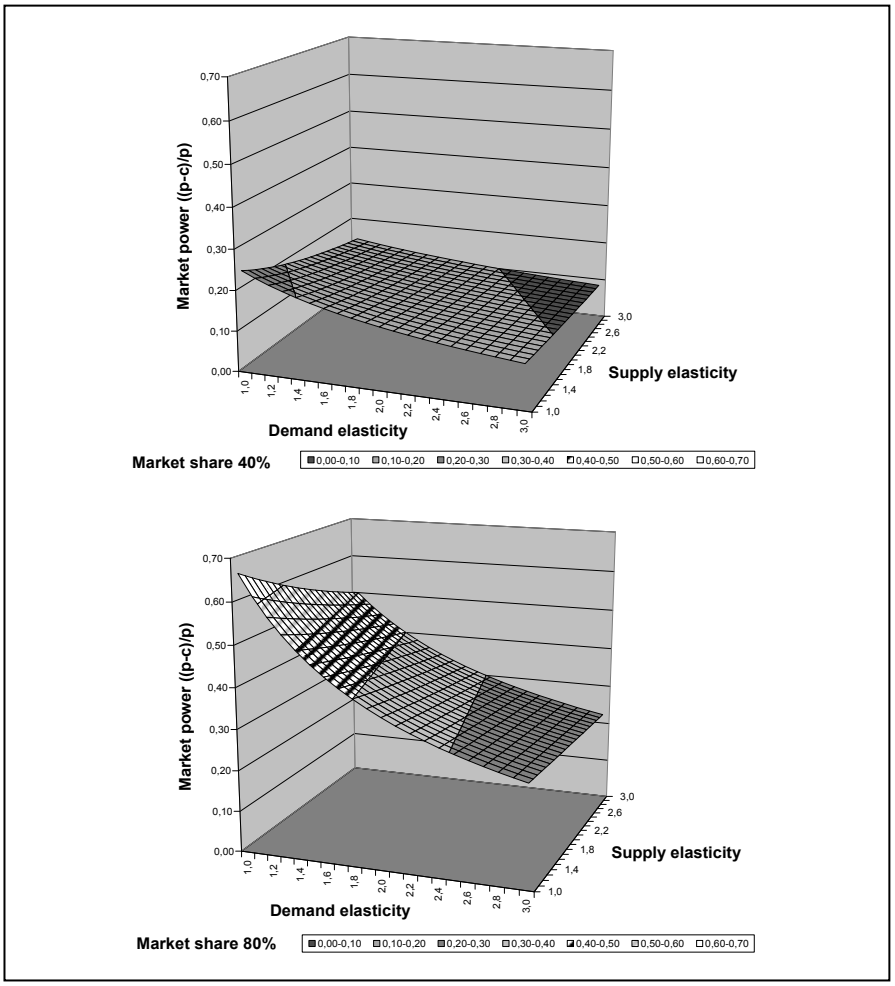

Figure 34 shows that – holding demand and supply elasticities constant – market power increases with market share. Furthermore, the graphs depict that the greater the market demand elasticity and the greater the supply elasticity of the competitive fringe, the smaller will be the dominant firm's market power. Finally, the graphs in Figure 34 indicate that changes of the demand elasticity influence the level of market power to a larger extent than similar changes of the supply elasticity. This finding is largely driven by the underlying model structure of a dominant firm with a competitive fringe.

From a practical perspective, Figure 34 implies that a high market share alone does not automatically allow the conclusion that a firm has high market power (measured by the Lerner index). As shown in Figure 34, even a very high market

share of 80% can coincide with still medium levels of market power (i.e., a Lerner index between 0,22 and 0,25) if demand and supply elasticities are sufficiently large. In fact, the same increase in price above competitive levels (between 22% and 25%) could be experienced by a firm with only a 40% market share which faces lower demand and supply elasticities (see Tables 57 to 60 in Annex 6.7). In other words, market power in this model world depends on *three* determinants: market share, demand-side substitution and supply-side substitution. Focusing only on one determinant, such as, for example, market shares, is likely to be misleading (see Landes and Posner, 1981: 947f., for a detailed discussion).

In antitrust practice, single market shares are typically used as evidence of a dominant market position. In the United States, market shares of "something over 50 percent" are required to constitute a monopoly (see Werden, 2002: 71). The EU Horizontal Merger Guidelines (Section III) also consider market shares of 50% or more as an upper threshold of a dominant market position; however, it is also noted that the Commission had, dependent on case specifics, decided to investigate mergers that would have resulted in combined market shares of below 40%. At the other end of the spectrum, the Commission believes that market shares below 25% are typically not liable to impede effective competition.

In addition to analysing single market shares, a still frequently used tool in antitrust policy is the aggregation of market shares s_i of the m largest firms in the market to derive so-called concentration ratios CR_m (with $m \leq n$):

$$CR_m = \sum_{i=1}^{m} s_i \ . \tag{40}$$

Although concentration ratios are not set aside in the Horizontal Merger Guidelines of either the United States[198] or the European Union, the usual concentration ratios of CR_4 and CR_8 are still regularly applied in antitrust investigations as well as general studies of market concentration. However, especially the disadvantage of only considering the largest m firms relative to the n-m other firms has led to the creeping replacement of concentration ratios by Herfindahl-Hirschman Indices.[199]

The Herfindahl-Hirschman index is a third measure of concentration. The HHI is defined as the squares of the market shares of all firms in an industry or a relevant market:

$$HHI = \sum_{i=1}^{n} (s_i)^2 \ , \tag{41}$$

with s_i being the market share of firm i. Given the definition of the HHI it becomes apparent that one advantage of the HHI over concentration ratios is that the

198 Concentration ratios were formerly used in the US Horizontal Merger Guidelines (1968) but replaced in the meantime by the Herfindahl-Hirschman Index. The new EU Horizontal Merger Guidelines also refer to HHIs.

199 As shown by Michelini and Pickford (1985: 301ff.), it is possible to estimate the Herfindahl-Hirschman Index from concentration ratio data.

HHI considers the distribution of market shares among all firms in the industry or market, giving, however, greater weight to the market shares of larger firms.[200] As shown by Schulz (2003: 49f.) it is possible to express the HHI in a slightly different form which allows bringing out this property more clearly:

$$HHI = \frac{1 + V^2}{n}, \tag{42}$$

with V being the variation coefficient and n the number of firms.[201] As Equation (42) shows, the HHI grows with market share inequality (measured by the square of the variation coefficient V) and shrinks with the number of n active firms in the market. At the upper end of the spectrum, the HHI equals 1 if the market is served by a monopoly. At the lower end, the HHI equals 1/n if the sales are equally distributed among the n firms in the market. If n is approaching infinity (as under perfect competition) the HHI approaches 0. The variation coefficient has a range of 0 to $\sqrt{n-1}$.

The additional dimension achieved by relying on HHIs instead of CRs can also be shown empirically. Figure 35 plots the concentration ratios CR_4 and CR_8 against the corresponding HHIs for 443 US manufacturing industries (four-digit Standard Industrial Classification, SIC) for the year 1992.

Figure 35 shows that low concentration ratios generally coincide with relatively low HHIs. However, growing concentration ratios coincide with an increasing dispersion of the corresponding HHIs for the respective industries. Take primary batteries (SIC 3692), for example. The HHI of the industry is about 3000, and CR_4

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200 Following Lipczynski and Wilson (2001: 111), the Hannah and Kay index, for instance, proposes to give weights to the firm's market shares from 0,6 to 2,5 depending on the preferences of the analyst with respect to the importance of the larger firms in the market:

$$HKI = \sum_{i=1}^{n} (s_i)^{\alpha}.$$

If α=2, the HKI is equal to the HHI (see Hannah and Kay, 1977, for a detailed assessment). Furthermore, the entropy coefficient measures the degree of uncertainty in an industry (see Hart, 1971). As described in Lipczynski and Wilson (2001: 111f.), the entropy coefficient is determined by the sum of the market share of each firm multiplied by the natural logarithm of its reciprocal:

$$ENC = \sum_{i=1}^{n} s_i \cdot \log \frac{1}{s_i}.$$

See Curry and George (1983) for a detailed treatment of the advantages and disadvantages of various concentration measures as well as a discussion of desirable properties of concentration measures.

201 $$V^2 = n \sum \left(s_i - \frac{1}{n} \right)^2 = n \sum_{i=1}^{n} (s_i)^2 - 1 = n \cdot HHI - 1.$$

and CR_8 are clearly above 80%. This indicates that this industry is dominated by a few firms with rather unevenly distributed market shares. Another industry shown in Figure 35 is household vacuum cleaners (SIC 3635). While the HHI of the whole industry lies at about 1000, the CR_8 is again clearly above 80%. This indicates that the market shares of the (few large) firms in this industry are distributed relatively evenly. A comparison of the primary batteries industry with the household vacuum cleaners industry shows that, although the CR_8 indicates that both industries have a comparable level of concentration, a comparison of the HHI levels reveal that the respective industry structures are actually quite different, probably leading to quite different conclusions with respect to possible competitive concerns.

From an antitrust policy perspective, an important characteristic of the HHI[202] as a measure of concentration *within a relevant market* is that it provides a formal connection to the Lerner index as a measure of market power (see Annex 6.6.10 for the proof):

$$L = \sum_i \frac{s_i^2}{\varepsilon_D^m} = \frac{HHI}{\varepsilon_D^m}. \tag{43}$$

Equation (43) shows that the Lerner index for a relevant market is given by the HHI divided by market demand elasticity. As already applied above, Equation (43) can be the starting point for the derivation of simple estimates of 'but-for' prices (which are needed to estimate cartel damages)

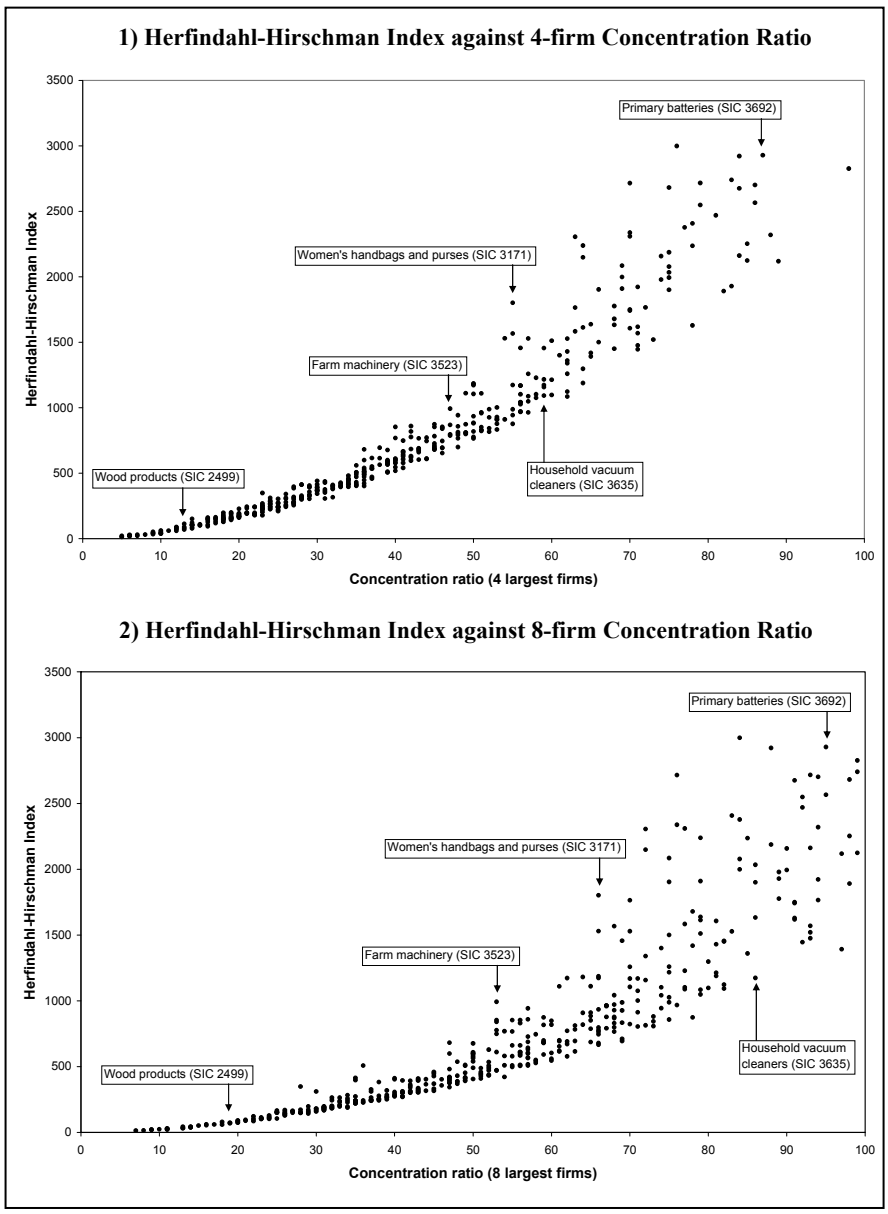
$$P = \frac{\varepsilon_D^m \cdot c}{\left(\varepsilon_D^m - HHI\right)}, \tag{44}$$

as well as simple estimates of the percentage price rises following a merger

$$\frac{\Delta p}{p} = \frac{\Delta HHI}{\varepsilon_D^m - HHI_{postmerger}}. \tag{45}$$

202 Please note that a certain HHI value demands different interpretations depending on whether it is used for unilateral effects assessments or coordinated effects assessments. While a unilateral effects assessment would probably be especially concerned about large HHI values, indicating that sales are unevenly distributed among an industry or market, a coordinated effects assessment would be more concerned about medium-level HHIs which might reflect that the market is relatively evenly distributed between a couple of firms. Such a situation typically speaks for a higher risk of coordination among the firms in the industry. See Frontier Economics (2004) for a discussion on the occasion of the Morrison-Safeway merger in the UK.

Fig. 35. Herfindahl-Hirschman indices against concentration ratios for 443 US manufacturing industries (1992)



In practice, antitrust authorities in the United States and the European Union frequently use HHIs – most prominently in (horizontal) merger enforcement – as a pre-screening tool to decide whether a proposed merger could raise competitive

concerns and should therefore be investigated more closely. A particular useful tool which is currently proposed by the Horizontal Merger Guidelines in the United States and the European Union is the combination of post-merger HHI and merger-induced change of HHI. The post-merger HHI can be expressed as follows

$$HHI_{post\,merger} = \sum_i (s_i)^2 - (s_1)^2 - (s_2)^2 + (s_1 + s_2)^2 = \sum_i (s_i)^2 + 2s_1 s_2 , \quad (46)$$

while the merger-induced change in HHI (delta) can be calculated to

$$\Delta HHI = HHI_{post\,merger} - HHI_{pre\,merger} = 2s_1 s_2 . \quad (47)$$

In other words, the merger-induced change in HHI can be calculated by doubling the product of the market shares of the two merging firms.

Following the current EC Horizontal Agreements Guidelines, competition concerns are unlikely to be raised by the Commission if the post-merger HHI is below 1000. The same conclusion is true for a post-merger HHI between 1000 and 2000 as long as the delta is below 250. Potential mergers leading to a post-merger HHI of more than 2000 and mergers leading to a delta of more than 250 can cause horizontal concerns and might be investigated further by the competition authorities.[203] However, antitrust enforcement practice shows that the actual HHI values typically have to be considerably larger in order to cause closer investigations by the authorities (see Box 24 for empirical evidence from the United States).[204]

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203 It should be noted that the EC Horizontal Merger Guidelines mention six caveats of fixing threshold levels. These caveats basically refer to situations in which HHI values are a bad indicator of potential competitive problems in cases such as: potential competition, one merging firm is an innovator, cross-shareholdings, mergers that eliminate a so-called maverick firm, past or ongoing coordination in the industry and one of the merging firms having a market share above 50%.

204 In the United States, the HHI thresholds and deltas are slightly different. A moderately concentrated market is defined for an HHI between 1000 and 1800 and a delta below 100. If the HHI is above 1800 and the delta exceeds 50, the merger potentially raises significant competitive concerns. If the delta is larger than 100, a merger creates or enhances market power or facilitates its exercise (see 1992 Horizontal Merger Guidelines, Section 1.51). Fisher (1987: 31) argues in this respect that the question whether these thresholds are correctly set depends on how the HHI relates to anticompetitive behaviour: "The danger of setting the trigger levels of the HHI too high is that anticompetitive mergers will slip through. One of the dangers of setting them too low is that the antitrust authorities will be beset with many cases of HHIs above the thresholds with claims of offsetting effects". He adds that HHI threshold levels can have a deterrence effect on mergers that involves HHI levels above the threshold level. As a consequence, setting low HHI threshold levels can deter socially desirable mergers.

Box 24. Investigation thresholds in practice – Evidence from the United States

Although the European Commission as well as the FTC and the US DOJ both set threshold levels for challenging mergers (in terms of post-merger HHI and change in HHI), it is typically mentioned that the thresholds are by no means deterministic in the sense that mergers below these thresholds will never be challenged (and vice versa). It is obvious that especially borderline cases, other things being equal, can raise comparable competitive concerns. This is also reflected in the real data on the post-merger HHI and change in HHI by mergers which were actually challenged in the US between 1999 and 2003 (see Table 26).

Table 26. Mergers challenged by the US agencies between 1999 and 2003

		Change in HHI								
		0-99	100-199	200-299	300-499	500-799	800-1199	1200-2499	2,500 +	total
Post-Merger HHI	0-1799	0	17	18	19	3	0	0	0	57
	1799-1999	0	7	5	14	14	0	0	0	40
	2000-2399	1	1	7	32	35	2	0	0	78
	2400-2999	1	5	6	18	132	34	1	0	197
	3000-3999	0	3	4	16	37	63	53	0	176
	4000-4999	0	1	3	16	34	30	79	0	163
	5000-6999	0	2	4	16	9	14	173	52	270
	7000+	0	0	0	2	3	10	44	223	282
	total	2	36	47	133	267	153	350	275	1263

Source: FTC and US DOJ (2003: 4)

As shown in the table, the enforcement agencies in the US decided to challenge 57 out of 1.263 mergers (around 4,5%) which led to a post-merger HHI of below 1.800. In terms of change in HHI, the agencies decided to challenge 2 mergers (around 0,2%) with a delta of less than 100. However, the table further shows that the majority of challenged mergers are high above the threshold levels set by the antitrust agencies.

Kwoka (2004: 9ff.) estimated that each 1.000 point increase in HHI results in a 5,75 percentage point increase in the probability of challenge. Furthermore, each 100-point increase in the delta leads to a percentage point rise in the probability of a challenge of 8,50. The full regression equation is PROB=41,2+0,00575HHI +0,00850ΔHHI. Consequently, the probability that a merger with a post-merger HHI of 3.000 and a delta of 600 is challenged after investigation is about 64% (PROB=41,2+0,00575*3.000+ 0,00850*600=63,55). See Coate and Ulrick (2005) for an extensive study of enforcement predictions based on past FTC actions.

Given these ranges, which delineate an area of potential horizontal concerns, and Equation (45), which derives an estimate of the percentage price increase due to a merger, it is possible to show how these ranges are related to the expected percentage price increases post-merger. This is done in Figure 36.

Figure 36 primarily shows ranges of the percentage price increases due to a merger dependent on post-merger HHI and change in HHI (for underlying market demand elasticities of 1,0 and 1,5). For example, for a post-merger HHI of 3.000 and a delta of 400, the homogenous Cournot model would predict a price increase in a range of 5,00% to 7,50% for a demand elasticity of 1,0 (the exact value is 5,71%; see Table 61 in Annex 6.7). These ranges of price increases can now be combined with the ranges fixed by the EC Horizontal Merger Guidelines (see the shaded area in Figure 36).[205] While the triangle on the left side of the graph marks an area which is impossible to reach (the post-merger HHI must be at least as high as the delta), the large shaded area in Figure 36 delineates the area of potential horizontal concerns. As revealed by Figure 36, it is rather unlikely that a merger which leads to a price increase by not more than 2,5% will be investigated further (assuming a demand elasticity of 1,0). Furthermore, for relatively low and relatively high post-merger HHIs, even predicted price increases in a range of more than 2,5% but less than 5% would likely not be investigated further by the European Commission. However, if a demand elasticity of 1,5 is assumed instead of 1,0, the price ranges are reduced substantially, and most mergers that would lead to price increases between 1,25% and 2,5% would fall into the area of potential horizontal concerns.

Although it is undisputed among economists that the described methods of concentration analysis are often an insightful part of an assessment of market power, it is equally undisputed that concentration analysis alone cannot provide a full picture of market power. The probably most important argument is that high concentration in a market is not necessarily 'bad' because it may simply be attributable to a superior product and not the absence of competition. Some industries might have a high concentration simply because the most efficient firms expanded[206] (see Goldschmid et al., 1984). The work of Sutton (1991, 1998) generally shows how competition in dimensions other than price can change the significance of indicators such as market concentration.

Furthermore, another striking reason for the insufficiency of concentration measures in assessing market power lies in the role of entry. As the theory of contestable markets has shown, market power is non-existent even in a market with a monopolistic firm as long as entry is free and consequently the respective monopolist is constrained in its pricing behaviour by potential competitors which would enter the market in a hit-and-run manner if the monopolist raises its price

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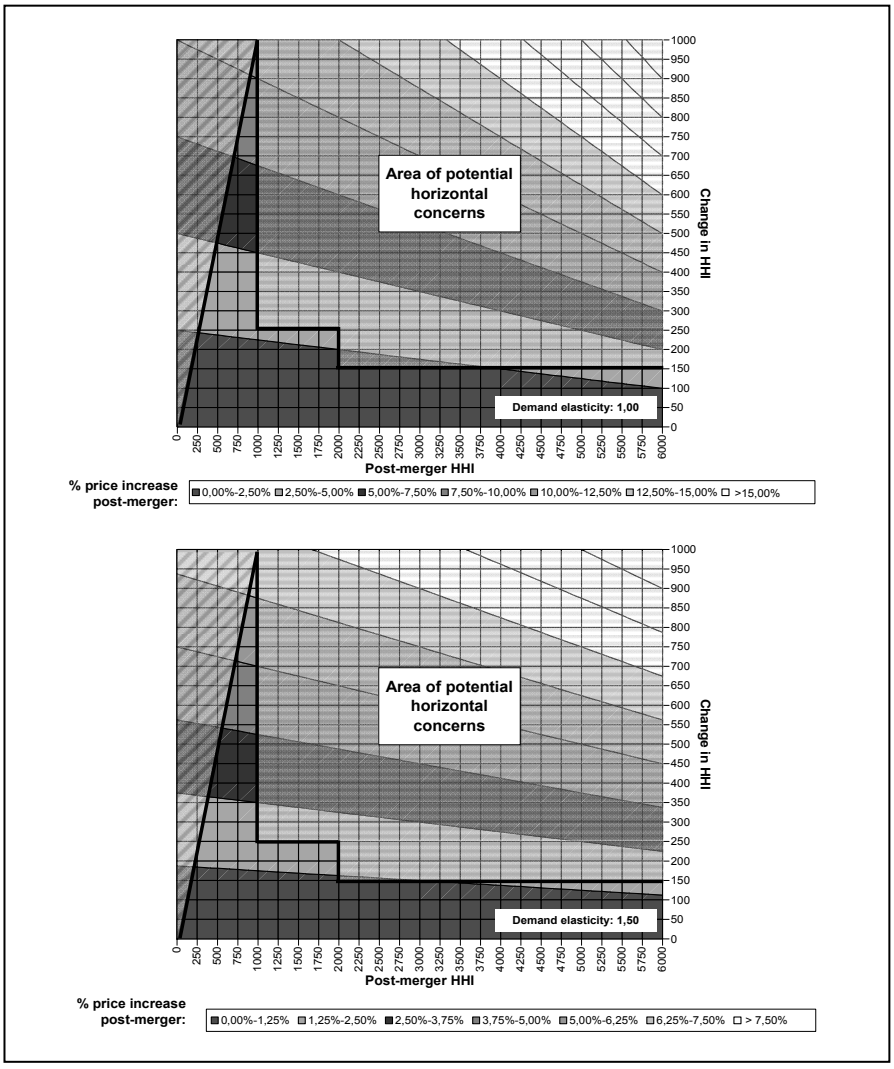
205 Although Hofer and Williams (2005a: 1) present a conceptually comparable graph of the so-called area of potential horizontal concerns, they do not connect their sketch to the price predictions of a Cournot model.

206 Additionally, it has to be considered that, following Gibrat's Law, horizontal concentration can just 'develop by accident' and consequently cannot automatically be related to restraints of competition. In connection to this finding, the Mosteller model allows predicting the structure of market shares in an industry. If the comparison of the model results with the actual structure of market shares shows statistically significant differences, existing restraints of competition are a possible explanation (see Neumann, 2000: 2ff.).

above the competitive level. So the basic argument is simple yet striking: If there are no barriers to entry, no monopoly power can persist. If, however, entry barriers are found to be high, monopoly power might persist and might harm consumers.

Fig. 36. Percentage price increase due to a merger dependent on post-merger HHI, change in HHI and demand elasticities of 1,0 and 1,5



In addition to these general limitations, reliance on concentration measures typically has an especially weak standing in special environments such as differentiated product markets, cluster markets, innovation markets and network indus-

tries (see ABA, 2005: 103ff.). With respect to differentiated product markets, the reliance on market shares bears a high risk of false conclusions if the market definition exercise beforehand turns out to be inexact or even wrong (see Fisher, 1979: 17). Although this statement as such might be generally true, it is often a major problem in so-called branded product (sub)markets, in which the decision whether different brands of the same product (such as, e.g., deluxe, standard and economy brand soups) belong to the same relevant market or constitute separate relevant markets can be deterministic in the sense that the result of the market definition exercise leaves no room for an in-depth assessment of the competitive effects[207] (see Box 25 as well as ICN, 2006, regarding the *0-1 fallacy* with respect to this problem).

Box 25. The role of market shares in differentiated product markets

Baker and Coscelli (1999) study the role of market shares in differentiated product markets with a simple hypothetical example from the soup industry. They assume that the industry is characterised by two deluxe brands (A and B), three standard brands (C, D and E) and two economy brands (F and G). The respective pre-merger sales and the respective market shares of two possible relevant market delineations ('all soups' and 'separate soup brands') are shown in Table 27.

Table 27. Market delineation and market shares in the soup industry

Brands	Sales (in thousands per month)		Share of 'all soup' market		Share of sub-market	
Deluxe brand A	50		5%		33%	
Deluxe brand B	100		10%		67%	
Total deluxe brands		150		15%		100%
Standard brand C	100		10%		20%	
Standard brand D	100		10%		20%	
Standard brand E	300		30%		60%	
Total standard brands		500		50%		100%
Economy brand F	200		20%		57%	
Economy brand G	150		15%		43%	
Total economy brands		350		35%		100%
Total all brands		1000		100%		

Source: Baker and Coscelli (1999: 413).

If now two alternative mergers between firms A and B and between firms E and F are considered, it becomes immanent how sensitive market share analysis reacts to

[207] As noted by Willig (1991), the HHI is also a poor indicator of market power in differentiated product markets, simply because the effects of an increase in concentration depend on cross-elasticities of the products.

changes in market definition. If the market is 'all soups', a merger between firms A and B would likely be unproblematic as it would lead to a combined market share of 15%, while a merger between firms E and F would potentially be problematic due to a combined market share of 50% for the merging parties. If, however, the relevant market is split among the three brand types, a merger between firms A and B would be a highly problematic 'merger to monopoly', while a merger between firms E and F would no longer raise any concern as both brands would belong to separate relevant markets. Based on this hypothetical example, Baker and Coscelli (1999: 413) conclude that "[t]he analysis based on market definition and market share copes poorly with differentiated product markets because such analyses implicitly give no weight to the competitive influence of products outside the defined market and give weight to products within the market in direct proportion to their market shares." As a consequence, additional factors which have to be taken into account are assessments of the respective marginal customers, the respective diversion ratios and the strength of preferences for certain brands.

Markets with high rates of innovation are another example for a special environment in which backward-looking concentration measures can hardly be used to assess market power. Pleatsikas and Teece (2001), for instance, remark that the use of high margins as an indicator of market power is inappropriate, because the few successful products which arise out of substantial research and development investments require high returns to pay back the costs of unsuccessful research efforts. Furthermore, "[a]bsent the chance to earn high returns on research and development and innovative activities, firms would normally avoid such activities, given the high risk they entail" (p. 690). The authors propose to investigate a firm's R&D portfolio – to evaluate whether monopoly returns are being earned – and the likely duration of possible market power.

Additionally, concentration measures typically provide only limited insights into the market power implications of vertical relationships.[208] Consider, for in-

[208] Another interesting area to study market power in vertical relationships is in so-called *aftermarkets*, that is, "markets for goods or services used together with durable equipment but purchased after the consumer has invested in the equipment" (Borenstein et al., 1995: 455). An example for such an industry would be computer printers (the durable – or primary – product) and the complementary ink cartridges (the aftermarket product). Potential competitive concerns typically arise because the durable good producers are often dominant providers of the aftermarket product and the customers are locked in due to their prior investment in the durable good. Generally, the potential of anticompetitive behaviour in aftermarkets depends on the characteristics of the trade-off between winning customers in the primary market (by setting low prices) and exploiting customers in the aftermarket (by setting high prices), which is determined by a couple of factors such as the ratio of locked-in customers to new purchasers, the ability to price discriminate in favour of new purchasers, the magnitude of switching costs, the quality of information available to marginal customers, the number of markets in which the selling firm competes and the strength of system competition (see Bishop and Walker, 2002: 205ff.). Borenstein et al. (1995) show that competition in the equipment market often does not discipline aftermarket prices and that consumers are likely harmed by the lack of aftermarket competition leading to

stance, the case of the two alternative vertical mergers between firms A and X and firms C and Z in Figure 37 (see Daniel, 2004: 52ff., for the following). The pre-merger HHIs in the upstream market (HHI=3.400) and the downstream market (HHI=5.350) are relatively high, indicating concentrated markets and therefore potential anticompetitive concerns. However, if the supply relationships of both mergers are analysed, a merger of firms A and X is unlikely to raise foreclosure concerns as firm A only delivers to firm X. However, if the merger of firm C with firm Z is considered, even despite the substantially lower market shares, it may raise concerns of foreclosure because firm C supplies not only firm Z but also its direct competitor firms X and Y. Consequently, a post-merger firm C+Z might find it profitable to raise the price it charges to firms X and Y.[209] Hence, from the viewpoint of foreclosure strategies, a merger of firms C and Z is likely to raise more significant concerns than a merger of firms A and X – although the latter involves higher market shares on both levels than the former.[210]

In a nutshell, although concentration measures are a standard tool used in almost every antitrust case, they can rarely be applied in isolation to draw conclusions on the extent of market power. One major reason is that there is no simple relationship between concentration measures and welfare; an increased concentration measured in terms of concentration ratios or HHIs does not necessarily lead to an increase in allocative inefficiency but might simply represent the superior efficiency of a firm in its respective industry or market. To put it simply: High con-

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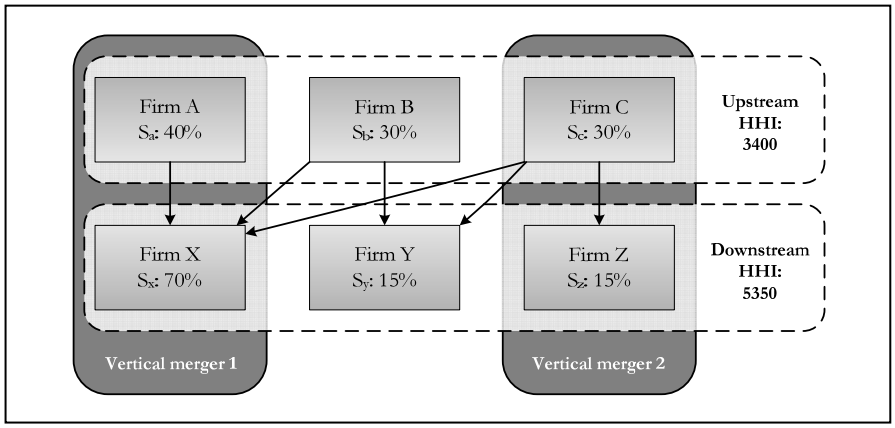
reduced output, exclusion of cost-reducing competition, and restrictions on product variety and quality (see Borenstein et al., 1995; Klein, 1996). Based on an in-depth study of market power problems in aftermarkets, Borenstein et al. (1995: 481f.) identify the following questions as key to an assessment of the existence and magnitude of anticompetitive behaviour: 1) How important are current aftermarket profits relative to future equipment and aftermarket profits? 2) What is the magnitude of switching costs? 3) How sensitive is aftermarket demand to changes in price and other terms? 4) How important are long-term reputations for favourable aftermarket practices in the industry? 5) How difficult is it for customers to write long-term contracts with equipment manufacturers that provide protection against aftermarket price increases and other policy changes?

209 The merged entity has an incentive to raise prices if the increased costs for X and Y lead to higher prices in the downstream market in which firms X, Y and Z compete. As the merged entity does not experience such an increase in costs, it could increase its margins. On a more general level, economic theory has identified various possible competitive effects of vertical mergers, including the degree of vertical integration, input substitutability downstream, the presence of transaction and contraction costs, the degree and type of competition at each vertical level, the ability to price discriminate (absent merger) and the feasibility of non-linear pricing (see Scheffman and Higgins, 2004, for an overview).

210 With respect to potential efficiencies created by vertical mergers, high market power on both levels could indicate that *double marginalisation* (see Annex 6.3 for a characterisation) plays a large role pre-merger and that a vertical merger might internalise this effect (i.e., the merger allows the realisation of substantial efficiencies which are translated into lower prices for the final product).

centration does not automatically imply high market power, and high market power does not automatically imply harm to welfare and/or consumers.

Fig. 37. Vertical mergers and pre-merger supply relationships



Source: Inspired by a comparable figure in Daniel (2004: 53).

The general need for a complementary study of entry barriers – which will be met in the following section – is characterised by Fisher (1979: 18) as follows:

> Well, the one proposition which most people believe is that a small share shows the absence of monopoly power and a large share its presence. … This is not true. The right question is that of what happens to share … when monopoly profits are sought. The fundamental issue is whether competitors are able to grow.

2.4.2.2 Entry Analysis

Entry analysis plays an important role in the assessment of market power as a necessary complement to an analysis of concentration measures. Even if market concentration is relatively high, incumbents may be unable to exercise market power (i.e., earning monopoly profits) as long as potential entrants could easily and quickly start producing substitutes. Consequently, an analysis of the likelihood, timeliness and sufficiency of entry following a price increase is a key component in assessing market power (see Waterson, 1981; Coate and Langenfeld, 1993; McAfee et al., 2004, for surveys). Furthermore, the analysis of (potential) entry usually plays an important role in the subsequent assessments of competitive effects of certain suspicious conducts as well as in the design of remedies.

The *likelihood of entry* is determined by the profitability and possibility of entry. The *profitability of entry* can be operationalised by estimating the expected net present value of the post-entry profits as well as the sunk costs of entry.[211] If the

[211] *Sunk costs of entry* are generally defined as costs which must be incurred to enter a market but which are not recoverable upon exiting the market.

discounted profits are larger than the sunk costs of entry, then entry would be profitable; otherwise it would not be (formal treatment of the determinants of entry profitability see Box 26 and Salop, 1986). Whether entry would actually take place, however, does not only depend on the profitability of entry but also on the possibility of entry. The *possibility of entry* is determined by barriers to entry existing in the market. The consequential key question of 'what is understood by barriers to entry' has been assessed by many economists, however, without reaching an agreement on an overarching concept of barriers to entry.

The first influential concept of *barriers to entry* was developed by Bain (1956: 3). He defines the term commonly as "an advantage of established sellers in an industry over potential entrant sellers, which is reflected in the extent to which established sellers can persistently raise their price above competitive levels without attracting new firms to enter the industry".[212] Stigler (1968) prefers a narrower definition. He proposes to think of a barrier to entry as "a cost of producing (at some or every rate of output) … which must be borne by a firm which seeks to enter an industry but is not borne by firms already in the industry". Fisher (1979: 23), however, bases his proposal on social welfare when he argues that "[a] barrier to entry exists when entry would be socially beneficial but is somehow prevented ... The social benefit-cost calculation is not correctly reflected in the private benefit-cost calculation of the potential entrant".

Box 26. Assessing entry profitability and ease of entry

The likelihood of entry crucially depends on the expected profitability of entry from the viewpoint of the potential entrant. In general, a profit-maximising, risk-neutral firm should enter a market if the net present value of expected post-entry profits is greater than the sunk costs of entry. Ross (2004) developed a simple model which studies this decision. It is assumed that an incumbent experiences entry in a market. Market entry requires the payment of a fixed, one-time sunk cost K. N periods after entry took place (the so-called *hit period*), the incumbent is able to react to entry and the entrant's success or failure is decided. It is further assumed that φ describes the probability that the entry attempt is successful. As mentioned above, entry will take place if the net present value of the expected profit stream following entry is positive. With a probability of $(1-\varphi)$, the entrant will fail after N periods and the per-period profits of π_e^h during that hit period create a profit stream of

[212] See McAfee et al. (2004) for a discussion of different definitions of *barriers to entry*. The sources of Bainian barriers to entry are diverse and reach from legal entry barriers (such as entry regulation by the state) to several forms of private entry barriers. Private entry barriers are typically subdivided into structural and strategic barriers to entry. Structural barriers to entry are related to structural or technical characteristics of an industry (e.g., economies of scale, absolute cost advantages such as favourable access to raw materials or a favourable geographic location, capital cost requirements, product differentiation advantages, etc.). Strategic barriers to entry are largely based on the notion of strategic entry deterrence, realising that existing firms might deliberately behave in ways that decrease the probability of entry of other firms (see Waldman and Jensen, 2000: 129, and chapter 3 below).

$$V_{Unsuccessful} = \frac{\left(1-\delta^N\right)}{(1-\delta)}\pi_e^h - K\,. \tag{48}$$

With a probability of φ, the entry attempt will be successful and the entrant will compete with the incumbent, forever realising profits of π_e^c per period and realising a total profit stream of

$$V_{Successful} = \frac{\left(1-\delta^N\right)}{(1-\delta)}\pi_e^h + \frac{\delta^N}{(1-\delta)}\pi_e^c - K\,. \tag{49}$$

The expected entry value *EV* is then given by $EV=(1-\varphi)\,V_{Unsuccessful}+\varphi V_{Successful}$ or

$$EV = \frac{\left(1-\delta^N\right)}{(1-\delta)}\pi_e^h + \varphi\frac{\delta^N}{(1-\delta)}\pi_e^c - K. \tag{50}$$

Entry is profitable if EV>0. If the profits of the hit period (the first term on the right side of Equation 50) are positive and already larger than the sunk costs of entry, entry will take place anyway. The second term on the right are the discounted profits if the entrant is accommodated weighted by the probability of success. The probability of success can also be interpreted as a measure of the ease of entry by defining a critical success probability φ* that leads to EV=0:

$$\varphi^* = \frac{(1-\delta)K - \left(1-\delta^N\right)\pi_e^h}{\delta^N\pi_e^c}\,. \tag{51}$$

As long as φ>φ*, entry will be profitable, otherwise it will not. From an antitrust perspective, assessing the ease of entry will have to estimate the right-hand side of Equation (50), that is, the required sunk investment, the length of the hit period and the profits before and after the reaction of the incumbent. Additionally, the complementary decision problem of the incumbent has to be studied in order to assess the profitability of entry-deterring strategies (see Ross, 2004: 87ff., and chapter 3).

Without wanting to enter into an in-depth discussion of the exact implications of the different definitions (see Waterson, 1981; McAfee et al., 2004), it is apparent that Bain's concept considers all factors as barriers to entry which increase an entrant's costs of producing and selling (or which reduce its revenues), while Stigler is only interested in factors that raise an entrant's costs relative to those experienced by the incumbent firms (see ABA, 2005: 122). As a consequence, while the Bainian definition considers scale economies, product differentiation, absolute cost advantages and capital requirements as classical entry barriers, the Stiglerian definition typically does not. Under the latter, scale economies are not an entry barrier as long as entrants and incumbents have equal access to the respective production technologies.[213]

[213] As von Weizsäcker (2004) commented, the determination of a suitable definition of *barrier to entry* crucially depends on the underlying concept of *competition*. Viewed from that angle, the differences in the definitions between Bain – belonging to the Harvard school and influenced by the structure-conduct-performance paradigm – and

Inspired by the significant differences in the application of these definitions, McAfee et al. (2004) proposed a new taxonomy of barriers to entry. The authors argue that the classical concepts à la Bain, Stigler and others typically aim at studying industry competition in the long run. Antitrust policy makers and consumers are more concerned, however, about the effects in the medium and the short run (see McAfee and Mialon, 2004: 6). McAfee et al. (2004) thus propose to differentiate between *economic* barriers to entry and *antitrust* barriers to entry. *Economic barriers* to entry are defined narrowly in Stiglerian terms, while an *antitrust barrier* to entry is defined as "a cost that delays entry, and thereby reduces social welfare relative to immediate but equally costly entry" (McAfee and Mialon, 2004: 4). Based on this definition, the authors argue that economies of scale could be an antitrust barrier to entry (albeit no economic barrier to entry) because they can delay entry and therefore can reduce social welfare (see McAfee et al., 2004: 464).

The question of how to measure entry barriers in practical antitrust policy was investigated in depth by NERA (2004: 10ff.), who proposes to measure the following entry barrier indicators:

- *Advertising ratio to sales* – aims at capturing the level of advertising which a potential entrant must pay to enter the market,
- *R&D expenditure ratio to sales* – aims at capturing the level of R&D expenditure a potential entrant must invest to enter and compete in the market,
- *Minimum efficient scale* – aims at capturing how large a production facility has to be in order to be able to compete on price with the incumbent firms,
- *Excess industry capacity* – aims at capturing the possibility of incumbents to flood the market in the event of entry,
- *Firm entry/exit rates* – aims at capturing the fact that the presence of sunk costs deters entry and postpones exit,
- *Ratio of capital expenditure to sales* – aims at capturing the fact that the greater the capital investment that must be financed for any return, the higher will be the hurdle of raising finance,
- *Regulatory/Licence restrictions* – aims at capturing the fact that new entrants may be barred from entering a market by virtue of government regulation.

The NERA report quantifies these ratios for various industries in the United Kingdom, affording a decent picture of the 'ease of entry' in these industries. However, the list should be considered only as a starting point for developing 'bespoke' indicators covering the specifics of the industry of interest.[214]

In addition to assessing the likelihood of entry, the *timeliness of entry* criterion examines "whether entry would be sufficiently swift and sustained to deter or defeat the exercise of market power" (EU Horizontal Merger Guidelines, Section VI,

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Stigler - belonging to the Chicago school of antitrust analysis - should not be too surprising, as they are driven by the fundamentally different concepts of competition.

214 The empirical literature has developed so-called 'indices of entry barriers' (see, e.g., Orr, 1974), which include other indicators such as risk (measured as the standard deviation of industry profit rates), past rate of growth in the industry and past profit growth in the industry.

No. 74). Typically, entry is considered timely if it could occur within two years (from initial planning to significant market impact). However, the time period considered appropriate depends on the characteristics and dynamics of the market as well as on the specific capabilities of the potential entrants (see Oxera, 2006). The analysis of the frequency and successfulness of historical entry episodes in the respective industries may help to assess whether 'timely entry' is likely to be expected (see ABA, 2005: 137ff.).

Finally, the *sufficiency of entry* criterion demands that entry must be of sufficient scope and magnitude to restrict the exercise of market power. Following the EU Horizontal Merger Guidelines (Section VI; No.75), even rapid and profitable entry might not be sufficient to defeat competitive concerns if entry is, for instance, small-scale and takes place into a market niche. Oxera (2006) proposes to concentrate an assessment of the sufficiency of entry on the general strength of potential entrants, in particular their ability to constrain incumbents' prices.

Summarising the section on the assessment of market power, it has been shown that any indirect assessment of market power needs to investigate the relevant market, the concentration levels within the relevant market and the likelihood, timeliness and sufficiency of entry following an increase in price.[215] Given the fact that the analysis of entry, and not the analysis of concentration, is key in understanding market power, Fingleton (2000: 2f.) proposes to use barriers to entry as a first point of reference:

> At present, this role goes to market definition and concentration, and barriers to entry are considered only if concentration is high. However, theory suggests that market power could exist with lower concentration figures if there are barriers to entry … within the market. Conversely, without barriers to entry or mobility, high concentration is not informative about market power.[216]

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215 With respect to the use of market power as a helpful screen or filter in antitrust cases, several scholars have posed the question whether the market power screen should also be applied in cases of per se unlawful conduct such as, for example, hard core cartels or certain naked restraints. As the concept of per se illegality is based on the precise belief that consumers are generally harmed by the form of conduct, a market power assessment does not seem to be necessary (although the market power concept plays an important role in determining whether a certain type of behaviour should be banned by per se prohibitions; see ABA, 2006: 12 ff.). If cases occur where the anticompetitiveness of the conduct is in doubt, ending the per se unlawfulness of that type of conduct should be considered (see Hay, 1991: 809ff.; ABA, 2005: 12ff.). A somewhat related question asks whether a finding of no market power should end the antitrust investigation. Following Hay (1991) and Easterbrook (1984), if market power represents the potential for competitive harm, the absence of market power should end any concerns about the anticompetitiveness of the respective conduct.

216 Lande (2007) proposes to differentiate between two very different sources of market power in antitrust analysis: the traditional market-share-based market power and market-failure-based market power. The former is the focus in antitrust investigations, and the latter usually plays a minor role. However, Lande states that market failures such as significantly imperfect information or unduly large transaction costs (based on time lags, search costs, faulty information or sunk costs) can result in elevated

Independent of the assessment order, which also has to follow investigation cost considerations, market definition and market power surely have important roles in antitrust investigations; however, " their proper roles are as parts of and in reference to the primary evaluation of the alleged anticompetitive conduct and its likely market effects. They are not valued for their own sake but rather for the roles they play in an evaluation of market effects" (Salop, 1999: 3).

2.4.3 Applying Economic Frameworks

The final stage on the operational level within the integrated approach focuses on the application of economic frameworks that are derived on the strategic level, which are suitable for the types of suspicious (i.e., potentially anticompetitive) conduct in antitrust cases. As argued at the beginning of section 2.4, in a world of limited enforcement resources and imperfect (and incomplete) information, the antitrust authority has to apply such frameworks as a tool not only to decide *how* cases should be investigated but also *which* cases are worth investigating in more detail. In other words, on the one hand, economic frameworks should aim at defining the necessary investigatory steps which the antitrust authority and the courts should apply to reach an appropriate conclusion on the anticompetitiveness of a certain conduct. This is an important instrument to ensure high-quality decisions and to provide important signals to firms which types of behaviour and under which circumstances might become critical from an antitrust point of view. On the other hand, it is important that a conclusion is reached in an economical fashion in the sense that cases of unlikely or minor anticompetitive behaviour are sorted out as soon as possible during the investigation in order to save resources and maximise the welfare contribution of antitrust enforcement.

Identifying the relevant market in conjunction with assessing the degree of market power within these market boundaries discussed in the preceding two sections must be understood as the first two, typically compulsory steps in applying such economic frameworks. If the delineated market in the case at hand is not characterised by a significant degree of market power, then it is believed that the firm(s) in such a market cannot abuse their position permanently to the detriment

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prices and harm to consumers even if no firm in the market has a large market share which would trigger investigations under the traditional market-share-based framework. Given this second form of market power, he proposes to think about adjustments in the traditional antitrust analysis (pp. 14ff.). First, one reaction could be to reduce the safe harbours based on market share in order to increase the likelihood that instances of 'consumer protection' market power are detected. Second, considering these market power effects during market definition might lead to narrower markets, simply because imperfect information refrains consumers from switching suppliers in case of a price increase. Third, it might be worth extending entry analysis in a market power investigation, for example, by considering entry incentives and entry possibilities over a longer period than the two years (after the price increase) currently considered.

of consumer (or overall) welfare. As a consequence, the temporary and limited damage caused is likely not significant enough to justify expensive antitrust investigations.

Although the assessment of market power is typically the first step in the application of an economic framework to investigate a certain type of business behaviour, it is typically not selective enough to reach a conclusion on anticompetitiveness. Consequently, more specific conditions, identified on the strategic level, need to be assessed and ideally quantified on the operational level in order to maximise the social benefit of antitrust policy. As stated by Evans and Padilla (2005: 26f.), "[t]hose conditions can be used to screen out practices that could not be anticompetitive, because the necessary conditions do not hold. When one of those necessary conditions fails, we can assume that the practice is not suspect".

Recent research has proposed several ways of structuring such filtering procedures to incorporate the essential insights of decision theory described at the beginning of section 2.4. Although the majority of these procedures naturally focus on one particular form of suspicious behaviour (such as mergers[217], predation, excessive pricing or tying), it is nevertheless possible to identify a certain unifying structure within most proposals. The framework by Ahlborn et al. (2003), for example, can be condensed to three fundamental questions: Is the suspicious conduct possible (first filter), plausible (second filter) and possibly offset by efficiency benefits (third filter)? The first filter has the function of ruling out cases in which anticompetitive behaviour is impossible or extremely unlikely. If essential preconditions (such as the presence of market power or substantial entry barriers) cannot be observed in the actual case, then the suspicious behaviour must be explained differently and the case can be closed.

The second filter has the function of finding logical (theory-based) and likely (case-based) arguments that make the suspicious behaviour plausible and probable (Bolton et al., 2000: 2266). To reach this aim, first market conduct (e.g., pricing behaviour, product strategy, research and innovation, plant investments, managerial incentives or legal tactics) has to be assessed. Second, suitable lines of argument (at best suitable economic models) and supporting empirical evidence have to be found to prove anticompetitive conduct. Thus the antitrust authority must present a legitimate explanation which clarifies the general rationality, the actual occurrence and the anticompetitive impact of the presumed strategic mechanism.

Ideally, only cases of anticompetitive behaviour will have to face the third filter. Before such conduct is prohibited (and eventually remedied or fined), the antitrust authority has to examine whether the behaviour generates efficiencies which

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217 For example, Fisher (1987a: 26f.) proposes to conduct merger policy as a two-stage process: "In the first stage, fairly simple tests should be used to decide what cases should be further investigated. I would use concentration measures heavily (but not exclusively) here and would consider a variety of reasonable market definitions. In the second stage, prospective mergers that fail such tests would be investigated in considerably more detail. The investigation will require a more sophisticated approach of market definition and concentration than is needed at the first stage." See the following concluding section for a further discussion.

offset the anticompetitive effects and which can only be achieved through the identified anticompetitive behaviour. It is obvious that the third filter uses the information collected in the previous two stages, supplemented by further internal information from the parties (e.g., cost data). Additionally, some projections (or scenarios) on the likely future development of the industry and the (dynamic) effects on competition and welfare would become necessary. Furthermore, following the integrated approach of antitrust policy, the framework by Ahlborn et al. (2003) needs to be amended by a forth stage focusing on the intervention stage as discussed in section 2.3.3.2. Again, case-specific data, simulation tools and qualitative evidence should ideally be used to derive optimal fines and optimal remedies.

From a methodological point of view, the discussion of the operational level in general and this section in particular has clarified that the delineation between the strategic level and the operational level is blurred when it comes to the design *and* application of economic frameworks, as the foundations and basic structure of the economic frameworks stem from the strategic level of the integrated approach. In designing economic frameworks on the strategic level, it is always necessary to anticipate incorporating the reality of implementing them in an antitrust policy. Otherwise, antitrust economics would run the risk of creating only ivory tower results. Vickers (2005: F260) is one leading antitrust scholar who clearly expressed this demand when he stated, "To be effective, however, economics must contribute in a way that competition agencies, and ultimately the courts, find practicable in deciding cases".

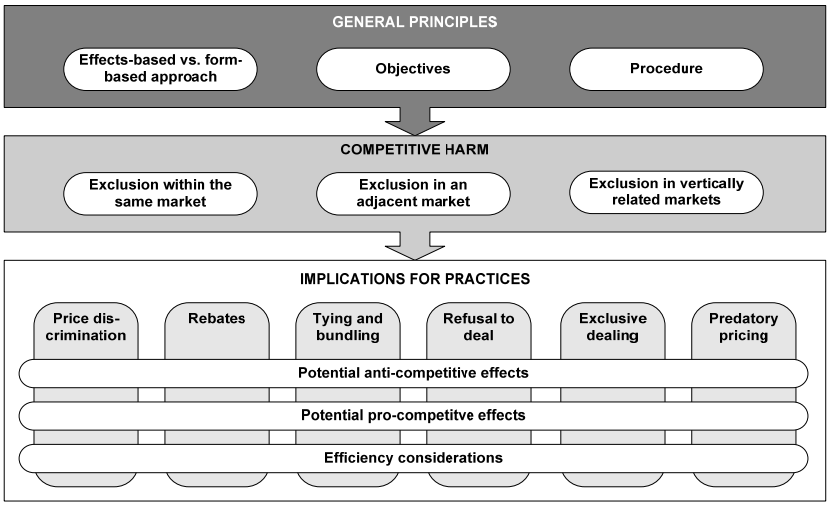
Consequently, aiming at developing ways to improve the efficiency of antitrust policy, the need for an operationalisation of antitrust frameworks was implicitly or explicitly already considered during the analysis on the strategic level and the development of policy proposals. For example, cost-benefit assessments already played a role during the choice between the per se rule and the rule of reason. As stated by Gavil et at. (2002: 96), "the per-se rule reflects a judgment that the costs of identifying exceptions to the general rule so far outweigh the costs of occasionally condemning conduct that might upon further inspection prove to be acceptable, that it is preferable not to entertain defenses to the conduct at all". Furthermore, the proposed application of strategies to detect cartels or the use of back-of-the-envelope formulas to evaluate horizontal mergers only makes sense in an imperfect world with resource constraints and imperfect information.

In addition to the detailed discussions on applying frameworks with respect to hard core cartels and horizontal mergers provided above and in the following section, further examples of such applications are provided for general forms of strategic behaviour (in chapter 3) and for franchising as one option to organise the vertical relationships in a market (in Annex 6.3). Furthermore, chapter 4 will review investigation frameworks developed to detect predation strategies and will also provide the complementary discussion of the optimal intervention against predation strategies. Additionally, Box 27 discusses a recent proposal to treat specifically exclusionary strategies based on a so-called effects-based approach.

Box 27. Effects-based versus form-based approach in cases of exclusionary conduct

In July 2005, the European Advisory Group on Competition Policy issued a report on An Economic Approach to Art. 82. Art. 82 of the EC Treaty basically prohibits the abuse of a dominant position and therefore covers exclusionary practices, such as price discrimination, rebates, tying and bundling and predatory pricing. The structure of the report is presented in Figure 38.

Fig. 38. An economic approach to Art. 82



As shown in the figure, the report contains three sections: general principles, competitive harm and implications for practices. Without wanting to go through all aspects of the report in detail, its key proposal must be seen in the switch from a form-based to an effects-based approach. Based on the finding that a form-based approach runs a high risk of treating practices with equally (anti-)competitive effects differently, an effects-based approach focuses on the assessment of the anticompetitive effects generated by business behaviour and therefore treats various practices consistently (when they are adopted for the same purpose). As a consequence, the antitrust authority will no longer have to prove dominance in a certain case, but it "will need to identify a [significant] competitive harm, and assess the extent to which such a negative effect on consumers is potentially outweighed by efficiency gains" (Gual et al., 2005: 3). Generally, the development and proof of such a 'significant competitive harm' by an exclusionary strategy can focus on the same market, an adjacent market or a vertically related market.

Procedurally, antitrust rules in an effects-based approach would typically include more than a single anticompetitive practice and would require a richer description of the relevant circumstances (see OFT, 2006, for an in-depth assessment). As a consequence, the implementation of such a proposal would typically lead to the application of rule-of-reason approaches. An assessment of market power would, however, still play a role in an effects-based approach as a 'selector' of the respective cases that

might harm society most significantly and should therefore enter an in-depth assessment by the antitrust authority on a preferential basis.

2.5 Summary and Conclusion

The focus of this chapter was to develop an integrated approach of competition policy analysis. Such a framework aims at providing a progression of compulsory analytical steps which help to create and maintain an efficient antitrust policy. An efficient antitrust policy consists of a set of effectively enforced rules that constrain the firms' competitive strategies aiming at maximising the total welfare contribution for a given enforcement budget.

For this purpose three different investigation levels were distinguished and analysed. The fundamental level aimed at answering existential questions of competition and competition policy. In particular, it assessed whether competition is worth protecting, whether competition needs protection and whether competition policy is bringing more benefits than costs to society. Subsequent, the strategic level basically developed a simple progression of necessary steps to assess whether and how certain conducts should be subject to antitrust policy. In addition to an initial characterisation of the business conduct, a welfare assessment and a concept of detection and intervention needed to be developed to ensure an integrated approach of antitrust analysis. The third level, the operational level, aimed at implementing the concepts developed on the strategic level in a world in which the antitrust authority faces resource constraints and imperfect information. This level therefore had to cope with approximation techniques, such as identifying the relevant market, assessing market power and applying economic frameworks in order to come to appropriate conclusions on the likelihood and the severity of anticompetitive effects in the case at hand.

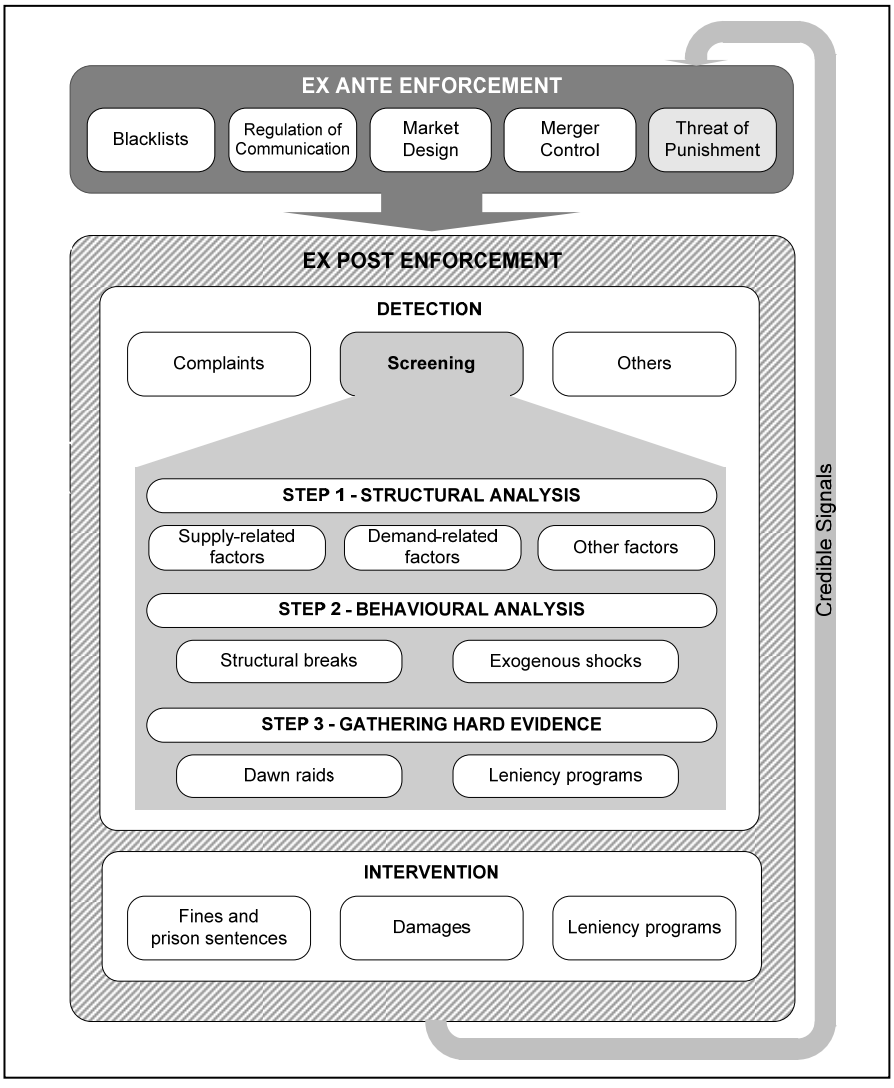
In order to demonstrate the universal applicability of the proposed integrated approach, it was applied to hard core cartel enforcement and to merger control. Both areas constitute traditional areas of antitrust enforcement and differ considerably in their respective enforcement requirements. While hard core cartel enforcement basically has to consider ways of preventing cartelisation and detecting breaches of the cartel ban, merger control traditionally has to assess the pro- and anticompetitive effects of a particular merger proposal. Despite these substantial differences in the treatment of both strategies, the integrated approach turns out to be equally applicable and helpful for the derivation of policy recommendations. Now the proposals for hard core cartels and horizontal mergers will be reviewed and compared to the current enforcement approaches in the United States and the European Union aiming at identifying the potential for policy improvement.

Policy conclusions for hard core cartel enforcement

With respect to hard core cartels, an efficient antitrust policy needs to consider ex ante as well as ex post instruments. Ex ante instruments aim at avoiding the for-

mation of cartels in the first place, while ex post instruments focus on the detection and intervention against existing cartel agreements. Both instruments together lead to the detection and enforcement framework developed on the strategic level above, which is sketched in Figure 39.

Fig. 39. A framework to enforce hard core cartels



As shown in Figure 39, instruments of ex ante enforcement include the development of blacklists, the regulation of communication between firms, adjustments in market design and coordinated effects analysis in merger control. Ex post cartel enforcement needs to differentiate between a detection stage and an intervention

stage. With respect to the detection stage, the integrated approach developed above focused on the active detection of cartels by the antitrust authority through the application of screening techniques (implemented as a three-step approach consisting of a structural assessment, a behavioural assessment and a step in which hard evidence is collected). However, the implementation of such a screening approach alone is unlikely to safeguard a sufficient detection level, especially because screening tools as such can often only provide rather broad indications of industries in which cartels are more likely than in others. As a consequence, ex post cartel enforcement must be complemented by more traditional detection mechanisms, such as motivating employees or customers to report information on possible cartel agreements. Furthermore, the design and implementation of leniency programs provide incentives for actual cartel members to come forward with the hard evidence that is needed to prove the existence of a hard core cartel in court.

With respect to the sanctioning of hard core cartels, the integrated approach proposes to concentrate on the imposition of optimal fines (determined by the fine level and the probability of detection) and prison sentences as well as the obligation to pay damages to parties injured by the cartel. Fines can be reduced or abandoned by leniency programs if a cartel member helps the authority to prove the existence of a cartel. The execution of this fine package aims at creating credible signals to firms that detected cartels will be punished and hence induces an ex ante threat of punishment, which ideally leads to the decision of firms not to form or to join hard core cartels.

A comparison of the proposed cartel enforcement framework with the current enforcement approaches followed in the United States and the European Union reveals that most instruments discussed above are already applied, albeit not necessarily to an economically optimal degree. With respect to ex ante enforcement, especially the regulation of communication between firms has not played a great role in these jurisdictions. Although several forms of communication via information exchanges are banned under both competition legislations, there does not seem to be a coherent approach to use the respective insights of relatively recent research efforts optimally (see also Kovacic, 2006: 815f.). With respect to market design, the altering of especially public procurement procedures in order to restrict collusion opportunities still contains improvement potential on both sides of the Atlantic. As discussed by Kovacic (esp. 830ff.), promoting entry and applying collusion-proof auction mechanisms can substantially mitigate the problem of cartelisation in public procurement. Finally, a coordinated effects analysis in merger control is well established in the United States as another ex ante instrument to prevent cartelisation, whereas the European Commission recently experienced several difficulties because decisions were later overturned by various European courts (see Kühn, 2002). However, the development and implementation of a new EC Merger Regulation (and the accompanying EC Horizontal Merger Guidelines) in 2004 should mitigate such problems in the future.

With respect to the detection stage in an ex post cartel enforcement approach, there does not seem to be a coherent attempt in either the United States or the European Union to implement a screening approach to detect cartels actively.

Nevertheless, the sector inquiries conducted in the European Union can provide useful insights into the specifics of certain industries and might therefore also help toward this effort (see Kroes, 2007a). Generally, current cartel enforcement in the United States and the European Union seems to build more on complementary detection mechanisms such as motivating employees or customers to come forward with information on possible cartels. Furthermore, it is believed that the recently reformed and implemented leniency programs have significantly raised the probability of detection (see Kovavic, 2006; Kroes, 2007a). The same conclusion is true for the intensification of international cooperations between antitrust authorities in their fight against international hard core cartels, which still contain plenty of potential for improvement.

With respect to the sanctioning of hard core cartels, both jurisdictions aim at deterring cartel formation with stiff fines and significant probabilities of detection. Nevertheless, as it was shown in section 2.3.3.2, despite the recent significant increases in fines, there are strong indications that the fine levels are still too low to deter cartelisation to an optimal degree. This is especially true for the European Union, where the still minor role of private enforcement reduces the fine package for cartel members (see Kroes, 2006: 3). In direct connection to this argument, the deterrence effect of cartel enforcement can be expected to be even lower in the European Union given the impossibility of sanctioning individuals responsible for cartel formation. While the responsible managers in the United States face prison terms of up to several years, comparable actions in Europe are only possible in selected member states (such as the UK (for price-fixing generally) or Germany (in cases of bid rigging only)). Consequently, policy actions are necessary – especially in the European Union – to further increase the fine package.

The current leniency program is a helpful instrument in the cartel enforcement approaches of the United States and the European Union for increasing the probability of punishment by providing strong incentives for cartel members to report the cartel when the probability of detection is sufficiently high. Nevertheless, it is unlikely that leniency programs in the current design have realised their full potential to influence the probability of detection. One possibility to improve such programs is to consider paying rewards to reporting cartel members instead of just reducing or cancelling the fine.

Finally, after the detection and prosecution of a cartel, an ex post monitoring of cartel-prone industries is an important additional tool for fighting cartels, as detection and punishment leave the industry structure unchanged and consequently make the (re-)formation of further cartels not unlikely. Although there are indications that suspicious industries are monitored on a random basis in both jurisdictions, it is worth considering extending these efforts in a more systematic way (see Frezal, 2006, for a recent proposal on structuring audits in an economical fashion, which theoretically makes it possible to deter collusion even with a small auditing budget).

In a nutshell, it is fair to say that hard core cartel enforcement in the United States and the European Union does not differ substantially (see Barnett, 2006; Kroes, 2007b) and that it incorporates the important aspects identified by the integrated approach of antitrust analysis, such as the importance of stiff fines, a suffi-

cient probability of detection and the implementation of leniency programs. However, further improvement potential was identified with respect to regulating communication between firms, appropriate market designs, leniency programs, fine levels, ex post monitoring of cartel-prone industries and, last but not least, the regular use of structural and behavioural tools to detect cartels actively. Especially the combination of actively screening industries and providing leniency programs might make cartel members sufficiently nervous to finally decide to come forward and apply for leniency.

Policy conclusions for horizontal merger control

As in the case of hard core cartels, an efficient antitrust policy with respect to horizontal mergers needs to consider a detection stage and an intervention stage. However, compared to hard core cartel enforcement, the characteristics and requirements of both stages differ considerably. With respect to the detection stage, the basic aim of merger control is typically not to detect the conduct of merging as such but rather to assess whether a notified merger would cause significant anticompetitive effects. As a consequence, while (ex post) cartel enforcement (and most other areas of antitrust policy) is backwards-oriented, aiming at detecting and proving breaches of the cartel ban, merger control needs to look into the future and must develop a picture of the likely competitive effects in case the proposed merger would be allowed.

With respect to the possible competitive effects, a horizontal merger inevitably leads to the loss of a direct competitor in the given market and is therefore suspicious of that leading to price increases. From an economic perspective, there are basically two strands of argument which explain this post-merger price increase potential. On the one hand, the merged entity unilaterally might have incentives to decrease output and increase price given the increase in market power post-merger. On the other hand, post-merger prices may be higher than pre-merger prices because the remaining firms in the post-merger market may find it easier to tacitly or overtly collude.

In addition to the effect on price, horizontal mergers may influence welfare through several other channels, such as product repositioning, product variety and incentives to innovate. As all these price and non-price effects might contribute to the overall pro or anticompetitiveness of a certain merger proposal, they are invariably reflected in the proposed four-step approach, which was designed to guide the analysis aiming at detecting anticompetitive mergers:

1. Estimate the post-merger price increase
2. Consider evidence on whether such a price increase would be sustainable
3. Estimate the effect of possible merger efficiencies on the post-merger price
4. Consider the effects of the merger on competition variables other than price (such as product variety or incentives to innovate)

The first step of the framework estimates the impact of a horizontal merger on the market price(s). Such an estimate can be achieved by applying either econometric or simulation techniques based on theoretical models. The second step of the framework assesses whether the price increase predicted in the first stage

would be sustainable post-merger. As econometric and simulation tools typically need to abstract from important factors – such as entry or product repositioning of existing competitors – these factors have to be separately assessed quantitatively (or at least qualitatively) and have to lead to a conclusion on whether these factors make it more likely or less likely that the merged entity would be able actually to impose the estimated price increase post-merger. The third step of the framework assesses, first, whether the merger efficiencies claimed by the merging parties are existent, whether they are merger-specific and whether they are likely to materialise post-merger. Second, it also estimates whether the accepted merger efficiencies are strong enough to hold at least the pre-merger price level. The fourth step of the framework considers the effects of a horizontal merger on other competition variables which might influence the overall welfare effects of a merger, such as product variety, marketing and R&D incentives post-merger.

Given this proposal to detect anticompetitive mergers, the complementary intervention stage in a framework of horizontal merger control becomes relevant when the antitrust authority concludes its preliminary analysis on the detection stage with the finding that the anticompetitive effects of a merger outweigh the procompetitive effects. However, in contrast to hard core cartel enforcement, it is not the aim of the intervention stage to sanction proposed anticompetitive mergers but to give the respective firms the possibility to resolve the identified competition problems in order to be allowed to proceed with their merger plans. As a consequence, from the viewpoint of the merging parties, merger remedies must have the potential 'just' to restore competition in the relevant market post-merger, but only subject to the conditions that neither the merger-induced efficiencies nor the already realised pre-merger efficiencies are reduced or even destroyed. From the viewpoint of the antitrust authority, the proposed merger remedies as an intervention instrument have to be effective in restoring competition in the relevant market post-merger. Only in cases where such remedies cannot be found (or agreed upon with the firms involved), the antitrust authority eventually has to ban the merger.

Conceptually, two general types of merger remedies are available: structural and behavioural. The former aims at changing the allocation of property rights (through divestitures), while the latter focuses on imposing constraints on the merged firms' property rights (often through regulatory-type interventions). Key advantages of structural remedies are their direct effectiveness, their easiness to administer and their limited vulnerability to circumventions. Key advantages of behavioural remedies include their flexibility and their ability to take account of existing efficiencies. Economic theory recently started to study especially structural merger remedies and found that the interests of the buyer and the merging parties are often similar, leading to a coalition against the antitrust authority. Furthermore, theoretical research extracted that structural merger remedies might ease collusion, might dissuade entry and might lead to a tendency of 'remedy overfixing' by the antitrust authority. Empirical evidence has revealed that problems in the effectiveness of especially structural remedies are common and have led to wrong decisions in the past. The evidence suggests that a deterrence effect of merger control can only be reached by prohibiting mergers, not by imposing

remedies, abandonments and monitorings. Given these problems of structural remedies, scholars recommend using behavioural remedies more frequently.

In contrast to the case of cartel enforcement, the *operational level* of the integrated approach is of fundamental importance in the field of merger control. In order to allow the analysis of competitive effects guided by the four-step approach described above, the relevant market typically needs to be delineated first. Concentration analysis and entry analysis are further compulsory steps in merger investigation. In particular, concentration measures should be used as a first filter – through the fixing of investigation thresholds – in determining whether it is worth proceeding with an examination of a merger or not. Entry analysis is equally pivotal in merger analysis, as it allows an economic interpretation of concentration measures (see especially section 2.4.2.2) and provides important input to the ultimate competitive effects analysis within the proposed detection framework (consider especially step two, which asks whether an estimated post-merger price increase would be sustainable).

Given this proposal for the design of an efficient horizontal merger control, the consequential next step is to compare this proposal to the current enforcement approaches in the European Union and the United States and to identify room for improvement. Starting with the European Union, the recent focus with respect to horizontal merger control has been the design, implementation and analysis of first experiences with the new EC Merger Regulation,[218] accompanied by new EC Horizontal Merger Guidelines,[219] which both went into force in 2004. The issuing of the new regulation was preceded by intensive economic and legal discussions on the appropriate design of such guidelines (see, for example, Kühn, 2002; Coppi and Walker, 2004; Verouden et al., 2004; Alfter et al., 2004). Although it is beyond the scope of this section to provide a detailed overview of the economic content of these discussions, focal points during the discussions – which were guided by the fundamental aim of improving the economic reasoning of the Commission – were in particular:

- the lowering of the thresholds levels for intervention (which might lead to a more interventionist policy towards mergers),
- the questionable necessity of introducing several exceptions under which the investigation thresholds (expressed in HHIs) do not provide a safe harbour for the merging firms,
- the missing link between theoretical analysis (covered in the guidelines) and empirical analysis (not covered in the guidelines),
- the replacement of the old ‘dominance test’ by a ‘significant impediment to competition test’,

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218 European Commission, Council Regulation (EC) No 139/2004 of 20 January 2004 on the control of concentrations between undertakings (the EC Merger Regulation), Brussels.

219 European Commission, Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings (2004/C 31/03), Brussels.

- the fundamental reliance on standard Cournot and Bertrand models while extracting relevant factors to investigate the competitive effects of mergers, and
- the general extent of convergence needed or possible between the EC Horizontal Merger Guidelines and the US Horizontal Merger Guidelines.

Somewhat representative of the majority of the huge number of comments provided by law firms, economic consultancies, competition authorities, corporations, associations and individuals on the draft guidelines, Alfter et al. (2004: 398f.) conclude that

> the Commission's Notice provides a welcome contribution to moving merger appraisal beyond a structural approach based mainly on market definition and market shares to a more dynamic, economics-based approach that focuses on how a merger changes the competitive dynamics in a given market.

In other words, the guidelines raise hopes that the Commission will abandon its mechanistic approach of a purely structural test and will instead turn towards the truly essential question whether a particular merger will significantly harm (consumer) welfare or not. However, Alfter et al. (p. 399) remark that the success of the new EC merger control regime will eventually depend on how the guidelines are applied in practice. Figure 40 provides an overview of the basic structure of the guidelines.

As shown in Figure 40, the guidelines propose a six-step approach. The first step focuses on an assessment of market shares and concentration levels. The necessary delineation of the relevant market is set out by separate guidelines provided by the European Commission.[220] The second step concentrates on the possible anticompetitive effects of horizontal mergers and differentiates between non-coordinated effects and coordinated effects. Focusing on the non-coordinated effects, the guidelines especially mention six factors which may influence whether significant non-coordinated effects are likely to result from a merger: the merging firms have large market shares, the merging firms are close competitors, the customers have limited possibilities of switching suppliers, the competitors are unlikely to increase supply if price increases, the merged entity is able to hinder the expansion by competitors and, finally, the merger eliminates an important competitive force.Following an assessment of the competitive effects, the guidelines propose to study the presence of countervailing buyer power and the analysis of entry (likelihood, timeliness and sufficiency of entry). Both aspects are important for putting the results of the analysis of market concentration and the competitive effects into perspective. Subsequently, merger-related efficiencies need to be investigated by focusing on benefits to consumers, merger specificity and verifiability. Finally, the sixth step of the framework outlines special conditions for mergers which involve a 'failing firm'.

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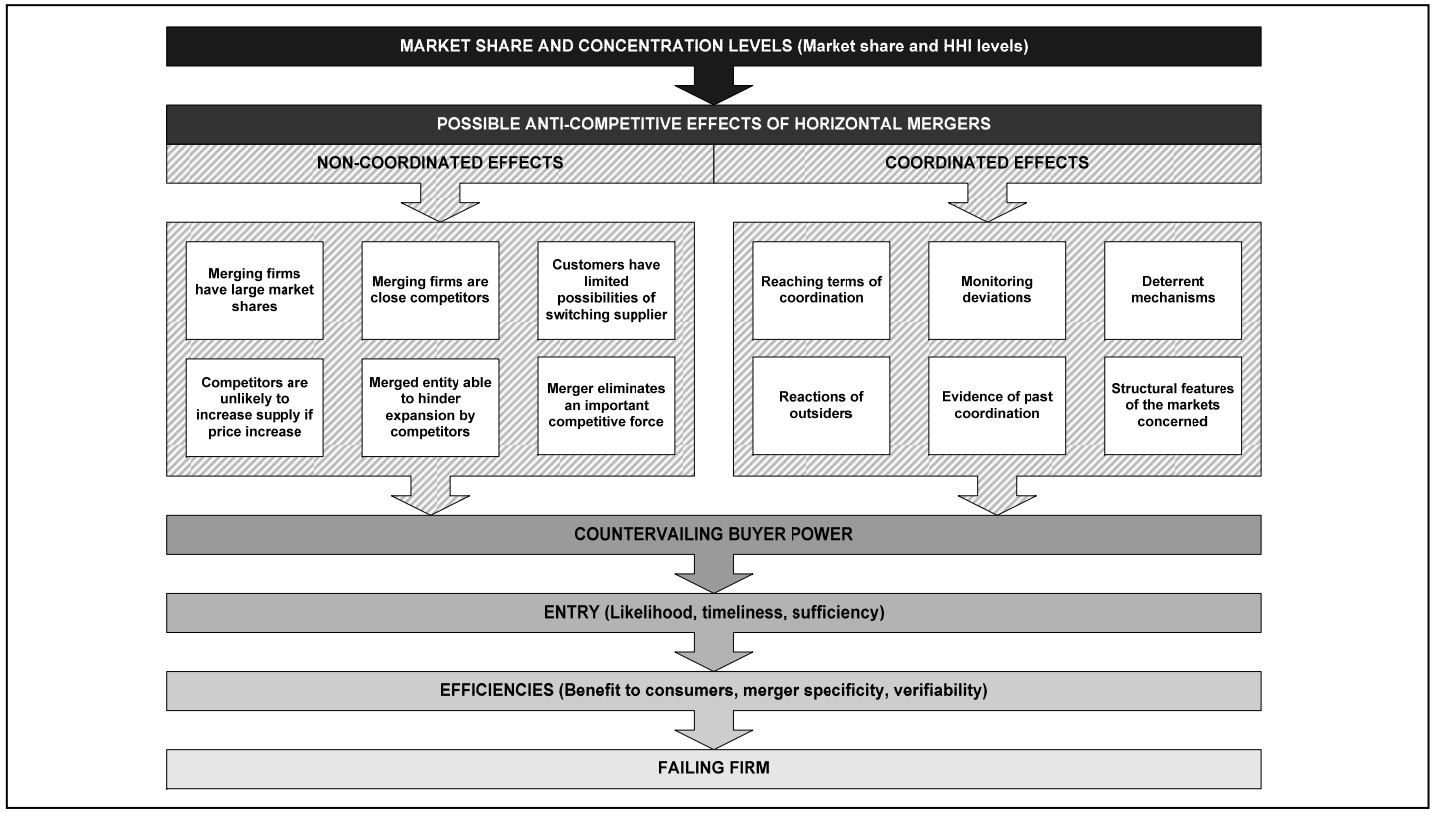
220 European Commission, Commission notice on the definition of the relevant market for the purposes of Community competition law, Published in the Official Journal: OJ C 372 on 9 Dec 1997, Brussels.

Fig. 40. The basic economic framework set out in the 2004 EU Horizontal Merger Guidelines



The fixing of remedies is not treated in the EC Horizontal Merger Guidelines but in a separate Commission notice,[221] which is currently under review to take account of the results of the in-house merger remedies study published in October 2005 (see section 2.3.3.2 for a discussion).

Although it is probably too early to decide on the successfulness of the new EC Merger Regulation Guidelines, most lawyers and economists see the guidelines as a promising attempt to reform merger procedures and to improve the overall quality of the economic analysis conducted by the European Commission (see Alfter et al., 2005).

Nevertheless, despite these steps in the right direction, antitrust scholars have identified several areas with potential for further improvement, as has the proposal of detecting and intervening against mergers developed above. For example, a frequent point of criticism is that the guidelines only mention a couple of possibly important factors (and their theoretical justification) without addressing the need to advise the merging parties on how to combine the theoretical analysis with the need to empirically assess whether the respective theories hold in the case at hand (see also Kühn, 2002). This caveat of the guidelines was already discovered during the discussions of the draft guidelines as mentioned by Alfter et al. (2004: 386f.):

> [A]lthough the Notice draws on the relevant economic theory in describing the conceptual framework the Commission will use to assess the competitive impact of mergers, questions remain as to the approach that will be taken to the empirical analysis that must accompany any theory of competitive harm. While theoretical models provide a valuable framework for the competitive assessment of mergers, any theory of competitive harm must be tested rigorously against the facts.

The four-step approach developed above proposes ways of linking the theoretical factors with empirical evidence.

A closely related argument refers to the assessment of non-coordinated effects, for which the guidelines provide a checklist of arguments that might be relevant, but without giving further details on the relative importance or even the standard investigation steps of a merger assessment. Although certain degrees of freedom are necessary when drafting guidelines, it would be possible to delineate the key investigatory steps further, such as proposed by the four-step detection approach developed above.

Furthermore, the initial draft of the guidelines frequently referred to Cournot and Bertrand models to characterise competition and to study the effects of mergers. However, again in line with the four-step approach proposed above, simply translating the predictions of these models into predictions of post-merger behaviour likely leads to erroneous results given other potentially important competition parameters, such as product variety, product quality or the influence on the incen-

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221 European Commission, Commission notice on remedies acceptable under Council Regulation (EEC) No. 139/2004 and under Commission Regulation (EC) No. 802/2004 (2007 draft), Brussels.

tives to innovate (addressed in the forth stage of the proposed detection framework).

With respect to the assessment of entry, the proposed three-part test (likelihood, timeliness and sufficiency of entry) basically follows the investigatory steps delineated at the operational level in section 2.4.2.2. However, although it is admittedly a difficult exercise, the guidelines do not concretise how an entry barrier assessment should be quantified in practice. Again, the discussion on the operational level at least provided several proposals of how to quantify the existence and especially the size of entry barriers by so-called 'entry barrier indicators'.

With respect to merger efficiencies, the guidelines explicitly aim at integrating the analysis of merger efficiencies into the overall competitive effects assessment (and not treating it as an efficiency defence after the study of the competitive effects).[222] The proposed three-part assessment is therefore in line with the proceedings in other jurisdictions, such as the United States, Canada, Australia or the United Kingdom, as well as with the four-step detection approach derived above. However, as in the case of entry analysis, the guidelines do not discuss ways to quantify the relevant factors (see section 2.3.3.1 and Box 13 for several proposals reaching from the application of back-of-the-envelope formulas to simple spreadsheet NPV calculations).

With respect to merger remedies, the currently drafted, separate Commission notice seems to contain most of the necessary arguments and investigation steps identified in section 2.3.3.2. However, the insights derived out of recent theoretical and empirical research suggest further improvement potential, especially with respect to the more frequent consideration of behavioural remedies, the treatment of information advantages on the side of the firms during the merger remedies negotiation process, the danger of fostering collusion by imposing remedies, the possibility to dissuade entry by fixing remedies and the tendency of antitrust authorities to over-fix remedies.

In the United States, horizontal merger policy is guided by the 1992 Horizontal Merger Guidelines, which were jointly issued by the US Department of Justice and the Federal Trade Commission.[223] The guidelines replaced earlier separate guidelines by the two antitrust authorities and are generally based on "the recognition that sound merger enforcement is an essential component of our free enterprise system benefiting the competitiveness of American firms and the welfare of American consumers" (DOJ and FTC, 1992: 1). Furthermore,

> [s]ound merger enforcement must prevent anticompetitive mergers yet avoid deterring the larger universe of procompetitive or competitively neutral merg-

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222 From a procedural perspective, there are several possibilities to incorporate efficiencies into merger control. Everett and Ross (2002: 15ff.) differentiate between 1) simply ignoring them, 2) efficiencies as motive, 3) adjusting the structural thresholds, 4) efficiencies as part of the lessening of competition test, 5) efficiencies as part of a dominance test and 6) an efficiency defense.

223 US Department of Justice and the Federal Trade Commission (1992), Horizontal Merger Guidelines, Issued: 2 Apr. 1992, Revised: 8 Apr. 1997 (Efficiencies section only), Washington DC.

> ers. The 1992 Horizontal Merger Guidelines implement this objective by describing the analytical foundations of merger enforcement and providing guidance enabling the business community to avoid antitrust problems when planning mergers.

The US Horizontal Merger Guidelines are structured into six sections. The initial section provides an overview of the purpose, the underlying policy assumptions and a general overview of the guidelines. That is followed by a detailed section on market definition, measurement and concentration. The potentially adverse competitive effects of mergers are listed and explained in detail in the third main section of the guidelines, followed by a section which aims at guiding entry analysis during a merger investigation. The fifth section provides guidance on how to cope with merger efficiencies. Finally, the concluding sixth section delineates special proceedings in the case that one of the merging partners is a 'failing firm'.

Generally, the US Horizontal Merger Guidelines seem to be widely accepted and are found to be helpful by the antitrust community (see Rubinfeld, 2006b; Willig, 2006; Rill and MacAvoy, 2005). Daniel Rubinfeld (2006b: 1), for instance, said in his recent testimony before the US Antitrust Modernization Commission (Economists' Roundtable on Merger Enforcement):

> Both in my role as antitrust enforcer and as a consultant and expert witness, I have found the guidelines generally to be extremely helpful in providing an overall framework for merger analysis, and in a number of situations in offering a specific roadmap for analysis.

However, critical points mentioned during the hearings were an identified lack of transparency in the application of the guidelines by the authorities as well as the still substantial influence of the delineation of the relevant market and concentration measures. In this respect, especially Willig (2006) argued that the focus should be on 'providing the best evidence of the anticipated impacts of a merger', which makes direct instruments of analysis (such as natural experiments) more valuable tools than the indirect approach of assessing (structural) market power (see section 2.4.2 for a discussion). Rill and MacAvoy (2005: 2f.) provide a longer list of critical points of the current US Horizontal Merger Guidelines. In addition to the arguments already mentioned, they criticise that the competitive effects section of the Horizontal Merger Guidelines provides nothing more than an 'unstructured, unweighted checklist' and that the efficiency section is 'too narrow and incomplete'. Interestingly, both of these arguments were also identified as critical issues in the new EC Horizontal Merger Guidelines.

Although the value created by the Guidelines as such is largely undisputed, Baker and Shapiro (2007) recently noticed considerable problems in the implementation of the guidelines into practical case work. In particular, based on a survey of twenty attorneys specialised in antitrust law, they find that

> [u]nfortunately, prospective horizontal merger enforcement has fallen into decline, as a result of an unhappy combination of a more flexible economic approach, which we endorse, with the too-ready acceptance by some courts and enforcers of unproven non-interventionist economic arguments about concentration, entry and efficiencies.

In order to 'reinvigorate' horizontal merger enforcement, they propose to partially restore the structural presumption and to require strong evidence to overcome the government's *prima facie* case.

With respect to the complementary step of fixing merger remedies, the FTC[224] and the Antitrust Division of the DOJ[225] have issued separate guidelines to guide negotiations of merger remedies. Both guidelines differ considerably in their structure and way of presentation but not so much with respect to their aims and economic content (see Baer et al., 2004, for a detailed overview). The FTC especially focuses on a characterisation of the assets to be divested, the characterisation of an acceptable buyer and the divestiture agreement, while the Antitrust Division decided to take a firm stand on their essential messages in the form of concise, one-sentence requirements focusing on fashioning the remedy and implementing the remedy:

Fashioning the remedy
- Structural remedies are preferred.
- A divestiture must include all assets necessary for the purchaser to be an effective, long-term competitor.
- Divestiture of an existing business entity is preferred.
- The merged firm must divest rights to critical intangible assets.
- Conduct relief is appropriate only in limited circumstances.

Implementing the remedy
- A fix-it-first remedy is acceptable if it eliminates the competitive harm.
- A hold separate provision is a necessary component of most consent decrees.
- The divestiture should be accomplished quickly.
- The antitrust division must approve any proposed purchaser.
- A successful divestiture does not depend on the price paid for the assets.
- Restraints on the resale of assets will ordinarily not be permitted.
- Seller financing of assets is strongly disfavoured.
- Crown jewel provisions are strongly disfavoured.

As especially the Antitrust Division's framework seems to reflect the past experiences with negotiating merger remedies in both institutions, there are only minor possibilities for further improvements (see the discussion of the draft Guidelines of the European Commission earlier in this section).

Generally, a comparison of the most recent Horizontal Merger Guidelines in the European Union (2004) and the United States (1992/1997) shows a high degree of convergence (see especially Coppi and Walker, 2004, for a detailed assessment). However, it is obvious that the value of good guidelines very much depends on their correct implementation in practice. While it is too early to risk a

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224 Bureau of Competition of the Federal Trade Commission, Statement of the Federal Trade Commission's Bureau of Competition on Negotiating Merger Remedies, 2 Apr. 2003, Washington DC.

225 US Department of Justice – Antitrust Division, Antitrust Division Policy Guide to Merger Remedies, October 2004, Washington D.C.

first judgment on the successfulness of the new Merger Regulation in the European Union, the recent experiences in the United States suggest that the vagueness of the guidelines provide plenty of opportunities for the merging parties 'to get the deal through' – partly with questionable economic lines of reasoning. Applying the integrated approach above provides at least some ideas on how to mitigate such problems.

3 Strategic Behaviour of Incumbents – Rationality, Welfare and Competition Policy

A victorious army first wins and then seeks battle.
A defeated army first battles and then seeks victory.

Sun Tzu (544-496 BC)

3.1 Introduction

The liberalisation of formerly regulated markets often leads to asymmetric market structures characterised by one or a few large incumbent firms retaining considerable market power and several smaller new entrants. These new competitors threaten the incumbents in at least two ways. On the one hand, they take market share away, reducing an incumbent's share of the profit pie. On the other hand, new entrants often intensify competition, reducing the size of the profit pie. Against this background, it is not surprising that incumbent firms would like to impede market entry or at least reduce the competitive threat of entry. One option for dominant incumbents to reach this aim is to use some form of strategic behaviour aiming at discouraging entry or encouraging exit of rivals.

However, what exactly is meant by *strategic behaviour*? What are necessary preconditions to make strategic moves possible, and which different strategic options are available to incumbents? What are the possible welfare consequences of strategic behaviour? And directly related to this: What role should antitrust policy play with respect to such strategic moves? The aim of this chapter is to give high-level answers to these essential questions. To reach the central objective, the chapter is structured as follows: In section 3.2 strategic behaviour is characterised generally, followed by an analysis of the rationality of strategic behaviour in section 3.3. Subsequently, section 3.4 focuses on the welfare implications of strategic behaviour. In section 3.5, the main features of the relationship between strategic behaviour and antitrust enforcement are assessed. Section 3.6 concludes the chapter.

3.2 Characterising Strategic Behaviour

A fairly large number of definitions of *strategic behaviour* exist. One reason for this might be that different disciplines (e.g., economics, management, political

science) have used and examined this term with respect to their backgrounds and motivations (see especially Ansoff, 1987, and Grundy and Wensley, 1999, for strategic management interpretations). Carlton and Perloff (2000: 332f.) provide a straightforward definition from the field of industrial organisation:

> Strategic behavior is a set of actions a firm takes to influence the market environment so as to increase its profits. The market environment comprises all factors that influence the market outcome (prices, quantities, profits, welfare), including the belief of customers and of rivals, the number of actual and potential rivals, the production technology of each firm, and the costs or speed with which a rival can enter the market. By manipulating the market environment, a firm may be able to increase its profits.[226]

This attempt to define *strategic behaviour* is very general and is being largely confined (and therefore substantiated) by research of several game theorists (see especially Schelling, 1960) and their formalised concept of a *strategic move.*

The basic idea behind a *strategic move* is that when making an optimal choice now, an incumbent must try to anticipate how his rivals will respond in the future. The incumbent's expectation is largely based on his perception of the rivals' payoffs and their perception of his payoffs. In the words of Dixit and Nalebuff (1991: 34), the incumbent must "[l]ook ahead and reason back" to make an optimal (i.e., profit-maximising) decision.

Given this first delineation, the more precise question of What are necessary attributes of strategic moves? immediately suggests itself. An essential element of the answer is the acceptance of short-term sacrifices[227] by the incumbent aiming at obtaining long-term (discounted) gains, which at least outweigh the sacrifices. This first delineation clarifies that strategic moves are always dynamic phenomena (i.e., dynamics requirement).

Strategic moves in the sense of Schelling (1960) are actions which benefit an incumbent firm indirectly via their effects upon the behaviour of the rival firm (see Church and Ware, 2000: 461ff., for a roundup). These actions "induce the rival to adopt a course of action more favourable to the incumbent" (Vickers, 1985: 33). Such strategic moves are often based on some first-mover advantage, thus a temporal edge of the incumbent in comparison with the entrant (i.e., 'first mover' requirement).

Another important feature of a strategic move is the non-revocation of decisions. In situations with perfect information this condition means that a successful strategic move is only possible if the incumbent changes the expectations of the rival in a credible way; for example, by making a binding and irrevocable decision (i.e., commitment requirement) which the rival can observe (i.e., communication requirement). In cases of imperfect information, the incumbent must be in a position to signal a credible threat of such a commitment.

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226 The authors differentiate between non-cooperative and cooperative strategic behaviour. In the following the latter case is omitted.

227 The term *sacrifices* should be interpreted in a very broad sense; for example, as investments which bond capital or as a sacrifice of current profits.

Strategic moves depend on situations where strategic interactions take place. *Strategic interaction* entails that pricing and production decisions of any one firm will affect overall industry price and production levels, and hence the performance of other firms. These characteristics, however, are only present in oligopolistic markets (i.e., market power requirement). In a monopoly situation, there is, by definition, only a single supplier and entry is impossible. A monopolist has no actual or potential rival and therefore has no need to contemplate strategic behaviour. A firm in a perfectly competitive market is, by assumption, a price-taker, hence there is no payoff to strategic behaviour[228] (see Martin, 2001, for a detailed analysis). The same conclusion is true for 'perfectly contestable markets' in the sense of the seminal book by Baumol, Panzar and Willig (1982).

3.3 Rationalising Strategic Behaviour

Free entry and exit is an essential assumption in the model of perfect competition. If the price of a good lies above average cost, the firm(s) in the market will realise supracompetitive profits. These supracompetitive profits are the central incentive for other firms wanting to 'join the party' (Saloner et al., 2001: 215). Over time, market entry will increase supply and will depress prices sufficiently for firms to return to normal economic profits. As abnormal profits are competed away, entry will cease and the market will reach its long-run equilibrium. This point coincides with the minima of the firms' average cost curve, the point where the firms use their resources in the most efficient manner.

This essential coherency between entry, competition and market performance is challenged by multiplicities of empirical studies (see Geroski, 1995, for a survey), which show that incumbents in many industries are able to earn high abnormal profits without stimulating entry for a long time (see Box 28 for evidence from the airline industry). In other words, these empirical results indicate that the model of perfect competition alone might be an insufficient description of many real markets.

The general significance of free entry and entry incentives for competition intensity and market performance is not restricted to the model of perfect competition. Similarly, in standard Cournot oligopoly models, current abnormal profits are a central incentive for market entry. With a growing number of firms in the market, industry prices decline and per firm output and profit ought to decrease (see Amir and Lambson, 2000, for an exact formal treatment). With an infinite number of firms in the market, Cournot competition leads to perfectly competitive outcomes.[229]

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228 It seems obvious that the polar cases of *monopoly* and *perfect competition* must be interpreted as valuable starting points for further theoretical reasoning rather than descriptions of real markets.

229 Besides the depicted effects of increased competition, entry also plays a creative role in markets, serving as a vehicle for the introduction and diffusion of innovations.

Box 28. Entry, exit, and performance in airline markets

Joskow et al. (1994) examine quarterly data on major, non-stop city pairs in the US between 1985 and 1987. They find that

- entry generally is not induced by price levels substantially above the norm;
- entry reduces fares and increases output, and exit increases fares and reduces output;
- incumbents cut prices and maintain output in response to entry; and
- survivors increase both prices and output in response to exit.

In oligopoly models, compared to the model of perfect competition, especially the conditions surrounding entry (such as the level of fixed cost, market size, cost differences between firms, heterogeneity of products etc.) become more important in determining the nature of market competition and market outcomes. Generally speaking, strategic interaction in oligopolistic markets complicates competition and makes market outcomes dependent on factors such as players, actions, timing, information and repetition (see Saloner et al., 2001: 187ff.).

3.3.1 Entry and Strategic (Re)Actions to Entry

For an individual firm, the decision to enter a market depends on various economic factors. Although actual profits in the market may typically be an important signal guiding the decision, the individual entry decision will depend particularly on two aspects: incentives and barriers. In other words, a potential entrant would first have to ask the question, Is entry profitable? and afterwards, Is entry possible?

Is entry profitable?

A profit-maximising, risk-neutral firm should enter a market if the net present value of expected post-entry profits is greater than the sunk costs of entry.[230] As post-entry profits depend on post-entry competition, the entry decision therefore is connected to the expectations of the entrant about the conduct and performance of the firms after entry. Furthermore, the level of sunk costs incurred is a critical de-

Geroski (1991: 219) therefore separates entry into two components: imitative entry and innovative entry. *Imitative entry* occurs when the entrant can reap profits by copying the established firm's product or method of production. This type of entry is regarded as an equilibrium force in that it competes away excess profits to an equilibrium level. *Innovative entry* occurs when an entrant finds new ways of, for example, producing more cheaply. This type of entry is seen as a disequilibrium force, which propels the industry from one equilibrium state to another (for a detailed overview, see Lipczynski and Wilson, 2001: 153f.).

230 Furthermore, as investment capital is scarce, the entry decision for a special market depends on the existence of and profit expectations of other investment alternatives.

terminant of the entry decision (see Besanko et al., 1996: 396ff.). The higher the necessary sunk costs to enter an industry are, the higher is the risk of entry and the lower are the expected profits. Additionally, the entry condition above clarifies that profits immediately after entry are not necessary for a rational entry decision. It is sufficient that, for example, market growth expectations should promise sufficient profits in the future.

Is entry possible?

A positive net present value (which at least outweighs sunk costs) is a necessary but not sufficient condition for entry. Imagine, for example, the US airline industry thirty years ago. In spite of many entry applications by new carriers, the Civil Aeronautics Board did not approve a single market entry request of a new firm. This example clarifies that barriers to entry are sometimes high enough to completely deter entry.

Barriers to entry are defined by Bain (1956: 3) commonly as "an advantage of established sellers in an industry over potential entrant sellers, which is reflected in the extent to which established sellers can persistently raise their price above competitive levels without attracting new firms to enter the industry".[231] The sources of such barriers to entry are diverse. Besides *legal* entry barriers (for example, entry regulation by the state), the literature focuses on *private* entry barriers (see Box 29 for some examples from the airline industry).

Box 29. Operating and marketing barriers in the airline industry

In a report on 'Aviation Competition – Challenges in Enhancing Competition in Dominated Markets', the US General Accounting Office (2001) found the following operating and marketing barriers which constrain new entry into dominated airline markets:

- Access to airport facilities, such as gates, ticket counters, baggage handling and storage as well as take-off and landing slots,
- Frequent flyer programs,
- Corporate incentive agreements,
- Travel agent commission overrides,
- Flight frequency, and
- Network size and breadth.

Private entry barriers are subdivided into structural and strategic barriers to entry. *Structural barriers to entry* are related to structural or technical characteristics of an industry, such as economies of scale, absolute cost advantages (e.g., favourable access to raw materials or a favourable geographic location), capital cost requirements or product differentiation advantages. *Strategic barriers to entry* are largely based on the notion of strategic entry deterrence, realising that existing

[231] See McAfee et al. (2004a) for a discussion of this and other definitions of *barriers to entry*.

firms may deliberately behave in ways that decrease the probability of entry by other firms (see Waldman and Jensen, 2000: 129).

Bearing this knowledge in mind, the entry decision of an entrant should be guided by an evaluation of the significance of entry barriers in a certain market. As many of these barriers simply reduce the expected post-entry profits in the market, the suggested separation between entry profitability and entry possibility does not seem to be very strict.

Additionally, it should be mentioned that entry decisions are much more complex – in practice as well as when examined by the economic profession – than described here by looking at incentives and barriers. Schulz (1995) provides an overview of the theoretical industrial organisation literature. Geroski (1995) shows that the empirical evidence sometimes contradicts the theoretical findings. Recent research in strategic management and marketing has exposed different options for entering a market. Montaguti et al. (2002: 23), for example, distinguish between strategies of penetration, compatibility, pre-announcing and external routes to market. The choice of a certain kind of entry strategy largely depends on factors such as technology characteristics (such as network externalities or appropriability), the competitive environment (such as industry concentration or level of incumbency) and firm-specific factors (such as reputation, multi-market contact or the order of entry). Box 30 provides some insights from the airline industry.

Box 30. Competitive dynamics of interfirm rivalry in the California commuter airlines market

Baum and Korn (1996) examined how firm-specific competitive conditions influence patterns of market entry and exit. Their research focused on two features of firms' competitive conditions: market domain overlap, which measures the potential for competition, and multi-market contact, which measures the potential for mutual forbearance. Their results for the California commuter airlines market between 1979 and 1984 show that increases in market domain overlap raised rates of market entry and exit, whereas increases in multi-market contact lowered them, especially in markets clearly dominated by a single airline. In other words, close competitors are not the most intense rivals: airlines that meet in multiple markets are less aggressive towards each other than those that meet in only one or a few markets.

Further important influences on the choice of an entry strategy as discussed in the marketing literature are the expected responses by the competitors and assessments of how consumer adoption decisions can be influenced.

Given the possibility of entry by a rival firm, it is the logical next step to ask what the possible options for (re)action are and how an incumbent firm should choose between these different options. In general, the incumbent can try to reduce the expected level of profits that the entrant can hope to earn.[232] If it is as-

[232] For example, as particularly signalling models in predation theory show, an incumbent can act strategically to make the entrant expect a lower profitability of market entry (see Ordover and Saloner, 1989). Furthermore, an alternative way for the in-

sumed that the profit of the entrant is given by $\pi^E = pq - cq - F$, then the incumbent has four alternatives to negatively influence this expected profit and hence to induce exit or prevent entry: first, to drop the price p; second, to raise variable costs c; third, to raise fixed costs F or finally, as $p>c$, to drop quantity q. In short, the incumbent can act in a way that raises rivals' costs and/or reduces rivals' revenues.

The precise ways to reach this aim are diverse. Simply speaking, one option for the incumbent is to raise the structural entry barriers with the aim of making entry impossible or at least unprofitable. However, as such a strategy might not be sufficient or too expensive, the incumbent might consider strategic moves to complicate or even deter entry. The choice of a particular strategy again depends on its profitability and its possibility to succeed.

Is strategic behaviour profitable?

Strategic behaviour normally incurs costs. Therefore, the decision to behave strategically or not should depend on a comparison between the expected costs and revenues of such behaviour. Bain (1956) uses this essential interrelation for the design of a classification of reactions against potential market entry. His approach differentiates between blockaded, deterred and accommodated entry:

- Entry is *blockaded* if it is not profitable, although the incumbent behaves like a monopolist. In such a situation strategic behaviour is useless and therefore irrational.
- Entry is *deterred* if the incumbent could not behave like a monopolist without causing entry and therefore changes its behaviour in a way that discourages entry. In such settings, strategic behaviour is rational and would deter entry completely as long as the costs of deterrence are smaller than the additional profits in the less competitive market.
- Entry is *accommodated* if structural barriers are low and the incumbent's costs of deterring entry are greater than the benefits it could gain from repelling the entrant. In other words, incumbent firms do not want to deter market entry completely. Even so, strategic behaviour could be rational, as far as it commits to a market conduct more favourable to the incumbent after entry has occurred.

To illustrate the cases of blockaded and deterred entry, consider the following decision tree shown in Figure 41. The incumbent (I) can first choose between non-strategic and strategic behaviour. The decision tree clarifies that the best outcome for the incumbent is reached when it behaves non-strategically and the entrant (E) stays out of the market: The incumbent reaps monopoly profits while the entrant's profit is zero. Could the incumbent ever achieve this outcome? The answer is Yes if the structural entry barriers are high enough to make entry unprofitable or impossible for the entrant. This is a position of blockaded entry in the taxonomy of Bain (1956).

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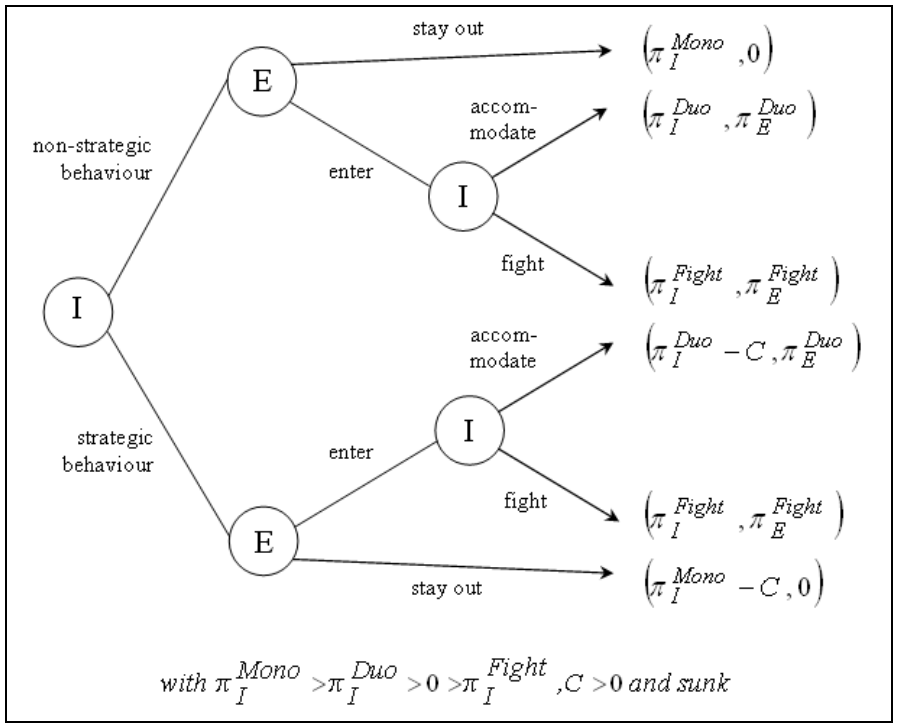
cumbent to deter entry would be to negatively influence the potential entrants' market growth expectations.

Now assume that the structural entry barriers are too low to deter entry and an entrant is in the position to enter the market. Can the incumbent deter entry (non-strategic) by simply threatening the entrant with a 'fight to death' in case of entry? The answer is No, as once the entrant has entered the market, the incumbent has no longer an incentive to keep its price low. As the duopoly profits are higher than the profits during a fight, the incumbent would find it more profitable to raise prices and accommodate entry. In other words, such an attempt of (non-) strategic behaviour is not credible.

Fig. 41. Strategic (entry deterring) behaviour of an incumbent



The central question therefore should be how the incumbent could credibly commit to a low post-entry price. Hence, imagine that the incumbent invests into some sunk costs *C*, such as excess production capacity (see Spence, 1979, and Dixit, 1980, for formal treatments). This commitment requires that the incumbent consciously chooses a strategy generating additional costs in the current period. The incumbent undertakes this move before it is known if the rival enters the mar-

ket or not. By undertaking this action, the incumbent wants to signal that it has now an incentive to react more aggressively towards market entry.[233]

Under what condition is such a behaviour rational (i.e., profit-maximising) for the incumbent and therefore a credible threat to the potential entrant? If a successful strategic move (which deters entry) occurs, the incumbent realises a profit of $\pi_I^{Mono} - C$. The incumbent now has to compare this profit with the profits that could be earned if entry was accommodated. These are the duopoly profits π_I^{Duo} (without the sunk costs *C*). Thus, one condition for rational strategic behaviour is that $\pi_I^{Mono} - C > \pi_I^{Duo}$, meaning that the monopoly profits less *C* are larger than the duopoly profits. The second condition requires that if the entrant does enter the market, aggression from the incumbent will be rewarded. This is the case if $\pi_I^{Duo} - C < \pi_I^{Fight}$. Rearranging the inequalities delivers the following condition for rational entry-deterring strategic behaviour:

$$\pi_I^{Mono} - \pi_I^{Duo} > C > \pi_I^{Duo} - \pi_I^{Fight}. \tag{52}$$

If this condition is fulfilled, the incumbent will undertake the strategic investment in *C*. As the aggressive reaction of the incumbent is now credible, the rival will not enter the market for fear to incur losses. If the above condition is not fulfilled, strategic entry deterrence is not profitable, because it is too expensive. In such a situation, the incumbent might have a continuing interest in strategic behaviour, which – although not deterring entry – could nevertheless improve its position after entry (see below and Tirole, 1995: 326ff.).[234]

Again, it should be noted that the economic knowledge about entry and determinants of (re)actions by incumbents to entry exceeds the characterisation presented here considerably. Gruca and Sudharshan (1995) review the strategic management and industrial organisation literature and construct a framework based on their findings. They emphasise that entry decisions depend particularly on three aspects: the realised and anticipated consequences for the incumbent, alternative entry deterrence strategies and the choice of the entry-deterring strategy. The existing competitive environment (e.g., cost conditions, demand conditions, industry history and legal climate) interacts with each of these factors. Box 31 highlights

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233 In technical terms, a *commitment* (i.e., an irreversible investment) makes an entry-deterring strategy credible because it alters the incumbent's best response function in the face of entry.

234 Based on a simple, two-stage game between a K_1-investing incumbent (with a first-mover advantage) and a potential entrant (with a profit of π^2 in the second period), Fudenberg and Tirole (1984) construct a whole taxonomy of business strategies dependent on the kind of investment (either tough, $d\pi^2/dK_1 < 0$, or soft, $d\pi^2/dK_1 > 0$, and the slope of the reaction function *R*' (strategic complements, R'>0, and strategic substitutes, R'<0). Products are strategic complements if an aggressive action in one product induces an aggressive reaction. Products are strategic substitutes when the reaction is dissimilar (see Bulow et al., 1985).

some empirical findings regarding incumbent reactions to entry in the US airline industry.

Box 31. Incumbent reactions to entry in the US airline industry

Lin et al. (2002) conducted an investigation of factors contributing to competitive reactions to entry by incumbent airlines in the short and longer runs. Using data on 889 incumbent reactions to entry between 1991 and 1997, the authors found several factors that have a significant impact on the level of incumbent price cuts in response to entry. They include:

- the size of the entrant's price cut,
- the number of passengers carried by the new entrant on the route, and
- the costs, size and number of complaints of the entrant.

Interestingly, Lin et al. found no evidence that incumbents respond more aggressively to small, low-cost carriers than to other carriers. Incumbents reserve their largest price cuts for larger new entrants with higher costs. The longer-run results of this study indicate that even if the entrant is forced to withdraw from a route, prices do not rise to pre-entry levels.

In another study, Ito and Lee (2003) examined incumbent responses to lower cost entry. Based on their analysis of 370 market events, the authors find that highly aggressive incumbent reactions (with respect to price and capacity) are more the exception rather that the rule. Furthermore, their study showed that the entrant's success or failure on a certain route cannot be explained by the incumbent's capacity or pricing decisions but rather depends on factors such as the entrant's capacity choice, pre-existing market density and the entrant's pre-entry presence at the endpoints of a market.

Is strategic behaviour possible?

Successful strategic moves are dependent on specific conditions. As explained in section 2, some type of first-mover advantage is a precondition for successful strategic behaviour. Furthermore, the rivals must be aware of the strategic move (and clearly understand it) before they move. In other words, a successful strategic move requires some form of communication. Additionally, the strategic move must credibly change the optimal behaviour of the incumbent in the future.

In this respect, recent marketing research on the question of how managers (acting under uncertainty) interpret competitors' signals in various market contexts is of particular relevance. One basic finding of this strand of literature is that the effect of signals critically depends on the context in which they are used. In their empirical study, Prabhu and Steward (2001: 63f.) find that the entrant's perceptions of the incumbent's aggressiveness depends on the focus and strength of the incumbent's signals. The strength of the entrant's responses to the incumbent's signals depends on the incumbent's use of 'bluffs' and the informational cost regarding the factors driving the incumbent's signals.

Furthermore, strategic behaviour is only possible in oligopolistic markets. In other words, a certain degree of market power is a necessary precondition for strategic behaviour. Moreover, as shown by von Weizsäcker (1980: 13), entry-deterring strategies are not available if there are no structural barriers to entry.

Other factors which might influence the possibility of strategic behaviour include informational asymmetries, managerial incentives, the expected market duration, the necessary amount of sunk cost investment, the presence of network effects and the role of antitrust enforcement.

It is important also to mention that strategic behaviour could have other potential disadvantages besides the cost burden. In this respect, the literature particularly analyses the trade-off between 'commitment and flexibility' (see Boyer and Moreaux, 1997; Ghemawat and del Sol, 1998) or more generally 'first-mover disadvantages' (see Lieberman and Montgomery, 1998). For example, in very dynamic markets, strategic commitments might incur a prohibitive risk, because the incumbent loses some of its flexibility to react to unexpected changes in the market environment and/or unexpected moves of (new) rivals.

3.3.2 Advantages of Incumbents

Advantages of incumbents (over entrants) generally stem from their persistent market power in conjunction with first-mover advantages and a profound general knowledge of the industry in question.[235] As incumbents often enjoy a quiet life like a monopolist – protected from entry threats by structural entry barriers – they will therefore use their advantages foremost to protect such monopoly positions. In other words, the incumbent's primary aim is to raise structural entry barriers to an entry-deterring level, such as by influencing politicians to introduce entry regulations (see, e.g., Viscusi et al., 1997: 331, for an example from the US peanut industry), achieving learning economies, creating customer loyalty and switching costs or attempting to generally raise the amount of sunk costs necessary to start business in the industry. Box 32 gives an example from the airline industry. If the structural entry barriers are not high enough to prevent entry (e.g., the incumbent is too weak to achieve entry regulations via the regulatory policy process or the formation of other sufficient barriers is too expensive), then the incumbent often has the opportunity and the incentive to introduce strategic behaviour: opportunity because the incumbents' position in the market often allows strategic behaviour; and incentive because, depending on the costs and the expected reaction of the entrant, strategic behaviour pays in the form of a higher net present value of the profit stream for the incumbent.[236]

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235 Salop (1981: 18f.) refers to information advantages of the incumbent simply from its longer experience in the industry or the product segment and strategic advantages stemming from the possibility of undertaking binding commitments. Following Spence (1981: 60), it is also important to mention that the evolutionary question of how firms acquire and maintain positions of market power in recently liberalised industries – which is essential for the understanding of strategic behaviour in a certain industry – is reduced to the question of maintaining market power.

236 It is often reasonable to assume that an incumbent is active in many product markets. As strategic behaviour might not be financially possible in every market, the incumbent has to decide which markets are most important to protect against entry. Based

Box 32. A structural entry barrier in the airline industry: Frequent flyer programs

As argued in detail in Hüschelrath (1998b: 277ff.), frequent flyer programs (FFP) can be interpreted as an attempt to create structural entry barriers in airline markets. By rewarding frequent flights with the same airline/alliance, the customers can secure private, non-pecuniary benefits such as free flights, luggage allowances, etc. Such an incentive system creates customer loyalty and raises the switching costs for the customers. From the viewpoint of a potential entrant, FFPs reduce the expected demand on a certain route and therefore may impede profitable service on the route in question. Furthermore, FFPs also have a strategic potential, for example, by raising the rewards on a certain route after entry has occurred ('marketing mix reaction after entry').

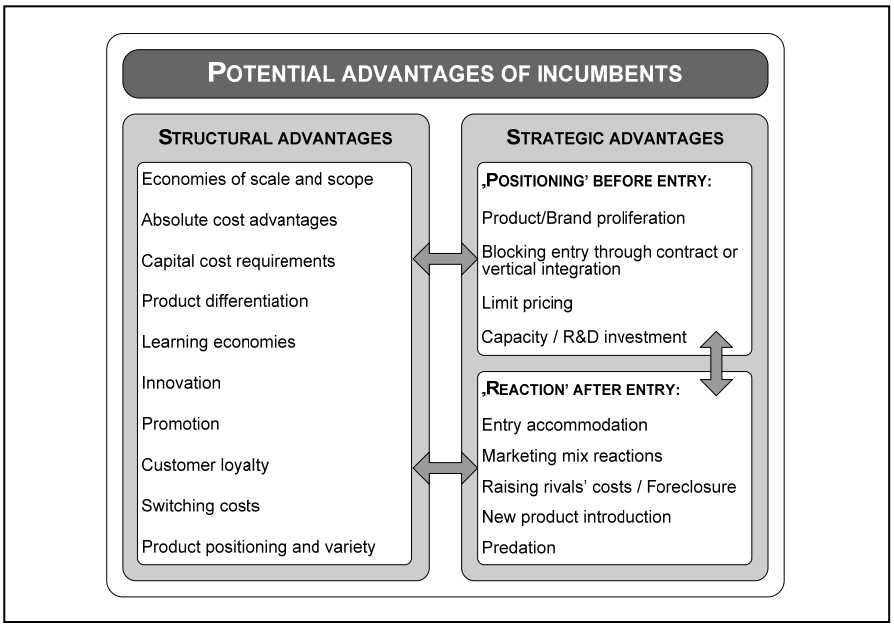
With the aim of reducing the threat of entry and/or promoting exit by rivals, incumbent firms have at least two major possibilities to (re)act. On the one hand, if the entrant is not already in the market, the incumbent could try to deter or at least to impede entry by negatively influencing the entry incentives of the potential entrant (i.e., 'positioning' or 'strategic action before entry'). Examples of those strategies include 'limit pricing' and 'capacity investments' (see Besanko et al., 1996: 407ff.).

On the other hand, if entry could not be prevented by those strategies, the incumbent could choose among different options to react to market entry (i.e.,' reaction' or 'strategic action after entry') (see Bunch and Smiley, 1992, for empirical evidence). Predatory pricing, for example, is by definition one of the after-entry reply options. Figure 42 summarises some central potential advantages of incumbents.[237]

on strategic management literature, it seems obvious that the incumbent's aim is foremost to protect so-called cash cow and star markets from market entry. *Cash cow markets* are characterised by a high relative market share and a low industry growth (high actual profits), while *star markets* combine a high relative market share and a high industry growth (high potential of high future profits; see Oster, 1994: 130). It is further worth mentioning that the financing of market protection by the incumbent is sometimes possible with the revenues of *rudiments of regulation*, meaning that the incumbent can subsidise strategic moves with revenues from state-granted monopoly markets.

237 The characterisation of 'positioning' for strategic moves before entry and 'reaction' to strategic moves after entry stems from Spence (1981: 53). Please note further that Figure 42 only uses one possible way to structure advantages of incumbents. Another possibility might be a characterisation by 'strategic behaviour through actions' and 'strategic behaviour through signals'. In an overview, Porter (1981: 499ff.) shows that signals might be a preferred strategic instrument, as its use is costless. However, some actions are still needed in order to make the signals credible and strategic behaviour possible.

Fig. 42. Potential structural and strategic advantages of incumbents



The arrows in Figure 42 indicate that interactions between the categories are expected. For example, if an incumbent reacts to market entry with predatory prices, this action might bring about a tough reputation. New potential entrants will take this reputation into account before deciding to enter the same (or a related) market. In general, after-entry strategies could have before-entry effects, because they influence the profit expectations of potential entrants. Furthermore, it is reasonable to assume that structural advantages influence the availability, the choice and the success of the incumbent's strategic instruments.[238]

It is however beyond the scope of this section to discuss in detail all the options in the toolbox of strategic behaviour available to incumbents presented in Figure 42 (see Saloner et al. 2001; Besanko et al. 1998; Gabszewicz, 1999; Grimm and Smith, 1997). At first glance, it may be questionable why accommodation of entry as such could be a strategic advantage. Ashiya (2000) gives an interesting answer to this question by showing the theoretical conditions under which 'weak entrants are welcome'. His basic idea is that the incumbent may allow entry of a weak firm in order to block other, more threatening potential entrants. Furthermore, Salop and Scheffman (1987) examine a variety of strategies by which firms could disad-

238 It is important to mention that structural advantages (or entry barriers respectively), according to Sutton (1991: 45ff.), are often the result of strategic escalations on particular endogenous sunk cost dimension(s), such as advertising or R&D. In other words, exogenous sunk costs interact with endogenous sunk costs in determining industrial structure.

vantage rivals by raising their absolute or relative costs (e.g., by raising switching costs or wages). Box 33 presents an example from the airline industry.[239]

Box 33. A strategic entry barrier in the airline industry: gate (sub)leases

As argued in detail in Hüschelrath (1998b: 263ff.), the necessary access to airport gates for potential entrants could be used as a strategic (and structural) entry barrier by an incumbent airline. Before entry, airline ownership of gates (or long-term contracts between the airport and a hub airline) may impede or deter entry of other airlines (and might therefore lead to an over-investment in gate capacities). If entry occurrs anyway, the entrant is often dependent on gate sublease contracts with the incumbent airline. This situation makes it possible for the incumbent airline to raise the input prices of the rival, for example, by demanding high subleasing fees. Using this tactic, the market can even be foreclosed to the entrant. Chen and Ross (2000) provide a theoretical examination of these relationships.

It is important to note further that the different strategic options of incumbents in Figure 42 can reach the same aim of deterring or impeding market entry. In other words, the incumbent often faces a trade-off between the undertaking of one or more positioning investments – which are costly and which have the aim to create an incentive for the established firm to react towards the entrant in a way that is destructive to the latter – and the undertaking of one or more reaction(s) after the entry event (see Spence, 1981: 56).[240] This trade-off is especially important for analysing the relationship between strategic behaviour, welfare and antitrust policy. It indicates that antitrust action against one particular instrument (e.g., predation) might not lead to the intended aim of increasing competition in the market, but simply to the incumbent switching from one (prohibited) strategy to another (permitted) strategy (e.g., capacity investment, assuming suitable industry characteristics).

[239] The results of Salop and Scheffman's models suggest that cost-raising strategies can be an important anticompetitive instrument even if the incumbent is a price-taker in the output market. Furthermore, they show that strategies designed to raise rivals' costs have a number of advantages over predatory pricing strategies: First, cost-raising strategies do not have a problem of credibility. Second, single-firm market power is not essential for the success of cost-raising strategies. Therefore, raising rivals' costs is not a strategic move in the sense of the definition in section 3.2. Nevertheless, such strategies can be an advantage for incumbents and are therefore part of Figure 42.

[240] LeBlanc (1992) examines this trade-off theoretically for the case of limit pricing (before entry) and predatory pricing (after entry). In his model setup, he finds that when the incumbent is likely to be strong relative to the entrant, predatory pricing is chosen. When the incumbent is likely to be weak relative to the entrant, limit pricing is chosen. For intermediate cases a strong incumbent may choose a combination of these two signalling strategies.

3.4 Welfare Effects of Strategic Behaviour

After characterising and rationalising strategic behaviour from a business perspective, the consequential next step is investigating strategic behaviour from a social welfare perspective. Assessing the welfare effects of strategic behaviour is a two-step process. First, a competitive benchmark has to be defined. Second, the market performance of the competitive benchmark has to be compared to the market performance of strategic behaviour to get an idea of the sign of the net welfare effect of strategic behaviour. Both steps are assessed in the following.

3.4.1 Characterising the Competitive Benchmark

Any judgment on the welfare effects of strategic behaviour first requires the determination of a competitive benchmark. The standard Cournot model is the usual suspect to fit into this role, basically due to its mathematical tractability but also because of significant econometric and experimental research which shows that Cournot models can be a good predictor of actual market behaviour and market results in an industry (characterised by capacity constraints).

To study the welfare effects of competition and entry in a basic Cournot model, suppose that market demand is given by $P(Q) = a - bQ$, where $Q = \sum q_i$. There are *n* firms in the market, all with the same cost function $C_i = cq_i$. In equilibrium, each firm's profit-maximising output equates marginal revenue to marginal cost.[241] The marginal revenue for firm i is given by

$$MR_i\left(q_i, \sum_{j \neq i} q_j\right) = \left(a - b\sum_{j \neq i} q_j\right) - 2bq_i . \tag{53}$$

Setting this equal to marginal cost, the best-response function for every firm is given by

$$a - b\sum_{j \neq i} q_j - 2bq_i = c . \tag{54}$$

Given the symmetry of the example, the best-response function for one firm is given by

$$a - b(n-1)q^c - 2bq^c = c . \tag{55}$$

Solving the above for q^c gives the equilibrium output for each firm

$$q^c = \frac{a - c}{(n+1)b} . \tag{56}$$

Industry output can be derived as

241 The setup of the model is taken from Church and Ware (2000: 243f.).

$$Q^C = nq^c = \frac{n(a-c)}{(n+1)b} \tag{57}$$

and the market price can be found by substituting Q^c into the demand function as

$$P^c = \frac{a+nc}{n+1}. \tag{58}$$

The profits of each firm are then given by

$$\pi^C = \left(\frac{a-c}{n+1}\right)^2\left(\frac{1}{b}\right) \tag{59}$$

while producer surplus (=industry profits) can be calculated to

$$PS = \left(\frac{a-c}{n+1}\right)^2\left(\frac{n}{b}\right). \tag{60}$$

The consumer surplus is given by

$$CS = \left(a-\left(\frac{a+nc}{n+1}\right)\right)\left(\frac{(a-c)n}{(n+1)b}\right)\left(\frac{1}{2}\right) \tag{61}$$

leading to an expression for total welfare of

$$TW = \left(a-\left(\frac{a+nc}{n+1}\right)\right)\left(\frac{(a-c)n}{(n+1)b}\right)\left(\frac{1}{2}\right) + \left(\frac{a-c}{n+1}\right)^2\left(\frac{n}{b}\right). \tag{62}$$

As $\partial CS/\partial n > 0$, the consumer surplus steadily increases with *n*. As $\partial PS/\partial n < 0$, the producer surplus is decreasing with *n*.

To allow a graphical interpretation of especially the effects of entry in a Cournot model, the general results above are applied to a certain market specification.[242] It is assumed that market demand is given by Q=1.000-1.000p (which is equivalent to an inverse demand function of p=1-0,001Q) and marginal cost by c=0,28. Inserting these values into the general expressions (60) and (61) lead to the following applied expressions for the producer surplus and the consumer surplus:

$$PS = \Pi = \frac{518{,}4n}{(n+1)^2} \tag{63}$$

and

$$CS = \frac{259{,}2n^2}{(n+1)^2}. \tag{64}$$

Given these expressions, the producer surplus, the consumer surplus and the overall welfare can be computed for different numbers of firms in the market. Figure 43 shows the results for n=[1,10].

242 The market specification is taken from Carlton and Perloff (2000: 161).

Fig. 43. Welfare components in a linear n-firm Cournot model

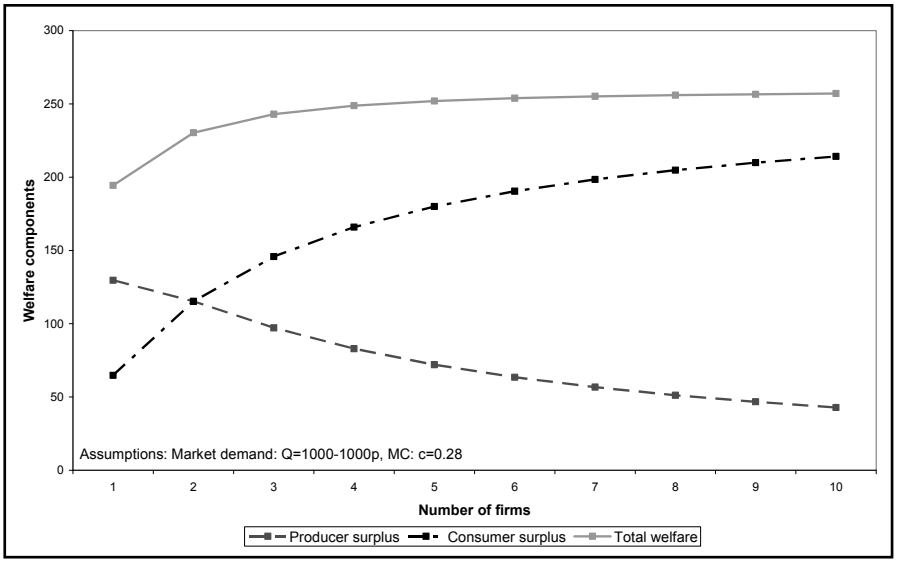


Figure 43 shows that producer surplus is steadily decreasing in n (with decreasing increments), while consumer surplus is steadily increasing (with decreasing increments). Overall welfare is steadily increasing with n, also with decreasing increments. All three curves converge to the perfect competition outcomes.

One important caveat against the significance of the analysis so far is the absence of fixed costs which – although not directly influencing the pricing decision – certainly affect the profits of the firms in the market, firm decisions to enter a market and the socially optimal number of firms in the market. Figure 44 shows the results for the same market specification as above, adding however a fixed cost of 10 for every firm in the market. It can be seen that consumer surplus is still steadily increasing (as it is independent of fixed costs) while producer surplus decreases with an increased slope. As a consequence, the overall welfare is not steadily increasing anymore but reaches a maximum when three firms are in the market. That is because the society has to cover the fixed costs of every additional firm, and a fourth firm would simply lead to a smaller increase in overall welfare than the additional fixed costs it creates. However, Figure 44 shows further that there is room for six firms in the market, as only the entry of the seventh firm would cause a negative producer surplus. Therefore, under the chosen market specification, a socially inefficient high number of firms would join the market.[243]

[243] Recapitulating the discussion in section 2.3.2 about the appropriate welfare standard for antitrust policy, Figure 44 shows that an ultimate antitrust goal of a 'pure' consumer welfare standard is pointless, as it would simply suggest to increase the number of firms indefinitely, because by definition it does not consider the costs of such an 'atomistic market structure' incurred at firm level.

Fig. 44. Welfare components in a linear *n*-firm Cournot model with moderate fixed cost

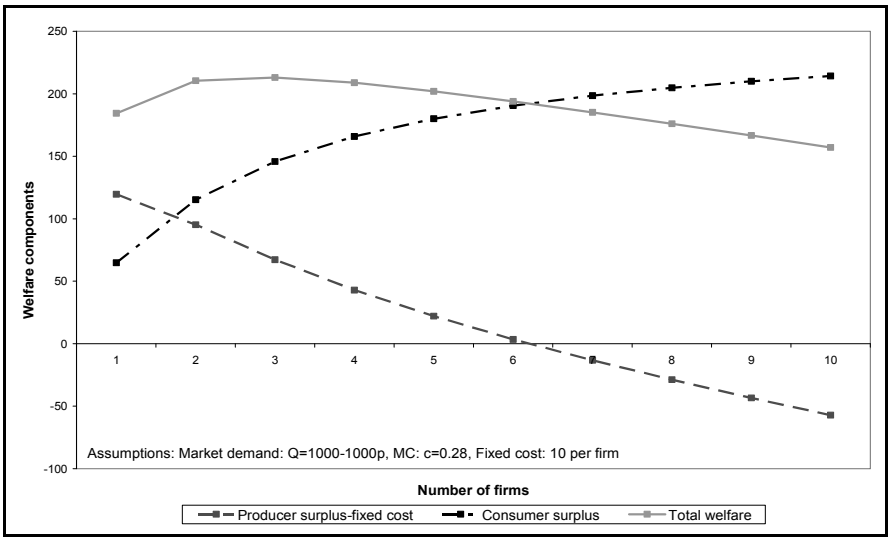
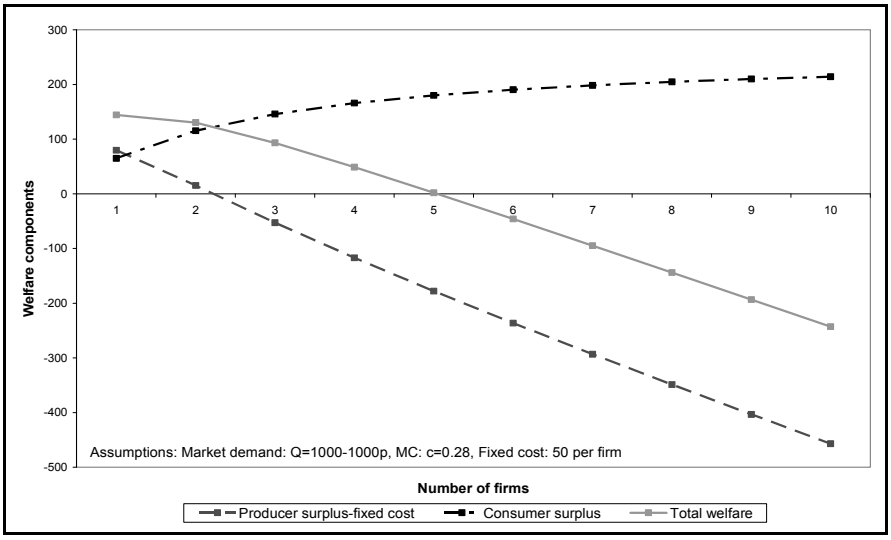


Fig. 45. Welfare components in a linear *n*-firm Cournot model with high fixed cost



To further clarify the argument, fixed costs of 50 are assumed. In such a case, Figure 45 shows that it is socially optimal to have only one firm in the market, although a second would be able to make positive profits. It is disputed in literature whether this already constitutes a natural monopoly; however, it clearly shows that a policy which aims at maximising the number of firms in the market can hardly be the optimal choice from an overall welfare perspective.

Based on these results, for the following assessment of strategic behaviour it is important to ask whether entry into a monopoly market is somewhat more important for the consumers (and for overall welfare) than entry into markets with n>1 (non-colluding) firms, simply because the gains in consumer welfare are highest in such a situation. Although it is obvious that the absolute gains depends on overall market size[244], it can be exemplified for the market specification above that the *relative* gains in consumer welfare are indeed highest in a monopoly to duopoly transition. This point is illustrated in Figure 46.

Based on these results, for the following assessment of strategic behaviour it is important to ask whether entry into a monopoly market is somewhat more important for the consumers (and for overall welfare) than entry into markets with n>1 (non-colluding) firms, simply because the gains in consumer welfare are highest in such a situation. Although it is obvious that the absolute gains depends on overall market size[245], it can be exemplified for the market specification above that the *relative* gains in consumer welfare are indeed highest in a monopoly to duopoly transition. This point is illustrated in Figure 46.

As Figure 46 shows, consumer surplus increases by almost 80% when an equally efficient firm enters the monopoly market. The producer surplus drops by about 11%, leading to an overall welfare increase of nearly 20% compared to the monopoly state. If a third firm enters the duopoly market, consumer surplus still raises by about 25%, while producer surplus drops by about 15%. Overall welfare rises by about 5%.[246]

In a nutshell, analysing entry in a Cournot model has shown for the assumed market specification that entry into a monopoly market increases consumer welfare and overall welfare by the largest amount. If two or more (non-colluding) firms are already in the market, the delta is significantly reduced. Second, it has been exemplified that the fixed costs level is an important feature in every analysis of competition in a market. Although the finding that entry into a monopoly market brings the largest delta is likely to hold for most markets, it has to be kept in mind that this is not true for natural monopolies.

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244 This means that entry into a small monopoly market can lead to a less absolute increase in consumer welfare than the entry of a third or fourth firm into a large oligopoly market. However, the relative increase might still be higher in the monopoly market.

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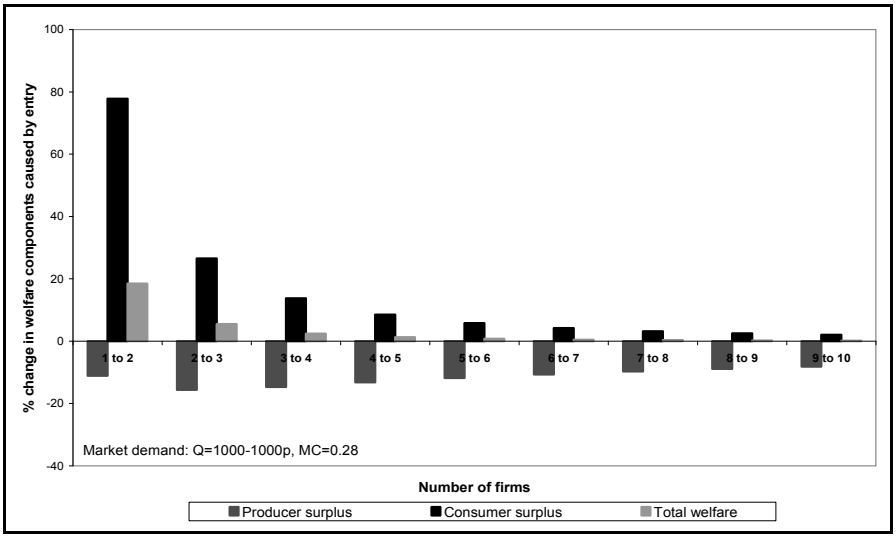
246 The exact percentages are as follows (absolute values in parentheses) – 1 to 2: PS=-11,11% (-14,4), CS=77,78% (50,4), TW=18,52% (36,0); 2 to 3: PS=-15,63% (-18,0), CS=26,56% (30,6), TW=5,47% (12,6); 3 to 4: PS=-14,67% (-14,26), CS=13,78% (20,09), TW=2,40% (5,83).

Fig. 46. Percentage change in welfare components after entry in a linear *n*-firm Cournot model



3.4.2 Characterising the Welfare Effects of Strategic Behaviour

At first glance, it seems obvious that strategic behaviour has a strong tendency towards a welfare reduction. Especially if the rival is completely deterred from *entry into a monopoly market*, the negative welfare effects can expect to be substantial simply because the gains from competition are unachievable. Allocative inefficiency, inefficient rent-seeking expenditures and productive inefficiencies remain persistent, leading to inefficiently high monopoly prices for a product with an inefficient (i.e., too high or too low) quality level. Due to these problems, the switch from monopoly to duopoly through market entry seems to be most desirable from a welfare point of view, even if the entrant is less efficient than the incumbent (see Edlin, 2002).

But even in such allegedly clear cases of a net welfare reduction due to strategic behaviour, there may be situations in which strategic behaviour enhances welfare. Generally speaking, these are situations in which strategic behaviour is used as an instrument to prevent socially inefficient entry. What would such situations look like? For example, if the cost structure and market demand interact in a specific way – technically, if the demand curve intersects the average cost curve of the monopolist in its sub-additive part – a natural monopoly is created (see Box 34 for evidence from the airline industry). In such situations market entry and competition reduce welfare, as the costs of competition for society (e.g., the fixed cost of the second firm) are bigger than the gains of competition (e.g., reduction in price; see the preceding section for a quantitative example).

Another prominent example is patent protection. Granting a monopoly position (with a patent) to an innovative firm might be necessary to preserve the innovation incentives for the future. As patents normally cannot provide perfect protection (e.g., consider the problem of 'innovating around a patent' by a rival), strategic moves by incumbents may be a substitute to reach the (socially efficient) degree of protection. A third example of 'too much entry' might be cases of high switching costs. Klemperer (1988) shows that in such cases, entry even into monopoly markets might be socially undesirable.

Box 34. Natural monopolies in the airline industry

Natural monopolies in the airline industry can be examined at different levels. For example, economies of scale on a firm level were analysed mainly prior to deregulation in the United States. The central finding was that "economies of scale are negligible or non-existent at the overall firm level" (White, 1979: 564). However, if scale effects are analysed on a route level, there are scale economies in aircraft size (because the average operating costs decrease) and in the amount of flights and passengers (as the average operating costs on the ground decrease). This leads to the conclusion that depending on aircraft technology and the traffic volume, many route markets are natural monopolies in the sense that only one firm can operate profitably. Especially short-haul markets are therefore often natural monopoly markets. However, it should be kept in mind that the extent of natural monopolies is limited: "as of 1988, only 11% of passenger miles travelled were in markets with only one carrier, compared with 22% in 1979 ... This suggests that, while natural monopoly exists in US airline markets, its importance should not be overstated" (Keeler, 1991: 127).

In the case of *entry deterrence into an already oligopolistic industry,* comparable arguments concerning welfare are valid. As the performance in oligopoly markets (absent collusion) is better than in the monopoly situation, it can be assumed that the social gains of market entry are (relatively) smaller (but still positive) than in the monopoly case above. Negative impacts on social gains of market entry can again be realised in cases where the efficient market structure is already reached ('natural oligopolies') and further competition would reduce welfare. In this respect, the preceding section presented a quantitative example of a case of excessive entry which was driven by the divergence of the private incentives to enter a market – determined by the possibility to realise a positive profit (even by largely stealing business from existing competitors) – and the socially optimal number of firms in a market – determined by the realisation of the maximum total surplus, which takes into account the costs (i.e., the additional fixed costs) and benefits (i.e., the additional downward pressure on price) of further competition (see Mankiw and Whinston, 1986, for a basic model). [247]

[247] As far as the argument of inefficient entry is concerned, it is important to mention two limitations of this theoretical finding. First, almost no empirical evidence concerning this question exists. The presumably first empirical study is delivered by Berry and Waldfogel (1999). They find a welfare loss due to excessive entry in the radio industry. The generality of their findings is reduced by the very special cost structure of ra-

In situations of *accommodated entry*, the welfare implications of strategic behaviour become more ambiguous than in the two former cases.[248] In order to show why, consider a two-period (strategic) game (t = 1, 2) with two firms α and β. In the first period (t = 1), there is no market demand ($P_1=0$), but firm α has the possibility to invest into some production capacity *K* (first-mover-advantage), which it can use in t = 2. This capacity must be interpreted as a commitment; hence the capacity cannot be sold in period 2. The inverse demand function in t = 2 is given by $P_2 = a - bQ$. The cost function is given by

$$C(q,K)=\begin{cases} cq+lK & \text{if} \quad q\le K \\ \infty & \text{otherwise} \end{cases}. \tag{65}$$

The profit π for firm α is then given by

$$\begin{gathered} \pi^{\alpha} = -lK_1+(a-b(q_\alpha+q_\beta))q_\alpha-cq_\alpha-l(K_2-K_1) \\ \text{with} \quad q_\alpha\le K_2, K_1\le K_2. \end{gathered} \tag{66}$$

The profit π for firm β is given by

$$\pi^{\beta} = (a-b(q_\alpha+q_\beta))q_\beta-cq_\beta-lK_\beta \quad \text{with} \quad q_\beta\le K_\beta . \tag{67}$$

Firm α uses its strategic advantage by taking the reaction function of the follower into account. After maximisation and a few transformations, the optimal capacity investment is given by

$$K_1^*=K_2^*=q_\alpha^*=\frac{a-c-l}{2b}. \tag{68}$$

By establishing the whole (irreversible) capacity in period 1, firm α can establish the credible threat that it will use this capacity in period 2. The rival realises this threat and provides a 'new' optimal quantity

$$K_\beta^*=q_\beta^*=\frac{a-c-l}{4b}. \tag{69}$$

This optimal quantity in response to firm α's strategic move leads to decreasing profits of firm β

$$\pi_\beta^*=\frac{(a-c-l)^2}{16b} \tag{70}$$

while firm α's profits are rising

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dio broadcasting (large fixed costs and zero marginal costs). In such situations, free entry is most likely to be inefficient. Second, the focus of the theoretical models is mainly static, with the consequence that positive dynamic welfare aspects – such as the welfare-enhancing expansion of product choice – are not part of the welfare assessment.

248 The model set-up follows unpublished lecture notes of Professor Norbert Schulz (University of Würzburg).

$$\pi_{\alpha}^{*} = \frac{(a - c - l)^2}{8b} \tag{71}$$

in each case compared to the symmetric profits of the Cournot outcome (in t = 2) of

$$\pi_{\alpha}^{c} = \pi_{\beta}^{c} = \frac{(a - c - l)^2}{9b} . \tag{72}$$

Therefore, as $\pi_{\alpha}^{*} > \pi_{\alpha}^{C}$, strategic behaviour is rational for firm α. In order to derive the welfare consequences of the strategic behaviour of firm α, the total market outcome (Q_S) of the strategic game

$$Q_S = q_{\alpha}^{*} + q_{\beta}^{*} = \frac{3}{4} \cdot \frac{a - c - l}{b} \tag{73}$$

must be compared with the reference outcome (Q_C) of Cournot competition (in t = 2)

$$Q_C = q_{\alpha}^{c} + q_{\beta}^{c} = \frac{2}{3} \cdot \frac{a - c - l}{b} . \tag{74}$$

As $Q_S > Q_C$, the consumers are better off in the situation with strategic behaviour than in the symmetric Cournot world. This example shows in a simple way that strategic behaviour in situations of accommodated entry does not reduce per se (consumer) welfare.[249] It shows further that increased market power could lead to higher consumer welfare. The market share of the leader in the strategic game is 67%, while the follower gets 33% of the market. In the Cournot case, both firms would gain a market share of 50%.[250] Therefore, at least in this case, asymmetry in market shares corresponds with higher outputs and correspondingly higher consumer welfare. It therefore provides an intuition about the robust theoretical finding that not the maximisation but the optimisation of competition (and entry) is congruent with the central aims of antitrust policy.

However, this positive judgment of strategic behaviour is only one side of the (welfare) coin. As Ordover and Saloner (1989: 538) clearly state,

> theoretical models ... provide a guarded support for the proposition that strategic choices made by dominant firms are not invariably consistent with the ob-

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249 In a general economic sense, this finding reminds of the *second best* problem, meaning that an increase in market power for a firm that already has some market power does not necessarily reduce welfare. "Therefore, if the strategist has market power absent of strategic activity, the theory of second best shows that as a theoretical matter, it is very difficult to establish that aggregate (or even consumer) welfare is necessarily reduced by the strategic activity" (Holt and Scheffman, 1989: 68).

250 As chapter 4 will show, the positive effect of strategic behaviour on welfare can increase further if cost asymmetries between the incumbent and the entrant are taken into account.

jective of welfare maximisation and that some constraints on firm behaviour may, in fact, increase welfare.

For example, if fixed costs are added to the cost function in the model above, we get a simple limit-pricing model with adverse effects on consumer welfare over a certain range.

Summing up this section, it was shown that strategic behaviour can reduce welfare by deterring or at least impeding market entry. Such behaviour forecloses the general gains from market competition to the consumers and the whole economy. Furthermore it was argued that strategic behaviour also has the potential to increase welfare either passively by maintaining a socially efficient degree of market power, or actively by leading to forms of asymmetric oligopolistic competition (after accommodated entry with strategic behaviour of the incumbent), which attain better market performances than symmetric oligopoly competition.

3.5 Strategic Behaviour and Antitrust Enforcement

The main purpose of the last sections was to illustrate under which conditions strategic behaviour is rational – in the sense of profit maximising – for an individual incumbent firm facing an entry threat. Furthermore, it was shown that strategic behaviour has ambiguous effects on market performance (measured in total welfare). The consequential next step is to assess the question whether some form of antitrust policy could ameliorate market performance when anticompetitive forms of strategic behaviour are applied.

3.5.1 Essential Features of Antitrust Policy

Despite the historical fact that antitrust law has been motivated and legitimised by various arguments (brought forward by diverse interest groups), the economic profession currently sees the central aim of antitrust policy as maintaining and improving economic efficiency. Given this primary objective, antitrust is largely concerned with two types of offences, which comprise the potential to harm competition and efficiency: exploitative and exclusionary behaviour (see Fox, 2002, for an overview). *Exploitative* implies that a number of firms have entered into some form of business together (e.g., they have formed a cartel or a strategic alliance). *Exclusionary* stands for the attempts of (usually) one firm aiming to achieve a higher degree of sole market power by harming rivals through certain forms of behaviour. For both types of behaviour, theoretical and empirical research has shown that they could have either procompetitive or anticompetitive motives and effects. While several forms of behaviour are presumed generally to be detrimental to efficiency, such as hard core cartels or certain refusals to deal, others could be either supportive or detrimental to competition and efficiency, such as strategic alliances or certain tying agreements.

This observation led to the development of two types of control strategies applied by the antitrust authority and the courts: per se rules and the rule of reason. The per se rule prohibits certain behaviour generally, because the detrimental effects are not only assumed to be dominant, but also almost certain and easily identifiable by the firms and the antitrust authority (see Carlton et al., 1997: 427). The rule of reason accommodates the more frequent case, where the anticompetitive effects of certain behaviours must be compared with the efficiency-enhancing effects on a case-by-case basis (see Black, 1997, for an overview).

The existence of different control strategies immediately leads to the question of the timing of control (ex ante or ex post). This criterion is often used to discriminate between regulatory interventions (which normally take place before specific business actions) and antitrust interventions (which normally take place after the business actions). It is obvious that both approaches differ in many aspects; for example, the information situation, the risk of regulatory capture or the enforcement cost burden (see Rey, 2002: 42ff., for an overview). The fact that antitrust interventions sometimes must take place ex ante (such as in the case of merger control) shows that the 'time of control' delineation between regulation and antitrust is not perfectly selective.[251]

All combinations of 'timing' and 'types' of control strategies contain the danger of antitrust errors in the form of wrong, and therefore welfare-reducing, case decisions. Basically, two types of false inference (errors) are differentiated: a failure to condemn an instance of anticompetitive behaviour (type II error) and an erroneous condemnation of procompetitive behaviour (type I error). Interestingly, Gal (2000: 93) identifies a third possible antitrust error (type III error), which arises "[w]here a court correctly identifies anticompetitive conduct, but its mode of interference, i.e., its prescribed remedy, harms competition". Consequently, with the aim of optimising antitrust policy, the antitrust authority must take into account the trade-off that "[t]oo little enforcement leads to bad behaviour and monopoly power, whereas too vigorous enforcement may deter firms from pursuing desirable forms of competition for fear that this competition will be misinterpreted" (Carlton and Perloff, 2000: 361).

3.5.2 Antitrust Enforcement Options Towards Strategic Behaviour

Antitrust policy's interest lies largely in maintaining and improving economic efficiency. The conversion of this aim into policy actions targeting strategic behaviour is challenged by (at least) two forms of identification problems. First, it might generally be problematic to distinguish competitive from strategic behaviour, as "[r]eal world competition involves direct rivalry between competitors, and rivalry cannot exist without recognition of interdependence and without winners and los-

[251] Furthermore, it is important to mention that from an institutional point of view, the aims and duties of regulation and antitrust authorities might conflict, at least as far as cases of 'liberalised industries with some form of regulatory oversight' (e.g., most telecommunication and post markets) are concerned.

ers (among the competitors)" (Holt and Scheffman, 1989: 66). The empirical observation that firms which operate in largely competitive industries often use variants of most types of strategies reinforces the existence of this 'signal jamming' problem for antitrust policy.[252] Second, even if certain behaviour is proven to be strategic, antitrust regulation encounters another form of identification problem, as "it is difficult to determine whether strategic behaviour raises or lowers welfare" (Carlton and Perloff, 2000: 360). Both identification problems together increase the likelihood of wrong case decisions (i.e., 'antitrust errors'), hence raising the question of what an optimal antitrust action against strategic behaviour would entail.

Given these challenges, antitrust policy has at least three possible ways to react against strategic behaviour: doing nothing, implementing a per se rule or introducing some form of rule-of-reason procedure. In the following, all three possibilities will be outlined and discussed, taking into account Spence's general warning (1981: 82) that "[s]ometimes the cure is worse than the disease. Indeed, the policy problem is to know or to learn what if any market processes are regulatable at reasonable cost and low risk, and by what means".

3.5.2.1 No-Rule Approach

The *no-rule* or *do-nothing approach* can be justified by various arguments. For example, hard core supporters of the Chicago school of antitrust analysis would probably argue that any antitrust action against strategic behaviour is unnecessary, because the market forces (in the long run) will 'automatically' select the most efficient firms and will lead to efficient market outcomes. Others may support the opinion that strategic behaviour is generally irrational and that suspicious cases only represent the richness of normal competitive behaviour. In both cases, any need for antitrust action is rejected in principle due to a strong belief in the power of market processes.

A related view acknowledges the welfare-reducing potential of strategic behaviour in real markets, but maintains that it is impossible for an antitrust authority to separate between normal competitive behaviour and harmful strategic behaviour. Generally speaking, dynamic market behaviour is assumed to be too complex to be interpreted correctly by the antitrust authority (see Joskow and Klevorick, 1979: 217). Interventions therefore contain the danger of errors and, as a consequence, the danger of socially harmful antitrust decisions.[253] Any antitrust action is rejected due to a strong belief in the failure of the antitrust authority.

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252 A further identification problem might arise concering the intent of a certain (strategic?) move. Excess capacity, for example, can be an instrument to deter or to impede entry, but it could also be an instrument to stabilise a collusive outcome (see Phlips, 1995: 151ff.).

253 In this respect it must be mentioned that antitrust rules (e.g., against predation) might demotivate incumbents to undertake welfare-enhancing activities (e.g., to drop prices), as they are concerned with being wrongly charged by the antitrust authority and the court(s).

Even in the hypothetical case that the antitrust authority is able perfectly to identify socially harmful strategic behaviour, this does not automatically imply the conclusion that antitrust action is always the welfare-optimising answer. Such a judgment should largely depend on some form of cost-benefit analysis, meaning that the optimal level of antitrust enforcement has to be chosen subject to cost considerations. If the detection and enforcement costs are extremely high, for example, and the benefits extremely low, a do-nothing approach might be the optimal antitrust response.

Without denying the general importance of such cost-benefit assessments, extreme policy conclusions need to be handled with care. Suppose, for example, that a certain form of strategic behaviour has a rare occurrence in a certain industry, the negative welfare effects are assumed to be small and the antitrust enforcement costs are relatively high (see Box 35 for an example from the airline industry).

Box 35. An empirical assessment of predation in the airline industry

In a study on behalf of United Airlines, Bamberger and Carlton (1999) assessed in more detail whether predatory pricing is a widespread occurrence in the airline industry. The authors examined entry by low-fare carriers since 1990, the survival rates of low-fare carriers, the fare and capacity responses of incumbents to entry by low-fare carriers and the fare responses of incumbents to exit by low-fare carriers. They conclude that the empirical evidence fails to support the growing concern that incumbent major carriers systematically engage in exclusionary or predatory conduct to force low-fare carriers out of the market. "The evidence shows that the type of fare and capacity responses that concern the DOT and others are rare and also occur in response to entry by major carriers" (p. 14).

At first glance, such a situation appears to call for the application of a do-nothing approach as the welfare-optimising solution. In order to show that such a conclusion may be drawn too hastily, consider the fact above that 'a certain form of strategic behaviour has a rather rare occurrence'. Such a finding might state little about the importance and influence of a certain form of strategic behaviour on industry competition, because it neglects the important reputation effects which are essential for several forms of strategic behaviour. In other words, some reputation-based forms of strategic behaviour (such as predatory pricing) would be very expensive, ineffective and therefore irrational if they had to be frequently employed before or after market entry. The value of these strategies to the incumbent stems from its pre-entry deterrence effect created by a combination of uncertainty and reputation. The incumbent uses such variables to reduce the profit expectations of the potential entrant, leading – as the case may be – to its decision not to enter at all. Consequently, observable cases of strategic behaviour should be relatively rare and could be interpreted as investments of the incumbent in the credibility of its strategic signals. The do-nothing approach can hence not be simply justified by demonstrating that a certain strategic option is rarely observable in a certain industry.

In a nutshell, the do-nothing approach might be regarded as a problematic general reaction to strategic behaviour, as it appears clear that some forms of strategic

behaviour lead to evident negative welfare implications and are only used to protect market power. Consequently, antitrust policy has at the very least the potential to improve welfare. Although the argument that antitrust policy contains the risk of errors is valid, it is not outstanding, as every policy action potentially faces similar problems. In general, a complete abandonment of all policy actions – which is equivalent to the maximisation of type I errors while minimising type II errors – is not a welfare-optimising solution. Therefore, the most important insight of the do-nothing approach is that costs and benefits should be taken into account when choosing and designing antitrust rules. Furthermore, the approach (unintentionally) points out that contemporary economic research should guide the analysis of antitrust authorities (e.g., by the development of analytical frameworks) in order to minimise the probability of erroneous case decisions.

3.5.2.2 Per-Se-Rule Approach

The *per-se-rule approach* prohibits certain behaviour generally. Accordingly, the antitrust authority only has to answer the question, Did the incumbent engage in the proscribed practice? If the answer is Yes, the antitrust authority and afterwards the courts are committed to suppress the behaviour in question and eventually fine the relevant firm. The authority or court actions are furthermore independent of the question whether there has been an injury to competition or not (see above and Calvani, 2001, for a more exact treatment). This per se commitment to suppression and punishment creates an important deterrence effect for incumbent firms who consider the adoption of such prohibited strategies.

The central characteristics of the per se rule predestine the approach for types of behaviour that are clearly identifiable[254] (for the firms and the antitrust authority) and have clearly (and almost certain) negative welfare consequences. However, assessing strategic behaviour generally faces problems in achieving one or even both of these necessary conditions, as strategic behaviour is often difficult to distinguish from other competitive actions and it is often unclear whether strategic behaviour reduces or enhances welfare. Therefore, it appears impossible to design one single (or a bunch of) per se rule(s) equally applicable to the large number of different forms of strategic behaviour (at least without accepting the frequent emergence of all three possible errors of antitrust action). Consequently, strategic behaviour overall should not be treated by a per-se-rule approach.

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254 Note that the interpretation of a strategy as ‘easily identifiable’ might contain errors. For example, for a long time, courts enforced predatory pricing by applying a rule of thumb, stating that only if prices are below average variable costs, is welfare-reducing predatory pricing assumed as a matter of principle. However, economic research has shown that such enforcement by rules of thumb can be highly error-prone and hence often the source of wrong case decisions. For example, Edwards (2002: 183ff.) shows conditions under which pricing below-average variable costs is welfare-enhancing. Edlin (2002) discusses the antithetic problem of successful predatory pricing above average variable costs. The OFT (2006: 65ff.) refers to this general problem of antitrust rules as ‘inclusion problem’.

Acknowledging this general judgment, it might be worth considering some form of conditional per-se-rule approach. Such a modified per se rule would still directly prohibit certain behaviour by the incumbent, but subject to certain environments and attributes of the incumbent, the entrant and the entry attempt. Box 36 outlines one example of a conditional per-se-rule approach.

Box 36. An ex ante, per se approach to stop above-cost predatory pricing in the airline industry

In a recent paper, Edlin (2002) proposes an ex ante, per se rule to reduce predatory pricing incentives of incumbents. The rule states that "in markets where an incumbent monopoly enjoys significant advantages over potential entrants, and the firm decides to enter anyway charging substantially lower prices (at least a 20% discount), the monopoly cannot respond with lower prices or significant product enhancements for 12-18 months or until the entrant's share grows enough that the monopoly loses its dominance. If the entrant does not observe these structures, … then the entrant under this proposal can sue successfully for predatory pricing without needing to demonstrate below-cost pricing or the opportunity for recoupment" (p. 949).

In order to better understand the general idea of conditional per se approaches, consider for example a liberalised industry characterised by a large number of monopoly markets. As discussed above, entry into such monopoly markets is on the one hand (normally) very desirable from a welfare perspective (it gives access to the general merits of competition), but on the other hand it is often relatively difficult (because entry deterrence and encouragement of exit might be relatively easy to achieve). In such an environment, it might be welfare-enhancing to introduce a conditional per se approach like the following: 'If the entry attempt fulfils certain conditions and takes place in a special environment (in other words if entry is most likely to be welfare enhancing), then the incumbent is prohibited from reacting in ways which are highly likely to strongly inhibit entry incentives and/or entry attempts. If the incumbent violates this rule, its behaviour will be automatically suppressed and fined'.

The general motivation for the design of such a conditional per se rule is twofold: First, pre-entry, the incumbent is encouraged to price low, "because otherwise entry will be attractive and the incumbent won't be able to respond" (Edlin, 2002: 955). Second, post-entry the rule will protect entrants from the particular form of strategic behaviour (e.g., predatory pricing above), which could otherwise lead to the failure of the entrant.

At first sight, such ex ante approaches appear to be the silver bullet of antitrust policy, because they seem to reduce or even block the gains of strategic behaviour almost for free. However, a closer inspection unfortunately reveals that the practicability of such approaches is often quite low. In addition to the general disadvantages of per se rules and ex ante antitrust action (consider for example the high information needs, the low flexibility and the introduction of a Type III antitrust error), such approaches are particularly challenged by a consistency problem. This problem emerges when one strategic option (out of the entire toolbox of strategic

behaviour) is scrutinised by antitrust policy, while other options (which might be substitutes) are assumed to be independent.

This 'independency' assumption bears problems, as it denies the fact that selective changes in antitrust policy obviously affect the relative advantages of the mechanisms of strategic behaviour. Under the assumption that the strategic choices of a dominant firm grow primarily out of the specific industry structure, such selective antitrust rules would most likely lead to switches between anticompetitive strategies rather than the intended complete disappearance of strategic behaviour.[255]

To illustrate the argument, imagine a scenario with a perfectly enforceable (but costly) per se rule targeting one certain form of strategic behaviour (such as predation). Such a perfect rule might not lead to the intended aim of more competition in the market but simply to a switch by the incumbent from the now prohibited and deterred strategy to a substitutive strategy (e.g., capacity investment), which is permitted or more difficult to identify by the antitrust authority. In the worst case scenario, antitrust action would lower overall welfare twice, because the general enforcement costs are used to achieve the switch to a strategy which is more harmful to society (and the incumbent) than the previous (see Smith, 1984: 521).[256]

In a nutshell, the analysis illustrates that although the per-se-rule approach has some desirable general advantages, the essential conditions for its welfare-enhancing use are not present in each possible case of strategic behaviour. An exception to this could be those environments in which entry is most likely to be welfare-enhancing and the entrant promises 'some degree of efficiency'. In such cases, a conditional per se rule may be (at least in theory) a desirable commitment of the antitrust authority. If and how such rules can overcome the identified problems of practicability (foremost the expected counterproductive reactions of incumbents to such rules) should be the focus of further research.

3.5.2.3 Rule-of-Reason Approach

The rule-of-reason approach stands for a case-by-case analysis of suspicious behaviour by the antitrust authority and the courts, respectively. Broadly, it is used when a per se rule is not applicable; that is, particularly when certain business behaviour cannot be clearly identified and/or its influence on welfare cannot be generally determined. Consequently, from a procedural point of view, the rule of reason allows the antitrust authority considerable administrative discretion.

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255 Nitsche (2002) shows in an entry game that the introduction of ex post predation rules can be detrimental to total welfare and to consumer welfare because incumbents choose a strategic response to the new legal environment. In his model, large incumbents crowd the product space in order to reduce the number of profitable entry opportunities for rivals.

256 One recently proposed way to mitigate such problems is to switch from a form-based approach to an effects-based approach in cases of exclusionary conduct (see Box 27 in chapter 2 for a characterisation).

At first sight, such a comprehensive case-by-case analysis might appear like the optimal general antitrust reaction to strategic behaviour, as it has advantages such as fairness or the minimisation of antitrust errors (see Black, 1997: 152, for a further discussion). However, when enforcement costs and predictability matters are taken into account, it becomes apparent that an inclusive analysis of every single case at hand would be a very expensive and inefficient undertaking (see Joskow and Klevorick, 1979, for a complete treatment). Consequently, with the aim of concentrating resources and efforts on the likely cases of anticompetitive strategic behaviour, the antitrust authority must filter out the unlikely cases at the earliest point possible during the investigation.

How would such a 'filtering procedure' take place, keeping the general finding in mind that the economic profession cannot "provide a universally valid set of conditions that can be used by competition authorities as a safe checklist in their rule of reason analyses" (Ahlborn et al., 2003: 56)? The central idea is to use essential (robust) preconditions for strategic behaviour and suitable economic lines of argument (at-best models). The questions investigated are as follows: Is anticompetitive strategic behaviour in a certain case possible (first filter), plausible (second filter) and possibly offset by efficiency benefits (third filter)? This basic structure of a policy framework for strategic behaviour is outlined below (see Ahlborn et al., 2003, especially for an application to the tying strategy).

First filter: Is strategic behaviour possible?

The first filter has the function to rule out cases in which strategic behaviour is impossible or extremely unlikely. Here the robust theoretical knowledge concerning essential preconditions of successful strategic behaviour is largely applied. If such preconditions cannot be observed in the actual case, the business behaviour must be explained differently and the case can be closed (at least as far as strategic behaviour is concerned).

The most robust precondition for successful strategic behaviour is some degree of market power. Therefore, cases in which a firm is alleged to behave strategically but does not have a considerable degree of market power can be closed immediately without causing further costs. Other necessary preconditions for strategic moves are the existence of a first-mover advantage, information advantages, a credible commitment and the possibility to send/receive signals. Besides these basic preconditions of strategic moves, other structural characteristics of the market might influence the general probability of strategic behaviour (see Scherer and Ross, 1990: 5). Important basic conditions on the supply side could be technology, product durability, business attitudes or the legal framework. On the demand side, especially price elasticity, substitutes, growth rates or the cyclical or seasonal character of the industry should be considered. The market structure (in the narrower sense) can be examined via the assessment of entry barriers, cost structures, the general status of competition, product differentiation, vertical integration, attributes of (potential) entrants (e.g., the likelihood of exit and the abilities to react)

and the maturity and dynamics of the market (particularly relevant for examining the role of reputation effects).[257]

In short, a case will have to face the second filter if the antitrust authorities or courts can reasonably expect that anticompetitive strategic behaviour could occur and could impose significant economic losses on society.

Second filter: Is strategic behaviour plausible?

The second filter has the function to find logical (theory-based) and likely (case-based) arguments making the observed behaviour "plausible ex-ante and probable ex-post" (Bolton et al. (2000: 2266). To reach this aim it is first necessary to generally assess market conduct (e.g., pricing behaviour, product strategy, research and innovation, plant investments, managerial incentives or legal tactics). Second, suitable lines of argument (at best suitable economic models) as well as supporting empirical evidence are needed to prove anticompetitive strategic conduct. In other words, the antitrust authority must present an explanation which clarifies the general rationality, the actual occurrence and the anticompetitive impact of the presumed strategic mechanism. In this respect, the second filter follows the instinct of Spence (1981: 58): "My instinct as an economist is to study industries on a case-by-case basis, applying and adapting models as appropriate."

Third filter: Are there offsetting efficiency benefits of strategic behaviour?

Ideally, only cases of anticompetitive strategic behaviour will have to face the third filter. Before such conduct is prohibited (and possibly fined), the antitrust authority has to examine if the behaviour generates efficiencies which offset the anticompetitive effects and which can only be achieved through anticompetitive strategic behaviour (the 'no-less-restrictive alternative' requirement (see Bolton et al., 2000: 2277). It is obvious that the third filter uses the information collected in the previous two stages, supplemented by further internal information from the parties (e.g., cost data). Additionally, some projections or scenarios of the likely future development of the industry, with and without terminating strategic behaviour, and the (dynamic) effects on competition and consumer welfare would become necessary.

With respect to the discussed major problems faced by antitrust analysis of strategic behaviour, the rule-of-reason approach has one important advantage: it directly addresses the central identification problems. This does not mean that the probability of antitrust errors is zero, but a diligent use of the approach minimises the occurrence of such errors, assuming that the antitrust authority has sufficient economic knowledge and enforcement budgets. Furthermore, the rule of reason has clear flexibility and fairness advantages compared to per se rules, as the pecu-

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257 It is beyond the scope of this chapter to show more precisely how these market structure characteristics interact with the rationality and the success of strategic behaviour. Such assessments obviously depend on the kind of strategic behaviour used. See Bolton, 2000, for an application to the predatory pricing strategy and Ahlborn et al., 2003, for an application to the tying strategy.

liarities of every case are examined and estimated during the investigation. These flexible investigations lead to another advantage of the rule of reason: new economic knowledge is easier and quicker to adopt than in a per se approach. This characteristic reduces antitrust errors further and enhances antitrust decisions (see section 2.4 for a further discussion).

Some disadvantages of the approach which should be taken into account while designing policy frameworks are, for example, that the framework approach provides only a very broad structure for analysis, which must be substantiated for special cases in special industries (complexity problem). It is obvious that such substantiation exacerbates the main problems of the rule-of-reason approach: it is often rather costly and time-consuming to implement (enforcement cost problem). In particular, the long processing time of the antitrust authority creates difficulties in situations where strategic moves are successful (e.g., induced market exit) before the antitrust authority is in the position to intervene (time lag problem). A further general problem lies in the large information needs of the concept. In order to make an informed framework-based decision, extensive industry and case data is necessary (information problem). Furthermore, as indicated above, the rule-of-reason approach sets high standards regarding economic competence in the antitrust authority and general enforcement cost budgets (competence and budget problem). Besides, as the rule-of-reason concept imparts the antitrust authority with vast administrative powers, a further channel of influence by political and private interest groups is opened (regulatory capture problem). This might reduce the optimality of antitrust decisions.

However, despite the disadvantages of the rule-of-reason concept as discussed, the major advantages (in addition to the disadvantages of the other approaches discussed above) support the application of this concept to problems of strategic behaviour. Exceptions might be cases in which the antitrust authority lacks sufficient resources (especially knowledge and manpower) to perform rule-of-reason analyses. In such cases, the application of a conditional per-se-rule approach might be preferable to simply doing nothing against anticompetitive strategic behaviour.

Complementary to all three antitrust approaches, a further way to fight undesirable strategic behaviour and to improve market performance could be an approach which reduces entry barriers. Box 37 discusses several examples of *entry stimulation* from the airline industry.

Some researchers generally favour this approach, because it is easy to implement and it minimises Type I errors as well as enforcement costs (see, e.g., Porter, 1981: 493ff.). Besides the fact that reducing entry barriers has in most cases indeed the potential to promote competition by enhancing the possibility and probability of entry, it is questionable if such an approach can act as a perfect substitute to some form of antitrust intervention. One problem which supports this sceptical judgment is that the reduction of mainly structural entry barriers does not necessarily lead to a reduction of strategic behaviour, but rather to an increase. The reason is the following: The reduction of mainly structural entry barriers does not erase the incentives of incumbents to impede entry. Such moves might still be profit-maximising and incumbents will use the cheapest instrument to reach their

aim. Therefore, if the structural entry barriers are reduced, a corresponding increase in strategic behaviour can be expected. Consequently, a reducing entry barriers approach might have a positive effect on the growth of strategic behaviour in the market. This in turn would reinforce the call for some form of antitrust policy.

Box 37. Examples of entry stimulation in the airline industry

One possibility to stimulate entry into airline markets is to reduce the loyalty effects of FFP, for example, by a taxation of these programs. Such a step would reduce the value of FFP for the customers and might therefore increase the demand potential for entrants. Further possibilities of entry stimulation include steps to ease access to essential facilities such as landing rights (e.g., by the introduction of slot trading in slot clusters; see Hüschelrath, 1998a: 253ff.) or airport gates (e.g., by the introduction of entrepreneurial gates; see Hüschelrath, 1998b: 259ff.).

A further problem which limits the influence of the reducing entry barriers approach is that antitrust authorities often do not have the executive powers to change policy parameters in favour of entry conditions. For example, the antitrust authority normally has only limited influence on tax levels, independent of the question whether they act as an entry barrier in an industry or not. In conclusion, although it is undisputed that reducing entry barriers is desirable in most industries, such an approach is not a substitute but rather a complement to the development and enforcement of antitrust rules.

3.6 Summary and Conclusion

What is meant by *strategic behaviour*? What are necessary preconditions for strategic moves, and which different strategic options are available for incumbents? What are the welfare consequences of strategic behaviour and – in direct connection – what role should antitrust policy play? The aim of this chapter was to provide high-level answers to these fundamental questions. This characterisation of strategic behaviour of incumbents is important for better understanding not only competitive interaction and antitrust policy in general, but also the following chapter on predation as one option from the toolbox of strategic behaviour for incumbents in particular.

After a short introductory section, section 3.2 concentrated on the initial characterisation of strategic behaviour from an industrial organisation point of view. It was shown that a successful strategic move is based on at least five necessary conditions: a dynamic context, a first-mover advantage, some form of (credible) commitment, some form of communication and last but not least some degree of market power. If these conditions are present, an incumbent is able to undertake a successful strategic move, meaning that by altering its own actions it can induce the rival to adopt a course of action more favourable to itself.

The interrelation between strategic behaviour and entry was assessed in more detail in section 3.3. After reviewing the general importance of entry for competi-

tion and market performance, the first focus lay on an analysis of the drivers of a firm's entry decision and an incumbent's (re)action to such entry. In both cases, the decision is dependent on its 'profitability' and its 'possibility'. The entrant will enter the market if the net present value of the expected post-entry profits is greater than the sunk costs of entry and if entry is not blocked or deterred by structural entry barriers. The incumbent will generally react to entry threats by acting in a way that raises rivals' costs or reduces rivals' revenues. The precise ways to reach this aim are diverse. One option for the incumbent is to increase the structural entry barriers with the aim of making entry impossible or at least unprofitable. As this strategy might not be sufficient or too expensive to deter entry, the incumbent might think about further strategic moves to secure its monopoly profits. The rationality and success of such moves depend on the difference between the monopoly and the duopoly profits, the level of the sunk investment and the difference between the duopoly profits and the profits during a fight (after entry of the rival). Even if the result of such a calculation is that entry deterrence is not profit-maximising, strategic behaviour might still act as an instrument to create an advantage in post-entry market competition.

Based on this notion of strategic behaviour, the second focus of section 3.3 was an assessment of the potential advantages of incumbents. The results show that incumbents often have market power and information advantages that allow them to raise structural barriers and to use some form of strategic behaviour. The strategic advantages of incumbents can be classified into pre-entry options (e.g., product proliferation, blocking entry through contract, limit pricing or capacity investment) and post-entry options (e.g., entry accommodation, marketing mix reactions, raising rivals' costs or predation). The incumbent can choose one or combinations of different options to reach its aim of maintaining monopoly profits.

After analysing the individual rationality of strategic behaviour for an incumbent, sections 3.4 and 3.5 focused on the question of how antitrust policy should (re)act to such strategic moves. A sound economic answer to this question must contain assessments, first, of the welfare effects of strategic behaviour, second, of the essential features of antitrust policy and third, of approaches to intervene using antitrust tools which have the potential to enhance economic efficiency and welfare. Generally, it was found that antitrust policy's central aim is maintaining and improving economic efficiency. Competition (as the central instrument to achieve economic efficiency) is endangered by exploitative and exclusionary behaviour of firms with considerable degrees of market power. Antitrust policy can react to these challenges with the implementation of different types of control strategies, which can be applied ex ante or ex post. However, all potential options contain the possibility of antitrust errors and therefore welfare-reducing case decisions.

In order to decide which antitrust reaction to strategic behaviour is appropriate, an examination of the likely welfare effects of such behaviour is essential. In cases of entry deterrence in monopoly markets, negative welfare consequences are most likely, because such moves foreclose the social gains of competition. But even in such cases, phenomena of socially inefficient entry (e.g., natural monopolies, patent protection and high switching costs) prevent an unambiguous negative welfare judgment. It is obvious that such a clear judgment cannot be reached either in

cases of entry deterrence in oligopolistic industries or in cases of accommodated entry. Therefore, two important conclusions of the welfare assessments are, first, that the welfare implications of strategic behaviour are diverse and, second, that entry into an industry is not always socially desirable.

These results are an important input requirement for assessing an appropriate antitrust reaction to strategic behaviour. Generally, three policy options are available: a do-nothing, a per-se-rule and a rule-of-reason approach. The decision between these options particularly depends on the characteristics of the strategy in question (especially its clear identification and welfare consequences), as well as on an assessment of enforcement cost and antitrust errors. A discussion of the policy options showed that the do-nothing approach is the least attractive option. Due to the diverse welfare effects and identification problems of strategic behaviour, a general per se rule can also be ruled out as an appropriate antitrust reaction. The theoretically attractive idea of some kind of conditional per se rule (subject to certain environments and certain attributes of the incumbent and the entrant) is often also flawed, because such rules do not take the strategic responses of incumbents into account.

Partly due to the disadvantages of these approaches, the application of a rule-of-reason or case-by-case approach was identified as the appropriate antitrust reaction to strategic behaviour. In order to make this approach operable (especially to impede the expensive examination of every case at hand), the antitrust authority must promptly identify those cases in which anticompetitive strategic behaviour is unlikely. Such a filtering procedure or framework approach should analyse the following: 1) Is strategic behaviour possible? 2) Is strategic behaviour plausible? 3) Are there offsetting efficiency benefits of strategic behaviour? In addition to the compulsory assessments of market structure and market conduct in such a framework, the antitrust authority must develop an explanation clarifying the general rationality, the actual occurrence and the anticompetitive impact of the presumed strategic mechanism. If these anticompetitive effects are not offset by efficiency benefits, the antitrust authority must prohibit this form of anticompetitive strategic behaviour.

In summary, the chapter showed that strategic behaviour can be a rational strategy for an incumbent firm facing an entry threat. As long as such strategic moves deter entry into monopoly markets, negative welfare effects are likely. In other markets, the probable welfare effects become unclear. When the identification problems of strategic behaviour are taken into account as well, the need for some antitrust action can best be met by the application of a rule-of-reason (case-by-case) approach. Although the difficulties with this approach should not be neglected when designing policies, it is unlikely that they would lead to the introduction of error-prone per se rules or even the complete abandonment of any kind of antitrust action. On the contrary, the problems with the rule-of-reason approach should provide a motivation for further economic research in antitrust economics. The positive influence of such research efforts on the quality of antitrust decisions during the last decades is beyond controversy.

4 Fighting Predation

In the long run, predatory pricing will reduce the number of airlines, ultimately cutting the number of flights and choices available, particularly in smaller markets. This will leave the few surviving airlines free to price just as high as they want for just as long as they want.

CEO of a major US airline,
quoted in Dempsey (2001: 2)

4.1 Introduction

The major interest of antitrust law and economics with respect to predation strategies has been largely twofold. On the one hand, there has been a lively discussion on the question whether predation can basically be a rational strategy for an incumbent facing an entry threat. On the other hand, research has focused on the problem of how an antitrust authority could and should detect predation strategies and especially distinguish such abuses from socially desirable, procompetitive behaviour. The focus of this chapter, however, is to think beyond these two standard questions of rationality and detection and to concentrate on a third stage in the antitrust analysis of predation: intervention. This stage acknowledges the necessity of appropriate detection rules for efficient predation enforcement, but it uses these insights to answer the complementary question of how these rules should be linked to intervention against predation strategies. As developed in chapter 2, thoughtful answers to the intervention question are key in the development and implementation of an integrated approach of antitrust analysis which aims at creating and maintaining an efficient antitrust policy.

Antitrust law and economics have developed two policy options for predation enforcement: an ex ante approach and an ex post approach. The former uses certain commitments of the antitrust authority to deter the occurrence of predation. An example of such a commitment would be an announcement that the authority will force the incumbent to keep its post-entry price for a certain period even after the entrant has left the market. The latter addresses the questions, What should be done with a dominant firm after the antitrust authority has proved predatory conduct? Should the firm only be forced to abandon its predatory behaviour, should it pay a fine, or are other interventions, such as the prohibition of certain forms of

market conduct, the right way to intervene against predatory behaviour ex post? Furthermore, given the availability of ex ante and ex post approaches as enforcement alternatives, the question is raised whether one option dominates the other in terms of its welfare effects or, alternatively, whether the optimal choice of the enforcement option depends on the presence of specific characteristics of the market, the incumbent, the entrant or the antitrust authority.

It is the aim of this chapter to provide answers to these key questions of optimal predation enforcement and to incorporate them into the development of a predation enforcement framework. In order to reach these aims, the chapter is structured into six sections which follow the general structure of the integrated approach of antitrust analysis developed above. The second section aims at characterising what should be understood by the term *predation*. In section 3, the literature on whether predation can be a rational (i.e., profit-maximising) strategy for an incumbent facing an entry threat is reviewed. Based on affirmative theoretical and empirical research, the fourth section focuses on assessing the welfare effects of predation strategies. Given the finding that predation strategies typically cause negative welfare effects, the fifth section explores how to enforce predation strategies. The chapter is introduced by a review of the vast amount of literature on how to detect predation. These insights are seen as important input for answering the question which lies at the heart of the chapter; namely, how predation should be fought. Consequently, after proving the practical relevance of such an assessment by providing an overview of recently decided predation cases in various jurisdictions, a Cournot oligopoly model is developed and applied to study the problem of optimal predation enforcement. The model approach, which takes account of efficiency advantages of the entrant, allows analysing the welfare effects of various enforcement options, such as a no-rule approach; an ex ante, per-se-rule approach; and an ex post, rule-of-reason approach. After deriving general theoretical results, specific demand and cost functions that assist in quantifying and interpreting the (applied) results are introduced, thereby delivering further insights into optimal predation enforcement in a world of certainty and perfect information as well as in a world of uncertainty and imperfect information. The results of the formal approach are subsequently incorporated into the development of a predation enforcement framework which aims at increasing the deterrence effect of predation strategies without biasing the fundamentally important incentives of firms for procompetitive price decreases. Section six concludes the chapter by summarising the key insights and delineating further research needs.

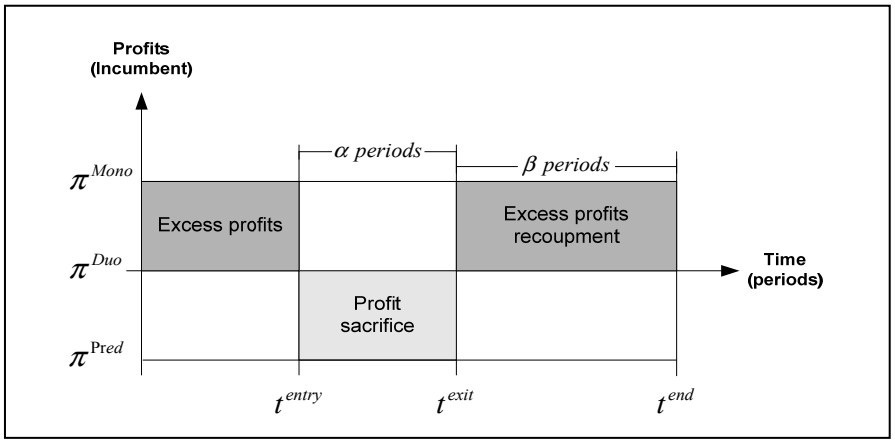
4.2 Characterising Predation

A fairly large number of definitions of *predation* exist. Cabral and Riordan (1997: 160), for example, define an action as 'predatory' if "a different action would increase the likelihood that rivals remain viable and … the different action would be more profitable under the counterfactual hypothesis that the rival's viability were unaffected." According to Farrell and Katz (2001: 2), predatory behaviour can be

schematically thought of as occurring in two phases: a predation phase and a recoupment phase. In the first phase, the predator tenders a product that offers 'too much value' to consumers (e.g., the price is too low, the quality is too high, or the product is too innovative)[258] and thus weakens rivals. In the second phase, the recoupment phase, the predatory firm takes advantage of the weakened rival and reduces the consumer value of its products to a level below the competitive one.

Based on this initial characterisation, Figure 47 clarifies the general business concept of a predation strategy by plotting the profits of the incumbent over time. Initially, a market in which a single incumbent sets the profit-maximising (monopoly) price is assumed. The incumbent gains a so-called *excess profit*, which is defined as the difference between the monopoly profit π^{Mono} and the duopoly profit π^{Duo}. At point t^{entry}, a rival firm enters the market[259]. If the incumbent accommodates the rival in the market, both firms would realise π^{Duo}. In a Cournot equilibrium, the profits of both firms are assumed to be positive[260] but of different size as long as both firms are not symmetrical in terms of their cost structures and production capacities. If the incumbent accommodates the entrant, it would lose its excess profit.

Fig. 47. Predation investment in future excess profits



258 Without wanting to deny the relevance of *non-price predation*, the chapter concentrates on *price predation* (or *predatory pricing* synonymously).

259 In the remainder of this chapter, predation is understood as an instrument of a dominant firm – but not necessarily a monopolist – to defend its dominant position in the context of entry. While such a definition coincides with most research, there are also deviating views (see, e.g., Adams et al., 1996, or Posner, 2001: 209 and antithetic Newton, 1999).

260 In technical terms, this assumption secures that there is room for an entrant in a competitive Nash equilibrium and that only the incumbent's pricing policy turns this entry value negative. See Phlips, 1995: 230ff.

Besides entry accommodation, the incumbent might think about the possibility of lowering the price, raising the quality, etc., by such an amount that the entrant makes losses and is forced to exit the market at point t^{exit}. Although the incumbent has to sacrifice profits during the predation period, he might regain its old monopoly position and the corresponding monopoly profit π^{Mono} until the market ends or another rival firm enters the market.

Following the set-up in Figure 47, the profitability of the predation investment depends on especially five factors: (1) the level of losses in the predation period ($\pi^{Duo} - \pi^{Pred}$); (2) the level of excess profits after the exit of the entrant ($\pi^{Mono} - \pi^{Duo}$); (3) the number of predation periods α; (4) the number of periods after the exit of the entrant β and (5) the discounting factor of future profits[261] δ. The specifics of these key success factors of predation strategies are determined by numerous market characteristics. Consider for example barriers to entry. The overall profit in the post-predation phase depends on the level of the excess profits and the length of the post-predation phase. The length of the post-predation phase depends on the possibilities (and profitability) of other firms to enter the market (e.g., extent of barriers to [re-]entry, [sunk] entry costs). As a consequence, the rationality of predation critically depends on the extent of barriers to entry respective entry costs.[262]

Another example focuses on the perceived strength of the entrant. The profitability of the predation strategy depends on the length of the predation period α, simply because it is one factor that determines the costs of a predation strategy. If the incumbent assumes that the entrant is strong – probably because it has a financially viable parent company – the predation period would likely be too long (or generally unsuccessful) to make predation a profitable strategy for the incumbent. As a consequence, the rationality of predation critically depends on the incumbent's perception of the entrant's strength.

Recent economic research has focused mainly on factors (2) and (4), namely assessing ways by which the predator can recoup its losses sacrificed in the predation period. The most straightforward answer is that it can achieve *changes in market structure* by forcing exit so that it can regain excess profits and strengthen

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261 For simplicity, the rest of the chapter will not discount future profits. However, the general intertemporal adjustment can be derived as follows. In order to make predation a rational strategy the discounted profits sacrificed (by the incumbent) in the α predation periods

$$\left(\pi^{Duo} - \pi^{Pred}\right)\left(1+\delta+\delta^2+...+\delta^{\alpha}\right)$$

must be the smaller than the discounted excess profits realised in the β post-periods

$$\left(\pi^{Mono} - \pi^{Duo}\right)\left(\delta^{\alpha+1}+\delta^{\alpha+2}+...+\delta^{\beta}\right)$$

Some transformations lead to the following expression

$$\frac{\left(\pi^{Duo} - \pi^{Pred}\right)}{1-\delta}\left(1-\delta^{\alpha+1}\right) < \left(\pi^{Mino} - \pi^{Duo}\right)\delta^{\alpha+1}\left(\frac{1-\delta^{\beta-\alpha}}{1-\delta}\right).$$

262 See Martin (1994: 452ff.) for a more complete roundup.

its dominant market position.[263] Another channel to reach the necessary recoupment are *changes in the nature of competition;* for example, the predator obtains a tough reputation and can deter future entry in the same or adjacent markets.[264] A third possibility to recoup the losses of the predation period is through *changes in the nature of demand;* for example, by (additional) consumers switching from the market-leaving entrant to the predator (see Frontier Economics, 2002).

4.3 Rationalising Predation

Based on this characterisation of predation deriving two basic conditions for rational predation is straightforward. First, the use of such a strategy must expect a positive net present value of the investment, meaning that the benefits gained in period two must exceed the cost stemming from period one (*effectiveness condition*). Second, in the decision situation at hand there must be no superior alternative strategy, meaning that no strategy is available which could reach the same profit level with less cost burden or a higher profit level with the same cost burden (*efficiency condition*). If one of the two conditions is not fulfilled, predation becomes an irrational strategy and the observed price cuts must be explained differently.

Focusing on the *efficiency* question first, one frequently cited argument for the irrationality of predation strategies is that in any situation in which predation would be profitable, it is not profit-maximising for a long-run profit-maximising firm. "A dominant firm would be better off acquiring its competitors, colluding with them to fix monopoly prices, or simply accommodating and sharing the profits of oligopoly" (Kate and Niels, 2002: 3). Without trying to prove the theoretical correctness of this proposition (which appears to be challenging at least in a multimarket context), it is obviously based on the presumption that acquisition, collusion or accommodation are suitable and reachable strategic answers to market entry for an incumbent. With respect to mergers and acquisitions it is obvious that such a presumption is critical as soon as some kind of merger control procedure is implemented. Such investigations would foreclose (or at least endanger) the success of strategic mergers, especially in cases where aggressive maverick firms are the target. Collusion as an alternative strategy is often confronted with severe agreement and stability problems; and accommodating might generally be a dangerous strategy in the long run, especially if the entrant is more efficient than the incumbent.[265] Moreover, colluding and accommodating can hardly be suitable

263 Hemphill (2001: 1581ff.) shows that the incumbent might be willing to engage in costly predation even if the total profit is negative, especially in situations in which the entrant is more efficient than the incumbent and the latter has to fear a continuous erosion of its own market share.

264 In other words, recoupment must not necessarily take place in the same market as the sacrifice.

265 However, as Ashiya (2000) shows, the incumbent might welcome weak entrants in the market in order to block other more threatening potential entrants.

general strategies for an incumbent in response to entry, as such conduct would reduce the entry risk of potential entrants and therefore would create some kind of 'reputation for faintness'.[266] Consequently, even in the case that other strategies are more efficient in a certain situation, predation can be some kind of second-best way of maintaining a monopoly position. Posner (1979: 939) fortifies this argumentation by remarking that a firm might prefer predation over strategic acquisitions, as predation is more difficult to detect by the antitrust authorities.

The *effectiveness* question is the general focus of most research on predation and produced a multitude of arguments in favour of or against its rationality. Starting with the simple delineation of predation in two periods, the arguments of the opponents are based on two simple, interrelated arguments. First, the incumbent's losses in the first period are severe because of its high market share.[267] Second, the expected gains in the second period are low, in fact, too low to outweigh the severe losses realised in the first period. Some scholars find it implausible, for instance, that the predator can foreclose the market effectively for new entrants in the post-predation period, especially if new entrants can buy the equipment of the market-leaving prey. A further argument states that investors have a profit-driven incentive to help efficient victims with credits to survive the predation period. As a rational predator can foresee this, the predation strategy becomes unprofitable and therefore irrational.

It is the merit of game-theoretic research to have investigated the correctness of such arguments in a rigid analytical framework. The fundamental results show that predatory actions could indeed be optimal strategies in a world of incomplete or asymmetric information. The so-called models of *financial market predation* address the question of why investors should not have an incentive to help efficient victims to survive the predation period. One answer is that, due to information asymmetries in efficient capital markets, investors do not know exactly the efficiency of the entrant and the entrant has incentives to covey a "misleading optimistic impression of its ability to survive" (Martin, 1994: 461). Given this incomplete information combined with opportunism, investors will not provide capital or at best a risk premium which increases the costs of the entrant.

The *signalling and reputation models* both consider low prices as instruments of the incumbent to mislead the (less informed) entrant into believing that market conditions are unfavourable for entry. One type of signalling models argues that a low price could (under certain conditions) be interpreted as a signal for the efficiency of the incumbent (e.g., if the entrant believes that the incumbent's low prices reflect low costs). The reputation models focus on the rationality of a price

266 Following Stigler (1950) and Salant, Switzer and Reynolds (1983), firms in an oligopoly might have limited possibilities of eliminating rivals by mergers, since the costs of such concentration are mainly carried by the acquiring firm, while the gains are spread to all firms in the industry.

267 This argument assumes that the incumbent has to sell every unit of its product at the predatory price. If price discrimination is possible during the predatory pricing period, such as in the airline industry, the costs for the incumbent might be substantially lower.

reduction in one market by means of establishing a reputation as a tough price cutter in other markets (see Bolton et al., 2000: 2299ff.). This reputation might induce the entrant to retreat from entering the same or an alternative market in which the incumbent is active.

Empirical studies on predation are relatively rare and often analyse historical cases (see Scott Morton, 1997: 683f., and Kaplow and Shapiro, 2007: 115f., for short surveys). Early studies such as the one by Koller (1971) were influenced by the belief that predation is typically irrational. He investigated 26 cases from 1907 to 1965 in which the defendant was found guilty of predatory pricing. In only 7 of these 26 cases, Koller was able to extract 'below-cost pricing with predatory intent'.[268]

The majority of the more recent empirical studies, however, confirm the theoretical finding that predation can be a rational strategy for an incumbent. Weiman and Levin (1994), for instance, find for the US telecommunications industry at the beginning of the twentieth century that Southern Bell Telephone priced below cost in areas where it faced rivals and, as a consequence, managed to get rid of most of these rivals by 1913. Genesove and Mullin (2001, 2006) study entry into the sugar refining industry before World War I. They find evidence that the price wars following two major entry episodes were predatory by a) undertaking direct comparisons of prices with marginal costs and b) by constructing predicted competitive price-cost margins. In another study, Lerner (1994) looks at the effect of entrant characteristics on pricing and finds that healthy firms choose a lower price for products which are located in the product space next to products of financially constrained firms aiming at driving those weak firms out of the market. These results can be explained by a financial market (or 'long-purse') predation theory sketched above.

Scott Morton (1997) examines the outcomes of cases of entry by merchant shipping lines into established markets around the turn of the last century. These established markets were dominated by an incumbent cartel composed of several member shipping lines. In the event of entry, the cartel made a decision whether or not to trigger a price war. As a consequence, it was observed that some entrants were formally admitted to the cartel without any conflict while others were forced out of the market by lowering prices substantially. Scott Morton (1997) uses characteristics of the entrant to predict whether or not the entrant will encounter a price war after entry. Her results show that 'weaker' entrants (in the sense of having fewer financial resources, less experience, smaller size or poor trade conditions) are fought while 'stronger' entrants are accommodated. These empirical results also provide support for a financial market (or 'long-purse') predation theory.[269]

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[268] In a follow-up study, Zerbe and Cooper (1982) took Koller's collection of cases and extended the sample with cases until 1982. For this enlarged sample, they find that predation was present in 27 out of 40 litigated cases.

[269] Additionally, the analysis of Scott Morton (1997) suggests that it might be helpful in predatory pricing cases not only to examine the characteristics of the incumbent but also to take the characteristics of the entrant into account.

Burns (1986) investigates whether predatory pricing reduces a trust's costs of acquiring its competitors. For the case of the American Tobacco Company between 1891 and 1906 he found that predation significantly lowered the acquisition costs of the tobacco trust for asserted victims and, through reputation effects, for competitors that are subsequently bought 'peacefully'.[270]

The experimental research conducted in the field of predation can be structured into single market designs and multiple market designs (see Gomez et al., 1999, for a roundup). In one of the first predatory pricing experiments, Isaac and Smith (1985) chose a single market design and were unable to produce predatory pricing in a (varied) structural environment that was ought to be favourable to the emergence of predatory pricing: two firms (one large, one small), a cost advantage of the larger firm over the smaller firm, a deep pocket possessed by the larger firm, sunk entry cost and incomplete information (at least in several experimental designs). In the aftermath of the Issac and Smith study, Jung et al. (1994) conducted an experiment that implemented repetitions of a simple signaling (chain-store) game in which one outcome can be interpreted as 'predatory pricing'. They chose a design with weak monopolists, whose single-period best response is to accommodate entry, and strong monopolists, whose dominant strategy is to fight entry. The results of the experiments demonstrate "that one can find predatory pricing and that it pays under some economic structures, so that allegations of such activity outside the laboratory cannot be simply dismissed as sour grapes on the part of the prey, or economically 'irrational' actions on the part of the predators" (p. 91). An important objection to the experimental design of Isaac and Smith is the single market context. Harrison (1988) constructed one of the first multiple market experiments by implementing five simultaneous, posted-offer markets with eleven sellers. This multi-market version of Isaac and Smith's design was able to produce predatory pricing. Another multiple markets experiment was conducted by Gomez et al. (1999). In their set-up, which is based on the approach of Harrison, the prices are chosen after entry decisions are made and announced. Therefore, the incumbents knew when to enjoy monopoly profits and when to punish. This setup resulted in reliable predation in most markets.

In a nutshell, rationality research clarifies that predation is not a universal monopolisation strategy which can be used profitably at any time by every dominant firm in every industry. Successful predation rather depends on the specifics of various market characteristics, such as entry barriers, capacity constraints, consumer behaviour, the level of product differentiation, multi-market contact, characteristics of the entrant and, last but not least, the informational situation present in the market (see Kate and Niels, 2002, for a detailed overview). This knowledge will help to cope with stage three ('enforcing predation') later on.

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270 Saloner (1987: 165 ff.) shows in a theoretical paper that a price-cutting phase before a merger might be rational because, first, it can convince the rival to sell out on favourable terms and, second, it signals to potential entrants that entry is unprofitable.

4.4 Welfare Effects of Predation

In the preceding section it was shown that predation can, under certain circumstances, be a profit-maximising business strategy for an incumbent facing entry. However, considering any kind of antitrust action against such a business strategy requires proof of its potential to impose overall negative welfare effects on society. The consequential question of how to measure welfare in an antitrust context is subject to ongoing discussions among antitrust scholars (see Farrell and Katz, 2006, and section 2.3.2 for an overview). While some researchers argue that antitrust should aim at maximising overall efficiency, others recommend concentrating on maximising consumer surplus or productive efficiency. An oftenmentioned advantage of the consumer surplus standard is that a maximisation of the consumer surplus coincides with a minimisation of the deadweight loss. However, a total welfare standard might be preferred simply because the producer surplus could be interpreted as just another form of consumer surplus.[271]

In the remainder of this chapter, a total welfare approach is followed. However, whenever it can be expected that the welfare standard considerably matters, the differences between a total welfare approach and a consumer welfare approach will be quantified and discussed. With respect to the assessment of the overall welfare effects of predation, it is helpful to split up the overall welfare effect into its components (i.e., consumer surplus and producer surplus, consisting of incumbent's profits and entrant's profits) and analyse them separately in the first place. This is sketched out in Figure 48.

The *consumer surplus effects* of a predation strategy are depicted in Figure 48-1. The starting point is a monopoly market in which the incumbent sets the monopoly price and the consumers realise a relatively small consumer surplus CS^{Mono}. In accordance with most (non-collusive) oligopoly models, it is reasonable to assume that the consumer surplus rises (here to CS^{Duo}) if a second firm enters the market at point t^{entry}, because entry typically puts pressure on price and raises overall quantities. Moreover, it is consequential to assume that the consumer surplus during the predation period, CS^{Pred}, is even higher than in normal duopoly competition.[272] In the post-predation period, the consumer surplus level depends on the successfulness of the predation attempt. If the entrant has to exit the market in t^{exit}, the consumers again only realise the small monopoly consumer surplus CS^{Mono} until the market ends or another firm enters the market at t^{end}. However, if the entrant somehow survives the predation period, the consumers can enjoy the higher consumer surplus CS^{Duo} for the rest of the post-predation period. Therefore, from an isolated consumer welfare perspective, it is essential to keep the entrant in

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271 This is basically because consumers are shareholders of the companies who realise the profit and therefore in the longer run pocket the producer surplus as well. See Motta (2004: 39ff.) and OFT (2002) for a discussion. Recent theoretical research on predation and mergers has made increasing use of a consumer welfare standard. See, e.g., Cabral and Riordan (1997); Neven and Röller (2006).

272 Sufficient capacities, which allow the saturation of the risen demand, and the absence of price discrimination are assumed.

the market to realise the higher consumer welfare under competition. In fact, consumer welfare when predation takes place (but is unsuccessful) is higher than when the incumbent accommodates the entrant.

The *entrant's profits* are another welfare component which has to be considered in a total welfare analysis. As Figure 48-2 shows, the entrant makes zero profits in the pre-predation period and realises even negative profits during the predation period. If the entrant manages to survive the predation period, it realises a duopoly profit until the market ends or another firm enters the market. Therefore, from the isolated viewpoint of the entrant, it is profit-maximising for him to be accommodated. If the incumbent decides to predate, the entrant's profits in the post-predation period have at least to outweigh the losses incurred in the predation period to make entry profitable for the entrant.

The *incumbent's profits* (Figure 48-3) are at the high monopoly level in the pre-predation period and drop, because of the predation strategy, to a negative level in the predation period[273] after the entrant has entered the market. As already shown, the profits of the incumbent are assumed highest if it imposes a successful predation strategy (which forces the entrant to leave the market in t^{exit}), as it can then regain its monopoly profits. However, if the entrant survives the predation period, the profits of the incumbent are reduced to a duopoly level and the incumbent consequently loses its excess profits. The *predation investment* of the incumbent – given by the differential between the duopoly profits and the predation profits in the predation period – turns out to be unprofitable.

The *overall welfare effect* of a predation strategy can be derived by adding up the three welfare components just analysed. If the predation attempt of the incumbent is successful, it is shown in Annex 6.6.11 that the net overall welfare would still increase – compared to a continuation of the monopoly situation – as long as

$$CS^{Pred} - CS^{Mono} > \pi_I^{Mono} - \left(\pi_E^{Pred} + \pi_I^{Pred}\right). \tag{75}$$

Inequality (75) basically says that the consumer surplus gain in the predation period has to be larger than the loss in producer surplus in the same period to increase overall welfare. As predation is assumed to be successful, the market performance in the post-predation period is the same as in the 'continuous monopoly' counterfactual scenario and therefore of no relevance for calculating the net welfare effect.

In an alternative scenario, it is assumed that predation is unsuccessful for the incumbent because the entrant somehow survives the predation period. Comparing such a situation with the realised welfare in the scenario of successful predation, it is shown in Annex 6.6.12 that the net welfare increases as long as

$$CS^{Duo} - CS^{Mono} > \pi_I^{Mono} - \left(\pi_E^{Duo} + \pi_I^{Duo}\right). \tag{76}$$

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273 Although the profits of the incumbent are assumed negative in Figure 48, this is not a general characteristic of a predation strategy. As shown in section 4.5.3 below, the size of the profit loss of the incumbent depends on the efficiency of the entrant and the level of fixed costs.

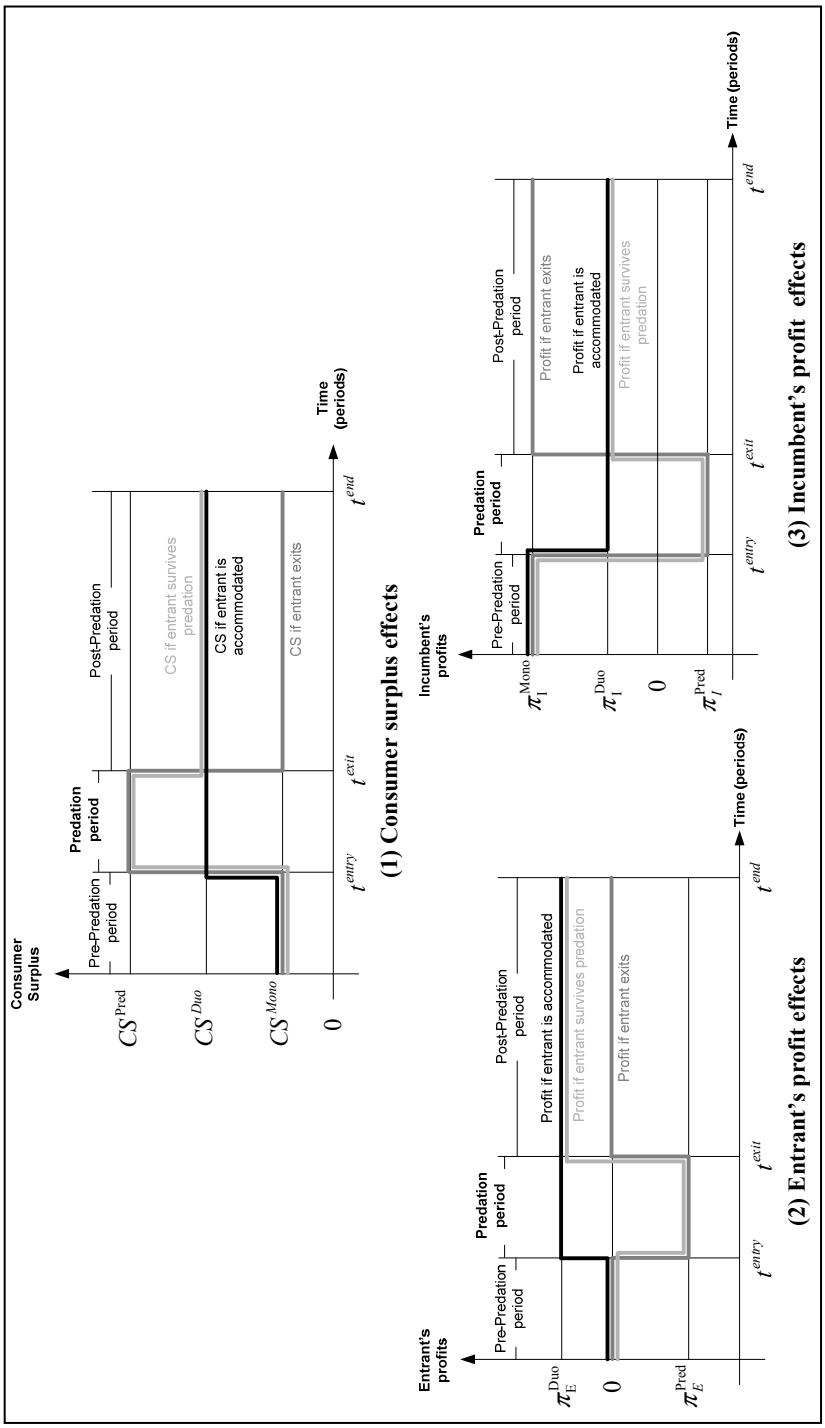

Fig. 48. Isolating the welfare effects of predation

Inequality (76) says that the consumer surplus gain due to increased competition (in the post-predation period) must be larger than the loss in producer surplus due to competition (in the post-predation period) in order to realise a net increase in overall welfare. Due to the deadweight loss caused by monopoly prices, this condition typically holds, and the welfare gain increases with the spread between the pre-predation price level and the price level which would exist under perfect competition. However, there are situations – such as the so-called natural monopoly – in which the derived inequality would not hold.[274]

Summing up the section on the welfare effects of predation, it can be said that making predation unsuccessful by introducing suitable antitrust rules and interventions has the potential to increase overall welfare. This is especially true if it is considered that successful predation in one market may cause spillovers to other markets in the sense that it deters entry into other markets in which the incumbent operates, causing additional welfare losses. It is therefore worthwhile to continue thinking about the design and especially the implementation of rules against predation.

4.5 Enforcing Predation

This section aims at developing a policy framework to enforce rules against predation. It contains four sub-sections. Sub-section 4.5.1 looks at predation enforcement in various legislations, followed by the characterisation of the basic enforcement options in sub-section 4.5.2. Subsequently, a linear duopoly predation model is developed and applied in sub-section 4.5.3 to evaluate the different enforcement options. This is done first in a world of certainty and perfect information and then in a world of uncertainty and limited information. The subsequent discussion of the results and possible extensions of the theoretical approach feeds into the construction of a policy framework to enforce predation in sub-section 4.5.4.

4.5.1 Enforcement in Various Legislations

Aiming at studying how to enforce anti-predation rules, an important foundation is an assessment of the current antitrust practice with respect to predation enforcement in various jurisdictions. Consequently, the following sections will sketch the

[274] Section 3.4.1 discusses the welfare effects of entry in a linear n-firm Cournot model with constant marginal costs. As the first derivatives show, the consumer surplus increases with the number of firms n in the market. However, the producer surplus decreases with n, leaving the overall welfare effect undetermined; its sign depends on the market characteristics. In a natural monopoly, for example, the overall welfare effect of entry would be negative, while it would be positive in a natural duopoly (if the market was supplied by a single firm prior to entry).

relevant legislative statutes (including the provisions which set out the possible fine spectrum) as well as landmark case decisions in the United States, the European Union, the United Kingdom, Germany, Canada and Australia.[275] The focus will be on public antitrust enforcement.

4.5.1.1 United States

In the United States, predation is often alleged as a means of attempted monopolisation proscribed under Section 2 of the Sherman Act (15 USC §2). Alternatively, a predation claim can be brought pursuant to Section 2(a) of the Robinson-Patman Act[276], which, inter alia, proscribes price discrimination by way of selling products below cost in one geographical area while pricing above cost in others ('underselling in particular localities').

Generally, violations of the Sherman Act are criminal and were initially punishable by up to three years' imprisonment and penalties up to $350.000 for an individual and up to $10 million for a corporation. In 1987, the Criminal Fines Improvement Act[277] regulated that fines may exceed these levels to the extent of twice the gross gain derived by the defendant from the offense or twice the gross loss resulting to others, unless imposition of such a fine would unduly complicate or prolong the sentencing process. In 2004, the Antitrust Criminal Penalty Enhancement and Reform Act[278] further increased antitrust criminal penalties from $350.000 to $1 million and the maximum prison sentence from three to ten years. For corporations, the law raises the maximum fine from $10 million to $100 million. The criminal penalties of the new law apply to all entities regardless of the amount of commerce affected. Furthermore, violations of §13a of the Robinson-Patman Act are punishable by up to one year imprisonment and penalties up to $5.000 for individuals. The possible remedies for corporations are, inter alia, the recovery of plaintiff's actual damages, a trebling of the amount proven as actual damages and a judgment ordering the defendant to divest of acquisitions. Despite these general punishment possibilities, however, the results of a recent OECD (2007) report on remedies and sanctions in abuse of dominance cases reveals that the US enforcement agencies currently do not impose fines for monopolisation violations. "They emphasise that a great deal of case-by-case judgment is required to determine whether unilateral anti-competitive conduct was unlawful. They therefore consider it inappropriate to impose fines because it is so difficult to decide whether there was a violation in the first place" (OECD, 2007: 9).

The legal history of predation in the United States can be divided into three periods. During the first period, from the enactment of the Sherman Act in 1890 to

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275 The countries were chosen based on size and on a considerable tradition in antitrust law and economics. For enforcement actions in other countries, see OECD (1989) and more recently OECD (2005).

276 15 USC §§ 13(a), 13a. Kovacic (2003: 411) shows that the importance of the Robinson-Patman Act has declined dramatically since the 1970s.

277 Criminal Fines Improvement Act, 18 USC §3571 (1987).

278 Antitrust Criminal Penalty Enhancement and Reform Act, HR 1086 (2004).

the early 1970s, predation enforcement was taken quite seriously (see Calvani, 1999: 4ff.). An early landmark decision was *Standard Oil Co. v. United States* (1911)[279], in which the defendant was thought to have cut prices below its costs to drive out its smaller rivals, intending later to raise prices and exploit consumers.[280] In order to deter such conduct of 'robber barons', the Supreme Court found Standard Oil guilty of monopolisation and imposed twofold interventions: "first, to forbid the continuance of the prohibited act, and second, to ... dissolve the combination as to neutralise the force of the unlawful power".

The enactment of the Robinson-Patman Act in 1936 led to a new instrument to fight especially below-cost pricing by large firms entering new geographic markets already occupied by smaller firms.[281] This type of predation enforcement reached a peak in *Utah Pie Co. v. Continental Baking Co.* (1967)[282], in which the Supreme Court found the conduct illegally discriminatory, despite the fact that the plaintiff (Utah Pie) had had a dominant share of about two-thirds of the relevant market (Salt Lake City) before entry and was still operating profitably after entry of the defendant (Continental Baking[283]). The decision was largely based on proving sales below average *total* costs and predatory intent. In the aftermath of Utah Pie's successful suit for treble damages and injunction, economists heavily criticised the Supreme Court for protecting competitors instead of competition and consumers (see, e.g., Bowman, 1967: 70ff.). They claimed that the courts need to become more cautious with predation enforcement, as erroneous enforcement deters vigorous price competition and increases prices to the detriment of consumers (see Calvani, 1999: 2).

The second period in the legal history of predation was heralded by the seminal article of Areeda and Turner in 1975.[284] By specifying the established 'criterion of pricing below cost' based on a simple cost-based rule, combined with the general sceptics about predation enforcement in the post-*Utah Pie* era, they changed the US enforcement climate, making it extremely difficult for the plaintiff to prevail in court. Between 1975 and 1982, the plaintiff's success rate fell to only 8% (4 out of 48 cases reported). Before *Utah Pie*, the plaintiff's success rate had been 77% (see Bolton et al., 2000: 2254).

Recognising the difficulties in applying the Areeda-Turner price-cost standard, the court of appeals in *A.A. Poultry Farms, Inc. v. Rose Acre Farms, Inc.* (1989)[285] stated that, to sort out unlikely predation cases before having to conduct difficult

279 *Standard Oil Co. of New Jersey v. United States*, 221 US 1 (1911).

280 It is disputed in literature whether Standard Oil ever actually engaged in a predation strategy (see, e.g., McGee, 1958: 137ff.).

281 In fact, the Robinson-Patman Act was enacted (as an amendment to the Clayton Act) in an effort to stem the growth of chain stores in the United States (see Calvani, 1999: 3).

282 *Utah Pie Co. v. Continental Baking Co*., 386 US 685 (1967).

283 Utah Pie Co. filed suit against Continental Baking Co. as well as against Carnation Co. and Pet Milk Co.

284 See section 4.5.2.1 for a short description.

285 *A.A. Poultry Farms, Inc. v. Rose Acre Farms, Inc.,* 881 F2d 1396, 1400 (1989).

cost assessments, one should first consider the likelihood that the alleged predator would be able to recoup its predation costs. Introducing this 'likelihood of recoupment' defines the starting point of the third period in the legal history of predation in the United States. In *Brooke Group v. Brown & Williamson Tobacco* (1993)[286], the Supreme Court explicitly defined the new two-part test standard. First, the allegedly predatory price must be below an appropriate measure of cost (not specified further), and second, there must be a dangerous probability that the alleged predator will be able to recoup its losses through monopoly prices once its rival(s) exit the market.

Since the *Brooke Group* decision, no single plaintiff has prevailed in court with a predation claim (see Bolton et al., 2000: 2258).[287] Probably the most promising attempt was undertaken in 1999, when the Department of Justice filed a complaint against American Airlines (AA) and its parent, AMR Corp., alleging a scheme of predatory pricing against three low-cost carriers. The government claimed that AA's pricing and capacity decisions on four routes emanating from Dallas/Fort Worth resulted in pricing below cost for certain periods from 1995 to 1998. In 2001, the district court[288] granted summary judgment in favour of American Airlines, because, first, it did not price below an appropriate measure of cost; second, it never undercut but only matched the prices of its competitors; and, third, there was no dangerous probability of AA recouping supposed profits by supra-competitive pricing. In 2003, the court of appeals upheld the district court's grant of summary judgment. [289]

4.5.1.2 European Union

In the European Union, predation is an infringement of Art. 82 of the EC Treaty, which picks out 'abuses of a dominant position' as a central theme. As any other infringement of Art. 81 or 82 of the EC Treaty, convicted predators are subject to interventions. According to Art. 15(2) of Regulation No 17[290], the European Commission can impose fines on undertakings "not exceeding 10% of the turn-

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286 *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.*, 509 U.S. 209 (1993). However, in 2005, the United States Court of Appeals for the Sixth Circuit (*Spirit Airlines v. Northwest Airlines*, 6th Cir, No. 03-1521, 2005) concluded that the district court erred in granting Northwest summary judgment in the *Spirit Airlines/Northwest Airlines* predation case (*Spirit Airlines vs. Northwest Airlines*, United States District Court for the Eastern District of Michigan, Detroit, No. 00-71535). The (private) antitrust case is remanded for further proceedings. The case comprises alleged predatory behaviour of Northwest on certain routes in 1996.

287 See Niels and Kate (2000: 787ff.) for a summary of cases in which the recoupment standard has been applied. Each of these cases found that recoupment was impossible due to a sufficiently competitive market structure, a low market share or low barriers to entry.

288 *United States v. AMR Corp*., 140 F Supp 2d 1141, 1194 (2001).

289 *United States v. AMR Corp*., 01-3202 (10th Cir 2003).

290 Regulation No 17: First Regulation Implementing Articles 85 and 86 of the Treaty, EEC Council, Official Journal P 013, P 0204 - 0211.

over in the preceding business year of each of the undertakings participating in the infringement". In 1998, the European Commission substantiated the method of setting antitrust fines by issuing a guideline[291] stating that the amount of a fine should depend on, in order, the gravity of the infringement (minor, serious, very serious), the duration of the infringement (short, medium, long), the aggravating and attenuating circumstances (e.g., repeated infringement) and final corrections (e.g., the ability to pay in social context).

The legal history of predation in the European Union is relatively short and begins only with the *Engineering and Chemical Supplies Ltd. v. AKZO Chemie BV* (1985)[292] decision, in which the Commission found that AKZO had abused its dominant position in the market for organic peroxides by selling flour additives at unreasonably low prices to damage the business of its smaller rival, ECS. In its explanatory statement, the Commission focused on price-cost comparisons and predatory intent. The Commission stated first that it regarded prices below average variable costs as predatory, as a firm has no interest in applying such prices except to weaken or eliminate rivals. Second, even prices below average total costs but above average variable cost can be regarded as predatory if they are determined as part of a plan for eliminating a competitor (see Bishop and Walker, 2002: 235).

With respect to interventions, the Commission determined that AKZO had to terminate the infringement and had to pay a fine of ECU 10 million. Furthermore, the Commission decided that

> [i]n the circumstances of the present case the Commission considers that it is essential not only to impose a substantial fine on AKZO but also to specify measures to ensure that the infringement is not repeated or continued ... It is also considered necessary to include a provision for reporting to the Commission at appropriate intervals so that the compliance of AKZO with the decision can be monitored.

Consequently, AKZO was committed to furnish for a period of five years a compliance report to the Commission,

> which shall for the year in question list the prices offered and applied by AKZO Chemie BV to each customer for each flour additive in the territory of the EEC, include the internal financial statements for the flour additive business and indicate the basis on which costing was calculated.[293]

In 1997 the Commission adopted a decision against Irish Sugar (1997)[294] for abuse of its dominant position in the market by offering low prices selectively to potential customers of rival sugar suppliers. The Commission imposed a fine of ECU 8,8 million, despite the fact that Irish Sugar only matched but did not undercut the prices of its rivals.[295] The Court of First Instance and the Court of Justice

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291 Guidelines on the Method of Setting Fines Imposed Pursuant to Article 15(2) of Regulation No 17 and Article 65(5) of the ECSC Treaty, 98/C 9/03.

292 *ECS v. AKZO II*, OJ L 374/1 (1985).

293 Ibid., §99ff.

294 Irish Sugar plc, OJ L 258, (1997).

295 This opinion is contrary to the *ECS v. AKZO II* decision, in which the commission argued that "it is not abusive for a dominant supplier to align its prices to match com-

approved the decision but reduced the fine to ECU 7,8 million, which was about 4,6% of the company's annual turnover in the 1995-96 business year.[296]

In *Tetra Pak II* (1997), the Commission and the Court of Justice reaffirmed their basic view on the proof of predation in the *ECS v. AKZO* case.[297] Interestingly, the Court rejected the defendant's argument that it had no reasonable prospect of recouping the losses incurred by the alleged predation strategy. This means – compared to the US approach – that the European Court of Justice has adopted only the first part of the two-tier test of the *Brooke Group* decision. The second tie, 'recoupment', is not seen as a necessary element of predation under Art. 82 (see Bishop and Walker, 2002: 235ff.). However, the Commission and the Court of Justice found that Tetra Pak used its power in the market for aseptic machines and cartons to exclude its rivals in two other markets, namely the markets for non-aseptic machines and non-aseptic cartons, by using different exclusionary strategies, including predatory pricing in the Italian (sub)market for non-aseptic cartons between 1976 and 1981.[298]

A comparable case of complex exclusionary behaviour including predation is *United Parcel Service v. Deutsche Post AG* (2001)[299], in which the Commission found that Deutsche Post AG (DPAG) engaged in predatory pricing in the market for business parcel services from 1990 to 1995 (as DPAG's revenue from mail-order parcels was below the incremental costs of providing this special service). However, the main abuse in this case was with so-called 'fidelity rebates', which granted a special price to mail-order companies if they sent all or a high percentage of packages via DPAG. The Commission imposed a fine of €24 million for the use of fidelity rebates between 1974 and 2000.

In 2003, the European Commission found that Wanadoo (owned by France Telecom) marketed its ADSL services between the end of 1999 to October 2002 at prices which where below their average cost and suffered substantial losses until the end of 2002 as a result of this practice. According to the Commission, this practice coincided with a company plan to pre-empt the strategic market for high-speed Internet access, and it imposed a fine of €10 million for abusing a dominant position.[300]

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peting offers made to its existing customers". See Andrews (1998: 49ff.) for a detailed discussion.

296 *Irish Sugar plc v. Commission of the European Communities*, T-228/97 (1999) and C-497/99 P (2001).

297 *Tetra Pak II*, OJ L 072 (1992); *Tetra Pak International SA v. Commission*, C-333/94 P (1994).

298 Consequently, the imposed fine of ECU 75 million cannot be assigned solely to predation enforcement.

299 *United Parcel Service v. Deutsche Post AG*, COMP/35.141 (2001).

300 In another case in 2003, Deutsche Telekom AG (COMP/C-1/37.451, 37.578, 37.579, 2003) was fined with €12,6 million for infringement of Art. 82. Deutsche Telekom charged its competitors and end-users unfair monthly and one-off charges for access to their local network, thus significantly impeding competition on the market for access to the local network.

4.5.1.3 United Kingdom

In the United Kingdom, predation is an infringement of Chapter II of the Competition Act of 1998, which prohibits conducts amounting to an abuse of a dominant position. In 2004, the Office of Fair Trading (2004: 6ff.) issued a draft competition law guideline for consultation about the appropriate amount of a penalty. The five-step approach proposed is almost identical to the approach followed in the European Union.

In March 2001, the OFT imposed a penalty of £3,21 million on Napp Pharmaceuticals for abusing its dominant position in the market for the supply of sustained-release morphine tablets and capsules in the United Kingdom. The OFT found that the company sold sustained-release morphine to patients in the community at excessively high prices while supplying it to hospitals at discounts well over 90%. Additionally, Napp had targeted these discounts at other sustained-release morphine products with the result that at least one competitor was forced to leave the market. In addition to the fine, the OFT made a directive requiring Napp to end the infringements, by immediately reducing the price of tablets to the community and by limiting the degree to which community prices can exceed hospital prices. In January 2002, the Competition Appeal Tribunal upheld the OFT ruling but reduced the fine to £2,2 million.[301]

In September 2002, the OFT ruled that *Aberdeen Journals* held a dominant position in the market for local newspaper advertising in Aberdeen and had engaged in predatory pricing against its only rival, the *Aberdeen & District Independent*. The OFT imposed a fine of £1,328 million for abusing a dominant market position, which was about 3,9% of the annual turnover of *Aberdeen Journals Ltd.* in 1999.[302] John Vickers, then director general of the OFT, commented (emphasis added):

> Aberdeen Journals deliberately incurred losses in a persistent campaign to remove its only direct rival from the market. This campaign continued despite … an OFT investigation already being in train. This was a serious infringement of the law, and *the penalty should act as a deterrent to others*.

In 2004, the OFT investigated a complaint by Lothian Buses plc, a bus operator in Edinburgh, that First Edinburgh Ltd. was abusing its dominant position by applying a predatory pricing strategy. The OFT concluded that it was not abusive for

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301 *Napp Pharmaceutical Holdings Ltd. and Subsidiaries v. Director General of Fair Trading*, CA98/2/2001 (2001). For an interpretation, see Ahlborn and Allan (2003: 233ff.); Office of Fair Trading, 'Pharmaceutical Company Fined', Press Notice PN 14/01, 30 March 2001, London; Idem, 'OFT Competition Ruling Upheld – Decision Saves the NHS £2m a Year', Press Notice PN 03/02, 15 Jan. 2002, London.

302 Predation by Aberdeen Journal Ltd., CA98/5/2001 (2002); A first case decision by the OFT in July 2001 was returned by the Competition Appeal Tribunal for further consideration; In June 2003, the fine was reduced by the Competition Appeal Tribunal to £1 million (about 2,95% of the annual turnover in 1999). See Office of Fair Trading, 'OFT Competition Ruling Upheld', Press Notice PN 84/03, 23 June 2003, London; Idem, 'OFT Fines Scottish Newspaper Publisher for Predatory Pricing', Press Notice PN 58/02, 16 Sept. 2002, London.

First Edinburgh to reduce its fares or increase services, as the balance of evidence suggests that this was a reasonable commercial strategy benefiting passengers rather than an unlawful attempt to push Lothian out of the market.[303] The UK bus industry has had numerous complaints of predation since its deregulation in 1985.

4.5.1.4 Germany

In Germany, predation is an infringement of Section 19 ('Abuse of a Dominant Position') of the Act Against Restraints of Competition (ARC).[304] According to ARC Section 32, the antitrust authority may impose all measures which are necessary to bring the antitrust infringement to an end and which are proportionate to the infringement established. Moreover, whoever violates a provision of the Act shall not only be obliged to refrain from such conduct, but as long as the violating party acted wilfully or negligently shall also be liable for the damages arising from the violation. Additionally, ARC Section 34 allows the antitrust authority a 'skimming-off of additional proceeds'.

In February 2002, the German Federal Cartel Office (FCO) found that Deutsche Lufthansa AG attempted to rule out its only competitor in the Frankfurt-Berlin-Frankfurt air traffic market, Germania Fluggesellschaft mbH, by a predatory pricing strategy. Shortly before market entry of the no-frills carrier in November 2001, Lufthansa almost matched Germania's announced price of €99 for a one-way ticket. Before the entry event, Lufthansa had charged €243 for a one-way flight. In its explanatory statement, the FCO found that Lufthansa's new tariff was not simply 'price matching', but factually 'price undercutting', as Lufthansa's product contained several auxiliary services such as better service on board, a frequent flyer program, more daily flight connections and customer lounges (see BKartA, 2002: 11f.). Therefore, Lufthansa was prohibited from offering a one-way ticket for less than €35 above the price of Germania, not to exceed €134, for two years. The fixing of the minimum price spread of €35 was not based on price-cost differences but on the value of auxiliary services offered only by Lufthansa. An appellate court largely approved the decision of the FCO. More detail about the case can be found in Annex 6.5.

4.5.1.5 Canada

In Canada, predation is an offence of Section 50(1)(c) of the Competition Act, which proscribes a policy of selling products at unreasonably low prices, having the effect or tendency of substantially lessening competition or eliminating a competitor, or designed to have that effect.[305] Additionally, the Competition Act con-

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303 Idem, 'First Edinburgh Buses not Predatory', Press Notice PN 75/04, 29 April 2004, London.

304 Additionally, predation claims can be brought pursuant to the Law against Unfair Competition, which was enacted initially in 1896.

305 Historically, it is interesting to note that Canada's original antitrust statute was passed into law in 1889, one year before the Sherman Act in the United States. As explained

tains a non-criminal provision, Section 79, which can be used to address abuses of market power with a broad range of anticompetitive acts, including predation. For criminal offences, the Competition Act allows imprisonment for a term not exceeding two years and statutorily unlimited pecuniary fines for both individuals and corporations. For infringements, Section 79 gives the Competition Tribunal authority to impose remedies that are reasonable and necessary to overcome the effects of anticompetitive practices. In March 1992, the Competition Bureau issued 'Predatory Pricing Enforcement Guidelines' in order to clarify its general approach in such cases[306], followed by the publication of the more general 'Enforcement Guidelines on the Abuse of Dominance Provisions' in July 2001. Finally, in March 2002, the Competition Bureau released a draft of 'Enforcement Guidelines for Illegal Trade Practices', in which its approach to geographic price discrimination and predatory pricing is specified (see Hunter and Brown, 2002).

The Canadian jurisprudence on predation is rather limited.[307] The only successful case was *R. v. Hoffman-La Roche* (1980)[308], in which the large drug manufacturer found itself, due to changes in patent legislation, in competition with an entrant in the hospital segment of the tranquilizer market. The court found that Hoffman-La Roche's entry response, which included large discounts on brand-name drugs, 3 one-dollar tenders to governments for supply contracts and 2 six-month programs supplying free tranquilizers to hospitals and governments, was partly predatory.[309] In *Boehringer Ingelheim* (1988), an Ontario court held that undercutting is necessary for a successful predation claim and that simply matching the prices of one's rival could not be predation even if those prices were below the defendant's costs.

in more detail in Ross (1998: 3ff.), the so-called Act for the Prevention and Suppression of Combinations formed in Restraint of Trade was also motivated as a response to public concern over the pricing practices of *combines*, organised groups of companies comparable to trusts in the United States.

306 The approach contains assessments of the presence of market power (market shares and concentration as well as conditions of entry), prices and costs, a general policy of selling at prices unreasonably low and the overall competitive impact.

307 From 1980 to 1990, the director of the Competition Bureau received some 550 complaints alleging an offence under the predatory pricing provisions. Of those complaints, only 23 resulted in formal inquiries under the Act, 4 were referred to the Attorney General, and only 3 resulted in the laying of charges (see Competition Bureau, Predatory Pricing Enforcement Guidelines, Ottawa, 1992, 5).

308 *R. v. Hoffman-La Roche Ltd* (1980), 109 DLR (3d) 5, 28 OR (2d) 164, 53 CCC (2d) 1 (Ont. HC), Affd (1981), 125 DLR (3d) 607, 33 OR (2d) 694, 62 CCC (2d) 118 (Ont. CA).

309 Unsuccessful cases were *R. v. Producers Diary Ltd*. (1966), 50 CPR (2d) 265 (Ont. C.A.); *R. v. Consumers Glass Ltd. and Portion Packaging* (1981), 33 O.R. (2d) 228, 124 D.L.R. (3d) 274 (S.C.); and *Boehringer Ingelheim Canada Inc. v. Bristol-Myers Squibb Canada Inc.* (1988), 83 C.P.R. (3d) 51 (Ont. Gen. Div.).

In March 2001, the Commissioner of Competition filed a notice alleging abuse of a dominant position by Air Canada.[310] According to the application, Air Canada responded to the entry of WestJet Airlines and CanJet Airlines on 7 routes in eastern Canada by increasing its capacity and/or decreasing its fares in a manner that did not cover the avoidable cost of operating the flights on these routes between April 2000 and March 2001. In May 2001, the Competition Tribunal ordered that the application will be heard in two phases: phase I had to deal with the application of the avoidable cost test to two sample routes, and phase II had to deal with the 'balance of the application' (see Mc Fetridge, 2003). In July 2003, the Competition Tribunal released its phase I decision, which approved the allegation of pricing below avoidable cost for two sample routes.[311] However, in October 2004, the Competition Bureau decided that "[i]n light of the passage of time and the significant changes in the industry … it would not be in the public interest to pursue the second part of this case."[312] Consequently, it remains undecided whether the pricing of Air Canada was anticompetitive or not.[313] The settlement of the case was preceded by a clarification of the Competition Bureau concerning its predation enforcement approach in light of significant structural changes in the airline industry.[314]

4.5.1.6 Australia

In Australia, predation is unlawful under Section 46(1) of the Trade Practices Act of 1974, which prohibits businesses that have substantial market power from taking advantage of that power.[315] Breaches of these rules can entail both penalties (up to A$500,000 for individuals and A$10 million for companies) and damage claims.

Few predatory pricing cases have been brought in Australia.[316] The only successful claim was *Victorian Egg Marketing Board v. Parkwood Eggs Pty Ltd.* (1978)[317], in which Victorian Egg was restrained from, inter alia, supplying or offering to supply eggs at prices lower than the lowest net sale prices at which the

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310 *Commissioner of Competition v. Air Canada*, Notice of Application, CT-2001/002 (2001).

311 *Commissioner of Competition v. Air Canada*, Comp Trib 13 (2003).

312 Competition Bureau, 'Competition Bureau Settles Case with Air Canada', News Release, 29 Oct. 2004, Ottawa.

313 I would like to thank Tom Ross for pointing this out to me.

314 Competition Bureau, 'Competition Bureau Clarifies Enforcement Approach in the Airline Industry', Information Notice, 23 Sept. 2004, Ottawa.

315 As Section 46 prohibits 'the taking advantage of substantial market power', the Australian understanding of predation does not necessarily coincide with that of the United States. This is especially reflected by the fact that the 'prospect of recouping losses' is not a necessary element for a predation claim in Australia.

316 See OECD (2005) for a detailed overview of predation cases in Australia.

317 *Victorian Egg Marketing Board v. Parkwood Eggs Pty Ltd*., 33 FLR 294 (1978).

applicant or a related person supplied.[318] In *Australian Competition & Consumer Commission v. Boral Besser Masonry Ltd* (2001)[319], the Federal Court decided that Boral breached the misuse of market power provisions of Section 46 by pricing below manufacturing costs to drive its rival, C&M Bricks, out of the concrete masonry products market. However, in February 2003, the High Court found in favour of Boral and reversed the decision by the Federal Court.[320]

4.5.1.7 Discussion

Recapitulating the foray through predation enforcement in several legislations, two major enforcement groups can be defined. The first group contains the United States, Canada and Australia and stands for a quite diffident predation enforcement approach. With respect to the United States, the high enforcement standards created by *Brooke Group* (1993) as well as the defeat of the Department of Justice in *AMR* (2001) cast doubt that predation enforcement in the United States will get going (again) in the near future. Additionally, even if the future would see convictions of predators, the US enforcement enforcement agencies would likely refrain from imposing any kind of sanction and would solely focus on restoring competition in the respective markets.

Canada and Australia slightly differ from the United States with respect to their predation approaches, but not with respect to their recent enforcement records. In all three countries, the last twenty years passed without a major conviction, and in all three countries, this reluctance is justified by realising and evaluating the danger of discouraging procompetitive price cuts – and therefore damaging consumers – by a tougher predation enforcement. However, such high standards with respect to predation can lead in fact to a no-rule approach. If the predator knows that predation enforcement is lash, no significant deterrence effect is created and the predator will use predation whenever it is the cheapest monopolisation strategy.

The second group, consisting of the European Union as well as some of its member states, has recently shown an increased willingness to fight predators and even to impose significant pecuniary fines such as in *Wanadoo* (2003) and *Aberdeen Journal* (2004). Furthermore, *Napp* (2001) and *Lufthansa* (2002) have awakened the problem of simply 'terminating the infringement' after revealing a predation attempt. Moreover, cases such as *Tetra Pak II* (1997) or *Deutsche Post AG* (2001) demonstrate that predation is often used as one instrument among others in order to maintain or enhance the market power of a dominant firm. This complicates antitrust enforcement and shows that even optimal predation enforcement would rather lead to a change in the monopolisation strategy of the incumbent than to a termination of the whole monopolisation efforts. In any case, it is clear that the question of enforcing and especially intervening against predation is not

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318 Unsuccessful claims were heard in *Trade Practices Commission v. CSBP & Farmers Limited* 53 FLR 135 (1980), and *Eastern Express Pty Ltd v General Newspapers Pty Ltd*, 30 FCR 385 (1991) at first instance and 35 FCR 43 (1992) on appeal.

319 *ACCC v. Boral Besser Masonry Ltd*, FCA 30 (2001).

320 *Boral Besser Masonry Ltd. (now Boral Masonry Ltd.) v. ACCC*, HCA 5 (2003).

simply an academic mind game but rather a problem of contemporary antitrust policy.

4.5.2 Characterising Enforcement Stages

In general, antitrust enforcement can be divided into two subsequent stages. The *detection stage* focuses on how predation should be revealed (and especially distinguished from procompetitive price decreases), while the *intervention stage* addresses the complementary question of what should be done with firms who applied predation strategies. While the intervention stage has attracted attention with respect to most antitrust activities such as hard core cartel enforcement and merger control (see chapter 2 for a detailed treatment), it is fair to say that predation research efforts concentrated solely on analysing the detection stage.[321] One reason for that might have been that successful predation cases (successful from the view of the alleged prey) have been quite seldom, and predation's overall economic impact is considered relatively small compared to other infringements such as hard core cartels. However, the recently experienced convictions of several predators in the European Union and some of its member states indicate that it is worth assessing the enforcement of predation in an integrated way by focusing on detection *and* intervention. Consequently, the following section aims at giving a brief overview of the state of the art in terms of detecting predation, followed by an in-depth analysis of the complementary question of how to intervene against predators in sections 4.5.2.2 and 4.5.3.

4.5.2.1 Detecting Predation

The key finding thus far is that predation can be a rational business strategy with negative implications on overall welfare. In order to use this knowledge for antitrust law purposes, the question of how to detect predation in real antitrust cases becomes crucial. In general, antitrust law offers two different answers: per se rules and the rule of reason. The *per-se-rule approach* prohibits a certain behaviour generally. Accordingly, the antitrust authority only has to answer the question 'Did the incumbent engaged in the proscribed practice?' If the answer is Yes, the antitrust authority and afterwards the courts are committed to suppress the behaviour and eventually fine the respective firm, independent of the question whether competition has been an injured or not (see Calvani, 2001: 201ff.). The per se commitment to suppression and punishment aims at creating a deterrence effect for firms who consider the adoption of such prohibited strategies. The central characteristics of the per se rule predestine the approach for types of behaviour that are clearly identifiable (for firms as well as for the antitrust authority) and have clear (and almost certain) negative welfare consequences (see Carlton et al., 1997: 423ff.). If these preconditions are not met, some kind of rule of reason ap-

[321] The only exceptions to my knowledge are Easterbrook (1981: 318ff.) and Landes (1983: 652ff.).

proach is applicable. The rule of reason accommodates the more frequent case that the efficiency-enhancing effects of a certain behaviour have to be compared with the anticompetitive effects.

In addition to the choice between two types of control strategies, the antitrust authority further has the choice of when to use a certain control strategy, namely before an infringement actually takes place (ex ante) or after a certain infringement occurred (ex post). This choice of the timing of control together with the different control strategies lead to the detection options presented in Table 28.[322]

Table 28. Detection options

		Control strategy		
		per se	rule of reason	no rule
Timing of control	ex ante	I	II	n.a.
	ex post	III	IV	n.a.

At first glance, it might be surprising to consider ex ante control (options I and II) as antitrust options, because the timing of control criterion is frequently used to separate regulation (ex ante) from antitrust interventions (ex post). However, the case of merger control has shown that ex ante actions might be a sensible antitrust option as well, partly because such a kind of invention could reduce the firms' uncertainty about the legality of its merger plans before they are implemented.[323]

Turning from general detection options to detecting predation, it is pivotal for an antitrust authority to find out if the prices of an incumbent are unreasonably low, aiming at swamping the entrant out of the market. Consequently, the usage of an (ex post) per se rule (as an objective indicator) seems to be the obvious antitrust reaction. Consistently, in 1975, Areeda and Turner (1975: 697ff.) proposed a pure cost-based rule to define and detect predatory pricing in antitrust cases. Under this approach, a price at or above the defendant's average variable cost (applied as a surrogate for short-run marginal cost) is conclusively deemed lawful and a price

322 As Table 21 shows, the no-rule option must be considered as a third control strategy besides per se rules and the rule of reason. Although it will be shown in the welfare assessment below that the no-rule option is always inferior to any kind of antitrust action, it has to be kept in mind that these results were derived in an environment without antitrust errors and positive costs of antitrust enforcement. However, a no-rule approach might still be an option in an imperfect enforcement environment.

323 On the other hand, the performance of an ex ante approach heavily depends on a good information situation and good analysing capabilities within the antitrust authority (as it has to assess the likely competitive effects of a merger in the future).

below the defendant's average variable cost is conclusively deemed unlawful, as a profit-maximising firm would never charge such a price.[324]

As every rule of thumb, the Areeda-Turner rule has certain drawbacks (see, e.g., Bishop and Walker, 2002: 231). The rule is, for instance, static and consequently ignores the strategic intertemporal nature of every predation strategy. Furthermore, economic research has shown that the Areeda-Turner rule is quite imprecise insofar as pricing below average variable cost can be welfare-enhancing and pricing above average variable cost can be predatory (following the game-theoretic characterisation of predation derived in section 4.2; see Edwards, 2002: 170ff., and Edlin, 2002: 941ff.). In other words, there is no clear link between the Areeda-Turner standard and total welfare which would be desirable for the efficient translation into an antitrust enforcement rule (see Kaplow and Shapiro, 2007: 117). Even one initially praised advantage of the rule, its manageability, disappeared as it turned out that the rule is rather difficult to apply in court (as cost data delivered by firms normally does not collude perfectly with the economic cost concepts). As a consequence, the often-cited clarity advantage of per se rules over a rule of reason disappears when the incumbent cannot estimate what the outcome would be if the antitrust authority applied an economic cost standard.

Since the deflagration of the initial Areeda-Turner enthusiasm, antitrust law and economics research has focused on especially three major areas. First, considerable effort has been undertaken to develop superior rules which try to avoid several problems of the Arreda-Turner rule (see Brodley and Hay, 1981: 738ff.). Williamson (1977: 284ff.), for instance, invented an (ex ante) 'no post-entry output increase' rule in 1977, followed by Baumol's (ex ante) 'no post-exit price increase' rule two years later (see Baumol, 1979, and section 4.5.3.2).

Second, more appropriate *cost concepts* for predation cases have been developed. The most influential proposals of this strand of research are the concept of *average avoidable cost* by Baumol (1996: 58ff.) and the *average incremental cost* standard defined by Bolton, Brodley and Riordan (2000), which both address the problem in practical predation cases to distinguish between the various cost test in a multi-product firm context.[325] To give an example of these cost concepts, suppose that the cost function $C(Q_1, Q_2)$ for the two products 1 and 2 is given as follows (see Ross, 2004):

$$C(Q_1, Q_2) = F_c+F_1+S_1+F_2+S_2+V(Q_1)+W(Q_2) \tag{77}$$

where (F_c) representing common fixed cost (including sunk), (F_1, F_2) being fixed non-sunk costs attributable to only one good, (S_1, S_2) representing fixed sunk (be-

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324 It is important to add that the rule is "designed around the notion that predatory pricing is rare and that any policy on predation should minimise deterrence to competitive pricing" (Calvani and Lynch, 1982: 381).

325 (Short-run) *average avoidable costs* are the average per unit cost that the predator would have avoided during the period of below-cost pricing had it not produced the predatory increment of sales. (Long-run) *average incremental costs* are the per unit cost of producing the added output to serve the predatory sales. See, e.g., Motta (2004: 447f.), Bolton et al. (2000: 2271ff.) and Lutz (2004).

fore predation) costs attributable to only one good, $(V(Q_1), W(Q_2))$ being variable costs and (Q_1, Q_2) representing the sold quantities. Given these definitions, the respective cost standards for product 1 are defined as follows:

- Marginal cost = $V'(Q_1)$
- Average variable cost = $V(Q_1)/Q_1$
- Average total costs = unknown due to common costs
- Average incremental cost (AIC) = $[F_1+S_1+V(Q_1)]/Q_1$
- Average avoidable cost (AAC) = $[F_1+V(Q_1)]/Q_1$

Given these definitions, Bolton et al. (2000) propose that a price below *AAC* should be considered unlawful and a price above *AIC* should be considered lawful. A price between *AIC* and *AAC* would lie in a grey area, perhaps presumptively lawful.[326]

Third, an (ex post) two-step standard for predation strategies was developed as an amendment to the compulsory price-cost comparisons. The basic idea is that before time-consuming cost calculations are undertaken, the general probabilities of future supra-competitive pricing and recovery of losses by the predator should be considered first to get a rough estimate whether predation could generally be a problem in the market at hand. This proposal was basically motivated by a decision-theoretic framework proposed by Joskow and Klevorick (1979: 218), in which the authors favour a policy "that would minimise the sum of the expected costs of error and the costs of implementation". The *cost of error* can be classified, as in statistical terminology, as type I and type II errors. A type I error would be an erroneous condemnation of procompetitive behaviour, while the failure to condemn an instance of anticompetitive behaviour would be a type II error.

Recent research has focused mainly on the extension of the two-step standard to a complete (ex post) rule-of-reason approach, which especially tries to integrate the fundamental game-theoretic insights as well as the new cost concepts sketched above.[327] Current research competition between different frameworks is tough (see, e.g., Bolton et al., 2000, and Mastromanolis, 1998) and becomes increasingly differentiated, as special industries and special industry characteristics (such as network effects; see Box 38 for an example from the airline industry) become the focal point of interest (see Oster and Strong, 2001, or Kate and Niels, 2004).

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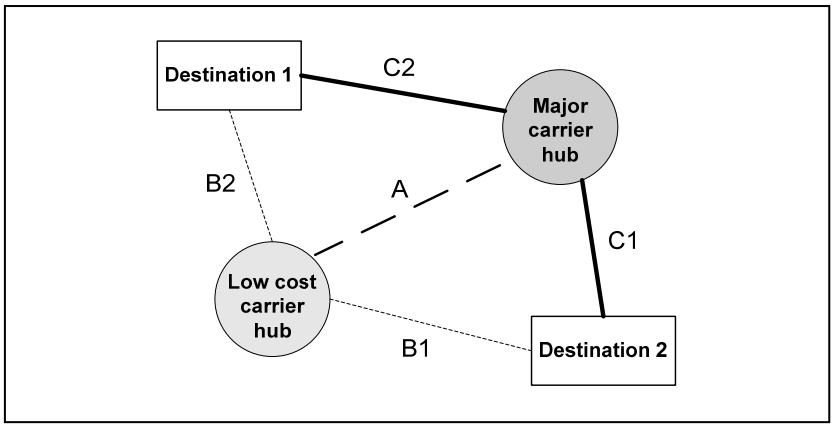
326 In the airline industry, 'outright avoidable costs' would be travel agent commissions, fuel and oil expenses, navigation fees, landing fees and parts of aircraft costs. 'Costs avoidable through redeployment' include flight crew labour, cabin crew labour and parts of aircraft costs. 'Potentially avoidable costs' are maintenance labour, ticketing agent labour, baggage handler labour and reservation labour. Finally, 'unavoidable costs' include executive salaries, building expenses and general overhead costs. See Canadian Competition Bureau (2001: 16ff.) for a detailed assessment.

327 Generally, the development of such frameworks can be interpreted as attempts by post-Chicago economists to increase the significance of their work or models in court decisions. Up to date, the courts have been reluctant to make use of most of these ideas (at least with respect to predation) because of, for example, low robustness, measurement difficulties or simply a low manageability; see Hovenkamp, 2001: 257ff.; Elzinga and Mills, 2001: 2475ff.

Box 38. Detecting predation in a simple airline network

Detecting predation crucially depends on a sound understanding of the existing market and network structure. The correctness of this proposition can be clarified by discussing possible predation strategies in a simple airline network. Such a simple network structure is depicted in Figure 49 (see Oster and Strong, 2001: 26ff.).

Fig. 49. A simple airline network



The figure shows two airline hubs, one major carrier hub and one low-cost carrier hub. In the initial stage, it is assumed that a connection between the two hubs is not existent and the low cost carrier is providing services on the routes B1 and B2, while the major carrier is providing services on the routes C1 and C2. Consequently, both carriers only compete in the market for travelling from destination 1 to destination 2. Now consider that the low-cost carrier decides to open a connection between its own hub and the hub of the major carrier. One economic motivation for such a move could be to satisfy the demand for direct flights between the two hubs. However, another motivation for the low-cost carrier - which might be crucial for the profitability of overall market entry - might be to divert traffic from the hub of the major carrier via its own hub to destinations 1 and 2. If the incumbent recognises this immediate threat of losing traffic on routes C1 and C2 due to market entry on route A, it might answer this threat with a predatory pricing strategy on route A, the route where entry took place. However, the incumbent might also be able to reach this aim by applying a predation strategy on routes C1 and C2 aiming at avoiding losing traffic on that route to the low-cost carrier (who provides potential substitute connections to 1 and 2 via its hub, routes A/B1 and routes A/B2, respectively). In other words, although market entry took place on route A, the predation strategy could be played successfully on routes C1 and C2. Whether an antitrust investigation would notice these relationships strongly depends on the correct delineation of the relevant market as well as an understanding of basic airline network economics.

Probably the most influential general attempt to construct a full rule-of-reason approach is the four stages framework of Bolton et al. (2000: 2262ff.). The authors recommend starting case work with an examination of the general market condi-

tions in order to sort out unlikely predation cases, such as those in which the defendant does not have market power, no significant entry barriers are present or the respective entrant is strong. The second stage looks for a general scheme of predation and supporting empirical evidence, followed by an assessment of the probability of recoupment in stage three. Subsequently, in stage four, prices and costs are examined, taking the 'average incremental cost' standard into account. The framework is amended by a so-called efficiency defense, which aims at "eliminating cases where below-cost pricing by a firm with market power is likely to be welfare-enhancing, rather than predatory. In these cases, the sacrifice of present profits through low pricing is justified for reasons other than exclusion or disciplining of rivals" (Bolton et al., 2000: 2274). In addition to the example of two-sided markets discussed in section 2.3, those reasons further include product promotions, penetration pricing in network industries, learning by doing, pricing in systems markets, monopoly with complementary products, irreversible exit, industry rationalisation, encouraging additional infra-marginal sales and disposal of excess or obsolete stock (see Edwards, 2002: 183ff., for a detailed description).

4.5.2.2 Intervening Against Predation

'Detecting' is a necessary but not sufficient condition for 'enforcing'. Even the cleverest detection rule remains an academic mind game if it is not applied in the sense that possible infringements are not pursued and possibly punished. Thoughtful answers to this intervention question are essential, as generally "[t]oo little enforcement leads to bad behavior and monopoly power, whereas too vigorous enforcement may deter firms from pursuing desirable forms of competition for fear that this competition will be misinterpreted" (Carlton and Perloff, 2000: 361).

To ensure respect for legal prohibitions, the law and economics literature works out three general methods (see Wils, 2002: 8ff.): prevention, stimulating moral commitment and altering the balance of expected cost/gain of violations.

The preceding section already revealed the two basic control strategies an antitrust authority can choose from to detect misconduct: a per se rule or a rule-of-reason analysis. The choice of when to use a certain control strategy, namely before an infringement actually takes place (ex ante), after a certain infringement occurred (ex post) or simply not to intervene at all (no control) leads to the five detection options shown in Table 28 in the preceding section.

Besides the choice of the control strategy and the timing of control, the antitrust authority has another decision variable: the type of intervention. In general, three types of interventions are available for an antitrust authority: fines, behavioural remedies and structural remedies. A *fine* is commonly understood as imprisonment or an amount of money which must be paid for a proved misdemeanour or felony; a *remedy* comprises all other possible non-pecuniary interventions with either a behavioural or a structural focus. Conceptually, fines and remedies differ

considerably, as "[r]emedies cure, correct, or prevent unlawful conduct, whereas sanctions penalise or punish it" (OECD, 2007: 7).[328]

Table 29 shows the resulting intervention options determined by the type of intervention and the timing of control. Ex ante interventions in case of predation are only considered in combination with behavioural remedies, simply because the typical law system hardly allows other interventions for prevention purposes. Ex post, all three intervention options are possible and have actually been used in the history of predatory enforcement.

Table 29. Intervention options

		Type of intervention		
		Fine (€)	Behavioural remedies	Structural remedies
Timing of control	ex ante	n.a.	A	n.a.
	ex post	B	C	D

Merging Table 28 (Detection) and Table 29 (Intervention) leaves in theory 17 enforcement combinations.[329] For the remainder of the chapter, only the following combinations are considered further: no rule, ex ante per se rule with behavioural remedy, and ex post rule of reason with fine and/or behavioural remedies. Figure 50 sketches the consumer surplus implications over time for these enforcement options.

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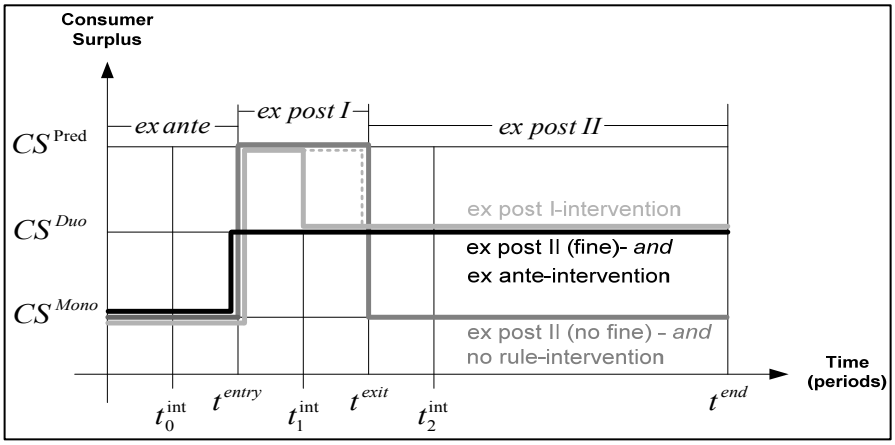
328 Lévêque (2000: 3) provides a classification of ways to intervene. He defines the following general targets: a firm's environment (e.g., optimal fines), a firm's outputs (e.g., regulations of price, quantity or quality) and a firm's frontiers (e.g., break-up of an undertaking). A good example for the first target would be antitrust fines. The second target mainly refers to behavioural remedies, such as regulations of price, quantity or quality. The third target stands for structural remedies, such as the break-up of an undertaking in order to end persistent abuse of a dominant position. Gavil et al. remark that "[i]n antitrust systems with criminal sanctions, criminal punishment ordinarily is reserved for well-defined categories of pernicious conduct such as price-fixing by competitors or bid-rigging. The more common remedies are civil sanctions. These include civil monetary penalties, such as fines and damages, limits on behavior, mandatory licensing of intellectual property, and the divestiture of assets" (Gavil et al., 2002: 57).

329 No rule plus the 16 possible combinations of I, II, III and IV from Table 21 and A, B, C and D from Table 22.

The basic assumptions underlying Figure 50 were already explained in section 4.4 (see Figure 48). In addition, Figure 50 defines three new points in time: t_0^{int} is assumed to be the point at which the antitrust authority commits itself to a certain ex ante rule; t_1^{int} is assumed to be the point at which the antitrust authority is able to end the predation attempt before the entrant has to leave the market (ex post I enforcement)[330]; and t_2^{int} is assumed to be the point at which the antitrust authority is able to prove predation after the entrant has left the market (ex post II enforcement). This basic set-up allows the following characterisation of the selected predation enforcement options.

Fig. 50. Consumer surplus effects of different enforcement options



No rule

In a no-rule approach, the antitrust authority on principle does not encroach upon any event of unreasonably low prices. Consequently, the incumbent is able to implement its predation strategy and swamps out the rival at point t^{exit}. The consumers can enjoy the additional high consumer surplus during the predation period but are condemned, after the forced exit of the rival, to the high monopoly price and the correspondingly low consumer surplus until the market ends or another firm enters the market at point t^{end}. In terms of *overall* welfare, Section 4.3 has already shown that a no-rule approach is inferior to an (ex post) antitrust intervention as long as the gain in consumer surplus due to increased competition is larger than the loss in producer surplus due to competition.

330 For the rest of the chapter, it is assumed that $t_1^{int} = t_{exit}$. In other words, the entrant is rescued just before he would have to exit the market.

Ex post rule of reason

Under an ex post approach, the antitrust authority's aim is to take appropriate action against predation strategies during or after the infringement occurred. Depending on intervention timing, an ex post I approach and an ex post II approach can be distinguished. Under the former, the antitrust authority ends the infringement before the entrant is forced to leave the market (at point t_1^{int} in Figure 50).[331] In such a case, the consumers are able to enjoy a period of low prices before the intervention and still get the duopoly price and the corresponding duopoly consumer surplus after the intervention of the antitrust authority until the market ends. In terms of overall welfare, section 4.4 in conjunction with Annex 6.6.12 has already proven that an ex post I approach is superior to a no-rule approach as long as the following condition holds:

$$CS^{Duo} - CS^{Mono} > \pi_I^{Mono} - \left(\pi_E^{Duo} + \pi_I^{Duo}\right). \tag{78}$$

Under the ex post II approach, the antitrust authority intervenes after the prey already left the market (point t_2^{int} in Figure 50). In such a situation, the antitrust authority cannot force the incumbent to set the duopoly price and the consumers would only realise the small monopoly consumer surplus in the post-predation period. However – as part of an ex post II approach – the antitrust authority normally imposes a fine for the proved misdemeanour or felony.

The economically appropriate way to fix the level of such a fine is the subject of ongoing discussions among antitrust scholars. Simply the aim of setting antitrust fines is one hotbed of dispute. While some scholars see fines as an important instrument in the prevention of violations (i.e., the creation of a deterrence effect), others understand fines more as reparation of the harm caused by the misdemeanour or felony (see Wils, 2002: 10ff., for a detailed discussion). Although both concepts do not necessarily fall foul with each other, it is shown below that both concepts can lead to quite different fine levels (see especially section 4.5.3.2).

With respect to the ex post II approach in predation enforcement, a deterrence effect would not be reached as long as the fine simply reduces but not matches the expected (net) excess profits of the incumbent (ex post II (no fine) approach). However, if the antitrust authority can credibly commit ex ante to imposing a fine which takes away that (net) excess profit of

$$F_{\text{Gain based}} = \beta\left(\pi_I^{Mono} - \pi_I^{Duo}\right) + \alpha\left(\pi_I^{Pred} - \pi_I^{Duo}\right) \tag{79}$$

such an approach would realise the same overall consumer surplus as the ex ante approach sketched below (see Annex 6.6.13 for the proof). This is simply because the incumbent would anticipate before applying the predation strategy that it will get caught and that the fine would take away the excess profit.

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331 The graph in Figure 50 shows that the realised consumer surplus depends on the exact enforcement timing of the antitrust authority. In order to maximise consumer surplus, it would be optimal to hold back the intervention to the point at which the entrant has to leave the market.

Although such a gain-based fine looks justified and attractive in the first place, theoretical research in law and economics has shown that so-called harm-based 'optimal' fines have under fairly general assumptions certain advantages over gain-based fines (see Wils, 2002: 22ff.). In situations, for instance, in which certain forms of behaviour harm the society less than it brings the offender, the offender would still commit the offence (and pay the fine). In such an environment, gain-based fines would lead to over-deterrence, as they would prevent such 'efficient' offences.[332] Additionally, gain-based fines might also lead to a problem of under-deterrence, which is caused when errors in the estimation of harm/gain occur. Underestimating the gain would lead to a complete loss of the deterrence effect as the offender would still make a profit while underestimating the harm could still hold up the deterrence effect (as the fine might still be higher than the gain).

Although harm-based fines might indeed have certain advantages over gain-based fines, it is not straightforward how *harm* should be defined. A frequently used definition for deterring antitrust violations was derived by William Landes (1983: 652ff.) based on the general work of Gary S. Becker (1968). Landes shows that the "optimal penalty should equal the net harm to persons other than the offender" (Landes, 1983: 678).[333] In the context of predation and referring to the set-up of Figure 50, the optimal harm-based fine is given by the following expression (see Annex 6.6.13 for the proof)[334]:

$$F_{\text{Harm based}} = \alpha\left[\left(CS^{Duo} - CS^{Pred}\right) + \left(\pi_E^{Duo} - \pi_E^{Pred}\right)\right] + \beta\left[\left(CS^{Duo} - CS^{Mono}\right) + \pi_E^{Duo}\right]. \quad (80)$$

In the predation period α, net harm to others is given by the sum of the difference between the duopoly and predation consumer surplus (harm to consumers) and the difference between the entrant's duopoly and predation profits (harm to other producers). If predation is successful, the net harm to others in the post-

332 This argument is based on the general work of Becker (1968: 169ff.), who shows that even if the enforcement costs are zero, it is not economically justified to deter all violations, as some offences are efficient in the sense that the gain to the offender exceeds the harm to the victim.

333 In fact, the complete rule says that the "optimal penalty should equal the net harm to persons other than the offender, adjusted upward if the probability of apprehension and conviction is less than one". This second part of the rule becomes relevant in an assessment of optimal enforcement in an imperfect world; see section 4.5.3.2.2 as well as Connor and Lande (2006) and Lande (2004).

334 An alternative definition of *harm* could be the cost that the violation has imposed on society. That would ignore the distributive effects of a predation strategy (namely, the lower consumer surplus due to higher monopoly profits) and would only focus on the net welfare losses (see Annex 6.6.13 for a formal treatment). It can be shown (e.g., with the model and market specification used in section 4.5.3) that such an alternative definition of harm typically cannot reach a deterrence effect, as the gains of the violation are typically larger than the optimal harm-based fine. Only if the entrant has a large efficiency advantage would such a definition of harm-based fine lead to a deterrence effect.

predation period β is given by the difference between the duopoly and the monopoly consumer surplus and the entrant's duopoly profits it would have earned without a successful predation strategy. The overall net harm to others shown above is just the sum of the two expressions.

This definition of a harm-based fine allows deriving the welfare differential between an ex post I and an ex post II approach. Both approaches realise the same welfare in the predation period. In the post-predation period, however, the approaches differ. The ex post I approach guarantees the duopoly welfare for the whole post-predation period β, which is given by the expression $\beta\left(CS^{Duo}+\pi_E^{Duo}+\pi_I^{Duo}\right)$. The welfare realised with an ex post II approach is the sum of the monopoly welfare realised during the whole post-predation period $\beta\left(CS^{Mono}+\pi_I^{Mono}\right)$ and the harm-based fine imposed by the antitrust authority, ε periods after the end of the predation period (with $0 \le \varepsilon \le \beta$)

$$W_{Ex\ post\ II} = \alpha\left[\left(CS^{Duo}-CS^{Pred}\right)+\left(\pi_E^{Duo}-\pi_E^{Pred}\right)\right]+ \varepsilon\left[\left(CS^{Duo}-CS^{Mono}\right)+\pi_E^{Duo}\right] \quad (81)$$

Overall, an ex post I approach is superior to an ex post II approach as long as the following inequality holds

$$\beta\left(CS^{Duo}+\pi_E^{Duo}+\pi_I^{Duo}\right) > \beta\left(CS^{Mono}+\pi_I^{Mono}\right)+ \left\{\alpha\left[\left(CS^{Duo}-CS^{Pred}\right)+\left(\pi_E^{Duo}-\pi_E^{Pred}\right)\right]+\varepsilon\left[\left(CS^{Duo}-CS^{Mono}\right)+\pi_E^{Duo}\right]\right\}. \quad (82)$$

Rearranging both sides leads to the following inequality:

$$(\beta-\varepsilon)\left(CS^{Duo}-CS^{Mono}\right)-\alpha\left(CS^{Duo}-CS^{Pred}\right) > \beta\left(\pi_I^{Mono}-\pi_E^{Duo}-\pi_I^{Duo}\right)+\alpha\left(\pi_E^{Duo}-\pi_E^{Pred}\right)+\varepsilon\pi_E^{Duo}. \quad (83)$$

A justifiable objection to this approach of deriving the ex post I to ex post II welfare differential could be based on Becker's fundamental theoretical result that says that optimal fines are simply costless transfers (and therefore superior to other sanctions; see Becker, 1968). In other words, although it is state of the art to assume that the collected fine raises consumer welfare, it reduces the producer welfare by the same amount, leaving overall welfare unaffected. Following such an approach, the ex post I to ex post II welfare differential would just be given by the expression $\beta\left(CS^{Duo}+\pi_E^{Duo}+\pi_I^{Duo}\right)$ representing the ex post I welfare and the expression $\beta\left(CS^{Mono}+\pi_I^{Mono}\right)$ representing the ex post II welfare. Rearranging would lead to the following inequality

$$CS^{Duo}-CS^{Mono} > \pi_I^{Mono}-\left(\pi_E^{Duo}+\pi_I^{Duo}\right) \quad (84)$$

which is the same expression as the welfare differential between an ex post I approach and a no-rule approach. In other words, except for situations of a natural monopoly, the ex post I approach would be superior to an ex post II approach, as the former holds the entrant in the market and the fine of the later is neutral in

terms of overall welfare. This relatively clear statement cannot be made if the fine enters the welfare assessment as done in the first approach.[335] In that case, the fine increases consumer surplus and the overall welfare effect depends – despite the choice between gain-based or harm-based fines – on the point in time the antitrust authority imposes the fine. It is obvious that imposing the fine immediately before the market ends maximises consumer welfare, as the predator is then fined for its predation strategy for the whole post-predation period. If, in contrast, the predator is caught and fined right after the entrant exited the market, it has to pay a small or even no fine, but the damage of monopoly prices and quantities for the rest of the market is inevitable for the consumers (see section 4.5.3.2 for a quantification of that effect).

Ex ante, per se rule

Under an ex ante rule approach, the antitrust authority commits itself to a certain entry reaction *before* an incumbent actually decides to predate. If the antitrust authority credibly announces ex ante (at point t_0^{int} in Figure 50) that it would, for instance, force the incumbent to keep its post-entry price for a certain period even after the entrant left the market, the costs of the predation period would rise substantially and recoupment possibilities would decline for the incumbent simultaneously. Hence, assuming that such a rule works frictionless, the incumbent's incentives are altered in a way that makes predation unprofitable and therefore irrational. Consequently, the consumers cannot enjoy the high consumer surplus during the predation phase but instead realise the duopoly consumer surplus from the point of entry to the end of the market.[336] A comparison of the realised welfare with an ex ante, per se rule and an ex post I rule of reason shows (see Annex 6.6.15 for the proof) that the former is the superior choice as long as

$$CS^{Duo} - CS^{Pred} > \pi_E^{Pred} + \pi_I^{Pred} - \pi_E^{Duo} - \pi_I^{Duo} . \qquad (85)$$

The inequality basically says that an ex ante per rule is superior to an ex post I rule of reason as long as the difference between the consumer surplus in duopoly and predation (in the predation period) is larger than the overall producer surplus difference between predation and duopoly (in the predation period).

335 Such an approach could, for example, be defended by arguing that the incumbent pays the fine from its general financial resources (not related to the market in which predation has taken place), while the fine collector (normally the state) uses the fine for the benefit of the consumers in the market in which predation has taken place.

336 In the simple set-up provided by Figure 50, the consumers are better off with an ex ante approach than with a no rule approach as long as the post-predation period is longer than the predation period.

4.5.3 Evaluating Enforcement Options in a Linear Duopoly Predation Model

The aim of the preceding sections was to derive general inequalities which allow a pair-wise comparison of different enforcement options in terms of their effects on overall welfare. Based on typical effects of competition, such as increases in consumer surplus and reductions in producer surplus, especially the general welfare differentials of no rule versus continuation of monopoly, ex post I rule versus no rule, ex ante rule versus ex post rule and ex post I versus ex post II rule were characterised in more detail. Furthermore, general expressions for the optimal gain-based and harm-based fines for predation strategies were derived.

Although it was possible to derive certain general propositions about the typical sign of certain welfare differentials, others had to remain undetermined. To allow a more detailed and sophisticated analysis, the next analytical step must be establishing a link between the derived general propositions and a model of competitive interaction. In order to saturate this demand, a linear Cournot model with cost differences will be developed first to derive the exact general welfare differentials in a widely accepted model context (section 4.5.3) and, second, to apply these results to a certain market specification (i.e., real demand and cost functions). In this second part, three different scenarios will be constructed which differ in the assumptions about the efficiency of the incumbent and the entrant (section 4.5.3.1). The market specification is applied to the three scenarios for two worlds; section 4.5.3.2.1 analyses the enforcement options in a world of certainty and perfect information while section 4.5.3.2.2 highlights the complementary case of a world of uncertainty and limited information. A discussion of the results as well as ways to extend the undertaken enforcement approach in section 4.5.3.3 concludes section 4.5.3.

4.5.3.1 Model Specification and General Results

The basic model setup follows a paper by Normann (1994).[337] It basically assumes a quantity-setting duopoly consisting of an incumbent (former monopoly) firm I and an entrant E. The inverse demand function is assumed to be linear $p=a-b(q_I+q_E)$ with a, b>0. Firms produce at constant marginal costs of c_I, c_E and fixed costs of FC_I, FC_E. Based on this basic set-up, three different market states have to be characterised in terms of its welfare effects: Monopoly, duopoly and predation.

In the *monopoly situation*, the profit function of the monopolist is given by

$$\Pi_I = (a - bQ)Q - c_I Q - FC_I . \tag{86}$$

The incumbent's profit is maximised by setting the marginal revenue equal to marginal cost, leading to the following quantity provided by the monopolist

[337] Although the basic model was developed by Normann (in an unpublished paper), the set-up of the basic model largely follows Phlips (1995: 241ff.). Phlips applies Normann's model.

$$Q^m = \frac{a - c_I}{2b}. \tag{87}$$

Substituting the quantity expression into the demand curve leads to the monopoly price

$$p^m = \frac{a + c}{2}. \tag{88}$$

Substituting the quantity expression and the price expression in the monopolist's profit function leads to the monopoly profit

$$\Pi^m = \frac{(a - c)^2}{4b}. \tag{89}$$

Finally, the consumer surplus can be derived as

$$CS^{Mono} = \frac{(a - p^m)Q^m}{2} = \frac{(a - c_i)^2}{8b}. \tag{90}$$

In the *duopoly situation,* the profit functions of the incumbent and the entrant are given by

$$\Pi_I = (a - b(q_I + q_E) - c_I)q_I - FC_I, \tag{91}$$

$$\Pi_E = (a - b(q_I + q_E) - c_E)q_E - FC_E. \tag{92}$$

Both firms maximise their profit functions by choosing their quantity *q* under the assumption that the quantity of the rival is fixed. The non-cooperative Cournot equilibrium – which serves as a benchmark for procompetitive, non-predatory behaviour – is determined by the interaction point of the two reaction functions in which the equilibrium quantities for I and E are given by

$$q_I^C = \frac{a - 2c_I + c_E}{3b}, \tag{93}$$

$$q_E^C = \frac{a - 2c_E + c_I}{3b} \tag{94}$$

leading to an equilibrium price of

$$p^C = \frac{a + c_I + c_E}{3}. \tag{95}$$

Firm profits in the equilibrium are

$$\Pi_I^C = \frac{(a - 2c_I + c_E)^2}{9b} - FC_I. \tag{96}$$

$$\Pi_E^C = \frac{(a - 2c_E + c_I)^2}{9b} - FC_E. \tag{97}$$

Finally, the consumer surplus realised in the duopoly state can be calculated to

$$CS^{Duo} = \left(a - \left(\frac{a + c_I + c_E}{3}\right)\right)\left[\left(\frac{a - 2c_I + c_E}{3b}\right) + \left(\frac{a - 2c_E + c_I}{3b}\right)\right]\left(\frac{1}{2}\right). \quad (98)$$

The *predation situation* is modelled by assuming that the predator sells a quantity such that the entrant makes zero profits. Given the predators sales q_I^P the entrant produces

$$q_E^P = \frac{\left(a - bq_I^P - c_E\right)}{2b} \quad (99)$$

as an optimal response. The entrant's profit function can be rewritten as

$$\Pi_E^P\left(q_I^P\right) = \left(\frac{a - bq_I^P - c_E}{2}\right)^2\left(\frac{1}{b}\right) - FC_E = 0. \quad (100)$$

Solving this for q_I^P leads to the following outcomes

$$q_I^P = \frac{a - c_E}{b} - 2\sqrt{FC_E / b}, \quad (101)$$

$$q_E^P = \sqrt{FC_E / b}, \quad (102)$$

$$p^P = \sqrt{FC_E b} + c_E. \quad (103)$$

The incumbent's profit in the predation period is given by

$$\Pi_I^P = q_I^P\left(p^P - c_I\right) - FC_I. \quad (104)$$

Using the derived expressions for the equilibrium price and quantity for the incumbent leads to

$$\Pi_I^P = \left(\frac{a - c_E}{b} - 2\sqrt{FC_E / b}\right)\left(\left(\sqrt{FC_E b} + c_E\right) - c_I\right) - FC_I. \quad (105)$$

The profits of the entrant are (by model construction) given by

$$\Pi_E^P = 0. \quad (106)$$

Finally, the consumer surplus realised under predation can be calculated to

$$CS^{Pred} = \left(a - \left(\sqrt{FC_E b} + c_E\right)\right)\left[\left(\sqrt{FC_E / b}\right) + \left(\frac{a - c_E}{b} - 2\sqrt{FC_E / b}\right)\right]\left(\frac{1}{2}\right). \quad (107)$$

After specifying the welfare components for the three different market states (which are summed up in the following Table 30), applying the model specifica-

Table 30. Isolating the welfare effects of predation

	Incumbent's profits	Entrant's profits	Consumer surplus
Monopoly	$\frac{(a-c_I)^2}{4b}-FC_I$	0	$\frac{(a-c_I)^2}{8b}$
Duopoly	$\frac{(a-2c_I+c_E)^2}{9b}-FC_I$	$\frac{(a-2c_E+c_I)^2}{9b}-FC_E$	$\left(a-\left(\frac{a+c_I+c_E}{3}\right)\right)\left[\left(\frac{a-2c_I+c_E}{3b}\right)+\left(\frac{a-2c_E+c_I}{3b}\right)\right]\left(\frac{1}{2}\right)$
Predation	$\left(\frac{a-c_E}{b}-2\sqrt{FC_E/b}\right)\times\left(\left(\sqrt{FC_E b}+c_E\right)-c_I\right)-FC_I$	0	$\left(a-\left(\sqrt{FC_E b}+c_E\right)\right)\left[\left(\sqrt{FC_E/b}\right)+\left(\frac{a-c_E}{b}-2\sqrt{FC_E/b}\right)\right]\left(\frac{1}{2}\right)$

Table 31. Predation enforcement options

(1)	Predation as a rational business strategy	$\alpha\left\{\left[\frac{(a-2c_I+c_E)^2}{9b}-FC_I\right]-\left[\left(\frac{a-c_E}{b}-2\sqrt{FC_E/b}\right)\times\left(\left(\sqrt{FC_E b}+c_E\right)-c_I\right)-FC\right]\right\}<$ $\beta\left\{\left[\frac{(a-c_I)^2}{4b}-FC_I\right]-\left[\frac{(a-2c_I+c_E)^2}{9b}-FC_I\right]\right\}$
(2)	Net welfare increase compared to monopoly	$\left\{\left(a-\left(\sqrt{FC_E b}+c_E\right)\right)\left(\sqrt{FC_E/b}\right)+\left(\frac{a-c_E}{b}-2\sqrt{FC_E/b}\right)\right]\left(\frac{1}{2}\right)\Big\}-\frac{(a-c_I)^2}{8b}>$ $\left[\frac{(a-c_I)^2}{4b}-FC\right]-\left[\left(\frac{a-c_E}{b}-2\sqrt{FC_E/b}\right)\times\left(\left(\sqrt{FC_E b}+c_E\right)-c_I\right)-FC_I\right]$
(3)	Predation unsuccessful (ex post I rule) compared to successful predation (no rule)	$\left\{\left(a-\left(\frac{a+c_I+c_E}{3}\right)\right)\left[\left(\frac{a-2c_I+c_E}{3b}\right)+\left(\frac{a-2c_E+c_I}{3b}\right)\right]\right\}\left(\frac{1}{2}\right)-\frac{(a-c_I)^2}{8b}>$ $\left(\frac{(a-c_I)^2}{4b}-FC_I\right)-\left(\frac{(a-2c_I+c_E)^2}{9b}-FC_I\right)-\left(\frac{(a-2c_E+c_I)^2}{9b}-FC_E\right)$

(4)	Gain-based fine	$\beta\left\{\left[\left(\frac{(a-c_I)^2}{4b}-FC_I\right)-\left(\frac{(a-2c_I+c_E)^2}{9b}-FC_I\right)\right\}+$ $\alpha\left\{\left[\left(\frac{a-c_E}{b}-2\sqrt{FC_E/b}\right)\times\left(\left(\sqrt{FC_E b}+c_E\right)-c_I\right)-FC_I\right]-\left(\frac{(a-2c_I+c_E)^2}{9b}-FC_I\right)\right\}$
(5)	Harm-based fine	$\alpha\left\{\left(a-\left(\frac{a+c_I+c_E}{3}\right)\right)\left[\left(\frac{a-2c_I+c_E}{3b}\right)+\left(\frac{a-2c_E+c_I}{3b}\right)\right]\left(\frac{1}{2}\right)-\left(a-\left(\sqrt{FC_E b}+c_E\right)\right)\left(\sqrt{FC_E/b}\right)+\left(\frac{a-c_E}{b}-2\sqrt{FC_E/b}\right)\right]\left(\frac{1}{2}\right)+\frac{(a-2c_E+c_I)^2}{9b}-FC_E\Big\}+\beta\left\{\left(a-\left(\frac{a+c_I+c_E}{3}\right)\right)\left[\left(\frac{a-2c_I+c_E}{3b}\right)+\left(\frac{a-2c_E+c_I}{3b}\right)\right]\left(\frac{1}{2}\right)-\frac{(a-c_I)^2}{8b}+\frac{(a-2c_E+c_I)^2}{9b}-FC_E\right\}$
(6)	Ex post I versus ex post II	$(\beta-\varepsilon)\left\{\left(a-\left(\frac{a+c_I+c_E}{3}\right)\right)\left[\left(\frac{a-2c_I+c_E}{3b}\right)+\left(\frac{a-2c_E+c_I}{3b}\right)\right]\left(\frac{1}{2}\right)-\frac{(a-c_I)^2}{8b}\right\}-$ $\alpha\left\{\left(a-\left(\frac{a+c_I+c_E}{3}\right)\right)\left[\left(\frac{a-2c_I+c_E}{3b}\right)+\left(\frac{a-2c_E+c_I}{3b}\right)\right]\left(\frac{1}{2}\right)-\left(\left(a-\left(\sqrt{FC_E b}+c_E\right)\right)\left(\sqrt{FC_E/b}\right)+\left(\frac{a-c_E}{b}-2\sqrt{FC_E/b}\right)\right]\left(\frac{1}{2}\right)\right)\right\}>\beta\left\{\frac{(a-c_I)^2}{4b}-FC_I-\right.$

		$\frac{(a-2c_E+c_I)^2}{9b}-FC_E-\frac{(a-2c_I+c_E)^2}{9b}-FC_I\Big\}+(\alpha+\varepsilon)\left(\frac{(a-2c_E+c_I)^2}{9b}-FC_E\right)$
(7)	Ex ante vs. ex post I	$\left(a-\left(\frac{a+c_I+c_E}{3}\right)\right)\left[\left(\frac{a-2c_I+c_E}{3b}\right)+\left(\frac{a-2c_E+c_I}{3b}\right)\right]\left(\frac{1}{2}\right)-\left\{\left(a-\left(\sqrt{FC_E b}+c_E\right)\right)\left(\sqrt{FC_E/b}\right)+\left(\frac{a-c_E}{b}-2\sqrt{FC_E/b}\right)\right]\left(\frac{1}{2}\right)\Big\}>\left(\frac{a-c_E}{b}-2\sqrt{FC_E/b}\right)\times\left(\left(\sqrt{FC_E b}+c_E\right)-c_I\right)-FC_I-\frac{(a-2c_E+c_I)^2}{9b}-FC_E-\frac{(a-2c_I+c_E)^2}{9b}-FC_I$

tion to the different general enforcement options derived above is straightforward. The results are presented in Table 31.

As the expressions in Table 31 cannot be interpreted straightforward, the following section applies a certain market specification in the form of certain demand and cost functions to allow an easier interpretation of the theoretical results.

4.5.3.2 Market Specification and Applied Results

In order to study the welfare effects of predation enforcement options further, it is assumed that market demand is given by $Q=1.000-1.000p$ (which is equivalent to an inverse demand function of $p=1-0{,}001(q_1+q_2)$). The marginal costs of the incumbent are fixed to $c_I=0{,}28$. However, the entrant's marginal costs are subject to change. In scenario 1, the entrant is equally efficient and therefore has constant marginal costs of $c_E=0{,}28$. In scenario 2, the entrant has marginal costs of $c_E=0{,}21$ and therefore a moderate cost advantage over the incumbent. In scenario 3, the entrant has a large cost advantage leading to constant marginal costs of $c_E=0{,}14$. With respect to fixed cost, two different states are differentiated in all three scenarios: $FC_I=FC_E=0$ and $FC_I=FC_E=10$. Finally, within every entry scenario, four different lengths of the post-predation period (β) are assumed: while α is fixed to $\alpha=5$, β has the four specifications 5, 7, 10 and 15. These essential scenario specifications are summed up in Table 32.

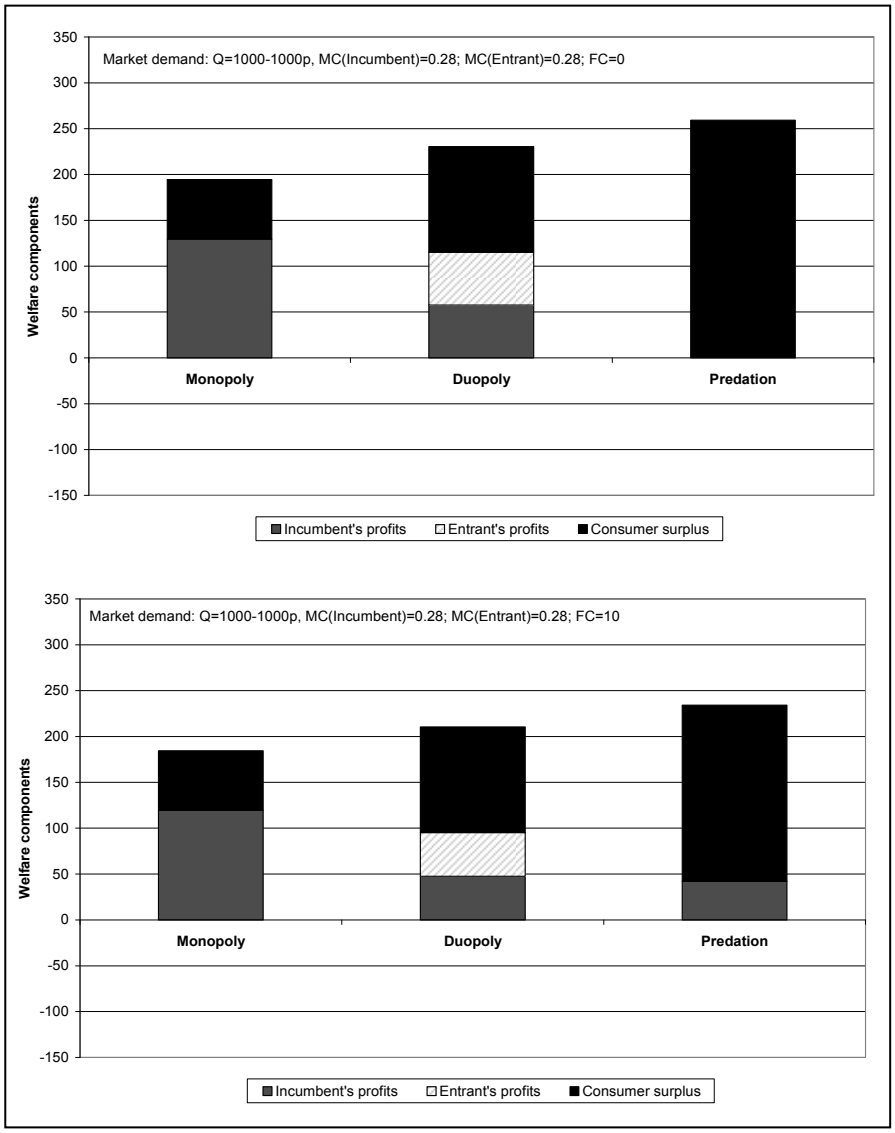
Table 32. Scenario specifications

	Marginal costs (Incumbent)	Marginal costs (Entrant)	Fixed costs (Incumbent and entrant)	Predation periods α	Post-predation periods β
Scenario 1	0,28	0,28	0; 10	5	5; 7; 10; 15
Scenario 2	0,28	0,21	0; 10	5	5; 7; 10; 15
Scenario 3	0,28	0,14	0; 10	5	5; 7; 10; 15

Given the market and scenario specifications, it is possible first to calculate consumer surplus, producer surplus and overall welfare of the three possible market states: monopoly, duopoly and predation. The following Figures 51, 52 and 53 show the results for the three scenarios.[338] In scenario 1, the monopolistic producer realises a relatively high profit while the consumers get a relatively small consumer surplus. In the duopoly situation, the consumer surplus increases significantly while overall producer surplus drops and is equally shared between the incumbent and the entrant. In the predation situation, the entrant (by construction) and the incumbent make zero profits. The consumer surplus is relatively high and

[338] The overall welfare is represented by the positive height of the boxes; if the producer surplus is negative, it has been subtracted from the consumer surplus for presentational purposes.

Fig. 51. Welfare components if entrant has no cost advantage (Scenario 1)



equal to the overall welfare.[339] The introduction of fixed costs does not change the picture much. In the monopoly situation, the consumer surplus is the same while the producer surplus is reduced by the amount of fixed costs. The same is basi-

339 In fact, it can be shown that the consumer surplus is equal to the surplus realised under perfect competition.

cally true for the duopoly situation. In the predation state, the incumbent is able to drive down the entrant's profits to zero and still realises a small positive profit. Total welfare is still substantially higher than in the duopoly case, but it is smaller than in the case without fixed costs.

Fig. 52. Welfare components if entrant has moderate cost advantage (Scenario 2)

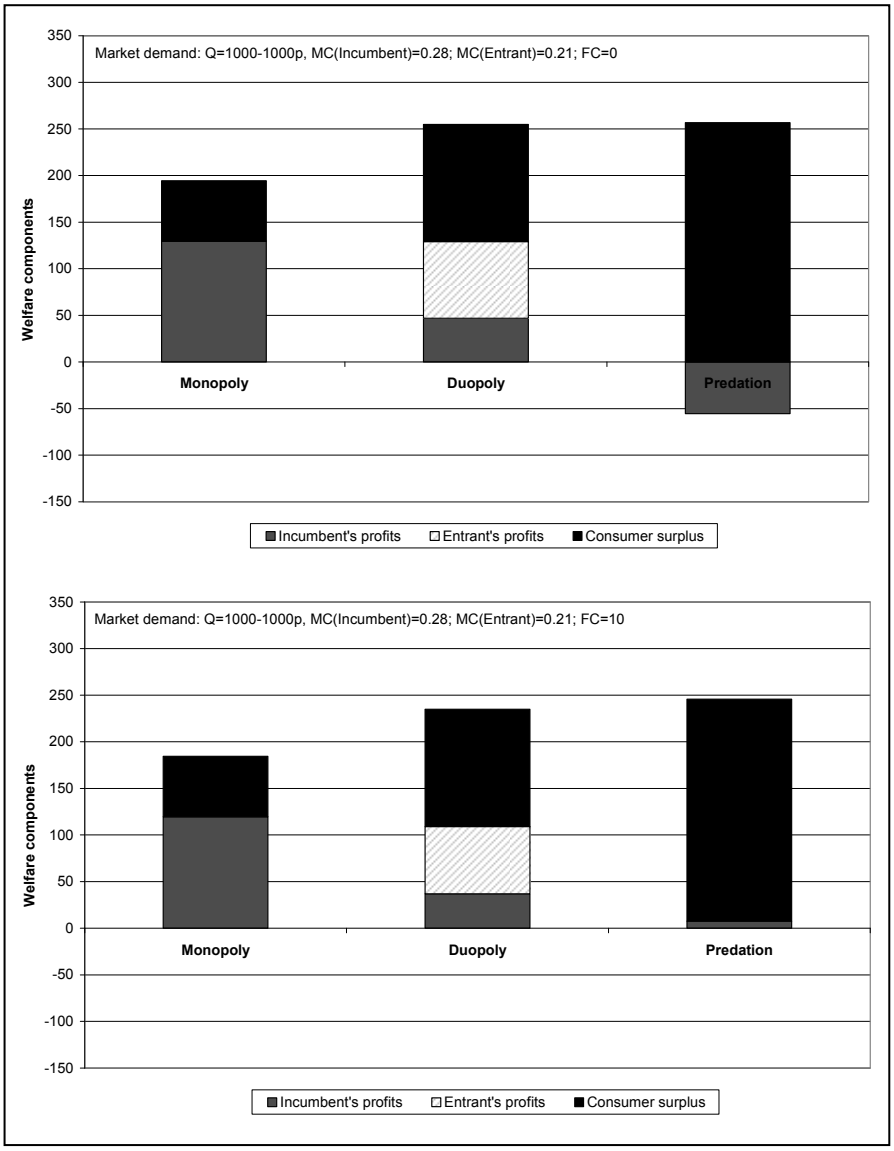
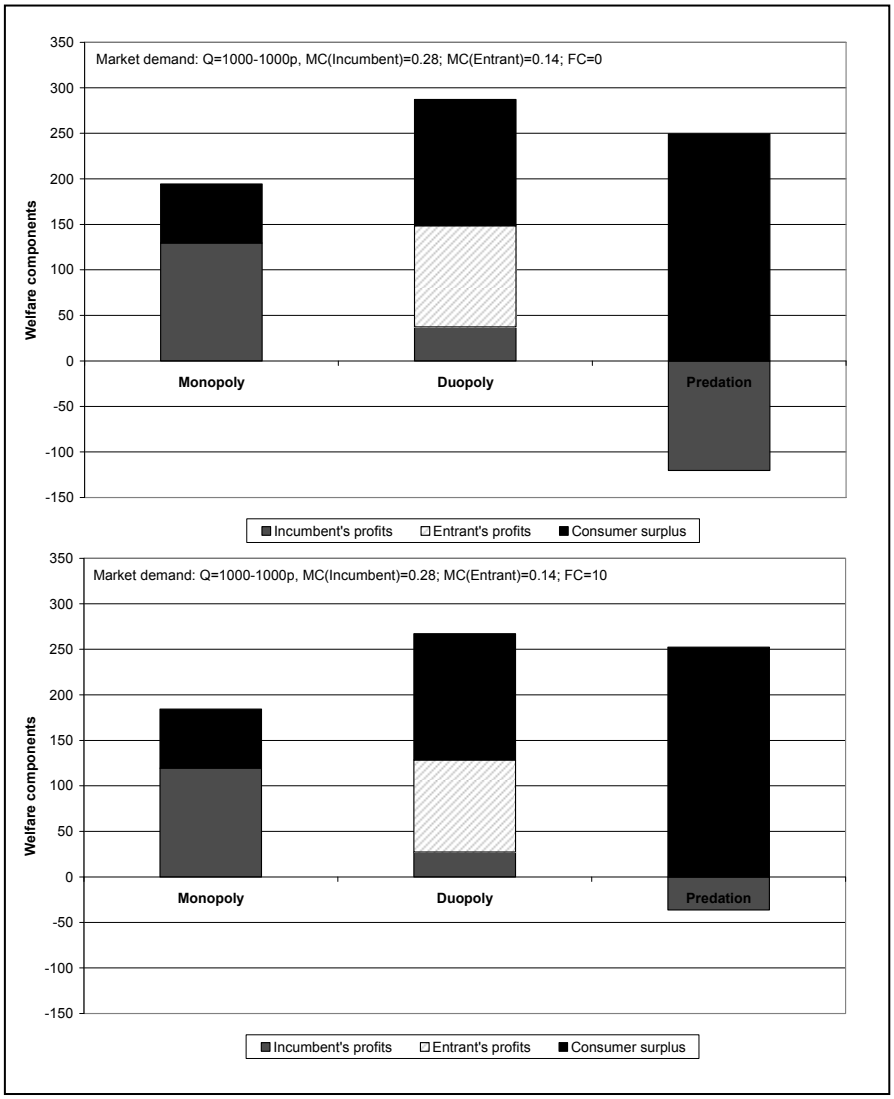


Fig. 53. Welfare components if entrant has large cost advantage (Scenario 3)



In scenario 2, the monopoly situation remains unchanged compared to scenario 1. In the duopoly situation without fixed costs, the cost advantage of the entrant leads to a higher duopoly total welfare, slightly higher consumer surplus and producer surplus. As the entrant has an efficiency advantage over the incumbent, it now gets a larger share of the producer surplus. In the predation period, the incumbent now has to accept losses in order to drive down the entrant's profits to zero. While the consumer surplus is unchanged, compared to scenario 1, overall

welfare drops by the amount of the negative producer surplus. Considering fixed costs basically has the same effects as described above. Monopoly and duopoly profits decline by the amount of the fixed cost, which directly feeds into a loss in overall welfare. In the predation situation, the incumbent can drive down the profit of the entrant to zero and still realises a small but positive producer surplus.

In scenario 3, the monopolist situation remains unchanged. The effects in the duopoly and predation situation are the same as described in scenario 2, but the effects are more distinctive due to the larger efficiency advantage of the entrant. Overall welfare in the duopoly and predation situations increases moderately. In the predation situation, the incumbent realises an even larger negative producer surplus, which leads to a reduction in welfare of the same size. Even in the state with positive fixed costs, the incumbent is still realising negative profits in the predation state.

In addition to an analysis of the welfare components for the different scenarios, a look at the resulting market prices predicted by the model is insightful. These prices are depicted for the different market states in Table 33. As explained above, the marginal costs of the incumbent are always given by 0,28, while the entrant can have no, a moderate or a large cost advantage.

Table 33. Market prices for the different market structures

	Cost advantage	FC=0	FC=10	FC=20
Monopoly		0,64	0,64	0,64
Duopoly	no	0,52	0,52	0,52
	moderate	0,50	0,50	0,50
	large	0,47	0,47	0,47
Predation	no	0,28	0,38	0,42
	moderate	**0,21**	0,31	0,35
	large	**0,14**	**0,24**	0,28

As Table 33 shows, the incumbent does not always have to drop prices below its own marginal costs to force the entrant out of the market. In the case of equal marginal costs, the incumbent's prices are always at or above its marginal costs. If the entrant has a moderate cost advantage, the incumbent's prices are below its own marginal costs in a world without fixed costs; however, as the table shows, in a world of FC=10, the incumbent can still predate with a price above its own marginal cost. If the entrant has a large cost advantage, the incumbent has to accept prices below its marginal costs even in a world of FC=10. However, if FC=20 he can get rid of the entrant with prices at his own marginal costs.[340]

[340] For FC=0, the incumbent has to match the marginal costs of the entrant to reach its exit. Overall, the table in combination with the welfare components analysis above re-

Additionally, the theoretically derived market prices which are sufficient to drive the entrant out of the market – presented in Table 33 – illustrate the fuzziness and consequently weak performance of the Areeda-Turner rule in detecting predation (see Box 39).

Box 39. Testing and improving the Areeda-Turner rule of thumb

The theoretically derived market prices which are sufficient to drive the entrant out of the market – presented in Table 33 – illustrate the fuzziness and consequently weak performance of the Areeda-Turner rule in detecting predation. Comparing the marginal costs of the incumbent with the market prices predicted by the Cournot model reveals that, in a world with FC=0, the Areeda-Turner rule would have detected two out of three predation attempts (67%), while it would have detected only one out of six (17%) in a world of FC=10 or FC=20 (namely, the predation case in which the fixed costs are FC=10 and the entrant has a large efficiency advantage).
In the case of positive fixed costs, an alternative rule of thumb would be that prices below average total costs (ATC) are defined as predatory (see Greer, 1983). A justification for such a rule would be that the incumbent also has to cover its fixed costs (which is not possible with marginal cost pricing). Predation enforcement in Canada, for instance, considers p>ATC as never predatory, p<AVC as likely predatory unless special reasons apply and AVC<p<ATC as a grey range, which should lead to a closer look on other things such as intent or excess capacity.

Table 34. Average total costs of the incumbent

	Cost advantage	FC=0	FC=10	FC=20
Duopoly	No	0,28	0,32	0,36
	Moderate	0,28	0,33	0,37
	Large	0,28	0,33	0,38
	Average	*0,28*	*0,33*	*0,37*

To test whether such an ATC rule would detect more predation attempts (in the model world used above), Table 34 shows the average total costs of the incumbent for the different scenarios.
Comparing these average total costs with the derived predation prices disclose that an ATC rule of thumb would unsurprisingly detect the same two out of three predation attempts if FC=0. However, in the case of positive fixed costs, the ATC rule is four times more successful in detecting predation (four out of six, 67%) than the classic

flects the well-known theoretical result that low prices are necessarily good for consumers as they increase consumer welfare, but are not necessarily good for overall welfare. In the model and market specification used above, the incumbent has to accept prices below its own marginal costs on three occasions to get rid of the entrant: FC=0 / moderate, FC=0 / large and FC=10 / large. While consumer welfare always increases in the predation situation, compared to the duopoly situation, total welfare is slightly higher in the FC=0 / moderate scenario and clearly smaller in the remaining two worlds with a large cost advantage.

Areeda-Turner (AVC) rule. Only the two predation attempts with no cost advantage of the entrant would remain undetected.

World of certainty and perfect information

Following the set-up and characterisation of the basic model of competitive interaction, the next step is to connect these results to the general enforcement options derived above. The analysis is therefore separated into two worlds. In this section, the results are applied to a world of certainty and perfect information; in the subsequent section they are fit into a world of uncertainty and imperfect information.

In a perfect world, antitrust enforcement is costless and the antitrust authority acts faultlessly. It is then possible to quantify the following conditions for the assumed market specification (see Table 31 for the general derivations):

1. Predation as a rational business strategy,
2. Welfare increases if predation is successful (compared to a continuation of monopoly),
3. Welfare increases if predation is unsuccessful (compared to a successful predation attempt) or – alternatively – whether an ex post I rule leads to a welfare increase compared to a no-rule approach,
4. Level of an optimal gain-based fine (including the percentage value of the monopoly profit in the preceding year),
5. Level of an optimal harm-based fine (including the percentage value of the monopoly profit in the preceding year),
6. Ex post I enforcement leads to higher welfare than ex post II enforcement,
7. Ex ante enforcement leads to a higher welfare than ex post I enforcement.

The quantitative results for all seven conditions can be found in Table 35. The derivation of the delta values for the various options can be exemplified for condition (2). As shown in Annex 6.6.11, this condition is met as long as

$$CS^{Pred} - CS^{Mono} > \pi_I^{Mono} - \left(\pi_E^{Pred} + \pi_I^{Pred}\right). \tag{108}$$

Rewriting the equation leads to

$$CS^{Pred} - CS^{Mono} - \pi_I^{Mono} + \pi_E^{Pred} + \pi_I^{Pred} > 0\,. \tag{109}$$

or short $\Delta>0$. This delta value is presented in Table 35 (multiplied by the relevant number of periods α and β). The deltas for the other conditions are derived in the same way.

In the first column of Table 35, it is specified whether predation is a rational business strategy for the given market specification. As it was argued in section 4.3, the profits in the post-predation period must be higher than the losses in the predation period to make predation a rational strategy. Formally, the condition can be expressed as follows:

$$\alpha\left(\pi^{Duo} - \pi^{Pred}\right) < \beta\left(\pi^{Mono} - \pi^{Duo}\right). \tag{110}$$

Table 35. Delta values for Scenarios 1, 2 and 3

	Predation as a rational business strategy	Net welfare increase compared to monopoly	Ex post I rule outperforms 'no rule'	Gain-based fine	Harm-based fine	Ex post I outperforms ex post II ($\varepsilon = 5$)	Ex ante outperforms ex post	Harm-based fine - % of monopoly turnover
	(1) $\Delta<0$	(2) $\Delta>0$	(3) $\Delta>0$	(4) $\Delta>0$	(5) $\Delta>0$	(6) $\Delta>0$	(7) $\Delta>0$	
Scenario 1-Same marginal cost								
a=5, b=5								
No fixed cost	-72,0	324,0	180,0	72,0	108,0	72,0	**-144,0**	4%
10 per firm	-332,0	249,0	130,0	332,0	343,0	**-213,0**	**-119,0**	12%
a=5, b=7								
No fixed cost	-216,0	324,0	252,0	216,0	324,0	144,0	**-144,0**	12%
10 per firm	-476,0	249,0	182,0	476,0	539,0	**-161,0**	**-119,0**	19%
a=5, b=10								
No fixed cost	-432,0	324,0	360,0	432,0	648,0	252,0	**-144,0**	23%
10 per firm	-692,0	249,0	260,0	692,0	833,0	**-83,0**	**-119,0**	30%
a=5, b=15								
No fixed cost	-792,0	324,0	540,0	792,0	1188,0	432,0	**-144,0**	43%
10 per firm	-1052,0	249,0	390,0	1052,0	1323,0	47,0	**-119,0**	48%
Scenario 2-Entrant has moderate cost advantage								
a=5, b=5								
No fixed cost	**97,9**	311,8	302,8	**-97,9**	196,0	106,9	**-8,9**	7%
10 per firm	-267,1	306,8	252,8	267,1	466,0	**-213,0**	**-54,0**	17%
a=5, b=7								
No fixed cost	-67,4	311,8	423,9	67,4	482,4	228,0	**-8,9**	17%
10 per firm	-432,4	306,8	353,9	432,4	732,4	**-112,0**	**-54,0**	26%
a=5, b=10								
No fixed cost	-315,4	311,8	605,6	315,4	912,1	409,7	**-8,9**	33%
10 per firm	-680,4	306,8	505,6	680,4	1132,1	39,7	**-54,0**	41%
a=5, b=15								
No fixed cost	-728,7	311,8	908,4	728,7	1628,2	712,5	**-8,9**	59%
10 per firm	-1093,7	306,8	758,4	1093,7	1798,2	292,5	**-54,0**	65%

Scenario 3-Entrant has large cost advantage								
a=5, b=5								
No fixed cost	**327,7**	275,0	463,9	**-327,7**	325,1	138,8	188,9	12%
10 per firm	-142,3	340,0	413,9	142,3	630,1	**-216,2**	73,9	23%
a=5, b=7								
No fixed cost	**143,2**	275,0	649,5	**-143,2**	695,1	324,4	188,9	25%
10 per firm	-326,8	340,0	579,5	326,8	980,1	**-50,6**	73,9	35%
a=5, b=10								
No fixed cost	-133,5	275,0	927,8	133,5	1250,2	602,7	188,9	45%
10 per firm	-603,5	340,0	827,8	603,5	1505,2	197,7	73,9	54%
a=5, b=15								
No fixed cost	-594,6	275,0	1391,7	594,6	2175,2	1066,6	188,9	79%
10 per firm	-1064,6	340,0	1241,7	1064,6	2380,2	611,6	73,9	86%

The values in the first column in Table 35 show that if the entrant has the same marginal costs as the incumbent, predation is always a rational business strategy for the incumbent. This is true even for the case that the post-predation period 'only' has the same length as the predation period. However, if the entrant has a moderate cost advantage, predation becomes an irrational strategy if $\alpha=\beta=5$ (indicating that it is profit-maximising for the incumbent to accommodate), but remains rational for $\beta=7$, 10 and 15. Finally, if the entrant has a large cost advantage, predation becomes irrational for α, $\beta=5$ and 7 but stays rational for $\beta=10$ and 15. It can be concluded that the more efficient the entrant, the larger the post-predation period must be in order to make predation a rational strategy. Furthermore, the existence of fixed costs generally makes the use of predation a more successful strategy for the incumbent.

In the second column, it is tested whether a successful predation attempt leads to a net welfare increase compared to a continuation of monopoly. As Table 35 shows, this is the case in every scenario and every specification of β. The economic reason behind this finding is basically that the gain in consumer surplus in the predation period is higher than the corresponding losses in producer surplus.

In the third column, it is tested whether making predation unsuccessful increases welfare compared to a situation in which predation is successful. Formally, this is equal to the question if an ex post I rule outperforms a no-rule approach. As the table shows, this is the case in every scenario. In other words, optimal antitrust enforcement has the potential to increase welfare in every scenario under the chosen model and market specification.

In the fourth column, the optimal gain-based fine is calculated. The fine is always positive except for the cases in which predation is an irrational strategy for the incumbent. The fine increases with β (as the gain increases with β). The existence of fixed cost – ceteris paribus – generally leads to a significant increase in the size of the optimal gain-based fine.

In the fifth column, the optimal harm-based fine is calculated. All values show positive fines indicating that predation is harmful in any case analysed. The harm-based fine is always larger than the corresponding gain-based fine. Furthermore, the harm-based fine increases with the efficiency of the entrant, indicating that the loss of a more efficient firm due to predation harms society more than the loss of an equally efficient firm.

In the sixth column, it is tested whether the switch from an ex post II rule (with an optimal harm-based fine after $\varepsilon=5$ post-predation enforcement periods) to an ex post I rule can lead to a welfare improvement. In general, the results show that as long as the fixed costs are equal to zero, it is always welfare-improving to trade an ex post I approach for an ex post II approach. The size of the welfare improvement rises with β and the efficiency of the entrant. This can be explained by the fact that $\varepsilon=5$ and that the period of monopoly after punishment ($\beta-\varepsilon$) increases, causing harm to society. The harm to society is increasing with the efficiency of the vanished entrant. If fixed costs of 10 are necessary to enter the market, it is often better to stay with an ex post II approach. As column six shows, if the entrant has the same efficiency, the welfare differential is negative for $\beta=5; 7; 10$. If the entrant is more efficient than the incumbent, the welfare differential remains negative for $\beta=5; 7$, indicating that it is welfare-improving to stay with an ex post II approach.

In the seventh column, it is tested whether an ex ante enforcement rule outperforms an ex post enforcement rule. As the column shows, this is not the case for scenarios 1 and 2. However, if the entrant has a large cost advantage, an ex ante rule indeed outperforms an ex post rule. This is basically because under an ex post regime, the producer surplus losses incurred by the predation strategy of the (inefficient) incumbent are bigger than the additional consumer surplus created in the predation period.

In the last column, the percentage shares of the harm-based fines with respect to the monopoly turnover in the preceding business year are calculated.[341] Compared to the maximum possible fine in the EU of 10% of the (worldwide) turnover, the percentages look relatively high, especially for large beta values and the 'more efficient entrant' scenarios. This gives an indication that the largest fines possible in the European Union are unlikely to reach a full deterrence effect or can compensate for the harm caused by the predation strategy.

Based on the spreadsheet calculations undertaken to derive the pair-wise welfare comparisons shown in Table 35, it is further possible to characterise the welfare consequences of selected iterative changes in the enforcement options graphically. This is done in Figures 54 and 55. Both figures include four charts depicting:

1. Welfare change due to switch from no rule to ex post I rule,
2. Welfare change due to switch from ex post II to ex post I,
3. Welfare change due to switch from ex post I to ex ante,
4. Aggregated welfare change due to predation enforcement.

Both figures differentiate only with respect to the underlying number of post-predation periods. While the charts in Figure 54 are based on $\beta=7$, Figure 55 as-

[341] The monopoly turnover is 2764,8.

sumes β=15. In line with the findings in Table 35, it is shown that a switch from a no-rule approach to an ex post I approach is always welfare-increasing, irrespective of the underlying β-value (although the welfare change as well as the efficiency of the entrant increases in β).

In the case of a switch from ex post II to ex post I – depicted in the second chart in Figure 54 – it is shown that β now becomes decisive with respect to the sign of the change in welfare. If β is sufficiently small, the welfare change is negative (as shown for the case of β=7); otherwise it is positive (as shown for the case β=15). Furthermore, the charts in Figures 54 and 55 reveal that the welfare loss/gain is decreasing or increasing with the efficiency of the entrant, respectively.

If there is a switch from an ex post I to an ex ante approach, the figures show that the results do not depend on beta. As explained above, such a switch in the enforcement option is only desirable from a total welfare perspective as long as the efficiency advantage is substantial (and the losses of the predator are correspondingly large).

Finally, Chart 4 in Figures 54 and 55 shows the aggregate welfare change due to predation enforcement. A comparison of both charts reveals that a no-rule approach in both cases realises the lowest welfare change due to predation enforcement. In terms of the other enforcement options, the picture is more diverse. For the case of β=7, it is shown that an ex post II approach is welfare-maximising if the incumbent and the entrant have the same marginal costs. This result holds for the case of a moderate cost advantage on the side of the entrant. If, however, the entrant has a large efficiency advantage, it is shown that an ex ante approach would realise the largest increase in welfare.

The pattern just described for β=7 changes significantly if β=15 is assumed. Now an ex post I approach would maximise welfare in a world in which incumbent and entrant are equally efficient. The same conclusion holds for a moderate cost advantage on the side of the entrant. If, however, the entrant has a large efficiency advantage, an ex ante approach again becomes the welfare-maximising enforcement option. It is further worth remarking that the performance of an ex post II approach deteriorates significantly with the increase in β. While in the β=7 world, all three active enforcement options realise comparable levels of welfare increase, the β=15 world shows that only the ex post I and ex ante approaches are still comparable with respect to their respective welfare improvements.

In addition to the graphical study of several important enforcement pairs and the aggregated welfare effects, the respective gain-based and harm-based fines can also be analysed graphically. Figure 56 depicts these fines, again for the two states of β=7 and β=15 and the three different levels of entrant efficiency.

As shown in Figure 56, the gain-based fine is always lower than the respective harm-based fine. If β=7, the gain-based fine decreases with the efficiency of the entrant, while it is relatively constant for β=15. The harm-based fine increases (for both β values) with the efficiency of the entrant and only differs in the absolute fine level (which is dependent on the number of post-predation periods β). Figure 56 further shows that the differences between the gain-based and harm-based fine levels increase with the efficiency of the entrant.

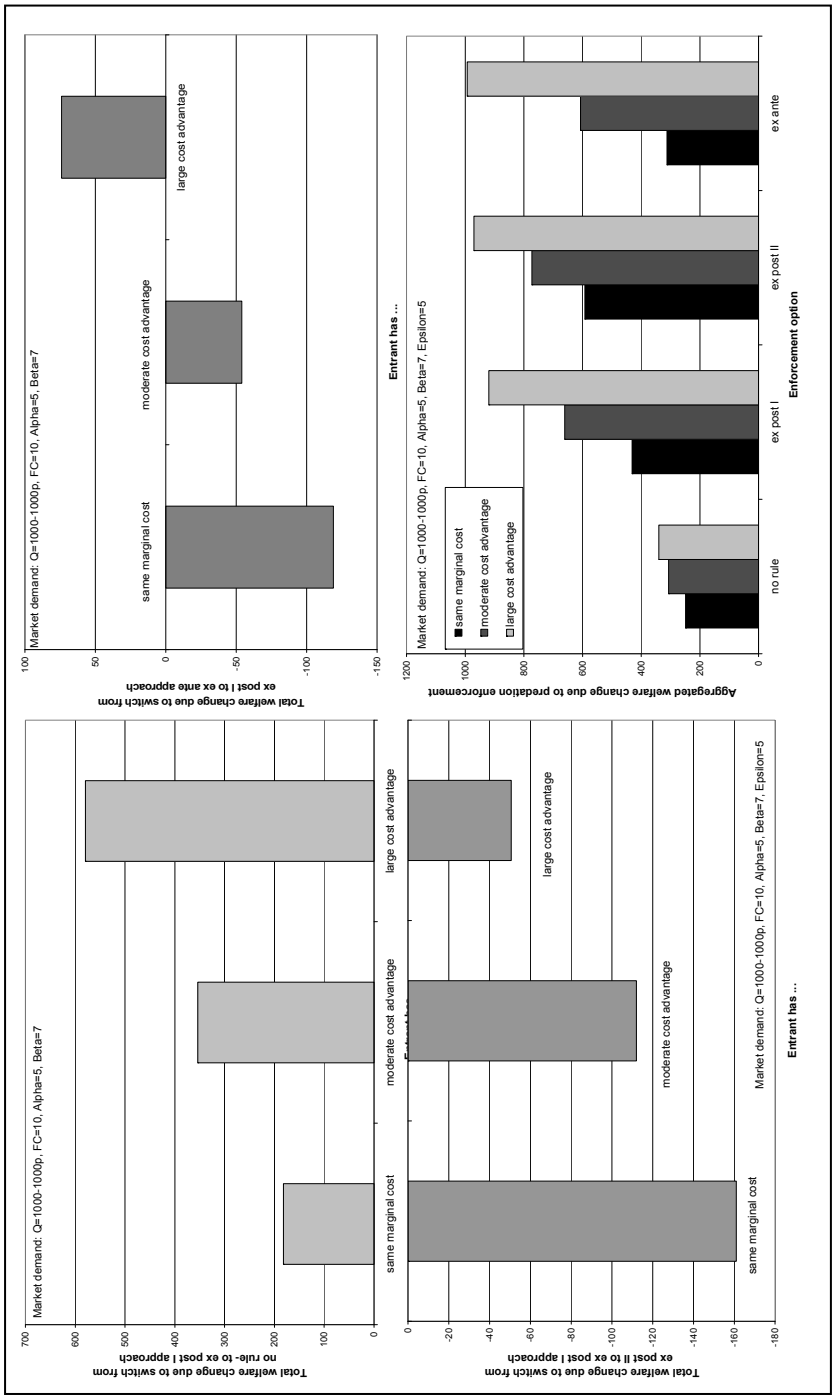


Fig. 54. Welfare changes and aggregated welfare change for different enforcement options (α=5, β=7)

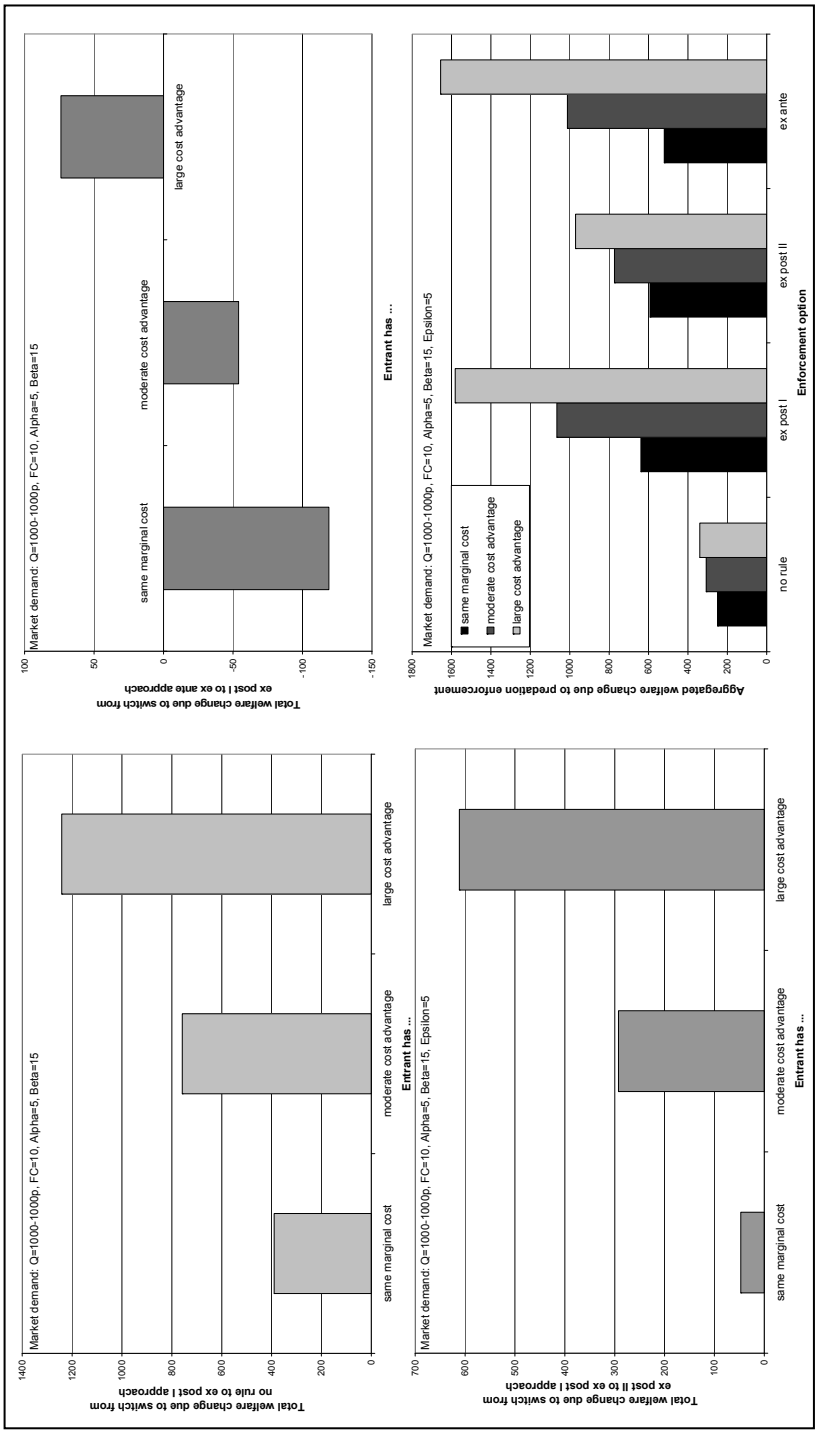


Fig. 55. Welfare changes and aggregated welfare change for different enforcement options (α=5, β=15)

World of uncertainty and imperfect information

A certainly critical assumption so far was that the antitrust authority is able to find and intervene against predators with certainty and without any cost.[342] In such an environment it is not surprising that "[a] policy that could identify and punish deviations from the competitive benchmark without error would increase social welfare unambiguously" (Evans and Padilla, 2004: 3). Additionally, the previous analysis contains a logical caveat: If the predator knows for sure beforehand that it will get caught, predation would become an irrational strategy and therefore would not occur in such an environment.

Therefore, with the aim of deriving practical policy recommendations, it is inevitable to assess the different enforcement options in a world of uncertainty and imperfect information. Immediate consequence of an imperfect world is that the antitrust authority is in danger of making welfare-reducing case decisions by (a) detecting and punishing an attempt of predation which was in fact procompetitive behaviour (type I error, 'punishing the innocent'), (b) not detecting and punishing instances of predation (type II error, 'acquitting the guilty') and (c) correctly detecting predation but choosing suboptimal remedies which harm overall welfare (type III error, 'suboptimal punishment of the guilty'). Furthermore, (d) general enforcement costs, as well as (e) costs from firms using alternative strategies to achieve the same ends and (f) costs due to non-predatory firms acting to avoid being mistaken for predators, must also be taken into account (see Easley et al., 1985: 445ff.).

As a consequence, optimal decisions in an imperfect world

> involve forming prior beliefs based on imperfect information, assessing the likelihood of making the right decisions, estimating the cost of making the wrong decisions and choosing those decisions that maximise the present discounted value of the decision and minimise the expected cost of errors (Evans, 2005: 15).

The following sections aim at analysing some important aspects of the three basic enforcement options (no rule, ex ante rule and ex post rule) in this imperfect world.

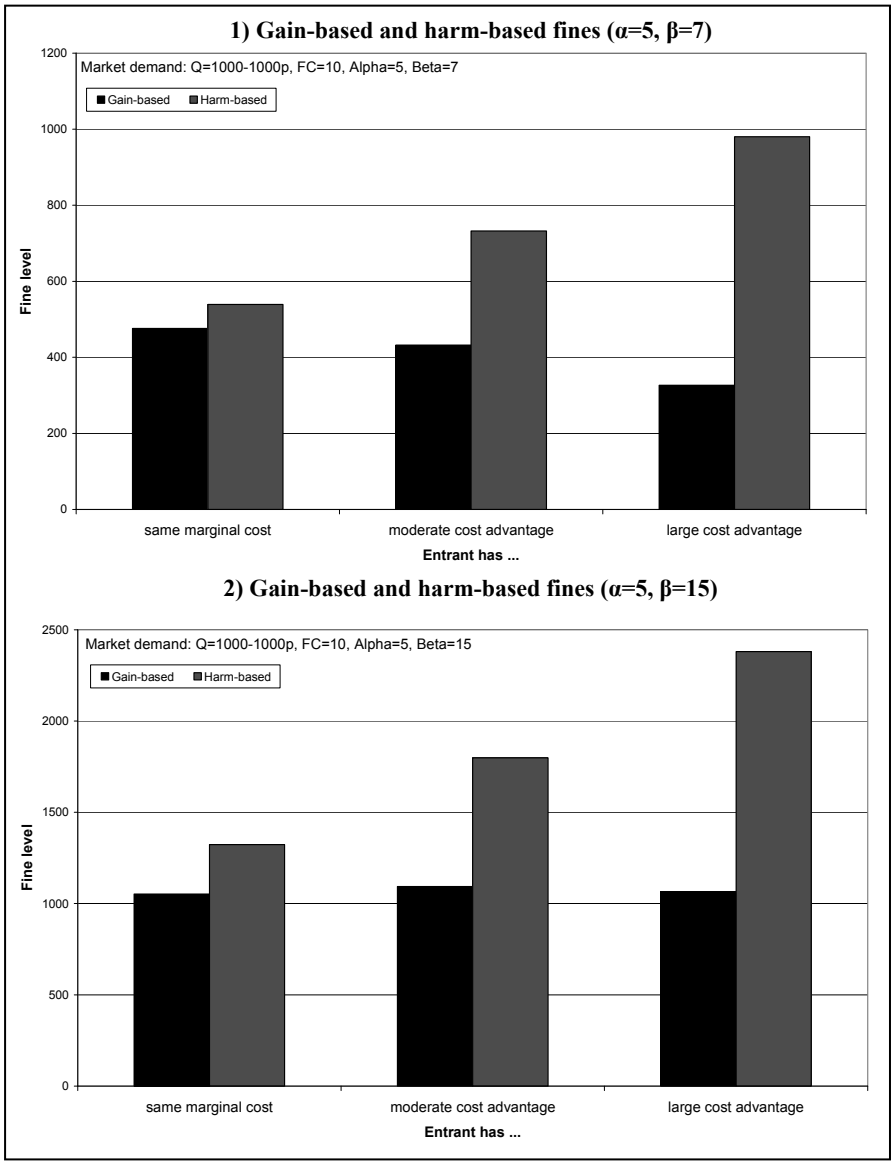
No rule

A considerable number of antitrust lawyers and economists believe that the best predation enforcement is no enforcement (e.g., Bork or McGee). One frequently used argument by supporters of the Chicago school is that any antitrust action against predation is unnecessary, because the market forces (in the long run) will automatically select the most efficient firms and lead to efficient market outcomes. Another argument says, as sketched above, that predation is irrational generally and that suspicious cases only represent the richness of normal competitive behav-

342 Phlips (1995: 240ff.) shows that the antitrust authority cannot differentiate between non-competitive Cournot outcomes and predation outcomes if it does not know all demand parameters and the marginal costs of the incumbent.

iour. Both lines of arguments inevitably lead to the same conclusion: the no-rule approach is the first and only sensible enforcement option as a matter of principle.

Fig. 56. Gain-based and harm-based fines with varying entrant efficiencies



Even if the welfare-reducing potential of predation in some cases is acknowledged, some scholars believe that it is hardly possible for an antitrust authority to distinguish normal competitive behaviour from harmful predatory behaviour.

Generally speaking, dynamic market behaviour is assumed to be too complex to be interpreted correctly by the antitrust authority (see Joskow and Klevorick, 1979: 217). Interventions therefore contain a high danger of errors and consequently socially harmful antitrust interventions.[343] A closely related argument says that predation should not be on the antitrust enforcement agenda because it is "rarely tried, and even more rarely successful."[344] In both cases, the no-rule approach is the first choice following an implicit cost-benefit assessment.

The universal correctness of such a cost-benefit assessment can certainly be questioned. Although it is of course sensible to choose the optimal level of antitrust enforcement subject to cost-benefit considerations[345], it is unclear whether this *generally* leads to a no-rule approach as the first choice. As shown by Easterbrook (1984: 318) and others, the society's welfare is maximised when the legal rule holds to a minimum the *sum* of, first, the welfare loss from the infringement; second, the welfare loss from an erroneous condemnation of procompetitive behaviour; and third the costs of administering the legal rule. For the following reasons, the supporters of a no-rule approach might underestimate the benefits and overestimate the costs of other forms of predation enforcement.

First, a no-rule approach is equal to a minimisation of type I errors while maximising type II errors. However, it is quite unlikely that both types of errors occur in the same frequency and gravity in every type of antitrust case. For example, in a monopoly market the likelihood of a type I error is typically considerably smaller than in an oligopoly market. However, consumers typically gain relatively more from introducing competition in a monopoly market (see chapter 3 for an assessment); hence, a type II error is likely to be big. Consequently, it might be sensible to think about using different enforcement standards/options for predation in monopoly markets and in oligopoly markets.

Second, the frequently used argument that predation is 'rarely tried, and even more rarely successful' is flawed from the perspective of recent theoretical and empirical work on predation.[346] Even if predation is not frequently observed, such

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343 In this respect, it should be mentioned that antitrust rules (e.g., against predation) might demotivate incumbents to undertake welfare-enhancing activities (e.g., to drop prices) just because they are afraid of being (wrongly) charged by the antitrust authority and the court(s).

344 *Matsushita Elec. Indus. Co. v. Zenith Radio Corp*., 475 US at 589 (1986).

345 This is a basic result of many 'optimal enforcement' models. For instance, Souam (2001: 1ff.) shows that it is welfare-optimal to tolerate some degree of collusion in the market when interventions are costly.

346 In a study (on behalf of United Airlines) Bamberger and Carlton (1999) assessed more exactly whether predatory pricing is widespread in the airline industry. The authors examine entry by low-fare carriers since 1990, the survival rates of low-fare carriers, the fare and capacity responses of incumbents to entry by low-fare carriers and the fare responses of incumbents to exit by low-fare carriers. The authors conclude that the empirical evidence fails to support the growing concern that incumbent major carriers systematically engage in exclusionary or predatory conduct to force low-fare carriers out of the market. "The evidence shows that the type of fare and capacity re-

a finding might state little about the importance and influence of a predation strategy on industry competition, because it neglects the important reputation effects which aim at spilling over to other entrants in the same or adjacent markets. In other words, predation would be an expensive (and probably irrational) strategy, if an incumbent would have to apply it frequently after market entry occurred. Part of the value of a predation strategy stems from its pre-entry deterrence effect, created by a combination of uncertainty and reputation in the head of the entrant. The incumbent reduces the profit expectations of the potential entrant, leading – as the case may be – to its decision not to enter at all. Consequently, observable cases of predation should be relatively seldom and could be interpreted as investments of the incumbent in the credibility of its strategic signals. Therefore, a no-rule approach cannot be justified by simply demonstrating that a certain strategic option is rarely observable in a certain industry.[347]

In short, although cost-benefit calculations might under many circumstances justify a no-rule approach, it is doubtable that such an approach is *generally* the optimal predation enforcement option.

Ex post rule

As already discussed in section 4.5.2, ex post predation enforcement can be separated into an ex post I approach in which the antitrust authority intervenes before the entrant has to exit the market and an ex post II approach in which the authority intervenes after the entrant has left the market. In an *ex post I approach*, the antitrust authority has to answer two fundamental questions. The first refers to competition in the post-predation period. In that respect, the antitrust authority has to decide on a minimum price for the incumbent which terminates the infringement and 'restores' competition. The second question to be assessed refers to the fixing of an ex post fine for the infringement. In an *ex post II approach*, the entrant has already left the market and a decision about the termination of the infringement is obsolete. Consequently, the antitrust authority only has to answer the question of how to fine the incumbent. Both approaches will be discussed in the following paragraphs.

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sponses that concern the DOT and others are rare and also occur in response to entry by major carriers" (p. 14).

347 Additionally, the consensus among some commentators that 'predatory pricing schemes are rarely tried, and even more rarely successful' might have become a self-fulfilling prophecy, because multiple barriers faced by predatory pricing plaintiffs make it almost impossible to get past summary judgment (see Zerbe and Mumford, 1996: 955f.). Hemphill (2001: 585) explains that because of the difficulty of winning a predation case in the United States, the government avoids an explicit predatory pricing allegation and instead tries to reach related conduct under the general sections standard. Consequently, it might be highly misleading to conclude from the few predation cases in the US that the whole form of anticompetitive behaviour is irrelevant. It might only be deterred by the high standards of proof and substituted by other forms of anticompetitive behaviour.

Ex post I approach – Terminating the infringement

After detecting predation, the antitrust authority has to terminate the infringement. How this should be done largely depends on how predation was detected in the first place. If the antitrust authority undertook price-cost comparisons, it has a picture of the costs of the incumbent and can therefore estimate a minimum price for the incumbent which covers (the used measure of) its costs. It is important to note that such a price must not ensure that the entrant can reach the break-even point. The aim is solely to secure that the incumbent does not price unfairly low[348]; it is a measure to secure (possible) competition, not competitors.

If the antitrust authority derived the non-cooperative Cournot-Nash equilibrium as a benchmark for procompetitive behaviour and proved predatory conduct by showing that actual market prices were lower, it has all necessary information to fix the correct minimum price for the incumbent. In that case, however, the efficiency of the entrant plays a role in the investigation, as it has to be shown first that the entrant 'is efficient enough' (and the market large enough) to reach break-even in a non-cooperative Cournot equilibrium (and only the incumbent's pricing policy turns this entry value negative).

Independent of the exact way of deriving the minimum price for the incumbent, the antitrust authority is in danger of choosing an improper mode of interference against (correctly identified) predatory behaviour. Such an error was introduced recently as *a type III error* (see Gal, 2000: 93). If the minimum price is too low (and therefore still predatory), the entrant might still make losses and may have to exit the market (at a later point in time). If the minimum price is too high, the incumbent suffers too much, which also distorts competition and especially reduces the incumbent's innovation and investment incentives and probably (through the creation of credible signals) in the economy as a whole.

Comparable problems are created with respect to the length of the period for which the minimum price for the incumbent should be valid. From a theoretical point of view, it is unclear why a minimum price should be subject to a time limit at all, as it just corrects misbehaviour that does not turn into approved misbehaviour after a certain amount of time. However, practical reasons such as the constant monitoring efforts of (probably asymmetric) cost and demand shocks in the industry (and the corresponding adjustments of the minimum price) make it economically sensible to constrain the minimum price to a certain time period. Such a time limit also reflects the belief that the entrant becomes established in the market after some time and probably is not that vulnerable to predation attacks any more.

Ex post I approach – Determination of fines

The antitrust authority generally has the choice between gain-based and harm-based fines. As shown in section 4.5.2.2, harm-based fines have certain advan-

348 There has recently been an interchange of ideas on the question of the relevance of above-cost predation by Edlin (2002) and Elhauge (2003). This discussion is not considered further in this chapter.

tages over gain-based fines, such as avoiding under- or over-deterrence. In a world of uncertainty, the optimal gain-based fine is given by the formulas derived above divided by the probability of detection and amended by the enforcement costs *C* in order to force the incumbent to bear all the costs of his misbehaviour (see Polinsky and Shavell, 2000: 57f. for a discussion):

$$F_{\text{Gain based}} = \frac{\beta\left(\pi_I^{\text{Mono}} - \pi_I^{\text{Duo}}\right) + \alpha\left(\pi_I^{\text{Pred}} - \pi_I^{\text{Duo}}\right)}{\rho} + C\,. \tag{111}$$

The same adjustment is necessary for the harm-based fine, which is given as follows

$$F_{\text{Harmbased}} = \frac{\alpha\left[\left(CS^{\text{Duo}} - CS^{\text{Pred}}\right) + \left(\pi_E^{\text{Duo}} - \pi_E^{\text{Pred}}\right)\right]}{\rho} + \frac{\beta\left[\left(CS^{\text{Duo}} - CS^{\text{Mono}}\right) + \pi_E^{\text{Duo}}\right]}{\rho} + C. \tag{112}$$

In both cases it is welfare-optimal to add the enforcement costs *C* to the fines in order to force the incumbent to bear all the costs of its misbehaviour.

If the antitrust authority ends the predation attempt before the entrant has left the market, the fixing of gain-based or harm-based fines is somewhat difficult. This is because the intervention of the antitrust authority makes the incumbent's investment unprofitable before it has a chance to earn a positive return on investment. In other words, the gain for the incumbent is negative at that point. Additionally, there is no harm to the consumers, as they enjoy a higher consumer surplus than in the duopoly counterfactual during the predation period. Total welfare is only reduced if the entrant has a large efficiency advantage and the incumbent has to accept large losses to drive down the entrant's profits to zero. Consequently, the only party which is harmed by the interrupted predation strategy is the entrant, as the predation attempt took away the duopoly profit he would have realised in the competitive situation. Consequently, the fixing of this amount can be derived easily in theory by multiplying the number of predation periods with the difference between duopoly profits and predation profits. Additionally, total welfare is further reduced by the enforcement costs invested by the antitrust authority. The consequential conclusion of this line of thinking is that the incumbent does not have to pay a fine in an ex post I approach, as he already fined himself by selling products at a suboptimal low price during the predation period. However, he should bear the enforcement costs.

Ex post II approach – Determination of fines

In an ex post II approach, the authority ends the predation attempt after the entrant has exited the market. In other words, predation was successful for the incumbent in the sense that it regained its monopoly position. In such a situation, the gain realised and the harm caused depend on α and β. If α is again fixed to α=5, Figure 57 shows the optimal gain-based and harm-based fines if the predator is detected

after β periods. The model and market specifications introduced above apply. The probability of detection and punishment is set to 1 and the enforcement costs are assumed to be 0. Additionally, the antitrust authority might estimate additional gains for the predator due to spillover of its tough predatory reputation into other markets in which the predator operates. If such a market entry is deterred by the predation strategy, the gain of the predator is larger than and the corresponding fine would have to consider that.

As shown in Figure 57, for small β, the gain-based fines for the incumbent swamping out an equally efficient entrant are larger than the fines for swamping out a more efficient entrant. The reason behind this observation is that it is more expensive to get rid of a more efficient entrant and the incumbent reaches the break-even point later. However, the slopes of the optimal fine functions increase with the efficiency of the entrant, indicating that the fines for getting rid of a more efficient entrant exceed the optimal fines for an equally efficient rival – if β is large enough. The reason is that the longer the post-predation period lasts and the more efficient the entrant was, the larger are the net gains of the incumbent due to monopolisation.

The harm-based fines show a different picture. For β equals 0 and 1, the optimal harm-based fines in all three scenarios are negative, indicating that the welfare gain realised by the low prices in the predation period outweighs the welfare losses in the post-predation period. For ß > 1, all scenarios show a positive harm-based fine. The slopes of the optimal fine functions are again increasing with the efficiency of the entrant, indicating that the harm of a successful predation strategy becomes larger with growing β and growing efficiency of the entrant.

Comparing the differential between gain-based and harm-based in the third chart of Figure 47 shows that if the entrant has a large efficiency advantage, the harm-based fine is always larger than the gain-based, indicating that predation is always deterred by a harm-based fine. This is also true for β>1 in the scenario in which the entrant has a moderate cost advantage. However, if the entrant is equally efficient, the difference between gain-and harm-based fines turns negative only for β>4, indicating that for smaller β it pays for the incumbent to violate antitrust law and to pay the corresponding fine because he would still realise a positive profit. In other words, in this certain range, predation becomes a socially efficient strategy, as it brings larger benefits to the offender than it harms society. It therefore confirms Becker's (1968) theoretically derived result that even in an environment in which enforcement costs are zero it is not optimal to deter all violations, as some offences are efficient in the sense that the gain to the offender exceeds the harm to the victim.

Instead of fixing α (as done in the calculations underlying Figure 57) it is possible to plot the optimal harm-based fines dependent on α and β for a given efficiency level of the entrant. Figure 58 shows the results for a moderate efficiency advantage of the entrant (see Table 64 in Annex 6.7 for the data matrix).

Fig. 57. Optimal gain-based and harm-based fine against β

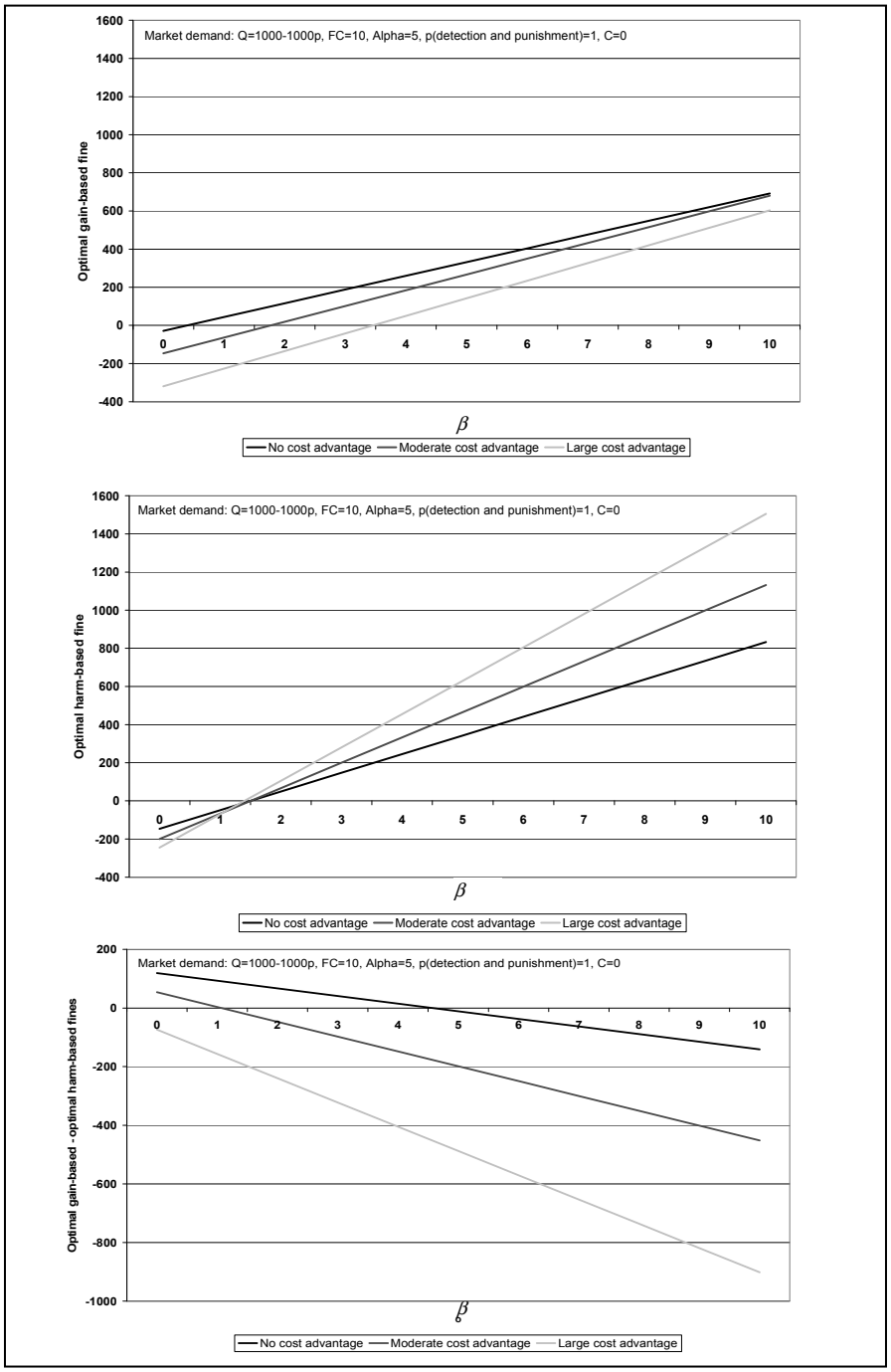

Fig. 58. Optimal harm-based fine against α and β

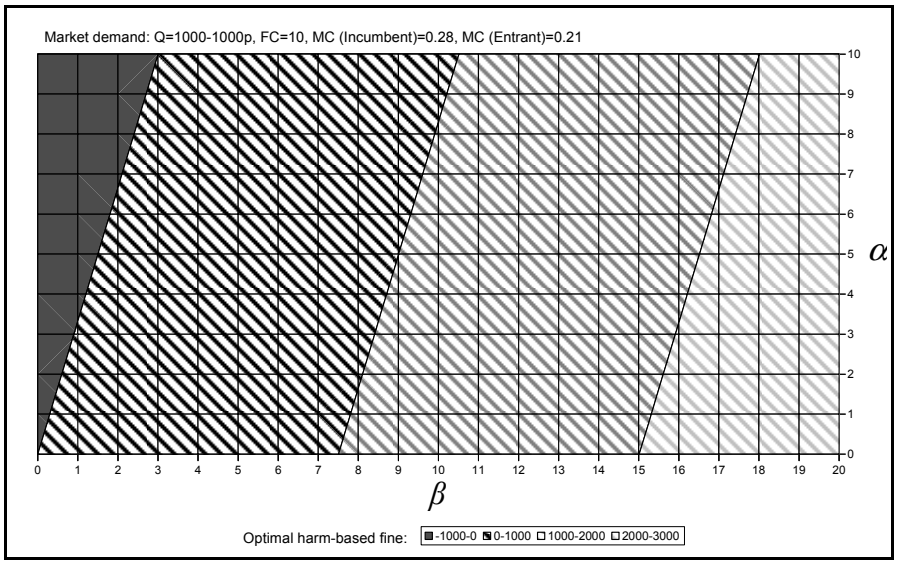

Figure 58 shows that the optimal harm-based fine is negative for large α and small β. This basically reflects the fact that the incumbent invests a relatively large amount during the predation period α and does not have the chance to realise a positive return on investment in the short post-predation period β. For a constant α (i.e., a constant welfare-improving predation investment), the harm-based fine increases with β (i.e., a growing abuse of market power in the post-predation period). Vice versa, for a constant β (i.e., a fixed recoupment possibility and a fixed harm caused) the harm-based fine decreases with increasing α (i.e., a growing welfare-improving predation investment).

Ex post I versus ex post II approach

The analysis so far differentiated between an ex post I approach in which the antitrust authority intervenes before the entrant has to leave the market and an ex post II approach in which the antitrust authority intervenes after the entrant exited the market. In general, one might think that the ex post I approach is always superior to an ex post II approach, as the latter loses the competitor in the market.

There are several arguments in a world of uncertainty and limited information, which indicate that that might not generally be the case. One is simply referring to enforcement costs, which tend to be the higher the quicker the analysis has to be delivered. As antitrust authorities' budgets are constrained and a lot of their resources are used for activities other than predation enforcement, this argument might act as an explanation why an antitrust authority would favour an ex post II approach.

A related argument refers to the likelihood of errors. As explained above, it is generally feared that firms might refrain from implementing procompetitive price drops because of the fear that such price drops could be interpreted as predatory and consequently fined. Furthermore, there is a chance that an ex post I approach protects inefficient entrants, as the antitrust authority only has an incomplete picture of the entrant and its entry attempt. Easterbrook (1984) therefore proposes not to intervene during the possible predation period but to act afterwards, if the old monopoly raises its prices and enjoys monopoly power.[349]

On the other hand, this advice could be very harmful for the consumers if the post-predation period is long (i.e,. the entry barriers are high) and the entrant is lost 'for the market' (see Eckert, 2002). This effect is shown graphically in Figure 59 (see Table 65 in Annex 6.7 for the data matrix) by plotting the welfare differential between an ex post I approach and an ex post II with optimal fine approach against the length of the post-predation period β and the period ε between the end of the predation period and the point in time when the antitrust authority imposes the fine (with $0 \leq \varepsilon \leq \beta$).

Figure 59 shows that for small β and large ε, the welfare differential is negative, indicating that an ex post II with optimal fine approach is superior in terms of overall welfare to an ex post I approach. For constant β, the welfare differential decreases with increasing ε, while vice versa for constant ε, the welfare differential increases with β.[350] As a consequence, the antitrust authority needs – after an indication of predation is made – a screening system which evaluates how important the entrant could be for the respective industry. If the entry barriers are generally high and an entrant nevertheless managed to enter the market, it can be expected to be more valuable to protect such an entrant than one in an industry with lower entry barriers and more frequent entry attempts.

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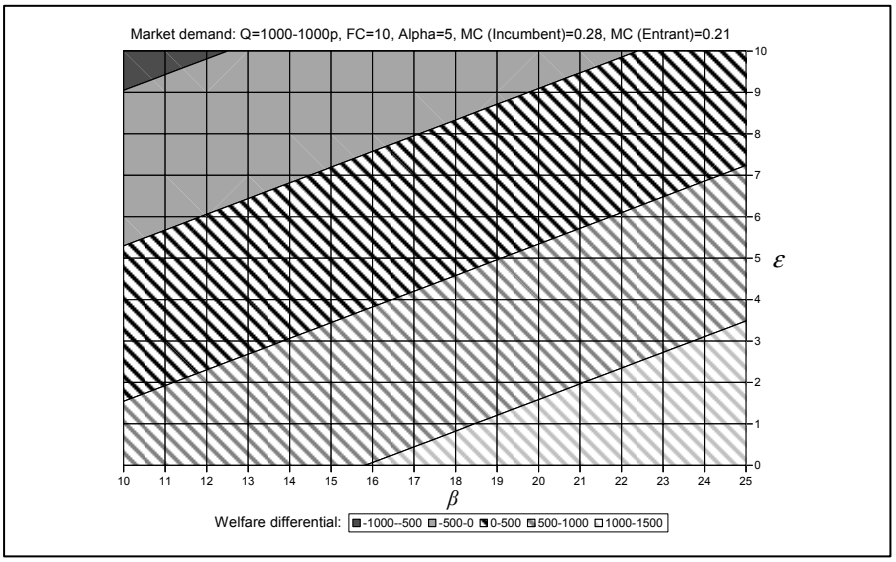
349 Although it would be thinkable to consider behavioural or structural remedies as part of an ex post II approach (in addition to fines), such options will not be discussed in detail here. The imposition of structural remedies (in the form of divestitures) played a role in the history of predation enforcement, for example in the break-up of Standard Oil (1911), but would typically not be considered as a potentially desirable option nowadays (see OECD, 2007: 31ff.). Imposing behavioural remedies, however, might be a valuable option within an ex post II approach in order to ease, for example, entry for other competitors (who might build on the experiences or even equipment of the exited entrant). In particular, introducing an ex ante approach as a reaction to a successful predation attempt in an industry would be a possible solution. Alternatively, remedies could be constructed following an eight-step proposal by Kovacic (1999), which was recently also applied in OECD (2007: 25ff.): 1) Promptly define the remedial objectives and develop a plan for attaining them; 2) Understand the industry; 3) Make adjustments if there is a history of misconduct; 4) Anticipate the defendant's likely response; 5) Identify side effects; 6) Analyse administrability; 7) Select a remedy; and 8) Develop a practical implementation framework.

350 The optimal enforcement from the viewpoint of consumer and overall welfare takes place immediately before the market ends, as the incumbent has to pay back the entire gain of its predation strategy or – alternatively – has to pay for the harm he caused during the entire post-predation period.

Fig. 59. Welfare differential between ex post I and ex post II with optimal fine against β and ε



Ex ante rule

Ex ante rules aim at destroying the incentives of dominant firms to play predation strategies. To apply such a rule, the antitrust authority has to commit to a certain reaction which, in case of entry, makes a predation strategy unprofitable. If such a rule works frictionless, it is profit-maximising for the incumbent to accommodate the entrant (or alternatively to choose an alternative form of strategic behaviour).

In a world of certainty and perfect information, it was found above that an ex-ante rule is only superior to an ex post I approach if the entrant has a large efficiency advantage over the incumbent. This was basically driven by the fact that with an ex post I approach, the consumers can enjoy the low prices during the predation period and still get – due to ex post I enforcement – the duopoly surplus in the post-predation period. With an ex-ante approach, the consumers only get the duopoly surplus from the occurrence of entry to the end of the market. Therefore, from an overall welfare perspective, the ex post rule is superior to an ex ante rule as long as the profit losses in the predation period are smaller than the consumer surplus gains in the same period. As the numerical example above indicated, this is typically the case as long as the entrant's efficiency advantage is not too large.[351]

In an environment of uncertainty and incomplete information, it becomes uncertain whether the antitrust authority is quick enough to rescue the entrant before

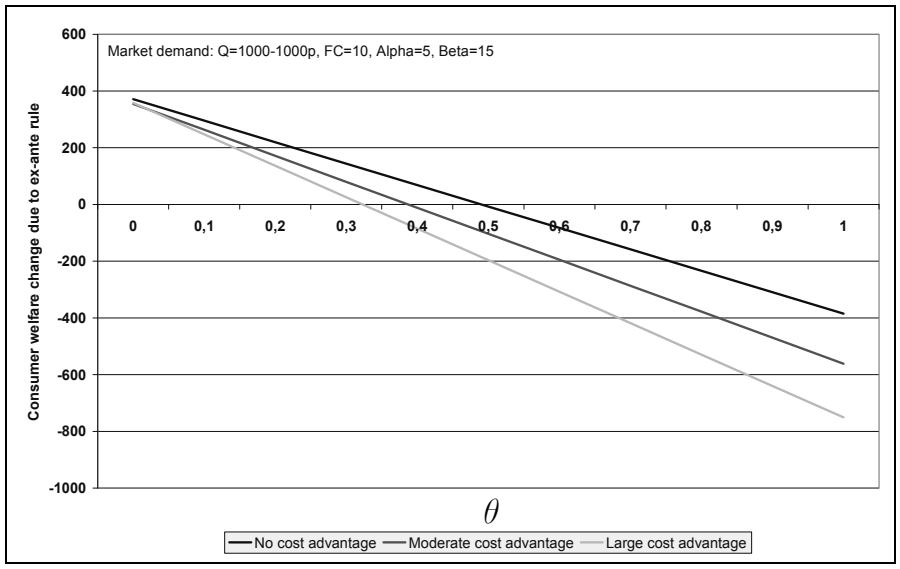
[351] In the model and market specification used above, the ex ante rule outperformed the ex post rule only in Scenario 3, in which the entrant had a large efficiency advantage over the incumbent.

it is forced to leave the market by a predation strategy. From a consumer perspective, the certain duopoly consumer surplus realised with an ex ante rule has to be compared with the sum of the higher predation consumer surplus and the expectancy value for post-predation period profits. Formally, this condition can be expressed as follows

$$(\alpha+\beta)CS^{Duo} > \alpha CS^{Pred} + \beta\left[\theta CS^{Duo} + (1-\theta)CS^{Mono}\right]. \quad (113)$$

θ can be interpreted as the likelihood that the antitrust authority quickly and exactly detects and intervenes against predators. If θ=0, the authority never detects and punishes predators ex post. If θ=1, the authority always detects and punishes predators ex post. The welfare change due to an ex ante rule against θ can be exemplified by using the model and market specifications specified above. The following Figure 60 does this for the three entrant scenarios with FC=10, α=5 and β=15.

Fig. 60. Consumer welfare changes due to ex ante rule against θ



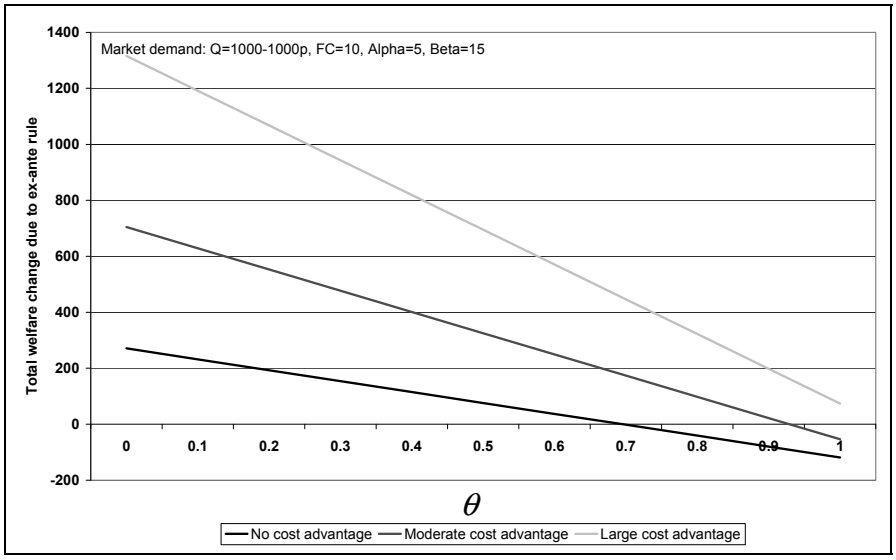
As Figure 60 shows, if the antitrust authority is not too exact or slow in detecting and intervening against predators – or alternatively if high ex post enforcement standards make a conviction unlikely – an ex ante rule leads to a welfare increase. This is the case in all three scenarios; however, the threshold value decreases with the efficiency of the entrant. The reason is that the consumers suffer more if a more efficient entrant is lost. If the antitrust authority is relatively efficient in intervening against predators, consumers are still better off with an ex post rule.

Although the consumer welfare approach depicted in Figure 60 provides helpful insights, this chapter primarily follows a *total welfare approach*. In a total welfare approach, the respective inequality changes to the following expression

$$(\alpha+\beta)\left(CS^{Duo}+\pi_E^{Duo}+\pi_I^{Duo}\right)>\alpha\left(CS^{Pred}+\pi_E^{Pred}+\pi_I^{Pred}\right)+ \\ \beta\left[\left(\theta\left(CS^{Duo}+\pi_E^{Duo}+\pi_I^{Duo}\right)+(1-\theta)\left(CS^{Mono}+\pi_I^{Mono}\right)\right)\right]. \tag{114}$$

While the general structure and the interpretation of θ remains unchanged from the consumer welfare approach, the total welfare inequality incorporates consumer surplus and industry profits. Applying the model and market specification used above to the total welfare inequality leads to the result depicted in Figure 61.

Fig. 61. Total welfare changes due to ex ante rule against θ



As Figure 61 shows, an ex ante approach always leads to a higher overall welfare when the entrant has a large efficiency advantage. If the entrant has no or only a moderate efficiency advantage, an ex post approach outperforms an ex ante approach only for high θ values, and the likelihood for an ex post enforcement is high. The welfare differential is growing with shrinking θ values.

Generally, a comparison between the consumer welfare approach in Figure 60 and the total welfare approach in Figure 61 reveals that the welfare standard matters. While the consumer welfare approach leads to the conclusion that an ex ante approach is only the best choice for a relatively small θ, Figure 61 shows that a total welfare approach leads to the conclusion that an ex ante approach is the better choice of an antitrust authority except for high θ values.

Although the ex ante rule might be a valuable enforcement option in theory, much of the practical success of this rule in a world of uncertainty and limited in-

formation would depend on its actual design. In that respect, the literature discusses especially two different types of ex ante rules: the 'no post-exit price increase' rule by Baumol and the 'price freezing' rule by Edlin.

– *The 'no post-exit price increase' rule*
  Baumol (1979) developed his 'no post-exit price increase' rule in 1979, motivated by the publication of Williamson's (1977) 'no post-entry output increase' rule two years earlier. The primary focus of his rule is to avoid reliance on cost-based tests completely. His rule permits price decreases in response to entry but forbids a dominant firm to raise prices again for a considerable period of time (Baumol suggests five years) after the entrant exited the market. The logic of this rule is the following: If a dominant firm only is allowed to raise prices after a certain time period after an entrant exits, the expected monopoly profits are unreachable during this time period. As a consequence, the predation strategy becomes more expensive, and therefore its actual usage becomes more unlikely. In short, Baumol's rule lowers or erases the incentives of the incumbent to select a price that it could not live with in longer terms.
– *The 'price freezing' rule*
  Edlin's proposal (2002) lies in the spirit of the rules of Baumol and Williamson. He proposes that in markets where an incumbent monopoly enjoys significant advantages over potential entrants, but another firm enters and provides buyers with a substantial discount,

  > the monopoly should be prevented from responding with substantial price cuts or significant product enhancements until the entrant has had a reasonable time to recover its entry costs and become viable, or until the entrant's share grows enough so that the monopoly loses its dominance (Edlin, 2002: 945).

  Edlin proposes that if an entrant prices 20% below an incumbent monopoly, the incumbent's prices will be frozen for 12 to 18 months. If the incumbent violates this behavioural intervention, the entrant can sue successfully for predation without the need to demonstrate below-cost pricing or the opportunity for recoupment.

Although both rules have apparent similarities, an important difference is that Edlin's rule encourages the incumbent to charge lower than monopoly[352] prices from the start (already in the pre-predation period) in order to discourage entry.[353] If entry takes place anyway, Edlin's rule offers the entrant some protection against predation attempts by freezing the incumbent's price but does not intent to make predation unprofitable. Therefore, Edlin's proposal must be understood more as an approach to constrain monopoly behaviour generally rather than a rule solely designed to fight predation. Baumol's rule, on the other hand, lies in the spirit of a predation ex ante rule used so far, as his rule tries to make predation unprofitable by artificially extending the costly predation period for the incumbent.

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352 The price the incumbent charges depends on his expectation of the likelihood of entry. If he believes that entry is impossible, he would continue to charge the monopoly price. If entry is immanent, he would charge the duopoly price.

353 As Williamson shows, his 'no post-entry output increase' rule also has positive pre-entry welfare effects.

Although applying these rules looks easy and straightforward, there are certainly many challenges in applying them in practice. Edwards (2002: 188) as well as Facey and Ware (2003: 625ff.) argue, for instance, that ex ante rules are not as easy to administer as their creators suggest, as they

> would require, for each industry, or in each case where a firm develops a monopoly, ongoing micro-management by the courts or a regulatory agency to determine the appropriate periods of price freezes and to review these determinations. These determinations would likely be subject to lengthy and ongoing litigious and non-litigious arguments between the interested parties (Edwards, 2002: 188).[354]

In other words, enforcement cost as such might be lower than in an ex post approach; however, the monitoring cost might eat away this advantage.

With respect to the necessary monitoring, ex ante rules might run into an institutional problem. As discussed by Geroski (2004), the aim of antitrust authorities is not constantly to oversee the performance of particular markets or senior management decisions, but only to "swing [..] into operation when serious, egregious problems are believed to exist" (p. 4). From that perspective, it is worth considering handing over the possible application of ex ante rules to the responsible regulatory authorities or, alternatively, to increase (further) the scope of antitrust authorities' activities into regulatory-type interventions (such as in the field of merger control).

Another major problem of ex ante rules is that they might also reduce incentives for socially desirable price decreases. "[B]y making price increases difficult, the rule might also make innocent firms leery of cutting prices, for fear of losing their ability to raise them later again" (OECD, 1989: 23). Edwards shows that this might be a considerable problem, especially in industries in which network effects play an important role.

Another challenge of an ex ante rule is the correct (ex ante) fixing of the number of periods of the rule's effectiveness. Baumol suggests a period of 60 months for his rule; Edlin only 12 to 18 months. In the former case, the duration of the price freeze determines whether predation becomes irrational or not. In the latter case, it depends on assumptions about the time the entrant needs to become established in the market. If the duration is too short, the Baumol rule does not negate all the predation gains and predation might still be a rational strategy. This effect can be shown formally. Suppose that the post-predation period β is divided into a

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354 Following Elhauge (2003: 682) an application of Edlin's rule would encourage 'cream skimming' where entrants can be protected in price cutting on lucrative submarkets. Another point of criticism, namely that the incumbent has an incentive to adjust its price immediately before entry, can be solved by using yearly average prices, for example. Another disadvantage of the rule derives from the fact that prices typically underlie many variations over time (with varying motivations). When unexpected cost changes occur, the dominant firm should be allowed to raise prices. As a consequence, the workability of Baumol's rule is relatively low, as the reviewing authorities would have to ensure that a price cut remains in effect for the required period following exit.

period χ in which the predator has to keep the predation price after the entrant exited and a period δ – from the end of the 'price fixing rule' to the end of the market – in which the incumbent can set its old monopoly price. Under such circumstances, the incumbent is indifferent toward predation and accommodating if

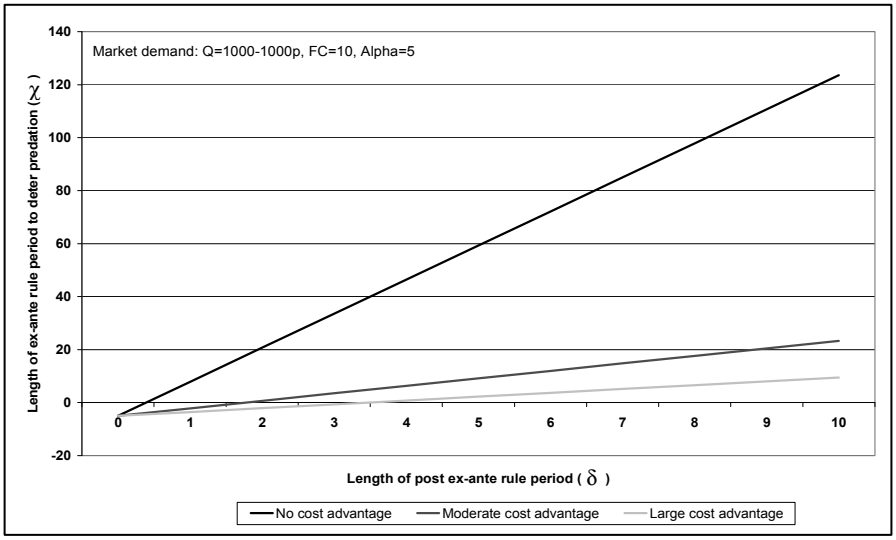
$$\alpha\left(\pi^{\text{Duo}} - \pi^{\text{Pred}}\right) + \chi\left(\pi^{\text{Duo}} - \pi^{\text{Pred}}\right) = \delta\left(\pi^{\text{Mono}} - \pi^{\text{Duo}}\right). \tag{115}$$

Rearranging leads to the minimum length of the ex ante rule χ:

$$\chi = \frac{\delta\left(\pi^{\text{Mono}} - \pi^{\text{Duo}}\right) - \alpha\left(\pi^{\text{Duo}} - \pi^{\text{Pred}}\right)}{\pi^{\text{Duo}} - \pi^{\text{Pred}}}. \tag{116}$$

Using the model and market specifications from above allows plotting the relationship between θ and δ for the three scenarios. This is done for FC=10 and α=5 in Figure 62.

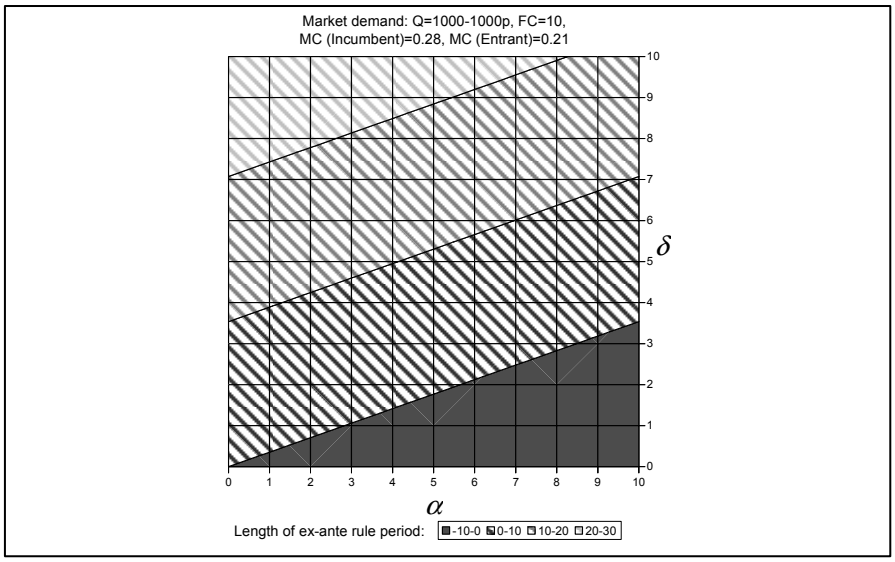
Fig. 62. Length of ex ante rule period against length of post–ex ante rule period



As Figure 62 shows, if the entrant and the incumbent are equally efficient, a relatively small δ leads to a relatively large χ. If there are 10 periods after the ex ante rule expired, the optimal number of punishing periods would be 123 in the case of equally efficient firms, 23 if the entrant has a moderate cost advantage and 9 if the entrant has a large cost advantage. This is basically because the predation strategy is relatively cheap for the incumbent in case the entrant has no cost advantage.

Another beneficial way to study ex ante rules is to plot the optimal length of the ex ante rule period dependent on the length of the predation period α and the length of the post–ex ante rule period δ. This is done in Figure 63 (see Table 63 in Annex 6.7 for the data matrix).

Fig. 63. Optimal length of the ex ante rule period against α and δ



As Figure 63 shows for the case of a moderate efficiency advantage of the entrant, the optimal length of the ex ante rule period is negative for large α and small δ, because such a configuration makes it impossible for the incumbent to at least regain its investment. In contrast, small α and large δ lead to the largest (positive) lengths of ex ante periods, because they are simply necessary to turn the 'net present value' of the predation strategy negative for the incumbent.

An important lesson from this example is that the choice of the optimal ex ante rule depends on the efficiency of the entrant. As the efficiency of the entrant and the level of fixed costs are likely unknown ex ante, it becomes apparent that an ex ante rule is quite imprecise. This fuzziness of the ex ante approach and the corresponding high danger of type I errors is further aggravated by the necessity of estimating δ and β by the antitrust authority. As a consequence, ex ante rules can hardly be a suitable general instrument to fight predation. Nevertheless, it is important to recall its positive characteristics, such as quickness and potential to keep the entrant in the market (which therefore has the potential to minimise type II errors). These advantages have to be traded off against the disadvantages, making the application of ex ante rules a socially desirable option if the likelihood of type I errors is low and the likelihood of type II errors is high.

4.5.3.3 Discussion and Possible Extensions

Before the theoretical model results can be incorporated into developing a policy framework to enforce predation, it is helpful to wrap up the basic findings and put them into perspective by discussing possible extensions of the model. Generally, it can be said that no enforcement option is dominated by another enforcement op-

tion. In a world of certainty and perfect information, a no-rule approach is typically inferior to any kind of antitrust enforcement. However, this is not true for situations in which the entry attempt would be socially inefficient. Furthermore, an ex post I approach is typically superior to an ex ante approach as long as the efficiency advantage of the entrant is not too great (for a given relation between predation period and post-predation period). An ex post I approach always outperforms an ex post II approach in a world without fixed costs. However, in a world with positive fixed cost, it depends on the length of the post-predation period, the timing of antitrust enforcement relative to the overall length of the post-predation period and the efficiency of the entrant, whether an ex post I or II approach is superior in terms of welfare.

In a world of uncertainty and limited information, it is not surprising that an attempt to derive a clear order of enforcement options gains additional complexity. A no-rule approach now might be the standard reaction, simply due to cost-benefit assessments. However, if reputation effects of predation strategies are taken into account (as well as an estimate of the size of type II errors), it becomes apparent that a no-rule approach cannot be the dominant predation enforcement option. The choice between an ex ante approach and an ex post approach depends on the quickness of the antitrust authority in an imperfect world. If the authority is quick, an ex post approach is typically superior; if the authority is slow, an ex ante approach is typically preferable as it holds the entrant in the market. The choice between an ex post I and an ex post II approach depends on the type of fine (gain-based or harm-based), the length of the post-predation period, the timing of antitrust enforcement relative to the overall length of the post-predation period and the efficiency of the entrant.

Although this overview is certainly helpful for designing a policy framework, it would be incorrect just to continue developing such a framework without putting the results into perspective. In their book on the effects of mergers, Cook and Cohen (1958: 17) describe simply and clearly what that essentially means: “There are many theories because each is based on different assumptions about the world; it is their relevance rather than their logic which is in dispute”. In other words, the link between the chosen approach and its practical relevance needs to be characterised and investigated. This will be done below by explaining the choices made and discussing possible extensions.

Model choice

The results of the different enforcement options presented above are based on a Cournot duopoly model with cost differences. This model type was chosen for two reasons: first, it is the most accepted and most widely used model in industrial organisation.[355] Second, some markets in which predation actually plays a role, in

[355] This finding can certainly be explained by the general mathematical tractability of the Cournot model and its flexibility to incorporate additional economic factors, such as product differentiation and entry. Furthermore, as Kreps and Scheinkman (1983) show, Cournot can be a possible outcome of a two-stage game with capacity choice followed by price competition.

particular aviation markets, are usually best described by assuming quantity competition.

The standard Cournot model was extended by introducing cost differences between firms. This decision was motivated by the empirical knowledge that entrants in markets imperilled by predation attacks often have cost advantages with potentially very significant effects on competition (e.g., low-cost airlines entering the market of a full-service airline). Including these cost differences in the model and scenarios allows the quantification of welfare differentials between the enforcement options depending on the efficiency of the entrant.

Turning from the actual model choice to alternative models not pursued in this chapter, two basic alternatives can be identified. On the one hand, it is possible to apply different types of 'quantity competition' models, such as the classical Stackelberg model (in which the entrant is treated as a follower) or an alternative Stackelberg warfare model (in which the entrant could operate efficiently as a follower but attacks the incumbent, aiming at becoming the market leader itself in the long run).[356] On the other hand, it is of course an option to deviate from the assumption of quantity competition for the benefit of other model types which, for example, broach the issue of price or quality competition. Such a step would be of great value in cases in which it can be expected that actual competition is shaped by setting prices or setting quality levels rather than setting quantities. However, the question whether the results presented above would change substantially has to remain open. As theoretical research has shown, it is at least possible that market results of price competition models can be similar to those of quantity competition models (see Kreps and Scheinkman, 1983).

Model set-up

Apart from model choice, the set-up of the basic model certainly offers several degrees of freedom. Exemplarily, as explained in section 4.5.3, predation was modelled by simply assuming that the predator sells a quantity that drives down the profits of the incumbent to zero. One might argue that this assumption is too weak given the practical experience that entrants usually experience severe losses during a predation attempt. Although this assumption is admittedly conservative, it is on the one hand the most straightforward way to model predation (and the literature on predation hardly provides suitable alternatives). On the other hand, it is generally imaginable that the creditors withdraw their funding after a certain period without any profit and the entrant is therefore forced to exit. However, the model as such does not incorporate this argument. It just implicitly assumes that the entrant has to leave the market at a certain point and that the incumbent has deep pockets to finance its predation strategy.

A more general dispute might arise from the fact that a more efficient entrant does not – as basic competition theory would expect – win the whole market and drive the (inefficient) incumbent out of business. Again, these interrelations are

[356] In other words, it is the entrant's actions which turn the market value negative (see Phlips, 1995: 244ff.).

not reflected in the model, basically because it would be difficult to handle from a conceptual perspective. From a practical perspective, several market characteristics such as capacity restrictions, brands or variety issues might explain why more efficient entrants do not necessarily win the whole market.[357]

Another possible area of extension is the focus on one market. The model looks at a single market and, for example, calculates the fines based on the harm caused in that single market. However, as sketched in section 4.3, predation only works in a multi-market context in which one successful predation attempt acts as a signal for other entrants not to enter the same or adjacent markets. In other words, the potential gain of a predation strategy is likely to be substantially larger than the single market analysis above may suggest. Consequently, the optimal fines would have to be considerably larger than calculated here in order to take away the gain of the incumbent or to cover the net harm to others in such a multi-market context.

A final point of extension of the present model lies in the assumption that entry takes place in a monopoly market (and correspondingly that predation takes place in a duopoly market). Following the results of most oligopoly models, such a set-up tends to lead to the clearest welfare improvements, as the increase in consumer surplus is likely to be largest in absolute and relative terms. Although in principle, the basic framework could cope with predation in a market with two incumbents and an entrant, other problems would have to be handled, such as explaining how the two incumbents decide on a joint predation strategy. Generally, it can be expected that the gains of predation enforcement are lower in a three-firm context than in a two-firm context (assuming the two incumbents have not colluded before entry).

Market specification

Another area of potentially fruitful research lies in the application of different market specifications (and different scenarios) to the general model. In this chapter, a simple linear demand function was assumed and applied. Although several robustness checks have been carried out within the group of linear demand functions, it has to remain open how sensitive the model results are to more fundamental changes of the demand function (such as a switch to non-linear alternatives such as iso-elastic demand curves). It would also be interesting to see the effects of different (more complex) cost functions on the model results. Both types of improvement must be reserved for further research efforts.

Broadly speaking, it can be said that the present model concentrates on the most relevant characteristics of predation cases: quantity competition with an efficiency advantage of the entrant. Although it would surely be a challenging task, it

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357 In a Cournot world with asymmetric marginal costs, it can be shown that the market share difference is determined by the marginal cost difference of the firms, the market price and the price elasticity of demand (see, e.g., Neumann, 1994: 158ff.):

$$s_1 - s_2 = \frac{\varepsilon_D}{p}(c_2 - c_1) \ .$$

would be worthwhile to find extensions that reach a better fit of model logic and practical relevance. Although this finding requires caution when transfering these insights into policy conclusions, it does not foreclose the inclusion of several important variables, like the efficiency of the entrant or the length of the post-predation period, into the development of a policy framework.

Discounting future profits

For simplicity reasons, the analysis in this chapter has not discounted future profits. As the aim of the chapter was developing a methodology to intervene against predation, this limitation does not seem to be substantial. However, if the concept is applied in real cases – for instance, to calculate the respective fines – it is important to discount future profits. How such an analysis can look is shown in Table 36.

Table 36 calculates the net present values of the cash flows of the incumbent, the entrant and the consumers for three different predation enforcement options: no antitrust enforcement, ex post I antitrust enforcement and ex ante antitrust enforcement. As shown in the table, it is assumed that the predation phase lasts 2 years followed by a post-predation period of 3 years. The cash flows shown in the table refer to the model and market specifications derived above for an entrant with a moderate cost advantage and fixed costs of 10 per firm.[358]

The results presented in the table indicate that a successful predation strategy without any kind of antitrust enforcement leads to a positive net present value for the incumbents, a negative net present value for the entrant and a positive (but relatively small) net present value for the consumers. The total net present value (which simply aggregates the three separate effects) is positive but relatively small.

Introducing ex post I antitrust enforcement turns the net present value of the incumbent to negative, indicating that his investment in market power does not create enough cash flow to make it a profitable investment. The entrant now has a positive but relatively small net present value given that it has to live with severe losses during the two-year predation period. The consumers realise a high net pre-

358 The model and market specification defined above result in the following cashflows (monopoly/duopoly/predation): incumbent profit's (119,6/36,9/7,7), entrant's profits (0/72,2/0) and consumer surplus (64,8/125,8/238,1). These values are multiplied by 12 to get the yearly estimate used in the table. As only the excess profits have to be considered for calculating the incumbent's cash flows for a successful predation strategy, the value shown in the table can be calculated as follows: (119,6-36,9)*12=992,4. The profits the entrant would have earned in the post-predation period without a successful predation strategy of the incumbent do not enter the net present value calculation for the entrant in Table 36. However, including them does change the net present values of the entrant (from -1.504 to -3.284) and therefore also changes the total net present value of the 'no antitrust enforcement' option (from +762 to -1.018). However, the changes only affect the policy conclusions in the sense that the 'no antitrust enforcement' option becomes even less attractive than before, as the total net present value of this option turns negative.

sent value, as they first enjoy the low prices during the predation period and afterwards continue to enjoy the merit of (duopoly) competition in the market (instead of a monopoly in the case of a successful predation attempt). Overall, the total net present value is positive and increases substantially in a world of ex post I enforcement compared to a world of no predation enforcement.

Introducing an ex ante antitrust enforcement causes the incumbent to abandon the predation strategy, indicating a net present value of zero. The entrant can enter the market without any problem and realises the duopoly profits for the whole five-year period analysed, leading to a relatively high net present value of the profit stream. From the viewpoint of the consumers, however, the ex ante approach reduces the net present value compared to the ex post I enforcement because the consumers can no longer enjoy the two years of low prices in the predation period. From an overall welfare perspective, however, the net present value clearly shows that an ex ante enforcement is superior to an ex post I enforcement, because the larger net present value of the entrant overcompensates for the consumers' reduced cash flow. In weighing the choice of optimal enforcement options, the results indicate that discounting future profits promotes the use of ex ante antitrust enforcement, because it avoids losses in the net cash-flow losses in the first two years of the market.

As already discussed in section 4.3, especially the incumbent's cash flow may increase substantially if spillover effects to other markets are considered. A practical assessment in a real case would also have to consider these spillover effects, as they are the basic motivation to conduct predation strategies for the incumbent.

Considering further factors

The proposed formal approach developed in the preceding section aimed at including the presumably most important factors which influence the choice of the optimal enforcement option. Apart from considering cost differences between the incumbent and the entrant, especially the significance of the pace of antitrust enforcement and the role of type I and type II errors, as well as enforcement costs and the probability of detection, were included in this assessment.

In addition to these factors, however, other factors might influence the choice between a no-rule, an ex ante and an ex post approach. A collection of such further evaluation factors – which are often difficult to quantify – is presented in Table 37. The table also includes the basic results of the general welfare assessment (the black row) as well as the factors already considered during that assessment (the grey-shaded rows).

Table 36. Intertemporal assessment of predation enforcement

	No predation enforcement					Ex post I predation enforcement					Ex ante predation enforcement				
	Years					Years					Years				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Incumbent firm															
Predation investment	-350	-350				-350	-350								
Excess profits of predation			992	992	992			0	0	0	0	0	0	0	0
Incumbent firm's cash flow	-350	-350	992	992	992	-350	-350	0	0	0	0	0	0	0	0
Net present value @ 10%			*1431*					*-608*					*0*		
Entrant firm															
Costs from predation	-866	-866				-866	-866								
Benefits from enforcement			0	0	0			866	866	866	866	866	866	866	866
Entrant firm's cash flow	-866	-866	0	0	0	-866	-866	866	866	866	866	866	866	866	866
Net present value @ 10%			*-1504*					*277*					*3284*		
Consumer surplus															
Benefits from predation	1348	1348				1348	1348								
Costs from predation			-732	-732	-732										
Benefits from enforcement								732	732	732	732	732	732	732	732
Consumer surplus cash flow	1348	1348	-732	-732	-732	1348	1348	732	732	732	732	732	732	732	732
Net present value @ 10%			*834*					*3843*					*2775*		
Total welfare cash flow	131	131	260	260	260	131	131	1598	1598	1598	1598	1598	1598	1598	1598
Total net present value			*762*					*3512*					*6059*		

Table 37. Evaluation factors for predation enforcement options

Evaluation factors	No-rule approach	Ex ante per se approach	Ex post rule-of-reason approach
Overall welfare assessment	+/o/-	+/o/-	+/o/-
Type I error	+	o	+
Type II error	-	o	+
Speed of antitrust enforcement	o	+	-
Enforcement costs	+	o	-
Probability of detection	-	+	+
Inter-industry robustness	o	-	+
Clarity of judgement	+	+	o
Integration capability	o	-	+
Communication possibilities	o	+	-
Cooperation requirements	o	o	-
Risk of regulatory capture	+	o	-

Legend: + = Advantage; o = Neutral; – = Disadvantage.

In addition to providing a simple list of additional evaluation factors, Table 37 makes a rough judgment of the enforcement alternatives. However, it should be evident that a rational choice of one of the approaches cannot be justified by simply counting the plus and minus signs, because, on the one hand, the table discusses *additional* factors not treated adequately by the formal welfare assessment. The question of to what magnitude these factors should influence the results of the general welfare assessment would have to be answered first. On the other hand, it is unlikely that all these additional factors are considered as equally important from a policy perspective. In other words, if Table 37 shall be used as a decision-making tool (e.g., in the form of a simple scoring table), an agreement on the relative importance of these factors – reflected by different weighting factors – would have to be agreed upon first.

Turning to the brief characterisation of the new factors evaluated in Table 37, the criterion of *inter-industry robustness* evaluates whether a certain enforcement option is universally applicable – irrespective of certain industry characteristics – or whether adjustments are necessary which increase costs and make antitrust decisions less foreseeable for firms. Generally it can be said that ex ante, per se rules require adjustments, while a rule-of-reason approach covers them more or less automatically by considering the case-relevant specifics within the general enforcement framework.

Another important evaluation factor is the *clarity of the judgment*. This factor refers to the question whether the respective enforcement option provides a clear differentiation between pro- and anticompetitive price decreases which allow firms to consider this information in their decision-making process. By way of design, rule-of-reason approaches have trouble providing a clear differentiation and therefore often provide firms with only blurred ex ante information on, for instance, how the antitrust authority differentiates between predation and other business strategies, such as battles for market leadership or the punishment phase in a cartel (which would also lead to severe price decreases in the relevant market). Per

se rules, however, are factually built upon the advantage that they provide clear signals to firms about the antitrust consequences of certain business decisions (see the application of Edlin's rule discussed above).

The *integration capability* factor evaluates how well the enforcement option incorporates new economic insights. Typically, a rule-of-reason approach has, again by way of design, advantages in this category; these might, however, be reduced by somewhat binding case law history. In any case, an ex ante, per se rule typically cannot reflect new research insights, as its conceptual makeup builds on simplicity and definiteness.What can be done from time to time, however, is to question the existence of a per se rule given new research insights. Such a process has led, for example, to the creeping demise of the Areeda-Turner rule of thumb.

The factor *communication possibilities* refers to the transferability of essential economic insights to academics with a background other than economics. To increase the significance of economics in antitrust policy, it is pivotal to derive simple rules which can be applied by lawyers. The per se rule here seems to have certain advantages over the rule-of-reason approach, as the latter normally needs to develop an economic story line, which may be partly difficult for non-economists to assess. The per se rule, however, is relatively easy to understand and relatively easy to administer.

The factor *cooperation requirements* investigates the scope of cooperation necessary between the antitrust authority and the firms during the process of antitrust enforcement. The rule-of-reason approach relies extensively on data which needs to be collected from the respective firms (which typically have incentives to submit data favourable to them). The per se rule, on the other hand, can be administered using easily observable data, such as market prices (in the proposal of Edlin, 2002). It is therefore likely that cooperation requirements – and correspondingly the ability of firms to influence antitrust decisions – are substantially greater in a rule-of-reason approach than in a per se rule approach.

The last factor discussed in Table 37 is the possibility of interest group influences and the corresponding *risk of regulatory capture*. As already discussed in the preceding paragraph, the risk of negative influences from firms on the antitrust process can be expected to be higher in a rule-of-reason approach. However, it may also be possible to influence the antitrust authority when a per se rule is applied, for instance, by questioning the assessment of the entrant's efficiency advantage or by questioning whether a per se rule is applicable for that particular case.

4.5.4 Towards a Policy Framework to Enforce Predation

The general aim of the chapter on fighting predation is to derive recommendations which can guide authorities in implementing an efficient predation policy. Consequently, having studied optimal predation enforcement from a theoretical perspective in the preceding sections, the next and final step lies in transforming the key insights into policy recommendations that can be implemented.

The policy relevance of the theoretical analysis can be separated into two channels: *refining* the current predation enforcement regime, or *amending* it. While the former channel focuses on an increased role of sanctions within the existing regime (which is applicable for all markets in an economy), the latter suggests implementing an additional enforcement approach for specific industries in which predation is more likely and potentially more harmful than in other industries.

The first channel of improvement deals with the refinement of the current predation enforcement regime. In this respect, the results of the integrated approach revealed that the relatively well-developed detection phase in predation enforcement is currently not complemented by an equally well developed intervention phase. If predation enforcement should aim at deterring the use of predation strategies by incumbents, the creation of a substantial threat by credibly committing to optimal fines is pivotal. Although the basic technique to calculate such optimal fines is shown in section 4.5.2.2, the credibility of such a step might be limited, at least in North America and Australia, where the very high predation enforcement standards (see section 4.5.1) would foreclose the effectiveness of fine increases simply because the probability of a conviction is so small. However, the somewhat lower predation enforcement standards in Europe – which even resulted in several convictions of predators in the last couple of years – may provide better possibilities to strengthen the existing (but likely small) deterrence effect by a commitment to optimal fines. Especially the UK Office of Fair Trading seems to follow this general idea by, on the one hand, actively referring to the role of deterrence in predation enforcement and, on the other hand, providing some first guidance on the calculation of harm caused by predation infringements (see OFT, 2005: 9ff.).

Thinking about further ways to improve the enforcement of predation strategies, a comparison of predation enforcement with other antitrust enforcement activities – such as hard core cartel enforcement or merger control – reveals especially two specifics of predation enforcement which need to be considered when developing policy recommendations. First, given the vulnerability of the entrant in a typical predation attack, it is pivotal for an efficient antitrust enforcement to react quickly to possible infringements to keep the entrant in the market. If the antitrust authority is slow or follows an ill-equipped predation enforcement framework, it is likely that the entrant has to leave the market before the authority is able (or wants) to react. As a consequence, the entrant is lost as a competitive regulator of the incumbent and consumers are likely to suffer from higher prices or may even have to decide to reduce or abandon the consumption of the respective good or service.

Second, with respect to the creation of a deterrence effect as the basic aim of antitrust enforcement, predation is somewhat more difficult to handle than hard core cartels or horizontal mergers given the significant danger of deterring not only anticompetitive but also procompetitive decreases in price. As procompetitive price decreases are the hallmark of competition, a predation enforcement which is tough but vague runs a high risk of creating a negative deterrence effect and consequently might harm overall welfare. It is essentially this danger that prevents the antitrust enforcers in the United States, Canada and Australia from fol-

lowing a tougher predation enforcement. As a consequence, any attempt to increase the deterrence effect has to consider the danger of discouraging procompetitive price decreases and must therefore delineate clear boundaries of predation enforcement in order to avoid a negative deterrence effect.

Based on these essential preconditions, together with other fundamental insights of the theoretical analysis derived above, the following three-step pre-screening approach as an *amendment* to the current regime of predation enforcement is proposed:

1. Assessment of incumbency advantages – How difficult is it to get in?
2. Assessment of the potential gains of entry – How desirable is it for society to establish entry?
3. Assessment of antitrust enforcement – How reliable is antitrust enforcement?

The first step of a pre-screening approach aims at identifying industries with difficult entry; the second step addresses whether there are economic reasons why incumbency advantages for these industries are socially desirable. Subsequently, all industries in which entry is difficult but socially desirable are investigated further in a third stage, where the quality of antitrust enforcement determines the optimal predation enforcement option (ex ante versus ex post approach). Before the specifics of these three steps are explained in more detail, it is important to emphasise that this pre-screening approach is designed to complement the existing enforcement of predation strategies largely dominated by ex post rule of reason approaches (see section 4.5.2.1 for an overview).

1. Assessment of incumbency advantages – How difficult is it to get in?

The starting point of the pre-screening approach is an assessment of the role of incumbency advantages. The basic justifications for such a step are that, on the one hand, significant incumbency advantages are a necessary precondition for the profitability of predation strategies and, on the other hand, they are a good indicator of the desirability of increased competition. As discussed in chapter 3, *incumbency advantages* comprise structural advantages and strategic advantages, whereas the latter group can be subdivided into 'positioning before entry' and 'reaction after entry' moves. Although it is perhaps not possible to quantify all important incumbency advantages in such an assessment, the discussion of several entry barrier indicators in section 2.4.2.2 has nevertheless shown that quantifications are possible. Complementary to this structural assessment of industries, previous predation experiences can be used, in the form of stylised facts, to identify industries in which predation might play a role structurally (such as in competition among airlines, busses or ships). Consequently, the result of the first stage should ideally be a list of industries that are characterized by high incumbency advantages and/or an industry in which predation strategies have been an issue historically. All industries that do not meet these criteria are dropped; they do not proceed to the second step of the pre-screening approach.

2. Assessment of potential gains of entry – How desirable is it for society to establish entry?

The second step of the pre-screening approach assesses the desirability of entry into the industries identified in the first stage of the framework. A full assessment must consider especially two factors: first, whether entry is generally desirable in the industry; second, how important is entry for the development of competition in the industry (i.e., how valuable is the entrant for post-entry competition in the industry). With respect to the first question, the discussion in chapters 2 and 3 indicated that the existence of high incumbency advantages as such does not automatically arrive at the conclusion that entry is desirable. On the one hand, competition might not be workable in certain industries in general (or in submarkets of industries). On the other hand, competition might lead to suboptimal results due to particular market characteristics, such as economies of scale on the supply and/or demand side. In both cases, the conclusion would be that, even if incumbency advantages are high, entry is not desirable from a welfare perspective.

The second factor considers the characteristics of a typical entrant in the industry. If it can be expected that an entrant has either efficiency advantages over the incumbent or other competitive advantages, such as a more innovative business concept, entry is more desirable from a welfare point of view than when an equally efficient entrant enters.

Fig. 64. Total welfare change due to predation enforcement (ex post I approach) with varying entrant efficiencies

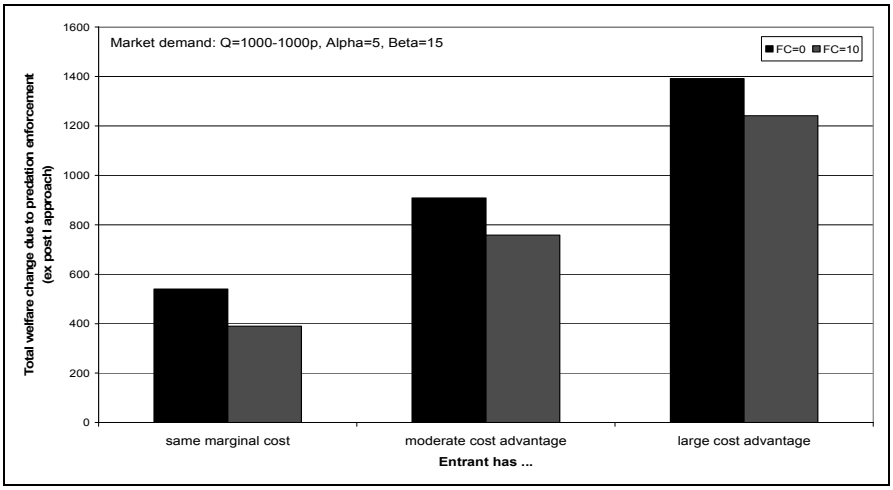

Figure 64 shows the effects of an entrant's efficiency on total welfare change due to predation enforcement (ex post I approach) compared to the situation of no such enforcement. Although entry of an equally efficient entrant would surely be socially desirable, it can be seen that the positive effects on overall welfare are substantially larger when the entrant has efficiency advantages over the incum-

bent. Therefore it is, ceteris paribus, more important to rescue a more efficient or more innovative entrant than an entrant who just copies the business concept of the incumbent. In other words, considering the efficiency of the entrant should play an important role in predation cases. Nitsche (2002: 38)[359] supports such a demand by stating that "there should be anti-predation rules that take into account the costs and benefits of entry."

A factor that further puts the focus on the efficiency of the entrant into perspective is market size. In particular, market size needs to be considered in the sense that the welfare contribution of predation enforcement in a large market facing entry of an equally efficient entrant can still be larger (in absolute terms) than that of a more efficient entrant in a smaller market. Although it would be, in principle, desirable to stop predation in both markets, the market size criterion might become relevant when the antitrust authority faces resource constraints and cannot investigate every instance of possible predation. Here a rule of thumb, such as 'try to catch the biggest ones' might guide the proper allocation of resources. Hemphill argues similarly, stating "[w]e should prefer rules that are especially likely to prevent the costliest false negatives (and false positives), for example, by always catching predators who make the most socially harmful price cuts" (Hemphill, 2001: 1586).

3. Assessment of antitrust enforcement – How reliable is antitrust enforcement?

The third pre-screening stage has to consider the specifics of antitrust enforcement in the respective jurisdictions. Based on the findings of the previous two stages, one fundamental aim of predation enforcement must be to keep efficient entrants in the market and help them defend themselves against predation attacks by incumbents. As mentioned above, the best way to reach such an aim depends on the qualities of the antitrust authority. If the antitrust authority has a well-equipped budget and is 'smart' and quick[360], an ex post I approach is the optimal solution for welfare, as it can quickly decide on the most suitable form of antitrust reaction in a predation attempt. If, however, the antitrust authority has a lower budget, has an ill-equipped predation approach or is constrained by restrictive case law (which makes convicting a predator unlikely), it is socially desirable to administer an ex ante approach for selected industries. Although such an approach is typically more inexact in detecting predation, it has the major advantage of keeping the entrant in the market and basically provides it with a chance to compete on fair terms with the incumbent. Furthermore, although in principle the likelihood of antitrust errors is relatively high under the ex ante approach, the pre-screening stages selected for

[359] Nitsche (2002) shows in an entry game that introducing ex post predation rules can be detrimental to total welfare as well as to consumer welfare, because incumbents choose a strategic response to the new legal environment. In his model, large incumbents crowd the product space to reduce the number of profitable entry opportunities for rivals.

[360] A 'smart' antitrust authority constantly keeps record of price and cost data and generally tries to acquire industry-specific knowledge (see Eckert, 2002: 382).

specific industries in which the likelihood of such errors is considerably reduced. In other words, the ex ante approach aims at creating a selective deterrence effect, specifically for those industries in which entry is unlikely but desirable and the standard antitrust enforcement is unlikely to help.

Figure 65 provides a graphic overview of the essential steps of the pre-screening approach and basic policy conclusions for the proposed amendment of the predation enforcement framework. As previously mentioned, the framework is designed to complement the existing treatment of predation strategies. Consider the airline industry, for example. As this industry is typically characterised by relatively high structural and strategic entry barriers and also has a certain history of predation or at least predation attempts, it passes stage one of the pre-screening approach. In the next step, figuring out whether it meets the criterion of high potential gains of entry depends on the specifics of the market, including the affected routes. Especially in cases of entry by a low-cost airline, the efficiency and innovativeness advantages become apparent, passing the airline industry through stage two of the approach. The third stage refers to the toughness of antitrust enforcement. As argued above, the respective jurisdictions have to be assessed. In the *Lufthansa-Germania* predation case, for example, the German Bundeskartellamt was proven to react quickly to possible predation attacks. Consequently, there was no need to implement an ex ante approach. In cases, however, where the antitrust authority is constrained, for example, by high enforcement standards that make it unlikely to ever prove the presence of a predation strategy, using the ex ante rule might be socially desirable.

In short, the pre-screening approach aims at identifying industries in which entry is difficult but desirable and in which a predation strategy might be a suitable instrument for an incumbent to fight occasional entry attempts. In those specific markets, it makes sense to reduce the high standard of proof in predation enforcement, as its basic justification, the danger of creating a negative deterrence effect, is significantly reduced. If the antitrust authority is tough and not restricted by 'counterproductive' case law, a deterrence effect might be reached with the standard ex post approach. However, if the antitrust authority is 'weak' in the meaning described above, the best way to reach a deterrence effect is by implementing an ex ante rule, such the one recently proposed by Edlin (2002). To simplify, the art of predation enforcement lies in the creation of a selective deterrence effect which discourages anticompetitive price cuts 'in suspicious industries' but leaves the firms' incentive to implement procompetitive price cuts unaffected.

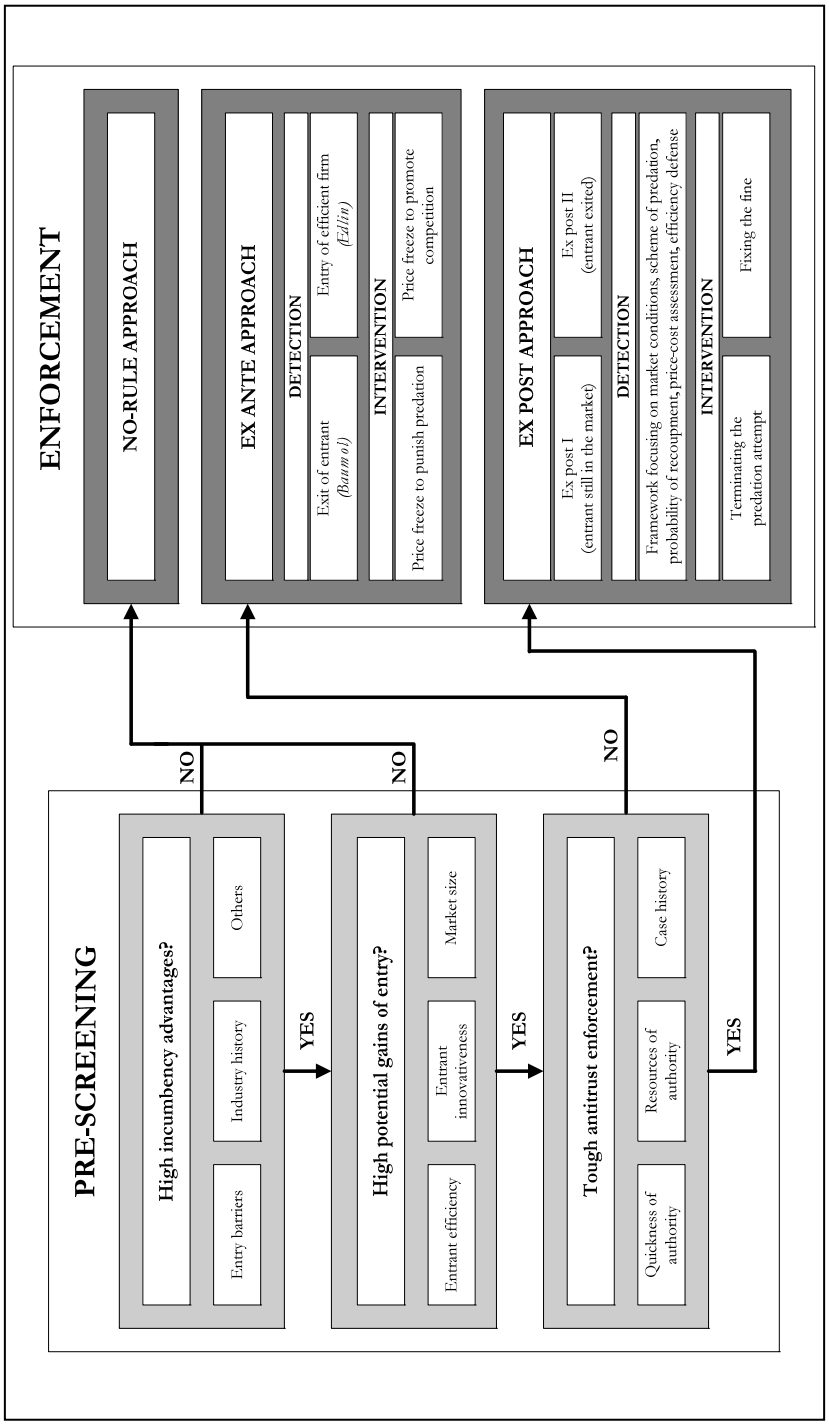

Fig. 65. A predation enforcement framework

4.6 Summary and Conclusion

The major interest of antitrust law and economics with respect to predation strategies has been largely twofold. On the one hand, there has been a lively discussion on the question whether predation can be a rational strategy for an incumbent facing an entry threat. On the other hand, research has focused on the problem of how an antitrust authority could and should detect predation strategies and, especially how it could distinguish such abuses from socially desirable procompetitive behaviour. The aim of this chapter was to think beyond these two standard stages of *rationality* and *detection* and to focus on a third one in the antitrust analysis of predation: *intervention*. This stage acknowledges the necessity of appropriate detection rules for efficient predation enforcement but goes beyond these insights, using them as input for determining how these rules should be linked to interventions against predation strategies. As developed in chapter 2, thoughtful answers to the intervention question are key in developing and implementing an integrated approach of antitrust analysis, which generally aims at creating and maintaining an efficient antitrust policy.

The chapter began with a short characterisation of what should be understood by the term *predation*, followed by a review of the literature focusing on whether predation can be a rational (i.e., profit-maximising) strategy for an incumbent facing an entry threat. Based on affirmative theoretical and empirical research, the fourth section centred on an assessment of the welfare effects of predation strategies. Given the finding that predation strategies typically cause negative welfare effects, the fifth section provided a detailed assessment of how to enforce predation strategies. The chapter was introduced by a review of the considerable literature dealing with how to detect predation. These insights were interpreted as important input for assessing the backbone of the chapter, namely how predation should be fought. Consequently, after proving the practical relevance of such an assessment by providing an overview of recently decided predation cases in various jurisdictions, a Cournot oligopoly model was developed and applied to study the problem of optimal predation enforcement. The model approach – which takes account of efficiency advantages of the entrant – allowed analysing the welfare effects of various enforcement options, such as a no-rule approach; an ex ante, per-se-rule approach; and an ex post, rule-of-reason approach. After having derived general theoretical results, specific demand and cost functions were introduced, allowing a quantification and easier interpretation of the (applied) results and thereby delivering further insights into optimal predation enforcement in a world of certainty and perfect information as well as in a world of uncertainty and imperfect information. The results of the theoretical approach were then incorporated into the development of a predation enforcement framework which generally aims at amplifying the deterrence effect for predation strategies without biasing the fundamentally important incentives for procompetitive price decreases.

Table 38 provides an overview of the fundamental theoretical results of the chapter, differentiated by the three basic enforcement options and the two worlds considered. Generally it can be said that no enforcement option is better or worse

than another. In a world of certainty and perfect information, however, a no-rule approach is typically inferior to any kind of antitrust enforcement. This is not true, of course, for situations in which the entry attempt would be socially inefficient. Furthermore, an ex post I approach is typically superior to an ex ante approach, as long as the efficiency advantage of the entrant is not too great (for a given relation between predation period and post-predation period). An ex post I approach always outperforms an ex post II approach in a world without fixed costs. In a world with positive fixed costs, however, that depends on the length of the post-predation period, the timing of antitrust enforcement relative to the overall length of the post-predation period and the efficiency of the entrant.

Table 38. Theoretical results for predation enforcement options

Enforcement Option	World of certainty and perfect information	World of uncertainty and imperfect information
No-rule	– Superior to a simple continuation of monopoly, as consumers typically gain more in the predation period than producers lose (in terms of surplus) – Inferior to any kind of antitrust enforcement in a perfect world – Only exceptions are cases in which entry is socially inefficient (such as in a natural monopoly or during patent protection to secure innovation incentives)	– Efficient in cases in which essential preconditions for successful predation are not met – Minimises type I errors while maximising type II errors – Although cost-benefit assessment might often speak for a no-rule approach, reputation effects and spill-over effects of predation strategies have to be considered on the cost side – Maximising type II errors is not generally the welfare-maximising answer to predation enforcement
Ex post rule of reason	– Differentiates between ex post I enforcement (while entrant is in the market) and ex post II enforcement (entrant had to leave the market) – Ex post I approach is typically superior to a no-rule approach – An ex post I approach always dominates an ex post II approach in a world without fixed costs. In a world with fixed costs, the ex post I approach is more likely to be superior to an ex post II approach the longer the post-predation period and the more efficient the entrant is – An ex post II approach uses fines to take away the gain of the predation strategy or alter-	– If the fine in an ex post II approach is viewed as part of the consumer surplus but not subtracted from the producer surplus, the sign of the welfare differential depends on the type of fine, the length of the post-predation period and the time of antitrust enforcement (relative to the overall length of the post-predation period) – In an ex post I approach the antitrust authority has to terminate the infringement (restoring competition) but should not impose a fine, as the incumbent has already fined itself by investing in a predation strategy without any positive payoff

	natively to compensate for the harm the predation strategy caused to others – Harm-based fines are found to have certain advantages over gain-based fines; typically, harm-based fines are larger than gain-based fines, indicating that a deterrence effect is always reached with optimal harm-based fines – Possible fine levels in the EU are unlikely to have a deterrence effect	– In an ex post II approach, the antitrust authority does not have to end the infringement but has to impose a fine which should be a function of the length of the predation period, the length of the post-predation period and the efficiency of the entrant
Ex ante, per se rule	– Inferior to an ex post I approach if the entrant is as efficient as the incumbent or only has a moderate efficiency advantage – Superior to an ex post I approach if the entrant is very efficient and the incumbent correspondingly makes huge losses while driving the entrant out of the market. An ex ante approach would avoid these huge losses	– Superiority or inferiority of an ex ante approach depends on the quickness of the antitrust authority. If the authority is quick, an ex post approach is typically superior; if the authority is slow, an ex ante approach is superior, as it holds the entrant in the market – A particular challenge of an ex-ante rule lies in the fixing of the length of the ex ante rule period, which is in theory only possible with some knowledge about the efficiency of the entrant and the length of the post-predation period

In a world of uncertainty and limited information, it is not surprising that an attempt to derive a clear order of enforcement options gains additional complexity. A no-rule approach here might be the standard reaction, simply relying on cost-benefit assessments. However, if reputation effects of predation strategies are taken into account (as well as an estimate of the size of type II errors), it becomes apparent that a no-rule approach cannot be the dominant predation enforcement option. The choice between an ex ante approach and an ex post approach depends on the quickness of the antitrust authority in an imperfect world. If the authority is quick, an ex post approach is typically superior; if the authority is slow, then an ex ante approach is typically preferable, as it holds the entrant in the market. The choice between an ex post I and an ex post II approach depends on the type of fine (gain-based or harm-based), the length of the post-predation period, the timing of antitrust enforcement relative to the overall length of the post-predation period and the efficiency of the entrant.

In terms of important policy conclusions, the relevance of the theoretical analysis can be separated into two channels: the *refinement* of the current predation en-

forcement regime and the *amendment* of the current predation enforcement regime. While the former channel focuses on an increased role of interventions (especially fines) within the existing predation enforcement regime (which is applicable for all markets in an economy), the latter proposes the implementation of an additional enforcement approach for specific industries in which predation can be expected to be more likely and more harmful than in other industries.

With respect to the refinement of the current enforcement regime, it is found that the proposal to increase the fines for detected and convicted predators might probably be too weak to significantly amplify the deterrence effect, basically due to the very low probability of conviction. As a consequence, the introduction of a pre-screening approach was proposed, which aims at identifying industries in which entry is difficult but desirable and a predation strategy might be a suitable instrument for an incumbent to fight such occasional entry attempts. In those industries, it makes sense to reduce the high standard of proof in predation enforcement, as its basic justification – the danger to create a negative deterrence effect – is significantly reduced. If the antitrust authority is tough and not restricted by 'counterproductive' case law, such a deterrence effect might be reached with the standard ex post approach. However, if the antitrust authority is weak, the best way to amplify the deterrence effect is by implementing an ex ante rule, such as the one recently proposed by Edlin (2002). To put it simply, the art of predation enforcement lies in the creation of a selective deterrence effect which discourages anticompetitive price cuts 'in suspicious industries' but leaves the incentives of firms to implement procompetitive price cuts unaffected.

5 Conclusions

Results? ... I have gotten a lot of results.
I know several thousand things that won't work.

Thomas Alva Edison (1847-1931)

There is no question that competition policy is on the agenda of policymakers and academics these days. From the viewpoint of policymakers, competition policy has established itself in most industrialised countries as an integral part of public policy that contributes substantially to the improvement of the wealth of nations. The ongoing reforms of European competition policy, however, together with the discussions on further harmonisation needs of antitrust rules around the world indicate that the process of designing and implementing an efficient antitrust policy has not reached an (even short-term) equilibrium yet. From the viewpoint of academics, the current challenges of competition policy provide plenty of opportunities to apply theoretical and empirical techniques when advising policymakers on an economically sound design and implementation of antitrust rules. The still-increasing supply and demand with respect to such questions is reflected, for instance, in the recent launch of three academic journals devoted to competition and competition policy.[361] Somehow incorporating the viewpoints of both, policymakers and academics, the exponential increase in the revenues of economic consultancies specialised in competition since the early 1990s in Europe (see Neven, 2005) indicate the rising need for competition economists who are able to translate economic reasoning and insights to policymakers and lawyers in the field in order to ameliorate the design, the implementation and the execution of competition law provisions.

Based on these general recent developments, the fundamental aim of the present work is to contribute to the design *and* the implementation of an efficient antitrust policy. An efficient antitrust policy consists of a set of effectively enforced rules that constrain the firms' competitive strategies aiming at maximising the total welfare contribution for a given enforcement budget. The work's six chapters are geared toward meeting this goal.

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[361] The academic journals are the *European Competition Journal*, the *Journal of Competition Law and Economics* and *Competition Policy International*. They were all launched in 2005.

Following a basic introduction in the first chapter, the second chapter focused on the development of an integrated approach of antitrust analysis. Three different investigation levels were distinguished and then analysed. The *fundamental level* aimed at answering existential questions of competition and competition policy. In particular, it was assessed whether competition is worth protecting, whether competition needs protection and whether competition policy brings more benefits than costs to society.

The *strategic level* of the integrated approach aimed at developing a progression of necessary steps to assess if and how certain business conducts should be subject to antitrust policy. In addition to an initial delineation and characterisation of the business conduct, a welfare assessment and a concept of detection and intervention was developed to ensure an integrated approach of antitrust analysis which in turn ensured the creation of the desired deterrence effect.

While the strategic level aimed at constructing investigation frameworks from a largely normative economic perspective, the *operational level* focused on the question how an antitrust authority should implement these recommendations in a world characterised by resource constraints and asymmetric information. Generally, resource constraints led to the problem that the antitrust authority typically cannot investigate every case of possible anticompetitive behaviour but has to find routines to identify those cases which promise to maximise the welfare contribution of antitrust policy for a given enforcement budget. The standard elements of such a 'routine' are the delineation of the relevant market and an assessment of market power (consisting of concentration analysis and entry analysis). The second fundamental problem faced by an antitrust authority and therefore discussed on the operational level is asymmetric information. Asymmetric information generally leads to the danger of wrong and hence welfare-reducing case decisions by the antitrust authority, and should therefore also be considered in the development of an efficient antitrust policy. Given the existence of resource constraints and asymmetric information, the insights derived on the strategic level need to be reassessed against this new background in order to guarantee an integrated approach of antitrust analysis. Consequently, the last stage on the operational level aims at providing recommendations for the design of practical frameworks for antitrust analysis.

To demonstrate the universal applicability of the proposed 'integrated approach', it was applied to hard core cartel enforcement and merger control. Both areas constitute traditional areas of antitrust policy, and both areas differ considerably with respect to enforcement requirements. While hard core cartel enforcement has to deal with ways of preventing cartelisation and detecting breaches of the cartel ban, merger control traditionally has to assess the pro- and anticompetitiveness of a particular merger proposal. Despite these substantial differences in the treatment of both strategies, the integrated approach turns out to be equally applicable and helpful when deriving policy recommendations.

Based on the development of the integrated framework in the second chapter, the third chapter aimed at applying parts of this framework to strategic behaviour. After generally characterising what is understood by strategic behaviour (from an economic perspective), the rationality of strategic behaviour was assessed in more

detail. Subsequently, the welfare effects of strategic behaviour were investigated, essentially by comparing them to the competitive benchmark of Cournot competition. Based on the finding that strategic behaviour contains a multitude of different strategies with diverse welfare implications, three different antitrust enforcement options to cope with such conducts were discussed: a no-rule or do-nothing approach, a per-se-rule approach and a rule-of-reason approach. In this section providing a high-level discussion of these basic tools was intended without making specific policy recommendations for strategic behaviour in general or certain forms of strategic behaviour in particular.

An in-depth antitrust analysis of one particular form of strategic behaviour – predation – was the focus of the fourth chapter. After briefly reviewing research on an appropriate characterisation of predation and assessing the basic rationality of predation strategies, the welfare effects of predation strategies were analysed. Based on the finding that predation strategies typically cause negative welfare effects, research on the question of how to detect predation was reviewed. The fourth chapter, however, took the analyses of the preceding levels for granted and analysed the complementary question of how predators should be fought. Although such an intervention phase is a compulsory part of the integrated appraoch for creating a deterrence effect, almost no research has been devoted to finding appropriate answers to this question. Consequently, after proving the practical relevance of the question by discussing recently decided predation cases in various jurisdictions, a Cournot oligopoly model was developed and applied to the problem of predation enforcement. The model approach – which takes account of efficiency advantages of the entrant – allowed analysing the welfare effects of various enforcement options, such as a no-rule approach, an ex ante, per-se-rule approach and an ex post, rule-of-reason approach. After derivating general theoretical results, specific demand and cost functions, which allow a quantification and easier interpretation of the (applied) results and therefore deliver further insights into optimal predation enforcement, were introduced. The results of the formal approach were subsequently incorporated in the development of a predation enforcement framework aimed at increasing the deterrence effect for predation strategies; however, without biasing the fundamentally important incentives for procompetitive price decreases.

Although the development of the integrated approach is intended to guide the design of antitrust policy generally, its true value can only be recognised by applying the framework to actual forms of suspicious (i.e., potentially anticompetitive) behaviour. Thus the general results for the three basic areas of antitrust enforcement discussed in detail in the present work – hard core cartels, horizontal mergers and predation – are compiled in Table 39.

Table 39. Key results of the analysis on the strategic and operational levels

STAGE	HARD CORE CARTELS	HORIZONTAL MERGERS	PREDATION
CHARACTERISATION	– A definition of the term *cartel* useable for antitrust policy is not straightforward – A *cartel* is a group of firms who have agreed explicitly among themselves to coordinate their activities in order to raise market price; that is, they have entered into some form of price-fixing agreement – The term *hard core cartel* subsumes the following agreements: price fixing, bid-rigging, output restrictions and quotas, allocation of customers, suppliers, territories or lines of commerce – Only 'hard core cartels' are considered in the following	– A *merger* is generally defined as the act (or alternatively process) of combining two or more existing companies into one new company – From an antitrust perspective, the differentiation between 'mergers' and 'acquisitions' is not crucial as long as a threshold value for the 'scope of investment' is set that might trigger antitrust investigations (e.g., % of voting rights) – Mergers are typically categorised with respect to the position of the merging companies in the value creation chain (horizontal mergers, upstream or downstream vertical mergers, conglomerate mergers) – As the business motives and the welfare effects can differ substantially between these merger types, antitrust analysis of the respective competitive effects has to be separated	– An action is called *predatory* if a different action would increase the likelihood that rivals remain viable and the different action would be more profitable under the counterfactual hypothesis that the rival's viability were unaffected – Predatory behaviour can be schematically thought of as occurring in two phases: a predation phase and a recoupment phase. In the first phase, the predator tenders a product that offers 'too' much value to consumers and thus weakens rivals. In the second phase, the predatory firm takes advantage of the weakened rival and reduces the consumer value of its products to a level below the competitive one

RATIONALISATION	– Firms have an incentive to form hard core cartels because coordinating the respective competitive activities leads to greater profits than acting independently – The basic rationale lies in the internalisation of a negative externality, as the cartel takes into account how changes in the output level of each firm affect joint cartel profits – Empirical findings are partly contradictory to the theoretically assumed aim of cartels (increasing joint profits), as colluding firms appear to be consistently less profitable than non-colluding firms – Some scholars have argued that hard core cartels might be a reaction to 'tough times' in the respective industry or the economy – Empirical findings are largely contradictory to this 'knights in shining armour' hypothesis – Historically, severe changes in the production technology (especially during the second half of the 19th century) led to high fixed costs facing volatile demand. In such an environment, cartels were probably a welfare-increasing instrument to fight the experienced price drops	– The literature studying the business motivations of mergers is diverse – The most fundamental and straightforward reason to merge is the expectation to increase profits 'somehow' – The channels of how this can be reached are diverse and reach from an increase in market power, via a realisation of cost efficiencies, up to a reduction of management inefficiencies via a market of corporate control – In a simple symmetric Cournot model world, mergers are only profitable if most firms in the market merge. As this is contradictory to practical observations, a so-called 'merger paradox' is identified – The paradox can be solved by introducing Stackelberg competition, price competition, a non-linear demand function, merger efficiencies or other motives for mergers, such as industry consolidation – Empirical evidence cannot provide clear support for one of the effects predicted by the neoclassical theories. The relationship between mergers and profitability was often found to be negative, while the effect of	– The profitability of the predation investment depends on five factors: the level of losses in the predation period, the level of excess profits after the exit of the entrant, the number of predation periods, the number of post-predation periods, and the discounting factor of future profits – Economic research has focused on the study of two separate effects which determine the rationality of predation: effectiveness and efficiency – The effectiveness condition demands that the predation strategy must expect a positive net present value of the investment, meaning that the gains in the post-predation period must be larger than the costs incurred during the predation period – The efficiency condition demands that there must be no superior alternative strategy which could reach the same profit level with less cost burden (and vice versa) – Game-theoretic research has shown that predatory actions could indeed be optimal strategies in a world of incomplete and asymmetric information. These models can be structured into financial market predation mod-

	well below average costs – Contemporary justifications for cartels brought forward by the detected cartels themselves include such arguments as: the industry cannot function with competition, the industry competes on service and quality, service and quality will decline without the cartel and the cartel is necessary to stop 'unfair' or 'unethical' competition	mergers on market growth was mostly found to be insignificant – An alternative way to explain mergers is by deviating from the assumption that mergers aim at maximising profits – So-called behavioural theories of 'why mergers occur' have been quite successful in explaining M&A activity (managerial discretion and managerial hubris) – The typically found pattern of event studies shows that the acquiring firms experience a decline in share prices, while the acquired firm's shares typically rise after the announcement of the merger plan and its completion	els, signalling models and reputation models – Although predation could be an expensive strategy, it might very well be a 'second-best' monopolisation strategy if alternatives (colluding, accommodating, merging) are not available – Econometric and experimental evidence suggest that predation can be a rational strategy for the incumbent. The question whether an entrant is fought or accommodated seems to be correlated to its strength (weak entrants are fought) – The rational use of a predation strategy depends on the presence of various market characteristics
WELFARE EFFECTS	– A perfectly functioning hard core cartel (involving all firms in the market) leads to the same market outcome as a monopoly and therefore is suspicious of causing similar types and degrees of inefficiencies – In one-shot games, non-cooperation is the dominant strategy, indicating that the negative welfare effects of cartels do not materialise – The introduction of repeated interaction creates possibilities to stabi-	– The underlying welfare standard is crucial for a judgment on the welfare effects of a horizontal merger – Unlike hard core cartels, mergers can lead to efficiencies and might facilitate necessary changes in industry structures – A policy focusing on consumer surplus would have to intervene against any merger which is expected to increase price post-merger – A policy focusing on total welfare	– The overall welfare effect of a predation strategy can be split into the effects on consumer surplus and producer surplus (consisting of the profits of the incumbent and the entrant) – The consumer surplus is relatively low in the monopoly state of the market in the pre-predation period. The predation attempt boosts the consumer surplus to a level beyond the competitive (Cournot) level. If

	lise cartels if the firms are sufficiently patient – More generally, firms have found ways to stabilise cartels, which is also underpinned by empirical evidence showing that cartels can be long-lasting and can even manage to overcome cartel crises, such as entry or a price war – Although cartels typically fail to reach monopoly outcomes, empirical research shows that cartels have often managed to raise prices significantly above competitive levels – Although there might be rare circumstances in which hard core cartels can increase welfare, a per se prohibition of these conducts is the appropriate antitrust reaction	needs to trade-off the welfare loss caused by a post-merger price increase against the increase in firm profits due to the realised merger efficiencies – A simple quantification indicates that relatively small efficiency increases can overcompensate the deadweight loss – Follow-up research relaxed some critical assumptions of the basic Williamson trade-off, such as pre-merger prices that exceed marginal costs or especially differences in marginal costs between firms – Farrell and Shapiro show in a Cournot framework that market prices always rise post-merger unless substantial merger-specific synergies are realised – Farrell and Shapiro's (static) model still abstracts from important competition variables (such as the effects on product variety or the incentives to innovate) – Empirical research on mergers is diverse and includes studies on the effects on profitability, market share, market growth and share prices – The results show that a considerable share of all mergers turn out to be	the entrant survives the predation period somehow, the Cournot competition consumer surplus level is realised; otherwise the monopoly consumer surplus level is realised – The entrant's profits are zero in the pre-predation period. If the entrant is fought by a predation strategy after entry, he realises no or even a negative profit and has to exit the market after a certain amount of time. If the entrant is accommodated or survives the predation attempt, he realises the duopoly profits (whose size depends on the efficiency of the entrant and the incumbent) – The incumbent's profits are at the high monopoly level in the pre-predation period. The entry of the rival leaves the incumbent with the decision to accommodate the entrant and accept the lower duopoly profits or to fight the entrant, which reduces the profits in the predation period below the duopoly level but may allow the incumbent to reap the monopoly profits in the post-predation period – The analysis of the overall welfare effect shows that predation can increase welfare compared to a simple

		‘unsuccessful’ for the merging parties – A multi-industry study by Gugler et al. suggests that 55,8% of all mergers included in the sample had negative effects on total welfare – Given the diverse welfare effects of horizontal mergers, a rule-of-reason approach is the appropriate antitrust reaction	continuation of monopoly – Furthermore, it can be shown that ‘making predation unsuccessful’ by antitrust actions against predation has the potential to increase overall welfare further
DETECTION	– The central questions are how an antitrust authority can reduce the formation of cartels and how it can detect existing cartels – A reduction in the formation of cartels can be reached by ex ante instruments, such as blacklists, regulation of communication, adjustments in market designs (which are less prone to cartelisation) and ‘coordinated effects’ analysis in merger control – Although ex ante instruments are important enforcement tools, they can hardly achieve a deterrence effect to an economically optimal degree. Ex post instruments to detect cartels are therefore an important complement – Practical methods of cartel detection are diverse (complaints by competi-	– In the case of horizontal mergers, ‘detection’ refers to the identification of anticompetitive mergers – Although cases of ex post merger enforcement exist, merger control typically takes place ex ante – The direct identification of anticompetitive mergers by focusing on abnormal stock returns in event studies is too inexact to be applied as a standard instrument in merger control – The development of an ‘indirect’ but generally applicable framework to detect anticompetitive mergers is necessary. A four-step approach is developed to meet this demand – In the first step, the post-merger price increase needs to be estimated. Depending on the data situation, simple back-of-the-envelope formulas or more sophisticated merger simulation	– ‘Detecting predation’ is approached by two different control strategies (per se rules and the rule of reason) and two possible timings of control (ex ante and ex post) – Initially, a simple per se rule à la Areda-Turner was preferred by economists. However, it turned out that such rules were relatively inexact and difficult to administer – Follow-up research tried to develop superior per se rules (such as the ‘no post-entry output increase’ rule or the ‘no post-exit price increase’ rule) and more appropriate cost concepts (such as the average avoidable cost standard, the average incremental cost standard) – Furthermore, a two-step standard was developed as an amendment to the compulsory price-cost compari-

	tors, customers or employees, other case investigations etc.) – Given recent advances in the economic knowledge about cartelisation, a three-step procedure is proposed which allows an antitrust authority to actively detect cartels – In the first step, a structural assessment of all industries in an economy is undertaken, based on the presence of structural, demand- and supply-related collusion factors (which have been identified by theoretical and empirical research) – In the second step, those industries which where identified as suspicious in the first step are subject to an in-depth behavioural study based on so-called collusion markers (such as low price variance or highly stable market shares over time) – In the third step, supposing that sufficient indicative evidence is found, the antitrust authority may apply a leniency program or may be allowed to execute a dawn raid with the aim of collecting written proof for the existence of a cartel agreement	tools can be applied. If neither of these tools are available, 'reduced form' natural experiments need to be applied in order to get an idea on the likely price increase post-merger – In the second step, quantitative (or at least qualitative) evidence needs to be collected to assess whether the derived price increase would be sustainable. The role of entry barriers is an example of the type of analysis that needs to be conducted at this stage – In the third step, it needs to be assessed, first, whether merger efficiencies claimed by the parties are existent, merger-specific and are likely to materialize post-merger; second, whether the 'accepted' efficiencies are strong enough at least to keep the pre-merger price level – In the fourth step, the effects of the merger on other competition variables such as product variety, marketing and innovation incentives need to be assessed	sons à la Areeda-Turner. Before these time- and resource-consuming cost comparisons are undertaken, it should be checked whether predation can be a rational strategy in the market situation at hand – Recently, the two-step approach was extended to a more-or-less full rule-of-reason approach with the following investigation stages: 1. Market conditions, 2. Scheme of predation, 3. Probability of recoupment, 4. Price-cost assessment, 5. Efficiency defense – Detection proposals have recently become increasingly differentiated as they take account of special industry characteristics (such as substantial network effects) – There might be situations in which predatory prices should not be considered anticompetitive. Those situations may include product promotions, penetration pricing in network industries, learning by doing, pricing in systems markets, monopoly with complementary products, irreversible exit, industry rationalisation, encouraging additional infra-marginal sales and disposal of excess or obsolete stock

INTERVENTION	– The basic aim of fines against hard core cartels is the creation of a deterrence effect – The deterrence effect is determined by the severity of the sanction and the probability of detection and punishment – The calculation of an optimal fine should be based on the 'net harm to others'. *Harm* in hard core cartel cases is a function of market size, cartel duration and the size of the price rise compared to the competitive level – Keeping up 'full deterrence' by a probability of detection of one or alternatively an extremely high fine is neither practical nor economically justified – Theoretical and empirical research shows that a deterrence effect is still working even if it does not aim at deterring cartelisation completely (as cartels drop prices below monopoly level to avoid detection) – Leniency programs can be seen as an instrument to increase the probability of punishment if the likelihood that the cartel will be detected is already sufficiently high – The influence of leniency programs	– Interventions against horizontal mergers become relevant when the antitrust authority detects anticompetitive effects of a horizontal merger – As mergers often involve multi-product companies, a prohibition of the whole merger due to anticompetitive concerns in one or a few relevant markets would be disproportionate – Consequently, the antitrust authority offers the merging parties the possibility to propose merger remedies – Merger remedies aim at 'restoring' competition in the relevant market post-merger, but without destroying the respective merger efficiencies or already realised 'pre-merger' efficiencies – Two general types of merger remedies exist: structural and behavioural remedies. The former aims at changing the allocation of property rights (through divestitures), while the latter focuses on the imposition of constraints on the merged firms' property rights (often through 'regulatory-type' interventions) – Key advantages of structural remedies are their direct effectiveness, their ease to administer and their limited vulnerability to circumventions	– A detailed presentation of the results for a world of certainty and perfect information as well as for a world of uncertainty and imperfect information is presented in Table 38. Only the results for the world of uncertainty are presented in this table – The general result of the intervention stage suggests that no enforcement option is dominant in terms of its welfare contribution – The no-rule approach is efficient in cases in which essential preconditions for successful predation are not met – The no-rule approach minimises type I errors while maximising type II errors – Although cost-benefit assessments might often speak for a no-rule approach, reputation effects and spill-over effects of predation strategies have to be considered on the cost side – Maximising type II errors is not generally the welfare-maximising answer to predation enforcement – If the fine in an ex post II approach is viewed as part of the consumer surplus but not subtracted from the producer surplus, the sign of the wel-

on the probability of detection is less clear; leniency programs may even have a stabilising effect on functioning cartels
- The empirical evidence on the successfulness of cartel enforcement is mixed. Post-cartel prices often seem to drop after the break-up of the cartel but reach collusion levels relatively quickly afterwards
- In order to keep up a deterrence effect, stiff fines and a sufficient probability of detection are compulsory instruments to send credible signals to the firms that cartel formation has a high likelihood of being detected and subsequently punished
- An additional component of the 'fine package' for cartelisation is stock market reactions triggered by the detection and prosecution of a cartel. Preliminary results of an event study by Langus and Motta suggest that dawn raids reduced the firm's stock market value by 2,2% on average on the day of the raid. Furthermore, the formal decision of the European Commission (that a cartel was detected) led to another loss of 3,0% on average of the

- Key advantages of behavioural remedies are their flexibility and their ability to take existing efficiencies into account
- Economic theory recently started to study especially structural merger remedies and finds that the interests of the buyer and the merging parties are often similar, leading to a 'coalition' against the antitrust authority
- Furthermore, structural merger remedies might ease collusion, might dissuade entry and might lead to a tendency of 'remedy over-fixing' by the antitrust authority
- Given the problems of structural remedies, scholars have proposed to think about the more frequent use of behavioural remedies under certain conditions
- Empirical evidence shows problems in the effectiveness of especially structural remedies and some wrong decisions in the sense that likely anticompetitive mergers were not challenged
- General empirical evidence on merger control is diverse. Some results suggest a protectionist motivation of European merger control; other studies find no indication that

fare differential depends on the type of fine, the length of the post-predation period and the time of antitrust enforcement (relative to the overall length of the post-predation period)
- In an ex post I approach the antitrust authority has to terminate the infringement ('restoring competition') but should not impose a fine, as the incumbent has already fined itself by investing in a predation strategy without any prospect of a positive return on investment
- In an ex post II approach, the antitrust authority does not have to end the infringement but has to impose a fine, which should be a function of the length of the predation period, the length of the post-predation period and the efficiency of the entrant
- Superiority or inferiority of an ex ante approach depends on the quickness of the antitrust authority. If the authority is quick, an ex post approach is typically superior; if the authority is slow an ex ante approach is superior, as it holds the entrant in the market
- A particular challenge of an ex ante rule lies in fixing the length of the ex

	firm's stock market value – However, empirical evidence suggests that cartelisation is currently under-deterred, indicating that it still pays for 'efficient cartels' to form, collect excess profits and simply pay the fine (out of the 'pool' of excess profits) if detected and prosecuted	European merger control allows political aspects to influence its decisions – A deterrence effect of merger control only seems to exist with respect to prohibitions of mergers but not with respect to remedies, abandonments and monitorings	ante rule period, which is - in theory - only possible with a profound knowledge of the efficiency of the entrant and the length of the post-predation period
POLICY RECOMMENDATIONS	– An efficient antitrust policy with respect to hard core cartels needs to consider ex ante as well as ex post instruments. Ex ante instruments aim at avoiding the formation of cartels in the first place, while ex post instruments focus on the detection and intervention against existing cartel agreements – With respect to ex ante instruments, especially identifying and regulating types of communication between competitors and considering antitrust aspects in market design has potential for further improvement in the United States and the European Union – With respect to ex post instruments, the possibility to improve current antitrust enforcement is more diverse	– Given the proposal for the design of an efficient horizontal merger control developed above, policy conclusions can be derived by comparing it to the current enforcement approaches in the European Union and the United States (omitted in the following) – In the European Union, the recent focus with respect to horizontal merger control has been the design, implementation and analysis of first experiences with the new EC Merger Regulation – accompanied by new EC Horizontal Merger Guidelines – which both came into force in 2004 – Although it is probably too early to decide on the successfulness of the new EC Merger Regulation or Guidelines, most lawyers and economists think that the guidelines raise hopes that the Commission will	– In general, the policy relevance of the theoretical analysis can be separated into two channels: the refinement of the current predation enforcement regime and the amendment of the current predation enforcement regime – With respect to the refinement of the current predation enforcement regime, the application of the integrated approach revealed that the relatively well-developed detection phase in predation enforcement is currently not complemented by an equally well-developed intervention phase – If predation enforcement should aim at deterring the application of predation strategies by incumbents, the creation of a substantial threat by credibly committing to optimal fines

- Based on the empirical finding that current cartel fines are suboptimally low, one policy option would be to make better use of the existing possibilities to fine cartels (or alternatively increase the possible fine spectrum). In countries without an established system of private antitrust enforcement, the implementation of such a system might be desirable simply because it would increases the 'fine package' for cartel formation
- A complementary policy option lies in increasing the probability of detection and punishment. In this respect especially an intensification of international cooperation between antitrust authorities has the potential to ameliorate hard core cartel enforcement
- Furthermore, the role of the antitrust authority in actively detecting cartels should be amplified as proposed by the three-step approach (structural assessment, behavioural assessment, collection of hard evidence) sketched above
- Additionally, alternative ways to detect cartels should be intensified as well (such as providing incentives

abandon its mechanistic approach of a purely structural test and will instead turn towards the truly essential question whether a particular merger will significantly harm (consumer) welfare or not. However, the success of the new EC merger control regime will eventually depend on how the guidelines are applied in practice

- Nevertheless, the current EC Merger Regulation contains several areas with potential for further improvement. For example, one point of criticism is that the guidelines only mention a couple of possibly important factors (and their theoretical justification) without addressing the need to advise the merging parties on how to combine the theoretical analysis with an empirical assessment of whether the respective theories hold in the case at hand. The four-step approach developed above proposes ways of linking the theoretical factors with empirical evidence
- A closely related argument refers to the assessment of non-coordinated effects, for which the guidelines provide a checklist of arguments that might be relevant, but without giving

is pivotal

- Given the vulnerability of the entrant in a typical predation attack, it is pivotal for an efficient antitrust enforcement to react quickly to possible infringements to keep the entrant in the market. If the antitrust authority is slow or follows an ill-equipped predation enforcement approach, it is likely that the entrant has to leave the market before the authority is able (or wants) to react. As a consequence, the entrant is lost as a 'competitive regulator' of the incumbent, and consumers are likely to suffer from higher prices or may even have to consider reducing or abandoning consumption of the good or service
- With respect to the creation of a deterrence effect as the basic aim of antitrust enforcement, predation is somewhat more difficult to handle than hard core cartels or horizontal mergers given the significant danger of deterring not only anticompetitive price decreases but also procompetitive price decreases. As procompetitive price decreases are the hallmark of competition, a predation enforcement which is tough but vague runs a high risk of creating a negative de-

	and possibilities for competitors, customers or employees to report cartels) – In jurisdictions without the possibility to punish the individuals responsible for cartel agreements, introducing such a provision should be considered, as it is likely that personal pecuniary fines or even incarceration has a significant influence on the decision to form or join a cartel – The current leniency program is a helpful instrument to increase the probability of punishment (by providing strong incentives for cartel members to report the cartel if the probability of detection is sufficiently high). Nevertheless, it is unlikely that leniency programs in the current design have already realised their full potential with respect to increasing the probability of detection. One possibility to improve such programs is to consider paying rewards to reporting cartel members instead of just reducing or cancelling the respective fine – Especially the combination of actively screening industries and the provision of leniency programs	further details on the relative importance or even the standard investigation steps of a merger assessment. Although certain degrees of freedom are necessary when drafting guidelines, it would be possible to delineate the key investigation steps further, such as proposed by the four-step detection approach developed above – Furthermore, the initial draft of the guidelines frequently referred to Cournot and Bertrand models to characterize competition and to study the effects of mergers. However, again in line with the four-step approach proposed above, simply translating the predictions of these models into predictions of post-merger behaviour likely leads to erroneous results given other potentially important competition parameters, such as product variety, product quality or the influence on the incentives to innovate (addressed in the forth stage of the proposed detection framework) – With respect to the assessment of entry, the proposed three-part test (likelihood, timeliness and sufficiency of entry) follows the investigatory steps	terrence effect and consequently might harm overall welfare. As a consequence, any attempt to increase the deterrence effect with respect to predation strategies has to consider the danger of discouraging procompetitive price decreases and must therefore delineate clear boundaries of predation enforcement in order to avoid a negative deterrence effect – Based on these essential preconditions for an efficient predation enforcement, together with the consideration of other fundamental insights of the theoretical analysis derived above, the following three-step 'pre-screening' approach is proposed as an amendment of the current regime of predation enforcement: 1. Assessment of incumbency advantages: How hard is it to get in? 2. Assessment of the potential gains of entry: How desirable is it for society to establish entry? 3. Assessment of antitrust enforcement: How reliable is antitrust enforcement? – The first step of a pre-screening approach basically aims at identifying industries in which entry is difficult. The second step asks the complementary question of whether there

might make cartel members sufficiently nervous to finally decide to come forward and apply for leniency
- Ex post monitoring of cartel-prone industries is an important additional tool for antitrust authorities to fight cartels, as detection and punishment leave the industry structure unchanged, which consequently makes the (re-)formation of further cartels not unlikely. Time series data on post-cartel prices further suggest that former cartel members may learn to collude tacitly after the detection and prosecution of the cartel
- An alternative way of tackling the post-cartel detection phase problems would be imposing behavioural or even structural remedies. One potentially suitable behavioural remedy would be to force each of the former cartel members to furnish a 'compliance report' with price data and reports on 'the state of competition in the industry' to the antitrust authority

delineated at the operational level. However, although it is admittedly a difficult exercise, the guidelines do not state explicitly how an entry barrier assessment should be quantified in practice. Again, the discussion on the operational level at least provided several proposals of how to quantify the existence and especially the size of entry barriers (by so-called 'entry barrier indicators')
- With respect to merger efficiencies, the guidelines explicitly aim at integrating the analysis of merger efficiencies into the overall competitive effects assessment (and not treating it as an efficiency defence after the study of the competitive effects). However, as in the case of entry analysis, the guidelines do not discuss ways to quantify the relevant factors (see section 2.3.3.1, especially Box 13, for several proposals reaching from the application of back-of-the-envelope formulas to simple NPV spreadsheet calculations)
- With respect to merger remedies, the currently drafted (separate) Commission Notice seems to contain most of the necessary arguments and investi-

are economic reasons why these incumbency advantages are socially desirable. Subsequently, all industries in which entry is difficult but socially desirable enter the third stage, in which the quality of antitrust enforcement decide the optimal predation enforcement option (ex ante versus ex post approach)
- It is important to emphasise that the pre-screening approach is designed to complement the existing enforcement of predation strategies, which is largely dominated by ex post, rule-of-reason approaches

	gatory steps identified above. However, potential for further improvement was identified especially with respect to the more frequent consideration of behavioural remedies, the treatment of information advantages on the side of the firms during the merger remedies negotiation process, the danger to foster collusion by imposing remedies, the possibility to dissuade entry by fixing remedies and the tendency of antitrust authorities to 'over-fix' remedies	

Based on the applied results of the present work presented in Table 39, the agenda of policymakers and academics on antitrust policy and antitrust enforcement probably cannot be described in a more appropriate way than done by Jonathan Baker in his essay on 'The Case for Antitrust Enforcement' in the *Journal of Economic Perspectives* (2003: 46):

> Given the size of the potential losses in economic welfare and to consumers from the exercise of market power, the success of antitrust enforcement as exhibited in many cases, the frequency, magnitude and length of competition problems that appear during periods of relaxed enforcement, and the importance of competition in promoting economic growth, innovation and prosperity, retreating to a minimalist antitrust policy makes no sense. Instead, the goal should be to apply sensibly, and sharpen as necessary, the tools of antitrust enforcement.

6 Annex

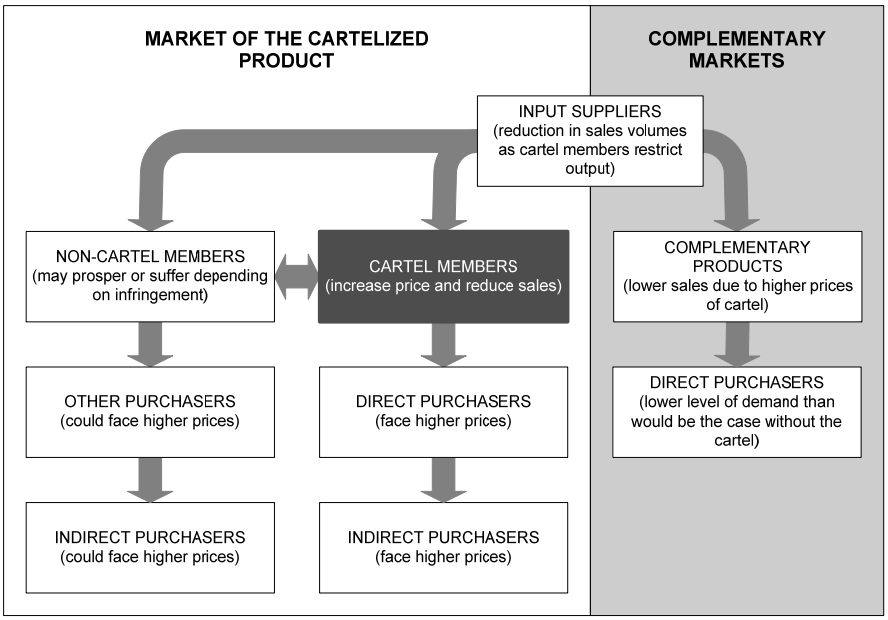
6.1 Estimating Customer Losses Due to Cartelisation – Evidence from the Lysine Cartel in the United States

One prominent contributor to the overall benefits of antitrust policy is cartel enforcement. Although the greatest benefits are probably achieved through the deterrence effect of cartel laws (which can hardly be measured), an analysis of customer losses due to actual cartelisation reveals important insights into the desirability of cartel enforcement from a consumer welfare perspective. One way to underpin this allegation is to argue that without successful cartel enforcement, the respective cartel would have continued to exist, causing welfare losses. In other words, the direct benefits of detecting a cartel can be approximated by the net present value of the yearly benefits for society in the future.

The desirability of such an analysis notwithstanding, it is important to note that not all customer losses are relevant for an antitrust policy that strictly follows a total welfare standard. Especially the consumers who only pay more for their products are not reflected in the total welfare loss, as their loss in surplus is just redistributed to the producers. The total welfare loss of a cartel agreement is created by the customers who would have bought the product at the competitive price but refrain from buying the product at the elevated cartel price. This total welfare loss is reflected in the so-called deadweight loss.

The detection of a cartel typically leads to two types of antitrust suits: a criminal suit and a private suit. In the criminal suit, the state punishes the cartel members for their misdemeanour or felony with fines and probably even incarcerates the individuals responsible for the cartel agreement; in the private suit, potentially damaged private parties can sue the cartel members for compensation of damages. In US antitrust law, for example, up to treble damages are possible as compensation, creating an additional fine for cartelisation and an incentive for the potentially damaged parties to file suits. The follow-up question of which parties are considered as ‘potentially damaged’ is given in Figure 66.

Fig. 66. Potentially damaged parties due to cartel members increasing prices



Source: Inspired by a comparable figure in Clark et al. (2004: 13).

As Figure 66 shows, on the upstream level, input suppliers of the cartel members might be damaged due to the reduction in sales volume caused by the cartel. Furthermore, the reduction in sales might lead to diseconomies of scale in the production process of the input suppliers and correspondingly might lead to an increase in its average total cost. As a consequence, every firm using the input product is eventually harmed by the cartel agreement due to elevated input prices.[362]

362 Answers to the question if and to what extent such cost increases are passed on downstream depend on the so-called *pass-on rate,* which is (in a competitive industry) given by $\psi = \left(1 / \left(1 + \varepsilon_D^m \cdot \varepsilon_S^m\right)\right)$. The variable ε_D^m represents the market demand elasticity and ε_S^m stands for the market supply elasticity, meaning the percentage increase in marginal costs when the output rises by 1%. Supposing a demand elasticity of 0,5 and a market supply elasticity of 1,0, the pass-on rate can be calculated to (1/[1+(0,5*1)])= 0,67. See van Dijk and Verboven (2005) and Kosicki and Cahill (2006) for longer treatments of pass-on rates – and indirect purchaser analysis in general – in cartel damage cases. The authors also provide an assessment of the chances that the potentially damaged parties (on different downstream levels) have to prevail in court with their damage claims. In general, no restitution is granted to parties who were not customers of the cartel but argue that they would have bought the cartel product at competitive prices. In other words, the deadweight loss caused by the cartel is not part of the damages estimate derived in court. As argued by Møllgaard (2006), the public fines – which are imposed as part of public enforcement – could be interpreted as restitution to society for the deadweight losses caused by the cartel (see

It is possible that non-cartel members have suffered due to the cartel agreement. However, as theoretical research has shown, it can very well be the case that non-cartel members manage to take advantage of the cartel (i.e., raise their prices and profits compared to the competitive counterfactual) without actually joining the cartel (see Phlips, 1995: 23ff.). Additionally, producers of products that complement the cartelised product might have been damaged due to lower sales caused by the cartel agreement. For example, if a shoe cartel is formed and the production and sales of shoes is reduced, it is imaginable that the producers of shoe polish (the complementary product) experience a decline in demand and consequently might also be damaged by the cartel agreement.

On the downstream level, the *direct effect* of the cartel is the damage caused by charging elevated prices to the direct purchasers of the cartel product. Typically, this damage is calculated by multiplying the difference between the price charged by the cartel and the price that would have existed in the absence of the cartel (the *'but-for' price*) with the respective sales volumes. Although the basic calculation concept is straightforward, its practical implementation is often challenging; the fixing of the but-for price is a particularly difficult exercise, as the resulting damage amount is typically sensitive to changes in the but-for price. A calculation of damages (and deadweight losses) is exemplified in the following with data from the (global) lysine cartel which operated from August 1992 until June 1995. Because of data limitations, however, only losses to customers in the United States can be estimated.

Lysine is an essential amino acid which helps (via its influence on proteins) to speed the development of muscle tissue in humans and animals.[363] From the beginning of lysine production in the 1960s until the early 1980s, the world demand for it was met by two firms 'acting as one' based in Japan. In 1980, a South Korean firm successfully entered the market on a smaller scale, followed by two additional newcomers in the early 1990s: Archer-Daniels-Midland (ADM) in the US and Cheil Sugar Co. in South Korea. The industry consequences of especially the large-scale entry of ADM were quite substantial, as described by Connor (2002: 10):

> Within 18 months, ADM's plant had expanded global production capacity by 25% above year-end 1990 levels; by 1993, ADM's single plant accounted for one-third of global capacity (780 million pounds). ADM's strategic objective was to acquire a global market share equal to the industry leader, Ajinomoto. Ruthless price cutting by ADM and the sudden appearance of large excess capacity caused lysine prices to plunge 45% in the first 18 months of the Decatur plant's operation.

Given the somewhat 'destructive' competition in the industry, the two Asian incumbents and ADM decided to form a lysine trade association, which was later joined by two other major lysine producers. The cartel investigations later assumed that the association began its operations in August 1992 and ceased to exist

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Leslie, 2006, for an in-depth assessment of the relationship between antitrust damages and deadweight losses).

363 The section on the lysine cartel history follows Connor (2002: 8ff. and 2001: 6ff.).

with the FBI raids in June 1995. During the cartel period, in early 1993, a brief price war occurred, because the cartel members could not agree on global market shares. However, the dispute was resolved after a couple of months and the cartel was reinstated. Figure 67 shows the lysine market prices for the United States and the European Union and the monthly production of ADM between July 1991 and May 1995.

First, Figure 67 shows that market prices between the United States and the European Union are highly correlated already in the pre-cartel period – indicating that both regions are in the same relevant (probably global) market. Second, the figure shows the substantial decline in market price prior to the cartel (at least partly caused by the substantial increase in ADM's lysine production) and the substantial market price increases (up to a level of $0,98 per lb. from November 1992 to January 1993) following the cartel agreements. It shows also the substantial price decline during the price war in early 1993 (down to a level of $0,62 in June 1993). However, after the price war, the cartel managed to raise (and stabilise) prices around $1.20 until the FBI discovered it in June 2005.

The availability of data on production, prices and average total cost of ADM between July 1991 and June 1995 (i.e., the pre-cartel period and the entire cartel period) allows a simple, back-of-the-envelope quantification of the additional profits ADM was able to collect due to the cartel agreement. The calculations are found in Table 40.[364]

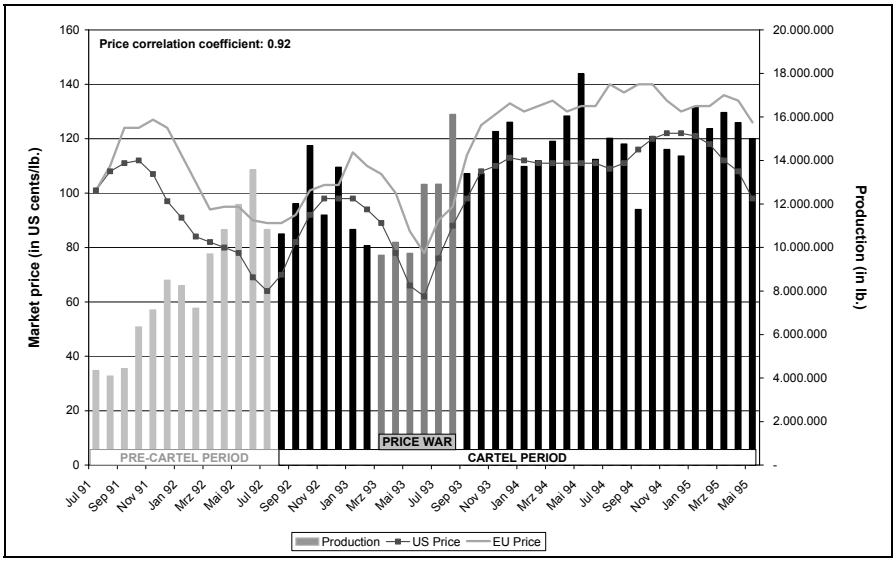
Columns 1 and 2 show the US and EU market prices for lysine, respectively. Only the US price is used for the estimation. Column 3 shows the average total cost of lysine production of ADM as estimated by Connor (2002: 34). Column 4 in the calculation spreadsheet above adds an average return on investment of 6% of sales (see Connor (2002: 25) to the ATC to get a cost-based but-for price which would have existed in the absence of the cartel. Column 5 shows the monthly ly-

[364] It is obvious that the simple spreadsheet approach to quantify the excess profits of ADM shown in Table 40 is very rough and would certainly not be considered acceptable in an actual trial for damages. However, the aim here is to derive not an exact calculation but only a ballpark figure on the economic effects of a cartel agreement. Veljanovski (2007b: 11f.) identifies the following ten steps which would be necessary to quantify the aggregate overcharge damages in a damages trial:

1. Determine or estimate the actual cartel prices for each period;
2. Determine or estimate the quantity purchased by each claimant;
3. Estimate the price for each period in the absence of the illegal cartel (known as the but-for price);
4. Calculate the overcharge in each year by subtracting the estimated but-for price from the actual price for each year period;
5. Estimate the proportion of the overcharge absorbed by upstream supplier;
6. Estimate any downstream pass-on of the overcharge;
7. Multiply the net annual overcharge absorbed by the claimant by quantity purchased in each year to arrive at the annual net overcharge absorbed by the claimant;
8. Apply the statutory simple pre-judgment interest rate;
9. Take account of other factors required by law, such as taxation; and
10. Aggregate annual net losses to arrive at a compensable amount.

sine production of ADM. As detailed sales data is unavailable, the calculations have to assume that the entire monthly production is sold to the US market price in the United States in the same month. Columns 6, 7 and 8 calculate total costs, revenues and profit of ADM during the cartel and prior to the cartel. Columns 9 and 10 provide the numbers on revenues and profits ADM would have made if they had faced the competitive but-for price. Finally, Column 11 calculates the excess profit collected by ADM during the cartel. To get this value, the but-for profit in column 10 simply has to be subtracted from the total profit estimate in column 8. The last column, 12, provides an estimate of the deadweight loss caused by ADM's participation in the cartel. Due to the unavailability of marginal cost data and (market) elasticity data, it is not possible to apply the general formula for the deadweight loss derived in section 2.2.1. Instead, a defensive general estimate of the deadweight loss of 10% of the total overcharge is used, based on Connor and Helmers (2006: 21), who typically experience the deadweight loss between 10% and 30% of the total overcharge.

Fig. 67. Average monthly lysine prices and ADM's lysine production between July 1991 and June 1995



Source: The raw data stems from Connor (2002).

Table 40. Estimating excess profits of ADM collected during the lysine cartel (1992-1995)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Month/ Year	US Price	EU Price	ATC	ATC + ROI 6% of sales	Production	Total costs	Total revenue	Total profit	But-for revenue	But-for profit	Excess Profit	DWL Estimate
	Cents /lb.	Cents/ lb.	Cents /lb.		lb.	US Dollar	US Dollar	US Dollar	US Dollar	US Dollar	US Dollar	10% of (11)
Jul 91	101	101	144,80	150,86	4.345.749	6.292.645	4.389.206	-1.903.438	6.555.997	263.352	-2.166.790	-216.679
Aug 91	108	110	146,90	153,38	4.091.849	6.010.926	4.419.197	-1.591.729	6.276.078	265.152	-1.856.881	-185.688
Sep 91	111	124	136,70	143,36	4.438.936	6.068.026	4.927.219	-1.140.807	6.363.659	295.633	-1.436.440	-143.644
Oct 91	112	124	112,80	119,52	6.351.685	7.164.701	7.113.887	-50.813	7.591.534	426.833	-477.647	-47.765
Nov 91	107	127	99,40	105,82	7.125.868	7.083.113	7.624.679	541.566	7.540.594	457.481	84.085	8.409
Dec 91	97	124	84,80	90,62	8.494.708	7.203.512	8.239.867	1.036.354	7.697.904	494.392	541.962	54.196
Jan 92	91	114	82,10	87,56	8.238.434	6.763.754	7.496.975	733.221	7.213.573	449.818	283.402	28.340
Feb 92	84	104	103,90	108,94	7.212.517	7.493.805	6.058.514	-1.435.291	7.857.316	363.511	-1.798.802	-179.880
Mar 92	82	94	81,90	86,82	9.705.598	7.948.885	7.958.590	9.706	8.426.400	477.515	-467.810	-46.781
Apr 92	80	95	75,10	79,90	10.817.071	8.123.620	8.653.657	530.036	8.642.840	519.219	10.817	1.082
May 92	78	95	68,50	73,18	11.976.225	8.203.714	9.341.456	1.137.741	8.764.201	560.487	577.254	57.725
Jun 92	69	90	68,30	72,44	13.562.577	9.263.240	9.358.178	94.938	9.824.731	561.491	-466.553	-46.655
Jul 92	64	89	69,60	73,44	10.827.913	7.536.227	6.929.864	-606.363	7.952.019	415.792	-1.022.155	-102.215
Aug 92	70	89	72,60	76,80	10.623.797	7.712.877	7.436.658	-276.219	8.159.076	446.199	-722.418	-72.242
Sep 92	82	92	68,40	73,32	12.015.189	8.218.389	9.852.455	1.634.066	8.809.537	591.147	1.042.918	104.292
Oct 92	92	101	62,20	67,72	14.684.324	9.133.650	13.509.578	4.375.929	9.944.224	810.575	3.565.354	356.535
Nov 92	98	103	66,50	72,38	11.489.102	7.640.253	11.259.320	3.619.067	8.315.812	675.559	2.943.508	294.351
Dec 92	98	103	64,80	70,68	13.688.529	8.870.167	13.414.758	4.544.592	9.675.052	804.886	3.739.706	373.971
Jan 93	98	115	71,00	76,88	10.831.684	7.690.496	10.615.050	2.924.555	8.327.399	636.903	2.287.652	228.765

Feb 93	94	110	73,90	79,54	10.081.811	7.450.458	9.476.902	2.026.444	8.019.072	568.614	1.457.830	145.783
Mar 93	89	107	81,40	86,74	9.642.060	7.848.637	8.581.433	732.797	8.363.523	514.886	217.911	21.791
Apr 93	78	100	79,80	84,48	10.240.442	8.171.873	7.987.545	-184.328	8.651.125	479.253	-663.581	-66.358
May 93	66	86	82,10	86,06	9.728.883	7.987.413	6.421.063	-1.566.350	8.372.677	385.264	-1.951.614	-195.161
Jun 93	62	78	69,00	72,72	12.901.675	8.902.156	7.999.039	-903.117	9.382.098	479.942	-1.383.060	-138.306
Jul 93	76	90	75,40	79,96	12.910.910	9.734.826	9.812.292	77.465	10.323.564	588.737	-511.272	-51.127
Aug 93	88	95	66,10	71,38	16.120.703	10.655.785	14.186.219	3.530.434	11.506.958	851.173	2.679.261	267.926
Sep 93	98	114	70,40	76,28	13.386.541	9.424.125	13.118.810	3.694.685	10.211.253	787.129	2.907.557	290.756
Oct 93	108	125	74,10	80,58	13.391.778	9.923.307	14.463.120	4.539.813	10.791.095	867.787	3.672.026	367.203
Nov 93	110	129	73,10	79,70	15.332.011	11.207.700	16.865.212	5.657.512	12.219.613	1.011.913	4.645.599	464.560
Dec 93	113	133	74,20	80,98	15.754.486	11.689.829	17.802.569	6.112.741	12.757.983	1.068.154	5.044.586	504.459
Jan 94	112	130	83,20	89,92	13.728.572	11.422.172	15.376.001	3.953.829	12.344.732	922.560	3.031.269	303.127
Feb 94	111	132	76,30	82,96	13.991.012	10.675.142	15.530.023	4.854.881	11.606.944	931.801	3.923.080	392.308
Mar 94	111	134	78,00	84,66	14.877.289	11.604.285	16.513.791	4.909.505	12.595.113	990.827	3.918.678	391.868
Apr 94	111	130	71,90	78,56	16.046.847	11.537.683	17.812.000	6.274.317	12.606.403	1.068.720	5.205.597	520.560
May 94	111	132	72,10	78,76	17.989.196	12.970.210	19.968.008	6.997.797	14.168.291	1.198.080	5.799.717	579.972
Jun 94	111	132	89,40	96,06	14.046.932	12.557.957	15.592.095	3.034.137	13.493.483	935.526	2.098.612	209.861
Jul 94	109	140	69,00	75,54	15.018.568	10.362.812	16.370.239	6.007.427	11.345.026	982.214	5.025.213	502.521
Aug 94	111	137	69,70	76,36	14.754.791	10.284.089	16.377.818	6.093.729	11.266.758	982.669	5.111.060	511.106
Sep 94	116	140	76,90	83,86	11.746.095	9.032.747	13.625.470	4.592.723	9.850.275	817.528	3.775.195	377.519
Oct 94	120	140	68,50	75,70	15.089.369	10.336.218	18.107.243	7.771.025	11.422.652	1.086.435	6.684.590	668.459
Nov 94	122	134	72,90	80,22	14.502.449	10.572.285	17.692.988	7.120.702	11.633.865	1.061.579	6.059.123	605.912
Dec 94	122	130	77,60	84,92	14.199.351	11.018.696	17.323.208	6.304.512	12.058.089	1.039.392	5.265.119	526.512
Jan 95	121	132	72,60	79,86	16.467.133	11.955.139	19.925.231	7.970.092	13.150.652	1.195.514	6.774.579	677.458
Feb 95	118	132	72,90	79,98	15.454.384	11.266.246	18.236.173	6.969.927	12.360.416	1.094.170	5.875.757	587.576

Mar 95	112	136	75,30	82,02	16.206.394	12.203.415	18.151.161	5.947.747	13.292.484	1.089.070	4.858.677	485.868
Apr 95	108	134	66,30	72,78	15.733.764	10.431.486	16.992.465	6.560.980	11.451.033	1.019.548	5.541.432	554.143
May 95	98	126	74,40	80,28	15.004.248	11.163.161	14.704.163	3.541.003	12.045.410	882.250	2.658.753	265.875
Jun 95	96	0	73,70	79,46	14.754.945	10.874.394	14.164.747	3.290.353	11.724.279	849.885	2.440.468	244.047
	101	115	73,31	79,37	482.435.264	352.530.077	495.264.847	142.734.771	382.245.967	29.715.891	113.018.880	11.301.888

Source: Own calculations based on data from Connor (2002); Connor's ATC estimates and US market prices used for calculations; Monthly production = Monthly sales assumed.

The results of the calculations in Table 40 show that the overall excess profit for ADM alone was about $113 million (or $3,229 million per month on average) during the cartel period from August 1992 to June 1995. The deadweight loss caused by ADM in the same period was about $11 million (or $0,322 million per month on average). The table further shows that the derived average but-for price of $0,7937 is relatively close to that of $0,8000 derived (by a different technique) during the trial (see Connor, 2006a: 18). The spreadsheet calculations further allow deriving the 'incremental' reduction in damages if the but-for price is reduced by one cent. The result of $4,82 million damage reduction per cent generally shows the sensitivity of the damage calculations to the but-for price mentioned above. From a practical perspective, this exercise shows why it usually pays for the defendant to hire economic experts: They might be able to reduce the but-for price by a few cents and so might save the defendant millions and millions of dollars in damages.[365]

From a conceptual perspective, it is important to mention that apart from the cost-based method applied above, several alternative methods to derive the but-for price exist (see van Dijk and Verboven, 2005, and Clark et al., 2004, for recent surveys). The *before-and-after method* undertakes price comparisons before and after the infringement, while the *yardstick method* analyses similar (ideally competitive) product markets to derive a but-for price for the cartelised market. One additional possibility is the application of economic models aiming at simulating competition and deriving an estimate for the but-for price. For example, as shown in Annex 6.6.10, in a simple Cournot model with homogenous goods, the market price P can be estimated by using the following expression (ε_D^m is the market demand elasticity, c is marginal cost and HHI is the Herfindahl-Hirschman index):

$$P = \frac{\varepsilon_D^m \cdot c}{\left(\varepsilon_D^m - HHI\right)}. \tag{117}$$

Equation (117) shows that the predicted but-for price decreases with the number of firms in the market. In a competitive industry, the but-for price would be equal to marginal costs. As reported by Connor (2000: 66f.), economists defending ADM actually used price estimates derived by a similar Cournot model to calculate damages. One basic problem with such estimates is sensitivity to small changes in the underlying assumptions on market demand elasticity and marginal cost. This can be exemplified by plotting Equation (117) for different marginal costs of lysine (range from $0,40-$0,90 per lb.) and different absolute demand elasticities (range from 0,0-2,0; see Figure 68).

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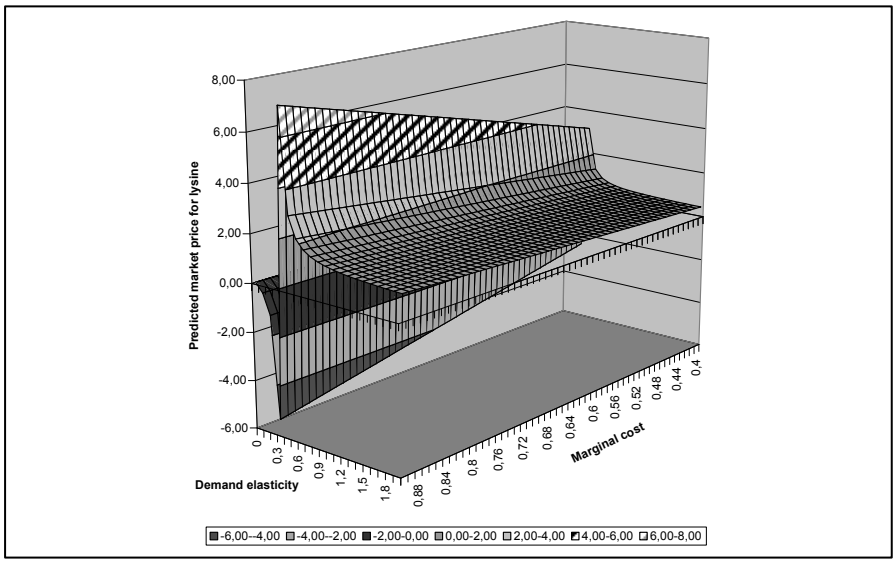
365 The exact values for different but-for prices are as follows: $157.560.162 for a but-for price of $0,70, $133.438.399 for a but-for price of $0,75, $109.316.636 for a but-for price of $0,80, $85.194.873 for a but-for price of $0,85, $61.073.110 for a but-for price $0,90, $36.951.346 for a but-for price of $0,95 and still $12.829.583 for a but-for price of $1,00.

Fig. 68. Predicted lysine but-for prices applying a basic Cournot model with homogenous goods (HHI=3.500)



As shown in Figure 68 (as well as in the corresponding Table 66 in Annex 6.7), the price predictions of the Cournot model can indeed be sensitive to slight changes of the marginal costs and the underlying demand elasticity. Especially when there is relatively inelastic demand (which was assumed to be the case for lysine), the predicted Cournot prices can even be negative or up to 800% higher than marginal cost. It is obvious that such model specifics make it difficult to use the results successfully in the courtroom – first of all because such results are easy to attack by the plaintiff.

However, it should not be concealed that economics provide much more sophisticated methods to simulate but-for prices. Given a sufficient data basis, it would be possible to conduct a simulation analysis which combines a demand model, a firm model and a model of competitive interaction to receive simulated market outcomes for different scenarios. De Roos (2006), for instance, constructs a more sophisticated collusion model to understand the lysine market and to derive 'meaningful' but-for prices.

Finally, it is worth mentioning that the criminal lysine price fixing conspiracy trials led to five corporate fines and seven personal fines. The US corporate fines added up to $92,5 million, compared to $97,9 million in the EU and $11,5 million in Canada. In 1999, three persons were sentenced to a total of 99 months in prison (with a maximum per individual of 36 months). The private antitrust suits ended with agreements that the cartel members pay damages of (in sum) about $85 million (only in the United States), which was roughly the loss of the lysine buyers in the United States. US antitrust law would have allowed up to treble damages.

6.2 Estimating the Potential Welfare Effects of a Merger – Evidence from the *Nuon-Reliant* Case in the Netherlands

Merger enforcement is another area which is believed to contribute substantially to the overall benefits of antitrust enforcement. It does so by banning anticompetitive mergers that would have likely resulted in higher prices through an increase in market power (the *unilateral effects*) and/or a market environment that would have been more favourable to collusion (the so-called *coordinated effects*). Evidence from the *Nuon-Reliant* case in the Dutch electricity market is analysed in this section with respect to its (hypothetical) contribution to the benefits of antitrust enforcement in the Netherlands.

Nuon is a Dutch energy utility which operates, amongst other activities, in the electricity wholesale and retail markets in the Netherlands. At the beginning of 2003, it also owned some generation capacity (about 900 MW decentralised capacity) and had a long-term contract (about 800 MW) with an independent Intergen power plant. In 2003, Reliant Energy Europe, one of the major electricity generators in the Netherlands (about 3.500 MW capacity), planned to withdraw its activities in the Netherlands, and Nuon saw the acquisition[366] of Reliant's assets as an opportunity to promote its plans to further vertically integrate on the upstream (generation) level. The general market structure of the Dutch electricity market in 2003 is depicted in Figure 69.

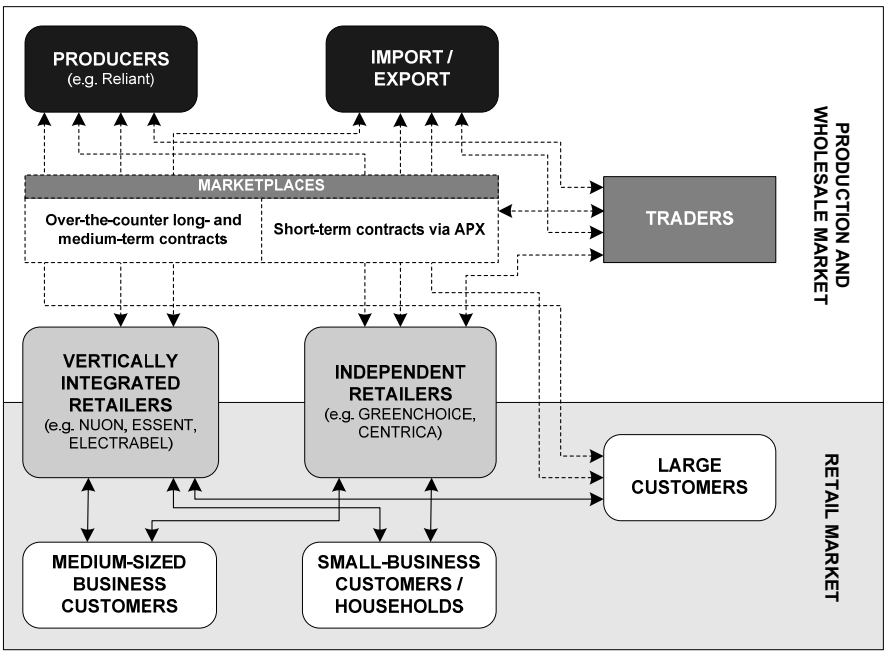
As shown in Figure 69, on the upstream level the producers of electricity (in the Netherlands and neighbouring countries) can basically use two different marketplaces to trade their product. The largest part of the expected demand is traded via long and medium-term contracts (*over-the-counter contracts*) from several years to months prior to supply. Short-term contracts come into play when actual demand can be estimated more precisely. These contracts are then traded at the Amsterdam Power Exchange (APX), the Dutch spot market for electricity. Traders generally buy and sell electricity aiming at using price differences to make a profit. On the downstream level, vertically integrated retailers (i.e., firms with own generation capacity) and independent retailers supply business customers and households with electricity. Large customers tend to secure their electricity needs by signing long-term contracts directly with the producers.

On 2 April 2003 Nuon notified the Dutch Competition Authority (NMa) that it wishes to acquire the Dutch electricity generation assets of Reliant. The NMa conducted an in-depth investigation of the case and concluded that the combination of the two firms' generation assets would create or strengthen a dominant position in the electricity generation and wholesale markets in the Netherlands. It therefore only cleared the merger (after several negotiations) subject to the remedy that Nuon has to undertake a series of virtual power plant auctions for 900 MW of capacity per year over a period of five years (see NMa decision, Case 2286

366 Although *Nuon-Reliant* is de-facto an acquisition, it is referred to as a merger here. This procedure is in line with antitrust literature, which typically does not use constructs such as 'acquisition control' or 'merger and acquisition control'.

Nuon/Reliant Energy Europe, 8 December 2003). The other major players in the Dutch market Essent (about 4.300 MW generation capacity) and Electrabel (about 4.000 MW generation capacity) are not allowed to participate in these auctions. Although Nuon started the required auctions by the end of 2004, it also appealed the NMa's decision at the District Court of Rotterdam. The court undertook a detailed review of the economic analysis of the NMa and annulled the decision of the NMa in June 2005 (Court of Rotterdam, *Nuon vs. NMa*, LJN: AT6440, 31 May 2005).

Fig. 69. The Dutch electricity market in 2003



Source: Inspired by a comparable Figure in NMa (2006: 19).

The investigation of the NMa was based on a relevant market as that for generation and wholesale supply of electricity. For generation, the pre-merger HHI was estimated at 1.754 and the post-merger HHI at 1.974 (see Oxera, 2004: 19), a range in which competitive concerns are possible. In terms of market shares, the merger would have led to a combined share between 20% and 30%, similar to that of the other major players in the market (Essent and Electrabel). Given these structural characteristics, the NMa argued that the proposed acquisition would create or strengthen a dominant position because of increased incentives of 'generators at the margin' to behave strategically in peak times and therefore to cause higher post-merger prices.[367] To underpin this argument, the authority appointed two con-

[367] As explained in more detail in Oxera (2004b: 18f.), the scope of market power for a particular electricity generator depends on its position in the merit order of genera-

sultancies to build simulation models of the Dutch electricity market for studying how the market would likely operate before and after the merger. The Energieonderzoek Centrum Nederland (ECN) designed the first model and the UK-based Frontier Economics (FE) designed the second.

The ECN model COMPETES is a Cournot model that contains information on marginal costs about production units and the electricity network in Benelux, Germany and France. Following the description of van Damme (2005: 163), the model is conceptually based on a linear demand curve and distinguishes twelve different demand curves for three seasons (summer, winter, fall/spring) and for each of these super-peak, peak, shoulder and off-peak periods. For each of these periods, one point on the demand curve is determined from historical data; at that point an elasticity of -0,2 (Scenario 1) or -0,1 (Scenario 2) is assumed. Information on marginal costs and demand allows computing the Nash equilibria of the Cournot game pre-merger and post-merger.

The SPARK model applied by Frontier Economics determines, inter alia, the Nash equilibrium bidding strategies for all generators under 'realistic' market conditions including, for example, generator operating characteristics, transmission losses and constraints or demand fluctuations (see Steinke et al., 2005: 5ff., and Frontier Economics, 2000, for the following description as well as a simple example). The model can be operated to find the least-cost operation of the system (i.e., the economic dispatch), or it can be operated to find the most profitable (=sustainable) operation of the market (that is, the equilibrium price). In this type of model the optimal bid will change, as it does in a real market, according to the changing market conditions – for example, operation of transmission constraints, plant failures or new investments. Many commentators such as NERA (2005) or van Damme (2005: 163) connect the Frontier model to the 'supply function equilibrium' approach formulated by Klemperer and Meyer (1989) as a third way to model competitive interaction in electricity markets next to Cournot and Bertrand models. However, FE itself did not explain which model of competitive interaction comes closest to their simulation approach.

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tors. At the lower end of the merit order are generators with low marginal cost but also a low flexibility to adjust production following demand changes, such as for nuclear power or coal-fired plants. These plants provide the base load. If demand increases (often from one minute to another), generators with higher marginal cost but also a higher flexibility, such as gas or oil-fired plants, will start producing electricity. Generators with very high marginal costs only operate in peak-demand periods. The last generator which is needed to meet existing demand sets the market price for electricity. This opens possibilities for the owners of generators to behave strategically, aiming at increasing the market price in peak hours (under the assumption that import capacity is constrained and already fully utilised at peak demand). As a consequence, the market-power effects of a merger between two base-load generators can be substantially lower than a merger between two peak-load generators, even if the increase in the Herfindahl-Hirschman Index for the former merger would be substantially larger. In other words, the HHI alone does not provide a full picture of the competitive forces and the likelihood of price increases due to a merger in the electricity industry (see Stoft, 2002: 357ff., and NMa, 2006, for detailed descriptions).

Based on their respective simulation approaches, ECN and FE both estimated the pre-merger price level and compared it with the post-merger price level. The ECN model shows a merger-induced price increase of 5,9% for an underlying demand elasticity of -0,2 and about 10,4% for an underlying demand elasticity of -0,1. Given the pre-merger quantity (approximated by the Dutch electricity production in 2001 (around 90.000 MWh) plus the import-export difference in 2001 (around +17.000 MWh)), deriving the post-merger quantity via the usual elasticity expression is straightforward. It is then possible to estimate the redistribution effect (per year) from consumers to producers as well as the deadweight loss (per year) caused by the proposed acquisition. The results are presented in Table 41.

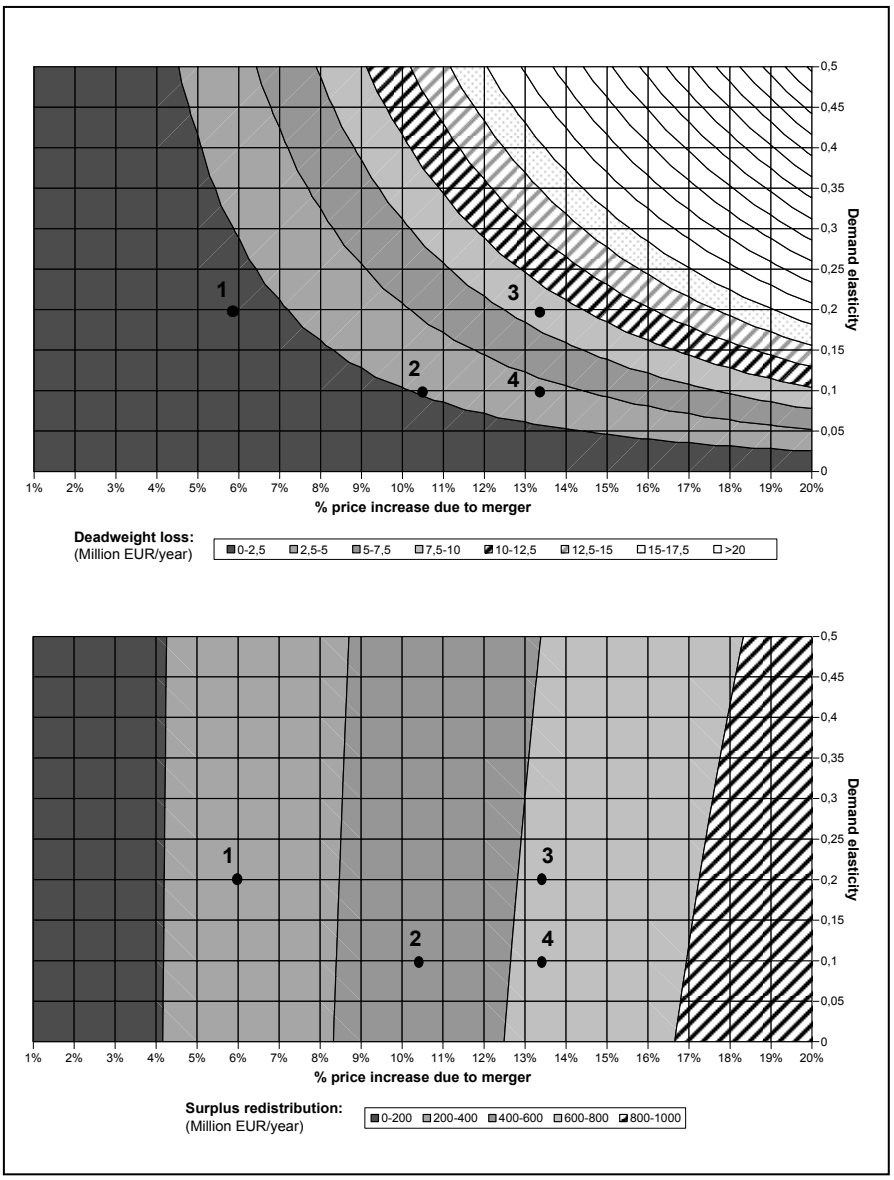
Table 41. Welfare effects of the attempted prohibition of the merger between Nuon and Reliant in the Netherlands

	ECN Simulation Model I	ECN Simulation Model II	FE Simulation Model I	FE Simulation Model II
	Price increase of 5,9%	Price increase of 10,4%	Price increase of 13,3%	Price increase of 13,3%
Pre-merger price (€/MWh)	44,9	44,9	43,7	43,7
Post-merger price (€/MWh)	47,5	49,6	49,5	49,5
Demand elasticity	-0,2	-0,1	-0,2	-0,1
Pre-merger quantity (MWh)	107.000.000	107.000.000	107.000.000	107.000.000
Post-merger quantity (MWh)	105.737.400	105.887.200	104.160.220	105.580.110
Redistribution effect (€/year)	280.108.946	494.450.869	604.024.074	612.258.002
Redistribution effect (% of sales)	5,57	9,42	11,72	11,72
Deadweight loss (€/year)	1.672.377	2.598.165	8.233.928	4.116.964
Deadweight loss (% of redistr.)	0,60	0,53	1,36	0,67

Source: Own calculations based on Oxera (2004b: 21).

As Table 41 shows, the four simulation results lead to relatively different redistribution effects and deadweight losses. However, the redistribution effect appears to be substantial across the board (between 5,57% and 11,72% of post-merger sales), while the deadweight losses are – due to the low demand elasticity – relatively small (between 0,60% and 1,36% of the redistribution effect). Aside from the fact that the quantitative results differ quite substantially, their 'signs' are identical for all four models. In other words, all four models predict substantial price increases following an acquisition of Reliant by Nuon. However, it has to be kept in mind that the whole analysis is static and therefore does not consider potentially important dynamic effects of merger enforcement on innovation intensity and productive efficiency in the Dutch electricity market.

Fig. 70. Different estimates of the deadweight loss and surplus redistribution per year in the Netherlands due to the proposed Nuon-Reliant merger



As already seen in the cartel case study above, simulation results tend to be quite sensitive to small changes in parameters such as demand elasticities or – as here – to the underlying price increase that is believed to be caused by the

merger.[368] In order to see the sensitivity of the results in this case, Figure 70 shows different ranges for the deadweight loss- and the redistribution effect dependent on a range of the assumed % increase in price due to the merger and a range of the assumed market demand elasticity.

In Figure 70, (1) marks the value of ECN's simulation result I and (2) the value of ECN's simulation result II; (3) marks the value of FE's simulation result I and (4) the value of FE's simulation result II. In general, the figure shows that the quantitative results are again quite sensitive to small parameter changes. These specifics were one cornerstone in the (successful) attempt of Nuon to convince the Court of Amsterdam that the simulations of ECN and FE are not sufficient to prove anticompetitive effects as a consequence of the merger (following Dutch competition law).

In the evaluation of the two models, several large economic consultancies were involved. Oxera was hired for an independent external evaluation of the models. NERA and RBB Economics supported Nuon (see van Bergeijk, 2005; Oxera, 2004; NERA, 2005; and RBB Economics, 2005 for their views on the case). As discussed in van Damme (2005: 163f.), the basic arguments against the significance of the merger simulations (and in particular the FE model) were: that the pre-merger price distribution is not in line with the one actually observed, inelastic demand is unrealistic, demand side bidding is neglected, the Nash equilibria are not sustainable (NERA, 2005), the multiple equilibria problem is (inappropriately) dealt with by the construction of price ranges and averages, no empirical evidence is given that strategic behaviour is a problem in the Dutch market pre-merger (see RBB Economics, 2005), the modelling of the interconnector is inappropriate, the specification of the strategy space is arbitrary and may influence the results, and the model assumes complete information. As mentioned above, the Court of Rotterdam decided that the NMa had not provided sufficient evidence to support its case. The NMa has appealed the judgement.

6.3 Antitrust Implications of Franchise Agreements

The question for the determinants of firm boundaries has triggered an extensive discussion in economics and management research during the last couple of decades. As far as the horizontal boundaries are concerned, cost considerations are presumed as one important determinant. With respect to the vertical boundaries, theoretical and empirical research has shown that the balance between investment incentives (specific assets) and performance incentives has a high explanatory value (see Cabral, 2000: 40ff.). As a consequence, both complexes together determine the efficient degree of vertical integration; that is, the degree which minimises the sum of production and transaction cost.

368 See Froeb et al. (2004) for a general discussion of advantages and shortfalls of merger simulations.

In addition to the two polar options of 'market' and 'integration', several hybrid organisational forms have emerged to reach the desired efficient solution for certain transactions within certain environments. Besides, for example, licenses, concessions, or commission affiliations, franchise agreements can be interpreted as one further solution to this general problem of vertical organisational structure.

Notwithstanding the fact that the motivations to enter franchise agreements are mainly efficiency-driven and simultaneously welfare-enhancing, it is obvious that such agreements normally influence competition in upstream, downstream and/or 'adjacent' markets. Hence, as far as some degree of market power is involved, there is the potential of an abusive use of franchise agreements to increase a dominant firm's margins in its 'own' brand market (harming intra-brand competition) or leveraging market power into related brand markets (harming inter-brand competition) and into adjacent markets. The resulting welfare losses are the main reason why franchise agreements are of interest for public policy makers in general and for antitrust economists and agencies in particular.

Based on these introductory considerations, this section aims at discussing the essential antitrust implications of franchise agreements. The section is structured into four parts. Section 6.3.1 characterises franchise agreements from a business perspective and from a welfare 'industrial economics' perspective. Section 6.3.2 assesses the rationality of franchise agreements by focusing on the instability of franchise agreements and instruments to stabilise them. Subsequently, section 6.3.3 focuses on a characterisation of the basic economic interrelation between franchise agreements and antitrust. First, it is argued why and under which circumstances such agreements might run into difficulties with antitrust regulations. Second, a simple framework to assess the antitrust effects of franchise agreements is developed. Section 6.3.4 concludes the section.

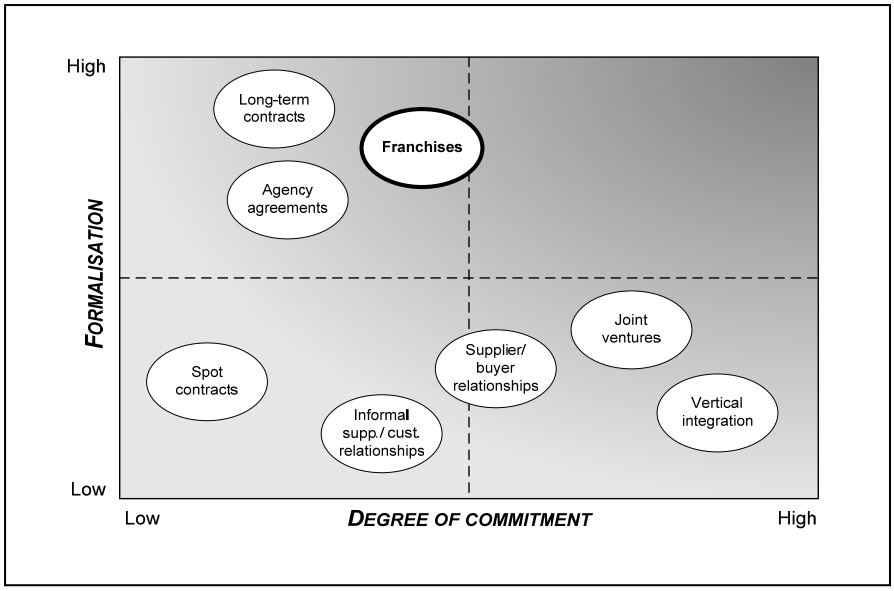
6.3.1 Characterising Franchise Agreements

Franchise agreements organise the vertical relationship between two independent firms: a franchisor and a franchisee. The franchisor, the producer of a certain product or owner of a business concept, sells this to the franchisee, subject to a specific contractual relationship and in return for set-up fees, license fees, royalties or other payments. The contracts address the topics what prices are to be charged, what services will be offered, location and marketing efforts, and so forth (see Lipczynski and Wilson, 2001: 289ff.).

6.3.1.1 Business Motivations for Franchise Agreements

From a firm's viewpoint, franchise agreements are one way to organise the vertical relationships in the market. Figure 71 provides an overview of select types of vertical relationships.

Fig. 71. Different types of vertical relationships



Source: Grant (1998: 325).

As shown in Figure 71, vertical relationships differ in their degree of formalisation and commitment. Franchise agreements can be characterised by a relatively high degree of formalisation (i.e., the contract is very specific) and by a medium degree of commitment (i.e., the contract is for a longer term than simple spot contracts but does not require the 'full commitment' of vertical integration).

This simple categorisation already indicates that franchise agreements are not an omnipresent distribution strategy for every product in every industry. Quite the contrary is true: franchising is typically found in industries where services have to be produced locally (while the customer is present) and where there are large advantages in developing and maintaining a business formula or a brand name (see Douma and Schreuder, 2002: 173; Fulop and Forward, 1997: 607).

This observation leads to the conjecture that franchise agreements are the most efficient governance structure for certain products or services in certain environments. To give some basic theoretical arguments which fortify this conjecture, consider a fully integrated local firm that has undertaken huge efforts to establish a brand name for its (locally produced) product or service. The fixed costs for establishing the brand name (understood as 'an implicit guarantee of a certain quality level') are largely sunk, but the marginal cost of expanding the brand name is almost zero. Therefore, it seems obvious that it is in the profit-maximising interest of the brand name owner to expand output, taking advantage of large economies by selling his brand name reputation (see Wainwright, 2002: 2).

During the growth process, the firm is subject to certain spatial and technological limitations. For example, local demand will become saturated and market ex-

tensions are subject to specialised local information which the manufacturers often do not have. Another internal growth restriction is technology-driven, as the expansion of output might lead to diseconomies of scale, e.g. due to the growing complexity of in-firm coordination. In this respect, the growth of a fully integrated firm is associated with the standard economic problems in hierarchies, such as shirking by the employees. A thinkable solution would be for the parent firm to intensify efforts to monitor the outlets. In a context of incomplete information, however, that often turns out to be problematic, as the parent firm typically lacks the necessary familiarity with local market conditions.

Auxiliary to these general problems of internal growth strategies, Grimes (1996: 108) identifies two further reasons why franchising could be an efficient way of distribution. First, franchising increases the ability of the franchisor to acquire capital to build a network of dealer outlets. He can do this perhaps more quickly and/or at lower cost than in a vertically integrated business. This might create first-mover advantages in brand name recognition and product market competition. Furthermore, franchising requires a smaller financial investment by franchisors and a lower capital risk than a company-owned network (see Fulop and Forward, 1997: 606ff.). Second, franchise agreements allow harvesting the entrepreneurial energy and dedication that flows from investor-owned and -operated outlets which can solve many typical hierarchical problems mentioned above (but it would raise others explained below).

Besides these advantages for the franchisor, franchise agreements are also profitable for the franchisees. For example, franchising reduces risk through trademarks and the franchisor's assistance with training, advice and support. Furthermore, commercial banks might be more generous in providing financing for start-ups based on a market-proven business concept from a well-known franchisor (see Fulop and Forward, 1997: 608). In summary, Klein (1995: 10) states,

> [f]ranchising is just one of many ways a firm can choose to distribute its product. The essential economic rationale for franchising is that it permits transactors to achieve whatever benefits of large scale may be available in, for example, brand name development and organisational design, while harnessing the profit incentive and retailing effort of local owners.

6.3.1.2 Franchising as a Vertical Relationship

From the viewpoint of industrial organisation, franchising is one option to organise the vertical relationships in a market. The simple, two-stage model presented here shows that entering a franchise agreement can lead to the same market results as a vertical merger or creating competition among the retailers.

Suppose that there are two firms in a vertical market, an upstream manufacturer U and a downstream retailer D. U faces production costs of c (with $c<a$) and charges a wholesale price w, while D pays w and charges the retail price P to the final customer. Downstream demand is given by $Q(P)=a-P$ with $a>0$ (see Motta, 2004: 309ff. or Bühler and Jaeger, 2002: 140ff., for comparable approaches, both of which refer to Tirole, 1995: 176ff.; the original idea goes back to Spengler, 1950).

Market results under separation with monopoly manufacturer and monopoly retailer

Given the general description of the vertical market structure, it is evident to assume that the game is being played in two stages. In the first stage, the upstream firm chooses the wholesale price that it charges to the downstream firm. Afterwards, the downstream firm chooses the final price *p,* at which it sells the final product to the customers.

In stage two of the game, the retailer has to choose *p* to maximise profits (given the wholesale price *w*):

$$\max_{P} \left(P - w\right)\left(Q(P)\right). \tag{118}$$

From the first-order condition and some algebraic manipulations, the following expressions for the retail price, quantity and retailer profit result:

$$P = \frac{\left(a + w\right)}{2}, \tag{119}$$

$$Q = \frac{\left(a - w\right)}{2}, \tag{120}$$

$$\pi^{D} = \frac{\left(a - w\right)^{2}}{4}. \tag{121}$$

In stage one of the game, the manufacturer has to choose the wholesale price *w* that maximises his profits. He anticipates the optimal (output) decision of the retailer and therefore maximises

$$\max_{w} \left(w - c\right)\left(\frac{a - w}{2}\right). \tag{122}$$

Taking the first derivative and equalling it to 0 leads (after some manipulations) to

$$w = \frac{\left(a + c\right)}{2} \tag{123}$$

Inserting this expression into the market results for the downstream market leads to the following equilibrium price, quantity and profits:

$$P = \frac{3a + c}{4}, , \tag{124}$$

$$Q = \frac{\left(a - c\right)}{4}, \tag{125}$$

$$\pi^{U} = \frac{\left(a - c\right)^{2}}{8}, \tag{126}$$

$$\pi^D = \frac{(a-c)^2}{16}, \tag{127}$$

$$\pi = \frac{3(a-c)^2}{16}. \tag{128}$$

Market results under vertical integration

Now suppose that upstream manufacturer and downstream retailer vertically integrate. The manufacturer now factually sells directly to the consumers and faces the 'standard' profit-maximising problem of a monopolist:

$$\max_P (P-c)(Q(P)). \tag{129}$$

Taking the first derivative and equalling it to 0 leads (after some algebraic manipulations) to

$$P = \frac{a+c}{2}, \tag{130}$$

$$Q = \frac{a-c}{2}, \tag{131}$$

$$\pi = \frac{(a-c)^2}{4}. \tag{132}$$

Market results under separation with monopolistic manufacturing market and competitive retail market

If the upstream firm is still a monopoly but the retail market is competitive, the downstream market will result in P=c=w, so that the quantity demanded is given by (Q(P))=(a-w). The upstream monopolist then solves

$$\max_w (w-c)(Q(P)) \tag{133}$$

which is the same problem as with vertical integration, and the market results derived above apply.

Market results under separation with competitive manufacturing market and monopolistic retail market

If the upstream market is competitive, the wholesale price equals marginal costs and the downstream firm's problem is

$$\max_P (P-c)(Q(P)) \tag{134}$$

which is again the same problem as with integration. The market results received above apply. Table 42 sums up the market results for the four different market structures just analysed.

Table 42. Market results of different vertical structures

	Separate monopolies of U and D	Vertical integration of U and D monopolies	Competitive U and monopolistic D	Monopolistic U and competitive D
Wholesale price W	$\frac{(a+c)}{2}$	n.a.	c	$\frac{a+c}{2}$
Retail price P	$\frac{3a+c}{4}$	$\frac{a+c}{2}$	$\frac{a+c}{2}$	$\frac{a+c}{2}$
Quantity sold Q	$\frac{(a-c)}{4}$	$\frac{a-c}{2}$	$\frac{a-c}{2}$	$\frac{a-c}{2}$
Wholesale profit π^U	$\frac{(a-c)^2}{8}$	n.a.	0	$\frac{(a-c)^2}{4}$
Retail profit π^D	$\frac{(a-c)^2}{16}$	n.a.	$\frac{(a-c)^2}{4}$	0
Total profit Π	$\frac{3(a-c)^2}{16}$	$\frac{(a-c)^2}{4}$	$\frac{(a-c)^2}{4}$	$\frac{(a-c)^2}{4}$

As shown in Table 42, the vertical merger is superior for the firms as well as for the consumers: Overall profits are higher leading to a higher producer surplus, and prices are lower (i.e., quantities sold are higher) leading to a higher consumer surplus than in the situation of separate monopolies. As explained above, this is because vertical integration avoids the price distortion that occurs when both firms add their own price-cost margin at their respective production stage. A merger avoids such a 'double marginalisation'. Furthermore, as shown in Table 42, competition in either the upstream or the downstream market also leads to the favourable market performance under vertical integration. This is simply because competition in one stage of the vertical structure also avoids a second price-cost margin being added to the retail price. In other words, if an upstream monopolist is able to create (perfect) competition in the downstream market, a vertical merger would be pointless (at least in a 'one input' world).

Franchising as an alternative to vertical integration

An alternative to vertical integration or creating competition in the downstream market for a producer aiming at maximising joint profits is franchising. Suppose the upstream firm decides to charge w = c per unit sold but also charges a fixed

franchise fee *F* from the downstream firm. The downstream firm then has to solve the following problem

$$\max_{p} \; (p - c)(Q(P)) - F \,. \tag{135}$$

As the fixed fee does not affect the first-order condition, the solution of the game is given by the results of the vertical integration state derived above. The distribution of the total profit between upstream and downstream firm will be determined by the amount of the franchise fee *F*. If the upstream firm has full bargaining power, for instance, it can collect the whole profit of the vertical structure by charging a fee equal to total profits. However, this result does not hold if the downstream firm is risk-averse or if demand varies. Furthermore, the upstream firm might have problems monitoring profits (see Tirole, 1995: 176ff.) – which might be a reason why the royalty fee the franchisee has to pay the franchisor often is a percentage of sales (ranging from 0,5 to 12,5%) rather than a percentage of profits (see Carlton and Perloff, 2000: 411f.). In general, the simple theoretical analysis indicates that franchise agreements (and vertical integration, for instance) can avoid the double marginalisation problem and therefore has the potential to increase welfare.

6.3.2 Rationality of Franchise Agreements

Franchise agreements typically restrict the franchisee with 'allowed forms of conduct'. In this respect it has to be assessed, first, why franchise agreements tend to be unstable without such restrictions and, second, which particular instruments are suitable to heal these stability problems?

6.3.2.1 Instability of Franchise Agreements

By signing a franchise agreement, it is reasonable to assume that the franchisor and the franchisee have congruent general interests in maintaining a workable and efficient franchise relationship. The franchisor would like to distribute its products in the most efficient way, and the franchisee expects a share of the joint profit. However, theoretical research has shown that under an unrestricted franchise agreement lies a *prisoner's dilemma:* On the one hand, it is in the collective interest that everybody acts in the agreed way to maximise joint profits. On the other hand, a single franchisee could raise its own short-run profits by deviating from the solution for joint profit maximisation. Such behaviour normally harms the other transactors, jeopardises the success of the whole franchise agreement and has the potential to harm social welfare. This incentive to deviate is one reason why franchise agreements need some restrictions (in the form of vertical restraints).[369] The drivers of such misbehaviour can be structured according to the

[369] Other justifications for franchise regulation are more obvious. For example, it seems reasonable that certain franchise restrictions are necessary to protect the franchisor's

possible relationships in a franchise agreement: between manufacturers and retailers, between retailers and between manufacturers (see OFT, 1997: chap. 7).

In the manufacturer-retailer relationship, one problem is *double marginalisation*. This problem is created when not only the franchisor but also the franchisee has some degree of market power (e.g., due to the granting of exclusive distribution rights). In such a situation, the franchisee does not set prices equal to marginal costs (as it would be in the interest of the franchisor), but has an incentive to set prices above the competitive level to exploit its retailer market power. As a consequence, from the franchisor's point of view, the franchisee sells too little of the product and therefore reduces the franchisor's profits. The economic problem behind this phenomenon is a vertical externality, as the franchisee only takes into account what is profit-maximising for him and does not look at the negative consequences of its behaviour for the franchisor.

Besides these diverging incentives in pricing, the same story can be applied to other product characteristics, such as product quality or retailer service. "[A]s long as manufacturer and retailer both stand to gain from any increase in the quality or promotion of the manufacturer's product, then neither will individually have incentives to do the jointly profit maximising amount of quality improvement or promotion" (OFT, 1997: Paragraph 7.1.1.1).

Another form of 'moral hazard' in unrestrained franchise agreements is *input substitution.* This phenomenon arises when the retailer has the possibility of receiving a (substitutive) input not only from the monopoly manufacturer but also from a competitive adjacent industry. In such a case the retailer has an incentive to substitute with the second input (because of a shift in relative prices, for example) and therefore consumes too little of the manufacturer's input good. This happens because the retailer does not take the franchisor's marginal profit into account. One result is that the franchisor's profit shrinks. Another result is that a socially suboptimal input combination is realised at the retailer level (see Tirole, 1995: 179ff., and Blair and Kaserman, 1978, for formal treatments).

Another justification for certain franchise restrictions is that they allow an incentive-compatible *distribution of quasi-rents* (see OFT, 1997; Klein and Murphy, 1988). "Vertical restraints, by shifting some rents from manufacturers to the dealers, have this effect [of an optimal distribution of quasi-rents] and thereby help to assure dealer performance of unspecified but essential elements of the contractual understanding." In other words, the manufacturer uses vertical restraints to decrease the short-run gain to non-performing dealers (by limiting their ability to expand output) and to increase the long-run gain to performing dealers (by creating a quasi-rent stream).

In the retailer-retailer relationship, *free-riding incentives* are a major problem. Klein (1995: 12ff.) discusses how this problem affects product quality. The free-rider problem is created when a franchisees tries to save costs by buying cheaper,

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intellectual property rights. Consequently, the franchisee should be prohibited from selling competing goods or services, "if the obligation is necessary to maintain the common identity and reputation of the franchised network" (European Commission, 2002: 23).

lower-quality inputs for producing a common brand name product. The quality of the product is thereby reduced, however, the consequential reduction of the perceived quality is borne by all franchisees using the brand through a reduction in future demand. In other words, a single firm does not bear the full negative consequences of its behaviour.

A closely related conflict could occur in businesses where some form of pre-sales services is provided. Free-riding franchisees might be able to cancel such services by relying on other firms to offer such initial services. This would reduce costs for the free-riding franchisee and would allow him to lower his retail price. The consumers take this into account and might get the pre-sales services for free from the rival and will buy the product afterwards from the free-riding franchisee. Eventually, the franchisees with pre-sale service have to leave the market; with the result that no pre-sales services are provided any longer. This reduces total sales, joint profits and welfare.

In the manufacturer-manufacturer relationship, *inter-brand competition*, which underlies many of the vertical issues explained above, is defined. For example, given various brands of a product, advertising any particular brand has positive spillover effects on other brands, which creates free-riding incentives between manufacturers. It leads to too little advertising in equilibrium, which regularly damages franchisors, franchisees and the consumers (see OFT, 1997: Paragraph 7.1.1.2).

6.3.2.2 Instruments to Stabilise Franchise Agreements

In economic terms, the connection between a franchisor and a franchisee is a principal-agent relationship. Accordingly, the principal (the franchisor) hires an agent (the franchisee) to perform an action (distributing products at the lowest possible cost) in a manner that the principal cannot fully control. The franchisor cannot perfectly observe the sales effort of the franchisee, who can use that fact to his advantage.

Stabilizing the franchise agreement is in the interest of both transactors: the franchisor and the franchisee. However, due to the presence of individual incentives to deviate from such a 'pure' franchise agreement (because of higher short-run profits for the deviating firm), the question of ways to stabilise franchise agreements immediately occurs. Lipczynski and Wilson (2001: 291) as well as the OECD (1993: 10) identify three basic forms of vertical control which have the potential to mitigate these problems. First, certain problems can be reduced (or even resolved) by giving the franchisor *direct control* over the franchisee's critical decisions (such as price-setting, quality and marketing effort). An obvious precondition for such solutions is that the franchisor is able to monitor these decisions. Second, a *restructuring of incentives* can be determined to ensure that the objectives of both parties coincide. Thus the contract could specify a franchise fee plus buying the inputs at marginal costs so that the franchisee is committed to the maximisation of aggregated profits (see the simple model above). Third, *contracts* may be used to reduce potential externalities. To reduce competition among franchisees (intra-brand competition), a franchisor may wish to offer exclusive territo-

rial contracts or fix a minimum retail price ('vertical restraints'). Actual franchise agreements might contain aspects of all three forms of vertical control.

It is important to note that several *empirical findings* corroborate this healing influence of certain vertical restrictions on several franchising problems explained above. For example, Brickley (1999), using a US dataset, identifies a positive correlation between the level of externalities present in the market and the level of restrictions included in the franchise agreement. In addition, Chaudey and Fadairo (2002), using a French dataset, report that the choice of the degree of coercion in vertical contracts is positively correlated with the level of horizontal externalities.[370]

In short, it has been shown that unrestricted franchising contracts contain several externalities and incentive problems which endanger the benefits (and therefore the stability) of franchise agreements. To make franchise agreements workable, several contractual restrictions on the franchisee are necessary. Which restraints the contractors choose critically depends on the information situation, certain product characteristics, the market environment and possible conflicts with antitrust rules.

6.3.3 Franchise Agreements and Potential Antitrust Conflicts

Despite the historical fact that antitrust laws have been motivated and legitimated by various arguments (brought forward by various communities), the economic profession nowadays sees the central aim of antitrust laws as maintaining and improving economic efficiency. Given this primary objective, antitrust is mainly interested in two types of offences that potentially harm competition: exploitative behaviour and exclusionary behaviour (see Fox, 2002, for an overview). *Exploitative behaviour* means that firms, for whatever purpose, are doing some form of business together (e.g., forming a cartel or a strategic alliance), while *exclusionary behaviour* comprises attempts by (usually) one firm to harm rivals while attempting to achieve a higher degree of market power.

For both types of behaviour, theoretical and empirical research has shown that they could have both efficiency-enhancing and anticompetitive motives and effects. While several types of conduct, such as horizontal cartels or certain refusals to deal, are generally presumed to be detrimental to efficiency, others, such as strategic alliances or certain tying agreements, could be either supportive or detrimental to competition and efficiency.

This trade-off led to the development of two types of control strategies: per se rules and the rule of reason. The *per se rule* prohibits certain behaviour generally, because the detrimental effects are assumed to be dominant, almost certain and

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370 Another form of empirical evidence is delivered by Salop (1993), who looked at the occurrence of free-rider justifications in court decisions in the United States between 1977 and 1992. He found that the courts mentioned free-riding justifications in 97 antitrust cases, and the courts accepted this justification for vertical restraints in 49 cases.

easily identifiable by the firms (see Carlton et al., 1997: 427). The *rule of reason* accommodates the more frequent case that the efficiency-enhancing effects of certain behaviours must be compared with the anticompetitive effects.

Because rule-of-reason assessments are relatively expensive to conduct, antitrust laws try to limit investigations of cases for which the probability of anticompetitive behaviour is high and the potential harm to competition is presumed to be substantial. Antitrust laws and authorities use a central initial indicator to differentiate between these and other cases: the *level of market power*. If the firm in question has a certain degree of market power (in the market identified as 'relevant') and if the usage of an anticompetitive strategy is likely, then the antitrust authority will investigate further.

6.3.3.1 General Relevance of Antitrust Law for Franchise Agreements

If antitrust is mainly interested in maintaining and enhancing economic efficiency, it seems questionable at first glance why efficiency-enhancing vertical restraints should be affected by antitrust regulations. The central justification for such a potential is the well-proved theoretical and empirical observation that vertical restraints are hybrids: They might have mainly procompetitive effects, but it might also be the case that they are mainly used for anticompetitive purposes. As the net welfare effects are unknown, antitrust analysis comes into play.

What do these potentially anticompetitive aspects look like? Generally speaking, franchise agreements contain the potential to harm competition by extending market power on the vertical (intra-brand) level as well as on the horizontal (inter-brand) level. Furthermore, as Kay (1990: 555ff.) shows, vertical restraints may be used to extend monopoly power into a previously competitive ('adjacent') industry, such as by distorting the transfer price between monopoly and competitive industries.

There are numerous other ways in which vertical restraints can cause anticompetitive effects. For example, vertical restraints might raise switching or search costs as well as sunk costs. Both factors might discourage entry and maintain or even increase market power. If entry occurs anyhow, vertical restraints can be used to impede competitors, for instance, by acts of preventing a firm from acquiring an essential input ('foreclosure'). Furthermore, as theoretical research has shown, several vertical restraints might have the potential to ease horizontal cartelisation in the product market. This small choice of aspects raises the conjecture that vertical restraints allow broad access to the so-called toolbox of strategic behaviour for dominant firms in oligopolistic markets (see examples later in this section). In other words – and recapitulating – a franchisor could use vertical restraints (under the guise of a franchise agreement) to enhance market power incurious of the regularly detrimental effects on competition and efficiency. This anticompetitive potential provides an economically sound foundation for the application of antitrust rules.

Unsurprisingly, several critics challenge this reasoning (or at least the deduced conclusion). One older strand of arguments says that antitrust laws and intervention harms the development of efficient distribution structures. For example,

Thompson (1969: 42ff.) identifies a 'franchisor's paradox' based on the idea that an integrated business enterprise is free, for example, to assign territories, select customers or fix prices for the sale of its products. However, a firm with identical business interests which chooses to operate through a franchise structure may find such obligations difficult to implement due to antitrust regulations.

This reasoning immediately raises the question of whether only inter-brand competition is the relevant focus for antitrust policy. Rey and Stiglitz (1995: 431ff.) show that this conclusion might be misleading. At least if (imperfect) competition among producers is taken into account, dominant firms might be able to reduce the effectiveness of inter-brand competition by manipulating intra-brand competition.

A related discussion surrounds the question whether franchise agreements are subject to antitrust law at all. The basic argumentation by Klein (1999) says that because a franchisor has no market power over the franchisee before the franchise contract is signed, post-contractual competitive abuses are not of interest for antitrust law but for contract law. Several scholars and judges disagree with this view by articulating their concern that the limitation on such pre-contract analysis of franchisor market power would eliminate antitrust protection (see Grimes, 1999) and would lead to abuses of market power. Grimes argues that franchisors often have ex post market power in dealing with franchisees because of the franchisee's sunk investments and the franchisor's power to confer benefits and impose costs on franchisees (see Grimes, 1996: 155).

A third point brought forward against antitrust interventions stems from the discussion on whether and how anticompetitive the contractual restrictions in question (the vertical restraints) really are. For example, the Chicago school contradicts the opinion that many vertical restraints are anticompetitive. Furthermore, even if such obligations have an anticompetitive impact, antitrust intervention would not be necessary "[b]ecause the market possesses remarkable self-correcting capacities" (Cann, 1986: 487f.). Consequently, it was proposed that purely vertical restrictions (involving no dealer collusion) should be declared legal per se (see Posner, 1981).

Especially recent research in game theory (see Tan, 2001) and its application has been successful in showing that "[t]he Chicago approach correctly recognises that vertical restraints may often serve wholly legitimate commercial purposes: but it underestimates the extent to which vertical restraints may be motivated by strategic objectives designed to change the structure of the industry, or to resist changes in the structure of the industry" (Kay, 1990: 560). More precisely, the idea of per se legality is flawed by various models of strategic competition which show that vertical restrictions can be introduced only for strategic purposes with the aim of disadvantaging rivals (see Williamson, 1979, for a transaction cost approach).

In a nutshell, theoretical and empirical observations infer the general statement that franchise agreements should be subject to antitrust rules because they could have either efficiency-enhancing effects or/and anticompetitive effects. Assuming a considerable harm of the potential anticompetitive effects and non-prohibitive

enforcement cost, the rule-of-reason approach seems to be the suitable antitrust reaction in such an environment.

6.3.3.2 Identifying Potential Antitrust Problems of Franchise Agreements

In a study by Patrick Rey and Steven Brenner on behalf of the OECD (1993: 95ff.), the authors found that the following vertical restraints might be at odds with antitrust laws: resale price maintenance (or vertical price restrictions), territorial or customer restrictions (or territorial exclusivity), tie-ins, exclusive dealing obligations, refusals to deal, obligations not to compete, minimum requirements and advertising restrictions.

It is far beyond the scope of this section to give an overview of all these vertical restraints (see, e.g., Chaudey and Fadairo, 2002). However, it is indispensable for further reasoning to give a broad idea of how these restraints can resolve certain franchising problems identified above. For example, the double marginalisation problem can be solved by imposing resale price maintenance. If the price is fixed by the franchisor (and if he can monitor retail prices), the franchisee will not have the possibility to impose the inefficient 'second marginalisation'.[371] Another example could be the problem of free-riding on pre-sales services. This externality can be internalised, for example, by introducing closed territories (see OECD, 1993, for a complete overview).[372] A third example – the so-called tie-ins – will be analysed more exactly in the following paragraphs by giving a broad overview of definitions, likely pro- and anticompetitive effects and antitrust policy and case examples.

Generally, a *tie-in* results when a franchisor sells a good or a service to a franchisee under the condition that the franchisee purchases a second good from the franchisor, which he does not want, or which he would prefer to purchase from another seller.

An example of a tie-in (Figure 72) could be the requirement of a fast food restaurant franchisor to buy not only the menu items (the tying good) but also to purchase the ingredients (the tied goods) from the franchisor. From the viewpoint of the franchisee, a tie-in no longer allows him to substitute a relatively high-priced, high-quality input good (i.e., P=X and Q=Y in Figure 72) with a low-priced, low-quality input good (i.e., P=X-1 and Q=Y-1 with X, Y>1 in Figure 72). From the viewpoint of the franchisor, the tie-in ensures that the franchisee uses the high-priced, high-quality inputs and therefore prevents damaging the brand by using a low-quality input good.

The efficiency-enhancing potential of tying is analysed by Ahlborn et al. (2003: 43ff.), among others. In particular, the authors show that tying can reduce produc-

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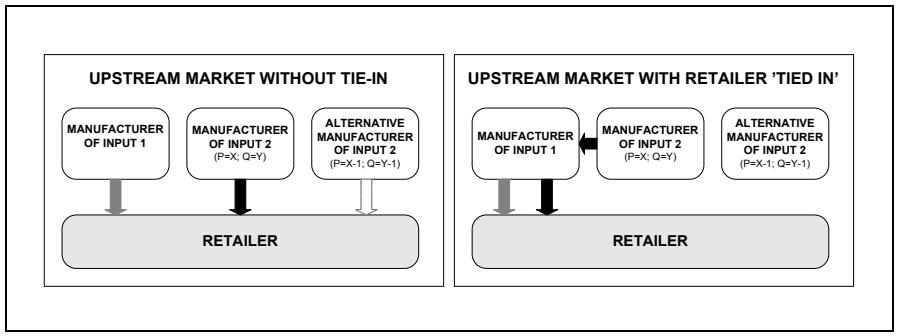
371 In fact, as shown above, the setting of a fixed franchise fee can lead to the same market results as a vertical merger between franchisor and franchisee.

372 It is obvious that most externality problems could be resolved by vertical integration. However, as shown above, franchise agreements were chosen because the disadvantages of vertical integration are dominant. In other words, the externalities have to be severe to outweigh the gains from vertical disintegration.

tion and distribution costs by realising economies of scale and scope, can reduce transaction costs by minimising search costs and can lead to product improvements by trying value-enhancing combinations of certain inputs. Additionally, as depicted in Figure 72, tying helps ensure a certain uniformity of quality.

Fig. 72. Example of a tie-in



Source: Inspired by a comparable graph in Tirole (1995: 173).

Besides this general efficiency-enhancing potential, tying is a vertical restraint which alleviates several of the incentive problems that every franchise agreement is confronted with. For example, tying has the potential to reduce or even eliminate free-riding on quality by franchisees, because the franchisor delivers all inputs (with the optimal quality level) to the dealers (see Klein and Saft, 1985). Furthermore, as Tirole (1995: 179ff.) shows, tie-ins combined with some form of resale price maintenance can alleviate the problem of input substitution.

As for the potential harm of tie-ins, theoretical research investigates three main areas of interest. One focus is tying's relationship to price discrimination (which could also be welfare-enhancing). Another focus is its ability to foreclose competition in the tied market (see Whinston, 1990). Recently, for example, Carlton and Waldman (2002) show that tying can also be used to preserve and extend a monopoly position in the tying market by deterring entry of efficient producers. The fundamental implication of all these models is that the occurrence and intensity of these anticompetitive effects depends on certain market characteristics, such as the level of market power in intra- and inter-brand competition. Such results of game-theoretic models are important when designing a rule-of-reason approach.[373]

[373] One example is provided by the European Commission (1995: 3), who states that "[t]he fiercer is interbrand competition, the more likely are the procompetitive and efficiency effects to outweigh any anticompetitive effects of vertical restraints. Anticompetitive effects are only likely where interbrand competition is weak and there are barriers to entry at either producer or distributor level".

As for antitrust policy and antitrust cases[374], the subtitle of the survey by Ahlborn et al. (2003), 'A farewell to per-se illegality', gives more than a hint about the past and actual judgment of tie-ins. After decades of a mainly sceptical view on tie-ins, the mainstream opinion in antitrust law and economics nowadays acknowledges their positive aspects and recommends applying a rule-of-reason approach. Ahlborn et al.'s study (p. 56ff.) proposes a framework for tie-in cases, preferring the following three screens of analysis: 1) Is an anticompetitive effect possible? 2) Is an anticompetitive effect likely? 3) Are there offsetting efficiency benefits (See Hylton and Salinger, 2001, and McDavid and Steuer, 1999, for alternative approaches)? This framework will be applied to franchise agreements in the following section.

6.3.3.3 Towards a Framework to Assess the Antitrust Effects of Franchise Agreements

As explained above, business behaviour with presumably pro- *and* anticompetitive effects is best dealt with by the rule-of-reason antitrust approach, at least as long as a general and considerable harm of potential anticompetitive effects as well as non-prohibitive enforcement costs are assumed.

Despite this clear assertion, design and implementation factors are complicated by at least two important characteristics: First, it may be the case that the same vertical restraint has a procompetitive effect in one environment and an anticompetitive effect in another environment. This complicates antitrust analysis, as the case analysis and the ensuing results critically depend on the correct assessment of the existing market environment (e.g., delineation of the relevant market, relevance of intra- and inter-brand competition, possibility to create impediments to entry, potential for strategic behaviour, etc.) and the role of a certain vertical restraint in the franchise agreement. A direct consequence of this characteristic is that the per se illegality of certain vertical restraints – as currently practiced in the European Union – is flawed. Such a policy faces an inconsistency problem, which stems from the fact that different vertical restraints might have the same (positive and/or negative) effects on competition, but are assessed differently by competition policy. Such a policy will provoke the inefficient substitution of one vertical restraint that is prohibited by another one that is permitted.

Second, different vertical restraints together might be necessary to resolve all franchise incentive problems. In other words, vertical restraints often interact in a complex way within one franchise agreement. Hence, the common isolation and analysis of one fragment of a franchise contract (e.g., tie-ins) might be misleading when examining its overall competitive impact. This leads to the conclusion that the popular way of analysing franchise agreements by a 'disaggregate view' might

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374 The most influential case (on tying and related vertical restraints) in the United States is *Kodak* (1992). Pivotal pre-*Kodak* tying cases are *Times-Picayune* (1953), *Northern Pacific* (1958), *Fortner* (1969/1977), and *Jefferson Parish* (1984). Influential post-*Kodak* cases are *Queen City Pizza* (1996), *Wilson* (1996/1997) and *Collins* (1996). Further information on the cases is provided by Joseph (2001) and Thier (1998).

be misleading, as the *mutual interdependences* remain undiscovered. An empirical study by Slade (1998) exemplifies how antitrust intervention might have led to welfare reductions in a franchise tying case in the UK brewery industry. The study investigates the increase of retail beer prices after brewer-owned public houses in the UK were divested by a decision of the UK Monopolies and Mergers Commission (renamed to Competition Commission in 1999). Slade concludes that "[s]ince these [tying] practices interact with one another in complex ways, the piecemeal policy that was enacted probably made both consumers and brewers worse off ... It is highly likely that these restrictive measures were undertaken with little understanding of the ultimate ramifications for retail prices and industry profits" (p. 600).

Taking these challenges as given, a general policy framework should specify a rule-of reason approach which guides firms and antitrust authorities and rationalises antitrust enforcement. According to Joskow and Klevorick (1979: 218),

> What is needed is an approach that can accommodate important market differences: the characteristics of firms and markets that affect the probabilities of error, the error costs, and the implementation costs of alternative policy approaches.

The first step toward this goal should exclude all franchising cases in which antitrust violations are unlikely. In other words, the first stage has to address the question, Is anticompetitive conduct possible? If the answer is Yes, then the second stage of the framework is activated (see below). If the answer is No, then no further antitrust efforts will be undertaken. The essential problem therefore is to discriminate between these two possibilities. And antitrust economics is based on the belief that the best way to do so is by assessing market power.

Consequently, after the relevant market has been delineated, important market structure criteria have to be assessed, such as the general status of competition, the number of sellers and buyers, the degree of product differentiation, barriers to entry and the role of buyer power. One outcome of this market structure analysis could be that an antitrust intervention is not necessary, because the franchisor underlies vigorous competition from other franchise systems or from other distribution modes. Another reasoning which would lead to the same conclusion could be that anticompetitive effects of vertical restraints are less likely, because the buyers have significant (countervailing) buying power.

If some degree of market power (inter- and/or intra-brand) was identified, the investigation would enter the second stage of the framework. The central question here is, Is anticompetitive conduct plausible? To assess this question, a detailed analysis of market conduct is necessary. With respect to franchising, it seems pivotal to estimate the intensity of the franchise problems (inefficiencies) which could be alleviated by introducing vertical restraints. Here, an investigation into the information environment is essential. What can be observed and enforced by the parties involved? Another important question in the second stage is, What are the likely forms of strategic behaviour? The general antitrust challenge is thus to find logical (theory-based) and likely (case-based) stories and show their basic mechanisms and interrelation.

The third stage of the framework should contain some kind of efficiency defense, because it might be unclear ex ante whether overwhelming procompetitive effects are able to more than outweigh the anticompetitive effects. Whether the observed vertical restraints are essential for the success of the franchise agreement is determined in this stage. It should also be investigated whether less restrictive (but reasonable) alternatives to these restraints exist (see Ferris, 2001, for several proposals) and are viable.

In short, the major challenge for antitrust economics is to provide antitrust authorities with theory-based narratives which expose the fundamental pro- and anticompetitive effects in a certain case. Unfortunately, such narratives are not globally applicable. Especially game-theoretic models deliver insights rather than clear and deterministic answers to antitrust questions. In this respect, Ahlborn et al. (2003: 56ff.) are perfectly right when they state that

> [u]nfortunately, the game-theoretic models … do not provide a universally valid set of conditions that could be used by competition authorities as a safe checklist in their rule of reason analyses. What these models do suggest is a series of screens for determining whether antitrust authorities should investigate.

Fortunately, some important insights of game-theoretic (and other) models – such as the pivotal role of market power for predicting market conduct – are so robust that antitrust authorities can set their mind to rest in this regard.

6.3.4 Summary and Conclusion

As stated by Rubin (1978: 223);

> there are many types of transactions which profit-seeking individuals might find worthwhile in the marketplace; products and markets have sufficiently diverse characteristics so that a large number of arrangements might be profit maximising. Thus, it would be surprising if there were in fact sharp distinctions between interfirm and intrafirm transactions; rather we would expect hybrid cases where markets allow various types of optimal blends. In fact, we do observe such mixed cases.

Franchise agreements can be interpreted as one such ‘mixed case’ on the continuum between ‘markets’ and ‘hierarchies’.

The aim of this section was to give an overview of the interrelationship between antitrust and franchise agreements. After discussing some essential reasons why firms engage in franchise agreements, it was emphasised that a prisoner’s dilemma can create economic instability: A single franchisee is tempted to raise its own short-run profit by deviating from the joint profit maximisation solution due to spill-overs, free-riding incentives and related inefficiencies. Such behaviour, however, normally harms the other transactors, jeopardises the success of the franchise agreement and has at least the potential to harm social welfare. As a consequence, contractual restrictions, the so-called vertical restraints, can have the potential to mitigate or even eliminate such inefficiencies.

Notwithstanding these efficiency-enhancing effects of vertical restraints (as part of a complex franchise contract), it was found that they can also work against

competition by reducing or eliminating competition on the manufacturer level and/or the retailer level. Which of these effects dominate and which restraint(s) should be chosen was found to be dependent on the vertical and horizontal market structures as well as on the information environment (e.g., what can be observed and enforced by the manufacturers; the relevance and scope of externalities in the relevant market).

Given these hybrid effects of vertical restraints on competition and efficiency, it was deduced that antitrust rules matter for franchising agreements. The use of a rule-of-reason approach was identified as the appropriate antitrust reaction for assessing the significance of pro- and anticompetitive effects of each case. Designing a corresponding policy framework was determined to be quite challenging for at least two reasons: First, a certain vertical restraint is only one part of a complex franchise contract with a multitude of mutual interdependences. As a consequence, it might be misleading to extract and evaluate one certain vertical restraint for its competitive effects, taking all other contract parts as given. Second, especially game-theoretic research delivers insights rather than clear and sufficiently robust antitrust recommendations.

Facing these challenges, the major objective for antitrust economics in the future lies in the further development of investigation tools. The sound design and implementation of the resulting frameworks – not only with respect to franchising strategies – would enhance the general calculability of antitrust decisions for firms, would reduce erroneous antitrust decisions which harm social welfare and would therefore promote the central aim of antitrust law and antitrust intervention; namely, to protect and improve economic efficiency.

6.4 Critical Loss Analysis in Market Definition and Merger Control

The past few years have seen an increasing use of critical loss analysis by courts, lawyers and economists – first and foremost in the United States. This development has been accompanied by an economic discussion about the underlying economics of critical loss analysis and its meaningful use in antitrust analysis.[375]

The *critical sales loss* is defined as the decrease in sales resulting from a particular price increase that is just large enough so that a hypothetical monopolist would not impose a price increase of at least that amount. If the actual loss is less than the critical loss, the price increase would pay; otherwise it would not. The most common uses of such critical loss analyses are for delineating relevant markets and assessing unilateral effects in merger control. With respect to market delineation, the critical loss analysis helps to answer the question of the SSNIP test.

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375 See, for example, the exchange between Katz and Shapiro (2003, 2004), Scheffman and Simons (2004) and O'Brien and Wickelgren (2003) in several issues of *Antitrust*, *Antitrust Source* and *Antitrust Law Journal*.

With respect to merger control, the concept assists in answering the question whether the merged entity can use its increased market power to increase prices.

It is therefore the aim of this section to explain the general method of critical loss analysis (section 6.4.1), to assess important properties of the concept (section 6.4.2), to show how critical loss analyses distinguish between market delineation exercises and evaluating competitive effects of mergers (section 6.4.3) and, finally, to come to some general conclusions for its meaningful application in antitrust analysis (section 6.4.4).

6.4.1 Definition and Economic Foundations

The question of which factors constrain a firm from raising its price is at the heart of antitrust policy. In almost every market definition exercise or proposed merger investigation, this question has to be answered in order to formulate meaningful economics-based conclusions on the competitive effects of a certain action.

In general, there are two constraints which might hinder firms to raise their price: supply side substitution and demand side substitution. On the supply side, competitor firms which offer (or could offer) products which are (or would be) considered as substitutes constrain the behaviour of a firm. On the demand side, reactions by customers to price increases limit the market power of a firm, as consumers might reduce their demand (lost sales per customer) or even decide not to consume the product at all (lost customers) in response to a price increase. In this context, critical loss analysis asks how large the loss in sales has to be in order to make a certain price increase unprofitable. The mechanics of this analysis are explained in the following sections.

6.4.1.1 First Step – Calculation of the Critical Loss

In the first step of a critical loss analysis, the critical loss must be calculated. Again, *critical loss* is defined as the (percentage) decrease in sales resulting from a particular price increase that is just large enough so that a hypothetical monopolist would not impose a (percentage) price increase of at least that amount. Formally, the critical loss can be derived as follows.[376]

Before the price increase the profits are given by

$$\pi_0 = (P_0 - c)Q_0 . \tag{136}$$

After the price increase the profits are given by

$$\pi_1 = (P_1 - c)Q_1 . \tag{137}$$

If $\Delta P = P_1 - P_0$ and $\Delta Q = Q_1 - Q_0$ is assumed, the profits after the price increase can be expressed as follows

[376] A similar derivation of the basic critical loss formula can be found in O'Brien and Wickelgren (2003: 166ff.)

$$\pi_1 = (\Delta P + P_0 - c)(\Delta Q + Q_0). \tag{138}$$

To calculate the critical loss, the amount the price can rise without realising a lower profit level has to be calculated.

$$\Delta\pi = \pi_1 - \pi_0 = 0 \Rightarrow \pi_1 = \pi_0. \tag{139}$$

Inserting (136) and (138) into (139) leads to

$$(P_0 - c)Q_0 = (\Delta P + P_0 - c)(\Delta Q + Q_0). \tag{140}$$

Rearranging (140) leads to

$$\frac{\Delta Q}{Q_0} = \frac{-\Delta P}{\Delta P + P_0 - c}. \tag{141}$$

Adding $((1/P_0)/(1/P_0))$ on the left side of (141) leads to the following expression

$$\frac{\Delta Q}{Q_0} = \frac{-\Delta P/P_0}{\Delta P/P_0 + ((P_0 - c)/P_0)}. \tag{142}$$

If $\Delta P/P_0 = X$ and $((P_0 - c)/P_0) = M$ is assumed, the critical loss formula is given by

$$-\frac{\Delta Q}{Q_0} = \text{critical loss} = \frac{X}{X + M}. \tag{143}$$

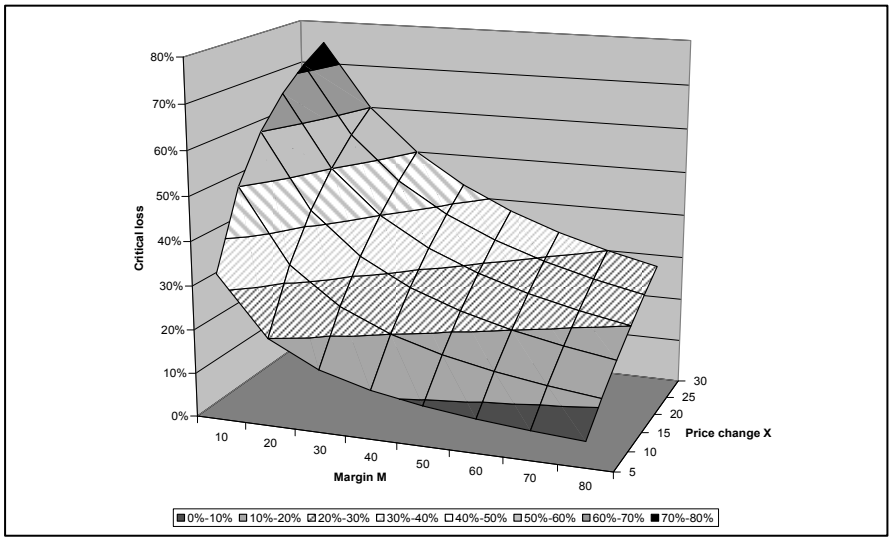
Equation (143) indicates that the critical percentage loss of units sold is determined by the percentage change in price divided by the sum of the percentage change in price and the (gross) margin. For given values of *X* and *M* the critical loss is easily calculated. If the margin is, for example, given by M = 10% and the percentage change in price is assumed to be X = 5%, the critical loss is 0,33 or 33%:

$$CL = \frac{X}{X + M} = \frac{0{,}05}{0{,}05 + 0{,}10} = 0{,}3\overline{3}.. \tag{144}$$

This calculation can be replicated for variable values of *M* and *X*. Figure 73 plots the critical losses for price changes of 5% to 30% against margins of 10% to 80% (see Table 69 in Annex 6.7 for the underlying data matrix).

Figure 73 shows that the critical loss increases with the price change *X* and decreases with the margin *M*. For example, while a margin of 80% at a price change of 5% would lead to a critical loss of 5,88%, a margin of only 40% would increase the critical loss to 11,11%. Furthermore, while a price change of 5% at a margin of 40% would result in a critical loss of 11,11%, a price change of 10% at a margin of 40% would lead to a critical loss of 20,00%.

Fig. 73. Critical losses plotted against different margins and different price changes



6.4.1.2 Second Step – Identification of the Real Loss

The derivation of a critical loss as such tells us how much substitution must occur as a consequence of a price rise in order to make that price rise unprofitable. In a second step, information must be collected to estimate whether such a substitution would actually take place in the case at hand. There are several ways to get an estimate of the size of the real loss. Harkrider (2004: 3ff.) for example differentiates between

1. Customer reaction to historical price changes;
2. Econometric evidence;
3. Customer interviews and affidavits;
4. Surveys.

All instruments might help to answer the question of how many customers would switch in response to a hypothetical price increase. In practice, the use of accounting and marketing data for antitrust economics purposes can be quite challenging and error-prone. This problem has to be dealt with in every application of quantitative techniques, however; it is not a special problem of critical loss analysis.

6.4.1.3 Third Step – Comparison of Critical Loss with Real Loss

After calculating the critical sales loss and estimating the real sales loss, both have to be compared in a third step. If the real loss in the market is smaller than the critical loss, then the increase in price would be profitable; otherwise it would not

be. The implications of these comparisons for competition analysis are investigated in more detail in section 6.4.3.

6.4.2 Important Properties of Critical Loss Analysis

Although the basic concept of critical loss analysis is straightforward, some caution is required in its application in antitrust cases. As shown below, the critical loss for a certain margin or price change combination can be sensitive to changes in the calculation method as well as in the underlying demand function.

6.4.2.1 Calculation Method

As seen in section 6.4.1.1, the critical loss was derived by answering the question whether a hypothetical monopolist *could* raise its price a certain percentage above the initial price P_0 without realising a lower profit level than in the initial situation. Consequently, such an approach does not ask whether the new price P_1 is the profit-maximising price for the monopolist. It was shown that in such a *'could' approach*, the critical loss is given by CL=(X/(X+M)).

An alternative way to calculate a critical loss is the so-called '*would' approach*. In such an approach, the question is asked whether a hypothetical monopolist *would* raise its price a certain percentage above the initial price (because it is the profit-maximising price). As shown by Baumann and Godek (1995: 894ff.), such an approach requires, first, the calculation of the profit-maximising price and, second, a comparison of that price to the initial price. If a linear demand function is assumed, it can be shown that the critical loss under a would-approach is given by CL=(X/(2X+M)).[377] Figure 74 plots the critical losses (would-approach) for price changes of 5% to 30% against margins of 10% to 80% (see Table 70 in Annex 6.7 for the underlying data matrix).

Comparing Figures 73 (could-approach) and 74 (would-approach) show that, although the shapes of the planes are similar, the plane levels differ considerably. The could-approach systematically leads to higher critical loss values than the would-approach. The implications of this finding are further clarified by Figure 75, which plots the differences in percentage points between the could-approach and the would-approach[378] for variable margins and the three most commonly used price increases: 5%, 10% and 15%.

As Figure 75 shows, the difference between the could and would-approaches is largest for small margins and is reduced with growing margins. It can also be seen that the difference between these approaches increases with growing percentage changes in price.

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377 See Werden (1998a: 410ff.) for the proof.

378 The basic idea of plotting the difference between could- and would-approach is taken from Baumann and Godek (1995: 891). However, Baumann and Godek make use of critical elasticities instead of critical losses in their paper.

Fig. 74. Critical losses (would-approach) for a linear demand function against different margins and price changes

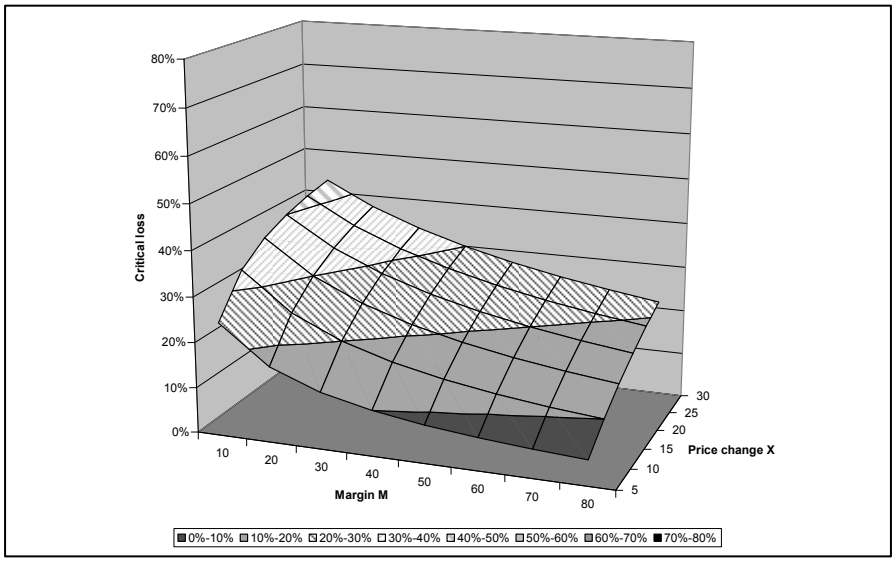
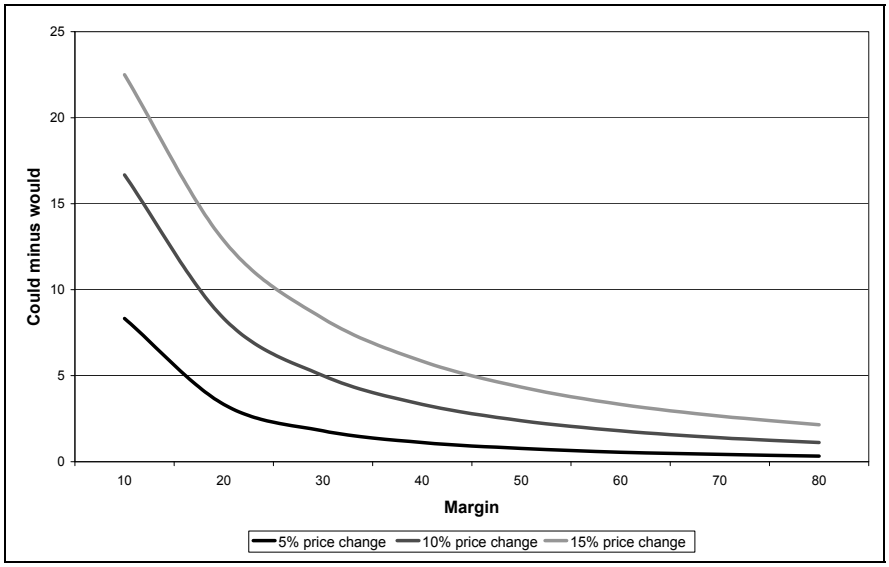


Fig. 75. Critical loss difference between could-approach and would-approach with linear demand function



6.4.2.2 Underlying Demand Function

A further attribute of the critical loss is that it can react sensitively to changes in the underlying demand function. In section 6.4.1.1, it was shown that for a linear demand function, the critical loss is given by CL=(X/(X+M)). The preceding section showed that this is in fact only true if a break-even method is used to calculate the critical loss. The profit-maximisation approach would instead lead to a smaller critical loss given by CL=(X/(2X+M)).

Besides linear demand functions, several other demand functions are frequently used in antitrust economics. For example, the critical losses for iso-elastic demand functions can be substantially different from the critical losses derived for linear demand functions. Table 43 shows the critical loss formulas for linear and iso-elastic demand functions under the two different approaches 'would' and 'could' (see Werden, 1998a: 410ff., for the proofs).

As shown in Table 43, the critical loss formulas derived by applying the could-approach are identical for linear and iso-elastic demand functions. However, the would-approach leads to different critical loss formulas for the two demand functions. In the linear case, it was shown above that the critical loss is given by CL=(X/(2X+M)). For the iso-elastic demand function, it can be shown that the critical loss is given by $1-(1+X)^{\frac{-1-X}{M+X}}$. Figure 76 plots the critical losses (would-approach) for an iso-elastic demand function and price changes of 5% to 30% against margins of 10% to 80% (see Table 71 in Annex 6.7 for the underlying data matrix).

Comparing Figures 74 and 76 (would-approach) shows that the shapes of the planes are still similar but that the plane levels again differ considerably. The would-approach with an iso-elastic demand function systematically leads to higher critical loss values than the would-approach with a linear demand function. Figure 77 shows the differences in percentage points between the could- and would-approaches with an iso-elastic demand function for variable margins and the three most commonly used price increases: 5%, 10% and 15%.

Table 43. Sensitivity of the critical loss with respect to chosen approach and demand function

Demand function	Profit-maximisation (would-approach)	Break-even (could-approach)
Linear	$\frac{X}{2X+M}$	$\frac{X}{X+M}$
Iso-elastic	$1-(1+X)^{\frac{-1-X}{M+X}}$	$\frac{X}{X+M}$

Fig. 76. Critical losses (would-approach) for an iso-elastic demand function against different margins and price changes

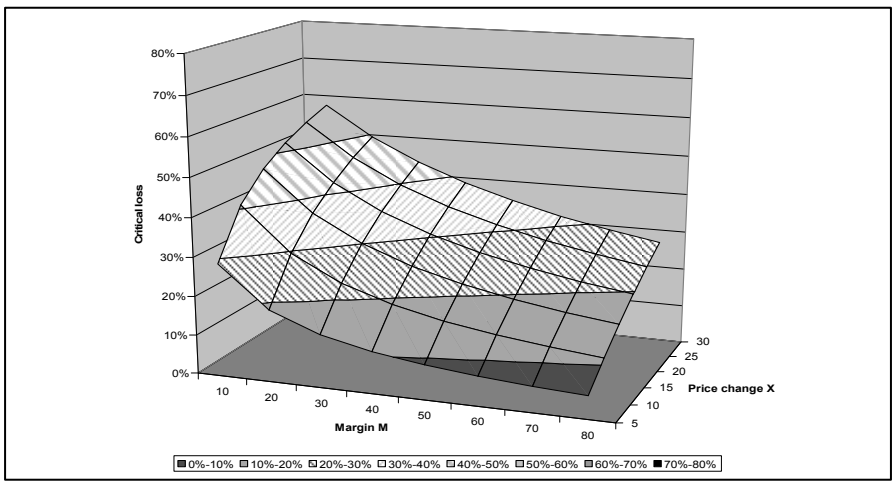
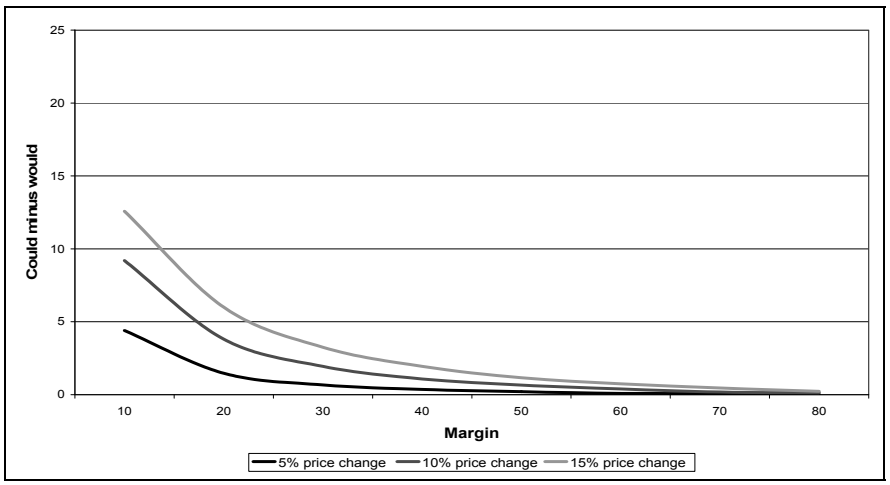


Figure 77 shows that the sensitivity of the critical loss between the could- and would-approaches is considerably smaller for iso-elastic demand curves than for linear demand curves (see Figure 75). However, following Katz and Shapiro (2003: 50), the observed gross margins are often in the 50% range, or even larger, in industries with large fixed costs and/or highly differentiated products. In these ranges of high margins, the differences in the approach are almost negligible.

Fig. 77. Critical loss difference between could- and would-approaches with iso-elastic demand function



A further interesting comparison is the difference between the critical loss (would-approach) with an iso-elastic demand function and a linear demand function. This is plotted in Figure 78.

Fig. 78. Critical loss difference between would-approach with iso-elastic and linear demand function

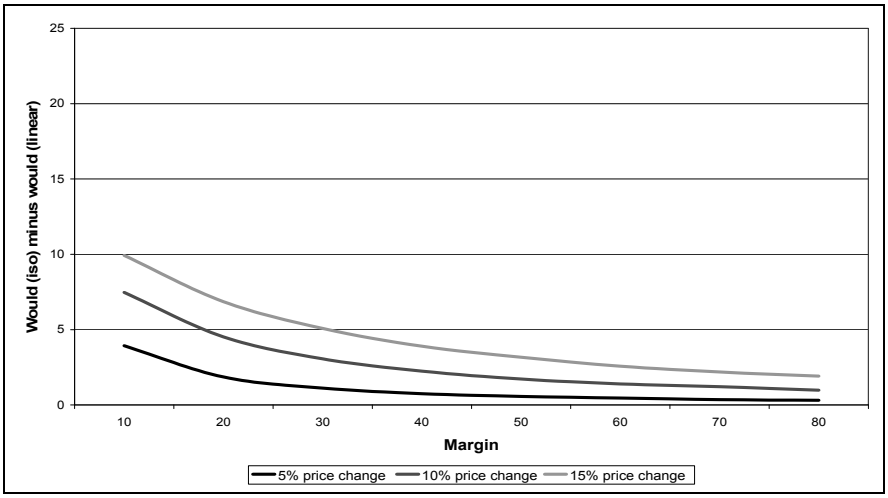


Fig. 79. Discontinuous demand function and price changes

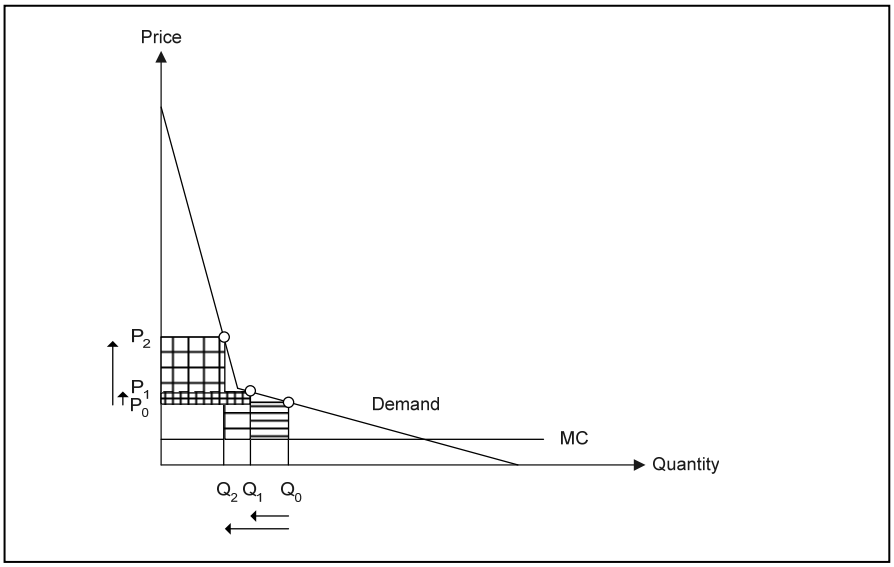


Figure 78 shows that the demand function especially matters if the margins are small. Again applying a gross margin of 50% shows that the difference between the critical losses – applying the different demand functions – is relatively small and therefore should not affect the result of a critical loss analysis in this area fundamentally.

In addition to the choice between linear and iso-elastic demand functions, critical loss analyses might be challenged by discontinuous demand functions. An example of such a demand function is plotted in Figure 79.

As shown here, discontinuous demand curves can have the unpleasant characteristic that small price increases are not profitable (such as from P_0 to P_1) but larger price increases would be profitable (such as from P_0 to P_2). This insight – together with the findings for other demand functions above – shows how important sensitivity checks of critical loss analyses (with different demand functions and different price increases) are in order to secure meaningful overall results (see Langenfeld and Lee, 2001: 334ff., for the theoretical proof).

6.4.3 Applications of Critical Loss Analyses

Critical loss analyses have two major application areas in antitrust policy: market definition and merger control. Particularities of both areas will be assessed in the following two sections.

6.4.3.1 Market Definition

The purpose of market definition is to identify the competitive constraints a firm faces by assessing whether it enjoys economic power in relation to the goods or services it supplies. In particular, market definition serves as a pre-requisite for identifying "those actual competitors of the undertakings involved that are capable of constraining their behaviour and preventing them from behaving independently of an effective competitive pressure".[379] A firm faces two kinds of competitive constraints: demand side substitution and supply side substitution. Demand side substitution relates to the possibility that an undertaking is competitively constrained by existing customers who can switch to other products (they view as 'comparable') in the event of a price increase. Supply side substitution may create competitive pressure as an undertaking which currently produces a different product (or the same good at a different location) might find it profitable to change its production (or target location) as a reaction to an increase in price.

To identify market boundaries it has become common practice to apply the SSNIP test. This test allows taking into account both demand and supply side substitution and can be seen as a rigorous framework to capture the relevant competitive constraints. In particular, it asks whether a so-called hypothetical monopolist

[379] European Commission Notice on the definition of the relevant market for the purposes of Community competition law. Published in the Official Journal: OJ C 372 (1997).

with control over the market under consideration would be able to impose a small but significant and non-transitory increase in price without reaching a lower profit level than in the initial situation.[380] The price increase used is typically 5%-10% over a period of typically 12 months. The test is applied first to a narrow definition of the market and then, if the test is not met, the product and geographic market definition is broadened with respect to product definition and geographic scope until such a price increase by a hypothetical monopolist appears both feasible and profitable.

Ordinary critical loss analysis (developed above) can directly be used to answer the question of the SSNIP test.[381] However, it is important to have in mind the sensitivity of the critical loss values to parameter changes as well as the sketched challenges of using accounting and marketing data to estimate the size of the actual sales loss. Therefore, a critical loss analysis should be viewed more as one piece of evidence among others (see section 2.4.1 for an overview) in the process of market delineation rather than the 'silver bullet' for identifying the relevant market.

6.4.3.2 Merger Control

The critical loss used in the unilateral effects analysis has to be modified compared to the critical loss in market definition. The intuitive reason for this is that some of the lost sales by firm A are recaptured by firm B and would therefore stay in the merged company A+B. This already indicates that the critical loss in the unilateral effects assessment has to be larger than the critical loss for a market definition assessment. This effect can be shown formally:[382]

Say that firms A and B plan to merge. When considering whether an increase in the price of firm A is profitable, the merged company will compare whether

$$\begin{aligned}\left(P_0^A + \Delta p^A - MC^A\right)\left(Q_0^A - \Delta Q^A\right) + \left(P_0^B - MC^B\right)\left(Q_0^B + \Delta Q^A\, D_{AB}\right) \geq \\ \left(P_0^A - MC^A\right)Q_0^A + \left(P_0^B - MC^B\right)Q_0^B\end{aligned} \tag{145}$$

is true. D_{AB} is defined as the diversion ratio from firm A to firm B.[383] Rearranging the terms of the inequality above and defining

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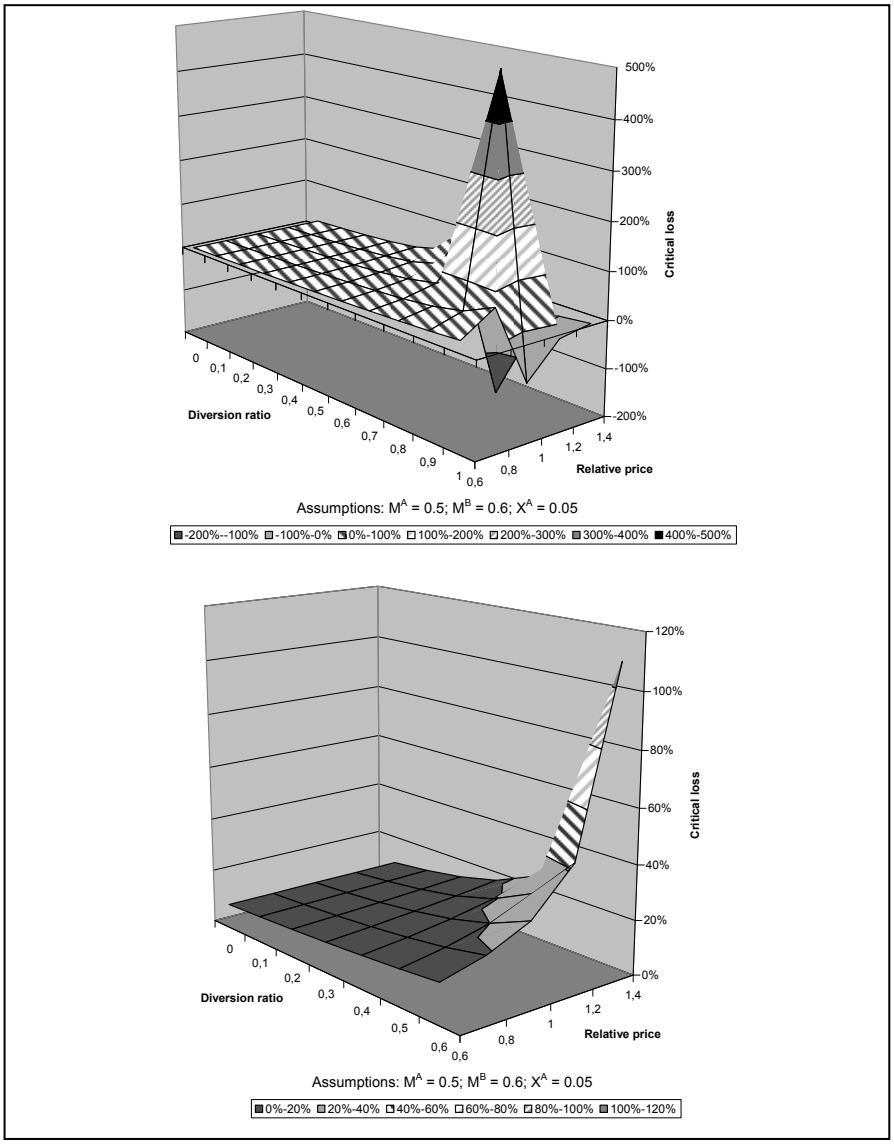
380 The prices of all other goods are assumed to be constant.

381 As explained in the main text, the SSNIP test incorporates the could-approach, although the would-approach would be desirable from a theoretical perspective.

382 The model approach follows Langenfeld and Li (2002: 336f.).

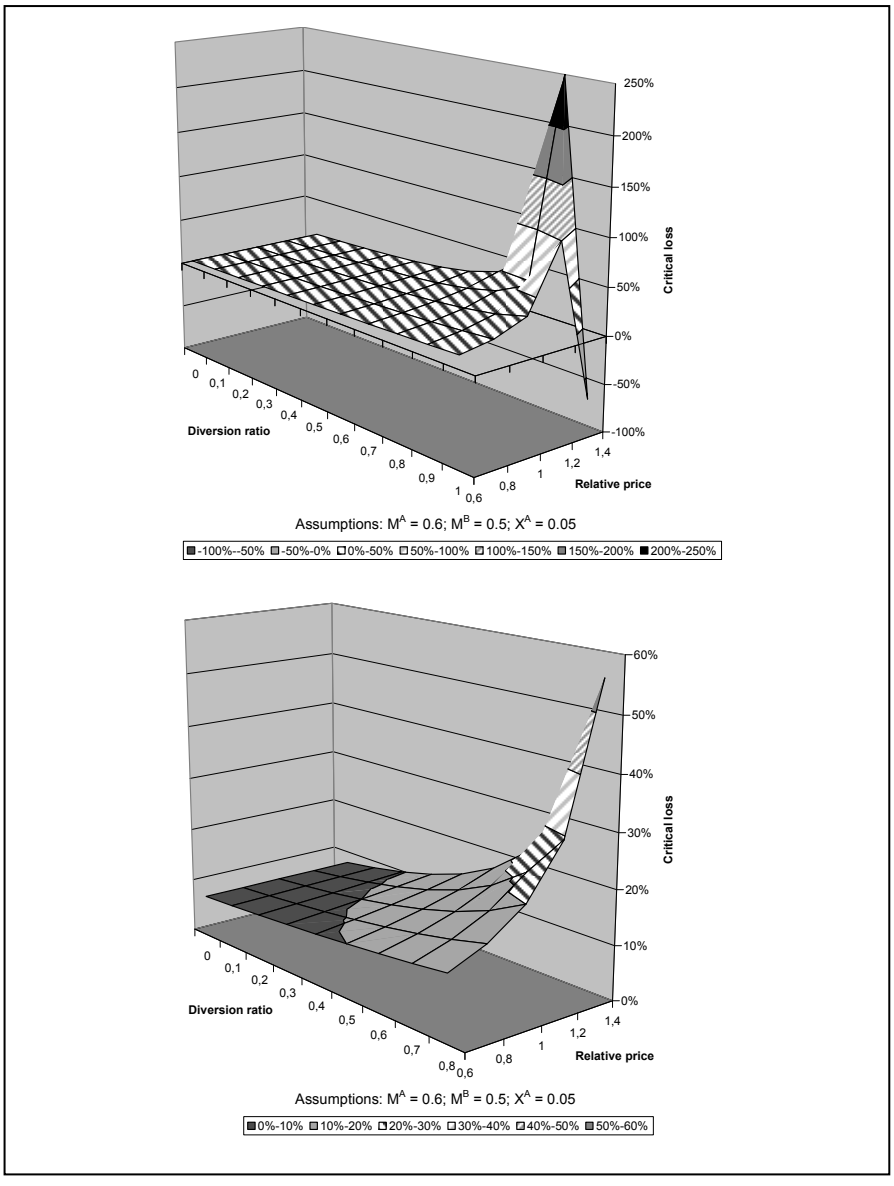
383 The *diversion ratio* was introduced by Shapiro (1995) and is defined as 'the fraction of sales lost by brand A that are captured by brand B' in case the price for product A is increased by x%. Formally, the diversion ratio from A to B is the ratio of the cross-price elasticity of demand for A with respect to the price of B over the own elasticity of demand for A". To give a practical example: If we know that a certain increase in the price of butter leads to a switch of 33% of the demand for margarine, the diversion ratio is 0,33. In other words, the diversion ratio gives an indication of how close

Fig. 80. Critical loss (could-approach) with linear demand function against different relative prices and diversion ratios (ranges 0-1,0 and 0-0,6)



the two products are in the product space. If the diversion ratio is 1, a merger of products A and B would eliminate any kind of competition between the two products. If the diversion ratio is 0, a merger would not lead to a loss of competition. See also section 2.3.3.1 for a characterisation and application of diversion ratios in horizontal merger control.

Fig. 81. Critical loss (could-approach) with linear demand function against different relative prices and diversion ratios (ranges 0-1,0 and 0-0,8)



$$X^A = \frac{\Delta p^A}{P_0^A}, \tag{146}$$

$$M^A = \frac{P_0^A - MC^A}{P_0^A}, \tag{147}$$

$$M^B = \frac{P_0^B - MC^B}{P_0^B} \tag{148}$$

leads to the following inequality

$$\frac{X^A}{M^A + X^A - M^B \frac{P_0^B}{P_0^A} D_{AB}} \geq \frac{\Delta Q_A}{Q_0^A}. \tag{149}$$

The left side of inequality (149) is the critical loss (could-approach) to be used in a unilateral effects analysis with a linear demand function. A comparison with the critical loss for market definition $\frac{X^A}{M^A + X^A}$ (derived above) shows that the denominator of the expression is by $M^B \frac{P_0^B}{P_0^A} D_{AB}$ smaller, which leads to larger ratio as a whole. In other words, the adjusted critical loss is larger than the ordinary critical loss. This means that price increases which were not profitable in the market definition context might be profitable in a unilateral effects context. Expression (149) further shows that the critical loss now depends on the relative price of the merging firms B and A as well as the diversion ratio between A and B. The relationship between both is shown in Figure 80 for fixed $M^A = 0{,}5$, $M^B = 0{,}6$ and $X^A = 0{,}05$. Figure 80 shows that the critical loss increases with the diversion ratio. However, if the assumptions are changed to $M^A = 0{,}6$, $M^B = 0{,}5$ and $X^A = 0{,}05$, Figure 81 shows that the critical loss plane becomes discontinuous with some single critical loss values reaching 500%.[384] As these very large values only appear for relatively large diversion ratios, Figures 80 and 81 offer both graphs with a restricted range for the diversion ratios to exclude the 'outliers' (see Tables 72 and 73 in Annex 6.7 for the underlying data matrices).

6.4.4 Summary and Conclusion

Critical loss analyses have been used increasingly by courts, lawyers and economists – first and foremost in the United States – in recent years. This development has been accompanied by an economic discussion about the underlying economics of critical loss analyses and its profitable use in antitrust analysis. In this context, it was the aim of this section to describe the general method of critical loss analysis, to assess several important challenges in applying the concept and to show

[384] Technically, the large critical losses simply result from the denominator in Equation (149) becoming very small.

how critical loss analyses differ between market delineation exercises and the evaluation of the unilateral effects of mergers.

As a general result it can be said that critical loss analyses have to be applied with care in order to get meaningful results. It was shown that the derivation of the critical loss is sensitive to changes in the method of evaluation and in the underlying demand function. Furthermore, kinks in the demand curve might indicate that small price increases are unprofitable and that large price increases might very well be profitable. It therefore makes sense to concentrate not only on a 5% increase but also to consider the profitability of larger price increases. Additionally, the ordinary critical loss formula used for market delineation has to be modified for an application in merger cases. It was shown formally that this leads to a higher critical loss value than in the case of market definition. Furthermore, for certain parameter combinations, the adjusted critical loss formula leads to extreme results with critical losses of 500% and more. In such cases, 'reality checks' (see RBB Economics, 2006) are particularly important instead of mechanically applying the critical loss methodology.

In general, a critical loss analysis can be a useful tool to obtain an initial idea of what the relevant market could be or to what extent a merged entity could raise prices post-merger. However, it possesses more the character of a back-of-the-envelope calculation rather than a sophisticated empirical technique. In cases where data, cost and time constraints do not allow an application of these more sophisticated techniques, critical loss analysis is a valuable second-best technique that can guide antitrust decisions in the right direction.

6.5 The *Lufthansa-Germania* Case at a Glance

This section gives an overview of the *Lufthansa-Germania* predation case (Bundeskartellamt, 2002). After a brief introduction and a description of the basic economic facts, the third section presents the key economic arguments brought forward in the decision. Section four discusses the economic implications of the decision.

6.5.1 Introduction

Cases of *alleged* predatory pricing in the airline industry are not a rare phenomenon and often follow a similar structure: A new and usually small airline enters a route and thereby threatens the incumbent operating in that city-pair. Consequently, and according to standard oligopoly theories, it is rational for the incumbent to adjust its pre-entry (monopoly) price 'significantly' downwards.[385] The regular antitrust question in such situations is whether the *kind* and *extent* of the

[385] This is normally not true for the often observable increases in capacity and/or flight frequency in response to the market entry of a rival (see Morrison, 2004: 91).

incumbents' adjustment(s) can be explained by 'normal competitive behaviour in the presence of market entry' or whether it is motivated by 'anticompetitive' interests in the sense that the adjustment(s) only aim(s) at conserving (monopoly) market power by swamping the entrant out of the market.

Much rarer than cases of alleged predatory pricing in the airline industry are successful antitrust cases of predatory pricing – *successful* from the view of the alleged prey. For example, Morrison and Winston (2000) reported that no alleged predator in the US airline industry, despite several attempts, has ever been prosecuted. The enforcement records in Europe and other parts of the world look quite similar.

Against this background, it is not the observed market conduct as such that makes the *Lufthansa-Germania* case worth describing, but the way the antitrust authority reacted to it: The incumbent, Deutsche Lufthansa AG, faced interventions for its attempt to rid its competitor, Germania Fluggesellschaft mbH, from the Frankfurt-Berlin-Frankfurt market. The following section briefly describes the market conduct. Section 6.5.3 presents the decision and clarifies the major arguments of the German Federal Cartel Office (FCO). Section 6.5.4 provides an outlook of interesting economic questions raised by the case decision.

6.5.2 The Facts

On 12 November 2001, Germania Fluggesellschaft (GER) started its first scheduled flights between Frankfurt/Main and Berlin/Tegel. Before then GER, which was privately owned by the German millionaire Hinrich Bischoff, had been operating only in the German charter market. The price for a flexible one-way economy ticket for the new route without normal restrictions had been set at €99 (including passenger fees and value added tax). A round-trip ticket cost €198. GER offered four flights in each direction per workday.

The previous monopolist on this route, Deutsche Lufthansa (DLH), offered fourteen daily flights (in both directions) at a price of €485 for the fully flexible round-trip ticket in the economy class. After DLH noticed GER's imminent market entry, it reacted – even before market entry actually took place – on 9 November 2001 with a new one-way tariff of €100 for economy class. A round-trip ticket cost €200. This price reduction of about 58% was limited to a relatively small number of seats per flight (Bundeskartellamt, 2002: 2f.).

Germania responded on 12 November 2001 with a tariff reduction from €99 to €55. According to a GER official, the airline was forced to take this step, as otherwise the customers would have had no incentive to fly with it, especially because DLH flights include several auxiliary services, such as free service on board, airport lounges, a frequent flyer program and more daily flight connections.

By the beginning of the year 2002, both airlines again changed their prices. Lufthansa slightly raised its tariff above €100. By mid-February 2002, the tariff was €105,11 for a flight from Berlin to Frankfurt and €105,31 for a flight from Frankfurt to Berlin. The round-trip ticket was thus available for €210,42. Additionally, the company introduced several restrictions on this reduced tariff: a re-

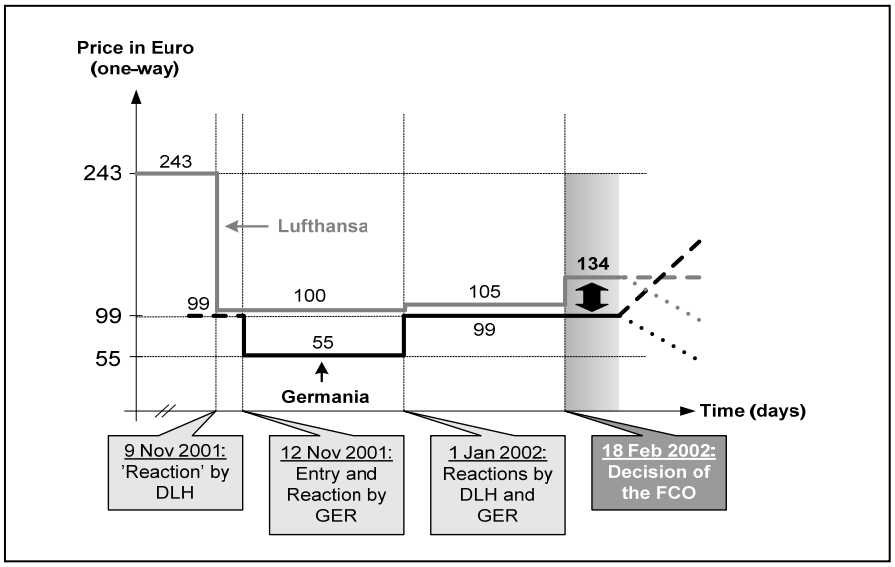
classification fee of €22 and a duty for booking inbound and outbound flights separately. It is important to mention that the new tariff was not subject to the typical restrictions to separate business travellers from leisure travellers, such as a minimum stay, a reclassification ban or a Sunday rule (p. 3).

Germania raised its fares on 1 January 2002 from €55 to €99 in an effort to reach the break-even point, which was, according to their information, not possible with the lower fare. Following the tariff increase, the demand for GER tickets declined by about 39%. The demand for DLH flights had not experienced much movement between December 2001 and January 2002.

6.5.3 The Antitrust Case

The described market conduct led to the *Lufthansa-Germania* antitrust case. This section presents the final decision of the German Federal Cartel Office (FCO), followed by the antitrust authority's general reasoning.

Fig. 82. Price changes in the Frankfurt-Berlin-Frankfurt market (November-February 2002) and the decision of the FCO



6.5.3.1 The Decision

On 18 February 2002, the FCO made the following decision, based on Section 19 of the German ARC (Abuse of a dominant position): DLH is prohibited from offering a price (including passenger fees) for a one-way ticket per passenger on the Frankfurt-Berlin route that is not at least €35 above GER's price, provided DLH

does not have to charge more than €134 as a result.[386] The ruling does not affect tickets with 'hard restrictions' such as a reclassification ban, a minimum stay, or a Sunday rule. The prohibition remains valid for two years, as within this period GER should have gained sufficient recognition and established a clientele base (Bundeskartellamt, 2002: 1). Figure 82 demonstrates the price changes in the Frankfurt-Berlin-Frankfurt market prior to the FCO's decision and the ramifications of this decision on future prices.

6.5.3.2 The Economic Reasoning of the FCO

The economic relevance of the Bundeskartellamt's decision is divided into two parts. The first part describes the FCO's positions supporting the assumption of Lufthansa's abuse of a dominant position. The second part addresses the economic reasoning in detail.

6.5.3.2.1 Introductory Propositions

The FCO built its case upon three economically relevant propositions:

Proposition 1: With the introduction of the new tariff, DLH not only adjusted to GER's price but in fact undercut it.

In the explanatory statement, the FCO mentioned that the reduced fare of DLH contains several auxiliary services, such as service on board, the frequent flyer program, more daily flight connections, customer lounges, better access to travel agencies and computer reservation systems, the existing airline network, the advantage of reputation especially among business travellers, better seats in the airplane and travel commission override programs between DLH and most of the 100 largest firms in Germany (pp. 11f.).

In the following analysis, the FCO tried to calculate an amount in euros of some of the auxiliary services offered by DLH. The motive for this step was the belief that it is essential for the predation analysis to find out if 'enough' people are ready to switch from DLH to GER (pp. 6ff.).

For example, the monetary value of the frequent flyer program was calculated as follows: Each flight with the new fare is rewarded with at least 500 miles in the program; a typical one-way flight within Germany is rewarded with 1000 miles. A free bonus flight (worth in average: €488) is provided when 20.000 miles have

[386] Section 19 of the German ARC constitutes in Paragraph 1 that "[t]he abusive exploitation of a dominant position by one or several businesses shall be prohibited. [...] (4) An abuse exists in particular if a dominant business, as a supplier or purchaser of certain kinds of goods or commercial services, 1. impairs the ability to compete with other businesses in a manner affecting competition in the market and without any objective justification; 2. demands payment or other business terms which differ from those which would very likely arise if effective competition existed; in this context, particularly the conduct of businesses in comparable markets where effective competition prevails shall be taken into account".

been acquired. This means that a free flight can be taken after 40 flights. Therefore, the monetary value of the frequent flyer program for one flight can be calculated to about €12 (pp. 7f.).

The FCO also tried to calculate the monetary value of the higher daily flight frequencies of DLH. They assumed a time advantage of about one hour for customers of DLH and estimated the benefit between €25 and €60. The FCO concluded that DLH's price must exceed GER's price by at least that much to compensate for the higher frequencies of DLH (pp. 10f.).

Proposition 2: Due to the low DLH tariff, GER is stripped of its only possibility to compete with DLH.

The FCO argued that GER has clear disadvantages compared to DLH in 'auxiliary service sections' as mentioned above. In the service aspects of safety, punctuality, efficient check-in and free choice of seats, the FCO evaluated that neither airline has a clear advantage. As a consequence, GER can only compete in the aspects of price and cabin personnel. Furthermore, the FCO argued that if DLH matches these last chances for competition from GER, then GER will have no chance to attract the passengers necessary to operate profitably (pp. 9f.).

Proposition 3: The new low fare tariff of DLH does not cover the average costs per passenger.

Following the (unpublished) calculations of the FCO, DLH does not cover the average costs per passenger with the low fare of €105. This is the result of an analysis of route profitability data provided by DLH (pp. 12f.).

6.5.3.2.2 The Economic Reasoning in Detail

Following the guidelines of Section 19 of the German ARC, the investigation had to start with the delineation of the relevant market followed by the determination that the company (or companies) of interest had a dominant position in this market. Afterwards, the abusive exploitation of this dominant position had to be established.

Relevant market and dominant position

The FCO provided only a short analysis of the relevant market. It interpreted business travellers between Frankfurt and Berlin as an independent relevant market, which consequently had to be separated from the less time-sensitive leisure travellers. The FCO especially mentioned that the possible substitution alternatives – travelling by car or rail – are no real alternatives for business travellers due to the significantly longer trip duration.

By excluding rail and car demand from the overall travel demand between Frankfurt and Berlin, GER had (at the time of the decision) a market share of about 10% on the Frankfurt-Berlin-Frankfurt route. Therefore, the FCO concluded

that DLH was the dominant firm in this market. The general resources of DLH compared to GER's were used as another argument to support this view (p. 14).

Determination of the abuse of a dominant position

Determining whether there is an abuse of a dominant position usually takes place in three steps. After formulating the allegation, the FCO is required to show the sufficiency of the price reduction to reach the presumed (anticompetitive) goal of the dominant firm. Then, the FCO has to prove the actual existence of such a strategy.

Alleged violation of Section 19

DLH is abusing its dominant position in the Frankfurt-Berlin-Frankfurt market by offering tariffs (with similar restrictions) which are not at least €35 above GER's price, as long as DLH does not have to charge more than €134 as a result.[387]

Suitability of the price decrease to reach the assumed aim

'Predatory prices'[388] damage the competitive possibilities of GER and therefore would have significant effects on future competition in the market for scheduled flights between Frankfurt and Berlin. DLH had a monopoly position before market entry of GER and would in all likelihood regain it after the exit of GER. The defense of the newcomer therefore would cause a considerable interference for competition in this and presumably also in other markets, as future entry attempts are deterred by the aggressive behaviour of DLH.

Predatory prices can, under certain conditions (e.g., a high degree of market power, deep pockets, and high entry barriers), be an effective instrument to reach the assumed aim of regaining the monopoly position in the Frankfurt-Berlin-Frankfurt market (p. 17).

Actual existence of the presumed predation strategy

The FCO first assessed whether the new DLH tariff affects the competitive possibilities of GER. The reaction of DLH seriously endangered the chance of GER to establish a new profitable service on this route. DLH's tariff of €105,21 – in conjunction with its auxiliary services – constituted a factual underselling of at least €35 and the acceptance of operative losses. The revenue per passenger is significantly smaller than the average costs per passenger.

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387 In other words, if GER continues to charge €99, DLH must charge at least €134 for a one-way economy ticket in order to avoid abusing its dominant position in that market. If GER lowers its price, DLH is allowed to meet the price drop proportionally. If GER raises its price, DLH is allowed to keep a price of €134.

388 The FCO defines *predatory behaviour* as follows: "Predatory behaviour is aggressive market conduct [...] by dominant firms with the aim of ruling out competitors from the market, to discipline them or to deter them from new market entry" (p. 15, translated by the author).

Such a strategy is only rational when it aims at forcing GER out of the market. Afterwards, the losses can be recouped by increasing prices up to the previous (monopoly) level. Additionally, the actual behaviour of DLH might set a deterrent signal to other potential entrants into this and other routes. Therefore, the FCO interpreted the introduction of the low tariff as an attempt to force GER out of the market (p. 17ff.). This judgment is strengthened by further arguments:

- DLH introduced the new tariff selectively on the route where the new entrant had started service. The tariff targeted the same group of passengers (business travellers) and DLH introduced the same tariff restrictions as the entrant.
- DLH's price reduction – almost to the level of GER's – is in fact a clear underselling, because DLH's tariff includes several auxiliary services (see above). DLH's low tariff foreclosed the possibility for GER to reach a sufficient switching rate of price-sensitive business travellers from DLH to GER.
- Experiences with market entries in other DLH monopoly markets (by other competitors) have shown the general suitability of a predation strategy to rule out competitors (e.g., after entry of Go-Fly in the London/Stansted-Munich market).
- Price comparisons with the only other competitive route within Germany (between Berlin and Munich) showed that DLH's Frankfurt-Berlin tariff was significantly below the price of a ticket in that market (€441). In that market DLH competed with Deutsche BA.
- Furthermore, DLH was financially strong and therefore able to survive a period of low (predatory) prices. The 'predatory investment' was therefore possible as well.

Due to these reasons, the FCO acted on the assumption that the pricing policy of DLH in the Frankfurt-Berlin-Frankfurt market had as its only aim to force out GER. Therefore, predatory intent was proven.

6.5.3.2.3 'No Objective Justification'

The FCO asserted that no objective justification for the underselling strategy existed. DLH's strategy aims at recovering and consolidating its monopoly position in the market. Even the special importance of the DLH hub in Frankfurt (and the corresponding economies) cannot justify the pricing strategy of DLH.

6.5.3.2.4 Fixing the Interventions

Fixing the minimum price distance

The fixing of the minimum price distance of €35 occurred according to the best judgment of the FCO. It was based on calculations of the monetary value of some of the auxiliary services mentioned above.[389] The FCO expected that after the introduction of the minimum price distance, the predatory effect would disappear

[389] The FCO assumed €3 for drinks and newspaper, €12 for the value of frequent flyer miles and €25 for the estimated value of the flight frequency. The total of €40 was reduced by €5, presumably as some kind of ad hoc adjustment.

and normal competitive pressures would dominate the market. The FCO further mentioned that the rule as used does not deliver unlimited protection for GER. Because GER stated that it can reach the break-even point with a price of €99, the protective interest for GER vanishes with increasing prices (pp. 21f.).

Fixing the validity of the minimum price distance

The intervention was set for two years. The FCO justified this fixing with its belief that the need for a minimum price distance vanishes after the new competitor has established itself in the market (e.g., reputation, optimisation of competition parameters) and therefore the predation possibilities for the incumbent are reduced (pp. 22f.).

6.5.4 Outlook

The *Lufthansa-Germania* case raises at least two groups of interesting economic questions. The first concerns the general question of whether the behaviour of DLH was really predatory. As the FCO did not deal with a complete theory-based framework for predation (e.g., such as the most recent one by Bolton et al., 2000, 2001), there is space for criticism and different opinions on the case. Unfortunately, due to the confidentiality of all cost and demand data, a rigorous *complete* analysis seems to be impossible. Furthermore, the case renews the questions of whether and how price-matching should be adjusted for service quality in predatory pricing cases (see Morrison, 2004, for a discussion).

The second interesting question raised by the case concerns how to intervene against predators after their predatory conduct is proven. This question seems to be relatively new, as most (recent) predation cases in the EU as well as in the US got held up in the detection phase and therefore never reached the intervention phase. In this respect, the *Lufthansa-Germania* case decision enters virgin soil, because a predator is convicted *and* a (behavioural) remedy is imposed which aims at 'restoring competition'. As far as the solution of the FCO – the 'minimum-price-distance rule' – is concerned, it is interesting to ask whether such a rule is a) helpful in fighting predators and b) the best possible answer to the problem of intervening against predation (see Edlin, 2002, for an ex ante predation rule as well as chapter 4 for a detailed discussion).

Independent of the answer to these questions, the *DLH-GER* decision surely opens a new discussion about the optimal antitrust answer(s) to predation strategies. From a practical point of view, the FCO has shown its willingness to intervene against predators. This might help the FCO to create (or maintain respectively) a tough reputation for enforcing competition rules, here in particular concerning Section 19 violations.[390] In principle, the *DLH-GER* case would pro-

[390] It is straightforward that the overall success of the FCO intervention depends on future competition in the market. In May 2004 – after the expiration of the FCO intervention – GER was still operating in the Frankfurt-Berlin-Frankfurt market. The one-

vide a welcome opportunity to estimate the benefits of antitrust enforcement in a predation case. Unfortunately, due to the confidentiality of cost and demand data, such an analysis would have to make so many (possibly heroic) assumptions that the results could hardly be considered as an acceptable estimate of the welfare effects of predation enforcement. As argued in chapter 4, however, as long as predation leads to exit in a duopoly market, positive benefits of antitrust enforcement are very likely.

6.6 Proofs

6.6.1 Allocative and Productive Inefficiencies in Monopoly

Welfare loss of monopoly (Deadweight loss)

Following a simple graphical analysis (see Figure 4 in Section 2.2.1), the deadweight loss (DWL) is given by

$$DWL = \frac{1}{2}\left(P^M - P^C\right)\left(Q^C - Q^M\right). \tag{150}$$

The expression can be extended as follows

$$DWL = \frac{1}{2}\left(P^M - P^C\right)\left(Q^C - Q^M\right)\left(\frac{Q}{Q}\right)\left(\frac{P}{P}\right)\left(\frac{\Delta P}{\Delta P}\right). \tag{151}$$

If we define $\Delta Q = Q^C - Q^M$, $\Delta P = P^M - P^C$, $\varepsilon_D = \left(\frac{\Delta Q}{\Delta P}\frac{P}{Q}\right)$, $M = \left(\frac{P^M - P^C}{P^M}\right)$ and $R^M = P^M \cdot Q^M$, the deadweight loss can be expressed as follows

$$DWL = \frac{1}{2}M^2 \cdot R^M \cdot \varepsilon_D. \tag{152}$$

The approach by Cowling and Mueller (1978) assumes that the firm's profit-maximising price satisfies the following relationship: $\frac{P^M}{P^M - MC} = \varepsilon_D$ which is just the inverse Lerner index - elasticity relationship. Using the Harberger terminology (P^C is replaced with MC) $\frac{1}{M} = \frac{P^M}{P^M - MC}$ and the inverse Lerner index, it follows

way tariff was €88 and customers could choose between four flight connections per day (morning/evening from/to Frankfurt). The cheapest online price for a round-trip ticket in economy class with DLH was €156 off-peak and €285 peak.

that $\varepsilon_D = \frac{1}{M}$. If 1/M is now substituted for ε_D in the Harberger Equation (152), the deadweight loss is given (as long as MC=AC) by

$$DWL = \frac{1}{2} M \cdot R^M = \frac{1}{2}\left(P^M - MC\right)Q^M = \frac{1}{2}\pi^M . \tag{153}$$

Welfare loss due to rent-seeking activities

Following a simple graphical analysis (see Figure 4 in section 2.2.1), the welfare loss due to rent-seeking activities (RSA) is given by

$$RSA = \lambda\left(\left(P^M - P^C\right)Q^M\right) \tag{154}$$

which is simply the whole monopoly profit and creates the upper bound for rent-seeking expenditures. The actual level of rent-seeking expenditures is determined by the dissipation ratio λ ($\text{with } 0 \le \lambda \le 1$). If, for example λ=0,5, the company/industry spends 50% of the overall profit on rent-seeking expenditures. Multiplying expression (154) with (P^M/P^M) and some simple algebraic manipulations leads to the following expression for the welfare loss due to rent seeking:

$$RSA = \lambda\left(M \cdot R^M\right). \tag{155}$$

The relationship between deadweight loss and rent-seeking loss used by Posner (1975) can be derived as follows. The size of the DWL is approximately equal to $-(1/2)\Delta p\Delta q$ while the size of the rent-seeking activities can be approximated by $\Delta p(Q^C+\Delta Q)$. The relative sizes are then given by

$$\frac{DWL}{RSA} = \frac{-\Delta Q}{2\left(Q^c + \Delta Q\right)}. \tag{156}$$

In terms of price elasticity of market demand at the competitive price, ε_D, and the relative mark-up over the competitive price, $U^C=\Delta p/P^C$, this becomes

$$\frac{DWL}{RSA} = \frac{U^C}{2\left(1/\varepsilon_D - U^C\right)}. \tag{157}$$

Welfare loss due to productive inefficiency

Following a simple graphical analysis (see Figure 4 in section 2.2.1), the welfare loss due to productive inefficiency (PI) is given by

$$PI = \left(\left(P^M - P^C\right)Q^M\right) - \left(P^M - P^{C'}\right)Q^{M'} + \frac{1}{2}\left(P^{M'} - P^M\right)\left(Q^M - Q^{M'}\right). \tag{158}$$

Using expression (155), the welfare loss due to productive inefficiency is given by

$$PI = \left(M \cdot R^M\right) - \left(P^M - P^{C'}\right)Q^{M'} + \frac{1}{2}\left(P^{M'} - P^M\right)\left(Q^M - Q^{M'}\right). \tag{159}$$

However, it is disputed in the literature whether Equation (159) really characterises the welfare loss due to productive inefficiency. As argued for example in Parish and Ng (1972), the welfare loss due to productive inefficiency is just given by the trapezoid ABCD in Figure 4 (the allocative inefficiency caused by productive inefficiency). The rectangle $P^{C'}DCP^{C}$ (the forgone monopoly profits due to productive inefficiency) would not be part of the welfare loss, as it represents (at least) the utility the monopolist gains from its quieter life. In such a case, the productive inefficiency would be given by

$$\begin{aligned} PI = \frac{1}{2}\left(P^{M'} - P^{M}\right)\left(Q^{M} - Q^{M'}\right) + \left(P^{M} - P^{C'}\right)\left(Q^{M} - Q^{M'}\right) \\ + \frac{1}{2}\left(P^{C'} - P^{C}\right)\left(Q^{M} - Q^{M'}\right) \end{aligned} \tag{160}$$

Simple algebraic manipulations lead to the following alternative equation for the welfare loss due to productive inefficiencies

$$PI = \frac{1}{2}\left(P^{M'} + P^{M} - P^{C'} - P^{C}\right)\left(Q^{M} - Q^{M'}\right). \tag{161}$$

In the same way as explained for the case of rent-seeking activities, a value judgment saying that society values the distribution of pecuniary and non-pecuniary rents in a 'quiet life' monopoly state less than in a state of competition is needed to interpret the entire hatched area in Figure 4-2) as a welfare loss due to monopoly (see also Neumann, 2000: 107).

Maximum welfare loss due to monopoly

Following a simple graphical analysis (see Figure 4 in section 2.2.1), the maximum welfare loss due to monopoly is given by

$$MWL = \left(P^{M'} - P^{C}\right)Q^{M'} + \left(\frac{1}{2}\right)\left(Q^{C} - Q^{M'}\right)\left(P^{M'} - P^{C}\right). \tag{162}$$

Simple algebraic manipulations lead to the following equation for the overall maximum welfare loss due to monopoly:

$$MWL = \left(\frac{1}{2}\right)\left(P^{M'} - P^{C}\right)\left(Q^{C} + Q^{M'}\right). \tag{163}$$

6.6.2 Instability of Cartels in One-Shot Games

Following Table 8 in section 2.3.2, cartels are chronically instable, as every cartel member has an incentive to deviate and the Nash equilibrium therefore is simply to compete against each other. The theoretical reasoning behind this finding is developed below based on a simple Cournot model (see, e.g., Haid et al., 1997: 193ff.).

Joint profits of cartelisation

The joint profits of the duopolists are given by

$$\max_{q_1+q_2} \pi(q_1+q_2) = [a - b(q_1+q_2) - c](q_1+q_2), \tag{164}$$

which have to be maximised by selecting outputs optimally. The first-order conditions are

$$\frac{\partial \pi_1}{\partial q_1} = \frac{\partial \pi_2}{\partial q_2} = a - c - 2b(q_1+q_2) = 0 \tag{165}$$

so that the total output is

$$Q^{\text{Cooperation}} = \frac{a-c}{2b} = Q^{\text{Monopoly}} \tag{166}$$

and the resulting market price is

$$P^{\text{Cooperation}} = \frac{a+c}{2} = P^{\text{Monopoly}} \tag{167}$$

This is exactly the monopoly outcome. If the colluding firms share profits equally, then

$$\pi_1^{\text{Cooperation}} = \pi_2^{\text{Cooperation}} = (p-c)\frac{Q^M}{2} = \left[\frac{a+c}{2} - c\right]\left[\frac{a-c}{4b}\right] = \frac{1}{8}\frac{(a-c)^2}{b}. \tag{168}$$

Profits in Cournot competition

If the duopolists engage in Cournot competition instead, profits are given by (see chapter 3 for the calculations in an *n*-firm Cournot model)

$$\pi_1^{\text{Cournot}} = \pi_2^{\text{Cournot}} = (p-c)q^c = \left[\frac{a+2c}{3} - c\right]\left[\frac{a-c}{3b}\right] = \frac{1}{9}\frac{(a-c)^2}{b}. \tag{169}$$

Comparing expressions (168) and (169) shows that cartel profits are higher than the profits under competition. Consequently, firms will have an incentive to engage in collusive agreements.

Profits if one firm deviates

Now assume that firm 1 believes that firm 2 sticks to the collusive agreement. In such a case, it is profit-maximising for firm 1 not to stick to the collusive agreement. Instead, firm 1 should produce the quantity that is the best response to the quantity

$$q_2^{\text{Cooperation}} = \frac{a-c}{4b} \tag{170}$$

provided by firm 2. If this quantity is considered in firm 1's best response function we get

$$q_1^{Defection} = \left(\frac{a-c}{2b}\right) - \left(\frac{q_2^{Cooperation}}{2}\right) = \left(\frac{a-c}{2b}\right) - \left(\frac{a-c}{8b}\right) = \frac{3(a-c)}{8b}. \quad (171)$$

Total output is then given by

$$Q = q_2^{Cooperation} + q_1^{Defection} = \frac{a-c}{4b} + \frac{3(a-c)}{8b} = \frac{5(a-c)}{8b} \quad (172)$$

which leads to a price of

$$\frac{3a+5c}{8b} \quad (173)$$

and profits of

$$\pi_1 = \frac{9(a-c)^2}{64b}, \quad (174)$$

$$\pi_2 = \frac{3(a-c)^2}{32b}. \quad (175)$$

Comparing these profits with the profits realised in a cartel shows that it pays for both firms to deviate from a cartel agreement (assuming that the other firm keeps the agreement). As both firms anticipate this, 'non-cooperation' is the Nash equilibrium of the simple game. Any form of cooperation is unstable due to a lack of trust. From a social welfare perspective, a comparison of the respective outputs shows that welfare is maximised under Cournot competition followed by the state of one deviating firm. In the cartel state, the industry provides the lowest output to the highest price and therefore realises the lowest surplus of all three states.
Additionally, it is insightful to analyse the same game as above for *n* firms in the market. As shown in Haid et al. (1997: 193ff.), the profit for the cartel member i in the collusion state is given by

$$\pi_i^{Cooperation} = \frac{1}{4n}\frac{(a-c)^2}{b} \quad (176)$$

while the profit of the same firm i in Cournot competition can be calculated to

$$\pi_i^{Cournot} = \frac{1}{(n+1)^2}\frac{(a-c)^2}{b}. \quad (177)$$

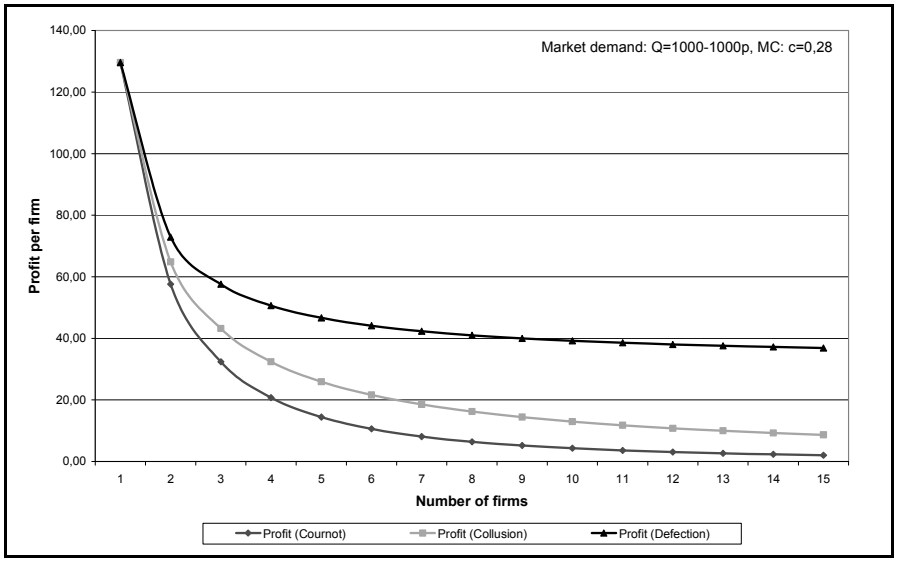
Finally, if n-1 firms are sticking to the cooperation quantity, and firm i deviates by maximising its profits by increasing quantity, the profit of firm i is given by

$$\pi_i^{Defection} = \frac{(n+1)^2}{(4n)^2}\frac{(a-c)^2}{b}. \quad (178)$$

Having calculated the three possible profit levels, Figure 83 plots them against the number of firms in the market. A demand function of Q=1000-1000p and marginal costs of c=0,28 are assumed.

As shown in Figure 83, the difference between the defection profit and the deviating profit increases with the number of firms in the market. In other words, incentives for deviation increase with the number of firms in the market as the share of the monopoly profits each firms gets decreases with the number of firms in the industry. For example, in a two-firm market, the deviation profit is about 13% higher than the collusion profit. However, for n=5, the respective deviation profit is about 80% higher and for n=10, deviating can increase profits by about 203%. For n=15, the percentage increase is more than 327%.

Fig. 83. Realised profits by a firm competing, colluding and defecting in a Cournot model



6.6.3 Stability of Cartels in Supergames

Based on the general model framework developed in the preceding section, it has to be assessed here under what conditions cartel agreements can be stable in a dynamic context. To be exact, the so-called supergames basically assume the repetition of a certain one-shot game for an infinite time horizon. The infinity (or at least the 'unknown ending') of the game is a crucial assumption – following Selten's concept of backward induction – as a definite ending of the game would again lead to the conclusion that cartel agreements are instable.

Assuming an infinite time horizon, the payoff for cooperation can be written as follows:

$$\Pi^{\text{Cooperation}} = \pi^{\text{Cooperation}}\left[1+\delta+...\right]. \tag{179}$$

If one firm is deviating from the cooperative output in the first period, it receives the higher deviation profit for one period but the lower non-cooperation profit in the subsequent periods. In an intertemporal context this leads to

$$\Pi^{\text{Defection}} = \pi^{\text{Defection}} + \pi^{\text{Non-Cooperation}}\left[\delta+\delta^2+...\right]. \tag{180}$$

Hence, a cartel agreement is stable if the following condition holds:

$$\pi^{\text{Cooperation}}\left[1+\delta+...\right] \geq \pi^{\text{Defection}} + \pi^{\text{Non-Cooperation}}\left[\delta+\delta^2+...\right] \tag{181}$$

or

$$\pi^{\text{Cooperation}}\sum_{t=0}^{T}\delta^t \geq \pi^{\text{Defection}} + \pi^{\text{Non-Cooperation}}\sum_{t=1}^{T}\delta^t\ . \tag{182}$$

Further rearrangements allow writing (182) as follows

$$\pi^{\text{Cooperation}}\frac{1}{1-\delta} \geq \pi^{\text{Defection}} + \pi^{\text{Non-Cooperation}}\frac{\delta}{1-\delta} \tag{183}$$

and finally

$$\delta \geq \frac{\pi^{\text{Defection}} - \pi^{\text{Cooperation}}}{\pi^{\text{Defection}} - \pi^{\text{Non-Cooperation}}}. \tag{184}$$

Inserting the payoffs derived from the one-shot game above lead to

$$\delta \geq \frac{\frac{(n+1)^2}{(4n)^2}\frac{(a-c)^2}{b} - \frac{1}{4n}\frac{(a-c)^2}{b}}{\frac{(n+1)^2}{(4n)^2}\frac{(a-c)^2}{b} - \frac{1}{(n+1)^2}\frac{(a-c)^2}{b}} = \frac{\frac{(n+1)^2}{(4n)^2} - \frac{1}{4n}}{\frac{(n+1)^2}{(4n)^2} - \frac{1}{(n+1)^2}}. \tag{185}$$

For n=2, the critical discount factor can be calculated to

$$\delta \geq \frac{\frac{9}{64}\frac{(a-c)^2}{b} - \frac{1}{8}\frac{(a-c)^2}{b}}{\frac{9}{64}\frac{(a-c)^2}{b} - \frac{1}{9}\frac{(a-c)^2}{b}} \approx 0{,}53\,. \tag{186}$$

Equation (186) shows the minimum discount factor necessary to stabilise the cartel agreement. In terms of the interest rate *r* – which is given by $\delta=(1/(1+r))$ – Equation (184) can be expressed as follows

$$r \leq \frac{\pi^{\text{Cooperation}} - \pi^{\text{Non-Cooperation}}}{\pi^{\text{Defection}} - \pi^{\text{Cooperation}}}. \tag{187}$$

6.6.4 Resource Allocation by an Antitrust Authority

To study the resource allocation by an antitrust authority (see Martin, 2000: 165ff.; 2001: 441ff.), suppose that in a country there are only two industries (i=1,2). Net social welfare generated in both industries is given by the sum of consumer and producer surplus

$$W_i(q_i) = \int_0^{q_i} [p_i(x_i) - c_i]dx_i \,. \tag{188}$$

There is one monopolist per industry who aims at maximising profits. If there is no antitrust enforcement whatsoever, both monopolists just charge the monopoly price. However, suppose that an antitrust authority starts overseeing both industries and sets a threshold price level g_i for both industries. If the observed market price exceeds the threshold price level, the authority starts – with a certain probability – an investigation and fines – again with a certain probability – the monopolists for their monopolistic behaviour. In such a world, Martin (2000: 185ff.) shows that the profit-maximising firm chooses an output level at which the expected marginal revenue is less than marginal cost in order to reduce the probability of investigation τ_i and the expected value of fines.[391] The extent of the 'price adjustment' downwards (i.e., the deterrence effect of antitrust policy) depends on the expected fine level (probability of punishment and fine level) and the threshold level chosen by the antitrust authority.[392]

From the viewpoint of the antitrust authority, the immediate solution to its enforcement problem is to fix the threshold levels at competitive prices and investigate every attempt to charge more than the competitive prices. However, if the antitrust authority faces positive investigation costs I_i (i=1,2) and is constrained by a budget B with $B \geq \tau_1 I_1 + \tau_2 I_2$, it has to solve the following constrained optimisation problem to derive the equilibrium threshold levels for industries 1 and 2:

$$\max_{g_1, g_2} \; W_1(q_1) + W_2(q_2) - \tau_1 I_1 - \tau_2 I_2 \; s.t. \; \tau_1 I_1 + \tau_2 I_2 \leq B \,. \tag{189}$$

The first-order conditions for the solution to the antitrust authorities' constrained optimisation problem come from the Lagrangian

$$L = W_1(q_1) + W_2(q_2) - B + \lambda[B - \tau_1 I_1 - \tau_2 I_2] \,. \tag{190}$$

Deriving the first-order conditions yield

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391 Following Martin (2000: 166ff.), τ_i is the probability that the realised price in the industry is above g_i leading to an investigation in industry with $\tau_i = \Pr[p_i(q_i) + \varepsilon_i \geq g_i] = \Pr[\varepsilon_i \geq g_i - p_i(q_i)]$. ε_i is a random element of demand.

392 For a constant threshold level, a greater output reduces the probability of investigation while – holding output constant – a lower investigation threshold increases the probability of investigation, leading firms to typically increase quantities in order to reduce the expected fines.

$$\frac{\partial L}{\partial \lambda} = B - \tau_1 I_1 - \tau_2 I_2 \equiv 0, \tag{191}$$

$$\frac{\partial L}{\partial g_1} = \frac{\partial W_1}{\partial q_1}\frac{\partial q_1}{\partial g_1} - \lambda I_1 \frac{\partial \tau_1}{\partial g_1}\left(1 - \frac{\partial p_1}{\partial q_1}\frac{\partial q_1}{\partial g_1}\right) \equiv 0\,, \tag{192}$$

$$\frac{\partial L}{\partial g_2} = \frac{\partial W_2}{\partial q_2}\frac{\partial q_2}{\partial g_2} - \lambda I_2 \frac{\partial \tau_2}{\partial g_2}\left(1 - \frac{\partial p_2}{\partial q_2}\frac{\partial q_2}{\partial g_2}\right) \equiv 0\,. \tag{193}$$

Equations (192) and (193) then imply

$$\lambda = \frac{\dfrac{\partial W_1}{\partial q_1}\dfrac{\partial q_1}{\partial g_1}}{I_1 \dfrac{\partial \tau_1}{\partial g_1}\left(1 - \dfrac{\partial p_1}{\partial q_1}\dfrac{\partial q_1}{\partial g_1}\right)} = \frac{\dfrac{\partial W_2}{\partial q_2}\dfrac{\partial q_2}{\partial g_2}}{I_2 \dfrac{\partial \tau_2}{\partial g_2}\left(1 - \dfrac{\partial p_2}{\partial q_2}\dfrac{\partial q_2}{\partial g_2}\right)}\,. \tag{194}$$

The numerator in expression (194) is negative. In absolute value, it gives the increase in welfare in industry 1 (and 2, respectively) if the antitrust authority lowers the threshold level g_1 marginally. The denominator in expression (189) represents, in absolute value, the increase in expected investigation costs if g_1 is lowered marginally. The Lagrangian multiplicator λ can be interpreted as the marginal increase in welfare in industry 1 (and 2, respectively) per marginal increase in spending on investigations in industry 1 (and 2, respectively). The antitrust authority's choice of the threshold levels is optimal when this ratio is the same for both industries. Furthermore, rearranging Equation (194) leads to

$$-\frac{\dfrac{\partial W_1}{\partial q_1}\dfrac{\partial q_1}{\partial g_1}}{\dfrac{\partial W_2}{\partial q_2}\dfrac{\partial q_2}{\partial g_2}} = \frac{I_1 \dfrac{\partial \tau_1}{\partial g_1}\left(1 - \dfrac{\partial p_1}{\partial q_1}\dfrac{\partial q_1}{\partial g_1}\right)}{I_2 \dfrac{\partial \tau_2}{\partial g_2}\left(1 - \dfrac{\partial p_2}{\partial q_2}\dfrac{\partial q_2}{\partial g_2}\right)} < 0\,. \tag{195}$$

The expression on the left side is the slope of an iso-welfare curve, while the expression on the right side is the slope of an iso-budget curve. The first-order conditions imply that the solution of the optimisation problem from antitrust authority constrainments occurs at the tangency of an iso-welfare curve and an iso-budget curve (Martin, 2000: 187ff.).[393]

6.6.5 Profitability of a Price Increase

The SSNIP test can be formalised as follows (see Geroski and Griffith, 2004: 304f.). Before the price increase the profits are given by

[393] See Martin (2001: 187ff.) for the derivation of second-order conditions and analytical solutions for increases in budget *B* and investigation cost *I*.

$$\pi_0 = (P_0 - C_0)Q_0 . \tag{196}$$

After the price increase the profits are given by

$$\pi_1 = (P_1 - C_1)Q_1 . \tag{197}$$

If $\Delta P = P_1 - P_0$, $\Delta Q = Q_1 - Q_0$ and $\Delta C = C_1 - C_0$ the change in profits is then given by

$$\Delta\pi = \pi_1 - \pi_0 = \Delta P Q_1 + (P_0 - C_0)\Delta Q - Q_1 \Delta C . \tag{198}$$

Dividing (198) by P_0 leads to

$$\frac{\Delta\pi}{P_0} = \frac{\Delta P}{P_0} Q_1 + \frac{P_0 - C_0}{P_0}\Delta Q - \frac{Q_1}{P_0}\Delta C . \tag{199}$$

Assuming constant average costs allows simplifying Equation (199) to

$$\frac{\Delta\pi}{P_0} = \frac{\Delta P}{P_0} Q_1 + \frac{P_0 - C_0}{P_0}\Delta Q . \tag{200}$$

It follows that a price rise is profitable if

$$\frac{\Delta P}{P_0} Q_1 > \frac{P_0 - C_0}{P_0}\Delta Q . \tag{201}$$

Equation (201) says that the price rise is profitable as long as the increased price charged on the new lower quantity is greater than the lost margin on the decrease in quantity.

6.6.6 Deriving the Price-Cost Margin for a Differentiated Good

The formula for the price-cost margin for a differentiated good can be derived with a differentiated Bertrand model (see Neumann, 2000: 90f.). It is assumed that the demand of a product i depends on the prices of all products in the relevant market: $q_i = (p_1, p_2, \ldots, p_n)$. Assuming constant marginal costs c_i and fixed costs F_i, the profit of firm i can be expressed as follows:

$$G_i = (p_i - c_i)q_i - F_i . \tag{202}$$

If the profit is maximised by choosing the optimal p, the first derivative is given by

$$\frac{\partial G_i}{\partial p_i} = q_i + (p_i - c_i)\left[\frac{\partial q_i}{\partial p_i} + \sum_{j \neq i}\left(\frac{\partial q_i}{\partial p_j}\right)\left(\frac{\partial p_j}{\partial p_i}\right)\right] = 0. \tag{203}$$

Multiplying by (p_i/q_i) and applying the definitions for the own demand elasticity, the cross-price elasticity and the conjectural elasticity $\mu_{ij} = (p_i/p_j)(\partial p_j/\partial p_i)$ lead to

$$\frac{p_i - c_i}{p_i} = \frac{1}{\varepsilon_i - \sum_{j \neq i} \mu_{ij} \varepsilon_{ij}} . \tag{204}$$

6.6.7 Price Effects of Mergers in a Differentiated Bertrand Model

This section aims at deriving Equations (21) and (22) in the main text which can be used as a back-of-the-envelope calculation to estimate post-merger percentage price increases. The derivation largely follows Shapiro (2004). In general, the following exercise compares the prices set for two products A and B (which are produced by separately owned firms) in a differentiated Bertrand duopoly with the profit-maximising prices for these two products if a single firm controls both products.

For the case of a linear demand function, the demand curves can be written as $q_A=a-p_A+Dp_B$ and $q_B=a-p_B+Dp_A$. The profit of firm A is then given by

$$\pi_A = (p_A - c_A)(a - p_A + Dp_B) . \tag{205}$$

Deriving the first-order condition with respect to p_A and rearranging leads to the following best response function for firm A:

$$p_A = \frac{(a + Dp_B + c_A)}{2} . \tag{206}$$

Assuming cost symmetry the unique market price can be calculated to

$$\overline{p}_A = \overline{p}_B = \overline{p} = \frac{a + c}{2 - D} . \tag{207}$$

The pre-merger price-cost margin is given by $\overline{m} = \frac{\overline{p} - c}{\overline{p}}$, as usual. Substituting (207) and some manipulations lead to

$$\overline{m} = \frac{a - c(1 - D)}{a + c} . \tag{208}$$

The merged company would control both prices and would set p to maximise $(p-c)(a-p+Dp)$ and would charge a post-merger (monopoly) price of

$$p^* = \frac{a + c(1 - D)}{2(1 - D)} . \tag{209}$$

The percentage price increase is given by $(p^* - \overline{p})/\overline{p}$ which is equal to

$$\frac{p^* - \bar{p}}{\bar{p}} = \frac{\frac{a + c(1-D)}{2(1-D)} - \frac{a+c}{2-D}}{\frac{a+c}{2-D}}. \tag{210}$$

Several algebraic manipulations lead to

$$\frac{p^* - \bar{p}}{\bar{p}} = \frac{D(a - c(1-D))}{2(1-D)(a+c)}. \tag{211}$$

Substituting for $\overline{m}$, Equation (211) can be written as

$$\frac{p^{Post-merger} - p^{Pre-merger}}{p^{Pre-merger}} = \frac{\bar{m}D}{2(1-D)}. \tag{212}$$

This is the equation used in the main text for a linear demand function.

For a constant elasticity of demand, it is assumed that the elasticity falls from its pre-merger level of ε to a post-merger level of *ε(1-D)*. Applying the usual mark-up $\bar{m} = 1/\varepsilon$, we get

$$\frac{\bar{p} - c}{\bar{p}} = \frac{1}{\varepsilon} \text{ and } \bar{m} = \frac{1}{\varepsilon} \text{ and } \bar{p} = \frac{c}{1 - \frac{1}{\varepsilon}}. \tag{213}$$

Furthermore, we can write

$$\frac{p^* - c}{p^*} = m^* = \frac{1}{\varepsilon(1-D)}. \tag{214}$$

and

$$p^* = \frac{c}{1 - \frac{1}{\varepsilon(1-D)}}. \tag{215}$$

To receive reasonable results, inequality *ε(1-D)>1* must hold. Using (213) this necessary condition can be written as $D < (1 - \bar{m})$. In other words, the diversion ratio must not be too large – especially if the pre-merger margins are large – to receive economically sensible results. As explained in more detail by Shapiro (2004: 4) this is another proof that the assumption of constant elasticity of demand cannot hold up for large price increases and should consequently only be considered for relatively small price increases.

Substituting the above equations, the percentage post-merger price increase is given by

$$\frac{p^* - \overline{p}}{\overline{p}} = \frac{\dfrac{c}{1 - \dfrac{1}{\varepsilon(1-D)}} - \dfrac{c}{1 - \dfrac{1}{\varepsilon}}}{\dfrac{c}{1 - \dfrac{1}{\varepsilon}}}. \tag{216}$$

Cancelling the *c* terms and multiplying it by *ε(1-D)* leads to

$$\frac{p^* - \overline{p}}{\overline{p}} = \frac{\dfrac{1}{\varepsilon(1-D)-1} - \dfrac{1}{\varepsilon(1-D)-(1-D)}}{\dfrac{1}{\varepsilon(1-D)-(1-D)}}. \tag{217}$$

Rearranging, multiplying by *(ε-1)(1-D)* and collecting terms leads to

$$\frac{p^* - \overline{p}}{\overline{p}} = \frac{(\varepsilon - 1)(1-D)}{\varepsilon(1-D)-1} - 1. \tag{218}$$

Combining these two terms leads to

$$\frac{p^* - \overline{p}}{\overline{p}} = \frac{D}{\varepsilon(1-D)-1}. \tag{219}$$

Using Equation (213) finally leads to

$$\frac{p^{Post-merger} - p^{Pre-merger}}{p^{Pre-merger}} = \frac{\overline{m}D}{1 - D - \overline{m}}. \tag{220}$$

This is the equation for an iso-elastic demand function used in chapter 2. Equation (220) only provides economically sensible estimates for $1 - D - \overline{m} > 0$ or $D < 1 - \overline{m}$. This is a relatively tight bound, as shown in Table 54 in Annex 6.7. Furthermore, a comparison of the percentage post-merger price increases show that even for the relatively small margin/diversion ratio values (in which the estimates with an iso-elastic demand curve are economically sensible), the percentage difference between both estimates are substantial. This is shown in Table 44.

As Table 44 shows, even for very small margins and diversion ratios the differences in the percentage price increase estimates between iso-elastic and linear demand functions are quite substantial. In other words, the choice of the correct type of demand function matters in the application of the equations derived above.

Table 44. Difference in percentage price increases between iso-elastic and linear demand

		Pre-merger price-cost margins										
		0	*0,05*	*0,1*	*0,15*	*0,2*	*0,25*	*0,3*	*0,35*	*0,4*	*0,45*	*0,5*
Diversion ratio	*0*	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	0,05	0,00	0,15	0,33	0,54	0,81	1,13	1,52	2,00	2,58	3,32	4,24
	0,1	0,00	0,31	0,69	1,17	1,75	2,46	3,33	4,42	5,78	7,50	9,72
	0,15	0,00	0,50	1,12	1,89	2,85	4,04	5,53	7,41	9,80	12,90	17,02
	0,2	0,00	0,71	1,61	2,74	4,17	5,97	8,25	11,18	15,00	20,09	27,08
	0,25	0,00	0,95	2,18	3,75	5,76	8,33	11,67	16,04	21,90	30,00	41,67
	0,3	0,00	1,24	2,86	4,97	7,71	11,31	16,07	22,50	31,43	44,36	64,29
	0,35	0,00	1,57	3,67	6,46	10,17	15,14	21,92	31,41	45,23	66,63	103,21
	0,4	0,00	1,97	4,67	8,33	13,33	20,24	30,00	44,33	66,67	105,00	183,33
	0,45	0,00	2,45	5,91	10,74	17,53	27,27	41,73	64,43	103,64	184,09	429,55
	0,5	0,00	3,06	7,50	13,93	23,33	37,50	60,00	99,17	180,00	427,50	Div/0

Unit: % points.

6.6.8 Sufficient Percentage Cost Reduction to Prevent Price Increases in a Homogenous Product Merger

In a Cournot model with homogeneous goods, Farrell and Shapiro (1990) showed that without creating substantial synergies, a merger necessarily leads to a reduction in industry output and therefore total welfare. Although the non-merging firms typically react to a decrease in output of the merged firm with an increase in their output, the net effect on total welfare is negative. If, however, a merger in such a Cournot world reduces the marginal costs of the merging firms by a 'sufficient amount', the merging firms have an incentive to increase output post-merger, leading to lower prices and increases in total as well as consumer welfare. The derivation of this 'sufficient amount' (which just leaves consumer surplus unchanged compared to the pre-merger state) is presented below.

The derivation of the sufficient percentage cost reduction to prevent price increases in a homogenous product merger starts with the well-known first-order condition for profit maximisation in a Cournot model (Froeb and Werden, 1998):

$$\frac{p - c_i}{p} = \frac{s_i}{\varepsilon_D^m}, \tag{221}$$

with s_i being the output-based market share of firm i. This equation can be rearranged to

$$c_i = \frac{\left(\varepsilon_D^m - s_i\right)p}{\varepsilon_D^m}. \tag{222}$$

Denoting the merging firms with subscripts *j* and *k*, and substituting the sum of the shares of firms j and k for the merged firm's share lead to the following expression for the merged firm's marginal cost post-merger:

$$c_i = \frac{\left(\varepsilon_D^m - s_j - s_k\right)p}{\varepsilon_D^m}. \tag{223}$$

The pre-merger (share-weighted) average marginal cost for the merged entity is then given by

$$c_i = \frac{p\left[s_j\left(\varepsilon_D^m - s_j\right) + s_k\left(\varepsilon_D^m - s_k\right)\right]}{\varepsilon_D^m\left(s_j + s_k\right)}. \tag{224}$$

The proportionate reduction in marginal cost necessary to restore the pre-merger price can then be calculated to

$$\frac{c_i^0 - c_i^1}{c_i^0} = \bar{c} = \frac{2s_j s_k}{\varepsilon_D^m\left(s_j + s_k\right) - \left(s_j^2 + s_k^2\right)}. \tag{225}$$

In the symmetric case, where $s_j = s_k = s$, Equation (225) simplifies to

$$\bar{c} = \frac{2s^2}{\varepsilon_D^m \cdot 2s - 2s^2} = \frac{s}{\varepsilon_D^m - s} \approx \frac{\left(s_j s_k\right)^{1/2}}{\varepsilon_D^m - \left(s_j s_k\right)^{1/2}}. \tag{226}$$

Following Froeb and Werden (1998: 269), substituting the geometric mean of the merging firm's market shares, $\left(s_i s_j\right)^{1/2}$, provides a good approximation of *s* in Equation (225) and allows the derivation of Table 18 presented in chapter 2.

6.6.9 Sufficient Percentage Cost Reduction to Prevent Price Increases in a Differentiated Products Merger

In a Bertrand model with differentiated goods, Deneckere and Davidson (1985) demonstrated that any merger (which generates no cost efficiencies) would lead to price increases for the products of the merging firms and would also create an incentive for the outsider firms in the market to increase product prices. Such a merger would therefore necessarily reduce consumer surplus. If, however, the merger generates sufficient marginal cost reductions for the merging firms, the post-merger equilibrium prices can even undercut the pre-merger equilibrium prices.

To derive the sufficient percentage cost reduction to prevent price increases in a differentiated product merger, it is initially assumed that the merger leaves the market price unchanged but reduces marginal costs (Werden, 1996: 410ff.). The proportionate reduction in marginal costs can be derived from the usual definition

of the price-cost margin *M* for product i. If superscript *0* represents pre-merger values and *1* post-merger values, that definition can be rearranged to

$$\frac{c_i^0 - c_i^1}{c_i^0} \equiv \bar{c}_i = \frac{M_i^1 - M_i^0}{1 - M_i^0}. \tag{227}$$

Equation (227) can, in turn, be used to derive an expression for the merger-induced cost reduction necessary to restore pre-merger prices. Under the assumption that each product is initially sold by a single firm, the pre-merger first-order condition for profit maximisation is

$$M_i^0 = -1/\varepsilon_{ii} \tag{228}$$

and leads to the following condition for a two-firm merger that maximises the sum of the profits for the two respective products i and j:

$$M_i^1 - M_j^1 D_{ji} p_j / p_i = -1/\varepsilon_{ii}\,. \tag{229}$$

Equations (228) and (229) can than be solved for the post-merger margins in terms of the pre-merger margins and other quantities

$$M_i^1 = \frac{M_i^0 + M_j^0 D_{ji} p_j / p_i}{1 - D_{ij} D_{ji}}. \tag{230}$$

Substituting Equations (228) and (230) into Equation (227) leads to the marginal cost reductions necessary to restore pre-merger prices

$$\bar{c} = \frac{M_i D_{ij} D_{ji} + M_j D_{ji} p_j / p_i}{(1 - M_i)(1 - D_{ij} D_{ji})}. \tag{231}$$

For the symmetric case, Equation (231) can be simplified to

$$\bar{c} = \frac{M}{1 - M} \frac{D}{1 - D}. \tag{232}$$

This is the equation for the marginal cost reduction necessary to restore pre-merger prices applied in chapter 2.

6.6.10 Assessment of Market Power

Some important links between market power and concentration measures will be proved here. In particular, the proofs for the Landes-Posner estimate of the elasticity of demand for a dominant firm and the discussed specifics of the Herfindahl-Hirschman index are derived.

Elasticity of demand for a dominant firm

Following Landes and Posner (1981: 985) it has to be shown that

$$\frac{(p-c)}{p} = \frac{s_i}{\left(\varepsilon_D^m + \varepsilon_S^j(1-s_i)\right)}. \tag{233}$$

In order to show that this relation is true, it is assumed that the market demand of a firm i is simply the market demand minus the amount supplied by competing firms: $Q_D^i = Q_D^m - Q_S^j$. The factor Q_D^i is the so-called residual demand faced by firm i. If we then ask how a small change in price would affect the demand for firm i's product we get

$$\frac{\partial Q_D^i}{\partial P} = \frac{\partial Q_D^M}{\partial P} - \frac{\partial Q_S^j}{\partial P}. \tag{234}$$

Multiplying the equation by $-\left(\frac{P}{Q_D^i}\right)$ and noting that $\varepsilon_D^i = -\left(\frac{\partial Q_D^i}{\partial P}\right)\left(\frac{P}{Q_D^i}\right)$ leads to the following expression:

$$\varepsilon_D^i = -\left(\frac{\partial Q_D^m}{\partial P}\right)\left(\frac{P}{Q_D^i}\right) + \left(\frac{\partial Q_S^j}{\partial P}\right)\left(\frac{P}{Q_D^i}\right). \tag{235}$$

Multiplying the first group of terms by $\left(\frac{Q_D^M}{Q_D^M}\right)$ and the second group by $\left(\frac{Q_S^j}{Q_S^j}\right)$ yields

$$\varepsilon_D^i = \varepsilon_D^m\left(\frac{Q_D^m}{Q_D^i}\right) + \varepsilon_S^j\left(\frac{Q_S^j}{Q_D^i}\right). \tag{236}$$

As $\left(\frac{Q_D^i}{Q_D^m}\right) = s_i$ and $\left(\frac{Q_S^j}{Q_D^i}\right) = \frac{(1-s_i)}{s_i}$ we finally get

$$\varepsilon_D^i = \frac{\varepsilon_D^m}{s_i} + \left(\frac{\varepsilon_S^j(1-s_i)}{s_i}\right). \tag{237}$$

Inserting Equation (236) into the classical Lerner index - elasticity relationship directly leads to Equation (237).

Specifics of the Herfindahl-Hirschman Index

It has to be shown that the following relation between the Lerner index L and the Herfindahl-Hirschman index HHI is true:

$$L = \frac{HHI}{\varepsilon_D^m}. \tag{238}$$

Following, for instance, Motta (2004: 123f.), it is assumed that firms compete in quantities, produce a homogenous good and have a constant marginal cost c_i. The profits of firm i are then given by

$$\pi_i = p(Q)q_i - c_i q_i, \text{ with } Q = q_i + \sum_{j \neq i} q_j. \tag{239}$$

Profit maximisation leads to the following first-order condition:

$$\frac{\partial \pi_i}{\partial q_i} = p(Q) + \frac{\partial p}{\partial q_i} q_i - c_i = 0.. \tag{240}$$

The equilibrium price p* is defined by the solution of all first-order conditions. At such a price, the first-order condition for firm I can be expressed as follows:

$$p^*(Q) - c_i = -\frac{\partial p}{\partial Q}\frac{\partial Q}{\partial q_i} q_i. \tag{241}$$

Dividing both sides by p* and multiplying the right-hand side by (Q/Q) we get

$$\frac{p^* - c_i}{p^*} = -\frac{\partial p}{\partial Q}\frac{Q}{p^*}\frac{q_i}{Q}. \tag{242}$$

This can be rewritten as

$$L_i = \frac{s_i}{\varepsilon_D^m}. \tag{243}$$

Given this 'Lerner index of market power for the firm i', it is also possible to derive an aggregate index of market power for an industry as a whole. If $L = \sum_i s_i L_i$ we get

$$L = \sum_i \frac{s_i^2}{\varepsilon_D^m} = \frac{HHI}{\varepsilon_D^m}. \tag{244}$$

Equation (244) basically shows that there is a direct relationship between industry concentration (HHI) and market power (L). Rearranging Equation (244) yields

$$P = \frac{\varepsilon_D^m \cdot c}{\left(\varepsilon_D^m - HHI\right)} \tag{245}$$

which can, for example, be used to derive so-called but-for prices, which are needed to estimate cartel damages (see, e.g., Clark et al., 2004: 65f.).

Furthermore, in merger cases, an important question is how the price changes from P_1 (pre-merger) to P_2 (post-merger) when the HHI changes from HHI_1 (pre-merger) to HHI_2 (post-merger). Simply applying Equation (244) for the pre-

merger and the post-merger equilibrium leads to the following expressions (see Nelson and Sun, 2001: 953f.):

$$\frac{p_1 - c}{p_1} = \frac{HHI_1}{\varepsilon_D^m} \quad \text{and} \quad \frac{p_2 - c}{p_2} = \frac{HHI_2}{\varepsilon_D^m}. \tag{246}$$

Calculating p_1 and p_2 as a function of HHI_1 and HHI_2 we get

$$p_1 = \frac{\varepsilon_D^m \cdot c_1}{\varepsilon_D^m - HHI_1} \quad \text{and} \quad p_2 = \frac{\varepsilon_D^m \cdot c_2}{\varepsilon_D^m - HHI_2}. \tag{247}$$

So

$$\frac{\Delta p}{p} = \frac{p_2 - p_1}{p_1} = \frac{p_2}{p_1} - 1 = \frac{c_2}{c_1}\frac{\varepsilon_D^m - HHI_1}{\varepsilon_D^m - HHI_2} - 1. \tag{248}$$

If it is assumed that there are no cost savings due to the merger (i.e., c_1=c_2) we get

$$\frac{\Delta p}{p} = \frac{\varepsilon_D^m - HHI_1}{\varepsilon_D^m - HHI_2} - 1 = \frac{HHI_2 - HHI_1}{\varepsilon_D^m - HHI_2} = \frac{\Delta HHI}{\varepsilon_D^m - HHI_2}. \tag{249}$$

Furthermore, as shown in section 2.4.2.1, HHI_2 can be expressed as follows

$$HHI_2 = \sum_i (s_i)^2 - (s_1)^2 - (s_2)^2 + (s_1 + s_2)^2 = \sum_i (s_i)^2 + 2s_1 s_2. \tag{250}$$

Therefore, the change in the HHI is given by

$$\Delta HHI = HHI_2 - HHI_1 = 2s_1 s_2. \tag{251}$$

and Equation (249) can be expressed in terms of market shares as follows

$$\frac{\Delta p}{p} = \frac{\Delta HHI}{\varepsilon_D^m - HHI_{postmerger}} = \frac{2s_1 s_2}{\varepsilon_D^m - \left(\sum_i (s_i)^2 + 2s_1 s_2\right)}. \tag{252}$$

6.6.11 Proof of Inequality (75) in Section 4.4

As discussed in section 4.4, an initial welfare assessment has to compare the welfare situation of a successful predation strategy against the welfare realised if the monopoly situation in the pre-predation period would have continued. Based on the setup shown in Figure 50, the welfare if predation is successful,

$$\begin{aligned} W_{Predation\ successful} = &\left[\left(t^{exit} - t^{entry}\right)\left(CS^{Pred}\right)\right] + \left[\left(t^{end} - t^{exit}\right)\left(CS^{Mono}\right)\right] + \\ &\left[\left(t^{exit} - t^{entry}\right)\left(\pi_E^{Pred}\right)\right] + \left[\left(t^{exit} - t^{entry}\right)\left(\pi_I^{Pred}\right) + \left(t^{end} - t^{exit}\right)\left(\pi_I^{Mono}\right)\right], \end{aligned} \tag{253}$$

has to be larger than the welfare realised in the case of continuous monopoly,

$$W_{\text{Continuous Monopoly}} = \left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(CS^{\text{Mono}}\right)\right] + \left[\left(t^{\text{end}} - t^{\text{exit}}\right)\left(CS^{\text{Mono}}\right)\right] + \left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(\pi_I^{\text{Mono}}\right)\right] + \left[\left(t^{\text{end}} - t^{\text{exit}}\right)\left(\pi_I^{\text{Mono}}\right)\right]. \tag{254}$$

Substituting $\left(t^{\text{exit}} - t^{\text{enrty}}\right) = \alpha$ and $\left(t^{\text{end}} - t^{\text{exit}}\right) = \beta$ and simplifying both expressions leads to

$$W_{\text{Continuous Monopoly}} = \alpha\left(CS^{\text{Mono}} + \pi_I^{\text{Mono}}\right) \tag{255}$$

$$W_{\text{Predation successful}} = \alpha\left(CS^{\text{Pred}} + \pi_E^{\text{Pred}} + \pi_I^{\text{Pred}}\right). \tag{256}$$

Further simplifying and rearranging leads to

$$CS^{\text{Pred}} - CS^{\text{Mono}} > \pi_I^{\text{Mono}} - \left(\pi_E^{\text{Pred}} + \pi_I^{\text{Pred}}\right). \tag{257}$$

6.6.12 Proof of Inequality (76) in Section 4.4

As discussed in section 4.4, antitrust rules and interventions increase welfare as long as the overall welfare realised with such interventions,

$$W_{\text{Antitrust}} = \left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(CS^{\text{Pred}}\right) + (t^{\text{end}} - t^{\text{exit}})(CS^{\text{Duo}})\right] + \left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(\pi_E^{\text{Pred}}\right) + \left(t^{\text{end}} - t^{\text{exit}}\right)\left(\pi_E^{\text{Duo}}\right)\right] + \left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(\pi_I^{\text{Pred}}\right) + \left(t^{\text{end}} - t^{\text{exit}}\right)\left(\pi_I^{\text{Duo}}\right)\right], \tag{258}$$

is larger than the welfare realised when the incumbent can successfully apply a predation strategy

$$W_{\text{No Antitrust}} = \left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(CS^{\text{Pred}}\right)\right] + \left[\left(t^{\text{end}} - t^{\text{exit}}\right)\left(CS^{\text{Mono}}\right)\right] + \left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(\pi_E^{\text{Pred}}\right)\right] + \left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(\pi_I^{\text{Pred}}\right) + \left(t^{\text{end}} - t^{\text{exit}}\right)\left(\pi_I^{\text{Mono}}\right)\right]. \tag{259}$$

Substituting $\left(t^{\text{exit}} - t^{\text{enrty}}\right) = \alpha$ and $\left(t^{\text{end}} - t^{\text{exit}}\right) = \beta$ and simplifying both expressions leads to

$$W_{\text{No Antitrust}} = \beta\left(CS^{\text{Mono}} + \pi_I^{\text{Mono}}\right), \tag{260}$$

$$W_{\text{Antitrust}} = \beta\left(CS^{\text{Duo}} + \pi_E^{\text{Duo}} + \pi_I^{\text{Duo}}\right). \tag{261}$$

Further simplifying and rearranging leads to

$$CS^{\text{Duo}} - CS^{\text{Mono}} > \pi_I^{\text{Mono}} - \left(\pi_E^{\text{Duo}} + \pi_I^{\text{Duo}}\right). \tag{262}$$

6.6.13 Proof of Inequalities (79) and (80) in Section 4.5.2.2

As discussed in section 4.5.2.2, optimal fines can be calculated on a gain-basis and on a harm-basis. In the following, proofs for both fines are provided.

Optimal gain-based fine

The optimal gain-based fine for an antitrust violation is equal to the additional gain the offender realises due to its misbehaviour. In the setup of Figure 50, the optimal fine is therefore defined as the difference between the incumbent's overall profits realised under successful predation

$$\pi_I^{Pred} = \left[\left(t^{exit} - t^{entry}\right)\left(\pi_I^{Pred}\right)\right] + \left[\left(t^{end} - t^{exit}\right)\left(\pi_I^{Mono}\right)\right] \tag{263}$$

and the incumbent's profit if it accommodates the entrant

$$\pi_I^{Duo} = \left[\left(t^{exit} - t^{entry}\right)\left(\pi_I^{Duo}\right)\right] + \left[\left(t^{emd} - t^{exit}\right)\left(\pi_I^{Duo}\right)\right]. \tag{264}$$

Substituting $\left(t^{exit} - t^{enrty}\right) = \alpha$ and $\left(t^{end} - t^{exit}\right) = \beta$ and simplifying both expressions leads to

$$\pi_I^{Pred} = \beta\pi_I^{Mono} + \alpha\pi_I^{Pred}, \tag{265}$$

$$\pi_I^{Duo} = \beta\pi_I^{Duo} + \alpha\pi_I^{Duo}. \tag{266}$$

Generally, the optimal gain-based fine is $F_{Gain\ based} = \pi_I^{Pred} - \pi_I^{Duo}$. Using the expressions above leads to the following optimal gain-based fine:

$$F_{Gain\ based} = \beta\left(\pi_I^{Mono} - \pi_I^{Duo}\right) + \alpha\left(\pi_I^{Pred} - \pi_I^{Duo}\right). \tag{267}$$

In a world in which predation enforcement is uncertain, the optimal fine derived above has to be divided by the probability of detection and punishment (ρ).[394] Furthermore, the enforcement cost has to be added. Therefore the optimal fine is then given by

$$F_{Gain\ based} = \frac{\beta\left(\pi_I^{Mono} - \pi_I^{Duo}\right) + \alpha\left(\pi_I^{Pred} - \pi_I^{Duo}\right)}{\rho} + C. \tag{268}$$

Optimal harm-based fine

As explained in the text, the optimal harm-based fine refers to the 'net harm to others' caused by the violation. In the predation period, harm is therefore given by

394 This is a basic result of the economic theory of the public enforcement of law (see, e.g., Polinsky and Shavell, 2000).

the sum of the difference between the duopoly and the predation consumer surpluses and the difference between the entrant's duopoly and predation profits

$$\text{Harm}_{\alpha} = \alpha\left[\left(CS^{Duo} - CS^{Pred}\right) + \left(\pi_E^{Duo} - \pi_E^{Pred}\right)\right]. \tag{269}$$

If predation is successful, the net harm to others is given by the difference between the duopoly and the monopoly consumer surpluses and the entrant's duopoly profits (it would have earned without a successful predation strategy)

$$\text{Harm}_{\beta} = \beta\left[\left(CS^{Duo} - CS^{Mono}\right) + \pi_E^{Duo}\right]. \tag{270}$$

The optimal harm-based fine is therefore given by

$$F_{\text{Harm based}} = \alpha\left[\left(CS^{Duo} - CS^{Pred}\right) + \left(\pi_E^{Duo} - \pi_E^{Pred}\right)\right] + \beta\left[\left(CS^{Duo} - CS^{Mono}\right) + \pi_E^{Duo}\right] \tag{271}$$

In a world in which predation enforcement is uncertain, the optimal fine derived above has to be divided by the probability of detection and punishment (ρ). Furthermore, the enforcement costs have to be added. The optimal fine is then given by

$$F_{\text{Harmbased}} = \frac{\alpha\left[\left(CS^{Duo} - CS^{Pred}\right) + \left(\pi_E^{Duo} - \pi_E^{Pred}\right)\right]}{\rho} + \frac{\left[\left(CS^{Duo} - CS^{Mono}\right) + \pi_E^{Duo}\right]}{\rho} + C. \tag{272}$$

An alternative definition of *harm* could be the cost that the violation has imposed on society. Such *harm* would ignore the distributive effects of a predation strategy (namely, the lower consumer surplus due to higher monopoly profits) and would only focus on the net welfare losses, which can be defined as the difference between the welfare level which would have been realised if the incumbent has accommodated the entrant

$$W_{\text{Accommodated}} = \left[\left(t^{exit} - t^{entry}\right)\left(CS^{Duo}\right)\right] + \left[\left(t^{end} - t^{exit}\right)\left(CS^{Duo}\right)\right] + \left[\left(t^{exit} - t^{entry}\right)\left(\pi_E^{Duo}\right)\right] + \left[\left(t^{end} - t^{exit}\right)\left(\pi_E^{Duo}\right)\right] + \left[\left(t^{exit} - t^{entry}\right)\left(\pi_I^{Duo}\right)\right] + \left[\left(t^{end} - t^{exit}\right)\left(\pi_I^{Duo}\right)\right], \tag{273}$$

and the welfare level which would have been realised if the incumbent has successfully applied a predation strategy

$$\left[\left(t^{exit} - t^{entry}\right)\left(\pi_E^{Pred}\right)\right] + \left[\left(t^{exit} - t^{entry}\right)\left(\pi_I^{Pred}\right) + \left(t^{end} - t^{exit}\right)\left(\pi_I^{Mono}\right)\right]. \tag{274}$$

Substituting $\left(t^{exit} - t^{enrty}\right) = \alpha$ and $\left(t^{end} - t^{exit}\right) = \beta$ and simplifying both expressions leads to

$$W_{\text{Accommodated}} = (\alpha+\beta)\left(CS^{\text{Duo}} + \pi_E^{\text{Duo}} + \pi_I^{\text{Duo}}\right), \tag{275}$$

$$W_{\text{Predation successful}} = \alpha\left(CS^{\text{Pred}} + \pi_E^{\text{Pred}} + \pi_I^{\text{Pred}}\right) + \beta\left(CS^{\text{Mono}} + \pi_I^{\text{Mono}}\right). \tag{276}$$

The optimal harm-based fine would then be given by

$$\begin{aligned} F_{\text{Harm based}} &= (\alpha+\beta)\left(CS^{\text{Duo}} + \pi_E^{\text{Duo}} + \pi_I^{\text{Duo}}\right) - \\ &\left\{\alpha\left(CS^{\text{Pred}} + \pi_E^{\text{Pred}} + \pi_I^{\text{Pred}}\right) + \beta\left(CS^{\text{Mono}} + \pi_I^{\text{Mono}}\right)\right\}. \end{aligned} \tag{277}$$

It can be shown (e.g., with the model and market specification used in section 4.5.3.2) that such an alternative definition of *harm* typically cannot reach a deterrence effect, as the gains of the violation are typically greater than the 'optimal' harm-based fine. Only if the entrant has a large efficiency advantage would this definition of a harm-based fine lead to a deterrence effect.

6.6.14 Proof of Inequality (83) in Section 4.5.2.2

The choice between an ex post I approach and an ex post II approach with an optimal fine can be expressed as follows. In an ex post I approach the overall welfare is given by

$$\begin{aligned} W_{\text{Ex post I}} = &\left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(CS^{\text{Pred}}\right) + (t^{\text{end}} - t^{\text{exit}})(CS^{\text{Duo}})\right] + \\ &\left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(\pi_E^{\text{Pred}}\right) + \left(t^{\text{end}} - t^{\text{exit}}\right)\left(\pi_E^{\text{Duo}}\right)\right] + \\ &\left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(\pi_I^{\text{Pred}}\right) + \left(t^{\text{end}} - t^{\text{exit}}\right)\left(\pi_I^{\text{Duo}}\right)\right]. \end{aligned} \tag{278}$$

As shown in section 4.5.2.2, the optimal fine is 0 in an ex post I approach, as the predator did not cause any harm. The overall welfare in an ex post II approach with an optimal fine is given by

$$\begin{aligned} W_{\text{Ex post II}} = &\left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(CS^{\text{Pred}}\right)\right] + \left[\left(t^{\text{end}} - t^{\text{exit}}\right)\left(CS^{\text{Mono}}\right)\right] + \\ &\left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(\pi_E^{\text{Pred}}\right)\right] + \left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(\pi_I^{\text{Pred}}\right) + \left(t^{\text{end}} - t^{\text{exit}}\right)\left(\pi_I^{\text{Mono}}\right)\right] + \\ &\left\{\alpha\left[\left(CS^{\text{Duo}} - CS^{\text{Pred}}\right) + \left(\pi_E^{\text{Duo}} - \pi_E^{\text{Pred}}\right)\right]\right\} + \varepsilon\left[\left(CS^{\text{Duo}} - CS^{\text{Mono}}\right) + \pi_E^{\text{Duo}}\right]. \end{aligned} \tag{279}$$

The welfare realised is just the welfare in an approach where the antitrust authority does not intervene and the welfare of collecting the optimal fine after ε periods. As the predator became successfully rid off the entrant, he can still charge monopoly prices for the remaining β-ε periods.

Substituting $\left(t^{\text{exit}} - t^{\text{enrty}}\right) = \alpha$ and $\left(t^{\text{end}} - t^{\text{exit}}\right) = \beta$ and simplifying both expressions leads to

$$W_{\text{Ex post I}} = \beta\left(CS^{\text{Duo}} + \pi_E^{\text{Duo}} + \pi_I^{\text{Duo}}\right), \tag{280}$$

$$\begin{aligned} W_{\text{Ex post II}} &= \beta\left(CS^{\text{Mono}} + \pi_I^{\text{Mono}}\right) + \\ &\left\{\alpha\left[\left(CS^{\text{Duo}} - CS^{\text{Pred}}\right) + \left(\pi_E^{\text{Duo}} - \pi_E^{\text{Pred}}\right)\right]\right\} + \varepsilon\left[\left(CS^{\text{Duo}} - CS^{\text{Mono}}\right) + \pi_E^{\text{Duo}}\right]. \end{aligned} \tag{281}$$

The welfare differential can be calculated by subtracting $W_{\text{Ex post II}}$ from $W_{\text{Ex post I}}$. The value of the positive differential shows how much the antitrust authority should invest at the maximum in the quicker but more expensive ex post I approach to increase overall welfare compared to an ex post II approach. This can be included in Equation (281) by assuming that the ex post I approach reduces the welfare by an additional enforcement cost *C*:

$$W_{\text{Ex post I}} = \beta\left(CS^{\text{Duo}} + \pi_E^{\text{Duo}} + \pi_I^{\text{Duo}}\right) - C. \tag{282}$$

6.6.15 Proof of Inequality (85) in Section 4.5.2.2

As discussed in section 4.5.2.2, an alternative to ex post antitrust rules is ex ante antitrust rules. If such rules work frictionless they turn predation into an unprofitable strategy before it is actually played by the incumbent. Consequently, the entrant will be accommodated under such a regime.

Ex ante rules are superior to ex post rules if the welfare realised under the former regime,

$$\begin{aligned} W_{\text{Ex-ante rule}} &= \left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(CS^{\text{Duo}}\right) + \left(t^{\text{end}} - t^{\text{exit}}\right)\left(CS^{\text{Duo}}\right)\right] + \\ &\left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(\pi_E^{\text{Duo}}\right) + \left(t^{\text{end}} - t^{\text{exit}}\right)\left(\pi_E^{\text{Duo}}\right)\right] + \\ &\left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(\pi_I^{\text{Duo}}\right) + \left(t^{\text{end}} - t^{\text{exit}}\right)\left(\pi_I^{\text{Duo}}\right)\right]. \end{aligned} \tag{283}$$

is larger than the welfare realised under an ex post regime,

$$\begin{aligned} W_{\text{Ex-post rule}} &= \left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(CS^{\text{Pred}}\right) + (t^{\text{end}} - t^{\text{exit}})(CS^{\text{Duo}})\right] + \\ &\left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(\pi_E^{\text{Pred}}\right) + \left(t^{\text{end}} - t^{\text{exit}}\right)\left(\pi_E^{\text{Duo}}\right)\right] + \\ &\left[\left(t^{\text{exit}} - t^{\text{entry}}\right)\left(\pi_I^{\text{Pred}}\right) + \left(t^{\text{end}} - t^{\text{exit}}\right)\left(\pi_I^{\text{Duo}}\right)\right]. \end{aligned} \tag{284}$$

Substituting $\left(t^{\text{exit}} - t^{\text{enrty}}\right) = \alpha$ and $\left(t^{\text{end}} - t^{\text{exit}}\right) = \beta$ and simplifying both expressions leads to

$$W_{\text{Ex-ante rule}} = \alpha\left(CS^{\text{Duo}} + \pi_E^{\text{Duo}} + \pi_I^{\text{Duo}}\right), \tag{285}$$

$$W_{\text{Ex-post rule}} = \alpha\left(CS^{\text{Pred}} + \pi_E^{\text{Pred}} + \pi_I^{\text{Pred}}\right). \tag{286}$$

Further simplifying and rearranging leads to

$$CS^{Duo} - CS^{Pred} > \pi_E^{Pred} + \pi_I^{Pred} - \pi_E^{Duo} - \pi_I^{Duo} . \quad (287)$$

6.7 Data Tables

Table 45. Deadweight loss (in % of GDP) against demand elasticity and price-cost margin (10% of industry monopolised)

		Price-cost margin																				
		0,00	*0,05*	*0,10*	*0,15*	*0,20*	*0,25*	*0,30*	*0,35*	*0,40*	*0,45*	*0,50*	*0,55*	*0,60*	*0,65*	*0,70*	*0,75*	*0,80*	*0,85*	*0,90*	*0,95*	*1,00*
Demand elasticity	*0,0*	0,0	0,0	0,0	0,0	0,0	0,0	0,00	0,00	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
	0,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	0,1	0,1	0,2	0,2	0,2	0,2	0,3	0,3	0,4	0,4	0,5	0,5
	0,2	0,0	0,0	0,0	0,0	0,0	0,1	0,1	0,1	0,2	0,2	0,3	0,3	0,4	0,4	0,5	0,6	0,6	0,7	0,8	0,9	1,0
	0,3	0,0	0,0	0,0	0,0	0,1	0,1	0,1	0,2	0,2	0,3	0,4	0,5	0,5	0,6	0,7	0,8	1,0	1,1	1,2	1,4	1,5
	0,4	0,0	0,0	0,0	0,0	0,1	0,1	0,2	0,2	0,3	0,4	0,5	0,6	0,7	0,8	1,0	1,1	1,3	1,4	1,6	1,8	2,0
	0,5	0,0	0,0	0,0	0,1	0,1	0,2	0,2	0,3	0,4	0,5	0,6	0,8	0,9	1,1	1,2	1,4	1,6	1,8	2,0	2,3	2,5
	0,6	0,0	0,0	0,0	0,1	0,1	0,2	0,3	0,4	0,5	0,6	0,8	0,9	1,1	1,3	1,5	1,7	1,9	2,2	2,4	2,7	3,0
	0,7	0,0	0,0	0,0	0,1	0,1	0,2	0,3	0,4	0,6	0,7	0,9	1,1	1,3	1,5	1,7	2,0	2,2	2,5	2,8	3,2	3,5
	0,8	0,0	0,0	0,0	0,1	0,2	0,3	0,4	0,5	0,6	0,8	1,0	1,2	1,4	1,7	2,0	2,3	2,6	2,9	3,2	3,6	4,0
	0,9	0,0	0,0	0,0	0,1	0,2	0,3	0,4	0,6	0,7	0,9	1,1	1,4	1,6	1,9	2,2	2,5	2,9	3,3	3,6	4,1	4,5
	1,0	0,0	0,0	0,1	0,1	0,2	0,3	0,5	0,6	0,8	1,0	1,3	1,5	1,8	2,1	2,5	2,8	3,2	3,6	4,1	4,5	5,0
	1,1	0,0	0,0	0,1	0,1	0,2	0,3	0,5	0,7	0,9	1,1	1,4	1,7	2,0	2,3	2,7	3,1	3,5	4,0	4,5	5,0	5,5
	1,2	0,0	0,0	0,1	0,1	0,2	0,4	0,5	0,7	1,0	1,2	1,5	1,8	2,2	2,5	2,9	3,4	3,8	4,3	4,9	5,4	6,0
	1,3	0,0	0,0	0,1	0,1	0,3	0,4	0,6	0,8	1,0	1,3	1,6	2,0	2,3	2,7	3,2	3,7	4,2	4,7	5,3	5,9	6,5
	1,4	0,0	0,0	0,1	0,2	0,3	0,4	0,6	0,9	1,1	1,4	1,8	2,1	2,5	3,0	3,4	3,9	4,5	5,1	5,7	6,3	7,0
	1,5	0,0	0,0	0,1	0,2	0,3	0,5	0,7	0,9	1,2	1,5	1,9	2,3	2,7	3,2	3,7	4,2	4,8	5,4	6,1	6,8	7,5
	1,6	0,0	0,0	0,1	0,2	0,3	0,5	0,7	1,0	1,3	1,6	2,0	2,4	2,9	3,4	3,9	4,5	5,1	5,8	6,5	7,2	8,0
	1,7	0,0	0,0	0,1	0,2	0,3	0,5	0,8	1,0	1,4	1,7	2,1	2,6	3,1	3,6	4,2	4,8	5,4	6,1	6,9	7,7	8,5
	1,8	0,0	0,0	0,1	0,2	0,4	0,6	0,8	1,1	1,4	1,8	2,3	2,7	3,2	3,8	4,4	5,1	5,8	6,5	7,3	8,1	9,0

	1,9	0,0	0,0	0,1	0,2	0,4	0,6	0,9	1,2	1,5	1,9	2,4	2,9	3,4	4,0	4,7	5,3	6,1	6,9	7,7	8,6	9,5
	2,0	0,0	0,0	0,1	0,2	0,4	0,6	0,9	1,2	1,6	2,0	2,5	3,0	3,6	4,2	4,9	5,6	6,4	7,2	8,1	9,0	10,0
	2,1	0,0	0,0	0,1	0,2	0,4	0,7	0,9	1,3	1,7	2,1	2,6	3,2	3,8	4,4	5,1	5,9	6,7	7,6	8,5	9,5	10,5
	2,2	0,0	0,0	0,1	0,2	0,4	0,7	1,0	1,3	1,8	2,2	2,8	3,3	4,0	4,6	5,4	6,2	7,0	7,9	8,9	9,9	11,0
	2,3	0,0	0,0	0,1	0,3	0,5	0,7	1,0	1,4	1,8	2,3	2,9	3,5	4,1	4,9	5,6	6,5	7,4	8,3	9,3	10,4	11,5
	2,4	0,0	0,0	0,1	0,3	0,5	0,8	1,1	1,5	1,9	2,4	3,0	3,6	4,3	5,1	5,9	6,8	7,7	8,7	9,7	10,8	12,0
	2,5	0,0	0,0	0,1	0,3	0,5	0,8	1,1	1,5	2,0	2,5	3,1	3,8	4,5	5,3	6,1	7,0	8,0	9,0	10,1	11,3	12,5
	2,6	0,0	0,0	0,1	0,3	0,5	0,8	1,2	1,6	2,1	2,6	3,3	3,9	4,7	5,5	6,4	7,3	8,3	9,4	10,5	11,7	13,0
	2,7	0,0	0,0	0,1	0,3	0,5	0,8	1,2	1,7	2,2	2,7	3,4	4,1	4,9	5,7	6,6	7,6	8,6	9,8	10,9	12,2	13,5
	2,8	0,0	0,0	0,1	0,3	0,6	0,9	1,3	1,7	2,2	2,8	3,5	4,2	5,0	5,9	6,9	7,9	9,0	10,1	11,3	12,6	14,0
	2,9	0,0	0,0	0,1	0,3	0,6	0,9	1,3	1,8	2,3	2,9	3,6	4,4	5,2	6,1	7,1	8,2	9,3	10,5	11,7	13,1	14,5
	3,0	0,0	0,0	0,2	0,3	0,6	0,9	1,4	1,8	2,4	3,0	3,8	4,5	5,4	6,3	7,4	8,4	9,6	10,8	12,2	13,5	15,0

Unit: %.

Table 46. Deadweight loss (in billion USD) against demand elasticity and price-cost margin (10% of industry monopolised)

		Price-cost margin																				
		0,00	*0,05*	*0,10*	*0,15*	*0,20*	*0,25*	*0,30*	*0,35*	*0,40*	*0,45*	*0,50*	*0,55*	*0,60*	*0,65*	*0,70*	*0,75*	*0,80*	*0,85*	*0,90*	*0,95*	*1,00*
Demand elasticity	*0,0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0,1	0	0	1	1	3	4	6	8	10	13	16	20	23	27	32	36	42	47	53	59	65
	0,2	0	0	1	3	5	8	12	16	21	26	32	39	47	55	64	73	83	94	105	117	130
	0,3	0	0	2	4	8	12	18	24	31	39	49	59	70	82	95	109	125	141	158	176	195
	0,4	0	1	3	6	10	16	23	32	42	53	65	78	93	110	127	146	166	187	210	234	259
	0,5	0	1	3	7	13	20	29	40	52	66	81	98	117	137	159	182	208	234	263	293	324
	0,6	0	1	4	9	16	24	35	48	62	79	97	118	140	164	191	219	249	281	315	351	389
	0,7	0	1	5	10	18	28	41	56	73	92	113	137	163	192	222	255	291	328	368	410	454
	0,8	0	1	5	12	21	32	47	64	83	105	130	157	187	219	254	292	332	375	420	468	519
	0,9	0	1	6	13	23	36	53	71	93	118	146	177	210	247	286	328	374	422	473	527	584
	1,0	0	2	6	15	26	41	58	79	104	131	162	196	233	274	318	365	415	469	525	585	648
	1,1	0	2	7	16	29	45	64	87	114	144	178	216	257	301	350	401	457	515	578	644	713
	1,2	0	2	8	18	31	49	70	95	125	158	195	235	280	329	381	438	498	562	630	702	778
	1,3	0	2	8	19	34	53	76	103	135	171	211	255	303	356	413	474	540	609	683	761	843
	1,4	0	2	9	20	36	57	82	111	145	184	227	275	327	384	445	511	581	656	735	819	908
	1,5	0	2	10	22	39	61	88	119	156	197	243	294	350	411	477	547	623	703	788	878	973
	1,6	0	3	10	23	42	65	93	127	166	210	259	314	374	438	508	584	664	750	840	936	1038
	1,7	0	3	11	25	44	69	99	135	176	223	276	333	397	466	540	620	706	796	893	995	1102
	1,8	0	3	12	26	47	73	105	143	187	236	292	353	420	493	572	657	747	843	945	1053	1167
	1,9	0	3	12	28	49	77	111	151	197	250	308	373	444	521	604	693	789	890	998	1112	1232
	2,0	0	3	13	29	52	81	117	159	208	263	324	392	467	548	636	730	830	937	1051	1171	1297
	2,1	0	3	14	31	54	85	123	167	218	276	340	412	490	575	667	766	872	984	1103	1229	1362

	2,2	0	4	14	32	57	89	128	175	228	289	357	432	514	603	699	802	913	1031	1156	1288	1427
	2,3	0	4	15	34	60	93	134	183	239	302	373	451	537	630	731	839	955	1078	1208	1346	1491
	2,4	0	4	16	35	62	97	140	191	249	315	389	471	560	658	763	875	996	1124	1261	1405	1556
	2,5	0	4	16	36	65	101	146	199	259	328	405	490	584	685	794	912	1038	1171	1313	1463	1621
	2,6	0	4	17	38	67	105	152	207	270	341	422	510	607	712	826	948	1079	1218	1366	1522	1686
	2,7	0	4	18	39	70	109	158	214	280	355	438	530	630	740	858	985	1121	1265	1418	1580	1751
	2,8	0	5	18	41	73	113	163	222	291	368	454	549	654	767	890	1021	1162	1312	1471	1639	1816
	2,9	0	5	19	42	75	118	169	230	301	381	470	569	677	795	921	1058	1204	1359	1523	1697	1881
	3,0	0	5	19	44	78	122	175	238	311	394	486	588	700	822	953	1094	1245	1406	1576	1756	1945

Unit: billion USD.

Table 47. Reduction in deadweight loss (in billion USD) due to antitrust enforcement

		Change in price-cost margin									
		0,1 to 0,0	*0,2 to 0,1*	*0,3 to 0,2*	*0,4 to 0,3*	*0,5 to 0,4*	*0,6 to 0,5*	*0,7 to 0,6*	*0,8 to 0,7*	*0,9 to 0,8*	*1,0 to 0,9*
Demand elasticity	*0,0*	0	0	0	0	0	0	0	0	0	0
	0,1	1	2	3	5	6	7	8	10	11	12
	0,2	1	4	6	9	12	14	17	19	22	25
	0,3	2	6	10	14	18	21	25	29	33	37
	0,4	3	8	13	18	23	29	34	39	44	49
	0,5	3	10	16	23	29	36	42	49	55	62
	0,6	4	12	19	27	35	43	51	58	66	74
	0,7	5	14	23	32	41	50	59	68	77	86
	0,8	5	16	26	36	47	57	67	78	88	99
	0,9	6	18	29	41	53	64	76	88	99	111
	1,0	6	19	32	45	58	71	84	97	110	123
	1,1	7	21	36	50	64	78	93	107	121	136
	1,2	8	23	39	54	70	86	101	117	132	148
	1,3	8	25	42	59	76	93	110	126	143	160
	1,4	9	27	45	64	82	100	118	136	154	172
	1,5	10	29	49	68	88	107	126	146	165	185
	1,6	10	31	52	73	93	114	135	156	176	197
	1,7	11	33	55	77	99	121	143	165	187	209
	1,8	12	35	58	82	105	128	152	175	198	222
	1,9	12	37	62	86	111	136	160	185	209	234
	2,0	13	39	65	91	117	143	169	195	220	246
	2,1	14	41	68	95	123	150	177	204	232	259

	2,2	14	43	71	100	128	157	185	214	243	271
	2,3	15	45	75	104	134	164	194	224	254	283
	2,4	16	47	78	109	140	171	202	233	265	296
	2,5	16	49	81	113	146	178	211	243	276	308
	2,6	17	51	84	118	152	185	219	253	287	320
	2,7	18	53	88	123	158	193	228	263	298	333
	2,8	18	54	91	127	163	200	236	272	309	345
	2,9	19	56	94	132	169	207	244	282	320	357
	3,0	19	58	97	136	175	214	253	292	331	370

Unit: billion USD.

Table 48. Percentage cost reduction sufficient to offset percentage price increases for different demand elasticities (range from 0,00 to 1,50)

		Demand elasticity															
		0,00	*0,10*	*0,20*	*0,30*	*0,40*	*0,50*	*0,60*	*0,70*	*0,80*	*0,90*	*1,00*	*1,10*	*1,20*	*1,30*	*1,40*	*1,50*
Price change	*0%*	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	1%	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,01	0,01
	2%	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,01	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,03
	3%	0,00	0,00	0,01	0,01	0,02	0,02	0,03	0,03	0,04	0,04	0,05	0,05	0,06	0,06	0,07	0,07
	4%	0,00	0,01	0,02	0,02	0,03	0,04	0,05	0,06	0,07	0,07	0,08	0,09	0,10	0,11	0,12	0,13
	5%	0,00	0,01	0,03	0,04	0,05	0,06	0,08	0,09	0,10	0,12	0,13	0,15	0,16	0,17	0,19	0,20
	6%	0,00	0,02	0,04	0,05	0,07	0,09	0,11	0,13	0,15	0,17	0,19	0,21	0,23	0,25	0,27	0,29
	7%	0,00	0,02	0,05	0,08	0,10	0,13	0,15	0,18	0,21	0,23	0,26	0,29	0,32	0,35	0,38	0,41
	8%	0,00	0,03	0,06	0,10	0,13	0,17	0,20	0,24	0,27	0,31	0,35	0,38	0,42	0,46	0,50	0,54
	9%	0,00	0,04	0,08	0,12	0,17	0,21	0,26	0,30	0,35	0,39	0,44	0,49	0,54	0,59	0,64	0,69
	10%	0,00	0,05	0,10	0,15	0,21	0,26	0,32	0,37	0,43	0,49	0,55	0,61	0,67	0,74	0,80	0,87
	11%	0,00	0,06	0,12	0,19	0,25	0,32	0,39	0,46	0,53	0,60	0,67	0,75	0,82	0,90	0,98	1,06
	12%	0,00	0,07	0,15	0,22	0,30	0,38	0,46	0,55	0,63	0,72	0,81	0,90	0,99	1,08	1,18	1,28
	13%	0,00	0,09	0,17	0,26	0,35	0,45	0,55	0,64	0,75	0,85	0,95	1,06	1,17	1,29	1,40	1,52
	14%	0,00	0,10	0,20	0,31	0,41	0,52	0,64	0,75	0,87	0,99	1,12	1,25	1,38	1,51	1,65	1,79
	15%	0,00	0,11	0,23	0,35	0,48	0,60	0,73	0,87	1,01	1,15	1,29	1,44	1,60	1,75	1,92	2,08
	16%	0,00	0,13	0,26	0,40	0,54	0,69	0,84	0,99	1,15	1,32	1,48	1,66	1,84	2,02	2,21	2,40
	17%	0,00	0,15	0,30	0,45	0,62	0,78	0,95	1,13	1,31	1,50	1,69	1,89	2,09	2,30	2,52	2,74
	18%	0,00	0,16	0,33	0,51	0,69	0,88	1,07	1,27	1,48	1,69	1,91	2,14	2,37	2,61	2,86	3,11
	19%	0,00	0,18	0,37	0,57	0,77	0,98	1,20	1,43	1,66	1,90	2,15	2,40	2,67	2,94	3,22	3,51
	20%	0,00	0,20	0,41	0,63	0,86	1,10	1,34	1,59	1,85	2,12	2,40	2,69	2,99	3,30	3,61	3,94
	21%	0,00	0,22	0,46	0,70	0,95	1,21	1,48	1,76	2,05	2,36	2,67	2,99	3,33	3,67	4,03	4,40

	22%	0,00	0,25	0,50	0,77	1,05	1,34	1,64	1,95	2,27	2,60	2,95	3,31	3,69	4,07	4,48	4,89
	23%	0,00	0,27	0,55	0,84	1,15	1,47	1,80	2,14	2,50	2,87	3,25	3,65	4,07	4,50	4,95	5,41
	24%	0,00	0,29	0,60	0,92	1,26	1,60	1,97	2,34	2,74	3,15	3,57	4,01	4,47	4,95	5,45	5,97
	25%	0,00	0,32	0,65	1,00	1,37	1,75	2,14	2,56	2,99	3,44	3,91	4,39	4,90	5,43	5,98	6,55
	26%	0,00	0,35	0,71	1,09	1,48	1,90	2,33	2,78	3,25	3,75	4,26	4,79	5,35	5,93	6,54	7,17
	27%	0,00	0,37	0,76	1,17	1,60	2,05	2,52	3,02	3,53	4,07	4,63	5,22	5,83	6,47	7,13	7,83
	28%	0,00	0,40	0,82	1,27	1,73	2,22	2,73	3,26	3,82	4,41	5,02	5,66	6,33	7,02	7,75	8,52
	29%	0,00	0,43	0,88	1,36	1,86	2,39	2,94	3,52	4,12	4,76	5,42	6,12	6,85	7,61	8,41	9,24
	30%	0,00	0,46	0,95	1,46	2,00	2,57	3,16	3,79	4,44	5,13	5,85	6,61	7,40	8,23	9,10	10,01

Unit: %.

Table 49. Overcharges and deadweight losses in the United States (1990-2005)

Market	Million Nominal US Dollars	Million Real 2005 US Dollars	Defensive DWL estimate (10%)	Aggressive DWL estimate (30%)	Total damage (defensive estimate)
Linerboard, US	11.000,00	13.033,18	1.303,32	3.909,95	14.336,50
Flat glass, US	8.700,00	10.494,57	1.049,46	3.148,37	11.544,03
DRAMs	4.700,00	5.549,11	554,91	1.664,73	6.104,02
Sulfuric acid, US	3.300,00	3.980,70	398,07	1.194,21	4.378,77
Insurance brokers, commercial, US	2.761,00	2.918,60	291,86	875,58	3.210,46
High-Fructose Corn Syrup, US	1.593,00	1.959,41	195,94	587,82	2.155,35
Corn Glucose Syrup, US	1.400,00	1.722,02	172,20	516,61	1.894,22
Carbon Fiber	1.375,00	2.627,70	262,77	788,31	2.890,47
Tobacco Leaf, US	1.220,00	1.648,82	164,88	494,65	1.813,70
Graphite Electrodes	1.025,00	1.376,11	137,61	412,83	1.513,72
Vitamin E	642,00	947,16	94,72	284,15	1.041,88
Vitamin Premixes	602,00	888,14	88,81	266,44	976,95
Vitamin C, US imports from China	411,00	419,39	41,94	125,82	461,33
Sorbates	400,00	1.056,25	105,63	316,88	1.161,88
Methionine	365,00	443,50	44,35	133,05	487,85
Carbon Black	335,00	360,60	36,06	108,18	396,66
Parcel Tankers, Chemical Shipping	300,00	335,18	33,52	100,55	368,70
Fine Arts (Art Auction Houses)	284,00	383,51	38,35	115,05	421,86
Explosives, commercial, US	280,00	432,87	43,29	129,86	476,16
Cardizem CD hypertension drug, US	274,00	274,10	27,41	82,23	301,51
Vitamin A	270,00	398,34	39,83	119,50	438,17

Vitamin C	242,00	431,08	43,11	129,32	474,19
Citric Acid	222,00	271,36	27,14	81,41	298,50
Vitamin B4, North America	167,00	273,24	27,32	81,97	300,56
Choline chloride (Vitamin B4)	158,00	380,39	38,04	114,12	418,43
Anti-anxiety drugs, US	150,00	136,49	13,65	40,95	150,14
Beta Carotene	120,00	160,63	16,06	48,19	176,69
Construction, USAID in Egypt	100,00	215,49	21,55	64,65	237,04
Lysine	80,00	97,79	9,78	29,34	107,57
Polyester staple, US and CA	60,00	63,63	6,36	19,09	69,99
Polychloroprene syn. Rubber	58,10	73,89	7,39	22,17	81,28
Vitamin B5 (Calpan)	57,00	113,66	11,37	34,10	125,03
Vitamin B12	50,00	60,75	6,08	18,23	66,83
Diamonds, Industrial	45,00	132,57	13,26	39,77	145,83
Vitamin B3 (Niacin)	41,70	61,52	6,15	18,46	67,67
Vitamin B2	31,70	51,87	5,19	15,56	57,06
Paper, thermal fax, US and CA	26,00	32,79	3,28	9,84	36,07
Biotin (Vitamin H)	25,00	30,38	3,04	9,11	33,42
Canthaxanthin	22,50	30,12	3,01	9,04	33,13
Methylglucamine	16,50	29,85	2,99	8,96	32,84
Ferrosilicon, US	16,50	23,08	2,31	6,92	25,39
Vitamin B6	13,00	15,80	1,58	4,74	17,38
Vitamin D	9,70	11,19	1,12	3,36	12,31
Aluminum Phosphide, US	9,50	11,98	1,20	3,59	13,18
Vitamin B1	9,10	11,06	1,11	3,32	12,17
Moving and storage, Germany-US	5,50	5,50	0,55	1,65	6,05

Stamp Auctions (Episode 1)	5,00	18,44	1,84	5,53	20,28
Folic Acid (Vitamin B9)	2,60	3,16	0,32	0,95	3,48
Carbon Cathode Block	2,50	3,89	0,39	1,17	4,28
Vitamin B4 (Choline Chloride) Europe	0,50	0,58	0,06	0,17	0,64
Total	*42.983,40*	*54.001,44*	*5.400,14*	*16.200,43*	*59.401,58*
Median	*154,00*	*243,43*	*24,34*	*73,03*	*267,77*
Mean	*859,67*	*1.080,03*	*108,00*	*324,01*	*1.188,03*

Source: Own calculations based on data from Connor and Helmers (2006: 49ff.).

Table 50. Overcharges and deadweight losses in Canada (1990-2005)

Market	Million Nominal US Dollars	Million Real 2005 US Dollars	Defensive DWL estimate (10%)	Aggressive DWL estimate (30%)	Total damage (defensive estimate)
Graphite Electrodes	185,00	272,93	27,29	81,88	300,22
Insurance brokers, commercial, US	144,00	149,84	14,98	44,95	164,82
Iron oxide, Canada	65,00	84,20	8,42	25,26	92,62
Vitamin Premixes	51,30	75,68	7,57	22,70	83,25
Carbon Black	50,00	52,74	5,27	15,82	58,01
Vitamin E	43,00	63,44	6,34	19,03	69,78
Methionine	39,00	45,03	4,50	13,51	49,53
Citric Acid	25,00	37,22	3,72	11,17	40,94
Vitamin C	17,00	30,28	3,03	9,08	33,31
Vitamin A	13,80	20,36	2,04	6,11	22,40
Choline chloride (Vitamin B4)	13,50	30,84	3,08	9,25	33,92
Sorbates	12,50	36,27	3,63	10,88	39,90
Vitamin B4, North America	10,60	17,34	1,73	5,20	19,07
Lysine	8,00	11,91	1,19	3,57	13,10
Beta Carotene	7,30	9,77	0,98	2,93	10,75
Vitamin B4 (Choline Chloride) Europe	3,90	5,22	0,52	1,57	5,74
Vitamin B6	3,60	4,16	0,42	1,25	4,58
Vitamin B5 (Calpan)	3,41	5,03	0,50	1,51	5,53
Diamonds, Industrial	3,10	3,73	0,37	1,12	4,10
Vitamin B2	2,53	4,14	0,41	1,24	4,55
Paper, thermal fax, US and CA	1,82	2,30	0,23	0,69	2,53

Insecticide, BT , CA	1,70	1,70	0,17	0,51	1,87
Vitamin B1	1,27	1,47	0,15	0,44	1,62
Vitamin B3 (Niacin)	1,25	2,37	0,24	0,71	2,61
Methylglucamine	0,90	1,63	0,16	0,49	1,79
Vitamin B12	0,89	1,59	0,16	0,48	1,75
Carbon Cathode Block	0,75	1,17	0,12	0,35	1,29
Vitamin D	0,68	0,75	0,08	0,23	0,83
Folic Acid (Vitamin B9)	0,45	0,52	0,05	0,16	0,57
Biotin (Vitamin H)	0,35	0,62	0,06	0,19	0,68
Canthaxanthin	0,19	0,26	0,03	0,08	0,29
Total	*711,79*	*974,51*	*97,45*	*292,35*	*1.071,96*
Median	*3,90*	*5,22*	*0,52*	*1,57*	*5,74*
Mean	*22,96*	*31,44*	*3,14*	*9,43*	*34,58*

Source: Own calculations based on data from Connor and Helmers (2006: 49ff.).

Table 51. Overcharges and deadweight losses in the European Union (1990-2005)

Market	Million Nominal US Dollars	Million Real 2005 US Dollars	Defensive DWL estimate (10%)	Aggressive DWL estimate (30%)	Total damage (defensive estimate)
Cable, high-voltage, Germany	14.256,00	39.272,70	3.927,27	11.781,81	43.199,97
Steel, flat stainless	9.300,00	11.328,20	1.132,82	3.398,46	12.461,02
PVC (polyvinyl-chloride) plastic	5.308,00	9.268,30	926,83	2.780,49	10.195,13
Cartonboard	3.000,00	4.692,50	469,25	1.407,75	5.161,75
Waste collection, Germany	2.800,00	2.913,60	291,36	874,08	3.204,96
Polypropylene plastic	2.417,00	3.172,30	317,23	951,69	3.489,53
Steel beams	2.320,00	4.114,90	411,49	1.234,47	4.526,39
TACA (Europe/No.Atlantic Shipping)	1.800,00	1.985,60	198,56	595,68	2.184,16
Petroleum, Iceland	1.625,00	2.413,40	241,34	724,02	2.654,74
Cement I, Germany	1.600,00	1.744,80	174,48	523,44	1.919,28
British Sugar	1.370,00	3.190,40	319,04	957,12	3.509,44
Graphite Electrodes	1.200,00	2.141,60	214,16	642,48	2.355,76
Vitamin Premixes	774,00	856,20	85,62	256,86	941,82
Vitamin E	699,00	1.247,50	124,75	374,25	1.372,25
Gasoline, FR	675,00	712,00	71,20	213,60	783,20
Gasoline, IT	661,00	719,30	71,93	215,79	791,23
Cell phones,	655,00	715,80	71,58	214,74	787,38
IT Insurance brokers, commercial, US	576,00	599,40	59,94	179,82	659,34
Citric Acid	570,00	1.128,20	112,82	338,46	1.241,02
Paper, carbonless	485,00	1.232,20	123,22	369,66	1.355,42
Compressed gases, NL	357,00	612,80	61,28	183,84	674,08

Vitamin A	319,00	569,30	56,93	170,79	626,23
Generic drugs, warfarin & penicillin, UK	316,00	344,60	34,46	103,38	379,06
Carbon Black	305,00	321,70	32,17	96,51	353,87
Parcel Tankers, Chemical Shipping	300,00	316,50	31,65	94,95	348,15
Steel pipes, insulated heating	242,00	360,30	36,03	108,09	396,33
Vitamin C	231,00	497,80	49,78	149,34	547,58
Steel tubes ("oil country tubes")	225,00	400,80	40,08	120,24	440,88
Construction, Netherlands	193,00	210,90	21,09	63,27	231,99
Beta Carotene	175,00	283,40	28,34	85,02	311,74
Choline chloride (Vitamin B4)	138,00	351,00	35,10	105,30	386,10
Construction, Norway	130,00	141,50	14,15	42,45	155,65
Fine Arts (Art Auction Houses)	122,00	178,90	17,89	53,67	196,79
Euro-Zone banks	112,00	100,60	10,06	30,18	110,66
Concrete, Eastern Germany	112,00	12,10	1,21	3,63	13,31
Lysine	105,00	191,40	19,14	57,42	210,54
Insurance, industrial property, Germany	100,00	105,50	10,55	31,65	116,05
Canthaxanthin	95,00	153,80	15,38	46,14	169,18
Vitamin B5 (Calpan)	92,00	164,20	16,42	49,26	180,62
Infant Formula (Episode 1), Italy	75,00	91,80	9,18	27,54	100,98
Gasoline, Sweden	57,00	60,90	6,09	18,27	66,99
Infant Formula (Episode 2), Italy	50,00	52,00	5,20	15,60	57,20
Vitamin B2	49,00	97,00	9,70	29,10	106,70
Danish air routes	49,00	53,20	5,32	15,96	58,52
Vitamin B12	47,00	54,30	5,43	16,29	59,73
Vitamin B3 (Niacin)	39,00	43,10	4,31	12,93	47,41

Vitamin B4 (Choline Chloride) Europe	30,00	54,30	5,43	16,29	59,73
Ferry services, English Channel	24,00	31,90	3,19	9,57	35,09
Vitamin B6	22,00	25,40	2,54	7,62	27,94
Hydro-Electric power equipment, NO	21,00	23,20	2,32	6,96	25,52
Biotin (Vitamin H)	18,50	39,90	3,99	11,97	43,89
Vitamin D	9,30	15,10	1,51	4,53	16,61
Zinc phosphate	8,00	13,00	1,30	3,90	14,30
Folic Acid (Vitamin B9)	7,70	8,90	0,89	2,67	9,79
Vitamin B1	6,60	7,60	0,76	2,28	8,36
Pharmaceuticals, respiratory, IT	6,50	7,10	0,71	2,13	7,81
Construction, public works, Meuse, France	2,80	3,00	0,30	0,90	3,30
Tobacco processing, Spain	2,60	3,70	0,37	1,11	4,07
Construction, SRO, Netherlands	1,80	3,10	0,31	0,93	3,41
Eurocheque	1,60	2,30	0,23	0,69	2,53
Paper, corrugated cardboard, Norway	1,10	1,40	0,14	0,42	1,54
Pharmaceuticals, cholesterol, IT	1,10	1,20	0,12	0,36	1,32
Total	*56.290,60*	*99.459,40*	*9.945,94*	*29.837,82*	*109.405,34*
Median	*134,00*	*201,15*	*20,12*	*60,35*	*221,27*
Mean	*907,91*	*1.604,18*	*160,42*	*481,26*	*1.764,60*

Source: Own calculations based on data from Connor and Helmers (2006: 49ff.).

Table 52. Overcharges and deadweight losses in other regions (1990-2005)

Market	Million Nominal US Dollars	Million Real 2005 US Dollars	Defensive DWL estimate (10%)	Aggressive DWL estimate (30%)	Total damage (defensive estimate)
Graphite Electrodes	1.100,00	13.033,18	1.303,32	3.909,95	14.336,50
Cement, Romania	909,00	957,50	95,75	287,25	1.053,25
Vitamin Premixes	700,70	801,70	80,17	240,51	881,87
Citric Acid	660,00	772,80	77,28	231,84	850,08
Vitamin C	640,00	1.037,50	103,75	311,25	1.141,25
Steel tubes ("oil country tubes")	638,00	755,50	75,55	226,65	831,05
Telephone services, local, Korea	567,00	611,00	61,10	183,30	672,10
Construction, Nigeria LNG plants	413,00	483,60	48,36	145,08	531,96
Vitamin E	359,00	482,00	48,20	144,60	530,20
Vitamin A	279,20	374,80	37,48	112,44	412,28
Canthaxanthin	244,30	275,00	27,50	82,50	302,50
Choline chloride (Vitamin B4)	226,00	267,60	26,76	80,28	294,36
Telephone services, long-distance, Korea	137,00	147,60	14,76	44,28	162,36
Insurance brokers, commercial, US	120,00	136,50	13,65	40,95	150,15
Broadband Internet service, Korea	118,00	127,20	12,72	38,16	139,92
Petroleum, Military fuels, Korea	96,00	116,10	11,61	34,83	127,71
Philippines telecom, US	95,00	96,90	9,69	29,07	106,59
Vitamin B12	93,10	110,30	11,03	33,09	121,33
Beta Carotene	77,70	87,50	8,75	26,25	96,25
Telephone services, international, Korea	73,00	78,70	7,87	23,61	86,57
Lysine	65,00	96,80	9,68	29,04	106,48

Vitamin B3 (Niacin)	41,10	47,00	4,70	14,10	51,70
Biotin (Vitamin H)	39,20	46,40	4,64	13,92	51,04
Vitamin B6	34,40	40,70	4,07	12,21	44,77
Transformers, power & distn, E. AU	27,50	47,20	4,72	14,16	51,92
Vitamin B5 (Calpan)	26,40	35,40	3,54	10,62	38,94
Vitamin B2	25,80	30,20	3,02	9,06	33,22
Coffee wholesaling, Hungary	15,30	13,10	1,31	3,93	14,41
Vitamin B1	12,00	14,20	1,42	4,26	15,62
Vitamin D	9,30	10,50	1,05	3,15	11,55
Folic Acid (Vitamin B9)	2,10	2,40	0,24	0,72	2,64
Coffee wholesaling, Czech Republic	0,50	0,40	0,04	0,12	0,44
Total	*7.844,60*	*21.137,28*	*2.113,73*	*6.341,18*	*23.251,01*
Median	*95,50*	*113,20*	*11,32*	*33,96*	*124,52*
Mean	*245,14*	*660,54*	*66,05*	*198,16*	*726,59*

Source: Own calculations based on data from Connor and Helmers (2006: 49ff.).

Table 53. Predicting the percentage post-merger price increase in a differentiated products industry (linear demand function; extract)

		Pre-merger price-cost margins										
		0	*0,05*	*0,1*	*0,15*	*0,2*	*0,25*	*0,3*	*0,35*	*0,4*	*0,45*	*0,5*
Diversion ratio	*0*	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
	0,05	0,00%	0,13%	0,26%	0,39%	0,53%	0,66%	0,79%	0,92%	1,05%	1,18%	1,32%
	0,1	0,00%	0,28%	0,56%	0,83%	1,11%	1,39%	1,67%	1,94%	2,22%	2,50%	2,78%
	0,15	0,00%	0,44%	0,88%	1,32%	1,76%	2,21%	2,65%	3,09%	3,53%	3,97%	4,41%
	0,2	0,00%	0,63%	1,25%	1,88%	2,50%	3,13%	3,75%	4,38%	5,00%	5,63%	6,25%
	0,25	0,00%	0,83%	1,67%	2,50%	3,33%	4,17%	5,00%	5,83%	6,67%	7,50%	8,33%
	0,3	0,00%	1,07%	2,14%	3,21%	4,29%	5,36%	6,43%	7,50%	8,57%	9,64%	10,71%
	0,35	0,00%	1,35%	2,69%	4,04%	5,38%	6,73%	8,08%	9,42%	10,77%	12,12%	13,46%
	0,4	0,00%	1,67%	3,33%	5,00%	6,67%	8,33%	10,00%	11,67%	13,33%	15,00%	16,67%
	0,45	0,00%	2,05%	4,09%	6,14%	8,18%	10,23%	12,27%	14,32%	16,36%	18,41%	20,45%
	0,5	0,00%	2,50%	5,00%	7,50%	10,00%	12,50%	15,00%	17,50%	20,00%	22,50%	25,00%
	0,55	0,00%	3,06%	6,11%	9,17%	12,22%	15,28%	18,33%	21,39%	24,44%	27,50%	30,56%
	0,6	0,00%	3,75%	7,50%	11,25%	15,00%	18,75%	22,50%	26,25%	30,00%	33,75%	37,50%
	0,65	0,00%	4,64%	9,29%	13,93%	18,57%	23,21%	27,86%	32,50%	37,14%	41,79%	46,43%
	0,7	0,00%	5,83%	11,67%	17,50%	23,33%	29,17%	35,00%	40,83%	46,67%	52,50%	58,33%
	0,75	0,00%	7,50%	15,00%	22,50%	30,00%	37,50%	45,00%	52,50%	60,00%	67,50%	75,00%
	0,8	0,00%	10,00%	20,00%	30,00%	40,00%	50,00%	60,00%	70,00%	80,00%	90,00%	100,00%
	0,85	0,00%	14,17%	28,33%	42,50%	56,67%	70,83%	85,00%	99,17%	113,33%	127,50%	141,67%
	0,9	0,00%	22,50%	45,00%	67,50%	90,00%	112,50%	135,00%	157,50%	180,00%	202,50%	225,00%
	0,95	0,00%	47,50%	95,00%	142,50%	190,00%	237,50%	285,00%	332,50%	380,00%	427,50%	475,00%
	1	Div/0	Div/0	Div/0	Div/0	Div/0	Div/0	Div/0	Div/0	Div/0	Div/0	Div/0

Table 54. Predicting the percentage post-merger price increase in a differentiated products industry (CES demand function; extract)

		Pre-merger price-cost margins										
		0	*0,05*	*0,1*	*0,15*	*0,2*	*0,25*	*0,3*	*0,35*	*0,4*	*0,45*	*0,5*
Diversion ratio	*0*	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
	0,05	0,00%	0,28%	0,59%	0,94%	1,33%	1,79%	2,31%	2,92%	3,64%	4,50%	5,56%
	0,1	0,00%	0,59%	1,25%	2,00%	2,86%	3,85%	5,00%	6,36%	8,00%	10,00%	12,50%
	0,15	0,00%	0,94%	2,00%	3,21%	4,62%	6,25%	8,18%	10,50%	13,33%	16,88%	21,43%
	0,2	0,00%	1,33%	2,86%	4,62%	6,67%	9,09%	12,00%	15,56%	20,00%	25,71%	33,33%
	0,25	0,00%	1,79%	3,85%	6,25%	9,09%	12,50%	16,67%	21,88%	28,57%	37,50%	50,00%
	0,3	0,00%	2,31%	5,00%	8,18%	12,00%	16,67%	22,50%	30,00%	40,00%	54,00%	75,00%
	0,35	0,00%	2,92%	6,36%	10,50%	15,56%	21,88%	30,00%	40,83%	56,00%	78,75%	116,67%
	0,4	0,00%	3,64%	8,00%	13,33%	20,00%	28,57%	40,00%	56,00%	80,00%	120,00%	200,00%
	0,45	0,00%	4,50%	10,00%	16,88%	25,71%	37,50%	54,00%	78,75%	120,00%	202,50%	450,00%
	0,5	0,00%	5,56%	12,50%	21,43%	33,33%	50,00%	75,00%	116,67%	200,00%	450,00%	Div/0
	0,55	0,00%	6,88%	15,71%	27,50%	44,00%	68,75%	110,00%	192,50%	440,00%	Div/0	-550,00%
	0,6	0,00%	8,57%	20,00%	36,00%	60,00%	100,00%	180,00%	420,00%	Div/0	-540,00%	-300,00%
	0,65	0,00%	10,83%	26,00%	48,75%	86,67%	162,50%	390,00%	Div/0	-520,00%	-292,50%	-216,67%
	0,7	0,00%	14,00%	35,00%	70,00%	140,00%	350,00%	Div/0	-490,00%	-280,00%	-210,00%	-175,00%
	0,75	0,00%	18,75%	50,00%	112,50%	300,00%	Div/0	-450,00%	-262,50%	-200,00%	-168,75%	-150,00%
	0,8	0,00%	26,67%	80,00%	240,00%	Div/0	-400,00%	-240,00%	-186,67%	-160,00%	-144,00%	-133,33%
	0,85	0,00%	42,50%	170,00%	Div/0	-340,00%	-212,50%	-170,00%	-148,75%	-136,00%	-127,50%	-121,43%
	0,9	0,00%	90,00%	Div/0	-270,00%	-180,00%	-150,00%	-135,00%	-126,00%	-120,00%	-115,71%	-112,50%
	0,95	0,00%	Div/0	-190,00%	-142,50%	-126,67%	-118,75%	-114,00%	-110,83%	-108,57%	-106,88%	-105,56%
	1	Div/0	-100,00%	-100,00%	-100,00%	-100,00%	-100,00%	-100,00%	-100,00%	-100,00%	-100,00%	-100,00%

Table 55. Percentage marginal cost reduction that restores pre-merger price in a homogenous product merger

		Market share of firm k										
		0	*0,05*	*0,1*	*0,15*	*0,2*	*0,25*	*0,3*	*0,35*	*0,4*	*0,45*	*0,5*
Market share of firm j	*0*	Div/0	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
	0,05	0,00%	5,26%	7,27%	8,57%	9,64%	10,64%	11,65%	12,73%	13,91%	15,25%	16,81%
	0,1	0,00%	7,27%	11,11%	13,79%	16,00%	18,02%	20,00%	22,05%	24,24%	26,67%	29,41%
	0,15	0,00%	8,57%	13,79%	17,65%	20,87%	23,81%	26,67%	29,58%	32,65%	36,00%	39,74%
	0,2	0,00%	9,64%	16,00%	20,87%	25,00%	28,78%	32,43%	36,13%	40,00%	44,17%	48,78%
	0,25	0,00%	10,64%	18,02%	23,81%	28,78%	33,33%	37,74%	42,17%	46,78%	51,72%	57,14%
	0,3	0,00%	11,65%	20,00%	26,67%	32,43%	37,74%	42,86%	48,00%	53,33%	59,02%	65,22%
	0,35	0,00%	12,73%	22,05%	29,58%	36,13%	42,17%	48,00%	53,85%	59,89%	66,32%	73,30%
	0,4	0,00%	13,91%	24,24%	32,65%	40,00%	46,78%	53,33%	59,89%	66,67%	73,85%	81,63%
	0,45	0,00%	15,25%	26,67%	36,00%	44,17%	51,72%	59,02%	66,32%	73,85%	81,82%	90,45%
	0,5	0,00%	16,81%	29,41%	39,74%	48,78%	57,14%	65,22%	73,30%	81,63%	90,45%	100,0%

Table 56. Percentage marginal cost reduction that restores pre-merger price in a differentiated products merger

		Pre-merger price-cost margins										
		0	*0,05*	*0,1*	*0,15*	*0,2*	*0,25*	*0,3*	*0,35*	*0,4*	*0,45*	*0,5*
Diversion ratio	*0*	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
	0,05	0,00%	0,28%	0,58%	0,93%	1,32%	1,75%	2,26%	2,83%	3,51%	4,31%	5,26%
	0,1	0,00%	0,58%	1,23%	1,96%	2,78%	3,70%	4,76%	5,98%	7,41%	9,09%	11,11%
	0,15	0,00%	0,93%	1,96%	3,11%	4,41%	5,88%	7,56%	9,50%	11,76%	14,44%	17,65%
	0,2	0,00%	1,32%	2,78%	4,41%	6,25%	8,33%	10,71%	13,46%	16,67%	20,45%	25,00%
	0,25	0,00%	1,75%	3,70%	5,88%	8,33%	11,11%	14,29%	17,95%	22,22%	27,27%	33,33%
	0,3	0,00%	2,26%	4,76%	7,56%	10,71%	14,29%	18,37%	23,08%	28,57%	35,06%	42,86%
	0,35	0,00%	2,83%	5,98%	9,50%	13,46%	17,95%	23,08%	28,99%	35,90%	44,06%	53,85%
	0,4	0,00%	3,51%	7,41%	11,76%	16,67%	22,22%	28,57%	35,90%	44,44%	54,55%	66,67%
	0,45	0,00%	4,31%	9,09%	14,44%	20,45%	27,27%	35,06%	44,06%	54,55%	66,94%	81,82%
	0,5	0,00%	5,26%	11,11%	17,65%	25,00%	33,33%	42,86%	53,85%	66,67%	81,82%	100,00%
	0,55	0,00%	6,43%	13,58%	21,57%	30,56%	40,74%	52,38%	65,81%	81,48%	100,00%	122,22%
	0,6	0,00%	7,89%	16,67%	26,47%	37,50%	50,00%	64,29%	80,77%	100,00%	122,73%	150,00%
	0,65	0,00%	9,77%	20,63%	32,77%	46,43%	61,90%	79,59%	100,00%	123,81%	151,95%	185,71%
	0,7	0,00%	12,28%	25,93%	41,18%	58,33%	77,78%	100,00%	125,64%	155,56%	190,91%	233,33%
	0,75	0,00%	15,79%	33,33%	52,94%	75,00%	100,00%	128,57%	161,54%	200,00%	245,45%	300,00%
	0,8	0,00%	21,05%	44,44%	70,59%	100,00%	133,33%	171,43%	215,38%	266,67%	327,27%	400,00%
	0,85	0,00%	29,82%	62,96%	100,00%	141,67%	188,89%	242,86%	305,13%	377,78%	463,64%	566,67%
	0,9	0,00%	47,37%	100,00%	158,82%	225,00%	300,00%	385,71%	484,62%	600,00%	736,36%	900,00%
	0,95	0,00%	100,00%	211,11%	335,29%	475,00%	633,33%	814,29%	1023,08%	1266,67%	1554,55%	1900,00%
	1	Div/0	Div/0	Div/0	Div/0	Div/0	Div/0	Div/0	Div/0	Div/0	Div/0	Div/0

Table 57. Market power I (20% market share)

		Demand elasticity																				
		1,0	*1,1*	*1,2*	*1,3*	*1,4*	*1,5*	*1,6*	*1,7*	*1,8*	*1,9*	*2,0*	*2,1*	*2,2*	*2,3*	*2,4*	*2,5*	*2,6*	*2,7*	*2,8*	*2,9*	*3,0*
Supply elasticity	*1,0*	0,11	0,11	0,10	0,10	0,09	0,09	0,08	0,08	0,08	0,07	0,07	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,06	0,05	0,05
	1,1	0,11	0,10	0,10	0,09	0,09	0,08	0,08	0,08	0,07	0,07	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05
	1,2	0,10	0,10	0,09	0,09	0,08	0,08	0,08	0,08	0,07	0,07	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05
	1,3	0,10	0,09	0,09	0,09	0,08	0,08	0,08	0,07	0,07	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05
	1,4	0,09	0,09	0,09	0,08	0,08	0,08	0,07	0,07	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05
	1,5	0,09	0,09	0,08	0,08	0,08	0,07	0,07	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05
	1,6	0,09	0,08	0,08	0,08	0,07	0,07	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05
	1,7	0,08	0,08	0,08	0,08	0,07	0,07	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05
	1,8	0,08	0,08	0,08	0,07	0,07	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05
	1,9	0,08	0,08	0,07	0,07	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,04
	2,0	0,08	0,07	0,07	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,04	0,04
	2,1	0,07	0,07	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,04	0,04	0,04
	2,2	0,07	0,07	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,04	0,04	0,04	0,04
	2,3	0,07	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,04	0,04	0,04	0,04
	2,4	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,04	0,04	0,04	0,04	0,04
	2,5	0,07	0,06	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,04	0,04	0,04	0,04	0,04	0,04
	2,6	0,06	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,04	0,04	0,04	0,04	0,04	0,04	0,04
	2,7	0,06	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04
	2,8	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04
	2,9	0,06	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04
	3,0	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04

Table 58. Market power II (40% market share)

		Demand elasticity																					
		1,0	*1,1*	*1,2*	*1,3*	*1,4*	*1,5*	*1,6*	*1,7*	*1,8*	*1,9*	*2,0*	*2,1*	*2,2*	*2,3*	*2,4*	*2,5*	*2,6*	*2,7*	*2,8*	*2,9*	*3,0*
Supply elasticity	*1,0*	0,25	0,24	0,22	0,21	0,20	0,19	0,18	0,17	0,17	0,16	0,15	0,15	0,14	0,14	0,13	0,13	0,13	0,12	0,12	0,11	0,11
	1,1	0,24	0,23	0,22	0,20	0,19	0,19	0,18	0,17	0,16	0,16	0,15	0,14	0,14	0,14	0,13	0,13	0,12	0,12	0,12	0,11	0,11
	1,2	0,23	0,22	0,21	0,20	0,19	0,18	0,17	0,17	0,16	0,15	0,15	0,14	0,14	0,13	0,13	0,12	0,12	0,12	0,11	0,11	0,11
	1,3	0,22	0,21	0,20	0,19	0,18	0,18	0,17	0,16	0,16	0,15	0,14	0,14	0,13	0,13	0,13	0,12	0,12	0,11	0,11	0,11	0,11
	1,4	0,22	0,21	0,20	0,19	0,18	0,17	0,16	0,16	0,15	0,15	0,14	0,14	0,13	0,13	0,12	0,12	0,12	0,11	0,11	0,11	0,10
	1,5	0,21	0,20	0,19	0,18	0,17	0,17	0,16	0,15	0,15	0,14	0,14	0,13	0,13	0,13	0,12	0,12	0,11	0,11	0,11	0,11	0,10
	1,6	0,20	0,19	0,19	0,18	0,17	0,16	0,16	0,15	0,14	0,14	0,14	0,13	0,13	0,12	0,12	0,12	0,11	0,11	0,11	0,10	0,10
	1,7	0,20	0,19	0,18	0,17	0,17	0,16	0,15	0,15	0,14	0,14	0,13	0,13	0,12	0,12	0,12	0,11	0,11	0,11	0,10	0,10	0,10
	1,8	0,19	0,18	0,18	0,17	0,16	0,16	0,15	0,14	0,14	0,13	0,13	0,13	0,12	0,12	0,11	0,11	0,11	0,11	0,10	0,10	0,10
	1,9	0,19	0,18	0,17	0,16	0,16	0,15	0,15	0,14	0,14	0,13	0,13	0,12	0,12	0,12	0,11	0,11	0,11	0,10	0,10	0,10	0,10
	2,0	0,18	0,17	0,17	0,16	0,15	0,15	0,14	0,14	0,13	0,13	0,13	0,12	0,12	0,11	0,11	0,11	0,11	0,10	0,10	0,10	0,10
	2,1	0,18	0,17	0,16	0,16	0,15	0,14	0,14	0,14	0,13	0,13	0,12	0,12	0,12	0,11	0,11	0,11	0,10	0,10	0,10	0,10	0,09
	2,2	0,17	0,17	0,16	0,15	0,15	0,14	0,14	0,13	0,13	0,12	0,12	0,12	0,11	0,11	0,11	0,10	0,10	0,10	0,10	0,09	0,09
	2,3	0,17	0,16	0,16	0,15	0,14	0,14	0,13	0,13	0,13	0,12	0,12	0,11	0,11	0,11	0,11	0,10	0,10	0,10	0,10	0,09	0,09
	2,4	0,16	0,16	0,15	0,15	0,14	0,14	0,13	0,13	0,12	0,12	0,12	0,11	0,11	0,11	0,10	0,10	0,10	0,10	0,09	0,09	0,09
	2,5	0,16	0,15	0,15	0,14	0,14	0,13	0,13	0,13	0,12	0,12	0,11	0,11	0,11	0,11	0,10	0,10	0,10	0,10	0,09	0,09	0,09
	2,6	0,16	0,15	0,14	0,14	0,14	0,13	0,13	0,12	0,12	0,12	0,11	0,11	0,11	0,10	0,10	0,10	0,10	0,09	0,09	0,09	0,09
	2,7	0,15	0,15	0,14	0,14	0,13	0,13	0,12	0,12	0,12	0,11	0,11	0,11	0,10	0,10	0,10	0,10	0,09	0,09	0,09	0,09	0,09
	2,8	0,15	0,14	0,14	0,13	0,13	0,13	0,12	0,12	0,11	0,11	0,11	0,11	0,10	0,10	0,10	0,10	0,09	0,09	0,09	0,09	0,09
	2,9	0,15	0,14	0,14	0,13	0,13	0,12	0,12	0,12	0,11	0,11	0,11	0,10	0,10	0,10	0,10	0,09	0,09	0,09	0,09	0,09	0,08
	3,0	0,14	0,14	0,13	0,13	0,13	0,12	0,12	0,11	0,11	0,11	0,11	0,10	0,10	0,10	0,10	0,09	0,09	0,09	0,09	0,09	0,08

Table 59. Market power III (60% market share)

		Demand elasticity																					
		1,0	*1,1*	*1,2*	*1,3*	*1,4*	*1,5*	*1,6*	*1,7*	*1,8*	*1,9*	*2,0*	*2,1*	*2,2*	*2,3*	*2,4*	*2,5*	*2,6*	*2,7*	*2,8*	*2,9*	*3,0*
Supply elasticity	*1,0*	0,43	0,40	0,38	0,35	0,33	0,32	0,30	0,29	0,27	0,26	0,25	0,24	0,23	0,22	0,21	0,21	0,20	0,19	0,19	0,18	0,18
	1,1	0,42	0,39	0,37	0,34	0,33	0,31	0,29	0,28	0,27	0,26	0,25	0,24	0,23	0,22	0,21	0,20	0,20	0,19	0,19	0,18	0,17
	1,2	0,41	0,38	0,36	0,34	0,32	0,30	0,29	0,28	0,26	0,25	0,24	0,23	0,22	0,22	0,21	0,20	0,19	0,19	0,18	0,18	0,17
	1,3	0,39	0,37	0,35	0,33	0,31	0,30	0,28	0,27	0,26	0,25	0,24	0,23	0,22	0,21	0,21	0,20	0,19	0,19	0,18	0,18	0,17
	1,4	0,38	0,36	0,34	0,32	0,31	0,29	0,28	0,27	0,25	0,24	0,23	0,23	0,22	0,21	0,20	0,20	0,19	0,18	0,18	0,17	0,17
	1,5	0,38	0,35	0,33	0,32	0,30	0,29	0,27	0,26	0,25	0,24	0,23	0,22	0,21	0,21	0,20	0,19	0,19	0,18	0,18	0,17	0,17
	1,6	0,37	0,34	0,33	0,31	0,29	0,28	0,27	0,26	0,25	0,24	0,23	0,22	0,21	0,20	0,20	0,19	0,19	0,18	0,17	0,17	0,16
	1,7	0,36	0,34	0,32	0,30	0,29	0,28	0,26	0,25	0,24	0,23	0,22	0,22	0,21	0,20	0,19	0,19	0,18	0,18	0,17	0,17	0,16
	1,8	0,35	0,33	0,31	0,30	0,28	0,27	0,26	0,25	0,24	0,23	0,22	0,21	0,21	0,20	0,19	0,19	0,18	0,18	0,17	0,17	0,16
	1,9	0,34	0,32	0,31	0,29	0,28	0,27	0,25	0,24	0,23	0,23	0,22	0,21	0,20	0,20	0,19	0,18	0,18	0,17	0,17	0,16	0,16
	2,0	0,33	0,32	0,30	0,29	0,27	0,26	0,25	0,24	0,23	0,22	0,21	0,21	0,20	0,19	0,19	0,18	0,18	0,17	0,17	0,16	0,16
	2,1	0,33	0,31	0,29	0,28	0,27	0,26	0,25	0,24	0,23	0,22	0,21	0,20	0,20	0,19	0,19	0,18	0,17	0,17	0,16	0,16	0,16
	2,2	0,32	0,30	0,29	0,28	0,26	0,25	0,24	0,23	0,22	0,22	0,21	0,20	0,19	0,19	0,18	0,18	0,17	0,17	0,16	0,16	0,15
	2,3	0,31	0,30	0,28	0,27	0,26	0,25	0,24	0,23	0,22	0,21	0,21	0,20	0,19	0,19	0,18	0,18	0,17	0,17	0,16	0,16	0,15
	2,4	0,31	0,29	0,28	0,27	0,25	0,24	0,23	0,23	0,22	0,21	0,20	0,20	0,19	0,18	0,18	0,17	0,17	0,16	0,16	0,16	0,15
	2,5	0,30	0,29	0,27	0,26	0,25	0,24	0,23	0,22	0,21	0,21	0,20	0,19	0,19	0,18	0,18	0,17	0,17	0,16	0,16	0,15	0,15
	2,6	0,29	0,28	0,27	0,26	0,25	0,24	0,23	0,22	0,21	0,20	0,20	0,19	0,19	0,18	0,17	0,17	0,16	0,16	0,16	0,15	0,15
	2,7	0,29	0,28	0,26	0,25	0,24	0,23	0,22	0,22	0,21	0,20	0,19	0,19	0,18	0,18	0,17	0,17	0,16	0,16	0,15	0,15	0,15
	2,8	0,28	0,27	0,26	0,25	0,24	0,23	0,22	0,21	0,21	0,20	0,19	0,19	0,18	0,18	0,17	0,17	0,16	0,16	0,15	0,15	0,15
	2,9	0,28	0,27	0,25	0,24	0,23	0,23	0,22	0,21	0,20	0,20	0,19	0,18	0,18	0,17	0,17	0,16	0,16	0,16	0,15	0,15	0,14
	3,0	0,27	0,26	0,25	0,24	0,23	0,22	0,21	0,21	0,20	0,19	0,19	0,18	0,18	0,17	0,17	0,16	0,16	0,15	0,15	0,15	0,14

Table 60. Market power IV (80% market share)

		Demand elasticity																					
		1,0	*1,1*	*1,2*	*1,3*	*1,4*	*1,5*	*1,6*	*1,7*	*1,8*	*1,9*	*2,0*	*2,1*	*2,2*	*2,3*	*2,4*	*2,5*	*2,6*	*2,7*	*2,8*	*2,9*	*3,0*
Supply elasticity	*1,0*	0,67	0,62	0,57	0,53	0,50	0,47	0,44	0,42	0,40	0,38	0,36	0,35	0,33	0,32	0,31	0,30	0,29	0,28	0,27	0,26	0,25
	1,1	0,66	0,61	0,56	0,53	0,49	0,47	0,44	0,42	0,40	0,38	0,36	0,34	0,33	0,32	0,31	0,29	0,28	0,27	0,26	0,26	0,25
	1,2	0,65	0,60	0,56	0,52	0,49	0,46	0,43	0,41	0,39	0,37	0,36	0,34	0,33	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,25
	1,3	0,63	0,59	0,55	0,51	0,48	0,45	0,43	0,41	0,39	0,37	0,35	0,34	0,33	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,25
	1,4	0,63	0,58	0,54	0,51	0,48	0,45	0,43	0,40	0,38	0,37	0,35	0,34	0,32	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,24
	1,5	0,62	0,57	0,53	0,50	0,47	0,44	0,42	0,40	0,38	0,36	0,35	0,33	0,32	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,24
	1,6	0,61	0,56	0,53	0,49	0,47	0,44	0,42	0,40	0,38	0,36	0,34	0,33	0,32	0,31	0,29	0,28	0,27	0,26	0,26	0,25	0,24
	1,7	0,60	0,56	0,52	0,49	0,46	0,43	0,41	0,39	0,37	0,36	0,34	0,33	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,25	0,24
	1,8	0,59	0,55	0,51	0,48	0,45	0,43	0,41	0,39	0,37	0,35	0,34	0,33	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,25	0,24
	1,9	0,58	0,54	0,51	0,48	0,45	0,43	0,40	0,38	0,37	0,35	0,34	0,32	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,24	0,24
	2,0	0,57	0,53	0,50	0,47	0,44	0,42	0,40	0,38	0,36	0,35	0,33	0,32	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,24	0,24
	2,1	0,56	0,53	0,49	0,47	0,44	0,42	0,40	0,38	0,36	0,34	0,33	0,32	0,31	0,29	0,28	0,27	0,26	0,26	0,25	0,24	0,23
	2,2	0,56	0,52	0,49	0,46	0,43	0,41	0,39	0,37	0,36	0,34	0,33	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,25	0,24	0,23
	2,3	0,55	0,51	0,48	0,45	0,43	0,41	0,39	0,37	0,35	0,34	0,33	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,25	0,24	0,23
	2,4	0,54	0,51	0,48	0,45	0,43	0,40	0,38	0,37	0,35	0,34	0,32	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,24	0,24	0,23
	2,5	0,53	0,50	0,47	0,44	0,42	0,40	0,38	0,36	0,35	0,33	0,32	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,24	0,24	0,23
	2,6	0,53	0,49	0,47	0,44	0,42	0,40	0,38	0,36	0,34	0,33	0,32	0,31	0,29	0,28	0,27	0,26	0,26	0,25	0,24	0,23	0,23
	2,7	0,52	0,49	0,46	0,43	0,41	0,39	0,37	0,36	0,34	0,33	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,25	0,24	0,23	0,23
	2,8	0,51	0,48	0,45	0,43	0,41	0,39	0,37	0,35	0,34	0,33	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,25	0,24	0,23	0,22
	2,9	0,51	0,48	0,45	0,43	0,40	0,38	0,37	0,35	0,34	0,32	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,24	0,24	0,23	0,22
	3,0	0,50	0,47	0,44	0,42	0,40	0,38	0,36	0,35	0,33	0,32	0,31	0,30	0,29	0,28	0,27	0,26	0,25	0,24	0,24	0,23	0,22

Table 61. Merger-induced percentage price increase for different changes in HHIs and post-merger HHIs (demand elasticity of 1,0; extract)

		Change in HHI												
		0	*50*	*100*	*150*	*200*	*250*	*300*	*350*	*400*	*450*	*500*	*550*	*600*
Post-merger HHI	*0*	0,00%	0,50%	1,00%	1,50%	2,00%	2,50%	3,00%	3,50%	4,00%	4,50%	5,00%	5,50%	6,00%
	250	0,00%	0,51%	1,03%	1,54%	2,05%	2,56%	3,08%	3,59%	4,10%	4,62%	5,13%	5,64%	6,15%
	500	0,00%	0,53%	1,05%	1,58%	2,11%	2,63%	3,16%	3,68%	4,21%	4,74%	5,26%	5,79%	6,32%
	750	0,00%	0,54%	1,08%	1,62%	2,16%	2,70%	3,24%	3,78%	4,32%	4,86%	5,41%	5,95%	6,49%
	1000	0,00%	0,56%	1,11%	1,67%	2,22%	2,78%	3,33%	3,89%	4,44%	5,00%	5,56%	6,11%	6,67%
	1250	0,00%	0,57%	1,14%	1,71%	2,29%	2,86%	3,43%	4,00%	4,57%	5,14%	5,71%	6,29%	6,86%
	1500	0,00%	0,59%	1,18%	1,76%	2,35%	2,94%	3,53%	4,12%	4,71%	5,29%	5,88%	6,47%	7,06%
	1750	0,00%	0,61%	1,21%	1,82%	2,42%	3,03%	3,64%	4,24%	4,85%	5,45%	6,06%	6,67%	7,27%
	2000	0,00%	0,63%	1,25%	1,88%	2,50%	3,13%	3,75%	4,38%	5,00%	5,63%	6,25%	6,88%	7,50%
	2250	0,00%	0,65%	1,29%	1,94%	2,58%	3,23%	3,87%	4,52%	5,16%	5,81%	6,45%	7,10%	7,74%
	2500	0,00%	0,67%	1,33%	2,00%	2,67%	3,33%	4,00%	4,67%	5,33%	6,00%	6,67%	7,33%	8,00%
	2750	0,00%	0,69%	1,38%	2,07%	2,76%	3,45%	4,14%	4,83%	5,52%	6,21%	6,90%	7,59%	8,28%
	3000	0,00%	0,71%	1,43%	2,14%	2,86%	3,57%	4,29%	5,00%	5,71%	6,43%	7,14%	7,86%	8,57%
	3250	0,00%	0,74%	1,48%	2,22%	2,96%	3,70%	4,44%	5,19%	5,93%	6,67%	7,41%	8,15%	8,89%
	3500	0,00%	0,77%	1,54%	2,31%	3,08%	3,85%	4,62%	5,38%	6,15%	6,92%	7,69%	8,46%	9,23%
	3750	0,00%	0,80%	1,60%	2,40%	3,20%	4,00%	4,80%	5,60%	6,40%	7,20%	8,00%	8,80%	9,60%
	4000	0,00%	0,83%	1,67%	2,50%	3,33%	4,17%	5,00%	5,83%	6,67%	7,50%	8,33%	9,17%	10,00%
	4250	0,00%	0,87%	1,74%	2,61%	3,48%	4,35%	5,22%	6,09%	6,96%	7,83%	8,70%	9,57%	10,43%
	4500	0,00%	0,91%	1,82%	2,73%	3,64%	4,55%	5,45%	6,36%	7,27%	8,18%	9,09%	10,00%	10,91%
	4750	0,00%	0,95%	1,90%	2,86%	3,81%	4,76%	5,71%	6,67%	7,62%	8,57%	9,52%	10,48%	11,43%
	5000	0,00%	1,00%	2,00%	3,00%	4,00%	5,00%	6,00%	7,00%	8,00%	9,00%	10,00%	11,00%	12,00%

Table 62. Merger-induced percentage price increase for different changes in HHIs and post-merger HHIs (demand elasticity of 1,5; extract)

		Change in HHI												
		0	*50*	*100*	*150*	*200*	*250*	*300*	*350*	*400*	*450*	*500*	*550*	*600*
Post-merger HHI	*0*	0,00%	0,33%	0,67%	1,00%	1,33%	1,67%	2,00%	2,33%	2,67%	3,00%	3,33%	3,67%	4,00%
	250	0,00%	0,34%	0,68%	1,02%	1,36%	1,69%	2,03%	2,37%	2,71%	3,05%	3,39%	3,73%	4,07%
	500	0,00%	0,34%	0,69%	1,03%	1,38%	1,72%	2,07%	2,41%	2,76%	3,10%	3,45%	3,79%	4,14%
	750	0,00%	0,35%	0,70%	1,05%	1,40%	1,75%	2,11%	2,46%	2,81%	3,16%	3,51%	3,86%	4,21%
	1000	0,00%	0,36%	0,71%	1,07%	1,43%	1,79%	2,14%	2,50%	2,86%	3,21%	3,57%	3,93%	4,29%
	1250	0,00%	0,36%	0,73%	1,09%	1,45%	1,82%	2,18%	2,55%	2,91%	3,27%	3,64%	4,00%	4,36%
	1500	0,00%	0,37%	0,74%	1,11%	1,48%	1,85%	2,22%	2,59%	2,96%	3,33%	3,70%	4,07%	4,44%
	1750	0,00%	0,38%	0,75%	1,13%	1,51%	1,89%	2,26%	2,64%	3,02%	3,40%	3,77%	4,15%	4,53%
	2000	0,00%	0,38%	0,77%	1,15%	1,54%	1,92%	2,31%	2,69%	3,08%	3,46%	3,85%	4,23%	4,62%
	2250	0,00%	0,39%	0,78%	1,18%	1,57%	1,96%	2,35%	2,75%	3,14%	3,53%	3,92%	4,31%	4,71%
	2500	0,00%	0,40%	0,80%	1,20%	1,60%	2,00%	2,40%	2,80%	3,20%	3,60%	4,00%	4,40%	4,80%
	2750	0,00%	0,41%	0,82%	1,22%	1,63%	2,04%	2,45%	2,86%	3,27%	3,67%	4,08%	4,49%	4,90%
	3000	0,00%	0,42%	0,83%	1,25%	1,67%	2,08%	2,50%	2,92%	3,33%	3,75%	4,17%	4,58%	5,00%
	3250	0,00%	0,43%	0,85%	1,28%	1,70%	2,13%	2,55%	2,98%	3,40%	3,83%	4,26%	4,68%	5,11%
	3500	0,00%	0,43%	0,87%	1,30%	1,74%	2,17%	2,61%	3,04%	3,48%	3,91%	4,35%	4,78%	5,22%
	3750	0,00%	0,44%	0,89%	1,33%	1,78%	2,22%	2,67%	3,11%	3,56%	4,00%	4,44%	4,89%	5,33%
	4000	0,00%	0,45%	0,91%	1,36%	1,82%	2,27%	2,73%	3,18%	3,64%	4,09%	4,55%	5,00%	5,45%
	4250	0,00%	0,47%	0,93%	1,40%	1,86%	2,33%	2,79%	3,26%	3,72%	4,19%	4,65%	5,12%	5,58%
	4500	0,00%	0,48%	0,95%	1,43%	1,90%	2,38%	2,86%	3,33%	3,81%	4,29%	4,76%	5,24%	5,71%
	4750	0,00%	0,49%	0,98%	1,46%	1,95%	2,44%	2,93%	3,41%	3,90%	4,39%	4,88%	5,37%	5,85%
	5000	0,00%	0,50%	1,00%	1,50%	2,00%	2,50%	3,00%	3,50%	4,00%	4,50%	5,00%	5,50%	6,00%

Table 63. Optimal length of the ex-ante rule period against α and δ

		Alpha										
		0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Delta	*0*	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
	1	3	2	1	0	-1	-2	-3	-4	-5	-6	-7
	2	6	5	4	3	2	1	0	-1	-2	-3	-4
	3	8	7	6	5	4	3	2	1	0	-1	-2
	4	11	10	9	8	7	6	5	4	3	2	1
	5	14	13	12	11	10	9	8	7	6	5	4
	6	17	16	15	14	13	12	11	10	9	8	7
	7	20	19	18	17	16	15	14	13	12	11	10
	8	23	22	21	20	19	18	17	16	15	14	13
	9	25	24	23	22	21	20	19	18	17	16	15
	10	28	27	26	25	24	23	22	21	20	19	18

Assumptions: Q=1000-1000p; MC (Incumbent)=0,28; MC (Entrant)=0,21; FC=10.

Table 64. Optimal harm-based fine against α and β

		alpha										
		0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
beta	*0*	0	-40,03	-80,06	-120,09	-160,12	-200,15	-240,18	-280,21	-320,24	-360,27	-400,3
	1	133,22	93,19	53,16	13,13	-26,9	-66,93	-106,96	-146,99	-187,02	-227,05	-267,08
	2	266,44	226,41	186,38	146,35	106,32	66,29	26,26	-13,77	-53,8	-93,83	-133,86
	3	399,66	359,63	319,6	279,57	239,54	199,51	159,48	119,45	79,42	39,39	-0,64
	4	532,88	492,85	452,82	412,79	372,76	332,73	292,7	252,67	212,64	172,61	132,58
	5	666,1	626,07	586,04	546,01	505,98	465,95	425,92	385,89	345,86	305,83	265,8
	6	799,32	759,29	719,26	679,23	639,2	599,17	559,14	519,11	479,08	439,05	399,02
	7	932,54	892,51	852,48	812,45	772,42	732,39	692,36	652,33	612,3	572,27	532,24
	8	1065,76	1025,73	985,7	945,67	905,64	865,61	825,58	785,55	745,52	705,49	665,46
	9	1198,98	1158,95	1118,92	1078,89	1038,86	998,83	958,8	918,77	878,74	838,71	798,68
	10	1332,2	1292,17	1252,14	1212,11	1172,08	1132,05	1092,02	1051,99	1011,96	971,93	931,9
	11	1465,42	1425,39	1385,36	1345,33	1305,3	1265,27	1225,24	1185,21	1145,18	1105,15	1065,12
	12	1598,64	1558,61	1518,58	1478,55	1438,52	1398,49	1358,46	1318,43	1278,4	1238,37	1198,34
	13	1731,86	1691,83	1651,8	1611,77	1571,74	1531,71	1491,68	1451,65	1411,62	1371,59	1331,56
	14	1865,08	1825,05	1785,02	1744,99	1704,96	1664,93	1624,9	1584,87	1544,84	1504,81	1464,78
	15	1998,3	1958,27	1918,24	1878,21	1838,18	1798,15	1758,12	1718,09	1678,06	1638,03	1598
	16	2131,52	2091,49	2051,46	2011,43	1971,4	1931,37	1891,34	1851,31	1811,28	1771,25	1731,22
	17	2264,74	2224,71	2184,68	2144,65	2104,62	2064,59	2024,56	1984,53	1944,5	1904,47	1864,44
	18	2397,96	2357,93	2317,9	2277,87	2237,84	2197,81	2157,78	2117,75	2077,72	2037,69	1997,66
	19	2531,18	2491,15	2451,12	2411,09	2371,06	2331,03	2291	2250,97	2210,94	2170,91	2130,88
	20	2664,4	2624,37	2584,34	2544,31	2504,28	2464,25	2424,22	2384,19	2344,16	2304,13	2264,1

Table 65. Welfare differential between ‘ex post I’ and ‘ex post II with optimal fine’ against β and ε

		epsilon										
		0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
beta	*10*	705,75	572,53	439,31	306,09	172,87	39,65	*-93,57*	*-226,79*	*-360,01*	*-493,23*	*-626,45*
	11	756,31	623,09	489,87	356,65	223,43	90,21	*-43,01*	*-176,23*	*-309,45*	*-442,67*	*-575,89*
	12	806,87	673,65	540,43	407,21	273,99	140,77	7,55	*-125,67*	*-258,89*	*-392,11*	*-525,33*
	13	857,43	724,21	590,99	457,77	324,55	191,33	58,11	*-75,11*	*-208,33*	*-341,55*	*-474,77*
	14	907,99	774,77	641,55	508,33	375,11	241,89	108,67	*-24,55*	*-157,77*	*-290,99*	*-424,21*
	15	958,55	825,33	692,11	558,89	425,67	292,45	159,23	26,01	*-107,21*	*-240,43*	*-373,65*
	16	1009,11	875,89	742,67	609,45	476,23	343,01	209,79	76,57	*-56,65*	*-189,87*	*-323,09*
	17	1059,67	926,45	793,23	660,01	526,79	393,57	260,35	127,13	*-6,09*	*-139,31*	*-272,53*
	18	1110,23	977,01	843,79	710,57	577,35	444,13	310,91	177,69	44,47	*-88,75*	*-221,97*
	19	1160,79	1027,57	894,35	761,13	627,91	494,69	361,47	228,25	95,03	*-38,19*	*-171,41*
	20	1211,35	1078,13	944,91	811,69	678,47	545,25	412,03	278,81	145,59	12,37	*-120,85*
	21	1261,91	1128,69	995,47	862,25	729,03	595,81	462,59	329,37	196,15	62,93	*-70,29*
	22	1312,47	1179,25	1046,03	912,81	779,59	646,37	513,15	379,93	246,71	113,49	*-19,73*
	23	1363,03	1229,81	1096,59	963,37	830,15	696,93	563,71	430,49	297,27	164,05	30,83
	24	1413,59	1280,37	1147,15	1013,93	880,71	747,49	614,27	481,05	347,83	214,61	81,39
	25	1464,15	1330,93	1197,71	1064,49	931,27	798,05	664,83	531,61	398,39	265,17	131,95

Assumptions: Q=1000-1000p; MC (Incumbent)=0,28; MC (Entrant)=0,21; FC=10; Alpha=5.

Table 66. Predicted lysine 'but-for' prices applying a basic Cournot model with homogenous goods (HHI=3.500)

		Demand elasticity															
		0	*0,1*	*0,2*	*0,3*	*0,4*	*0,5*	*0,6*	*0,7*	*0,8*	*0,9*	*1,0*	*1,1*	*1,2*	*1,3*	*1,4*	*1,5*
Marginal cost of lysine production	*0,40*	0,00	-0,16	-0,53	-2,40	3,20	1,33	0,96	0,80	0,71	0,65	0,62	0,59	0,56	0,55	0,53	0,52
	0,41	0,00	-0,16	-0,55	-2,46	3,28	1,37	0,98	0,82	0,73	0,67	0,63	0,60	0,58	0,56	0,55	0,53
	0,42	0,00	-0,17	-0,56	-2,52	3,36	1,40	1,01	0,84	0,75	0,69	0,65	0,62	0,59	0,57	0,56	0,55
	0,43	0,00	-0,17	-0,57	-2,58	3,44	1,43	1,03	0,86	0,76	0,70	0,66	0,63	0,61	0,59	0,57	0,56
	0,44	0,00	-0,18	-0,59	-2,64	3,52	1,47	1,06	0,88	0,78	0,72	0,68	0,65	0,62	0,60	0,59	0,57
	0,45	0,00	-0,18	-0,60	-2,70	3,60	1,50	1,08	0,90	0,80	0,74	0,69	0,66	0,64	0,62	0,60	0,59
	0,46	0,00	-0,18	-0,61	-2,76	3,68	1,53	1,10	0,92	0,82	0,75	0,71	0,67	0,65	0,63	0,61	0,60
	0,47	0,00	-0,19	-0,63	-2,82	3,76	1,57	1,13	0,94	0,84	0,77	0,72	0,69	0,66	0,64	0,63	0,61
	0,48	0,00	-0,19	-0,64	-2,88	3,84	1,60	1,15	0,96	0,85	0,79	0,74	0,70	0,68	0,66	0,64	0,63
	0,49	0,00	-0,20	-0,65	-2,94	3,92	1,63	1,18	0,98	0,87	0,80	0,75	0,72	0,69	0,67	0,65	0,64
	0,50	0,00	-0,20	-0,67	-3,00	4,00	1,67	1,20	1,00	0,89	0,82	0,77	0,73	0,71	0,68	0,67	0,65
	0,51	0,00	-0,20	-0,68	-3,06	4,08	1,70	1,22	1,02	0,91	0,83	0,78	0,75	0,72	0,70	0,68	0,67
	0,52	0,00	-0,21	-0,69	-3,12	4,16	1,73	1,25	1,04	0,92	0,85	0,80	0,76	0,73	0,71	0,69	0,68
	0,53	0,00	-0,21	-0,71	-3,18	4,24	1,77	1,27	1,06	0,94	0,87	0,82	0,78	0,75	0,73	0,71	0,69
	0,54	0,00	-0,22	-0,72	-3,24	4,32	1,80	1,30	1,08	0,96	0,88	0,83	0,79	0,76	0,74	0,72	0,70
	0,55	0,00	-0,22	-0,73	-3,30	4,40	1,83	1,32	1,10	0,98	0,90	0,85	0,81	0,78	0,75	0,73	0,72
	0,56	0,00	-0,22	-0,75	-3,36	4,48	1,87	1,34	1,12	1,00	0,92	0,86	0,82	0,79	0,77	0,75	0,73
	0,57	0,00	-0,23	-0,76	-3,42	4,56	1,90	1,37	1,14	1,01	0,93	0,88	0,84	0,80	0,78	0,76	0,74
	0,58	0,00	-0,23	-0,77	-3,48	4,64	1,93	1,39	1,16	1,03	0,95	0,89	0,85	0,82	0,79	0,77	0,76
	0,59	0,00	-0,24	-0,79	-3,54	4,72	1,97	1,42	1,18	1,05	0,97	0,91	0,87	0,83	0,81	0,79	0,77
	0,60	0,00	-0,24	-0,80	-3,60	4,80	2,00	1,44	1,20	1,07	0,98	0,92	0,88	0,85	0,82	0,80	0,78
	0,61	0,00	-0,24	-0,81	-3,66	4,88	2,03	1,46	1,22	1,08	1,00	0,94	0,89	0,86	0,83	0,81	0,80

0,62	0,00	-0,25	-0,83	-3,72	4,96	2,07	1,49	1,24	1,10	1,01	0,95	0,91	0,88	0,85	0,83	0,81
0,63	0,00	-0,25	-0,84	-3,78	5,04	2,10	1,51	1,26	1,12	1,03	0,97	0,92	0,89	0,86	0,84	0,82
0,64	0,00	-0,26	-0,85	-3,84	5,12	2,13	1,54	1,28	1,14	1,05	0,98	0,94	0,90	0,88	0,85	0,83
0,65	0,00	-0,26	-0,87	-3,90	5,20	2,17	1,56	1,30	1,16	1,06	1,00	0,95	0,92	0,89	0,87	0,85
0,66	0,00	-0,26	-0,88	-3,96	5,28	2,20	1,58	1,32	1,17	1,08	1,02	0,97	0,93	0,90	0,88	0,86
0,67	0,00	-0,27	-0,89	-4,02	5,36	2,23	1,61	1,34	1,19	1,10	1,03	0,98	0,95	0,92	0,89	0,87
0,68	0,00	-0,27	-0,91	-4,08	5,44	2,27	1,63	1,36	1,21	1,11	1,05	1,00	0,96	0,93	0,91	0,89
0,69	0,00	-0,28	-0,92	-4,14	5,52	2,30	1,66	1,38	1,23	1,13	1,06	1,01	0,97	0,94	0,92	0,90
0,70	0,00	-0,28	-0,93	-4,20	5,60	2,33	1,68	1,40	1,24	1,15	1,08	1,03	0,99	0,96	0,93	0,91
0,71	0,00	-0,28	-0,95	-4,26	5,68	2,37	1,70	1,42	1,26	1,16	1,09	1,04	1,00	0,97	0,95	0,93
0,72	0,00	-0,29	-0,96	-4,32	5,76	2,40	1,73	1,44	1,28	1,18	1,11	1,06	1,02	0,99	0,96	0,94
0,73	0,00	-0,29	-0,97	-4,38	5,84	2,43	1,75	1,46	1,30	1,19	1,12	1,07	1,03	1,00	0,97	0,95
0,74	0,00	-0,30	-0,99	-4,44	5,92	2,47	1,78	1,48	1,32	1,21	1,14	1,09	1,04	1,01	0,99	0,97
0,75	0,00	-0,30	-1,00	-4,50	6,00	2,50	1,80	1,50	1,33	1,23	1,15	1,10	1,06	1,03	1,00	0,98
0,76	0,00	-0,30	-1,01	-4,56	6,08	2,53	1,82	1,52	1,35	1,24	1,17	1,11	1,07	1,04	1,01	0,99
0,77	0,00	-0,31	-1,03	-4,62	6,16	2,57	1,85	1,54	1,37	1,26	1,18	1,13	1,09	1,05	1,03	1,00
0,78	0,00	-0,31	-1,04	-4,68	6,24	2,60	1,87	1,56	1,39	1,28	1,20	1,14	1,10	1,07	1,04	1,02
0,79	0,00	-0,32	-1,05	-4,74	6,32	2,63	1,90	1,58	1,40	1,29	1,22	1,16	1,12	1,08	1,05	1,03
0,80	0,00	-0,32	-1,07	-4,80	6,40	2,67	1,92	1,60	1,42	1,31	1,23	1,17	1,13	1,09	1,07	1,04
0,81	0,00	-0,32	-1,08	-4,86	6,48	2,70	1,94	1,62	1,44	1,33	1,25	1,19	1,14	1,11	1,08	1,06
0,82	0,00	-0,33	-1,09	-4,92	6,56	2,73	1,97	1,64	1,46	1,34	1,26	1,20	1,16	1,12	1,09	1,07
0,83	0,00	-0,33	-1,11	-4,98	6,64	2,77	1,99	1,66	1,48	1,36	1,28	1,22	1,17	1,14	1,11	1,08
0,84	0,00	-0,34	-1,12	-5,04	6,72	2,80	2,02	1,68	1,49	1,37	1,29	1,23	1,19	1,15	1,12	1,10
0,85	0,00	-0,34	-1,13	-5,10	6,80	2,83	2,04	1,70	1,51	1,39	1,31	1,25	1,20	1,16	1,13	1,11
0,86	0,00	-0,34	-1,15	-5,16	6,88	2,87	2,06	1,72	1,53	1,41	1,32	1,26	1,21	1,18	1,15	1,12

	0,87	0,00	-0,35	-1,16	-5,22	6,96	2,90	2,09	1,74	1,55	1,42	1,34	1,28	1,23	1,19	1,16	1,13
	0,88	0,00	-0,35	-1,17	-5,28	7,04	2,93	2,11	1,76	1,56	1,44	1,35	1,29	1,24	1,20	1,17	1,15
	0,89	0,00	-0,36	-1,19	-5,34	7,12	2,97	2,14	1,78	1,58	1,46	1,37	1,31	1,26	1,22	1,19	1,16
	0,90	0,00	-0,36	-1,20	-5,40	7,20	3,00	2,16	1,80	1,60	1,47	1,38	1,32	1,27	1,23	1,20	1,17

Table 67. Deadweight loss per year in the Netherlands due to the proposed Nuon-Reliant merger for varying percentage price increases and demand elasticities

		Demand elasticity										
		0	*0,05*	*0,1*	*0,15*	*0,2*	*0,25*	*0,3*	*0,35*	*0,4*	*0,45*	*0,5*
% price increase due to merger	*1%*	0	0,01	0,02	0,04	0,05	0,06	0,07	0,08	0,10	0,11	0,12
	2%	0	0,05	0,10	0,14	0,19	0,24	0,29	0,34	0,38	0,43	0,48
	3%	0	0,11	0,22	0,32	0,43	0,54	0,65	0,76	0,86	0,97	1,08
	4%	0	0,19	0,38	0,58	0,77	0,96	1,15	1,35	1,54	1,73	1,92
	5%	0	0,30	0,60	0,90	1,20	1,50	1,80	2,10	2,40	2,70	3,00
	6%	0	0,43	0,86	1,30	1,73	2,16	2,59	3,03	3,46	3,89	4,32
	7%	0	0,59	1,18	1,77	2,35	2,94	3,53	4,12	4,71	5,30	5,89
	8%	0	0,77	1,54	2,31	3,07	3,84	4,61	5,38	6,15	6,92	7,69
	9%	0	0,97	1,95	2,92	3,89	4,86	5,84	6,81	7,78	8,76	9,73
	10%	0	1,20	2,40	3,60	4,80	6,01	7,21	8,41	9,61	10,81	12,01
	11%	0	1,45	2,91	4,36	5,81	7,27	8,72	10,17	11,63	13,08	14,53
	12%	0	1,73	3,46	5,19	6,92	8,65	10,38	12,11	13,84	15,57	17,30
	13%	0	2,03	4,06	6,09	8,12	10,15	12,18	14,21	16,24	18,27	20,30
	14%	0	2,35	4,71	7,06	9,42	11,77	14,12	16,48	18,83	21,19	23,54
	15%	0	2,70	5,40	8,11	10,81	13,51	16,21	18,92	21,62	24,32	27,02
	16%	0	3,07	6,15	9,22	12,30	15,37	18,45	21,52	24,60	27,67	30,75
	17%	0	3,47	6,94	10,41	13,88	17,36	20,83	24,30	27,77	31,24	34,71
	18%	0	3,89	7,78	11,67	15,57	19,46	23,35	27,24	31,13	35,02	38,91
	19%	0	4,34	8,67	13,01	17,34	21,68	26,02	30,35	34,69	39,02	43,36
	20%	0	4,80	9,61	14,41	19,22	24,02	28,83	33,63	38,43	43,24	48,04

Unit: million € per year.

Table 68. Surplus redistribution per year from consumers to producers due to the proposed Nuon-Reliant merger for different percentage price increases and demand elasticities

		Demand elasticity										
		0	*0,05*	*0,1*	*0,15*	*0,2*	*0,25*	*0,3*	*0,35*	*0,4*	*0,45*	*0,5*
% price increase due to merger	*1%*	48,043	48,02	47,99	47,97	47,95	47,92	47,90	47,87	47,85	47,83	47,80
	2%	96,086	95,99	95,89	95,80	95,70	95,61	95,51	95,41	95,32	95,22	95,13
	3%	144,129	143,91	143,70	143,48	143,26	143,05	142,83	142,62	142,40	142,18	141,97
	4%	192,172	191,79	191,40	191,02	190,63	190,25	189,87	189,48	189,10	188,71	188,33
	5%	240,215	239,61	239,01	238,41	237,81	237,21	236,61	236,01	235,41	234,81	234,21
	6%	288,258	287,39	286,53	285,66	284,80	283,93	283,07	282,20	281,34	280,48	279,61
	7%	336,301	335,12	333,95	332,77	331,59	330,42	329,24	328,06	326,88	325,71	324,53
	8%	384,344	382,81	381,27	379,73	378,19	376,66	375,12	373,58	372,04	370,51	368,97
	9%	432,387	430,44	428,50	426,55	424,60	422,66	420,71	418,77	416,82	414,88	412,93
	10%	480,43	478,03	475,63	473,22	470,82	468,42	466,02	463,61	461,21	458,81	456,41
	11%	528,473	525,57	522,66	519,75	516,85	513,94	511,03	508,13	505,22	502,31	499,41
	12%	576,516	573,06	569,60	566,14	562,68	559,22	555,76	552,30	548,84	545,38	541,93
	13%	624,559	620,50	616,44	612,38	608,32	604,26	600,20	596,14	592,08	588,02	583,96
	14%	672,602	667,89	663,19	658,48	653,77	649,06	644,35	639,64	634,94	630,23	625,52
	15%	720,645	715,24	709,84	704,43	699,03	693,62	688,22	682,81	677,41	672,00	666,60
	16%	768,688	762,54	756,39	750,24	744,09	737,94	731,79	725,64	719,49	713,34	707,19
	17%	816,731	809,79	802,85	795,90	788,96	782,02	775,08	768,14	761,19	754,25	747,31
	18%	864,774	856,99	849,21	841,43	833,64	825,86	818,08	810,29	802,51	794,73	786,94
	19%	912,817	904,15	895,47	886,80	878,13	869,46	860,79	852,11	843,44	834,77	826,10
	20%	960,86	951,25	941,64	932,03	922,43	912,82	903,21	893,60	883,99	874,38	864,77

Unit: million € per year.

Table 69. Critical loss (could-approach) for linear demand function, different margins and price changes

Variable margin (in %)	*Price change (in %)*					
	5	*10*	*15*	*20*	*25*	*30*
10	33,33%	50,00%	60,00%	66,67%	71,43%	75,00%
20	20,00%	33,33%	42,86%	50,00%	55,56%	60,00%
30	14,29%	25,00%	33,33%	40,00%	45,45%	50,00%
40	11,11%	20,00%	27,27%	33,33%	38,46%	42,86%
50	9,10%	16,67%	23,08%	28,57%	33,33%	37,50%
60	7,69%	14,29%	20,00%	25,00%	29,41%	33,33%
70	6,67%	12,50%	17,65%	22,22%	26,32%	30,00%
80	5,88%	11,11%	15,79%	20,00%	23,81%	27,27%

Table 70. Critical loss (would-approach) for linear demand function, different margins and price changes

Variable margin (in %)	*Price change (in %)*					
	5	*10*	*15*	*20*	*25*	*30*
10	25,00%	33,33%	37,50%	40,00%	41,67%	42,86%
20	16,67%	25,00%	30,00%	33,33%	35,71%	37,50%
30	12,50%	20,00%	25,00%	28,57%	31,25%	33,33%
40	10,00%	16,67%	21,43%	25,00%	27,78%	30,00%
50	8,33%	14,29%	18,75%	22,22%	25,00%	27,27%
60	7,14%	12,50%	16,67%	20,00%	22,73%	25,00%
70	6,25%	11,11%	15,00%	18,18%	20,83%	23,08%
80	5,56%	10,00%	13,64%	16,67%	19,23%	21,43%

Table 71. Critical loss (would-approach) for iso-elastic demand function, different margins and price changes

Variable margin (in %)	*Price change (in %)*					
	5	*10*	*15*	*20*	*25*	*30*
10	28,93%	40,80%	47,42%	51,77%	54,91%	57,37%
20	18,53%	29,52%	36,86%	42,13%	46,22%	49,45%
30	13,62%	23,06%	30,08%	35,44%	39,74%	43,41%
40	10,75%	18,92%	25,33%	30,56%	34,85%	38,61%
50	8,90%	16,01%	21,92%	26,78%	31,11%	34,80%
60	7,60%	13,90%	19,25%	23,93%	27,97%	31,46%
70	6,60%	12,32%	17,19%	21,53%	25,51%	28,90%
80	5,87%	10,98%	15,56%	19,65%	23,32%	26,63%

Table 72. Critical loss (could-approach) for linear demand function, different relative prices and diversion ratios, $M^A<M^B$

Relative price (B to A)	*Diversion ratio*					
	0	*0,1*	*0,2*	*0,3*	*0,4*	*0,5*
0,6	9,09%	9,73%	10,46%	11,31%	12,32%	13,51%
0,8	9,09%	9,96%	11,01%	12,32%	13,97%	16,13%
1	9,09%	10,20%	11,63%	13,51%	16,13%	20,00%
1,2	9,09%	10,46%	12,32%	14,97%	19,08%	26,32%
1,4	9,09%	10,73%	13,09%	16,78%	23,36%	38,46%

Relative price (B to A)	*Diversion ratio*				
	0,6	*0,7*	*0,8*	*0,9*	*1*
0,6	14,97%	16,78%	19,08%	22,12%	26,32%
0,8	19,08%	23,36%	30,12%	42,37%	71,43%
1	26,32%	38,46%	71,43%	500,00%	-100,00%
1,2	42,37%	108,70%	-192,31%	-51,02%	-29,41%
1,4	108,70%	-131,58%	-40,98%	-24,27%	-17,24%

Assumptions: M^A=0,5, M^B=0,6; X^A=0,05.

Table 73. Critical loss (could-approach) for linear demand function, different relative prices and diversion ratios, $M^A > M^B$

Relative price (B to A)	*Diversion ratio*					
	0	*0,1*	*0,2*	*0,3*	*0,4*	*0,5*
0,6	7,69%	8,06%	8,47%	8,93%	9,43%	10,00%
0,8	7,69%	8,20%	8,77%	9,43%	10,20%	11,11%
1	7,69%	8,33%	9,09%	10,00%	11,11%	12,50%
1,2	7,69%	8,47%	9,43%	10,64%	12,20%	14,29%
1,4	7,69%	8,62%	9,80%	11,36%	13,51%	16,67%

Relative price (B to A)	*Diversion ratio*				
	0,6	*0,7*	*0,8*	*0,9*	*1*
0,6	10,64%	11,36%	12,20%	13,16%	14,29%
0,8	12,20%	13,51%	15,15%	17,24%	20,00%
1	14,29%	16,67%	20,00%	25,00%	33,33%
1,2	17,24%	21,74%	29,41%	45,45%	100,00%
1,4	21,74%	31,25%	55,56%	250,00%	-71,43%

Assumptions: M^A=0,6, M^B=0,5; X^A=0,05.

List of Figures

List of Tables

List of Boxes

List of Abbreviations

AA	American Airlines
AD	Antitrust Division (US)
AG	Aktiengesellschaft (Germany)
AT	Airtours
ABA	American Bar Association
ADM	Archer Daniels Midland Company
AMR	AMR Corp. (parent company of American Airlines)
APX	Amsterdam Power Exchange
ARC	German Act against Restraints of Competition
ACCC	Australian Competition and Consumer Commission
ADSL	Asymmetric Digital Subscriber Line
AIDS	Almost Ideal Demand System
AKZO	AKZO Chemie BV
BC	Before Christ
BKartA	Bundeskartellamt (Germany)
BvDEP	Bureau van Dijk Electronic Publishing
CA	Competition Act (UK)
CAN	Canada
CAT	Competition Appeal Tribunal (UK)
CES	Constant Elasticity of Substitution
CFI	Court of First Instance (EU)
DG	Directorate General (EU)
DLH	Deutsche Lufthansa AG
DOJ	Department of Justice (US)
DOT	Department of Transportation (US)
DTe	Office of Energy Regulation (The Netherlands)
DPAG	Deutsche Post AG
EC	European Commission
EU	European Union
ECN	Energy Research Centre of the Netherlands
ECS	Engineering and Chemical Supplies Ltd.
ECU	European Currency Unit
EEC	European Economic Area
FE	Frontier Economics Ltd.
FBI	Federal Bureau of Investigation (US)
FTC	Federal Trade Commission (US)
FCO	Federal Cartel Office (Germany)

FFP	Frequent Flyer Program
FMA	Financial Markets Authority (The Netherlands)
FMCG	Fast Moving Consumer Goods
GAO	General Accounting Office (US)
GCP	Gross Corporate Product
GCR	Global Competition Review
GDP	Gross Domestic Product
GER	Germania Fluggesellschaft mbH
GNP	Gross National Product
GWB	Gesetz gegen Wettbewerbsbeschränkungen (Germany)
HMT	Hypothetical Monopolist Test
ICN	International Competition Network
IMF	International Monetary Fund
LLP	Limited Liability Partnership
LTD	Limited
M&A	Merger & Acquisition
MC	Marginal cost
MW	Mega Watts
MEA	Ministry of Economic Affairs (The Netherlands)
NMa	Competition Authority (The Netherlands)
NPV	Net present value
NZa	Healthcare Authority (The Netherlands)
NERA	National Economic Research Associates Ltd.
OJ	Office Journal
OFT	Office of Fair Trading (UK)
OECD	Organisation for Economic Cooperation and Development
OPTA	Post and Telecommunications Authority (The Netherlands)
OXERA	Oxford Economic Research Associates Ltd.
R&D	Research & Development
RBB	Ridyard Bishop Baker Economics Ltd.
ROI	Return on Investment
SIC	Standard Industrial Classification
SSNDP	Small but Significant Non-Transitory Decrease in Price
SSNIP	Small but Significant Non-Transitory Increase in Price
TWA	Trans World Airlines
UK	United Kingdom
US	United States of America
ZEW	Zentrum für Europäische Wirtschaftsforschung

List of Mathematical Symbols

α	Number of predation periods
β	Number of post-predation periods
δ	Discount factor, end of ex ante rule until end of market
ε	Number of periods after the antitrust authority imposes fine
ε_D^M	Market demand elasticity
ε_D^I	Firm demand elasticity
ε_{ij}	Cross-price elasticity
ε_S	Market supply elasticity
θ	Likelihood of tough antitrust authority
κ	Firm-specific expenditure on rent-seeking
λ	Dissipation ratio, Lagrange multiplier
μ	Conjectural elasticity
π	Profit
π^M	Monopoly profit
σ	Conjectural-variation elasticity
τ	Probability that realised price is above investigation threshold
φ	Probability that market entry is successful
χ	Minimum length of ex ante rule
ψ	Pass-on rate
ω	Probability of an audit of the industry by the antitrust authority
A	Advertising expenses
a	Vertical intercept of the demand curve
AC	Average cost
AL	Actual loss
AAC	Average avoidable cost
AIC	Average incremental cost
ATC	Average total cost
AVC	Average variable cost
B	Budget, iso-budget curve
b	Slope of the demand curve
C	Costs, cost function
c	Marginal cost
CL	Critical loss

CR ..... Concentration ratio
CS ..... Consumer surplus
D ..... Diversion ratio
Duo ..... Duopoly
DWL ..... Deadweight loss
E ..... Entrant
ENC ..... Entropy coefficient
F ..... Fine, gain-based fine
F_C ..... Fixed cost
Fight ..... Aggression by the incumbent
g ..... Investigation threshold
H ..... Harm, harm-based fine
HHI ..... Herfindahl Hirschman index
HKI ..... Hannah-Kay index
I ..... Incumbent, investigation cost
K ..... Strategic investment
L ..... Lerner index, number of leader firms
M ..... Price-cost margin
m ..... Number of merging firms
MC ..... Marginal cost
MR ..... Marginal revenue
MS ..... Market share
Mono ..... Monopoly
N ..... Number of firms
NEE ..... Net external effect (of a horizontal merger)
NPV ..... Net present value
P ..... Market price
P^C ..... Market price under perfect competition
P^M ..... Market price under monopoly
P_d ..... Probability of detection
P_p ..... Probability of punishment
PI ..... Productive inefficiency
Pr, Prob ..... Probability
PS ..... Producer surplus
Pred ..... Predation
Q ..... Market quantity, product quality
q ..... Firm quantity
Q^C ..... Quantity supplied under perfect competition
Q^M ..... Quantity supplied under monopoly
R^C ..... Revenue under perfect competition
R^M ..... Revenue under monopoly
RSA ..... Rent-seeking activities
S ..... Fixed sunk costs, sales
s_i ..... Market share of firm i
t^{end} ..... Point in time of end of market or new entry

t^{exit} ..... Point in time of exit
t^{entry} ..... Point in time of entry
t_0^{int} ..... Point in time of fixing an ex ante rule
t_1^{int} ..... Point in time of enforcing with an ex post I approach
t_2^{int} ..... Point in time of enforcing with an ex post II approach
TW ..... Total welfare
U^c ..... Price-cost markup
V ..... Variation coefficient
$V(Q_1)$ ..... Variable costs of product 1
$W(Q_2)$ ..... Variable costs of product 2
W ..... Net social welfare, iso-welfare curve
w ..... Wholesale price
X ..... Percentage change in price
X_a ..... Probability that guilty firm gets away
X_c ..... Probability that innocent firm is falsely convicted
Z ..... Arc elasticity of demand

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