Discussion Paper No. 04-87

I Like The Way You Move

An Empirical Investigation into the Mechanisms Behind First Mover and Follower Strategies

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Non-technical summary

There has been a lot of discussion among scholars and business leaders whether it is beneficial for a firm to be the first to bring an innovation to the market ("first mover") or to wait until someone else does and than imitate the new products or services ("follower"). No clear cut answer has been provided for this question. There is evidence that first movers outperform followers, but cases have been found for which the opposite is true. Many factors influencing the decision to become a first mover or a follower have been identified in the relevant literature. First mover advantages can arise in the form of learning curve effects or a temporary monopoly in utilizing a new technology. Switching costs for buyers from the first mover to a potential follower are also given as a reason why first movers have an advantage over followers. There are however also disadvantages of moving first or rather advantages of being a follower: Followers are able to free ride on the investment of the first mover, profit from the resolution of technological and market uncertainty and may not experience the "incumbent inertia" which sometimes hampers innovative activities of first movers. The literature on first movers has not only identified the potential advantages and disadvantages of first movers but also the specific factors at the firm and industry-level that either hamper the realization of these advantages or leverage them.
In our analysis we try to investigate empirically how these factors influence the decision to become a first-mover or a follower. What we focus on is not the strategic position a firm currently assumes but rather on the strategy of the firm. While we can not observe the former (whether a company actually pioneers a new product) we can observe the latter (whether a company's strategic goal is to be first in new products in its industry). In addition to that we want to shed light on the interesting interplay between the firm and the industry it operates in determining the decision to become a first mover.

Using data from the Mannheim Innovationpanel of 2003 and analysing actual not best practices we find that firms that choose a first mover strategy operate in industries with intensive knowledge exchange, additionally leveraging this advantage through excellent absorptive capacities. It might very well be that these companies find themselves on the forefront of innovation with no one else to wait for.

On the follower side we identify companies that operate in industries with a lack of external knowledge spillovers to benefit from. This environment, in combination with underdeveloped absorptive capacities, prevents them from going it alone and instead favors a "wait and see" approach. In order to compete, they do not so much rely on external information sources as on internal operational excellence and efficiency. This allows them to compete on lower costs once an adventurous first mover has sufficiently reduced uncertainty in the industry.

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Abstract

There appears to be an ambivalent dimension in innovation strategies: timing. When is an innovation ready for the market or when is the market ready for the innovation? This paper empirically investigates the determinants of a firm's decision to become a first mover or a follower in innovation strategies. Much of theoretical and empirical work has focused on whether first mover strategies pay off or not. Here we take a different approach by analysing the determinants that lead companies to opt for either a first mover or a follower strategy. One of this paper's major goals is to distinguish between firm and industry specific effects on this particular strategic choice. We estimate our model using the most recent data from the German innovation survey of 2003. This dataset allows us to identify deliberate followers rather than outstripped first movers. One of our main findings is that firms choosing a first mover strategy operate in industries with intensive knowledge exchange and further leverage this advantage through excellent internal absorptive capacities. Followers, though, compete by way of their operational excellence for streamlining processes and cutting costs. Hence, we argue that neither of these two innovation strategies is per se superior to the other.

Keywords: innovation strategy, first mover, bivariate probit
JEL-Classification: L10, O32

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1 Introduction

When it comes to new and exciting but less strategically tangible business opportunities like the internet or China we tend to hear about the enormous advantages of being fast - leaving competitors behind. Before the e-commerce bubble burst we were told what mattered was being first, not necessarily best, to succeed (Economist, 2002). Regarding China, we already hear that the "first-mover advantage has often turned into first-mover curse" (Economist, 2004). Why do companies still choose first mover strategies? And why do some firms shy away from the alleged wisdom of being first and concentrate on follower strategies once others have opened up new markets? This paper aims to contribute comprehensive answers to these questions on a solid empirical basis.

The important role of imitation in spreading new products, processes and organisational practises within an economy has most prominently been outlined by Schumpeter (1942). Nevertheless, he also already pointed towards imitations' Janus face: the prospect of imitation is a disincentive for innovation while imitation is also a driving force in fostering fresh innovation. On the firm level a lot of research was focussed on the occurrence and sustainability of first mover and follower advantages, respectively. There is substantial evidence for both positions best summarized by Kerin et al. (1992) and VanderWerf and Mahon (1997). The latter find that first mover advantages are more likely to be encountered if market shares are used to assess performance, as exemplified by Urban et al. (1986) in consumer product brands or Dos Santos and Peffers (1995) in the ATM business. Stories of successful pioneers might be intriguing but they may only be the notable tip of an otherwise invisible iceberg of failed first movers; or as Bolton (1993) puts it: "The economic landscape is littered with the bones of bankrupt innovators."
While there has been some methodological critique brought forward by Golder and Tellis (1993) on studies that identify first mover advantages (the frequently used PIMS database includes only survivors, relies on self classification of pioneers and is somewhat unreliable in defining a pioneer) there is also a bulk of academic work that identifies superior late mover or follower advantages. Among others, Boulding and Christen (2003) find a first mover profit disadvantage, Bryman (1997) shows in a historical case study that late entrants survive more frequently in the US animation industry and Schnaars (1994) draws a long list of 28 product categories, ranging from light beer to commercial jet aircrafts, in which followers outperformed first movers. In essence, the jury is still out on whether pioneering firms can harvest the benefits of their first moves or if smart followers are eventually better off.

This uncertainty in the outcomes of first mover or follower strategies is the starting point for our analysis. We try to tackle the issue from a different perspective by distinguishing between strategic position and strategy. While we can not observe the former (whether a company actually pioneers a new product) we can observe the latter (whether a company's strategic goal is to be first in new products in its industry). This is all the more important in the follower segment, where we can focus on firms that deliberately choose to react only once a competitor has made its first move (follower strategy) rather than treating firms with a first mover strategy that came in second as legitimate followers. Hence, we are not seeking to tender another study on whether first mover strategies pay off or not. We rather contribute to questions on the mechanisms that let companies opt for a first mover or a follower strategy. Nevertheless, it should be pointed out that this approach investigates *actual* not *best* practises. We consider the former a necessary building block to investigate the latter. We acknowledge that for the development of comprehensive management recommendations a combination of both concepts would be required. Still, this endeavour would go beyond the scope of this paper. Hence, we limit our analysis and subsequent conclusions at this point to the actual strategic choices. Exploring optimal choices is a subject for future work.

Our somewhat distinct setup also allows us to deviate from the analytical frameworks of most of the studies mentioned above. We do not rely on a case study approach, nor do we choose a particular industry perspective. Instead, we rely on empirical analysis and using a large sample of almost 2,300 German companies from both the manufacturing and service sectors. This allows us to draw more in-depth conclusions and distinguish between firm specific and industry specific effects.

The paper is organized as follows. The subsequent chapter outlines major theoretical terms and concepts in greater detail. Chapter 3 focuses on the empirical implementation of the analysis, while Chapter 4 summarizes the results. Chapter 5 eventually presents our conclusions.

2 Theoretical framework

Lowe and Atkins (1994) define a first mover as a company "being the first (or among the first) to embark upon a particular action […] pioneering or preemptive moves in areas of business strategy, ranging from new products and technology to new advertising themes and positioning." Subsequently, first mover advantages are considered the ability of pioneering firms to earn positive economic profits (Lieberman and Montgomery, 1988). Thus, a follower strategy in line with the imitation strategy of Bolton (1993) is a company's delay in adopting a new product or practice. In contrast with most other studies in the field we define first movers and followers as strategies, not strategic positions. Therefore, a first mover in our context is not a company that actually pioneers in a new segment but all companies strongly emphasizing an innovation strategy of being first in the industry to introduce new products. Additionally, we define followers not as prospective the first movers that came in second behind the actual pioneer but as companies indicating explicitly that their prime innovation strategy is to react upon a competitor's move.

As stated initially, there is an ongoing discussion on whether pioneering firms can reap the benefits of their first mover advantages or to put it differently if they merely incur first mover disadvantages compared to follower firms. While this paper sidesteps this particular issue, it does aim to shed some light on the mechanisms behind the strategic choice of being a first mover or a follower. Still, one can not fully comprehend this strategic decision without a clearer understanding of the nature of the respective advantages of first movers and followers. Hence, those shall be outlined briefly.

In essence, companies decide to be first movers because such a strategy can be profitable by creating either a monopoly (blockaded entry) or a subtle implementation makes its replication unprofitable for latecomers (Caves, 1984). In the same context Chan Kim and Mauborgne (2004) coin the term "blue ocean" strategy for firms flourishing in uncontested market spaces as opposed to operating in "red oceans," the colors of which have changed through the "bloodshed" caused by fierce competition. The resource-based theory of the firm offers also an important stream of literature on incentives or barriers to imitation that includes timing decisions (first moves) as one component among others. Apart from first mover advantages, this literature emphasizes impediments to factor accumulation, social complexity, causal ambiguity, tacit knowledge, economies of scale and scope, and adjustment costs (Barney, 1991; Dierickx and Cool, 1989; Lippman and Rumelt, 1982; Rivkin, 2000). In contrast to this rather broad approach we narrow our analysis to the particular timing decisions. Nevertheless,

we acknowledge that some of the subsequent reasoning could also be grounded in resource-based theory. Still, we decided to concentrate on the core concern of our analysis (the choice between a first mover and a follower strategy) instead of raising the larger imitation question.

Hence, we derive the primary sources of first mover advantages based on Lieberman and Montgomery (1988):

– *Technological leadership*
  First mover advantages can arise in the form of learning curve effects and subsequent lower costs (Golder and Tellis, 1993) or through patents that give a company a temporary monopoly in utilizing a new technology.

– *Preemption of scarce assets*
  First movers may be able to forestall acquisitions of important input factors, locations in geographic space, product characteristics or investments in plants and equipment, as exemplified by Schmalensee (1978) on product space preemption or Schmanske (2004) for the golf course industry.

– *Switching costs and buyer choice under uncertainty*
  First movers benefit from switching costs since followers have to deploy additional resources to lure customers away from pioneers. This allows pioneers to lock in their customers (Golder and Tellis, 1993). Additionally, first mover firms might establish a strong brand loyalty early or position their product as prototypical, i.e., the pioneer becomes strongly associated with the category, exemplified by Kleenex (Carpenter and Nakamoto, 1994). Under buyer uncertainty[1] the additional search costs might not justify the switching of a customer to a superior but later entered brand (Lowe and Atkins, 1994). Ries and Trout (1986) show that this brand positioning can have lasting effects: 20 out of 25 leading brands in 1923 were still leaders in the 1980s. These reputational advantages are particularly relevant in service industries. In essence, as Kerin et al. (1992) describe, first movers might be able to shape customer preferences, while later entrants may have to accept them as given.

– *Signaling effects to shareholders*
  The announcement of product innovations leads to an increase in shareholder value for the innovating firm, while it induces negative effects on the valua-

1 In this paper we talk about different types of uncertainty: Here the concept of buyer uncertainty, i.e. the uncertainty of a customer if the new product will satisfy his needs as well as the product he previously used, is introduced. Another concept of uncertainty is market uncertainty, representing the uncertainty about the market potential of an innovation. In what follows we focus on technological uncertainty, i.e. the uncertainty whether an innovation activity will actually lead to an invention or innovation.

tion of industry rivals (Lee et al., 2000; Akhigbe, 2002). Hence, shareholders welcome the prospect of new revenue streams and subsequently improve the company's position in accessing external capital.

Naturally, first mover disadvantages and follower advantages are deeply intertwined. Therefore a presentation of the latter should be sufficient (Lieberman and Montgomery, 1988):

– *"Free ride" on first mover investments*
  As Mansfield et al. (1981) find in their analysis on imitation activities "the ratio of imitation cost to innovation cost was on average 0.65, and the ratio of the imitation time to the innovation time was about 0.70." Additionally, Guasch and Weiss (1980) point out that early entrants into a market make it easier to assess the productivity of workers through their hiring decisions and thereby improving the corresponding distribution of labor for all participants. Hence, there is a rationale of leaving R&D expenditures, buyer education and infrastructure development to the first mover, while later entrants exploit the benefits of their investments, too. This is especially true if co-investments of the buyers of new products are needed in order to be able to use the innovations efficiently.

– *Resolution of technological and market uncertainty*
  Moving first into a new market involves considerable risks. Jensen (2003) argues that leading innovative firms might be better off waiting and learning from first movers' experiences instead of choosing early adoption. Primarily in the absence of a dominant design (Christensen et al., 1998), latecomers might find it easier to "leapfrog" pioneers through superior product or service quality (Bryman, 1997). The same logic applies to shifts in technology or customer needs.

– *Incumbent inertia*
  Bound by sunk cost investments, the fear to cannibalize existing products or breaking up established organizational structures, first movers might become less responsive to market needs than later entrants. Still, this should not necessarily be misinterpreted as sluggishness it can also be a rational, profit-maximizing strategy (Tang, 1988). Still, in the words of Fudenberg and Tirole (1984) they may become vulnerable to a strategic "Fat-Cat Effect" instead of displaying a "Lean and Hungry Look."

Extensive research has been conducted in the field of game theory on whether first mover advantages outweigh follower advantages or vice versa. Gal-Or (1985) shows that first movers will only realize higher profits if the reaction curves of its followers are negatively sloped. If this is not the case (i.e., their re-

action curves are upwards sloped) first movers and followers act on so-called strategic complements; the followers will then earn higher profits. Aoki (1998) adds that this follower advantage becomes less inevitable if respective investment levels among rival firms are included. Henkel (2002) elaborates on the case of strategic complements and suggests that firms should commit only partially by choosing a de facto role between first and second mover; generating (in his words) a "1.5^{th} –mover advantage."

As stated before, the purpose of this paper is not to explain whether pioneers or followers are better off deploying their respective strategies. Instead, we want to shed more light on the mechanisms that lead companies to choose a first mover or a follower strategy. While these two topics are necessarily strongly connected, the former has certainly gained more attention thus far, we also want to contribute to a more in-depth, econometrically grounded understanding of the latter.

The literature on first movers has not only identified the potential advantages and disadvantages of moving first, but also the specific factors at the firm or industry level that either hamper the realization of these advantages or leverage them.[2] Assuming that firms know what factors are important in realizing first mover advantages, they will decide to be first movers only if they think their resources and capabilities fit the requirements of being successful as a first mover in their industry. Naturally, the firm environment also plays an important role for the entry decision (Kerin et al., 1992). In light of this, a firm's strategic decision to be a first mover or a follower can be explained by the factors outlined in the following section.

Spillovers, absorptive capacity and appropriability

We argue that a firm will be less likely to choose a first mover strategy if the level of outgoing spillovers[3] - i.e., the amount of knowledge spilling over to (potential) competitors - is high. If "learning-by-watching" is prevalent (Bolton, 1993) it will be easier for a follower to imitate the product or processes of the first mover or to learn from mistakes made by the first mover (Mellahi and Johnson, 2000). As a consequence the expected profitability of being a follower increases. In addition, with a high level of spillover learning curve effects can no longer be regarded as a high entry barrier for followers (Lowe and Atkins, 1994)

2 See Kerin et al. (1992) for an excellent overview of the various factors leading to first mover advantages and those factors hampering them.

3 Following Cassiman and Veugelers (2002) we use the term "outgoing spillovers" for the amount of knowledge spilling over to other actors and the term "incoming spillovers" for the amount of knowledge a firm is able to assimilate and use from external sources.

because the follower firms can more easily benefit from learning curve effects achieved by the first mover.4

The level of outgoing spillovers is essentially determined by the effectiveness of appropriability mechanisms for knowledge generated within a firm, such as secrecy. If these protection methods are efficient, less knowledge will be available to competitors per se. Appropriability is usually discussed in the context of patents. Patents are, however, not always the most effective method of protecting knowledge and creating entry barriers for firms. Mansfield et al. (1981) show that 60% of the 48 patented innovations in their sample had been imitated within four years. Nonetheless some authors argue that patent protection is important in generating (e.g., Lowe and Atkins, 1994; Cremers, 2004) and sustaining (e.g., Bresnahan, 1985) first mover advantages. Among other protection methods, a high degree of patent protection by firms can thus be regarded as a motive to moving first.

The determinant of the level of incoming spillovers is the firm's "absorptive capacity"5, i.e. the ability to use and profit from external knowledge available through market research, publications, mobility of the workforce, or other channels. If a significant amount of knowledge is available in a certain industry but the corresponding firms do not have the capability of assimilating and using it, the positive effect of high outgoing spillovers on the profitability of being a follower in that industry will be weaker. These absorptive capacities might be the result of experience driven learning, which is typically closely related firm age.

Technological uncertainty and incumbent inertia

A first mover is more likely to profit from its pioneering position if technological uncertainty in its sector is high. Christensen et al. (1998) investigate the rigid disk drive industry and find that firms which target new technological areas (which can be characterized by higher technological uncertainty) are more likely to succeed than those entering a market after a dominant design has been established.

In contrast Kerin et al. (1992) reason that the rate of technological change decreases first mover benefits because the first movers' cost advantages which are based on past experience and learning effects of currently sold products, will become obsolete faster. The window of opportunity to reap the benefits of being first in the market for a new product is shorter if the life cycle of the product is shorter. Then again, this mechanism also reduces the time span in which a follower can operate successfully in that market segment. In contrast, Wernerfelt

4 For more on the role of learning and entry barriers see Spence (1981).

5 Cohen and Levinthal (1989), p. 569: "[…] the firm's ability to identify, assimilate, and exploit knowledge from the environment [is] what we call a firm's 'learning' or 'absorptive' capacity."

and Karnani (1984) argue that technological uncertainty increases the probability of choosing a follower strategy. They write that it is generally more risky to move first than to follow, stating that "… the greater the degree of uncertainty in the situation, the greater is the incentive to wait." (p. 43). Consequently, firms in industries characterized by high (technological) uncertainty should be more likely to choose a follower strategy than firms in more stable industries, with less uncertainty. Mellahi and Johnson (2000) also shed some light on the problems market uncertainty may cause for first movers. They state that investing in a new market involves the risk of betting on the wrong horse, as a failed investment might have repercussions on their current market share and profits. Again, increasing market uncertainty raises the incentive to wait due to the higher risks of failure involved.

"Incumbent inertia" is also seen as a deterrent to adopting a first mover strategy if uncertainty is high, as it "… inhibits the ability of a firm [first mover] to respond to environmental change…" (Lieberman and Montgomery, 1988). However, this is mainly a problem for firms which are already operating as first movers in a certain market as mentioned above.

Dynamic economies of scale and size

As previously stated, first movers advantages can arise in the form of learning curve effects and subsequent lower costs (Golder and Tellis, 1993). Thus, a firm should be more likely to choose a first mover strategy if it can realize scale advantages after entering a new market. Kerin et al. (1992) support this view, writing that first movers might be able to achieve cost advantages over followers, which depend on scale, if they preemptively invest in capacity. In addition, by investing in additional capacity first movers also raise the entry barrier for followers, which might not be willing to invest at the large scale required. If preemptive capacity investment is possible and profitable for a firm, it will be more likely to choose to move first. In practice, however, the evidence that preemptive investment in plant and equipment resources poses an entry barrier is incloncusive.[6]

In most cases, firm size has an influence on its strategy. This is also the case for its entry decision, as Lowe and Atkins (1994) have shown. They conclude that small firms have an incentive to be first movers if scale economies are to be expected in the market they are appraising. Small firms simply might not be able to enter the market late if the minimum required scale is too high. However, Lowe and Atkins (1994) note that despite first mover advantages small firms might have over larger firms (such as flexibility and lower overheads), the competitive environment sometimes leads them to adopt a follower strategy instead.

6 See Lieberman and Montgomery (1988) for a more detailed discussion.

Note that Lowe and Atkins (1994) only investigate firms with 100 employees or less. Compared to the overall size structure of firms in large countries like Germany, all of these firms could still be considered relatively small. In our opinion the results would change if firms of all sizes were considered. We hypothesize that larger firms are more likely to be first movers because they can generate larger economies of scale and better share the risk of failure due to their participation in different markets.

Industry vs. firm effects

Most of the arguments presented above focus on the influence the industry has on a firms' decision be a first mover. However, the different aspects discussed are also relevant at the firm-level. To make this clear, consider the following example: A firm is operating in an industry characterized by a high level of spillovers. We argued before that this should lead firms to be followers instead of leaders. Now suppose that, relative to the industry, the level of spillovers received by the firm in question is higher than the industry average. In this case the firm might still opt to be a first mover because it can make better use of external knowledge and can, for example, reduce uncertainty more effectively than other firms. If the resources and competencies of the firm did not matter for the entry decision, all firms in an industry would choose the same strategy, which is clearly not the case. A similar case can be made for the other motives for becoming a first mover or follower.

Therefore, we suggest an interesting interplay between the company and the industry it operates in. While every company in an industry has unique features, competencies and capabilities, most of the firms in an industry face similar internal and external forces (Farrell, 2004). Not surprisingly, the industry has a significant influence on the variance of profitability among firms (McGahan and Porter, 1997). With that in mind we ask: is the choice between becoming a first mover or a follower born out of operational effectiveness or strategy? While the former means "performing similar activities better than rivals", the latter implies the "creation of a unique and valuable position, involving a different set of activities" (Porter, 1996). Zander and Kogut (1995) show that the replication of new knowledge in the absence of an adequate social community is difficult. McEvily and Chakravarthy (2002) reason that the complexity, tacitness and specifity of technological knowledge prevent the imitation of product improvements. Hence, given complexity, tacitness and specifity exist, a firm could achieve a competitive advantage compared to its industry counterparts even if they operate under similar structures and circumstances. In this line Rivkin (2000) points out that "would-be imitators could understand most of the ingredients that make up a successful business system yet still fail to grasp the recipe." He also concludes that the combination of a complex strategy and limits on what managers know

about rivals and their capabilities raises the barriers to imitation and that companies trying to copy complete strategies from successful competitors face severe penalties for small mistakes.

In our empirical analysis we will try to disentangle the effects of industry and firm characteristics and determine the importance of both. We use a concept called “preventive appropriability” in this section to account for the effects of complexity, tacitness and specifity. Based on the argument presented above we expect this concept to have a positive influence on the decision to choose a first mover strategy. However, whether operational effectiveness propels first mover or follower strategies remains to be seen. We try to draw a clearer picture on this issue by separating the relative industry performance of a firm in three functional areas: Absorptive capacities, cost cutting and R&D.

3 Data and Empirical implementation

For the empirical part of this paper we use data from a survey on the innovation behavior in Germany called the "Mannheim Innovation Panel (MIP)". The survey is conducted by the Center for European Economic Research (ZEW) on behalf of the German ministry for education and research every year. The methodology and questionnaire of the survey, which is targeted at enterprises with at least five employees, is comparable to the Community Innovation Survey (CIS) conducted every four years by Eurostat. For our analysis we use the 2003 survey in which data was collected on the innovation behaviour of enterprises during the three year period 2000-2002. About 4,000 firms in manufacturing and services responded to the survey and provided information on their innovation activities.[7]

In 2003, the detailed data gathered on the innovation strategies of firms allowed us to generate the two key variables for our analysis, namely "firstmover" and "follower", which are defined as follows[8]:

Firstmover: This variable takes the value one if the firm in question indicated that its innovation strategy in 2000-2002 was being its industry leader in the introduction of new products or services. It is zero otherwise.

Follower: This variable takes the value one if the respective firm indicated that its innovation strategy in 2000-2002 was reacting to innovations of competitors. It is zero otherwise.[9]

As was already mentioned, this is a unique approach; we do not model whether a firm actually was a first mover or a follower, but rather whether its strategy was to be a first mover or a follower. Hence, previous work on timing decisions reasoning from a strategic position perspective necessarily finds a single pioneer while everybody else in the market is a follower. This is not the case in our analysis. Here companies choose a first mover or a follower strategy, while it is also perfectly feasible for them to assign no high importance to timing in their innovation strategies. Besides, in the theoretical part of the paper we have treated the two strategies first mover and follower as mutually exclusive strategies. This is certainly the case with respect to a certain product or field of technology. The innovation survey uses the subject approach however, meaning that we cannot analyse specific innovations but rather multi-product firms. Thus, a firm can fol-

7 For a more detailed description of the survey see Janz et al. (2001).

8 The exact definition of all the variables can be found in the annex.

9 The exact question was: "Towards what did your enterprise in the years 2000-2002 orientate its innovation strategy?" Among the possible answers were "Leader in the introduction of new products/services" and "Reaction to the innovations of competitors"

low both strategies at the same time, as it can be a follower in one product segment and a leader in another. Consequently we include two dependent dummy variables in our model and opt for a bivaritate probit technique.

To analyze the determinants of this strategic choice, we generate additional variables for each group of determinants proposed by related literature (see previous section).[10]

For the group "spillovers, appropriability and absorptive capacity", we use several indicators.

The first one is a knowledge spillover variable which captures the importance of external knowledge sources for the performance of a firm's innovations (measured as the share of turnover generated through innovative impulses from customers, suppliers or competitors). In order to be able to distinguish the influence of the industry in which the firm is operating and the influence of firm characteristics, knowledge spillovers were investigated at the industry level[11], i.e., the average importance of spillovers in the industry was introduced (indubusispills) as well as the firm level. For the firm level variable we did not use the absolute importance of knowledge flows but the relative importance, we divided the absolute importance a firm assigned to spillovers by the average importance of spillovers in the industry (quotbusispills). Consequently a firm which values knowledge spillovers more than the industry average will have a value higher than one, while other firms will have a value less than one. The rationale for looking at the relative position instead of the absolute value is that we think that the probability of choosing a first mover or follower strategy in a given industry is more likely to be high if the respective firm is superior in some regard to the average firm.

For this variable a problem arises: the problem of endogeneity. We model the variable capturing the relative importance of knowledge spillovers for a firm as an endogenous variable because we have reason to believe that, first of all an above average value for this variable should influence the concerned firm's decision to lead or follow and secondly, if a firm has chosen a first mover or follower strategy, this should influence the importance the firm assigns to knowledge spillovers. Since we use cross-sectional data we can not disentangle the two effects.

Two other variables used for this group measure the importance of formal (legal_prot) and informal protection methods (prev_prot) for innovation.[12] This is a direct measure of appropriability. In the absence of adequate data for 2003 we constructed these variables from the 2001 innovation survey at the industry level.

10 The exact description of the variables can be found in the Annex.

11 To generate the industry level variables we group certain NACE-Classes together. For a complete list of all NACE Classes included see the Annex, Section 6.2.

12 Schmidt (2005) has shown that it makes sense to keep these two groups separate.

This procedure appears suitable because the importance of different protection measures should have remained relatively stable from an industry perspective. This explicit assumption should be kept in mind when interpreting the results. Further, these appropriability variables are not subject to endogeneity concerns because of the given time structure.

Finally, in order to be able to investigate the influence of absorptive capacity we again constructed a relative measure (quotR&D) dividing the amount a firm spent on R&D in 2002 by the average amount a firm in the industry spent on R&D in the same year. Again, we argue that this variable is endogenous because we presume that, depending on the strategy a firm chooses, it will (have to) invest more or less in R&D; a high level of R&D spending might influence this strategic choice. Czarnitzki and Kraft (2004) found that the follower (in their terminology the "challenger") spends more on R&D than the leader ("incumbent")

The group "technological uncertainty and the product life cycle" is only represented in the estimation equation by one industry level variable, the average amount spent on R&D in a firm's industry (induavgR&D). We argue that the greater the technological uncertainty the more R&D is necessary.[13]

The third group of determinants can be summarized under "Economies of scale and size". Here we assume that the level of cost reduction through process innovation is a good measure of the significance of scale economies. We again generate a variable for the industry level of cost reduction (inducostred) and for the firm-level (quotcostred). The firm level variable is treated as an endogenous variable. The ability of a firm to operate at competitive cost levels and hence prices is a central ingredient to any strategic choice. Nevertheless, the direction of this relationship remains ambiguous; i.e., whether a firm's cost position enables a certain strategic choice or if it is, in fact, the result of the strategy. To illustrate the latter, a first move might allow a firm to realize economies of scale and drive down costs to generate entry barriers for followers. Size is measured directly as the natural logarithm of the number of employees (size, size^2).

Two more variables which try to capture the "interaction" among the strategic decisions of first movers and followers were used in the regression analysis. In line with the game-theoretical argument from Gal-Or (1985) we would expect that a follower strategy is always preferable in the presence of an existing first mover and strategic complements. Then again, relying on the same reasoning on strategic complements the presence of followers in an industry should deter first movers. We introduced two additional variables to test this hypothesis: the percentage of firms in an industry that adopt a first mover strategy (relfirstmover)

13 There was a question regarding the product life cycle in the survey, but the item non-response was too high to compute the average product life cycle for a number of industries, especially in services.

and the percentage of followers in an industry (relfollower).[14] It remains to be seen whether firms can actually recognize a competitor's entry strategy, whether this influences their own decisions and whether they actually operate under strategic complements.

As an additional variable a dummy indicating if the respective firm is situated in Eastern Germany (east) is used. Previous studies using the MIP data have shown that there are still differences in the innovation behavior of Eastern and Western German firms.

So far we have largely discussed the endogeneity challenge from a conceptual point of view. In statistical terms[15] this means that economic data reflect a system of economic relations that are dynamic, stochastic, and simultaneous. Especially the simultaneous aspect is of importance in our case. As indicated before, some of our variables are characterized by joint, interdependent, endogenous instantaneous feedback attributes. Hence, these variables are correlated with the error term and a simple application of the least squares rule would not yield unbiased estimators. In general, this result would still allow an assessment in the sense of "if one factor is present, so is the other" without a clear indication on the direction between cause and effect. To address this shortcoming and to ensure that we actually measure the effect of our explanatory variables on the strategy decision and not the other way around, we devised a two-step procedure. This technique also improves the consistency of the estimation. In essence, this approach is superior to its single-step counterpart since it allows more precise predictions and conclusions.

It is subsequently presented in more detail. We design a two-step estimation procedure including instrument variables that are highly correlated with the endogenous variables but not with the dependent variable. Hence, in the first step we regress the endogenous variables on all the exogenous variables (including the instruments) and use the resulting predicted values in the second stage. On the first step we also encounter censoring of our dependent variables (quotbusispills, quotcostred, quotR&D). Accordingly, we estimated three separate tobit models to tackle this issue.[16] The instruments we used for the endogenous variables are:

- turnover per employee in 2001 (Salesperempl01)
- share of employees with higher education (Grads01)
- a dummy variable for "continuous R&D" (R&Dcon)
- amount spent on R&D in 2001 (R&D01)

14 To account for potential problems with endogeneity of these variables they were constructed as an industry ratio excluding the reporting firm itself.

15 For an introduction to this topic see Griffiths et al. (1993).

16 Greene (1993).

- a dummy variable indicating that the firm perceived a lack of appropriate sources of finance as a hampering factor for innovation (Obstaclefinance)
- a dummy variable indicating that the firm perceived a lack of qualified personnel as a hampering factor for innovation (Obstaclestaff)
- a dummy variable indicating that the firm perceived a lack of information on technology as a hampering factor for innovation (Obstacletech)

As already mentioned, we use the MIP survey to generate the different variables. Item non-response for certain questions was fairly high, especially because non-innovating firms were not asked innovation related questions, including questions on innovation strategies. However, 2,279 out of the 4,428 surveyed firms provided answers to all the questions we needed to construct the variables mentioned above. Of these 2,279 firms, 254 indicated they intend to be a first mover and 105 to be a follower; all other companies assigned no high importance to either of these two innovation strategies.[17]

The decisions to adopt a first mover or a follower strategy are not independent of one another. In some cases it might be possible for a firm to choose both strategies, such as when it is operating in multiple industries (we found some of these cases in the data). Typically however, a firm will have to choose between the two. To model this link between the two decisions adequately we used a bivariate probit model instead of estimating the equations for each strategy separately. The bivariate probit model is directly derived from the standard probit model while allowing more than one equation with correlated disturbances. This technique is quite comparable to the seemingly unrelated regressions model. Estimating both equations simultaneously allows us to improve the estimated sampling precision and subsequently a more complete usage of the available information.[18] The specification for our two-equation model is

$$\begin{aligned} \text{firstmover}^* &= \beta_1' x + \varepsilon_1, & \text{firstmover} &= 1 \text{ if firstmover}^* > 0,\ 0 \text{ otherwise,} \\ \text{follower}^* &= \beta_2' x + \varepsilon_2, & \text{follower} &= 1 \text{ if follower}^* > 0,\ 0 \text{ otherwise.} \\ \text{Cov}(\varepsilon_1, \varepsilon_2) &= \rho \end{aligned}$$

where x is the vector of dependent variables presented above and includes the predicted values of the endogenous variables from the first stage regressions.

17 Additional descriptive statistics can be found in the Annex.

18 For a more in depth description of the bivariate probit procedure see Greene (1993).

4 Results

Our empirical analysis reveals some interesting insights; Table 1 summarizes the main results.[19] We find a more complex connection between firm size and the strategic decision to move first than Lowe and Atkins (1994) suggest. The likelihood of choosing a first mover strategy increases as the number of employees grows, but decreases again after a certain threshold has been crossed. Subsequently, the first mover strategy is less likely for both exceedingly small and large enterprises, while we find no significant connection between firm size and the decision to deploy a follower strategy.

Interestingly enough, we find no significant evidence that firms choose a particular first mover or follower strategy based on the choices of their counterparts in the industry. Still, from our results we can not conclude whether these companies do not face strategic complements, whether they can not observe the strategies of other firms in the industry or whether these choices are simply not a factor in their own strategic decision processes.

With an eye on the specific situation of Germany it comes as a surprise that even twelve years after re-unification, a company located in the Eastern part of Germany is significantly more likely to adopt a follower strategy, while companies from Western Germany exhibit an increased likelihood of becoming first movers. This result is especially noteworthy since it displays neither a firm nor industry specific aspect but rather a regional one. We argue that Eastern German firms still find themselves in a catching-up process resembling the post-war experiences of Japan, Western Germany or South Korea. During such rebuilding periods firms might be more inclined to rely on tried and proven concepts and technologies (hence follower strategies) to close the gaps with Western competitors instead of bearing the additional risks of a first mover strategy.

Table 1: Regression results for bivariate probit estimations of the probability to choose a first mover or a follower strategy in the introduction of product innovations (2-Step procedure)

Definitions	Variables	Firstmover	Follower
Firm-level			
Absorptive capacity for business spillovers	Quotbusispills	1.790 *** (I)	-2.068 *** (I)
		(0.449)	(0.945)
Excellence in cutting costs	Quotcostred	-0.025 * (I)	0.060 *** (I)
		(0.014)	(0.017)
Relative strength in R&D activities	QuotR&D	0.022 *** (I)	0.033 (I)
		(0.006)	(0.027)

19 The effects of the two step procedure on the results can be found in Table 3 of the appendix.

Definitions	Variables	Firstmover	Follower
Company age in years	Age	0.003	0.003
		(0.002)	(0.002)
Number of employees (in logs)	Ln empl	0.295 ***	0.061
		(0.109)	(0.113)
Squared number of employees (in logs)	Ln empl, squared	-0.024 **	-0.009
		(0.011)	(0.012)
Location in former Eastern Germany	East	-0.222 **	0.296 **
		(0.101)	(0.132)
Industry-level			
Intensity of preventive appropriability	Prev_prot	5.624 ***	-3.404
		(2.023)	(2.940)
Intensity of formal appropriability	Legal_prot	-4.340	2.685
		(2.688)	(3.832)
Share of companies with first mover strategies	Relfirstmover	-0.024	-0.008
		(0.019)	(0.026)
Share of companies with follower strategies	Relfollower	0.012	-0.008
		(0.028)	(0.035)
Intensity of knowledge spillovers from business sources	Indubusispills	0.703 ***	-0.622
		(0.337)	(0.455)
Importance of cost reductions (economies of scale)	Inducostred	-0.011	0.035
		(0.017)	(0.021)
Level of technological uncertainty	InduavgR&D	-0.001	0.002
		(0.001)	(0.002)
Constant	Constant	-5.917 ***	3.918
		(1.383)	(2.505)
	Observations	2274	
	X^2	406.53	
	Loglikelihood	-958.53	
	Rho	0.230 ***	

*** significant at 1%; ** significant at 5%; * significant at 10%
(I) Instrumented
Robust standard errors in parentheses

One of the major goals of this analysis was to distinguish between firm and industry effects on this particular strategic choice. The industry variables shall be considered first. In line with our theoretical reasoning, we find that technological uncertainty in an industry is not a reliable predictor of first mover or follower strategies. On the one hand, it opens up windows of opportunity for first movers but it also increases the individual danger of failure from a “going it alone” strategy.

While the respective literature led us to believe that intensive knowledge spillovers within an industry would make entry barriers gained through first mover strategies less defendable thereby making such strategies less attractive, we find quite the opposite. There is a significant positive relationship between first mover strategic choices and the intensity of knowledge spillovers from the private sector in an industry, while the relationship with the adoption of follower strategies is significantly negative. We conclude from this fact that first movers prefer an industry environment where extensive knowledge sharing enables skill and resource development. Still, the argument of fading first mover advantages through rapid knowledge exchange might be better described in the context of the market and not necessarily the industry. In the absence of any meaningful market definition information we decided to use the industry as a proxy, but this concept might be too broad. Cost reductions at the industry level showed no significant impact.

Additionally, we were surprised to find that formal protection measures of intellectual property in an industry had no significant influence on the strategic decision under consideration. While the findings of Mansfield et al. (1981) suggest such a result for the first mover decision, we had expected that any form of intellectual property protection (legal or otherwise) would deter followers. This is not the case. Hence, the weight assigned to the topic of appropriability through patents in entry strategy decisions appears to be at least overstated or highly case sensitive. Still, as the literature suggests, preventive protection measures like secrecy and complexity of design enable first movers to keep their learning proprietary and thus propel this strategic choice. We argue that when choosing a first mover strategy, firms might not be willing to accept the associated costs and knowledge spill-outs of patenting but rather use cheaper and more flexible preventive protection measures.

Then again, the influence of knowledge spillovers and preventive appropriability on first mover strategies has been investigated separately thus far. The use of any form of protection instruments in an industry, though, should confine the flow of knowledge and therefore prove counterproductive for spillovers. Nevertheless, we find a positive relationship between both factors and first mover strategies. However, this argument largely rests on the assumption that the volume of a knowledge flow is a good proxy for its importance. Small pieces of information, when collected proficiently and interpreted adequately, might actually prove far more valuable than large, meaningless quantities. Therefore, we measure knowledge spillovers in terms of their importance and relevance to their recipients (share of turnover). While this concept reflects the value for the recipient, our measure of preventive appropriability does the same for the sources of spillovers. It covers the importance of preventive protection activities in an industry but not their effectiveness. Hence, we find that companies in these industries realize the value of the knowledge embodied in their company and their product and go to great lengths to protect it, but not to the degree to which they actually succeed. Consequently, we identify two sides of the same coin; it should

not come as a surprise that they show both a positive impact on the decision to choose a first mover strategy. First movers operate in industries with extensive knowledge spillovers where the term “extensive” should not be narrowly interpreted as “provided in large quantities”, but as “valuable” in the sense that they hold extensive possibilities of generating economic value.

Moving away from an industry perspective we find many more firm-specific factors in the decision processes of companies on product entry strategies. Following the afore mentioned argument that first movers tend to operate in industries with extensive knowledge flows, we find that those first movers are significantly more adapt to utilize and benefit from such spillovers. Obviously, they are better prepared to learn from their respective environments and leverage the know-how they obtain in this manner than their industry counterparts. What is more, the significantly enhanced value of R&D expenditures points towards a firm-specific relationship between absorptive capacities (Cohen and Levinthal, 1989;1990) and the adoption of a first mover strategy.

Firms that adopt a follower strategy find it significantly more difficult to leverage their knowledge environment. While their own R&D activities show no significant impact on the strategic choice, their access to knowledge spillovers and their utilization of external knowledge spillovers is significantly below industry averages. Nevertheless, when it comes to economies of scale firms that show superior performance in streamlining processes and cutting costs prefer a follower strategy while the opposite is true for first mover firms. Therefore, followers rely on lower costs and subsequent lower prices to overcome pioneering firms.

In essence, the factors presented above lead us to believe that a firms chooses a first mover strategy because of superior capabilities in not only absorbing external knowledge, but also combining this knowledge with existing expertise embodied within the company and its organizational structure. These absorptive capacities allow it to reduce the risk of failure. On the contrary, firms that adopt a follower strategy lack these mechanisms. Instead, they rely on superior excellence in cutting costs and streamlining processes. While this does not put them on the forefront of product innovation it allows them to realize meaningful economic profits by competing on their operational excellence and efficiency once a pioneering firm has ventured a first move.

5 Conclusions

Moving away from the traditional question of whether first mover advantages are sustainable or not, we shed some light on the mechanisms behind the strategic choices of firms between first mover or follower strategies. The project benefited from the almost unique opportunity to identify strategies instead of strategic positions in a representative sample by especially allowing us to identify deliberate followers instead of outstripped first movers.

We find that firms that choose a first mover strategy operate in industries with intensive knowledge exchange, additionally leveraging this advantage through excellent absorptive capacities. It might very well be that these companies find themselves on the forefront of innovation with no one else to wait for.

On the follower side we identify companies that operate in industries with a lack of external knowledge spillovers to benefit from. This environment, in combination with underdeveloped absorptive capacities, prevents them from going it alone and instead favors a "wait and see" approach. In order to compete, they do not so much rely on external information sources as on internal operational excellence and efficiency. This allows them to compete on lower costs once an adventurous first mover has sufficiently reduced uncertainty in the industry.

When our results are not completely in line with what other authors suggest, notably the relationship between knowledge spillovers and first movers and the insignificance of intellectual property protection through patents, it is most likely due to our specific setting. While most other studies observe actual pioneers in their respective field, we observe the companies that choose a strategy to become one (strategy vs. strategic position). Hence, we focus on a somewhat earlier stage where a prospective pioneer decides that she has the necessary technological and organizational expertise and courage to venture a first mover strategy. At that point, external knowledge spillovers and absorptive capabilities are a prerequisite facilitating such a strategy. Then again, once this first mover firm has actually achieved pioneering status - and we do not observe this situation - its focus may shift towards defending its competitive position which readily includes the protection of intellectual property and the suppression of knowledge spillovers to keep learning proprietary.

While a first mover strategy appears to be more prestigious, there are good reasons to go with a follower strategy. Firms with underdeveloped absorptive capacities but superior operational skills only act rationally when they decide to become smart followers instead of ill-equipped, hazardous first mover. Accordingly, we argue that neither strategy is per se superior to the other. Instead, our findings are perfectly in line with the case from Bolton (1993), who portrays Japanese electronic giant Matsushita as a successful follower by "deliberately arriving late in the marketplace, competing successfully through an outstanding

global distribution system and low-cost, high-quality production." Hence, Matsushita chooses a perhaps less celebrated but still sustainable strategy compared to its first moving rival Sony.

Future work might pick up where we left it and consider whether choosing a first mover strategy that does not lead to the actual pioneer position might still be superior to a deliberate follower decision, or whether overtaken first movers are the quintessential losers in this race. Moreover, a unifying view on this strategy versus strategic position framework might also bring valuable insights. As stated previously, we also consider it necessary for the derivation of management recommendations to extend our approach from the analysis of actual practices towards best practices. Still, we hope we have made a nice first move into this field and attract promising followers.

6 Annex

6.1 Variables

a) Dependent variables

firstmover: One if the firms indicated that its innovation strategy in 2000-2002 was to be the industry leader in the introduction of new products or services.

follower: One if the firm indicated that its innovation strategy in 2000-2002 was to react to innovations introduced by its competitors.

b) Exogenous variables at firm level

quotbusispills: Quotient between index of importance of spillovers from business sources and industry average.

quotcostred: Quotient between firm percentage of cost reduction and industry average.

quotR&D: Quotient between firm expenditures on R&D and industry average.

age: Age of the company in 2002 since founding in years.

lnempl: Natural logarithm of number of employees in the year 2002

lnempl^2: Natural logarithm of number of employees in the year 2002, squared

east: One if the company is located in Eastern Germany

c) Exogenous variables at industry level

prev_prot: Sum of importance of strategic protection methods for innovations (secrecy, complexity of design and lead-time advantage). Rescaled between 0 (not used) and 1 (maximum usage). Industry average.

legal_prot: Sum of importance of formal protection methods for innovations (patents, copyrights, trademarks, registration of design patterns). Rescaled between 0 (not used) and 1 (highly used). Industry average.

relfirstmover: Percentage of firms in an industry which indicated that their innovation strategy in 2000-2002 was to be their industry's leader in the introduction of new products or processes, excluding the reporting firm itself.

relfollower: Percentage of firms in an industry which indicated that their innovation strategy in 2000-2002 was to react to innovations introduced by their competitors, excluding the reporting firm itself.

indubusispills: Index of importance of customers, competitors and suppliers as sources of innovations weighted by the share of turnover resulting from these sources. Industry average.

inducostred: Industry reduction in costs due to process innovation in per cent.

induavgR&D: Average industry expenditures for intramural R&D in million Euro in 2002.

d) Instruments used in the first step tobit regressions

R&Dcon: One if a firm indicated that it conducted R&D activities continuously between 2000 and 2002.

Grads01: Share of employees with higher education in 2001.

R&D01: Firm's expenditures for intramural R&D in million Euros in 2001.

Salesperempl01: Turnover per employee in million Euros in 2001.

Obstaclefinance: One if a firm indicated that a lack of appropriate sources of finance was an obstacle to innovation in the years 2000 to 2002.

Obstaclestaff: On, if a firm indicated that a lack of skilled labor was an obstacle to innovation in the years 2000 to 2002.

Obstacletech: One if a firm indicated that a lack of information about technology was an obstacle to innovation in the years 2000 to 2002.

6.2 Industries included

Industry	NACE Code
Mining and quarrying	10 – 14
Food and Tobacco	15 – 16
Textiles and Leather	17 – 19
Wood / Paper / Publishing	20 – 22
Chemicals / Petroleum	23 – 24
Plastic / Rubber	25
Glass / Ceramics	26
Metal	27 – 28
Manufacture of machinery and equipment	29
Manufacture of electrical machinery	30 – 32
Medical, precision and optical instruments	33
Manufacture of motor vehicles	34 – 35
Manufacture of furniture, jewellery, sports equipment and toys	36 – 37
Electricity, gas and water supply	40 – 41
Construction	45
Retail and motor trade	50, 52
Wholesale trade	51
Transportation and Communication	60 – 63, 64.1
Financial Intermediation	65 – 67
Real Estate Activities and Renting	70 – 71
ICT services	72, 64.2
Technical services	73, 74.2, 74.3
Consulting	74.1, 74.4
Other business oriented services	74.5 – 74.8, 90

6.3 Regression Results and Descriptive Statistics

Table 2 : Descriptive Statistics [a]

	Mean Entire Sample	Mean Firstmover	Mean Follower
Observations	2274	254	105
% of total	-	11.2%	4.6%
Quotbusispills	0.952	1.700	1.867
	(0.763)	(1.192)	(1.266)
Quotcostred	1.034	2.028	3.412
	(11.908)	(9.303)	(12.465)
QuotR&D	0.660	3.883	3.477
	(7.505)	(20.369)	(18.936)
Age	18.858	18.807	23.810
	(19.565)	(19.644)	(28.141)
Ln empl	3.819	4.772	5.012
	(1.744)	(1.927)	(1.948)
East	0.376	0.287	0.314
	(0.484)	(0.453)	(0.466)
Prev_prot	0.192	0.262	0.245
(industry variable)	(0.113)	(0.115)	(0.120)
Legal_prot	0.088	0.126	0.120
(industry variable)	(0.063)	(0.069)	(0.070)
Relfirstmover	13.514	17.558	16.419
(industry variable)	(7.078)	(7.247)	(7.571)
Relfollower	5.781	7.382	7.383
(industry variable)	(3.109)	(3.218)	(2.979)
Indubusispills	1.678	1.899	1.856
(industry variable)	(0.387)	(0.425)	(0.431)
Inducostred	4.231	5.700	6.003
(industry variable)	(3.560)	(3.672)	(3.935)
InduavgR&D	20.578	44.351	41.599
(industry variable)	(53.055)	(74.853)	(72.126)

[a] standard deviations in parenthesis

Table 3: Regression Results for Bivariate-Probit Estimations of the Probability to choose a first mover or a follower strategy

	Everything Exogenous		2-Step Procedure	
	Firstmover	Follower	Firstmover	Follower
Firm-level variables				
Quotbusispills	0.497 ***	0.404 ***	1.790 *** (I)	-2.068 *** (I)
	(0.045)	(0.046)	(0.449)	(0.945)
Quotcostred	0.001	0.004 **	-0.025 * (I)	0.060 *** (I)
	(0.002)	(0.002)	(0.014)	(0.017)
QuotR&D	0.001	0.004 **	0.022 *** (I)	0.033 (I)
	(0.002)	(0.002)	(0.006)	(0.027)
Age	-0.004 *	0.003	0.003	0.003
	(0.002)	(0.002)	(0.002)	(0.002)
Ln empl	0.221 **	0.234 **	0.295 ***	0.061
	(0.097)	(0.109)	(0.109)	(0.113)
Ln empl, squared	-0.011	-0.012	-0.024 **	-0.009
	(0.010)	(0.011)	(0.011)	(0.012)
East	-0.158 *	0.067	-0.222**	0.296 **
	(0.088)	(0.115)	(0.101)	(0.132)
Industry-level variables				
Prev_prot	4.691 **	0.616	5.624 ***	-3.404
	(1.826)	(2.547)	(2.023)	(2.940)
Legal_prot	-3.160	3.037	-4.340	2.685
	(2.520)	(3.472)	(2.688)	(3.832)
Relfirstmover	-0.004	-0.016	-0.024	-0.008
	(0.018)	(0.025)	(0.019)	(0.026)
Relfollower	0.013	-0.019	0.012	-0.008
	(0.028)	(0.037)	(0.028)	(0.035)
Indubusispills	0.056	0.074	0.703 ***	-0.622
	(0.274)	(0.367)	(0.337)	(0.455)
Inducostred	0.002	0.052 **	-0.011	0.035
	(0.016)	(0.021)	(0.017)	(0.021)
IduavgR&D	0	-0.001	-0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.002)
Constant	-3.210 ***	-3.489 ***	-5.917 ***	3.918
	(0.363)	(0.481)	(1.383)	(2.505)
Observations	2274		2274	
X^2	439.81		406.53	
Loglikelihood	-964.13		-985.53	
Rho	0.136 *		0.230 ***	

*** significant at 1%; ** significant at 5%; * significant at 10%

(I) Instrumented; Robust standard errors in parentheses

Table 4: First Step Tobit Regressions

	Quotbusispills	Quotcostred	QuotR&D
Age	0	0.019	-0.032
	(0.001)	(0.046)	(0.020)
Ln empl	0.012	3.33	-0.519
	(0.032)	(2.121)	(0.85)
Ln empl, squared	0.005	0.002	0.306 ***
	(0.004)	(0.211)	(0.084)
East	0.018	-2.269	-0.926
	(0.032)	(2.219)	(0.897)
Relfirstmover	0	-0.187	0.218
	(0.007)	(0.455)	(0.184)
Relfollower	0.009	-0.014	0.429
	(0.010)	(0.69)	(0.294)
Indubusispills	-0.501 ***	-2.062	-5.656 *
	(0.115)	(7.272)	(2.956)
Inducostred	-0.005	-0.199	0.063
	(0.006)	(0.399)	(0.162)
InduavgR&D	0.001**	-0.009	-0.010
	0	(0.024)	(0.010)
Legal_prot	2.179 **	90.491	-26.13
	(0.94)	(62.509)	(26.502)
Prev_prot	-1.242 *	-1.818	21.294
	(0.686)	(45.217)	(19.067)
R&Dcon	0.467 ***	15.468 ***	10.638 ***
	(0.027)	(1.420)	(0.627)
Grads01	0.003 ***	0.017	0.081 ***
	(0.001)	(0.049)	(0.019)
R&D01	-0.000 **	0	0.005 ***
	(0)	(0.001)	0
Salesperempl01	-0.014	0.599	-0.706
	(0.022)	(1.545)	(0.716)
Obstaclefinance	0.240 ***	14.992 ***	3.115 ***
	(0.048)	(2.489)	(1.01)
Obstaclestaff	0.224 ***	5.241 *	-0.07
	(0.06)	(3.016)	(1.189)
Obstacletech	0.013	1.765	4.020 ***
	(0.072)	(3.603)	(1.372)
Constant	1.385 ***	-56.879 ***	-20.666 ***
	(0.139)	(8.971)	(3.652)
Observations	2274	2274	2274
X^2	592.58	402.09	1105.99
Loglikelihood	-2350.001	-2517.015	-2642.933
Share of censored observations	2.6%	80.5%	72.9%

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