

Why Hedge?

- A Critical Review of Theory and Empirical Evidence -

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Zusammenfassung

Der Artikel gibt einen Literaturüberblick zur Fragestellung, warum Unternehmen Risikomanagement betreiben und analysiert die Umsetzung in der Unternehmenspraxis. Ausgehend von den Irrelevanzthesen von Modigliani/Miller wird gezeigt, daß die starke Betonung des Risikomanagements in Unternehmen auf zweierlei Arten erklärbar ist: Zum einen erhöht Hedging den Shareholder Value, da es Steuern, Bankrott-kosten, die Kosten von externem Kapital und den Absicherungsbedarf von schlecht diversifizierten Aktionären verringern kann. Zum anderen kann Hedging den Nutzen von Managern erhöhen, soweit es einen Einfluß auf deren Vermögen oder Ruf hat. Was die Umsetzung der Hedging-Ziele in die Unternehmenspraxis anbetrifft, haben die Modelle unterschiedliche Konsequenzen bezüglich der Art und des Ausmaßes des abzusichernden Risikos.

Keywords: Risk Management, Hedging, Agency Theory, Shareholder Value

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Nontechnical summary

Finance theory does not provide a comprehensive framework for explaining risk management within the imperfect financial environment in which firms operate. Corporate managers, however, rank risk management as one of their most important objectives. Therefore, it is not surprising that papers on the question why firms hedge are mushrooming. This paper critically reviews this literature and analyses the implications for risk management practice.

It is distinguished between two competing approaches to corporate hedging: equity value maximising strategies and strategies determined by managerial risk aversion. The first category suggests that managers act in the best interest of shareholders. They hedge to reduce real costs like taxes, costs of financial distress and costs of external finance or to replace home-made hedging by shareholders. The second category considers that managers maximise their personal utility rather than the market value of equity. Their hedging strategy, therefore, is determined by their compensation plan and reputational concerns.

There is ambiguous empirical evidence on the dominant hedging motive. It depends on the environment in which firms operate (e.g. tax schedule) and on firm characteristics (e.g. capital intensity). In general, one can observe that (i) hedging taxable income is of minor importance, (ii) firms with a high probability of financial distress hedge more, (iii) companies with greater growth opportunities hedge more, (iv) managers with common stockholdings hedge more than managers with option holdings and (v) high ability managers hedge more than low ability managers.

The total benefits of hedging are not the sum across the various motives. Therefore, a manager has to concentrate on a primary motive to implement an effective risk management programme: If his primary motive is to minimise corporate taxes, he will hedge taxable income. If his primary concern is to reduce the costs of financial distress and if he can faithfully communicate the firm's true probability of default, his hedging strategy will focus on the market value of debt and equity. If hedging is prompted to reduce the demand for costly external finance, he will hedge cash flows. If the manager is concerned with his reputation, he will focus on accounting earnings. Once he has focused on a certain exposure, the manager has to decide whether he wants to minimise the volatility of this exposure or simply avoid large losses.

1 Introduction

In recent years, corporations have taken risk management more and more seriously. This development was accompanied by the rapidly increasing volume of derivative securities, the increasing volatility in financial prices and spectacular losses in companies like Metallgesellschaft, Daimler Benz or Barings. The fact that firms rank risk management as one of their most important objectives [see Rawls and Smithson (1990)] contrasts with the nobel-prize-winning financial irrelevance theories of Modigliani and Miller (1958, 1963). The so called M&M (1958) propositions state: If there are no taxes, no costs of financial distress, no information asymmetries, no transaction costs and if investors can perform the same transactions as companies, then the financial policies of the firm are irrelevant. Risk management is one of the firm's financial policies¹. It is irrelevant in the M&M world because investors can create their own risk management by holding diversified portfolios. To explain hedging, academics have turned the M&M propositions on its head: If financial risk management affects value, it must do so because of its impact on taxes, costs of financial distress, agency costs or transaction costs. In recent years, the theoretical and empirical literature investigating motives for hedging based on deviations from the M&M world has mushroomed.

This paper presents a systematic and critical overview of the current state of the discussion. Moreover, I analyse the implications of hedging theory for the corporate hedging strategy. I find that models have different implications on the questions what exposure a company should hedge and whether hedging should minimise volatility or simply avoid lower tail outcomes.

This review is organised as follows. In section 2, it is demonstrated that in a world with symmetric information shareholders benefit from corporate hedging, since it can reduce taxes and costs of financial distress. Once the assumption of symmetry information is released, agency conflicts arise. Section (3.1) explains how hedging can mitigate financial agency costs arising from conflicts of interest between existing shareholders and new equityholders, shareholders and bondholders as well as shareholders and other stakeholders². Section (3.2) investigates hedging in a principal-agent framework. It is shown how compensation and reputational concerns of managers impact their risk taking behaviour. In section 4, corporate hedging is shown to be advantageous whenever hedging by shareholders is not feasible or more expensive. Section 5 summarises major findings of theory and empirical studies.

¹ MacMinn (1987) shows that the M&M theorems, which refer to capital structure policies, can also be applied to corporate hedging.

² Stakeholders are all groups of people with claims to the company. They include shareholders, bondholders, customers, suppliers and employees.

2 Hedging can reduce taxes and the costs of financial distress

In this chapter I assume risk neutral shareholders and a world with symmetric information, i.e. all market participants assess taxes, costs of insolvency and transaction costs correctly. In such a world, conflicts of interest between shareholders and stakeholders or principal agent problems do not exist, because information symmetry allows entering into „optimal“ contracts. Managers act in the interest of shareholders and, therefore, maximise the market value of equity. Shareholders can diversify the risks of the corporation on their own, except for systematic risk. Hence, corporate risk management can increase the market value of equity only if it can reduce real costs. Finance literature has identified two such real resource gains: (i) risk management can reduce expected tax payments; (ii) risk management can reduce the costs of financial distress.

To show that risk management can reduce taxes and the costs of financial distress, I assume that in $t=0$ the company has a given portfolio of contracts (and potential future transactions) P_0 which result in stochastic future cash flows³. This portfolio is equity financed. The cash flows in $t=1$, x_1 can be hedged with derivative financial instruments, because the distribution of cash flows depends on a financial price, e.g. the exchange rate of a certain currency. Future cash flows $2 \leq t \leq T$ are independent of this financial price. They are exclusively a function of external factors which cannot be hedged. Their market value at $t=1$ is V_1^{ex} . Therefore, the value of the company in $t=1$ is

$$V_1 = x_1 + V_1^{ex}.$$

Managers act in the shareholder's interest, i.e. they maximise the expected equity value at $t=1$. In order to simplify the analysis, I assume that all market participants are risk-neutral and that the company has no view on the future financial price⁴.

2.1 Taxes

Stulz (1984) and Smith and Stulz (1985) observe that progressive tax rates and consequently convex tax schedules cause the firm's expected tax liability to rise with variance of taxable income, indicating that hedging increases firm value by reducing the present value of future tax liabilities. To demonstrate their results, I assume that taxes in $t=1$ are calculated as $x_1 * \tau$, where τ is the tax rate. The market value of future cash flows V_1^{ex} is not taxed at $t=1$. The question, therefore, is whether hedging can increase the expected value of after-tax cash flows

³ The following analysis is done in imitation of Pfennig (1998), who analyses the impact of hedging on the utility function of risk averse shareholders.

⁴ A view would create an incentive to increase firm value by speculating on the financial price. I assume, however, that financial instruments are fair valued from the companies' point of view. In other words, the net present value of financial instruments is zero. Therefore, the firm has no incentive to speculate with derivatives. However, it uses derivatives to influence the distribution of cash flows, firm value or taxable income (hedging).

in $t=1$, $x_1^*(1-\tau)$. If the tax rate is independent of x_1 , hedging cannot increase $E(V_1)$, because the after-tax value of the firm is a linear function of its pre-tax value of x_1 .

If the marginal tax rate is progressive, on the other hand, hedging can increase the value of the firm. To demonstrate this, assume for the moment that there are only 2 states of the world, „u“ and „d“ which both occur with probability 0.5. The cash flow in $t=1$ may, therefore, be x_1^u or x_1^d , where $x_1^u > x_1^d$ and $\tau^u > \tau^d$. I assume that the company can hedge the cash flows in $t=1$, by holding a hedge portfolio such that $x_1^u + H^u = x_1^d + H^d$. The hedge portfolio is self-financing in the sense that $0.5 * H^u + 0.5 * H^d = 0$, i.e. hedging is costless⁵. It follows that the expected cash flow with hedging x_1^h is equal to the expected cash flow without hedging, i.e. $x_1^h = 0.5 * x_1^u + 0.5 * x_1^d$ and

$$V_{1,h} - V_1 = [x_1^h * (1 - \tau^h) + V_1^{ex}] - [0.5 * x_1^u (1 - \tau^u) + 0.5 * x_1^d (1 - \tau^d) + V_1^{ex}] > 0.$$

The reason for this inequality is that the tax rate is a concave function of cash flows and $\tau^u < \tau^h < \tau^d$. The more concave the tax rate function is, the higher the tax-reducing benefits of hedging.

In a *dynamic model*, hedging can increase the market value of equity even if tax rates are constant. This would be the case if tax loss carry-backs and carry-forwards are limited. In other words, hedging pays whenever the taxman pays a smaller amount than $[x_t * \tau]$ for losses (negative cash flows), and the probability of a loss is positive. A practical example is that unlimited tax loss carry-forwards are allowed, but the resulting tax reduction is not compounded and the market interest rate is positive⁶. Alternatively, the interest rate may be zero, but the time period over which tax loss carry-forwards are allowed is limited and a potential loss cannot be completely used over this period. In extreme cases, tax loss carry-forwards may not be possible at all [see Pfennig (1998)].

Since the incentives for hedging depend on the tax code, I will demonstrate potential tax benefits of hedging by taking the example of US, UK and German corporations. In the *USA*, there is currently a progressive corporate tax rate for taxable incomes between nil and \$18,333,333, ranging from 15% to 35%. Over \$ 18,333,333 the tax rate is 35%. The tax loss carryback period is two years, the carryforward period is 20 years [see U.S. Master Tax Guide (1997)]. The US tax code generally specifies that if the firm's pretax income falls below some level, the value of tax preference items is reduced by either the loss of the tax shield or postponement of its use [see Nance, Smith and Smithson (1993)]. Hence, tax-based incentives to hedge are greater for firms with more of the range of their pretax income in the progressive region of the tax schedule and for firms with more tax preference items. Corporate tax savings

⁵ See Smith and Stulz (1985).

increase the market value of equity because only after tax earnings are distributed to shareholders as dividends. Each shareholder must pay personal taxes on these dividends. Corporate taxes are not credited on his tax account. Graham and Smith (1996) try to quantify the potential tax savings from hedging in the USA. They simulate likely tax savings from reducing the volatility of taxable income and find that the average tax savings from a 5% reduction in volatility is about 3% of taxable income.

However, empirical evidence for the tax hypothesis of hedging in the USA is rather weak. Nance, Smith, and Smithson (1993) and Goldberg, Godwin, Kim, and Tritschler (1993) find that firms with more tax credits and more of their income in the progressive region of the tax schedule hedge more. Francis and Stephan (1990) test the hypotheses, that hedging companies are exposed to higher tax rates. Their result is that the correlation between tax rates and hedging activities has a positive sign, but is not significant. Géczy, Minton, and Schrand (1997) turn over the argumentation of Smith and Stulz (1985) and suppose a negative correlation between hedging activities and the convexity of the tax schedule. Using the argumentation of Froot, Scharfstein and Stein (1993) they suppose that companies with high internal funds will pay higher taxes. Since companies with a high degree of internal financing have less incentives to hedge, hedging and taxes are negatively correlated. They reject the tax hypothesis empirically.

The *UK* has the following corporate income tax structure: For a taxable income up to £ 300,000, the tax rate is 21% (small companies rate), for a profit over £ 1.5 million, the tax rate is 31% (normal tariff). For profits between these amounts, the tax rate rises gradually from 21% to 33%. The tax loss carryback period is one year, the carryforward period is unlimited [see British Tax Guide (1997)]. Corporate taxes on distributed profits are partially credited on the shareholders' tax account⁷. The UK tax schedule creates an incentive to hedge whenever there is some probability that taxable income will fall below £ 1.5 million. Nevertheless, Joseph and Hewins (1997) found in their questionnaire survey among UK multinational companies (MNCs) only very weak support for expected tax liabilities as a motive for foreign exchange hedging.

In *Germany*, there are two corporate tax rates. Retained profits are taxed at a constant rate of 47.5% and distributed profits at 31.7%. Corporate taxes on distributed profits are fully credited on the shareholders' tax account [see Jacobs and Spengel (1996)]. Tax loss carrybacks are limited to two years, tax loss carryforwards are unlimited. In addition to corporate taxes, firms have to pay a trade tax on income (Gewerbeertagsteuer), which is on average about 17,5% of taxable income [see Eckerle (1997)]. Abstracting from a speculation

⁶ For a further analysis of the tax-advantages of hedging see MacMinn (1987) and Smith (1995). Numerical examples can be found in Smith, Smithson and Wilford (1990) and Menichetti (1993).

⁷ For details see Jacobs and Spengel (1996). Note that a decrease in the corporate tax burden increases the market value of equity only to the extent that corporate taxes are not credited on the shareholders' tax account.

on changing tax rates, the German tax code provides only interest determined tax-incentives to hedge⁸. The fact that German firms can use the choice of accounting or valuation methods to smooth taxable income further restricts potential tax-benefits of hedging. For MNCs with subsidiaries abroad, however, there might be tax benefits of hedging to the extent the foreign tax code applies. The tax-hypothesis by Smith and Stulz (1985) was not yet tested empirically in German multinationals.

Apart from hedging incentives resulting from convex tax schedules, there is a significant *indirect tax incentive to hedge*. Assuming that the firm wants to keep a certain credit rating, hedging can reduce taxes by providing the opportunity for increased leverage. Since all coupon payments to bondholders are tax-deductible, leverage creates tax benefits. On the other hand, leverage creates costs: Bondholders have to be compensated with a higher yield for the fact that the probability of default increases. Trading off between these effects, tax benefits and bankruptcy costs, produces an optimal capital structure. Ross (1996) demonstrated that hedging a firm's assets can result in an enhanced optimal capital structure, worth an extra 10% - 15% for current shareholders. His theoretical findings are confirmed by empirical studies in the US: Hentschel and Kothari (1995) show that leverage is highly positively correlated with derivatives use. As firms aspire to higher optimal leverage, they must hedge and so dampen the leverage's effect on the risk of equity. Dolde (1995) finds that leverage is an insignificant explanatory variable for derivative use, but becomes significant when currency, commodity and interest rate risk are controlled for. Géczy, Minton and Schrand (1997) report leverage to be the second most significant variable in explaining interest rate derivative use. Tufano (1996) finds leverage to be extremely significant in explaining delta-hedging by North American gold mining firms when he controls for heteroskedasticity. Nance, Smith and Smithson (1993), on the other hand, do not find significance for leverage variables in the use of derivatives⁹. There exists no evidence in the German and UK environments.

2.2 Cost of financial distress

Smith and Stulz (1985) and Stulz (1984) show that hedges can reduce expected costs of financial distress by reducing the likelihood of encountering distress. I will review their major findings by introducing costs of financial distress instead of taxes into the model.

⁸ Note that the postponement of taxes in future periods may increase the market value of equity whenever external finance cannot be raised at fair prices. In this case, lower cash outflows would reduce the need to raise costly external finance and consequently mitigate the underinvestment problem [see 3.1.1].

⁹ Note that these studies assume that derivatives are used for hedging rather than speculation.

A company is insolvent whenever (i) it cannot fulfil its financial commitments, i.e. if cash flow falls below a critical value¹⁰ $x_t < x_t^I$ or (ii) the market value of the company V_t is smaller than the market value of its debt V_t^D . Since I assume an equity financed firm, I will restrict to case (i) and distinguish between direct costs of insolvency $c_1^{I_d}$ and indirect costs of insolvency $c_1^{I_i}$.

Direct costs of insolvency are those costs which are caused as a direct consequence of bankruptcy, for example the payment of court costs, lawyers, liquidators etc. [see Drukarczyk (1993) and Stulz (1997)]. If the firm goes bankrupt, the level of these costs are usually independent of the level of x_1 and the market value of the company [see Smith, Smithson, and Wilford (1990)]. Therefore,

$$c_1^{I_d} = \begin{cases} c^{I_d} & \text{for all } x_1 < x_1^I \\ 0 & \text{for all } x_1 \geq x_1^I \end{cases}$$

Indirect costs of insolvency, on the other hand, result from the reaction of stakeholders on the threat of insolvency [see Cornell and Shapiro (1987)]. The risk of bankruptcy may have an impact on (i) existing claims to the company, and (ii) potential future contractual agreements. *Existing claims* to the company can be explicit and implicit in nature. Explicit claims are contracted, for example guarantees or credit contracts. Implicit claims, on the other hand, are not contracted, but they have a value for stakeholders. They include, for example, the service demand of customers or job security and social benefits of employees. The value of these claims decreases if the entity's probability of bankruptcy increases. However, this devaluation does not have a direct impact on the future cash flows of this company and, therefore, does not cause costs of insolvency¹¹. However, an increasing risk of insolvency decreases the cash inflow or increases the cash outflow once the *contracts have to be extended* or when *new contracts* are concluded: For example, the sales price of the company's products may decrease, because customers fear that the promised service is not provided in the case of bankruptcy. Employees may move over to other companies or demand a higher salary to compensate for higher employment risk and worse career opportunities¹². While direct costs of insolvency arise only in the state of actual bankruptcy, indirect costs of insolvency $c_1^{I_i}$ arise before a firm actually goes bankrupt. They occur if the future prospects of the company

¹⁰ Note that in an equity financed company this critical value x_t^I is expected to be below zero, because the company can raise external capital in form of bonds or shares to finance a cash flow shortfall.

¹¹ Note, however, that stakeholders ex ante take the expected development of a company into consideration when they enter into contracts.

¹² For details and illustrative examples see Cornell and Shapiro (1987), Shapiro and Titman (1985), Sercu and Uppal (1995), Jensen and Meckling (1976), Smith, Smithson and Wilford (1990). For an empirical quantification of indirect costs of insolvency see Altman (1984).

deteriorate, that is when the probability of insolvency increases. Therefore, the critical level of cash flows at which indirect costs of insolvency arise, \bar{x}_1^I , is higher than the level of cash flows at which the company is bankrupt and at which direct costs of insolvency arise, x_1^I . More formally, $x_1^I < \bar{x}_1^I$.

Assuming that (i) the value of all cash flows occurring after $t=1$, V_1^{ex} depends not just on existing contracts, but also on the value of potential contractual agreements entered into after $t=1$, (ii) the value of potential contractual agreements depends on x_1 , and (iii) the value of potential contractual agreements reduces for $x_1 < \bar{x}_1^I$, we can write

$$c_1^{I_i} = \begin{cases} c_1^{I_i}(x_1) & \text{with } \frac{dc_1^{I_i}}{dx_1} < 0; \frac{d^2c_1^{I_i}}{d(x_1)^2} < 0 & \text{for all } x_1 < \bar{x}_1^I \\ 0 & & \text{for all } x_1 > \bar{x}_1^I \end{cases}$$

The value of the company in $t=1$ is given by $V_1 = x_1 - c_1^{I_d} - c_1^{I_i} + V_1^{ex}$. Hedging has no impact on firm value where $\text{Prob}_0(x_1 < \bar{x}_1^I) = 0$. However, if $\text{Prob}_0(x_1 < \bar{x}_1^I) > 0$, hedging can reduce indirect costs of insolvency, and if $\text{Prob}_0(x_1 < x_1^I) > 0$ hedging can also reduce direct costs of insolvency¹³.

To *summarise*, under the restrictive M&M assumptions about corporate financial policy, the magnitude of reduction in financial distress costs is shown to be a positive function of (i) the probability that the firm will encounter financial distress if it does not hedge, and (ii) the costs the firm incurs if it does encounter financial distress.

Empirical studies test both factors. Point (i) implies that corporate hedging increases with the probability of financial distress. Most studies proxy the costs of financial distress by the debt-equity ratio or similar variables and confirm this hypothesis [see, for example, Francis and Stephan (1990), Géczy, Minton, and Schrand (1997), Mayers and Smith (1990), Tufano (1996), Mian (1996), and Visvanathan (1995)]. Nance, Smith and Smithson (1993), on the other hand, do not find significance for leverage variables in the use of derivatives. Similarly, Joseph and Hewins (1997) find in their questionnaire survey among large UK MNCs only weak support for financial distress as a motive to hedge. However, their results may be due to the lower probability of financial distress of large MNCs relative to that of purely domestic firms and small MNCs.

¹³ For a proof that hedging can reduce the costs of bankruptcy see Smith and Stulz (1985). Note that a hedging strategy will only reduce expected bankruptcy costs to the extent that the firm can commit *ex ante* to their stakeholders that it will follow a hedging strategy after the contract is entered into.

Point (ii) implies that small firms should have more incentives to hedge. The reason is that direct costs of insolvency are widely independent on firm size and can, therefore, be regarded as a fixed cost component [see Warner (1977)]. In other words, the relative importance of direct costs of insolvency is higher for small firms. This contrasts with the hypothesis that large firms hedge more because fixed costs in hedging an efficient risk management programme requires a minimal size (see 5.1). Dolde (1993) solves this conflict and confirms both hypotheses. He shows that large firms use significantly more hedging instruments, but small firms hedge a greater part of their exposure.

The analysis showed that even in the case of risk neutral shareholders and stakeholders and fully equity financed companies hedging can increase the market value of equity via the reduction of taxes and costs of insolvency. In the next chapter I analyse whether hedging can increase the market value of equity in a world with asymmetric information¹⁴. In such a world, first best contracts [see Barnea, Haugen and Senbet (1985)] are not feasible and agency conflicts arise. To analyse the impact of these conflicts on corporate hedging, I have to review the agency literature.

3 Hedging can reduce agency costs

An *agency relationship* is a contract in which one or more persons (the principal(s)) engage another person (the agent) to take actions on behalf of the principal(s) which involves the delegation of some decision-making authority to the agent. *Agency conflicts* arise whenever the interests of principal(s) and agent(s) diverge and agents have better information. The agent will act in a way that maximises his own utility. The value of the resulting decrease in the principal's utility as compared to the value of his utility in the absence of agency conflicts and symmetric information is called *agency costs*¹⁵. A rational principal anticipates the potentially opportunistic behaviour of the agent and takes them into account when he enters into contracts with the agent [see Jensen and Meckling (1976)]. Therefore, it is in the agent's interest to take actions which reduce agency costs.

Barnea, Haugen and Senbet (1985) distinguish between the financial theory of agency and the economic theory of agency. The *financial theory of agency* focuses on the relationship between different groups of securityholders (equity and bondholders) in the context of optimal financing of the firm. Agency conflicts arise when management, which is presumed to act in the interest of existing shareholders, attempts to raise additional capital from outsiders. Management possesses inside information on the future values of the firm, but it cannot

¹⁴ Taxes and costs of insolvency are not considered.

¹⁵ Jensen and Meckling (1976) divide agency costs in (i) the monitoring expenditure by the principal, (ii) the bonding expenditures by the agent, and (iii) the residual loss, i.e. the monetary equivalent of the reduction in

convey the information to the market unambiguously because of moral hazard problems¹⁶. The *economic theory of agency*, on the other hand, focuses on the relationship between a single principal (shareholder) who provides capital and consequently possesses a claim on the end-of-period value of the firm and an agent (manager) whose efforts are needed to produce this value. Agency conflicts arise because, under the behavioural assumption of self interest, agents do not invest their best efforts unless such investment is consistent with maximising their own utility. While the financial theory of agency analyses optimal financial contracts, the economic theory of agency analyses optimal employment contracts for the agent. An optimal contract is one which motivates managers with their specific objectives, risk attitudes, and informational advantages to act as closely as possible in the interest of the principals, i.e. the shareholders¹⁷.

3.1 Financial theory of agency

The financial theory of agency distinguish between four groups of people with different interests: Owner-managers who possess the equity of the company (internal or old equityholders)¹⁸, potential buyers of new shares (external equityholders), bondholders and other stakeholders of the company. I assume that the information and the objectives of the different groups of people can be aggregated¹⁹. Contrary to the previous chapter, investments can be financed with external equity capital and debt. The objective of managers is to maximise the utility of existing shareholders. Interests of other groups are considered since they anticipate incentives for opportunistic behaviour of internal shareholders correctly and require compensation for it. Agency conflicts in a world with asymmetric information and opportunistic behaviour, therefore, can be divided into three categories: (i) conflicts between internal and external shareholders; (ii) conflicts between internal equityholders and bondholders, and (iii) conflicts between internal equityholders and stakeholders. To isolate agency conflicts from other incentives to hedge, I will ignore taxes, costs of financial distress and transaction costs. As in chapter 2 I assume that all stakeholders are risk-neutral²⁰.

welfare experienced by the principal due to the divergence between the agent's decisions and those decisions which would maximize the welfare of the principal.

¹⁶ For more details see, for example, Ross (1973); Jensen and Meckling (1976); Haugen and Senbet (1979); Barnea, Haugen and Senbet (1985).

¹⁷ For more details see, for example, Harris and Raviv (1978); Holmstrom (1979); Shavell (1979); Barnea, Haugen and Senbet (1985).

¹⁸ Conflicts of interest between managers and „old“ shareholders are ignored here. They will be discussed in the chapter „economic theory of agency“.

¹⁹ The assumption of a representative investor is usual in finance theory. In this way potential conflicts of interest between bondholders or equityholders are ignored [see Senbet and Taggart (1984) and MacMinn (1987)]. However, Brennan (1995), questions the validity of this assumption.

²⁰ With this assumption I want to avoid the possibility that shareholders have an incentive to hedge even in the absence of incomplete information and agency costs. This would be the case, for example, if bondholders are risk-averse and, therefore, demand a risk premium whenever there is a nonzero probability of default.

The model-based literature on the three categories of financial agency conflicts can be divided into two and one-period models. In *two-period models*, capital is raised in period $t=1$, while the hedging strategy is chosen in period $t=0$. In these models, hedging has an impact on firm value because it may reduce the amount of external capital which is necessary to fund positive net present value (NPV) projects in $t=1$. Due to information asymmetries, this external capital cannot be raised at fair terms²¹. *One-period models*, on the other hand, are characterised by the fact that capital is raised before the company chooses its hedging strategy or investment policy, i.e. at $t=0$. In this case, hedging reduces the costs of external finance if the company can faithfully communicate ex ante that it will not increase corporate risk after raising external capital. I will first use a two period model to summarise all financial agency conflicts related to the investment policy of the company and their impact on the value-maximising risk management policy. In the second step, I will review some one-period models to demonstrate how bond-covenants and reputation-building can increase the market value of equity.

3.1.1 Liquidity models (two-period models)

According to Lessard (1990) the most compelling arguments for hedging lie in ensuring the firm's ability to meet two critical sets of cash flow commitments: (i) the exercise prices of their operating options reflected in their growth opportunities (for example, the R&D or promotion budgets) and (ii) their dividends. Liquidity models pick up this argument and identify the need to align the demand of funds with the internal supply of funds as the major objective of hedging. In this way, the need to raise costly external finance and the resulting underinvestment and asset substitution problem can be mitigated. In order to compare the two-period models most relevant in analysing the benefits of hedging, I will change the assumptions made in section 2:

Internal shareholders (owner-managers) manage the firm. These internal shareholders are passive, that is, they do not buy issued shares. Therefore, they maximise the intrinsic value of the existing shares. At time $t=0$, the firm starts with two purely equity financed portfolios (assets in place). Portfolio 1 matures at $t=1$ and yields a random payoff x_1 . Portfolio 2, on the other hand, yields the random payoff x_2 at $t=2$. The randomness of the payoff from portfolio 1 results from the exposure of the whole portfolio to the financial price S_t . Portfolio 2 is independent of S_t . At $t=0$, the company can choose a hedging strategy to reduce the riskiness of the cash flows x_1 . The motive to reduce the risk of portfolio 1 results from the fact that the firm knows at $t=0$, that at $t=1$ it will have the opportunity to invest the amount I , which offers a certain payoff at $t=2$ of $V_2^I(I)$. This investment yields a positive NPV and can be funded out

²¹ On the costs of external finance and arguments why external finance cannot be raised at fair terms see Froot, Scharfstein and Stein (1993), Jensen and Meckling (1976), and Myers (1977) among others.

of the internal cash flow x_1 , or funds can be raised externally. At $t=2$, the firm is liquidated. The market interest rate is zero²².

(a) Conflicts of interest between internal and external shareholders

The fundamental papers on agency conflicts between internal shareholders and external shareholders are by Jensen and Meckling (1976) and Myers and Majluf (1984). They both show that whenever financial slack²³ or internal cash flows are not sufficient to finance investment projects with positive NPV, owner managers will underinvest. However, they differ in respect of the causes and consequences of agency costs: In the Jensen and Meckling model, agency conflicts arise from the potential consumption of on-the job perquisites by the owner manager. Myers and Majluf, on the other hand, demonstrate that agency costs arise from the mispricing of equity by parties external to the firm. Supposing that the investment project is „all or nothing“ and the firm can't take part of it, they show that owner managers may forego positive-NPV projects. I will employ these models to demonstrate that hedging can mitigate agency costs.

The Jensen and Meckling model

The Jensen and Meckling model (1976) assumes that the expected utility of the internal shareholder depends on (i) the market value of the firm, (ii) money wages, which are assumed to be fixed, and (iii) on-the job perquisites, which are inseparable from the firm. If the firm would be completely financed by the owner-manager, he would fully bear the cost of additional perquisite consumption in the form of a reduction in the value of the firm. Once the owner-manager raises external equity capital, he continues to enjoy the full benefit of additional perquisite consumption, while he bears only his proportional ownership fraction of the associated reduction in the value of the firm's stock. Rational outsiders make unbiased estimates of the costs associated with the increased perk consumption, and they pass these costs back to the owner-manager in full, in the form of a reduction in the price they are willing to pay for the securities he initially desires to sell. Jensen and Meckling show that whenever x_1 is not sufficient to finance the optimal investment volume in $t=1$, I^* , utility maximising owner-managers will choose an investment volume I' , which is below the optimal investment volume. The difference between the NPV which can be achieved with the optimal investment volume and the NPV achieved with the investment volume actually realised by owner-managers are agency costs of external equity capital, c_1^{ac} :

²² The analytical approach in chapter (3.1) imitates Pfennig (1998), who analyses the impact of hedging on the utility function of risk averse shareholders.

²³ Financial slack includes cash on hand, marketable securities and the amount of default-risk-free debt the firm can issue [see Myers and Majluf (1984)].

$$c_1^{ac} = [V_2^I(I^*) - I^*] - [V_2^I(I') - I'] \quad (3.1).$$

Concerning the consequences of these results for the risk management of owner managers, the situation is similar to the analysis of costs of financial distress (see 2.2): Whenever $\text{Prob}_0(x_1 < I^*) = 0$, it will not be necessary to raise external equity capital and consequently no agency costs exist. However, in cases where the cash flows in $t=1$ may fall below the optimal investment volume, that is $\text{Prob}_0(x_1 < I^*) > 0$, the share of I' which is financed externally rises with decreasing cash flows in $t=1$ and consequently the agency costs of external equity will increase [see Jensen and Meckling (1976)]. In other words, hedging can increase the utility of owner-managers whenever $0 < \text{Prob}_0(x_1 < I^*) \leq 1$. The maximal benefit of hedging is c_1^{ac} and it can be achieved if hedging can avoid the risk of cash flows falling below I^* ²⁴.

The modified Myers and Majluf model

Next, I adapt the model of Myers and Majluf (1984) by replacing financial slack, which is given exogeneously, by portfolio 1 with payoffs depending on the financial price S_t . Myers and Majluf assume that at $t=0$, both managers and the market know the distributions of the cash flows $g(x_1)$ and $g(x_2)$ ²⁵. At $t=1$, only the management knows the realisations x_1 and x_2 . If internal and external shareholders had the same information or if old shareholders could costlessly and faithfully communicate the realisations x_1 and x_2 to new shareholders at $t=1$, no agency conflicts would exist. Similarly, no agency conflicts arise whenever $\text{Prob}_0(x_1 < I) = 0$. However, if $\text{Prob}_0(x_1 < I) > 0$, and only internal shareholders know x_1 and x_2 in $t=1$, agency costs in form of foregone positive NPV projects arise. Myers and Majluf show that the higher x_2 , the higher the probability that owner managers will not raise new equity capital to fund the positive NPV project. The reason is that the price, which new shareholders are willing to pay [based on $g(x_1)$ and $g(x_2)$], becomes less attractive for old shareholders with an increase in x_2 ²⁶. In other words, agency costs increase with the size of equity required to finance the investment.

Applied to risk management, this result is similar to the one derived from the Jensen and Meckling model: Whenever $\text{Prob}_0(x_1 < I) > 0$, hedging of x_1 can increase the market value of equity since the probability, that the positive-NPV investment is foregone increases with a decrease in x_1 .

(b) Conflicts of interest between shareholders and bondholders

²⁴ Note that portfolio 2 is not used in this model.

²⁵ Note that, since the risk-free interest rate is assumed to be zero and there are no interim payouts, expected cash flows and market values are identical.

Contrary to conflicts between internal and external shareholders, agency conflicts between internal shareholders and bondholders arise from the different nature of their claims: Bondholders receive a fixed amount or, if the company is bankrupt, the whole value of the company. Shareholders, on the other hand, are residual claimants. They receive the market value remaining after bondholders are paid. Owner-managers are better informed than bondholders and, therefore, have incentives to take decisions which transfer wealth from bondholders to shareholders²⁷. Smith and Warner (1979) identify four major sources of conflict between bondholders and shareholders: (1) Underinvestment - when a substantial portion of the value of the firm is composed of future investment opportunities, a firm with outstanding risky bonds can have incentives to reject positive NPV projects if the benefit from accepting the project accrues to the bondholders. (2) Asset substitution or risk shifting - the value of the shareholders's equity rises and the value of the bondholders' claim is reduced when the firm substitutes high-risk for low risk projects. (3) Claim dilution - if bonds are priced assuming that additional debt of the same or higher priority will not be issued, the value of the bondholders' claims is reduced by issuing such additional debt. (4) Dividend payout - if bonds are priced assuming that the firm will maintain its dividend policy, their value is reduced by unexpected dividend increases financed either by reductions in investments or by the sale of debt.

Rational bondholders recognise incentives faced by shareholders in each of these four dimensions and forecast the value effects of future opportunistic decisions by owner managers. Therefore, on average, bondholders will not suffer losses unless they systematically underestimate effects of such future actions. They will rather increase the interest rate demanded or ration their credits to the firm. Consequently, shareholders pay the agency costs resulting from all non-optimal decisions motivated by wealth transfers from debtholders to shareholders [see Smith and Warner (1979)].

Generally, there are three ways to mitigate these agency costs of debt: First, the government may impose legal constraints like dividend constraints. Second, shareholders and bondholders can agree on voluntary contractual constraints. For example, bond covenants may constrain activities such as asset sales or mergers. Third, the company may implement a risk management programme. I will restrict to the role of risk management in reducing the underinvestment problem and the asset substitution problem.

²⁶ For a proof see Myers and Majluf (1984).

²⁷ See Jensen and Meckling (1976), and Smith and Warner (1979). Note, however, that this conflict arises only when the probability of default is not zero. In the case of profitable companies with abundant cash flows, the interests of these two classes of the company's owners would appear to be relatively similar. However, the higher the probability of financial distress, the more interests of shareholders and bondholders may diverge.

The underinvestment problem

If investment projects are partially debt financed, owner managers may underinvest [see Myers (1977)]. I will demonstrate that hedging can reduce the underinvestment problem by employing the models of Froot, Scharfstein and Stein (1993) and Myers and Majluf (1984).

The Froot, Scharfstein and Stein model

The model of Froot, Scharfstein and Stein (1993) is based on the costly state verification approach by Townsend (1979) and Gale and Hellwig (1985). They assume that the investment volume I in $t=1$ is variable and can be financed with cash flows x_1 and debt D_1 , for which in $t=2$ a payment D_2 is promised. In $t=2$ the company receives the payoff from the investment and the payoff from portfolio 2, which has the probability distribution $g(x_2)$ and the cumulative distribution $G(x_2)$. In contrast to x_1 , the distribution of x_2 cannot be hedged. The central assumption for the underinvestment problem is that the certain payoffs from the investment $V_2^I(I)$ cannot be observed by debtholders and that the observation of x_2 causes costs of c^{Obs} . Whenever the firm is bankrupt in $t=2$, that is when it cannot fully pay D_2 , debtholders will invest c^{Obs} to collect x_2 . Risk neutral debtholders will demand an amount D_2 which can be defined as:

$$\int_0^{D_2} (x_2 - c^{Obs}) * g(x_2) dx_2 + \int_{D_2}^{\infty} D_2 * g(x_2) dx_2 = D_1 = I - x_1 \quad (3.2).$$

This equation is condition for the optimisation problem of shareholders. Risk neutral owner managers will choose an investment volume in $t=1$, which maximises their expected payoff in $t=2$:

$$\max_I \left[V_2^I(I) + \int_{D_2}^{\infty} (x_2 - D_2) * g(x_2) dx_2 \right] \quad (3.3).$$

Differentiating (3.3) under the condition (3.2) yields the following optimal investment volume:

$$V_2^{I^*}(I) = \frac{1 - G(D_2)}{1 - G(D_2) - c^{Obs} * g(D_2)} \geq 1 \quad \text{for } c^{Obs} \geq 0 \quad (3.4)$$

The optimal investment volume is achieved when the company is purely equity financed or when $c^{Obs} = 0$. In this case, $V_2^{I^*}(I^*) = 1$. However, from (3.4) can be seen that whenever $c^{Obs} > 0$, owner managers will choose a lower investment volume. Underinvestment occurs in this model because an increase in I necessitates an increase in D , which raises the probability of default and consequently the costs of debt.

Denoting the expected agency costs of underinvestment as c^{UI} , we can use (3.2) and (3.4) to express these costs as a function of the cash flows in $t=1$:

$$c^{UI}(x_1) = c^{Obs} * G[D_2(D_1(x_1))] \quad (3.5).$$

For a given cash flow x_1 and an optimal investment volume I , the market value of equity at $t=1$, $V_1^E(x_1)$, can be written as

$$V_1^E(x_1) = x_1 + \max_I [V_1^I(I) - I - c^{UI}(x_1)] \quad (3.6).$$

Froot, Scharfstein and Stein (1993) showed that the function $V_1^E(x_1)$ is strictly concave, whenever x_2 follows a normal, an exponential or a uniform probability distribution. This means that the owner manager's attitude to the risk factor S_t (e.g. exchange rate) will be strictly risk averse. Hedging the cash flow x_1 , therefore, increases their expected utility.

The modified Myers and Majluf model

The modified Myers and Majluf (1984) model yields similar results. If the investment project can be financed with internal cash flows and debt instead of internal cash flows and external equity capital, the underinvestment problem demonstrated in (a) arises²⁸. As in the case of equity financing, in some states of the nature the investment project will not be undertaken although it has a positive NPV. However, the average opportunity loss is less with debt than with equity financing [see Myers and Majluf (1984)]. Although the reduction in the market value of internal shareholders as a result of information asymmetries is lower with debt financing, it is still positive. Consequently, hedging can still increase the market value of equity whenever $\text{Prob}_0(x_1 < I) > 0$.

The Asset Substitution Problem

To understand the asset substitution or risk shifting problem, it is useful to follow Mason and Merton (1985) and interpret equity capital as a call option on the firm value and debt capital as a short put option. Assuming constant expected returns, this implies that an increase in the volatility of the firm's cash flows shifts wealth from bondholders to shareholders. Shareholders, therefore, have an incentive to increase risk after the credit contract is concluded [see Pritsch and Hommel (1997)]. The asset substitution problem is usually demonstrated in one-period models [see Fama and Miller (1972), Galai and Masulis (1976) and Jensen and Meckling (1976)]. It can, however, also be extended to two periods [see Pfennig (1998)]. I will use the two-period model described above to analyse the asset substitution problem. This is easily achieved by ignoring portfolio 2 and assuming that in $t=1$

the company can choose between several risky investment projects $I^i = (\sigma^i, V_1^{I^i})$ which all require the same investment volume I . Potential investments are mutually exclusive and differ in respect of their market value $V_1^{I^i}$ and their riskiness σ^i . I assume that the market value of potential investments decreases with an increase in their riskiness.

If the cash flow x_1 is sufficient to finance the investment completely, i.e. whenever $x_1 \geq I$, utility maximising owner managers will choose the investment project with the highest market value I^* . If $x_1 < I$, on the other hand, a part of the investment has to be financed with debt. Once the firm is leveraged, the claim of shareholders is comparable with a call option on the operating entity of the company where the exercise price of the option is the amount payable to redeem the debt [see Black and Scholes (1973), Galai and Masulis (1976) and Jensen and Meckling (1976)]. Option pricing theory suggests that the market value of equity capital, V_1^E , increases with an increase in market value of the investment $V_1^{I^i}$ and with an increase in the total risk σ^i of the investment²⁹:

$$\frac{dV_1^E}{dV_1^{I^i}} > 0, \quad \frac{dV_1^E}{d(\sigma^i)^2} > 0 \quad (3.7).$$

The market value of equity does not decrease with a decrease in the market value of the investment, whenever the risk of the investment increases at a corresponding rate. Barnea Haugen and Senbet (1985) and Pfennig (1998) show that the riskiness of the investment project value maximising managers will choose increases with the amount of debt financing. Since a riskier investment project involves by assumption a lower market value $V_1^{I^i}$, the difference between the market value of the investment project with the highest expected return $V_1^{I^*}$ and the investment project realised by owner managers $V_1^{I^i}$ are agency costs of the asset substitution problem. Assuming that these agency costs are paid by shareholders, risk management can increase the market value of equity whenever $\text{Prob}_0(x_1 < I) > 0$. Once again, the risk management objective at time zero is to decrease the probability and expected value of a cash flow shortfall below the investment volume I .

(c) Conflicts between Shareholders and Stakeholders

Although in the case of bankruptcy explicit claims of customers, suppliers and employees are usually preferred to the claims of debtholders, these claims are generally comparable. Both are characterised by a maximal payment which is agreed ex ante and both are preferred to the

²⁸ The underinvestment problem does not arise if risk free debt can be raised [see Myers and Majluf (1984)].

²⁹ Note that since I ignore portfolio 2 and assume no financial slack, the volatility of the company's cash flows equals the volatility of the investment I^i .

claims of shareholders³⁰. Therefore, the analysis of agency conflicts between shareholders and bondholders generally can be applied to agency conflicts between shareholders and stakeholders³¹.

The discussion showed that hedging is value enhancing because it can mitigate the underinvestment and the asset substitution problem. Due to the extensive use of derivatives, the classical version of the asset substitution problem has lost its relevance, because with derivatives, managers can more inexpensively and more quickly alter volatility than with the investment policy. Speculation with derivatives dominates risk shifting by a change in the investment policy [see Ross (1997)].

Ignoring the asset substitution problem, the *major result* of the analysis is that hedging cash flows can increase the market value of equity whenever there is some probability that cash flows fall below the optimal investment volume. Hedging can increase the market value of equity by the full amount of agency costs if it can avoid the probability of a cash flow shortfall below I^* and it can reduce agency costs if the probability and expected value of a cash flow shortfall can be mitigated. An alternative strategy would be to hold high cash balances, since they would also reduce the demand for external finance at time one and thereby mitigate the underinvestment problem. However, assuming that hedging involves no transaction costs and the market interest rate is positive, this would be the more expensive strategy.

Applied to corporate risk management, liquidity models have the following testable implications: First, assuming a constant optimal investment volume I^* or that the risk factor S_t is unrelated with the optimal investment volume I^* , companies should hedge S_t to reduce *cash flow variability*. Joseph and Hewins (1997) identify in their questionnaire survey among UK multinationals that the minimisation of fluctuations in operational cash flow is the primary motive for foreign exchange hedging.

Second, the benefits of hedging are expected to increase with greater *growth opportunities* and tighter *financial constraints*, because financial agency costs are most significant for such firms. The demand for external finance is expected to be positively related to the amount of growth opportunities. Assuming that external finance cannot be raised at fair terms and the costs of external finance increase with the amount of external finance [see Froot, Scharfstein and Stein (1993)], the benefits of hedging increase with growth opportunities³². Financial

³⁰ However, Pfennig (1998) notes that this is only true for explicit, contracted claims of stakeholders. Shareholders may have an incentive, however, to refuse the payment of implicit claims in $t=1$ even when the company is not bankrupt, but the probability of bankruptcy increased.

³¹ Bessembinder (1991) shows the applicability of underinvestment problems to conflicts of interest between shareholders and stakeholders. Titman (1984) demonstrates that the agency costs resulting from shareholder-stakeholder conflicts are absorbed by the firm's current shareholders.

³² The intuition is that the probability of a large cash flow shortfall is higher for growth companies than for other firms. Hedging can mitigate the probability of such a large cash flow shortfall.

constraints, on the other hand, are largest for firms that invest more in intangibles than they do in plant and equipment. The reason is that capital-intensive companies can collateralise newly purchased plant and equipment. Service firms or pharmaceuticals, on the other hand, will find it difficult to collateralise investments in human capital or research and development. These „soft“ investments are subject to large incentive and information problems. This makes it especially expensive and in some cases impossible to use externally raised funds to finance hard-to-collateralise or soft assets [see Froot (1995)]. Most empirical studies strongly support this hypothesis. The higher the market/book value, research and development (R&D) expenditures and leverage, the higher the probability that companies hedge [see, for example, Géczy, Minton, and Schrand (1997), Lewent and Kearney (1990) and Nance, Smith, and Smithson (1993)]. Additional anecdotal support for the underinvestment hypothesis is provided by Lewent and Kearney (1990) in their explanation of the way Merck decided to hedge their foreign exchange exposure. Merck noted that R&D expenditures „furnish the basis for future growth“ and that „success in the pharmaceutical industry requires a continuous, long-term commitment to a steadily increasing level of research funding.“ Evidence by Tufano (1995), on the other hand, fails to support the view that companies hedge to reduce financial agency costs resulting from the underinvestment problem. The disadvantage of empirical tests of liquidity models is that they do not consider that if future positive NPV projects are large, hedging may eliminate any possibility of avoiding external financing [see Ross (1996)]

Third, if firms see external financing as costly, they will actually *cut investment spending* when they do not have the internally generated cash flows to finance all their investment projects. Indeed, Fazzari, Hubbard and Petersen (1988) found that companies reduce their capital expenditures by roughly 35 cents for each \$1 reduction in cash flow.

Fourth, since financial agency conflicts are caused by *information asymmetries*, potential benefits of cash flow hedging aimed at reducing the need for external finance should increase with the extent of information asymmetry. Géczy, Minton, and Schrand (1997) proxy information asymmetry with the percentage of institutional ownership and the number of analysts following. They find, however, that firms which hedge with currency derivatives are characterised by greater rather than smaller analysts following and institutional ownership. This conflicts with the Froot, Scharfstein and Stein (1993) model.

Finally, *cash is a substitute for hedging*. Nance, Smith and Smithson (1993) and Géczy, Minton, and Schrand (1997) test this hypothesis and confirm that cash holdings are negatively related to hedging activities. Harford (1996) shows that firms with more volatile cash flows hold larger cash-reserves to compensate for fluctuations. Similarly, Opler, Pinkowitz, Stulz and Williamson (1997) find that US-firms with strong growth opportunities and riskier cash flows hold relatively high ratios of cash to total assets. Firms that have the greatest access to the capital markets (e.g. large firms and those with good credit ratings) tend to hold lower

ratios of cash to total assets. They do not confirm, however, that risk management and cash holdings are substitutes.

There are two major *drawbacks* of most studies using accounting data. First, they derive from the use of derivatives whether a firm is a hedger or a non-hedger³³. The concern with comparing derivative users and nonusers to make inferences about hedging is that this method has the potential of mis-classifying hedgers as non-hedgers and speculators as hedgers. Derivatives can be used to either lower or raise a firm's risk exposure³⁴. Second, most studies do not identify risk exposure. To determine the value-maximising strategy, however, exposure must be known. This is especially true whenever the optimal investment volume I^* significantly depends on the risk factor S_t . For example, a firm's cash flow may be highly volatile but perfectly correlated with its investment opportunities. In this case liquidity models suggest that the firm has little need to reduce the volatility of its cash flows (natural hedge). Empirical studies of liquidity models, however, implicitly assume a constant optimal investment volume.

Petersen and Thiagarajan (1997) study two gold mining firms which have diametrically opposed policies toward derivatives: American Barrick aggressively hedges its gold price risk using derivatives. Conventional studies would identify it as a hedger. Homestake Mining, on the other hand, uses no derivatives, but a combination of operational and accounting decisions to manage its risk. Homestake Mining adjusts its operations such that both cash inflows (sales of gold) and cash outflows (extraction costs of gold) move with the price of gold. Conventional studies would classify Homestake Mining as a non-hedger. The result of Petersen and Thiagarajan is that the exposure of the two firm's equity to gold price risk is surprisingly similar. They conclude that tests of risk management theory must account for the different methods, not just the different objectives, which firms use in managing risk.

3.1.2 One-Period Models

While two-period models suggest that companies should hedge cash flows in order to reduce the need for expensive external finance, one-period models investigate financial agency costs if the company needs to raise external capital. The question is how firms can reduce the costs

³³ For example, Francis and Stephan (1990) construct a sample of hedgers by searching financial databases for keywords such as hedging, swaps, or options. Géczy, Minton and Schrand (1997) take a sample of S&P 500 firms with foreign exchange rate exposure and classify them as hedgers based upon finding references to derivative instruments in their financial statements. Hentschel and Kothari (1995) use a combination of the two selection methods.

³⁴ Hentschel and Kothari's (1995) finding that the volatility of derivative users and nonusers is similar is consistent with this view.

of external finance if required. I will use the models by Myers (1977) and Bessembinder (1991) to analyse whether hedging can reduce agency costs of debt in this framework³⁵.

The Myers model

Myers (1977) assumes that at time zero the company raises equity and debt capital to finance a growth option, that is a potential positive NPV investment at time one. The maturity of debt is beyond time one, a condition which is necessary to create a situation in which outstanding debt will change the firm's investment decision in some states. At time one the company can exercise its growth option by investing in a positive NPV project. This project can only be financed if internal shareholders issue additional shares³⁶. The required outlay for this positive NPV investment is not known at time zero. Supposing that the investment is „all or nothing“, at time one owner managers will exercise the option to invest only if the value of the firm $V_1(S_1)$, which is assumed to be the NPV of the investment project whenever the financial price is S_1 , exceeds the sum of I_1 , the required outlay, and D_2 , the promised payment to the firm's creditors. If $V_1(S_1) < I_1 + D_2$ and the investment is made, shareholders' outlay I_1 will exceed the market value of their shares³⁷. Therefore, there will be some realisations S_1 where owner managers will bypass the positive NPV project [see Myers (1977)]. The incentive to underinvest results from the fact that current shareholders have to pay the full amount invested I_1 , while the benefit from the investment $V_1(S_1)$ is shared with debtholders or other senior claimants. This change in incentives compared to the completely equity financed company reduces firm value and increases the price of debt at time zero.

The Bessembinder model

Alternatively, agency costs of debt can be modelled in the way suggested by Bessembinder (1991). In his model, the firm also operates at two dates. At time zero, the firm first borrows and second selects the level of capital investment, one after the other. The net time zero cash flow, the difference between proceeds from the sale of debt and the capital investment, accrues to shareholders as a dividend if positive, and as an equity infusion if negative. At time one, the firm sells its output and settles the debt claim. Since the proceeds from the investment V_1^I are used to repay the debt D_1 and there may be some states where $V_1^I < D_1$, that is there is some probability of default, shareholders will not always receive the full amount they invested

³⁵ I still assume that internal shareholders manage the firm and that the market interest rate is zero.

³⁶ Note that the money raised at time zero is not held as cash or used to purchase assets. It may be assumed that the money is used to prepare the production at time one. At time one, the company therefore has no financial slack and consequently has to raise money for additional investments, I_1 .

at time zero. Assuming a variable amount of investment, their optimal investment volume I_0^{\dagger} , therefore, will be smaller than the optimal investment volume in the case of a purely equity financed firm I_0^* .

In both models the reason for underinvestment is that debt has a positive probability of default. Therefore, any action that reduces the probability of default may help to avoid or at least mitigate the underinvestment problem. The question is whether in these models hedging is suitable to reduce agency costs of debt financing.

Since *Myers* assumes that at time 1, there are some realisations of S_1 where the firm defaults, it cannot issue safe debt at time zero. The creditors will receive nothing at all if the growth option is not exercised. It is only exercised if $V_1(S_1)$ exceeds D_2 . Therefore, the value of debt at time zero can be written as

$$V_0^D = \int_{S_1^{\dagger}}^{\infty} D_2 q(S_1) dS_1 \quad (3.8),$$

where $q(S_1)$ is the current equilibrium price of a unit of money delivered at time 1 if and only if the financial price S_1 is realised [see *Myers* (1977)]. S_1^{\dagger} is the critical financial price: rational owner managers will exercise their growth option at time one only if $S_1 \geq S_1^{\dagger}$. If the company shorts a forward contract, the value of the growth option and consequently the value of the company at time one will be independent of the financial price S_1 . In other words, a full hedge may achieve that $V_1 > D_2$, independent of the financial price realised at time one, making the debt default free, eliminating the incentive to underinvest and, therefore, saving agency costs of debt.

The results are similar to those of *Bessembinder*, who assumes that at time zero the company selects forward contracts simultaneously with the sale of debt, that is before the selection of the investment volume I_0 . The hedge with the forward contract can shift individual future states from default to nondefault outcomes, increasing the number of future states in which equity holders are the residual claimants. As a result, the sensitivity of senior claim value to the investment at time zero is reduced. Due to the hedge, equity holders receive a larger proportion of the incremental benefits from new investment projects. This increases their willingness to provide funds for additional investment.

³⁷ *Myers* (1977) assumes that the value of the investment depends on the state of nature at time one. However, to simplify my analysis I assume that V_1 depends exclusively on the financial price S_1 which can be hedged with financial instruments.

The discussion showed that hedging may reduce the agency costs of debt because debtholders will offer better prices to internal shareholders if the probability of default is decreased³⁸. However, it is important to see that the firm enjoys improved contracting terms with creditors as a result of hedging only if it can credibly commit *ex ante* to following a hedging strategy after debt proceeds are received. The assumption that the company can commit to hedging, with zero probability of a subsequent shift to a more speculative position, is not fully realistic. If shareholders are allowed to alter the forward position of the company subsequent to sale of debt, they have incentives to shift to a speculative forward position in order to shift wealth from bondholders to shareholders [see Smith and Stulz (1985)]. Myers (1977) discusses several solutions how owner managers may commit not to increase the risk position of the company, e.g. renegotiation of debt contracts whenever new investment opportunities arise. However, some of these methods involve prohibitively high costs of monitoring and contract enforcement. The agency literature, therefore, usually concentrates on bond covenants and reputation building as devices to reduce the costs resulting from shareholder-bondholder conflicts.

By *bond covenants* the company may commit to a restrictive investment policy or commit to follow a certain hedging strategy. Smith and Warner (1979) emphasise that restrictive covenants seeking to specify a firm's future investment policy directly are generally expensive to monitor and make it costly for the firm to alter investment plans, even when appropriate. Bessembinder (1991) stresses that an explicitly defined hedging policy requires comparably low monitoring costs and violations of the covenants are unambiguous. Therefore, covenants referring to the risk management policy are preferable to bond covenants restricting the investment policy. Moreover, Smith and Stulz (1985) note that whenever covenants restricting the investment policy are implemented, hedging can reduce the likelihood that such covenants become binding. Géczy, Minton, and Schrand (1997) note that at least four of their sample firms disclosed in 1991 that bond covenants or credit agreements require them to hedge some portion of their interest rate exposure.

Diamond (1989) shows that in a multiperiod model with repeated contracting, a *reputation for hedging* would become valuable. However, Smith and Stulz (1985) note that such a reputation is not likely to be sufficient to insure that the firm will hedge when the probability of bankruptcy is large. Then, the gain from no longer hedging may outweigh the cost of lost reputation, since the reputation is valuable only if the firm successfully avoids bankruptcy.

Apart from bond covenants and reputation building, a firm could control agency costs of debt for example by using preferred stock or convertible debt rather than straight debt and by dividend restrictions. *Preferred stock* has the advantage that although similar to debt, it first increases the equity ratio and second reduces cash outflows if the financial situation of the

³⁸ Note that underinvestment increases the probability of default. This can be easily seen in the Myers model, where the company defaults if owner managers do not realise positive NPV projects at time one.

company is bad. This is because firms can omit a preferred dividend payment without being forced into default. In contrast, a bankruptcy filing is almost inevitable if an interest payment on debt is not met. *Convertible bonds* include an embedded option on the firm's assets which makes this liability more sensitive to firm-value changes and thereby reduces the sensitivity of equity value to firm-value changes. It reduces shareholder's benefits from an increase in the company's risk and consequently their incentive for risk shifting. *Dividend constraints* can reduce the agency costs of debt because lower dividend-payout ratios help to assure bondholders that funds will be available to pay fixed claims [see Nance, Smith and Smithson (1993) and Barnea, Haugen and Senbet (1985)].

In sum, one-period models suggest that firms should include covenants defining a firm's hedging policies in contracts with bondholders, build up a reputation for hedging and/or use hedging substitutes like convertible debt and preferred stock. There is no evidence that companies build on a reputation for hedging or define their risk management policy by covenants³⁹. In the USA, however, contractual dividend constraints and other restrictive bond covenants are common. Francis and Stephan (1990) find that the hedging probability of US-firms increases with the risk of violating such covenants. Nance, Smith and Smithson (1993) show that hedging with derivatives is negatively correlated with alternative methods to reduce financial agency costs like the issue of preferred stock.

A *major drawback* of financial agency theory is that it assumes homogeneous objectives of all shareholders, i.e. no conflicts of interest between different shareholders. All shareholders agree which investment, capital structure and hedging policy should be chosen to maximize their utility. Dividend payments are irrelevant. Shareholders certainly agree that managers should maximise the net present value of all future cash flows, even if capital markets are not perfect. However, they may have different views what discount rate should be chosen to value future cash flows [see Speckbacher (1997)]. Especially in countries with a corporate governance structure like Germany, where only about 1% of all companies are listed on the stock exchange [see Copeland, Koller and Murrin (1993)], and where ownership is concentrated [see Mayer (1996) and Ménil, Portes and Sinn (1997)], a clearly defined value maximising corporate policy does not exist.

3.2 Economic theory of agency

The financial theory of agency assumes that managers act in the interest of internal shareholders (owner managers). In modern corporations, however, there is separation between ownership and control. As owner (principals) of the firm, shareholders delegate decision-making authority to managers. Managers are the shareholders' agents and their responsibility

³⁹ At this stage, I intentionally ignore the literature on income smoothing.

is to run the company in the shareholders' best interest. However, managers will maximise their own expected utility. Their goals may conflict with those of shareholders. The economic theory of agency covers these conflicts of interests between managers and shareholders as well as methods to mitigate them. In joint stock companies, three conflicts of interest between the firm's managers and shareholders may arise⁴⁰:

(i) *Choice of effort*: additional effort by the manager generally increases the value of the firm, but it reduces his utility [see Ross (1973)]⁴¹.

(ii) *Differential risk preferences*: the components of managers' wealth portfolios consist of the income produced from their employment with a firm, their ownership of shares and options in the enterprise, and their remaining assets unrelated to the firm. Managers are usually less able to diversify their risks than shareholders, because they own substantial equity stakes in the firms they manage. They may, therefore, be more risk averse than shareholders and be more concerned about the variability of total firm value, including that portion of firm risk that can be eliminated through diversification by the firm's stockholders. Risk can refer directly to the monetary income of managers or to their reputation.

(iii) *Differential horizons*: the manager's time horizon may be shorter than that of investors; while the value of the stock is the present value of dividends stretching to infinity, the executive will only be in the company for a finite period of time. Managers, therefore, have incentives to place lower values on cash flows occurring beyond their horizon than is implied by the market values of these cash flows [see Jensen and Meckling (1979)]. Moreover, short-termism may be motivated by reputational concerns [see Hirshleifer (1993)].

For the discussion in this paper, the impact of differential risk exposures on hedging is most relevant. Since most models assume risk averse managers, I have to release the assumption that all market participants are risk neutral. Risk aversion of managers causes economic agency problems, since managers may not pursue the value maximising investment and financing policy just in order to reduce the total risk of the company. For example, managers might not invest in positive NPV projects which increase the total risk of the company (underinvestment problem) or they might diversify in projects outside the core business of the company, although they have a negative NPV, just in order to reduce risk (overinvestment problem). Moreover, managers might choose a leverage, which is not value-maximising in terms of taxes and the costs of financial distress. Since risk-reduction activities may induce a wealth-transfer from shareholders to bondholders, and real resources are employed to reduce

⁴⁰ Note that the separation of ownership and control is less significant in other organisational forms [see Fama and Jensen (1983)]. For example, in proprietorships, which are characterised by 100 percent ownership of the residual claims by the top-level decision agent, ownership and control are not separated and consequently no conflicts of interest arise.

⁴¹ Note that the assumption that managers are effort averse seems to be unrealistic. Kaplan (1984) and Holmstrom and Ricart i Costa (1986) consider effort-based models highly inadequate for capturing the incentive

risk, shareholders are actually paying for the manager's increased security [see Amihud and Lev (1981), Smith and Stulz (1985), Jensen (1986), Stulz (1990) and Fite and Pflleiderer (1995)]⁴².

These agency costs can be reduced by the multitude of control and incentive procedures discussed in the literature. The most important ones are first control mechanisms of the capital market, the labour market and the markets for corporate control⁴³ and second optimal compensation plans⁴⁴. Hedging can mitigate economic agency costs, because a reduction of financial risk minimises the manager's exposure and, therefore, the risk that he employs a suboptimal investment and capital structure policy.

I will divide the literature relevant to explain risk choice and hedging behaviour of managers in two categories. The first one includes papers where managers are motivated primarily by compensation and the second one papers where managers are concerned with their reputation⁴⁵.

3.2.1 Compensation

Compensation contracts can mitigate economic agency conflicts in two respects: On the one hand, they can induce managers to take actions that increase returns. This is achieved by managing the sensitivity of managers' wealth to firm performance, i.e. the *pay-performance slope* [e.g., see Jensen and Meckling (1976), Lewellen, Loderer, and Martin (1987), and Smith and Watts (1992)]. On the other hand, they can motivate managers to take risks as desired by risk neutral shareholders. This can be achieved by managing the *convexity of the relation between performance and manager's wealth* [e.g., see Jensen and Meckling (1976), Haugen and Senbet (1981), and Smith and Stulz (1985)].

Let's first assume that the manager's wealth depends exclusively on his compensation⁴⁶ and they receive a *fixed salary*. In this case, managers may not be motivated to increase firm performance, because the pay-performance slope is flat. Ignoring the risk of bankruptcy and reputational effects, however, they also do not have a reason to behave more risk averse than shareholders would wish.

issues that management faces. Managers are likely to be industrious enough. What shareholders worry about more is how effective are managers in making decisions.

⁴² Note, however, that the conservatism of managers may help to align the interest of creditors and shareholders and mitigate agency costs of debt.

⁴³ The role of markets in resolving agency problems are discussed in the following papers: Capital markets: Barnea, Haugen and Senbet (1985) and Neus (1989). Labour markets: Barnea, Haugen and Senbet (1985), Alchian (1984), Fama (1980) and Jensen and Meckling (1976). Market for corporate control: Jensen and Ruback (1983).

⁴⁴ For a discussion of optimal compensation contracts see, for example, Ross (1973), Holmstrom (1979), Barnea, Haugen and Senbet (1985), Neus (1989), Harris and Raviv (1978), and Shavell (1979).

⁴⁵ Note that it is not useful to continue with an analytical approach to review the literature, since relevant papers cannot be usefully integrated in a consistent model framework.

⁴⁶ If managers are not well diversified, the results are very similar to the case where manager's revenue stream consists of the compensation of the company and other sources.

Usually, compensation of managers is positively related to the performance of the company in order to create a positive pay-performance slope. This is typically accomplished through *discounted stock purchase* programmes or the granting of *stock options*. Smith and Stulz (1985) analyse the impact of such compensation plans on manager's risk taking behaviour. They predict that managers with greater share ownership would be more risk averse, while those with greater option holdings would be less risk averse, because stocks provide linear payoffs as a function of stock prices whereas options provide convex payoffs. The global convexity of the option contract may induce managers to take on greater risk, because lower risk would reduce the volatility and hence the value of the expected utility of their option contracts.

The question is, what implications the theory of Smith and Stulz (1985) have on the hedging and investment behaviour of managers. If hedging is costless, risk averse managers with a significant amount of *shares* of the company will hedge all hedgeable risks⁴⁷. This strategy might be in the best interest of shareholders for two reasons: First, managerial hedging can reduce the compensation for risk required by management. Second, hedging can decrease taxes, costs of financial distress and financial agency costs⁴⁸. However, since some risks are not hedgeable, risk averse managers may pass up risk-increasing, positive NPV projects (underinvestment problem) or invest in risk-increasing, negative NPV projects (overinvestment problem). If managers hold *European call options* on shares of the company, their risk taking behaviour will depend on the time to maturity and the strike price of these options. The shorter the time to maturity and the more the options are out of the money, the more risk seeking managers will be. Assuming that the manager's options are not deep in the money and that their time to maturity is not excessively long, managers will not hedge all hedgeable risks, because convexity in the incentive scheme makes the manager's expected wealth an increasing function of firm risk. Thus, the manager prefers to retain some level of firm risk. However, since the manager is risk-averse, the preferred level of risk will be limited. The manager will choose the level of risk where his utility from increased expected wealth is just offset by his disutility due to risk aversion [see Guay (1997)]. The utility maximising hedging and investment policy are therefore hard to predict.

Campbell and Kracaw (1987) investigate the case where manager's utility depends not just on compensation, but also on their choice of effort. They show that when incentive contracts are treated as independent of the risk management decision or when the incentive contract is taken as given, then managers will find it optimal to insure to the maximum extent possible at fair prices. However, in this case, well-diversified shareholders will be hurt by risk management since optimal managerial effort will decline with a decline in the risk for a given

⁴⁷ As is still assumed that manager's do not have a view on future financial prices.

⁴⁸ Note, however, that hedging the level of cash flows can mitigate financial agency costs only if the optimal investment volume I^* is constant or the risk factor is not correlated with the optimal investment volume.

compensation contract. On the other hand, if shareholders are able to adjust incentive contracts either in anticipation of hedging or after observing hedging, but before managers expend effort, then they will benefit from that hedging. The gain to shareholders is twofold: First, as suggested by Smith and Stulz (1985), they can reduce fixed payments to managers. Second, they will find it optimal to raise the managers share of risky returns, which will induce the manager to exert more effort.

Tests on the impact of compensation on risk taking are ambiguous. They can be divided into studies on the *impact of the manager's wealth portfolios on the investment strategy* and studies that directly refer to hedging. Most studies in the first category assume that the relationship between equity ownership by managers and firm risk taking is positive. They do not differentiate between equity ownership in the form of shares or options, as suggested by Smith and Stulz (1985). For example, Amihud and Lev (1981), Agrawal and Mandelker (1987), and Hill and Snell (1988) found empirically that the motive behind diversification or mergers is risk reduction when insiders own small stakes in the company. These studies argue that to the extent that insiders employment income is linked to changes in corporate value, an increase in the variance of firm returns increases the risk of their employment income. When managers possess large equity claims, however, they are less likely to reduce corporate risk, because their interests become more aligned with those of shareholders⁴⁹. Similarly, Johnson, Hoskisson and Hitt (1993) reported that corporate restructuring (reverse diversification) was internally induced with greater levels of managerial equity ownership. Wright, Ferris, Sarin and Awasthi (1996), on the other hand, do not confirm a linear relationship between equity ownership by managers and corporate risk taking. Their empirical results rather indicate that a low degree of equity ownership by the managers of growth companies positively influences corporate risk taking. With an increasing equity stake in the firm, however, managers tend to reduce corporate risk taking. The reason is that an increase of manager's holdings of the firm's equity decreases the diversification of their personal wealth portfolios, making managers more risk averse with respect to the firm's cash flows. For firms without growth prospects, the impact of manager's equity ownership is statistically insignificant.

Studies analysing the *direct impact of compensation on hedging* generally assume that compensation plans are exogenous. Most papers confirm the results of Smith and Stulz (1985). For example, Tufano (1996) provides evidence that hedging activities in the gold-mining industry are positively related to managers' common stockholdings and negatively related to the number of stock options held. Schrand and Unal (1995) analyse the risk management changes of S&L's changing their organisational form from mutual ownership to stock ownership. They find that the S&L's where management has options end up having greater one-year gaps, hence greater exposures to interest rates. Géczy, Minton and Schrand (1997), on the other hand, note that currency derivatives user firms are characterised by

greater managerial option holdings. A drawback of all these studies is that they do not consider the convexity of the portfolio of executive stock options, because exercise prices and maturity dates of options outstanding are not reported.

More recent papers investigate how the *kind of compensation contract chosen* by owners depends on the investment opportunity set available. The thought is that risk-related economic agency problems are greatest for firms with valuable risky projects. Therefore, the severity of agency problems is positively related to the fraction of a firm's growth options. Thus, the magnitude of convexity in firms' executive compensation plans is predicted to be positively related to the proportion of growth options in their investment opportunity sets [see Smith and Watts (1992)]. Gaver and Gaver (1993), and Baber, Janakiraman and Kang (1996) test the relation between the investment opportunity set and the *slope* of the compensation-performance relation. They provide evidence that firms with substantial investment opportunities more closely tie managers' compensation to firm performance than firms without significant investment opportunities. Guay (1997) investigates the impact of the *convexity* in the compensation-performance relation on manager's compensation plans. He finds that the magnitude of the convexity in corporate executive's incentive schemes is positively related to the proportion of growth options in firms' investment opportunity sets. Thus, firms provide managers with incentives to take risky projects when the potential loss from underinvestment in valuable risky projects is greatest. Moreover, Guay (1997) found convexity to be negatively related to financial leverage and positively related to firm size, providing some support for risk management theory as a determinant of the risk-taking incentives provided to managers.

3.2.2 Reputation

Absent explicit incentive schemes, a manager is concerned only about his reputation [see Holmstrom and Ricart i Costa (1986)]. Apart from the direct value of prestige, high reputation gives the manager better bargaining power to increase his pay and improves his job security. Relevant papers assume that managers are more short-sighted than investors and show that this affects their risk choice, i.e. their investment and hedging policy.

Most studies analysing the impact of managers' reputational concerns refer to investment strategies⁵⁰. The majority of these studies conclude that a manager who is concerned with his reputation will sometimes be too conservative in the sense that he will forego positive NPV projects (*underinvestment problem*). For example, Holmstrom and Ricart i Costa (1986) argue that managers tend to be excessively cautious because unfavourable outcomes will negatively affect their reputations. Reputation is relevant because the manager's freedom to quit a firm to

⁴⁹ This argumentation implies that contrary to the view of Smith and Stulz (1985), managers are well diversified.

⁵⁰ For an overview see Hirshleifer (1993).

get higher pay elsewhere gives him an incentive to build his reputation in the short run⁵¹. Given this assumption, Holmstrom and Ricart i Costa (1986) conclude that shareholders need to give managers incentives to take risks⁵². Alternatively, hedging with derivatives may be a substitute for a conservative investment policy and therefore mitigate the underinvestment problem.

The fact that managers tend to *overinvest* when cash flows are higher than the volume of all new positive NPV investments might also be motivated by reputational concerns. The reason for overinvestment may be that managers keep the funds within the firm and therefore under their control [see Froot (1995)]. In other words, reputation may depend on the size of the company. Blanchard, López-de-Silanes and Shleifer (1993) confirm the overinvestment view empirically. They find that firms did not typically return the excess cash to investors by paying down debt, increasing dividends, or repurchasing shares. Instead they tended to use the funds to make acquisitions, to continue existing loss-making operations, and to increase executive compensation. If cash flows are lower than the volume of all positive NPV projects, managers tend to underinvest.

The question how managerial reputation may impact the *hedging strategy* pursued by managers is addressed by DeMarzo and Duffie (1995), Breeden and Viswanathan (1996), DeGeorge, Boaz and Zeckhauser (1996), and Raposo (1997). These models imply that due to the information effect of hedging, hedging policy can have a real effect on the value of the firm. All these papers are close to the model of learning and career concerns by Holmstrom and Ricart i Costa (1986). However, contrary to Holmstrom and Ricart i Costa, outsiders cannot observe managerial quality, nor can they observe the firm's risk exposure. In such a world, financial hedging can improve the informativeness of corporate earnings as a signal of managerial ability by the elimination of extraneous noise.

All models assume that incentives concerning information transmission may be different for managers and shareholders, resulting in conflicts of interest in the hedging and disclosure policy. *Shareholders* wish managers to hedge for two reasons: First, hedging brings about real improvements in the firm's investment decisions. The reason is that hedging provides insurance to the risk averse manager and, therefore, increases his incentive to select risky value maximising investment projects. Second, since hedging filters away external factors, shareholders can better assess the manager's ability and can better decide whether to replace him. *Manager's* incentives to hedge depend on the inferences shareholders are expected to draw from reported earnings: Most models assume that manager's compensation in the current period depends on the expected firm value and contracts are renegotiated at the end of each

⁵¹ Note that this contrasts with a more traditional analysis of agency problems which assumes that the manager and the firm are inseparably bound together.

⁵² Holmstrom and Ricart i Costa (1986) assume symmetry in beliefs between the manager, the owner, and the market, and that managers only value their lifetime income stream.

period⁵³. Payment in the next period, therefore, depends on realised profits in the current period and additional risk disclosures.

Both *Breeden and Viswanathan (1996)* and *DeGeorge, Boaz and Zeckhauser (1996)* show that under these assumptions, manager's hedging decisions depend on their ability. High ability managers wish to lock-in the higher profits that result from their higher ability. Thus they tend to hedge to improve the informativeness of the learning process. Lower ability managers rather gamble, trying to appear like good managers. Breeden and Viswanathan (1996) show what additional impact managerial equity holding has on manager's risk taking behaviour. They find that whenever managers hold equity in the firm in addition to caring for their managerial reputations, hedging reduces the option value of equity. The greater the fraction of equity that the manager owns, the higher is the implicit cost of hedging and hence the more likely the prediction that hedging occurs only when a high ability manager has a substantial performance differential over other related firms. DeGeorge, Boaz and Zeckhauser (1996) note that differences in the hedging behaviour of high and low ability managers increase with the uncertainty of shareholders about whether companies are good or bad.

DeMarzo and Duffie (1995) and *Raposo (1997)* address the interaction between the disclosure of hedging positions and manager's hedging strategies. Both models show that assuming the risk exposure of the firm is not known, disclosure is not desirable. Disclosing the value of hedging instruments can destroy the manager's incentive to hedge because hedging can reveal more information about the manager's ability and thereby make his future compensation more risky. If hedging profits are aggregated with other revenues, on the other hand, managers will hedge to reduce the volatility of earnings and in this way reduce their employment risk. The major difference between these models is that DeMarzo and Duffie (1995) considers only disclosure and nondisclosure, while Raposo (1997) contemplates voluntary disclosure. According to Raposo (1997), the hedging and disclosure policy that most benefits shareholders depends on the complexity of the underlying investments and not on the extent of disclosure as suggested by DeMarzo and Duffie (1995).

The reputation literature has several *drawbacks*. First, models are static. In reality, learning about managerial ability is an ongoing process. Therefore, the reputational impact of reported profits is likely to be larger early in the manager's career, because the prior on the manager's ability is diffuse⁵⁴. Second, papers usually assume a perfect labour market, where information on the manager's ability are reflected in his salary as soon as they are revealed. The real-world labour market, however, is far away from this ideal. This fact might mitigate reputational

⁵³ DeGeorge, Moselle and Zeckhauser (1996) model managerial incentives slightly different. They assume that the firm is sold in the next period and the manager's wealth is a weighted average of current expected profits and expected proceeds from the sale of the firm in the next period, where the weights are determined by the discount rate. However, as in the models by DeMarzo and Duffie (1995), Breeden and Viswanathan (1996) and Raposo (1997), managers are concerned with the implications shareholders draw from reported earnings in the current period.

concerns of management. Third, most models presume that a single manager runs the firm. Empirical studies, however, show that decision-making authority is often vested in a larger group of persons. The degree to which responsibility for decisions is shared among several managers is expected to have an impact on the willingness to take risks. Japanese firms, for instance, might have been able to take more risks with higher expected payoffs than U.S. firms, because responsibility is shared in their managerial culture [see Holmstrom and Ricart i Costa (1986)]. Actual risk aversion of managers might, therefore, be smaller than expected by theory. Fourth, models usually assume that compensation contracts with managers are renegotiated each period. Long-term managerial incentive schemes would mitigate the impact of reputational concerns. Finally, the models do not distinguish between accounting exposure and economic exposure. For example, the models of DeMarzo and Duffie (1995) and Raposo (1997) suggest that non-disclosure is in the best interest of shareholders, since it induces risk averse managers to hedge accounting risk. However, since hedging accounting risk may increase economic risk and vice versa [see Beaver and Wolfson (1995)], non-disclosure of hedging positions and hedging strategy might reduce shareholder's utility.

Empirical tests of the model of DeMarzo and Duffie (1995), Breeden and Viswanathan (1996), DeGeorge, Boaz and Zeckhauser (1996), and Raposo (1997) are problematic, because the quality of management can hardly be measured. However, DeGeorge, Boaz and Zeckhauser (1996) take annual returns of asset (ROA) as a proxy for the quality of a firm and the volatility of ROA as a proxy for a firm's risk. For most industries in their sample of 415 US firms they find significantly negative correlations between performance and volatility, confirming their model implication that high ability managers hedge more than low ability managers. Tufano (1995) finds that younger managers in the gold mining industry are more likely to hedge than older managers. Since there is probably greater uncertainty about the ability of younger managers, the result of Tufano is consistent with the version of the Breeden and Viswanathan (1996) model, where hedging is costly. This model implies that greater dispersion of abilities leads to more separation, i.e. high ability young managers hedge while lower ability young managers do not hedge. In the case of older managers, on the other hand, dispersion of ability is too low to compensate for the costs of hedging. Kruse (1991) finds evidence that employees may be willing to accept greater variability in their compensation in exchange for more stable employment, indicating that job security is an important factor in a manager's utility function.

My *major criticism* of economic agency theory in general is the assumption that shareholders wish managers to invest in all positive NPV projects, where the discount rate is calculated with the CAPM. The discussion of value-maximising hedging strategies showed, however,

⁵⁴ A dynamic signalling model like the one suggested by Spence (1973) would be more suitable in this context.

that (i) even risk neutral shareholders wish firms to be risk averse and (ii) total risk rather than systematic risk matters. Therefore, capital budgeting techniques like that suggested by Froot and Stein (1996) should be applied to identify value-enhancing investment projects. In agreement with liquidity models [see 3.1.1], they assume increasing costs of raising external funds and, therefore, consider shareholders' desire that managers should align the supply of funds with the demand of funds. The implication of the Froot and Stein (1996) model for risk management is that companies should hedge all tradable risks. The implication for capital budgeting is that firms should price not just the market risk, but also the contribution of the new non-tradable risk to the variance of the firm's overall portfolio of non-tradable risks. Economic theory of agency ignores these findings and, therefore, possibly mis-states conflicts of interest between shareholders and managers. For example, an investment might have a negative NPV, if the expected market rate of return is applied. If this investment is negatively correlated with the firm's cash flows, however, the model of Froot and Stein (1996) suggests that the investment might well be in the best interest of shareholders. Economic theory of agency would mis-specify such an investment as overinvestment.

4 Corporate hedging can replace home-made hedging by shareholders

In the previous analysis, I assumed no transaction costs as well as well diversified shareholders. In this section, I reveal these assumptions. This involves that financing decisions by shareholders to change the risk profile of their portfolio are not perfect substitutes for corporate financing decisions. Home-made hedging may be (i) unfeasible and it (ii) may not be concluded at the same prices as corporate hedging.

4.1 Home-made hedging is unfeasible

Risk averse, ill-diversified shareholders value corporate hedging, because home-made hedging may not be feasible for three reasons: First, shareholders usually have far *less information* than managers about the firm's exposure. Therefore, DeMarzo and Duffie (1991) show that shareholders typically want managers to hedge completely. They assume, that (i) managers act on behalf of shareholders and (ii) that the actual hedging portfolio held by a firm is not directly observable by shareholders. The second assumption is based on the premise that the firm has proprietary information, i.e. disclosure would not be in the interest of shareholders. In this situation, it is impossible for shareholders to adopt for themselves financial strategies, because the information necessary to implement such strategies is private to the firm. The firm, therefore, should hedge on shareholder's behalf. Second, individual investors may not have unlimited *access to market-based hedging instruments*, because they are often dealt in sizes which are too large for them. Moreover, the initial margin, price fluctuation and daily

settlement arrangements can impose enormous cash flow problems on individual investors [see Sercu and Uppal (1995)]. Finally, a firm has access to *internal hedging techniques* such as leads and lags, which are not available to shareholders. Mayers and Smith (1990) confirm the view that firms with ill-diversified investors have an incentive to hedge empirically. They investigate Lloyds associations and closely held common stock companies and find that these firms hedge (reinsure) more than do firms with more diverse ownership.

4.2 Home-made hedging is more expensive

The costs of hedging are another reason, why shareholders may value corporate hedging. Hedging causes two major cost components: First, costs that arise with initiating and maintaining a risk management programme in general (including the opportunity cost of management's time). Second, transaction costs associated with choosing a particular derivative or other hedge instruments. For derivatives, transaction costs include out-of-pocket costs such as brokerage fees in futures markets and the implicit cost of the bid-ask spread. Both risk management programmes and transaction costs involve scale economies [see Block and Gallagher (1986), Booth, Smith, and Stolz (1984) and Sercu and Uppal (1995)].

This implies that risk averse shareholders wish firms to hedge, because firms can hedge at lower costs. Moreover, large firms are more likely to hedge with derivatives than small firms. Nance, Smith, and Smithson (1993), Bodnar, Hayt, Marston, and Smithson (1995), and Géczy, Minton, and Schrand (1997) confirm this hypothesis and find that firms with greater economies of scale in implementing and maintaining a risk management programme are more likely to hedge.

5 Conclusion

Risk management theory can be divided in two competing approaches: equity value maximising strategies and strategies determined by managerial risk aversion. The first category suggests that hedging can increase the market value of equity and that companies should be concerned with total risk rather than systematic risk. There is, however, no comprehensive framework for explaining risk management within the imperfect financial environment in which firms operate. Therefore, it is not possible to draw undisputed conclusions on the value maximising risk management policy. Assuming imperfect capital markets, hedging theory suggests the following policies to maximise the market value of equity:

Hedging objective	Hedging motives	Hedging strategy
Reduce taxes	<ol style="list-style-type: none"> 1. Progressivity of corporate tax rates and limited or delayed deductability of large losses 2. Opportunity for increased leverage and tax-benefits that follow 	<ol style="list-style-type: none"> 1. Minimise the volatility of taxable income 2. Minimise the volatility of cash flows
Minimise costs of financial distress	Direct costs of insolvency and contracting costs for extended and new contracts	Avoid (i) cash flow shortfalls and/or (ii) firm value shortfalls ⁵⁵
Minimise the demand for costly external finance	Avoid underinvestment	Align the demand of funds with the supply of funds: (i) Minimise the probability of cash flows falling below the volume of all positive NPV projects and (ii) minimise the volatility of cash flows if investment volume is constant
Minimise the costs of debt finance	Contracting costs of debt finance	Use bond covenants or build up a reputation for hedging
Replace „home-made“ hedging by shareholders	Risk averse shareholders with limited information on the firm’s exposure, limited access to market-base hedging instruments and no access to company specific hedging techniques	Minimise the volatility of stock returns ⁵⁶

Table 1: Hedging by owner managers

Assuming no transaction costs, a constant volume of positive NPV projects and that cash flows are used to calculate taxes as well as costs of financial distress, the value-maximising strategy would be to minimise the volatility of cash flows. The different benefits of hedging would not be mutually exclusive. Thus, the total benefits of hedging would be the sum across the various motives.

⁵⁵ In (2.2) I analysed the costs of financial distress only in the context of a cash flow shortfall, because I assumed an equity financed firm. Leveraged companies, however, may also have the objective to minimize the probability of the firm value falling below the market value of debt. Assuming symmetric information, this hedging strategy can reduce both direct and indirect costs of insolvency.

⁵⁶ Assuming symmetric information, minimising the volatility of stock returns would be identical with minimising the volatility of cash flows and firm value. However, in a world with asymmetric information the volatility of returns may also depend on other factors such as the volatility of reported earnings.

Once these assumptions are removed, however, it is not obvious whether a firm should hedge taxable income, the market value of the company or cash flows. And it is unclear, whether a firm should minimise volatility or simply avoid lower tail outcomes. Therefore, the company has to concentrate on a primary motive to implement an effective hedging programme. If the primary motive for a particular firm to minimise *taxes*, then this firm should focus on minimising the volatility of taxable income. If the firm's primary concern is to reduce the *costs of financial distress* and it can faithfully communicate its true probability of default, the firm should minimise the likelihood of the firm value falling below the market value of debt and/or avoid cash flow shortfalls⁵⁷. If hedging is prompted to reduce *the demand for costly external finance* and the investment volume is independent of the risk factor(s), the firm should perfectly hedge all hedgeable risks to minimise cash flow variability. If the firm wants to minimise the demand for external finance and the optimal investment volume is perfectly correlated with the risk factor(s), the firm has a natural hedge and, therefore, does not need to manage risk actively. If external debt has to be raised, the company should *minimise contracting costs*. To achieve this goal, the firm can faithfully define a conservative risk management policy by bond covenants or reputation building, it can choose preferred stock or convertible debt instead of straight debt and it can constrain its dividend payments. Once the hedging policy is identified, the firm has to trade-off *hedging costs* and the benefits of hedging.

The competing approach to value enhancing risk management techniques claims that *managers will maximise their expected utility* rather than the market value of equity. This approach may have other implications for risk management, because managers tend to be more risk averse than shareholders. The reasons for manager's risk aversion are their ill-diversified portfolios and reputational concerns. Manager's risk aversion may induce them to under- or overinvest or to „overhedge“. To mitigate this problem, shareholders attempt to motivate managers to hedge and follow the value-maximising investment strategy using discounted stock purchase programmes or stock option plans.

There is ambiguous *empirical evidence* on whether theories of managerial risk aversion or those of value maximisation identify a dominant motive for hedging. Similarly, there is limited evidence on the relative importance of the different hedging motives. However, from studies on the hedging behaviour of firms the following conclusions can be drawn: (i) Tax incentives to hedge resulting from convex tax-schedules are rather weak. However, evidence

⁵⁷ The difference between cash flow hedging and market value hedging can easily be explained by taking the example of an interest-bearing, fixed-rate asset. Such a security exposes an enterprise to a gain or loss in the market value of the asset as a consequence of a change in market rates of interest. If the enterprise is not planning to sell the security, however, it does not represent an exposure to risk of a lower cash flow because interest rates and the repayment of the principal are fixed. However, the fixed-income security increases the volatility of firm value. Therefore, if the firm wants to minimize the volatility of cash flows, it should not hedge at all. If it wants to minimize the volatility of the firm's market value, it should use an interest rate swap to transform the security in a variable rate instrument.

that firms with higher leverage tend to hedge more may indicate that hedging is used to increase leverage and the tax-benefits that follow. (ii) Firms with a high probability of financial distress hedge more. (iii) Companies with greater growth opportunities hedge more. (iv) There is some interaction between the slope and convexity of managers' compensation and their risk taking behaviour. For example, managers with significant stockholdings in the firm tend to hedge more than those with option holdings. (v) High ability managers tend to hedge more than low ability managers.

Although empirical studies on the hedging motives of firms are mushrooming, there is still scope for future research in this area: First, there is not ample empirical evidence on the question *what exposures* companies hedge: firm value, cash flows or accounting earnings. For example, if a firm aims to reduce the costs of financial distress, it has to think about the question how the market estimates the probability of default in a world with asymmetric information. Accounting earnings might play a significant role in this context. However, Beaver and Wolfson (1995) show that hedging accounting exposure may increase economic exposure. The question is, how companies deal with this conflict and whether reporting has an impact on risk management. Second, there is a lack of evidence whether companies minimise *volatility* or simply try to avoid *lower tail outcomes*. Third, it should be investigated whether hedging activities actually depend on *expected investment volumes* as predicted by Froot, Scharfstein and Stein (1993). Finally, most studies fail to take different approaches to risk management into consideration. They proxy hedging activity by the volume of derivatives and thereby may *mis-classify* hedgers as non-hedgers and speculators as hedgers. More sophisticated studies should take alternative methods of risk management into consideration, for example a reduction of operating leverage or insurance. Since publicly available data are not sufficient for such studies, questionnaire surveys should be applied to get a more comprehensive view of corporate risk management.

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