

# WHY DO RISK NEUTRAL FIRMS HEDGE?

## A REVIEW OF THE LITERATURE

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### Abstract

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According to classical finance theory, a risk neutral firm has no incentives to hedge. We will investigate why firms hedge by starting from the assumptions underlying the Modigliani-Miller propositions. One at a time, we will relax the assumptions and investigate the effect on hedging incentives. Theory and empirical evidence reviewed in this thesis suggest that firms hedge because some of the Modigliani-Miller assumptions do not hold. In particular, to have an increased debt capacity and thereby enabling a larger interest tax shield and the fact that external financing is costly appear to be important reasons why firms hedge.

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# 1. INTRODUCTION

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In this paper we will examine why risk neutral firms hedge. We will systematically explore the most common reasons for hedging by corporations. But first, let us provide two recent examples where risk management received significant attention in the media; the bankruptcy of Orange County and the trading of Nicholas Leeson that brought down Barings Bank. The Orange County bankruptcy took place in 1994 and is the largest ever municipal bankruptcy. It occurred because the treasurer Robert Citron had taken a highly leveraged position in interest rate derivatives, and when interest rates rose he was not able to roll over the repo contracts. Orange County defaulted on their payments and had to file for bankruptcy. Barings Bank was the oldest investment bank in the UK and Nicholas Leeson was a derivatives trader mainly trading in Asian markets. With a history of speculative trading where he managed to hide losses for several years, his luck ran out in 1995. Leeson had placed a bet that the Japanese stock market would not move significantly overnight on January 16, 1995. Unfortunately the Kobe earthquake hit Japan early in the morning of the 17<sup>th</sup> and he incurred large losses. To cover these losses he made additional risky investments which were unsuccessful. In total the losses exceeded \$1.4 billion.

In the cases above there were both a lack of risk management and a speculative and fraudulent behavior by individuals. Surely a careful documentation and understanding of the risk levels of those operations would have led the firms to stop the behavior. Therefore, risk management has become an increasingly important corporate activity. In fact, Rawls and Smithson (1990) find that risk management is one of the most important activities to CFOs. Tufano and Servaes (2006) find that CFOs estimate risk management to contribute 3.8% of market capitalization.

The notion that risk management, or more specifically hedging, contributes to firm value is however in contrast with the Nobel prize-winning financial irrelevance propositions of Modigliani and Miller (1958, 1961, 1963). Risk neutral firms should, if capital markets are perfect, not need to hedge since shareholders themselves could undertake hedging.

## PURPOSE

*The main purpose of this thesis is to investigate why risk neutral firms hedge.* The starting point will be to assume that all assumptions behind the Modigliani-Miller (MM) propositions hold and that hedging does not increase firm value. Clearly, all MM assumptions do not hold and we will relax them one at a time to investigate what hedging would contribute if that specific assumption did not hold. Furthermore, we aspire to shed some light on the relative importance of different reasons for hedging.

## LIMITATIONS

We will make four important limitations to this study. First, we will not distinguish between different types of risk reduction. Second, we will not discuss how much or by which means hedging should be performed. Third, we will not discuss what exposures should be hedged. Finally, we will assume that hedging is undertaken rationally and that speculation is of marginal importance.

## Different types of risk reduction

Bodie and Merton (2000) categorize risk management strategies according to three different types of risk reduction: hedging, insurance and diversification. *Hedging* refers to the elimination of a risk exposure entirely, thus eliminating both potential gains and losses. *Insurance* on the other hand refers to strategies which eliminates the down side while keeping the up side. Thus hedging refers to contracts with a linear payoff function but insurance refers to contracts with non-linear payoff. *Diversification* is the strategy to engage in a wider range of activities and thereby reducing the reliance on any single activity.<sup>1</sup> In this paper all these three strategies will be seen as a means to reduce variability of outcomes. The literature on risk management is not consistent with regard to what the purpose of the risk reduction is and a distinction is difficult to make. For the purpose of this thesis we will use the term hedging for all these strategies, thus

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<sup>1</sup> If the firm engages in almost identical activities or shifts focus to engage in many more but highly correlated activities true diversification might not be achieved and risks not reduced. However, in the general case where resources are spread across a wider set of activities risk is reduced.

incorporating not only elimination of both gains and losses but also insurance and diversification. The rationale for this is that all three strategies categorized by Bodie and Merton (2000) strive to reduce volatility.

## **How and how much to hedge**

We will not discuss how much a firm should hedge, merely suggest in what cases hedging is advantageous and try to compare what reasons for hedging might be more plausible than others. This is due to the fact that the literature on the subject of determining the optimal hedge is very scarce. Since determining the optimal hedge requires that all relevant risks and factors are quantified it would be impossible to include that within the scope of this paper. In particular the valuation of corporate debt with credit risk has proven to be very difficult according to Leland (1998).

## **What to hedge**

In the literature, three main variables subject to hedging have been suggested: cash flows, accounting earnings and market value of the firm. We will not discuss explicitly what exposures are hedged since there is very little data available on the subject.

## **Hedging versus speculation**

Finally there has been considerable debate whether hedging, often in the form of derivatives use, is a rational strategy or more speculative. Stulz (1996) suggests that firms engage in some speculation because they let their view on the future impact how they hedge. However, the size of this effect is uncertain and there is evidence supporting the notion that the effect is small on average. For example Géczy, Minton and Schrand (1997) find that firms with currency risk exposures appear to engage in rational currency contracts, thereby supporting the notion that firms are hedging instead of speculating. Therefore we will assume that firms are hedging rationally and that speculation has a negligible impact on the results.

## OUTLINE

This paper will continue with a chapter providing a short theoretical background and a brief overview of methodologies used in hedging papers. Next are the main chapters where we investigate the Modigliani-Miller assumptions one by one, and analyze the theory and evidence of hedging in relation to the assumptions. The thesis is ended by a conclusive chapter in which the main points of the analysis are summarized.

## 2. BACKGROUND

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This chapter contains two sections. First we will explain the underlying theories and concepts which this paper is based upon. We will then summarize what empirical research has been undertaken in the field of hedging by describing how to identify hedgers, how to measure corporate hedging and what costs are associated with hedging. Later in the thesis we will provide more details on the empirical evidence of specific hedging reasons.

### DEFINITIONS

In this paper we will use the concept *risk neutral*. A risk neutral investor is indifferent between two investments if their expected values are the same, but will always prefer an investment with a higher expected value. If investors are risk neutral and the Modigliani-Miller assumptions hold there should be no incentives for firms to hedge.

The central theme in this paper is hedging. *Hedging* is here broadly defined as any activity which reduces the absolute value of the variance of firm value. The perhaps most commonly known and explicit hedging activity is the use of derivatives but hedging can also be undertaken by investing in real assets.<sup>2</sup>

### THEORY

The Modigliani-Miller theorem comprises several invariance propositions, showing that under certain assumptions a firm would be indifferent in its choices regarding financing, leverage and dividends (see Modigliani and Miller 1958, 1961, 1963).<sup>3</sup> The assumptions under which the propositions stated by Modigliani-Miller hold are absence of taxes,

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<sup>2</sup> Consider a firm with operations only in Sweden as an example. By merging with an American firm with operations only in the US the Swedish firm would likely reduce the variability in firm value. (Smith and Stulz 1985) However, there are usually other stronger reasons for undertaking a merger than hedging.

<sup>3</sup> One should have in mind that Modigliani-Miller stated their propositions well before the Capital Asset Pricing Model (CAPM) was developed.



bankruptcy costs, asymmetric information, contracting costs and where all actors can undertake the same transactions. There are three main propositions from which several others can be derived:

- *Proposition I*, also known as the *value-invariance proposition*, states that the firm market value is unaffected by the choice of financing (see Modigliani and Miller 1958).
- *Proposition II* states that the firm's leverage has no impact on its weighted average cost of capital (see Modigliani and Miller 1958).
- *The dividend invariance proposition* establishes that firm market value is independent of its dividend policy (e.g. if the firm pays dividends or retains earnings) (see Modigliani and Miller 1961).

The main contribution of the Modigliani-Miller propositions has not been to establish that the propositions in fact hold. Contrary, the assumptions behind the propositions have been used to structure the discussion around the reasons for why the propositions do not hold. In a paper to celebrate the thirty year anniversary of the initial paper from 1958 Miller himself expressed it as follows:

*“Looking back now, perhaps we should have put more emphasis on the other, upbeat side of the “nothing matters” coin: showing what doesn’t matter can also show, by implication, what does.”* (Miller 1988)

## IDENTIFYING HEDGERS

Three main approaches have been used to identify hedgers in empirical studies according to Triki (2005): direct surveys, keyword search of public documents and private datasets. Direct surveys were used primarily in earlier papers when data on risk management was not widely disclosed. Questions in the surveys mainly covered the use of derivatives to hedge. The major drawback of such surveys is the non-response bias, since hedgers have larger incentives to respond than non-hedgers. The second method used to identify hedgers is keyword searches of public company reports for words related to hedging. An important development for the possibility to identify hedgers is the disclosure in financial statements of derivatives usage, a common hedging instrument. However, there is little

disclosure of the reason for derivatives usage, thus making it difficult to explicitly link a derivative position to hedgeable risk. Unfortunately, this approach will add noise to the data since there is no guarantee that identified firms are rationally hedging. However, Mian (1996) find that the conclusions concerning the determinants of hedging are robust, by comparing firms which have explicitly stated that they hedge, and firms only disclosing that they use derivatives. The third way to identify hedgers is by using proprietary data sets.

## MEASURING CORPORATE HEDGING

Two common ways to measure corporate hedging are identified by Triki (2005): discrete measures and continuous measures. The most common discrete measure is a dummy variable reflecting whether the firm uses derivatives or not. There are several continuous variables used, most of which employ different measures of derivative usage. The main advantage with using continuous variables is that the magnitude of hedging can be investigated.

### **3. INTRODUCTION TO ANALYSIS**

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The analysis section in the paper is divided into six chapters. Each one will investigate an aspect of the Modigliani-Miller assumptions to determine what the effects on hedging are if the assumption is abandoned. The five Modigliani-Miller assumptions are in order: financial distress costs, absence of taxes, no asymmetric information, no transaction costs and that all actors can undertake the same transactions.<sup>4</sup>

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<sup>4</sup> For the Modigliani-Miller assumptions, see Modigliani and Miller (1958, 1961, 1963).

## 4. COSTS OF FINANCIAL DISTRESS

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In this chapter the assumption of no financial distress costs is relaxed and we will show why financial distress costs give firms incentives to hedge. Financial distress costs further decrease the firm value in unfavorable states (e.g. when a firm is in bankruptcy). Thus, firms are given stronger financial incentives to avoid financial distress when financial distress costs are present.<sup>5</sup>

### THEORY

There are two types of financial distress costs as suggested by Warner (1977) and Stulz (1996). First, there are *direct costs of bankruptcy* which include the costs of lawyers, accountants and the value of managerial time spent dealing with the bankruptcy. Second, there are *indirect costs of bankruptcy* which include lost sales, lost profits, the inability to obtain credit and issue securities and the losses due to customers and employees abandoning the firm. It should be noted that the firm does not have to be in bankruptcy for financial distress costs to occur, even before the firm goes into default there will likely be large indirect costs of bankruptcy.<sup>6</sup>

The expected cost of financial distress is the most relevant measure for our discussion. It is calculated as the probability of financial distress multiplied with the expected cost if a state of financial distress is reached. This suggests that there are two levers to pull to reduce the expected costs of financial distress, both the probability of financial distress and the expected costs if a state of financial distress is reached can be reduced. Mayers and Smith (1982) argue that insurance is one way to reduce the expected costs of financial distress. As an example they take a firm with a large proportion of assets

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<sup>5</sup> Hedging to reduce costs of financial distress should hence be mainly focused on avoiding lower tail outcomes but as stated in the limitations we will not investigate that completely.

<sup>6</sup> Bankruptcy refers to the legally defined state when a firm is unable to pay their creditors. Default refers to the case where a firm has not paid creditors or violated a bond covenant. Thus default usually occurs as a first step and if the situation is not solved bankruptcy can be declared.

invested in a single plant. Clearly such a firm would have difficulties if there was no insurance on the plant and a fire occurred. By the purchase of insurance for such a large part of the firm value, there is less risk that the firm will experience financial distress since the insurance will pay for rebuilding the plant, in a state where the firm would otherwise almost certainly have entered bankruptcy.

Smith and Stulz (1985) generalize the argument and show that firms which suffer from financial distress costs will increase in value if the variability of firm value is reduced. This will decrease the expected costs of financial distress and the gains will, for a healthy firm, accrue to shareholders.

## EMPIRICAL EVIDENCE

In previous literature there has been a focus on direct costs of bankruptcy since those are easier to quantify. One of the groundbreaking papers is the one by Warner (1977), who found that in a sample of railroad firms, direct bankruptcy costs as a percentage of firm value appear to decrease when the firm value increases. No evidence was found that higher market value firms spent longer time in bankruptcy (and thereby increasing the direct costs) than lower market value firms. Moreover, the data suggested that there were significant fixed costs and hence economies of scale associated with bankruptcies. The implication is that direct costs are more important for low market value firms, giving them incentives to hedge relatively more than large firms. On the other hand, it might still be more beneficial for large firms to hedge if there are large fixed costs, which small firms can not recuperate, associated with hedging.<sup>7</sup>

It appears expected costs of bankruptcy are relatively small, in absolute terms. Warner (1977) found that bankruptcy costs were on average about one percent of the firm value. As a thought experiment, let us assume that the probability of the firm going bankrupt is 10 percent (e.g. the expected lifetime of the firm is 10 years) and that the bankruptcy costs are five percent of the market value, we get an expected bankruptcy cost of half a

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<sup>7</sup> Firm size as a determinant of hedging behavior is examined when transaction costs are discussed.

percent of the firm value by multiplying the two. With these estimates we have probably vastly overestimated the cost and probability of bankruptcy, suggesting that direct costs of bankruptcy play a relatively small part in hedging decisions.

The number of papers published since 1979 supporting the notion that firms hedge to reduce the expected costs of financial distress, is manifold. The most common variable to measure the expected costs of financial distress is leverage, which is included in virtually all papers. Leverage is used since it is generally considered a good indicator of financial risk level. More recently Nance, Smith and Smithson (1993), Géczy, Minton and Schrand (1997), Gay and Nam (1998), Haushalter (2000) and Graham and Rogers (1999) all find a positive correlation between hedging and expected costs of financial distress.

The reduction of financial distress costs can not be treated isolated from all other motives to hedge. If the costs of financial distress are decreased, a firm could leave the debt capacity unused and thereby decrease the expected costs of financial distress or it could use the debt capacity to take on more debt and more deductible interest payments. The second scenario will be further explored in the chapter where taxes and hedging are examined.

## SUMMARY

The direct costs of financial distress seem to be relatively small and not a critical determinant of hedging behavior. There is little academic research on indirect costs of bankruptcy due to the difficulty of quantifying them.

## 5. TAXES – CONVEXITY OF THE TAX FUNCTION

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In this chapter we will focus on why the corporate income tax function, and more specifically a convex tax function, might induce firms to hedge. There are two main reasons for the convexity of the tax function: a progressive tax rate and different treatment of gains and losses (e.g. carrybacks and carryforwards). A carryback is a tax credit that you can apply to offset taxes paid in previous years and a carryforward is a tax credit which you can use to offset future losses.

### THEORY

Stulz (1984) and Smith and Stulz (1985) show that if the effective marginal tax rates for corporations are an increasing function of the corporation's pre-tax value, then the post-tax firm value will be a concave function of the pre-tax firm value. Thus if hedging reduces the variability of pre-tax firm values the expected tax liability could be reduced, provided the cost of hedging is smaller than the expected increase in post-tax firm value. In simple terms this is because if the firm makes a large profit one year and a small profit another year it will pay more taxes than a firm which always earns the average profit. Smith and Stulz (1985) prove that a progressive tax function will make it advantageous for firms to hedge, but their proof is fairly complex and lengthy. We will provide a shorter proof explicitly based on Jensen's inequality and the expected tax liability for the case where a firm faces a progressive tax rate.

Let pre-tax profits be a stochastic variable with a known distribution  $X$ . Let us assume the tax rate is a function of the pre-tax profits,  $T_c(X)$ . As assumed earlier the tax rate is assumed to be progressive and hence  $T_c(X)$  is a convex function. If we assume that there are only two groups of claimholders on the firm, the tax collectors (e.g. the government) and the other claimholders, then the purpose for all claimholders other than the government must be to minimize taxes paid.

From Jensen's inequality we know that if  $T_c(x)$  is a convex function then the following relationship holds  $E[T_c(X)] \geq T_c(E[X])$ . Put differently, the expected tax rate is equal to or higher than the tax rate of the expected pre-tax profit. Thus our best choice is to select the hedging strategy leading to that tax rate. If we can find a perfect hedge we could potentially achieve  $T_c(E[X])$  as the tax rate. Hence we have shown that if the tax function is progressive the optimal strategy would be to completely hedge if costs of hedging are smaller than the tax gain from hedging,  $(E[T_c(X)] - T_c(E[X])) * E[X]$ .

If the tax treatment of gains and losses differ, the tax function is clearly more convex, which will increase the hedging incentive.<sup>8</sup>

## EMPIRICAL EVIDENCE

Two main methods have been used to determine if firms hedge: surveys and regressions. In the survey approach the result is dependent on honest and knowledgeable answers<sup>9</sup> and in the regression approach relevant proxies for hedging have to be found (see Graham and Smith 1999).

Graham and Smith (1999) find that in a sample where 75 percent of firms face a convex tax function the average tax savings from a five percent reduction in the volatility of taxable income is 5.4 percent of expected tax liabilities. They investigate two common cases: core tax structure and extended tax structure. The *core tax structure* has a progressive tax function but lacks tax-loss carrybacks and carryforwards, investment tax credits and alternative minimum tax. In the *extended tax structure* those are all included. In both cases there are theoretical gains to hedging. When comparing the two cases, the incentives for the firms that hedged under the core tax structure decreases, but the range

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<sup>8</sup> Assuming that gains are taxed whereas there is no negative tax associated with losses.

<sup>9</sup> Managers are expected to be reluctant to admit to speculation rather than hedging and in some cases might engage in pure speculation even though they perceive it as hedging.



of firms that has something to gain from hedging increases by broadening the region where the tax function is convex.

Graham and Rogers (1999) find no evidence that firms hedge with derivatives to reduce the expected tax liability in response to a convex tax function, even though the cost of derivative hedging was lower than the expected gains. Instead they suggest that the gains from hedging a convex tax function are small compared to other hedging incentives and that firms might use accounting policies rather than derivatives to hedge taxable income.<sup>10</sup>

## SUMMARY

A convex tax function is an accepted theoretical explanation for hedging. However, the empirical evidence seems weak and instead suggests other reasons for hedging.

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<sup>10</sup> Petersen and Thiagarajan (2000) find evidence that a company which faces substantial gold price risk use accounting policies to limit tax liabilities.

## 6. TAXES - INCREASE LEVERAGE

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We mentioned earlier that a firm which experiences a reduction in the risk level can either enjoy lower expected costs of financial distress or take on more debt to increase the expected tax shields from interest payments. In the financial distress section we concluded that the expected direct costs of financial distress were small. Therefore we now investigate the incentive to hedge in order to take on more debt.

### THEORY

Ross (1996) makes the case that risk reduction to increase debt capacity is a different motive compared to the reduction of financial distress costs and the mitigation of the underinvestment problem.<sup>11</sup>

The reason why increased leverage is beneficial is that interest expenses are deductible in many tax schemes. Hence the taxes can be lowered by increasing interest expenses, leaving more money for shareholders and bondholders to divide between themselves. However, to increase interest expenses the firm needs to take on a larger portion of debt. A specific firm can however only accommodate a certain amount of debt at a reasonable interest rate. To accommodate more debt at the same terms, the debt capacity has to be increased *ceteris paribus*.

### EMPIRICAL EVIDENCE

Leland (1998) finds that hedging increases debt capacity as suggested by theory and hence the case for hedging as a measure to increase the debt capacity can be made.

When Ross (1996) put this rationale for hedging forward he based it on Hentschel and Kothari (1995) who show that leverage is highly positively correlated with derivative

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<sup>11</sup> The underinvestment problem will be discussed in the agency section.

usage, suggesting that firms hedge to increase leverage.<sup>12</sup> To furthermore support the claim that it is the tax advantages of increased leverage that gives firms incentives to hedge, Hentschel and Kothari (1995) found only a marginal relationship between derivatives usage and equity volatility. Hence equity volatility did seem to be of minor importance to the hedging decision. In line with that, Dolde (1995) finds leverage to be an insignificant explanatory variable for derivative use, but becomes significant when currency, commodity and interest rate risks are controlled for.

Graham and Rogers (1999) also find evidence consistent with the notion that firms hedge to increase debt capacity and increase firm value by recognizing larger interest deductions. They also put this finding in relation to the convexity of the tax function and conclude that the tax gains from increased debt capacity are significantly larger than those related to the exploitation of the tax curve convexity.

## SUMMARY

Being able to increase leverage seems to be a more important incentive to hedging than the incentive resulting from a convex tax function.

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<sup>12</sup> Nance, Smith and Smithson (1993) points out that the relationship between leverage and hedging is often difficult to establish due to the fact that leverage is a proxy for the firm's investment opportunity set. Firms with more growth options will use less leverage and have stronger incentives to hedge hence making the relationship between leverage and hedging difficult to detect.

## 7. ASYMMETRIC INFORMATION AND AGENCY PROBLEMS

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The concepts of *information asymmetry* and the *agency theory* are not new. Adam Smith touched upon the issues in his ground-breaking work *The Wealth of Nations* in 1776. Information asymmetry implies that there exists heterogeneity in information, whereby some actors have an advantage relative to others. The principal-agent problem arises under conditions with incomplete and asymmetric information where a principal contracts an agent to act on his behalf (see Jensen and Meckling (1976)). If the principal is at an information disadvantage relative to the agent, the agent can potentially act in self interest without the principal noticing it.

In this chapter we will relax the assumption of perfect information and examine the effects on hedging. We will distinguish between two types of actors: insiders and outsiders. Insiders are current shareholders of the firm and employees by the firm, especially managers. Outsiders are current bondholders and potential new shareholders and bondholders. First we will consider the case when managers act in the interest of shareholders. This gives rise to informational asymmetry problems, which together with capital market imperfections makes external financing costly. Costly external financing makes it advantageous to engage in hedging to ensure availability of funds. Secondly we will investigate what happens when we relax the assumption that managers are behaving in the best interest of existing shareholders and instead assume that they maximize their personal utility. This gives rise to agency conflicts manifested in the form of hedging.

### COSTLY EXTERNAL FINANCING

According to Myers and Majluf (1984), firms prefer to use the least costly type of financing. Generally it is assumed that the preferred order is, starting with the cheapest type of capital: internal funds, debt and equity. A conflict could arise between insiders and outsiders when new equity is raised since the insiders benefit from the new capital to a greater extent than do the outsiders.

## Theory

Froot, Scharfstein and Stein (1993) conclude that hedging alleviates the problems associated with costly external financing, by ensuring available internal funds when needed. They argue that it is not the growth options per se that creates the need for hedging, but the risk of not having sufficient cash flows to meet investment needs. To arrive at this conclusion they first assume that external financing is more expensive than internally generated funds. Furthermore they assume that in the absence of hedging and as a consequence of volatility in the internal cash flow, a firm faces either variability in external financing or variability in investments.<sup>13</sup> Typically, variability in investments is not desirable, assuming that the returns are diminishing. If hedging can reduce the cash flow variability, it can hence increase the value of the firm. This is shown by modeling a situation in which the firm makes the investment and financing decisions in the first period, while in the second period the investment cash flow will be realized and investors will be repaid. As described before, the firm will prefer internally generated means to fund the investment, as this is cheaper than external capital. External capital is more expensive due to dead weight costs, possibly originating from information asymmetries, bankruptcy costs, agency costs et cetera. It is furthermore assumed that the level of initial internal wealth is variable and can be subjected to hedging. If profits are a concave function of internal wealth, then hedging activities will be worth engaging in.

Myers and Majluf (1984) show how agency conflicts develop from information asymmetry between insiders and outsiders. Specifically, managers hold information regarding the value of the firm's assets in place at the time for the investment decision. The managers will know the realization of the cash flow from investments and the assets in place before the investors. Adding to the complexity, there is no way for management to convey the information to investors without alerting the competitors, and thereby risk losing the investment opportunity. If both internal and external shareholders act rationally

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<sup>13</sup> For some firms the investment opportunities are positively correlated to cash flows (e.g. when firms need to invest only in "good" times) and then there is no need for a constant cash flow, but for most firms there is a benefit of relatively constant investments.

in these situations, projects with positive net present value will be foregone. This is because managers see no reason to issue equity at a bargain price, since it is assumed that they act in the best interest of the shareholders. Rational investors, aware of their informational disadvantage, will realize this and hence treat any equity issue with suspicion. The decision to issue shares will signal bad news and vice versa. In the absence of sufficient financial slack and debt financing possibilities, managers will choose not to invest, if the cost associated with the bargain equity issue exceeds the NPV of the investment opportunity. This problem is similar to Akerlof's (1970) "lemon" market in which the buyer cannot judge the quality of the goods being offered. Hence buyers will demand a discount which will drive sellers of decent quality goods from the market.

Myers and Majluf (1984) started out by assuming that only equity financing was available and then introduced the possibility of raising debt. They show that the same information asymmetry problems remain but that the problem is less severe with debt than equity. This is in line with the pecking order of finance. Myers (1977) offers an explanation different from information asymmetry for why external financing is costly. He shows that the existence of corporate debt can reduce the present market value of the firm by weakening the corporation's incentive to undertake good future investments or force the firm and the creditors to take the cost of avoiding the suboptimal strategy. By viewing growth opportunities as call options, Myers (1977) shows that a firm with risky debt outstanding that acts in the interest of existing stockholders will discard positive NPV projects. He divides the value of the firm in two components; the value of assets in place and the value of growth options which depend on whether the firm undertakes investments. Since the value of an investment opportunity will accrue to bondholders first, the stockholders will only invest if the return from the investment is larger than both the investment costs and what has to be repaid to bondholders. If the value of the investment opportunity is less, the shareholders will not get any value from it and will hence not invest. The implication of this is that the break-even point of investing is moved from the payoff of the investment to the payoff of the investment plus the amount that needs to be repaid to bondholders. In his framework this conflict arises when the

value of the growth option becomes known after the investment has been made. Hence external financing is costly also when debt is raised, even though less expensive than equity.

In their section on the agency costs of debt, Jensen and Meckling (1976) outline the asset substitution problem. They model a situation in which the manager can choose between two projects with different levels of risk. If the manager has the possibility to first issue debt and then choose projects, there will be a strong incentive to choose the riskier one after having promised the bondholders to choose the less risky one. The reason for this behavior is that the equity holders have limited liability. This means that the bondholders would bear most of the costs if the project fails while almost the entire gain would accrue to equity holders should the project turn out to be a success. The Jensen and Meckling (1976) reasoning is based in part on Black and Scholes' (1973) theory on option pricing. According to Black and Scholes (1973), the equity of a leveraged firm can be viewed as a European call option. This is true under certain assumptions, such as that the firm holds assets consisting only of stock in another company, that the firm has issued zero coupon bonds maturing at the same time as when the assets are being sold, that no dividends can be paid until bondholders have been redeemed and finally that the residual amount, if any, from the liquidation will be paid to the holders of common stock. The value of the option will, *ceteris paribus*, increase with the volatility of the underlying instrument, in this case the total assets of the company. It is therefore possible to shift wealth from bondholders to holders of equity by shifting to riskier assets, i.e. assets with returns that are more volatile. Bondholders are worse off since the probability of default increases with the increase in volatile returns, which in turn will be reflected in the pricing of the debt.

Both the debt overhang, or underinvestment problem, and the asset substitution problem can be mitigated by the use of bond covenants or by issuing debt with convertible features. However, to the extent that agency costs associated with conflicts of interest between shareholders and bondholders increase the cost of external financing, the underinvestment and asset substitution problems offer explanatory value to why firms

engaging in hedging activities. Assuming that hedging, at least in theory, could be used to align the internal cash flows with the need for cash flows for investment opportunities. In line with the reasoning of Froot, Scharfstein and Stein (1993), the need for external financing would be reduced while investment levels could be maintained. Given that those alternatives of external financing are costly, a reduction in usage of external financing would increase firm value *ceteris paribus*.

## **Empirical evidence**

In this section we will first review the evidence supporting that external financing is costly. If external financing is not costly, information asymmetry problems do not impact financing. Then we will proceed by describing what firms are especially prone to the problem of costly external financing.

There is a vast literature investigating equity issues in the form of primary and secondary distributions. Rock (1986) produced one of the first papers suggesting that IPOs suffer from information asymmetry problems by applying Akerlof's (1970) "lemon model". However, we will not focus on primary offerings since if secondary offerings are costly, then primary offerings will have even higher costs.

There are three costs associated with secondary distributions according to Mikkelsen and Partch (1985): 1) underwriting spread 2) other expenses incurred by the seller 3) difference between the offering price and the closing price at the day of the sale. They find that the underwriting spread is usually 5-7% and that the abnormal stock return is negative 2-3%. This suggests costs associated with secondary distributions from 7-10% of the amount issued. Hence we suggest that the information asymmetry related cost of raising equity is significant and that there are large gains from hedging as a means to avoid having to raise equity.

Given that external financing is costly, two conditions must hold to cause financing problems: 1) the firm must have access to positive NPV projects 2) there must be a risk that internal financing is insufficient for the value maximizing investment strategy. If



those two conditions are met, the firm benefits from hedging to ensure available funds. Most studies have focused on the first condition of having an extensive set of investment opportunities. The second argument is sometimes implicitly assumed to hold and sometimes it has explicitly been investigated.

The most common proxy for the investment opportunity set is the market-to-book-value ratio. The reasoning is that firms with many positive NPV investment opportunities will have a higher proportion of the market value attributed to non-book-value assets, e.g. future investments. Two versions of this variable have been used, some studies have used the market-to-book-value ratio and some have used the inverse (e.g. the book-to-market-value ratio). For all our purposes those two are equivalent but with opposite signs and will be treated so. The expected relationship between hedging and the market-to-book-value ratio is positive (and negative for the book-to-market-value ratio).

The evidence is mixed compared to the theory. Supporting evidence for a relationship between hedging and investment opportunities is found by Nance, Smith and Smithson (1993), Géczy, Minton and Schrand (1997), Gay and Nam (1998) and Graham and Rogers (2002) among others. Nance, Smith and Smithson (1993) find a negative but statistically insignificant relationship with book-to-market-value. Géczy, Minton and Schrand (1997) and Graham and Rogers (2002) both find a negative relationship between hedging and the market-to-book-value contrary to the predictions. However, if the debt ratio is multiplied by the market-to-book-value Géczy, Minton and Schrand (1997) confirm the expected positive correlation which is significant for both studies. This suggests that financially constrained firms are more likely to experience cash flow shortfalls. This is also consistent with Gay and Nam (1998) who find that out of firms with investment opportunities, firms with low cash stocks are hedging to a larger extent.

The second most used proxy variable for investment opportunities is R&D spending. The expected relationship between R&D spending and hedging is positive, since firms with future opportunities should invest more *ceteris paribus*. Nance, Smith and Smithson (1993) find a positive but statistically insignificant relationship between R&D/MV and

hedging. Gay and Nam (1998) find a statistically significant relationship with the same variable but that hedging is lower for firms when investments are correlated with cash flows, implying that they have a natural hedge.

## Summary

Empirical evidence suggests that firms hedge to minimize dependency on costly external financing.

## MANAGERIAL BEHAVIOR

When discussing the costly external financing we assumed that the group of insiders was one homogenous group with a common agenda. However, in the modern corporation there is usually a split between ownership and control between shareholders and managers. Specifically we assumed that managers acted in the best interest of shareholders. Given that incentives for managers and shareholders differ it is probable that there exist conflicts of interest. This is the classic principal-agent problem where the owner (principal) delegates control to the manager (agent) to take decisions in the best interest of the owner. The main conflict of interest arises because managers are usually risk averse whereas shareholders are assumed risk neutral. In this chapter we will examine three reasons why managers do not act in risk neutral ways: managers do not hold well-diversified portfolios, managers have short time horizons and managers are concerned with reputation and performance. Due to the risk averseness of managers they have incentives to engage in hedging. It should be emphasized that contrary to the case of costly external financing, it is not in the best interest of shareholders to engage in hedging, since they can handle diversifiable risk. In the literature, managerial risk attitude is widely recognized as a reason for hedging.<sup>14</sup>

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<sup>14</sup> See Smith and Stulz (1985), Stulz (1996), Tufano (1996), and Hentschel and Kothari (1998) among others.

### **III-diversified managers**

The manager's total wealth consists of the income from the employment with a firm and the future income from employment, the ownership of shares and options in the enterprise, and other assets unrelated to the firm. To align incentives between managers and owners, managers are usually awarded equity related contracts (i.e. shares or options) or contracts with payoff linked to firm performance. Hence managers are generally ill-diversified and have a relatively larger share of their wealth invested in the firm. Due to this concentration of wealth, managers have incentives to behave risk aversely and engage in hedging.

Theory would suggest that managers with a large stock ownership hedge relatively more since they have relatively more of their wealth linked to the performance of the firm. Berkman and Bradbury (1996) find a positive relationship between stock ownership of managers and hedging.

However, as mentioned above, the compensation contracts have been engineered so that manager incentives should be as closely aligned as possible with those of shareholders. To achieve this, non-linear contracts such as options are frequently used in management compensation. The effect of managerial option ownership on hedging is not completely clear. Since options generally increase in value with increased volatility there are incentives to increase volatility to maximize the value of options. But if the value of options is larger or if managers also have large stock ownerships or expect to receive large salary payments in the future, there are reasons to hedge even though the value of options might decrease slightly. Further complicating the study of options is the fact that option values behave very differently depending on if the option is in the money or not. If the option is deep in the money there is less to gain from pursuing a very risky strategy, but if the options is far out of the money a risky strategy might increase the value of the option. Thus it is difficult to say if there should be a positive or negative relationship between option ownership and hedging. Empirical studies have also shown mixed evidence of the correlation between option ownership and hedging but seem to indicate a positive correlation, thus supporting the theory that wealth concentration is indeed

motivating managers to hedge. Tufano (1996) find a positive correlation for heavy option users versus average users of options, but a negative correlation for average versus non-users of options. Géczy, Minton and Schrand (1997) find a positive correlation between option ownership and hedging.

To conclude we find that hedging is used by ill-diversified managers but that non-linear payoff instruments are used to incentivize them to take on risky projects as desired by the risk neutral shareholders.

## **Differential time horizons**

Managers will only work for the firm a finite period of time, but risk neutral shareholders and most valuation methods (e.g. discounted free cash flow, present value of expected dividends etc.) assume an infinite time horizon. This will make managers attach lower value to outcomes occurring after their time horizon has ended and they will consequently focus on maximizing the value in the shorter term. (See Ammon 1998) If there is a hedging strategy that smoothes the earnings in such a way that they are realized earlier, short-sighted managers will find it attractive to hedge.

To illustrate the point, consider the following scenario: a firm could experience a shortfall in earnings the next couple of years but if the threat materializes, the firm can look forward to increased earnings the next couple of years. The firm could also hedge and secure smooth earnings. The key point is that the manager will only remain with the firm until time  $t$  where he/she retires. Hence the manager will attribute lower utility to values after point  $t$  in time. A manager with a short time horizon will therefore benefit from a hedge instrument which smoothes earnings. From the shareholders perspective this hedge could either increase or decrease the expected firm value. Most probably, if you consider that hedging is costly, the expected firm value will be lower and hence shareholders do not want to hedge.

## **Managerial reputation and performance**

Future compensation and status can indeed be viewed as a component of the manager's perceived utility. In this section we introduce further theories that explain why managers are risk averse.

Holmstrom and Ricart i Costa (1986) show that career concerns rather than effort aversion is the reason for different risk preferences between managers and owners. They introduce a model of learning where a manager's ability is uncertain in the beginning and is being inferred over time. Further evidence of risk aversion is provided by Tufano (1996) who shows that young managers in the gold mining industry are more likely to hedge than old managers. Since there is 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 and thus only undertaken by actors who find it beneficial.

DeMarzo and Duffie (1995), Breeden and Viswanathan (1996), Degeorge, Boaz and Zeckhauser (1996), and Raposo (1997) suggest that hedging can have a strong informational effect. This effect means that the hedging policy can influence the value of the firm. The reason for the informational effect is that managerial quality and the firm's risk exposure is difficult to determine for outsiders. Managerial quality is difficult to determine since firm performance is largely impacted by other variables outside of control (e.g. the general business cycle), some of which are to their nature random. This is the classical lemon market and owners of high quality goods (e.g. high quality managers) need to signal their performance in a credible way. Hence, financial hedging can improve the information quality of earnings and help distinguish good managers from bad ones.

Degeorge, Boaz and Zeckhauser (1996) use 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 that high ability managers hedge more.

## **Summary**

For various reasons, it seems plausible to assume that managers are risk averse and therefore have incentives to hedge. This assumption holds in particular for managers who are concerned with reputation and for managers who are ill-diversified.

## **8. ADVANTAGE IN HEDGING - FIRMS OR INDIVIDUALS**

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If capital markets were perfect, risk-averse investors could undertake any hedging themselves. Thus a firm would not benefit from engaging in hedging to accommodate risk-averse owners; those owners could undertake the transactions themselves. In this chapter we will review the evidence on this subject.

### **THEORY**

The basic assumption for individual hedging to be of interest is that some investors are risk-averse and would therefore like to hedge. Assuming, some investors are risk-averse, the question who should hedge arises. If individuals can undertake the same transactions as corporations, we would not observe hedging due to this motive. There is however reason to believe that individual hedging is sub-optimal compared to firm-wide hedging. There are three reasons to why home-made hedging might be unfeasible.

First of all, shareholders have far less information than managers about the firm's exposure and hence can not undertake the same transactions. Naturally the managers of a corporation have a better insight in the business than an outsider and would therefore be able to undertake better hedging decisions.

Secondly, the firm has proprietary information and disclosure would not be in the best interest of shareholders. If the firm has material information that might affect stock markets, suppliers or customers it might not be beneficial to reveal the information to the market prematurely to give owners the possibility to hedge the risk themselves.

Third, a firm will probably have access to internal hedging techniques not available to outsiders. As an example the firm has the choice to locate production in countries with the same currency as the revenues and thereby reduce foreign exchange risk. As another example, foreign exchange risks can be hedged by entering into swaps. It would be

practically impossible for individuals to set up swaps on the same terms as for the company as a whole.

## EMPIRICAL EVIDENCE

First of all, the claim that some investors are actually risk-averse is supported by evidence from Mayers and Smith (1990) who confirm that ill-diversified investors have an incentive to hedge. Mayers and Smith (1990) investigate closely held common stock companies and Lloyds and find that these firms hedge more than comparable firms with a more dispersed ownership. Thus, some investors would like to hedge and the question is if the firm or the individual is in the best position to hedge.

With regard to information about the current exposures and the importance for the firm DeMarzo and Duffie (1991) show that managers are in a much better position to hedge and investors would typically want them to hedge completely.

Many of the hedging techniques used by firms would be impossible to undertake for individuals due to the lack of access or due to large transaction costs. The transaction costs of hedging will be explained in the next chapter. Naturally an individual can not relocate operations in a specific country to offset a foreign exchange risk. Sercu and Uppal (1995) note that cash flow problems related to settlement of financial instruments suggests that hedging by the firm is preferable.

## SUMMARY

It is clear that the firm has an advantage to hedge compared to an individual due to information and transaction problems.



## 9. TRANSACTION COSTS – THE EFFECT OF FIRM SIZE ON HEDGING PRACTICES

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According to the Modigliani-Miller assumptions there are no transaction costs, but in the financial markets of today that is clearly not true. What can be debated is the size of the transaction costs. In this chapter we will investigate how transaction costs could impact the hedging behavior of firms by looking how firm size is correlated to hedging.

### THEORY

Hedging has two major cost components according to Brealy and Myers (2003):

- 1) Setting up a risk management program in general is costly.
- 2) There are costs associated with choosing a particular derivative or hedging instrument.

If the fixed cost component of setting up a risk management program is large, only firms with larger gains from hedging would engage in it. Firms with more to gain from hedging are those where the earlier conditions hold: tax incentives, bankruptcy costs, asymmetric information, economic agency costs and the possibility for individuals to undertake the same transactions as the firm. If we assume that the degree to which those conditions hold is largely independent of firm size, we would expect larger firms to hedge more *ceteris paribus*. Thus, how hedging depends on firm size could be seen as a proxy for the size of the fixed cost of setting up a risk management program or engaging in a hedge.

Several factors would suggest that small firms should hedge more from a theoretical point of view. First of all, small firms are more likely to have income in the convex region of the tax schedule and would therefore have more the gain from hedging. Secondly, according to Warner (1977) bankruptcy costs are to a large degree fixed and hence smaller firms would find it relatively more beneficial to hedge. Third, small firms have in general more volatile cash flows and would therefore gain more from hedging when the firm has an incentive to hedge.

Regarding the variable transaction costs, we would not see hedging at all if those costs were larger than the gains from hedging. Since we observe hedging in the real world, there is clearly a net benefit from hedging in many situations. Variable costs should be easy to evaluate and hence easy to compare to the expected benefits of hedging, which might be more difficult to estimate.

## EMPIRICAL EVIDENCE

The empirical evidence is in favor of the fact that larger firms hedge more than small firms, suggesting that the fixed transaction costs are of significance in the hedging decision.

Larger firms use far more derivatives than small firms even though small firms have more variable cash flows according to Stulz (1996) and Graham and Rogers (1999). Furthermore there is overwhelming evidence that larger firms hedge more than small firms, among others Nance, Smith and Smithson (1993), Bodnar, Hayt, Marston and Smithson (1995), and Géczy, Minton and Schrand (1997) support that notion. Stulz (1996) finds that users of corporate derivatives seem to employ a selective hedging approach where the hedging depends on their view of the future, suggesting that firms with resources to have a view on the future are more likely to hedge, e.g. firms which can afford large fixed costs.

## SUMMARY

Larger firms hedge more than smaller firms, and the academic literature suggests that the large fixed cost associated with setting up a hedging program is at cause. It should be noted that firm size in it self is not an incentive to hedge. However, given existing incentives, large firms are more prone to hedging.

## 10. SUMMARY

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We set out to explain why risk neutral firms hedge by relaxing the Modigliani-Miller assumptions one at a time. Theory and empirical evidence presented in the hedging literature suggest that firms hedge because the assumptions in the Modigliani-Miller model do not hold.

We conclude that costs of financial distress and taxes offer little explanation as to why firms hedge in real life. However, reducing expected taxes by means of increasing the debt capacity through hedging does. The most interesting, and probably the most important of the possible explanations, is found within the assumption regarding agency costs. It is clear that if external financing is costly, firms will hedge in order to minimize the potential loss in firm value due to foregone investment opportunities. Furthermore, it can be argued that firms do not act risk neutrally since agency problems cause managers to become risk averse.

Relaxing Modigliani and Miller's final assumption about all actors being able to undertake the same transactions shows that firms more easily can hedge than can individuals.

We have also presented research which shows that large firms benefit from hedging to a greater extent than small firms do, due to risk management costs.

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