The determinants of selective hedging –

Evidence from German non-financial corporations

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Abstract

Survey studies on corporate risk management show that firms follow very diverse risk management strategies. The observed behavior is difficult to reconcile with established hedging theories and with the standard procedure for testing them. The present paper wants to link the discussion on risk management theories more closely to the observed firm behaviour. The paper is based on a survey study on the risk management of German non-financial firms. Like previous studies, we find that a majority of firms follow profit-oriented, forecast-based hedging strategies. We adapt the existing hedging theories in order to explain which firms are likely to adopt selective or speculative risk management strategies. Multiple logistic regression analysis is applied in order to test the hypotheses. The proposed model is able to explain the firms' choice of foreign exchange risk strategies reasonably well. Highly levered firms are less likely to take bets in the currency markets. Secondly, German firms with significant bank ownership are more likely to adopt a profit-oriented risk management strategy. Thirdly, there is a negative correlation between profitability and the likelihood to follow selective hedging. Futher, there is a tendency for larger firms to be more inclined to use forecasts in their exchange risk management decisions. The proposed model is not able to explain the choice of the firms' interest rate risk strategies.

I. Introduction

Corporate risk management is a topic which currently attracteds a lot of attention. This is particularly true for the management of financial risks, i.e. the management of foreign exchange risk, interest rate risk and other financial market risks. There are several reasons for this: the increased volatility of financial markets and the firms' competitive environment in general, the development of new instruments and techniques for corporate risk management, the spectacular losses some firms have experienced in the markets for financial derivatives, and the increasing attention given to the firms' risk management activities by investors, analysts, and supervisory authorities.

The attitude of the financial management literature towards the management of financial risks has changed over time. Traditionally, in the practice-oriented literature it was assumed without further discussion that firms should adopt a risk averse attitude to financial risks. For instance, it was taken as given that firms engaged in exporting or importing activites should hedge their exposed foreign exchange positions. Older text books or articles then described the various instruments and techniques that enable firms to achieve this goal. From about the end of the 1970s onwards, theoreticians belonging to the neoclassical school of thought took up a very different attitude. Pointing to the efficiency of financial markets and to equilibrium relationships in international financial markets they argued that firms could not add value by simply engaging into financial contracts. The seemingly logical conclusion was that corporate management of financial risks is unnecessary and potentially even harmful (see, for instance, *Logue/Oldfield* 1977).

Since the middle of the 1980s, a more detailed discussion of the arguments for and against corporate hedging activies has developed. Several papers have shown under which conditions corporate hedging of exchange risk and other financial risks may add to firm value (see, for instance, *Mayers/Smith* 1982, 1987; *Smith/Stulz* 1985; *Froot et al.* 1993). The conditions are based on market imperfections which are neglected in neoclassical capital market theory. Examples are the costs of financial distress, the problems of synchronizing investments and financing activities coupled with the costs of external funding, agency conflicts between managers and shareholders, and the convexity of the tax function.

Several studies have attempted to test the theories of the determinants of corporate hedging (see *Nance et al.* 1993; *Mian* 1996; *Berkman/Bradbury* 1996; *Geczy et al.* 1997; *Fok et al.* 1997; *Goldberg et al.* 1988; *Howton/Perfect* 1998; *Jalilvand* 1999). The results of these studies can be summarized as follows. Most studies conclude that larger firms are more likely to engange in risk management activities than smaller firms. The evidence with respect to the other arguments brought forward to explain corporate hedging is mixed. While some studies have found support for the financial distress argument and for firms' desire to reduce cash

flow volatility in order to protect valuable investments, this was not confirmed by other studies.[1]

Most of the studies on the determinants of hedging are based on comparisons between firms that use derivative financial instruments and firms that do not use them. The former are classified as hedgers, the latter as non-hedgers. In other words, the studies assume that firms which use derivatives do so uniformely and solely for hedging pupuses. However, firms can use derivatives both to hedge existing risks or to create additional risk exposure, and the well-publicized examples of firms that have experienced large losses in the derivatives markets show that not all firms use derivatives only for the purpose of hedging. This suggests that the discussion on the theories of corporate risk management could benefit from closer insights into the actual practices of risk management within the corporate sector. Such insights have been provided by numerous survey studies over recent years. Reports by *Price Waterhouse* (1994, 1995) describe corporate practices in the wider area of treasury management. *Glaum/Roth* (1993), *Batten et al.* (1993), *Aabo* (1999), *Greenwich Treasury Advisors* (1999) and *Glaum* (2000) focus on the exchange risk management practices of multinational corporations. Further evidence comes from empirical work on the use of derivative financial instruments by non-financial firms (see, for example, *Bodnar et al.* 1995, 1996, 1998; *Grant/Marshall* 1997; *Howton/Perfect* 1998; *Bodnar/Gebhardt* 1999; *AFP* 1999; *De Ceuster et al.* 1999).

All of these survey studies show that firms in reality follow very heterogenous exchange risk management practices. Some firms do not manage their open positions at all. Others attempt to hedge their positions immediately on arising. The majority of firms, however, follow a so-called selective hedging strategy. That is, they hedge only positions for which they expect a currency loss while leaving open positions for which they expect a currency gain (for details see, for example, *Glaum* 2000). Obviously, such a strategy is based on forecasts of future exchange rate changes. The managers must predict which foreign currencies will appreciate and which will depreciate (relative to the current forward rates) over the time horizon of the open positions. The surveys on corporate risk management thus present some puzzling results. It appears that a majority of coporate financial managers believe that they are able to "beat the market" and, thus, dismiss the concept of market efficiency that plays such a pivotal role in finance theory. It is difficult to reconcile this evidence with the above mentioned theories of hedging (also see *Stulz* 1996 on this). Further, the survey findings are not compatible with the assumptions underlying the previous tests of the theories of hedging. Clearly, with the wide

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1   Also see *Simkins/Laux* 1997; *Allayanis/Weston* 1998; *Hentschel/Kothari* 1999; and *Fehle* 1999 who relate the use of derivatives to the firms' economic exposure to financial risk. The findings of these studies are very mixed. *Simkins/Laux* (1997) find that derivatives use actually accentuates operating exposure; they conclude that this seems to indicate that firms use derivatives for speculation rather than for hedging purposes. *Allayanis/Weston* (1998) find that derivatives use is positively related to firm value as measured by Tobin's *q*. *Hentschel/Kothari* (1999) investigate whether the use of derivatives has any impact on the firms' riskiness (total risk, systematic risk) or on their exposures; however, they fail to find such a relationship. Similarly, *Fehle* (1999) also fails to rationalize derivatives use based on the argument that firms hedge their economic exposures. Like *Hentschel/Kothari, Fehle* argues that his findings are consistent with the notion that firms are hedging short-term discretionary exposure rather than overall economic exposure.

range of risk management strategies pursued by firms in reality, including profit-oriented strategies based on market forecasts, it seems inappropriate to characterize all firms using derivatives uniformely as hedgers.

The present paper wants to link the discussion on risk management theories more closely to the observed corporate risk management behaviour. We firstly present key results from a survey study on the risk management strategies of German non-financial corporation.[2] The survey was undertaken in late 1998, early 1999. We surveyed all non-financial German firms listed on the Frankfurt Stock Exchange with a minimum sales volume of DM 400 million in the financial year 1997. Of the 154 companies that met the selection criteria, 74 took part in the survey (response rate: 48 %). Similar to previous studies of this kind, we find that a majority of firms follow forecast-based, profit-oriented risk management strategies. In order to explain this result, we adapt the prevailing risk management theories to provide explanations for the adoption of selective or speculative risk management strategies by non-financial firms. More precisely, we describe conditions under which (i) firms are more likely to generate superior know-how with regard to making forecasts in financial markets; (ii) managers may be led to believe that they possess superior forecasting capabilities, although this may not actually be true; and (iii) a firm's management is in a position which allows it to take bets in financial markets even though this may not be a profit maximizing strategy. Univariate tests and multiple logistic regression analysis are then used to test the modified theories.

The rest of the paper is organized as follows. In part II, an overview over the main theories of corporate risk management is given. In Part III, alternative potential explanations for profit-oriented risk management strategies are outlined. In part V, following a brief section in which we describe the methodology of our empirical study, we present findings on the risk management practices of German firms. Based on our findings that a majority of German firms follow profit-oriented, forecast-based risk management strategies, we adapt the existing risk management theories and deduce and finally test hypotheses on which firms are more likely to follow such strategies than others. The paper concludes with a brief summary.

II.   Determinants of corporate hedging: Theories and empirical evidence

In a neoclassical, Modigliani-Miller type of world, management could not increase firm value by engaging into risk management activities. In such a perfect world without any information asymmetries, transaction costs or taxes, all hedging activities by the firm could be done (or undone) in the same way by investors. The reason for this is that the firm does not have any comparative advantage over investors in managing risks or, to put it differently, that the costs

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[2]   The study actually addressed a broader range of questions on corporate risk management (strategic risk management, use of derivatives, management of exchange rate risk and interest rate risk, accounting for financial instruments and risk disclosure). However, only the results on the management of exchange rate risk and interest rate risk are of relevance here. Preliminary results of the survey were presented in *Fatemi/Glaum* 2000; for details, see *Glaum* 2000.

for bearing risks are the same inside the firm and outside of it. Under these conditions, corporate risk management would be irrelevant. To the extent that it incurs costs, it would destroy shareholder value (see *Stulz* 2000a for details).

Therefore, in order for risk management to be potentially value increasing, market imperfections must exist. These imperfections drive a wedge between the costs of bearing risks within the firm and outside of it and in doing so create comparative advantages for hedging to be undertaken by management rather than by the investors themselves. As was already pointed out, the literature has identified several market imperfections which may allow firm value to be increased through corporate risk management. The most important arguments are presented in the following.

a) *Costs of financial distress*

In the neoclassical model world, there are no bankruptcy costs or, more generally, costs of financial distress. If the firm runs into default, creditors take control over the firms' remaining assets. In theory, this process is costless. In the real world, however, there are positive costs associated with bankruptcy, such as costs for lawyers and courts. The present value of these costs is a function of the probability of default and the costs associated with default. By reducing the volatility of the firm's cash flows through hedging, management can reduce the probability of running into default and, thereby, the present value of the costs of bancruptcy. Investors, on the other hand, have no possibility to reduce these costs. Hence, in the presence of positive costs of bankruptcy, management has a comparative advantage in managing risk (*Smith/Stulz* 1985). Assuming that the cost of implementing the risk management programme is lower than the present value of the costs of bankcrupcy, risk management will lead to an increase in firm value.

For most firms, bankruptcy is a highly unlikely event, and the above-mentioned direct costs of bankruptcy appear to be very small (see *Weiss* 1990). However, there are also indirect costs that arise when a firm encounters financial distress. Once it becomes relatively likely that a firm will run into liquidity problems, its suppliers may refuse to do business with the firm, or they may resort to more costly forms of transactions (e.g. short-term contracts, immediate payment, higher prices). By the same token, customers may be reluctant to purchase the firm's products if they fear negative implications due to a possible bankruptcy (e.g. because the firm will not provide after-sales services or because it may not honour its warranty obligations). Other costs of financial distress include higher wages demanded by employees who fear that their specific investments in the firm become devalued. The indirect costs of financial distress may be substantial and they are relevant in situations where actual default is (still) not the issue.

Nance et al. (1993) did not find evidence supporting the financial distress argument. More recent studies, however, have given support to the notion that firms with lower liquidity and higher leverage are more likely to use derivatives (see, for instance, *Geczy et al.* 1997; *Fok et*

al. 1997; *Goldberg et al.* 1998). *Jalilvand* (1999), in particular, finds that derivatives use for Canadian firms is negatively related to credit rating.

b)   *Funding growth opportunities*

Unexpectedly low cash flow may prevent a firm from pursuing positive net-present-value projects if it is costly to obtain outside funding. Under these conditions, stabilizing the firm's cash flows through risk management can be value increasing (*Froot et al.* 1993). Outside funds are assumed to be a more expensive than internal funds because of transactions costs and agency costs (see, for instance, *Myers* 1977; *Myers/Majluf* 1984; *Bessembinder* 1991). Hedging may ensure that the internally generated cash flows do not fall below levels which would require the firm to issue new debt or equity in order to fund profitable investment projects. This justification for risk management is the more relevant (i) the larger a firm's growth options, (ii) the more pronounced the informational asymmetries between management and outside investors as well as between different classes of claim holders, and (iii) the higher the costs of external funding. For instance, on the basis of this argument, one would expect firms in high-growth industries to be more likely to implement risk management programmes than firms in stable industries.

Several empirical studies have shown that firms with higher R&D expenditures and higher book-to-market ratios, which proxy for firms' future growth opportunities, are more likely to use derivatives financial instruments than other firms (see, for instance, *Geczy et al.* 1997; *Fok et al.* 1997; *Goldberg et al* . 1998). The findings of *Berkman/Bradbury* (1996) and *Jalilvand (*1999), on the other hand, do not corroborate the argument, and *Mian* (1996) even finds a counterintuitive outcome, i.e., in his sample, hedgers have smaller market-to-book ratios than non-hedgers.

c)   *Convexity of the tax function*

Hedging can increase the value of the firm if it faces a convex tax function (*Mayers/Smith* 1982, *Smith/Stulz* 1985). With a convex tax function, volatility of income leads to low tax payments in some periods and overproportionally high tax payments in other periods so that the average tax burden exceeds the taxes the firm would have to pay on a stable stream of income. The same argument applies on investor level. That is, if investors face a convex tax function (e.g., because of the progressivity of the marginal tax rate), a corporate hedging programme that leads to a steadier dividend stream would, ceteris paribus, increase shareholder value. Therefore, in principle, one has to simultaneously analyze the tax effects of hedging on the corporate and the investor level. However, because of the complexities of real world tax systems and because of the fact that large firms have thousands or even millions of domestic and foreign investors facing very different tax functions, investors' personal taxes are usually not taken into account in the discussion on corporate hedging.

A recent simulation study undertaken by *Graham and Smith* (1999) shows that a substantial number of US firms could reduce the net present value of their taxes through hedging. However, most firms' can smooth their income only to a very limited degree with the help of financial derivatives so that the actual tax benefits of hedging are probably much smaller than the potential tax savings computed by *Graham and Smith* (see *Fenn et al.* 1997 on this point). The empirical evidence on the tax argument for corporate hedging is weak. *Berkman/Bradbury* (1996) find some support for their sample of New Zealand firms. The studies of *Nance et al.* (1993) and of *Mian* (1996) produced inconclusive results. Others (e.g., *Geczy et al.* 1997; *Fok et al.* 1997; *Goldberg et al.* 1998) have not found any support for the hypothesis that hedging is undertaken in order to minimize the net present value of the firms' expected future tax payments.

The tax function argument may be even less relevant in the German context. In Germany, financial accounting and tax accounting are closely interlinked and commercial income constitutes the basis for the calculation of taxable income (for details, see *Haller* 1992). German financial accounting, however, is well known for offering relatively large scope and numerous options for accounting and valuation so that management has great freedom to accumulate and transfer hidden reserves and, thus, smooth their companies' profits. Accounting policies may thus present the management of German firms with more efficient ways to manage taxable income than financial hedging.[3]

d) *Leverage*

There is, however, a further, indirect tax-related argument in favour of corporate hedging that may be more relevant than the above. Since hedging reduces the probability that a firm may run into default, it increases a firm's debt capacity. The implementation of a risk management programme may thus allow a firm to take on more debt and thereby to take full advantage of the tax shield effect of debt (*Ross* 1996). In this sense, hedging can be interpreted as a substitute for equity (also see *Dolde* 1995 on the relationship between leverage and hedging). It is important to point out, however, that the increase in the debt capacity depends on the firm's ability to convince creditors that it will indeed implemement and sustain a risk management programme (*Stulz* 2000a).

The empirical evidence on the relationship between leverage and corporate hedging is mixed. *Nance et al.* (1993) fail to find a significant relationship in their study. They point out that their inconclusive results might be due to the fact that firms with high growth opportunities tend to have lower leverage (also see *Smith/Watts* 1992 on this point). *Mian* (1996) also does not find any overall relationship between leverage and the use of derivatives. However, after separation of interest-risk and exchange-risk management they find that firms managing interest rate risk tend to have higher leverage while firms firms employing exchange-risk

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3   For an introduction to German accounting see *Brooks/Mertin* 1996; for a discussion of accounting policy under German accounting standards, see ### 199#.

derivatives have lower leverage than firms not managing the respective types of risk. *Berkman/ Bradbury* (1996) find some support for their sample of New Zealand firms.

Strong support for a positive relationship between hedging and leverage finally comes from *Dolde* (1995). His study is based on a questionnaire study. Managers of US firms were asked (i) whether their firms had ever used derivatives before and (ii) to which degree they aimed to offset open positions both when they did and when they did not have a view on the future direction of market prices. Using univariate tests, he does not find a relationship between use of derivatives and leverage. However, when controlling for the degree to which firms are exposed to risk, and for other firm characteristics, *Dolde* finds a significant complementary relationship.

e)   *Managerial interests*

Large portions of managers' wealth are related to the well-being of the firm in the form of income and, possibly, share ownership. Since managers are not fully diversified, they have an incentive to hedge the risks inherent in their position (*Smith/Stulz* 1985). The managers could possibly hedge the risks themselves. However, since this incurs costs it is in their interest to have the firm hedge them. To the extent the managers might otherwise refuse to undertake positive but risky net-present-value projects, the implementation of a risk management programme may also be in the shareholders' interest. One may note that while managerial share ownership acentuates their incentive to implement a risk management programme, stock options, on the other hand, provide management with an incentive not to hedge because the value of their options is positively correlated to stock price volatility (*Smith/Stulz* 1985, *Geczy et al.* 1997).

There is a further reason why it might be in management's interest to implement a risk management programme. Reducing those components of income volatility which are not under their control ("noise"), they allow investors and other outside observers to better judge their managerial performance. This, in turn, reduces the risk of the managers' specific investments in the firm. Obviously, this incentive to eliminate risks is most pronounced for managers with high abilities. Managers with low abilities may actually want to increase firm risk in order to obscure their low performance (*Breeden/Viswanathan* 1996).

The empirical evidence on the managerial argument for hedging is very weak. In most studies on the use of derivatives, the variables used to proxy for managerial interests (managerial share ownership, stock options held by management) come out insignificant, some studies even find counter-intuitive results (see, *Berkman/Bradbury* 1996; *Geczy et al.* 1997; *Fok et al.* 1997). A study by Wysocki (1998) which focuses on managerial motives in a sample of US firms finds that corporate use of derivatives is unaffected by the risikiness of CEO compensation, the level of insider wealth invested in equity or CEO post-retirement compensation. As *Fenn et al.* 1997 point out, the inconclusive results may be explained by the fact that derivatives may be used by firms to hedge or to speculate. The predicted relationship

between derivatives use and managerial stock and options holdings are exactly the opposite for hedging and for speculation. Therefore, mixing up hedgers and speculators in one sample might lead to inconclusive results. Support for the managerial comes from a study on North American gold mining firms by *Tufano* (1996). *Tufano* finds "virtually no relationship between risk management and firm characteristics that value-maximizing risk management theories would predict."[4] However, the firms' hedging activities were positively related to the value of the shares held by corporate managers and negatively related to managers' stock option holdings.

f) *Economies of scale*

Setting up a risk management programme involves significant costs. These costs have to be set against the expected benefits in order to analyse whether corporate risk management will create value on a net basis. Large portions of the costs of risk management are fixed costs such as the costs for specialized personnel and for information systems. Scale economies are also associated with transactions in financial markets. Because of this, it is more economic for larger firms to set up risk management programmes. At the same time, the expected cost of financial distress is negatively related to size. This is because the probability of default decreases as firm size increases and, secondly, because the the direct costs of bancruptcy (legal costs etc.) do not rise proportionally with firm size. As a consequence, the overall theoretical relationship between firm size and hedging is indeterminante (*Nance et al.* 1993, *Mian* 1996). Empirically, however, the relationship is very clear. Practically all empirical studies have found that larger firms are more likely to use derivative financial instruments. This seems to indicate that the economies-of-scale argument in reality clearly dominates the cost-of-financial-distress argument.

III. Selective hedging, speculation and market efficiency

Survey studies on corporate risk management and on the use of derivatives have shown that firms follow very different risk management practices. Taking exchange risk management as an example, some firms do not hedge open positions at all. Others attempt to fully hedge exposures immediately on arising. Most firms, however, hedge only positions for which they expect a currency loss while leaving open positions for which they expect a currency gain (selective hedging). Finally, a minority of firms engage in outright speculation in that they purposefully create risk exposures beyond the limitiations of the exposures arising from their normal business operations. As will be shown below for our sample of German firms, the proportion of firms using profit-oriented and forecast-based strategies is even higher in area of interest risk management than in foreign exchange risk management.

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4   *Tufano* 1996, pp1229.

From a theoretical point of view, then, the most important result of the studies is that a majority of corporate financial managers believe that they are able to "beat the market". By using forecasts to predict future exchange rate changes and by attempting to making (abnormal) profits in the currency and capital markets they reject the concept of market efficiency.

Despite the well-established empirical evidence, hardly any theoretical work exists on selective or on other profit-oriented risk management strategies.[5] The only systematic attempt to provide a theoretical explanation for speculative corporate risk management strategies stems from *Stulz* (1996). He suggests that there are two types of firms for which it would be rational to "take bets on financial markets". Firstly, financially distressed have an incentive to speculate even if markets are efficient. Such firms have nothing to lose from actively seeking new risks if bancruptcy is imminent, anyway. If successful, on the other hand, large bets on future movements of financial prices may rescue the firm. Although theoretically consistent, however, this argument cannot explain why a majority of large and financially sound industrial firms in the US and in Europe engage in profit-oriented risk management strategies.

Secondly, according to *Stulz* firms with very low probabilities of financial distress may take bets "provided management has specialized information that would give it a comparative advantage in a certain maket" (*Stulz* 1996, p16). The example put forward by *Stulz* is an industrial company that uses large amounts of copper as a major input. By knowing its own demand pattern and by studying the supply of copper, such a firm might gain special knowledge about the copper market allowing it to profit from selectively hedging its future copper purchases. This case also does not provide a convincing explanation for the results of surveys on corporate exchange risk and interest risk management. While it is conceivable that industrial firms gain special insights into markets for primary or intermediate goods, it is highly unlikely that they have any comparative advantages in major financial markets such as the markets for foreign exchange and for raising or investing capital.

The efficiency of the foreign exchange markets was subject to a large number of empirical tests. Most of these studies test whether forward exchange rates are unbiased predictors of future spot rates ("unbiased forward rate hypothesis"). While earlier studies seemed to confirm the hypothesis, more recent studies have shown that the forward rates are not unbiased. That is, differences exist between the forward rates and the corresponding future spot rates. In principle, such differences mean that profitable opportunities exist for speculation in the currency markets. However, it is difficult to interpret the results since the differences can be due to inefficienes or to risk premia. Furthermore, the differences fluctuate over time, and their sign changes. A possible explanation for this phenomenon is a "time varying risk premium". Recently, theoreticians increasingly tend to believe that the results

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5   In an earlier paper, *Lessard/Nohria* (1990, p198) very scathingly criticized the observed behavior of firms in the following way: "In fact, to the extent that it includes a speculative element by factoring possible gains into the hedging decision, [selective hedging] differs little from staking the assistant treasurer with a sum of money to be used to speculate on stock options, pork bellies or gold." However, the authors did not try to explain why firms would use such strategies.

have to be interpreted as inefficiencies (systematic expectation errors). (for details, see *Frenkel* 1994; *Lewis* 1995). The discussion on the forward efficiency is still open; currently, there is no generally accepted model which could explain the "forward bias". For practical purposes, in particular for the exchange risk management of industrial firms, it is therefore a useful approximation to assume that forward rates are unbiased predictors of future spot rates. In the words of Shapiro (1999):

> "However, the premium appears to change signs – being positive at some times and negative at others – and averages near zero. ... In effect, we wind up with the same conclusion: ... That is, on average, the forward rate is unbiased."[6]

To conclude, economists are very doubtful about the possibilities of making predictions of future exchange rate changes. Studies on the performance of professional forecasting services also show that it is extremely difficult if not impossible to forecast future exchange rate changes (see *Levich* 1980; *Eun/Sabherwal* 2000).

Similarly, numerous empirical studies have concerned themselves with the efficiency of the capital markets, that is, with the question whether it is possible to predict future interest rate changes. The results can be summarized as follows (for details, see *Ahrens* 1999): (i) most studies show that it is impossible to earn abnormal profits by forecasting future interest rates on the basis of historical interest rates or with other macroeconomic data; (ii) recent studies indicate that short term interest rates can be predicted with a somewhat higher reliability than long term interest rates (which are of greater interest for the financing of industrial firms); (iii) interest rate forecasts published by so-called experts generally perform poorly.

A study by *Braas/Bralver* (1999) shows that even banks rarely make money from taking speculative positions in financial markets. They write:

> "Traders are naturally inclined to believe that the primary source of earnings in trading fixed income securities, equities, or foreign exchange is positioning. The underlying premise is that quality traders are able to predict the movements of interest rates, foreign exchange rates, and stock prices with sufficient accuracy to 'beat the market' … . Having analyzed trading rooms around the world, …, our experience suggests the above premise is ill-founded. For most trading rooms and traders, the financial markets are in fact very efficient, and betting on price movements is not a sound business proposition."[7]

To conclude, financial managers of industrial corporations should analyze very (self-) critically whether their firms truly have access to privileged information, or whether they possess superior abilities to analyze the publicly available information. If this is not the case, it is very unlikely that speculative activities, including selective hedging, will systematically increase the value of the firm. In the words of *Stulz* (2000b, p10):

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6   *Shapiro* 1999, p233; also see *Dufey/Giddy* 1997 for a similar line of arguments.

7   *Braas/Bralver* 1999, p. 67.

> "Problems arise when managers make their own forecasts and use them as part of a hedging strategy. Corporate managers should not be in the business of speculating on foreign exchange, or more generally on financial prices and rates, when they do not have a comparative advantage in doing so".

How, then, can we explain the the widespread corporate usage of profit-oriented, forecast-based risk management strategies? Logically, there are the following three possibilies to explain the firms' behavior:

(i)   The firms *are indeed* able to beat the market, that is, their forecasts of future exchange rates and interest rates are of a quality which allows them to earn (risk-adjusted) profits on their bets. As has been shown above, this is rather unlikely.

(ii)   The firms *are not* able to beat the market, but managers are unaware of this. That is, *the firms' managers themselves believe they are able to generate profits* by successfully forecasting future market prices.[8] It is well accepted in the behavioral sciences that human beings do not always behave in a fully rational manner. For instance, people tend to pay more attention to information which confirm their expectations than to information which contradicts them. Due to distorted perception, corporate treasurers may more often feel proven correct by exchange rate or interest rate changes even though their predictions are correct only about half the time. This may lead to a further type of cognitive bias, the "illusion of control". Under certain circumstances, people behave as if they were able to exert control over events which in reality are uncontrollable. Empirical work by *Fenton-O'Creevy et al.* (2000) has shown that illusions of control are rather common among traders in investment banks and that the behavioral patterns associated with them lead to bad performance. As *Fenton-O'Creevy/Soane* (2000, p14) explain:

> "Illusion of control is more common in circumstances where there are cues often associated with skill-based tasks (such as an element of choice, familiarity with the stimulus, competition and involvement in decisions)."

Following this line of argument, corporate treasurers may feel that they are systematically able to predict future market prices, although price changes are largely random, if they are experienced financial experts, if they base their decisions on careful analyses, and if they apply sophisticated forecasting techniques. What may also contribute to the managerial overconfidence is the lack of adequate performance evaluation systems. Survey studies show that performance measurement in the treasury area is underdeveloped or even completely lacking even in many large multinational corporations (see *Glaum/Roth* 1993; *Price Waterhouse* 1995, *Aabo* 1999, *Glaum* 2000). Only very few firms apply risk adjusted performance measurements. Overall, this problem appears to be even more pronounced in the area of interest risk management than in exchange risk management (see *PriceWaterhouseCoopers* 2000).

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8   This explanation is similar to the so-called "hybris theory" which has been brought forward by *Roll* 1986 to explain why a large number of mergers and acquisitions destroy shareholder value.

(iii)   The third logical possibility is that the firms *are not* able to beat the market and the *managers are aware of this*, but they *nonetheless take bets in the markets*. As has been explained above, this would be a value maximizing strategy for firms in financial distress. Under normal circumstances, however, one would expect this behavior to lead to value destruction. Managers might have an incentive to engage in selective hedging or speculation if their renumeration is related to the profits such strategies produce but not to the losses they incur. Furthermore, managers may try within their firms to build up a reputation as financial experts. Taking bets in financial markets may help them to achieve this goal if the perception of their peers and superiors is distorted so that they give more weight to speculative gains than to speculative losses. Obviously, this will only work only as long as their firms' performance evaluation systems do not uncover their delusions.

V.   Empirical study

a)   *Methodology and sample*

The empirical work presented in this paper is based on a questionnaire study undertaken in late 1998, early 1999. The questionnaire used in the study was pre-tested with financial executives, treasury management consultants and specialized auditors. All listed German corporations that were not subsidiaries of other companies and had revenues of at least DM 400 million in 1997 were addressed. Excluded from the survey were banks and insurance companies. This resulted in a total sample of 154 companies. Of these, 74 responded (response rate: 48.1%). In Table 1, the corporations that were addressed are characterized by important economic indicators. The figures show that the willingness to participate in the study was correlated to the size of the corporations.[9] All major industrial segments are represented in the survey.

Table 1   Characteristics of responding and non-responding corporations

	Responding Corporations (n = 74)		Non-responding Corporations (n= 80)	
	mean	standard-deviation	mean	standard-deviation
Revenues (million DM) – percentage abroad	12,492,7 44.36%	23,845.2 31.30%	6,111.7 38.89%	12,243.0 26.65%
Employees – percentage abroad	36,762 38.77%	72,237 23.01%	17,906 32.32%	30,298 26.19%
Market Value (million DM)	7,352.6	15,282.9	2,441.8	5,054.3

Notes: (i) Figures for sales revenues and employees are for the calendar year 1996. (ii) The number of employees is the average for 1996. (iii) Market capitalization figures are based on the prices of common and preferred

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9   The significance of the differences in turnover, number of employees and market capitalisation was tested with a two-tailed *t*-test; the test statistics are: $t = 2.05$, p $= 0.043$ (turnover); $t = 2.07$, p $= 0.041$ (number of employees) and $t = 2.59$, p $= 0.011$ (market capitalisation).

shares as of December 31, 1997. Sources of data: (i) Revenues and employees: annual reports and telephone inquiries; (ii) Market value: Börse online, No. 52, 1997.

b)   Survey results

90 % of the firms in our sample reported that they use derivative financial instruments. This is a much higher proportion than previously reported in other studies. For instance, in their most recent *Wharton Study*, *Bodnar et al.* (1998) find that only about half of the large US corporations use derivates.[10] The instruments used most intensively by our sample firms are foreign exchange forward contracts, followed by interest rate swaps, currency swaps, caps/ floors, forward rate agreements und OTC currency options (see Figure 1). A large majority of firms (88 %) indicated that they only use derivatives for hedging purposes. A closer inspection of the firms' risk management practices reveals, however, that the firms that use derivatives nonetheless cannot unambiguously be characterized as hedgers. As will be shown below, most German firms follow profit-oriented exchange risk and interest risk management strategies.

Figure 1   Frequency of use of derivative instruments
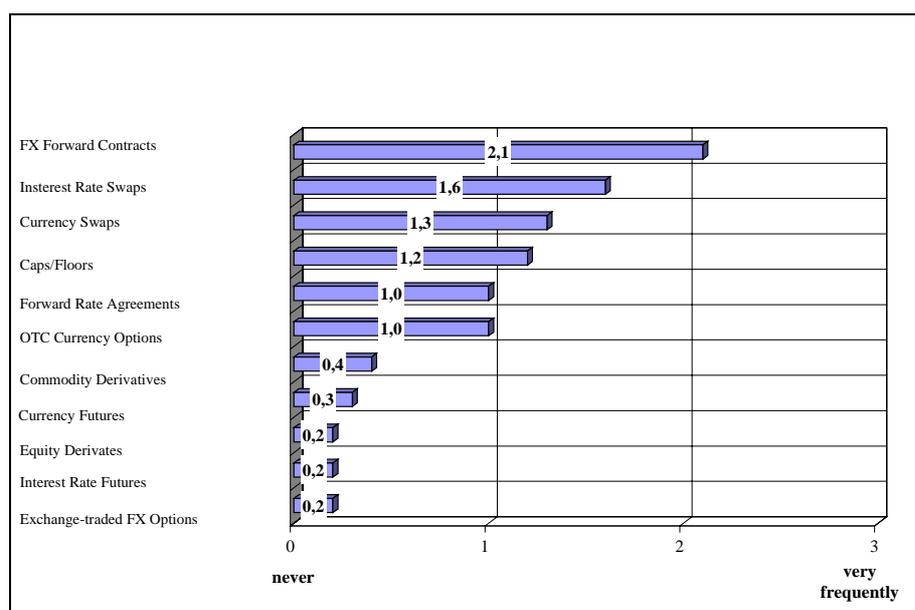
Based on the results of previous interview-based studies (see *Belk/Glaum* 1990; *Glaum/Roth* 1993), the questionnaires contained descriptions of alternative approaches to the management of foreign exchange risk. The respondents were asked to indicate which of the alternatives

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10   Earlier survey studies of the same authors reported even smaller proportions of derivatives users; similar results were obtained by *Howton/Perfect* (1998) who also surveyed US firms, by *Jalilvand et al.* (1999) for a sample of Canadian firms and by *De Ceuster et al.* (1999) for Belgian firms. In a comparative study on US and on German firms by *Bodnar/Gebhardt* (1998), 78% of the German sample firms used derivates. Studies by *Grant/Marshall* (1997) in the UK and by *Berkman et al.* (1997) in New Zealand also resulted in relatively high proportions of derivative users.

best described the rules and procedures of their own firm's exchange risk management.[11] As shown in Figure 2, a minority of 11% of the firms do not hedge their foreign exchange rate risk at all. Most of these five firms are, according to further information given in the survey, not significantly exposed to foreign exchange risk. 22% of the firms follow the strategy to hedge all open positions immediately. 12% of the firms follow a fixed rule according to which they always hedge a certain portion of their exposure with forward and/or option contracts, while leaving the remainder exposed. For example, some firms always hedge half of their exposure, others always hedge a third of their position with forward contracts, another third with currency options and leave the remaining third unhedged. The majority of firms (54%) follow the selective hedging strategy. About a third of the firms in this category always hedge a certain minimum percentage of their exposures; the remainder may then be left unhedged depending on the exchange rate forecast. In the other two thirds of the firms, the managers have full discretion to leave up to 100% of the positions unhedged. Finally, one of the respondent firms indicated that, based on exchange rate forecasts, it is willing to create exchange risk exposure beyond that arising from its business activities in order to profit from exchange rate movements.

In order to get a deeper insight into the exchange risk management practices, we asked the participants questions about their strategy towards their firms' US-dollar exposures. Firstly, we asked whether the firms had a significant exposure towards the US-dollar and, if so, whether this exposure consisted of a "long position" (net inflows in US-dollars) or a "short position" (net outflows in US-dollars). Given the traditional export orientation of German firms, it was not surprising that the majority of the firms (55%) reported that their operations typically generate net inflows in US-dollars. In 19% of the cases, the exposure have the opposite sign, that is, these firms typically generate net outflows in US-dollars. The remaining 26% do not have significant US-dollar exposures.

The firms' hedging strategies towards the US-dollar are summarized in Figure 3. 13% of the firms that replied to this question - six firms decided not to respond to the question - explained that at the time of the survey they had not hedged their US-dollar position at all. With one exception all of these firms had no significant US-dollar exposure. 10% of the firms had hedged up to 25% of their exposure, and another 10% had realized a hedge ratio between 25 and 50%. 23% of the firms had hedged between 51% and 75%, and 29% had hedged between 76% und 99 % of their exposure. A minority of 16% was fully hedged.

While the management of exchange rate risk has received considerable attention in the academic literature, very little is known about corporate interest risk management practices. According to the results of our survey study (see Figure 4), only 3% of the German firms (or,

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11   The approaches apply to the management of transaction exposure, that is, foreign currency denominated contractual commitments. In line with previous empirical work on exchange risk management, the survey showed that German firms focus on the management of this type of exposure. Translation exposure or economic exposure, the other two types of exposure commonly distinquised in the literature, are of relatively little practical importance. For details, see *Glaum* 2000.

Figure 2   Foreign exchange risk management strategies
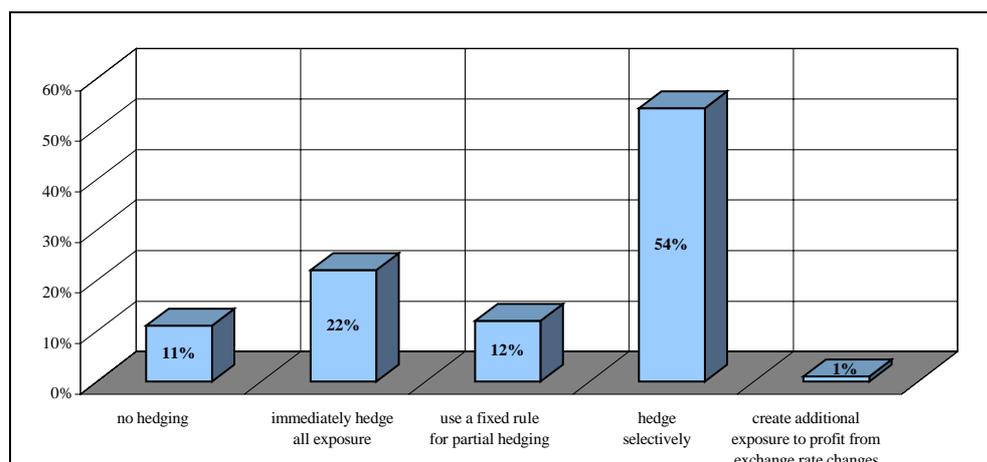
Figure 3   Hedge ratio of US-dollar position
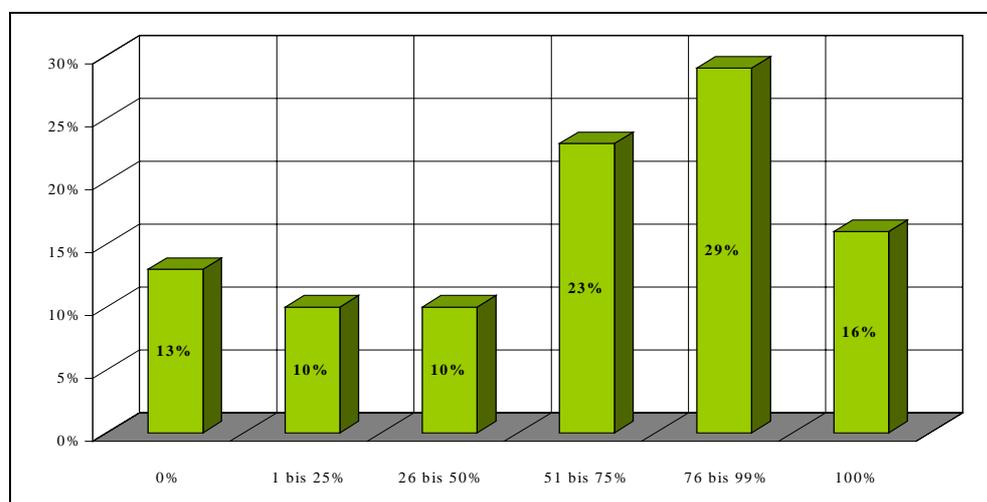
Figure 4   Interest risk management strategies
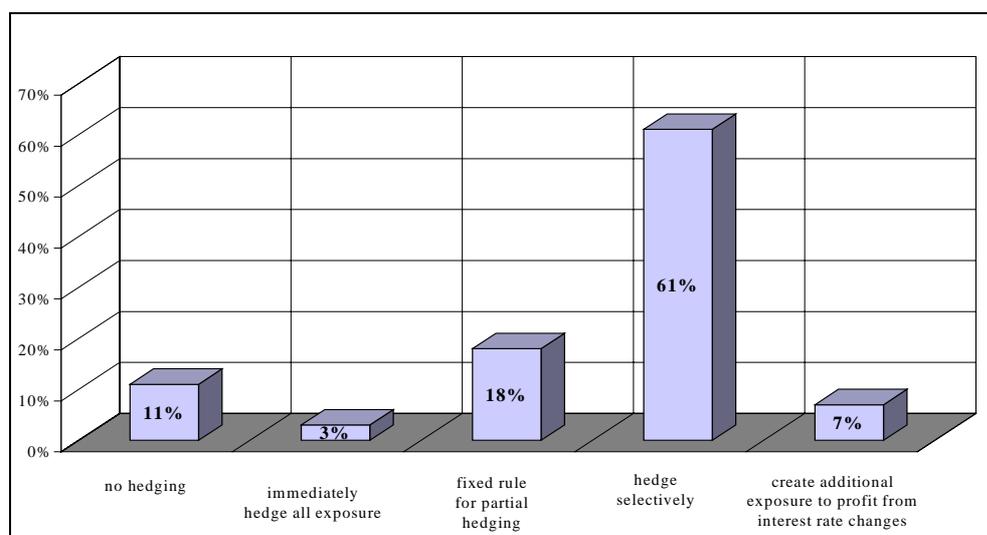
in absolute terms: two firms) indicated that they attempt to hedge all their interest rate exposure. At the other extreme, 11% engage in no hedging of interest rate risk at all. About one fifth (18%) fall in between the two extremes by indicating that they partially hedge their exposure. However, the vast majority (61%) indicated that they use forecasts of interest rates to decide whether to cover their interest rate exposure. The remaining 7% indicated that, based on interest rate forecasts, they deliberately create open interest rate positions to generate profits. The results show that profit-oriented, forecast-based risk management strategies are even more widely used in the area of interest risk management than in exchange risk management.

c)   *Determinants of risk management strategies: Hypotheses*

The above results raise the question of how the risk management behavior of the large German corporations can be explained. It does not appear to be fruitful to follow the example of previous studies on the theories of hedging and analyze what distinquishes users of derivatives from non-users. Firstly, as has been pointed out before, with the heterogenous risk management approaches followed by the firms in reality, it appears questionable to categorize all users of derivatives uniformly as hedgers. Secondly, given the uneven distribution of users and non-users in our sample (90% vs. 10%), and our relatively small sample size, statistical tests would have little discriminatory power.

From a theoretical perspective it appears most interesting to ask why certain firms follow profit-oriented and forecast-based risk management strategies while other firms hedge risks without recourse to exchange-risk or interest-rate forecasts. The question is whether there are discernable and economically relevant differences between firms that employ forecasts in order to beat the markets and firms that hedge risks in a non-discretionary way? Or, in other words, is it possible to identify variables that explain which firms tend to follow profit-oriented and forecast-based risk management strategies?

Based on the theoretical considerations in part III of the paper, in the following we adapt the existing risk management theories in order to predict which firms are more likely to follow profit-oriented and forecast-based risk management and which firms will tend to hedge risks without recourse to exchange-risk or interest-rate forecasts. The hypotheses describe conditions under which (i) firms are more likely to generate superior know-how with regard to making forecasts in financial markets; (ii) managers may be led to believe that they possess superior forecasting capabilities (although this may be due to illusion of control); and (iii) management is in a position which allows it to take bets in financial markets even though this may not be a profit maximizing strategy. The hypotheses will be tested with the survey data for our sample of German firms. In order to do this, we group our firms into two categories. The first category is made up of all firms that use forecasts in order to generate abnormal profits in financial markets; we call these firms "selective hedgers" (although firms which deliberately open up short or long positions in financial markets over and beyond exposures arising from business activities are also included in this group). The second category is made

up of firms which hedge financial risks according to fixed rules without the use of forecasts. This group comprises firms that attempt to hedge all open exchange-risk or interest-risk positions immediately on arising as well as firms which always hedge a certain (fixed) portion of their exposures with forward and/or option contracts. Firms belonging to the second category are called "non-discretionary hedgers". The distinctive difference between the two groups of firms is that the former use forecasts of future market prices in their risk management decisions while the latter do not use forecasts. The small number of firms that do not manage risk exposures at all are excluded from the analysis.

Firstly, following Stulz' (1996) argument that only financially very sound firms should consider taking bets in financial markets, we expect a positive relationship between firm liquidity and the use of forecast-based, profit-oriented risk management, or a negative relationship between the expected cost of financial distress and selective hedging (hypothesis H-1).[12] Interest coverage (earnings before interest and taxes over interest expense) is used to proxy for the expected cost of financial distress (INT-COV).[13] Likewise, we expect that firms with low leverage are more likely to adopt profit-oriented risk management strategies while highly levered firms will tend to hedge (H-2). We use the ratio between owners' equity and total assets as a proxy for leverage (LEVER).

We also adopt the hypothesis that firms with growth opportunities will not jeopardize the funding of their positive net present value project by speculative activities; in other words, the larger a firm's growth opportunities the less likely it is to use forecased-based risk strategies, the more likely it is to hedge (H-3). The firms' book-to-market ratios proxy for growth opportunities (GROWTH).

In previous studies on the determinants of hedging it has was pointed out that the relationship between firm size and the use of derivatives is theoretically indeterminate. On the one hand, larger firms are less likely to go bankrupt; therefore, it was argued, they are less likely to use derivatives in order to hedge. On the other hand, significant economies of scale are involved in setting up risk management programmes; therefore, larger firms are more likely to make use of derivatives. With the perspective taken in the present paper, there is no indeterminateness. Devising, running and controlling forecast-based treasury management operations involves considerable fixed costs (spezialized personnel and systems). These costs can be borne more easily by large firms. By the same token, larger firms appear better able to take on the risks involved in taking bets in financial markets. Therefore, we expect a tendency for larger firms to be selective hedgers and smaller firms to be non-discretionary hedgers

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12 This and all other hypotheses apply only *ceteris paribus*.

13 *Stulz* (1996) actually argues there are two types of firms which can be expected to take bets in financial markets, firms which are in financial distress and firms where financial distress is only a very remote possibility. This would call for a U-shaped relationship between liquidity and profit-oriented risk management. Hence, we also run our regression with a squared interest coverage variable. The overall results were similar; however, the significance level of the regressions was slightly lower. Futher, alternative calculations which we carried out with other specifications for liquidity (liquidity ratio, current ratio) also produced very similar results. Again, the explanatory power of these regressions was however somewhat smaller.

(H-4). Size is measured by firm value, that is, the market value of equity plus the book value of debt (SIZE).

There are several firm chararcteristics which determine the ability of firms to take bets in financial markets. One would expect highly diversified firms to be better able to absorbe the risks involved in selective hedging strategies (H-5). Unfortunately, reliable data on product market diversification is not available for German firms. Therefore, subjective judgement was used to construct a dichotomous (dummy) variable; it is one for all diversified firms in our sample, and zero other firms (DIVERS). The degree of multinationality is another likely determinant. Firstly, geographically diversified firms are better able to take risks in financial markets. Secondly, treasurers of the firms which are present in a large number of geographical markets may have, or believe to have, privileged access to information about foreign exchange rates or interest rates. Hence, we expect a positive relationship between a firm's degree of multinationality and the likelihood of this firm pursuing a selective hedging strategy (H-6). The degree of multinationality is proxied by the ratio of foreign sales to total sales (MULTI).

Further hypotheses are derived from agency considerations. Previous research on the determinants of derivatives use have focused on managerial share ownership and managerial stock option holdings. These variables are not used in the current study because their relationship to the adoption of selective hedging strategies is not clearcut and, moreover, the necessary data is not available for German firms.[14] However, we expect highly profitable firms to be more inclined to take bets in financial markets than other firms (H-7). Profitability is measured by return to equity (PROFIT).

A second agency-related hypothesis is connected to the pivotal role banks play for the financing and control of German corporations. It is characteristic for the German system of universal banking that banks not only provide loans to companies but also control major proportions of the equity capital of the large corporations, either directly or as trustees for their customers. A study by *Baums/Fraune* (1995) substantiates this assertion. They analyze shareholders' annual general meetings of German corporations with widely distributed equity capital. They find that such corporations are effectively controlled by banks. In 20 out of the 24 cases analyzed, banks controlled the majority of the voting rights. In 18 cases, banks even accounted for more than 75 % of the voting rights (also see *Deutsche Bundesbank* 1997 on the ownership structure of German corporations). A general drawback of this form of capital market organization is that effective ownership control does not exist, despite ownership concentration. As far as financial risk management is concerned, banks may have an interest in the firms pursuing forecased-based, profit-oriented risk strategies since this will generate business for them in the form of derivatives dealings and the sale of related services (consulting, treasury management systems). This leads us to hypothesis H-8: Bank-controlled German firms are more likely to engage in selective hedging than other firms. The variable used to measure control by banks is a dichotomous (dummy) variable. It is one for all sample

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14   German firms are not obliged to publish data on managerial share ownership or stock option holdings.

firms in which banks own 10% or more of the equity capital, and zero for all other firms (BANK).[15]

Previous studies on risk management took account of the fact that firms can reduce both the probability of financial distress and agency problems between stockholders and bondholders by using so-called hedging substitutes, i.e. preferred stock and convertible debt (see, for instance, *Nance et al.* 1993; *Berkman/Bradbury* 1996). Although the use of such instruments would increase the firms' risk taking capacities, we do not expect that preferred stock or convertible debt plays an important role in German firms hedging decisions. Only few firms use convertible debt (for instance, only five firms out of our sample of 74 firms used had convertible debt on their balance sheet in 1997). Preferred stock is predominantly issued by closely held corporations as a means for acquiring funds in the equity market without giving up decision-making rights; for several of our firms, only preferred stock is listed on a stock exchange while ordinary (voting) stock is closely held by families or by (the decendents of) the founders of the companies. Despite these reservations, we test whether the inclusion of a variable for the use of hedging substitutes holds any explanatory power. If so, we would expect that firms using preferred stock or convertible debt are more likely to hedge selectively than other firms (H-9). A dummy variable is used to measure the use of these instruments; it is one for all sample firms which use preferred stock or convertible debt, and zero for all other firms (SUBSTI).

Table 2   Hypotheses on the determinants of selective hedging of German firms

H-No.	Hypothesis	Variable	Name	Exp. Effect: [*]
H-1	Financial distress	Interest Coverage	INT-COV	↑
H-2	Leverage	Equity / Total Capital	LEVER	↑
H-3	Growth opportunites	Book-to-Market Ratio	GROWTH	↑
H-4	Size	Firm Value	SIZE	↑
H-5	Diversification	Diversified Firm (y/n)	DIVERS	↑
H-6	Multinationality	Foreign Sales / Total Sales	MULTI	↑
H-7	Profitability	Return to Equity	PROFIT	↑
H-8	Agency / Governance	Bank Ownership (y/n)	BANK	↑
H-9	Hedging substitutes	Conv. Debt, Pref. Stock (y/n)	SUBSTI	↑

[*]   ↑:   the *higher x* the *more likely* the firm is to hedge selectively
       (= the less likely it is to hedge non-discretionary)

Finally, we do not put forward any hypothesis concerning the influence of taxation on risk management. Firstly, the taxation argument has not been supported by previous empirical research on risk management. Secondly, as was already pointed out, we believe that the

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15 This variable may actually under-estimate the actual degree of bank influence on German firms since it only captures the direct share ownership of the banks; it does not take into account the shares the banks control as trustees for their customers.

taxation argument is even less relevant for German firms than in the US context; this is because German accounting rules present firms with more efficient ways to manage taxable income than financial hedging. Thirdly, in our survey the financial executives of our sample firm were asked to which degree their firms' risk management decisions are influenced by tax consideration. The answers indicate that taxation is of only minor concern for risk management in general and for exchange risk hedging decisions in particular.[16]

Table 2 summarizes the ten hypotheses on the determinants of selective hedging.

The balance-sheet data used in our analysis has been supplied by two academic data bases compiled at the universities of Aachen and Halle.[17] This data has been completed using the firms annual reports and telephone enquiries. Information on market capitalization (end of year figures for 1996 – 1998) is from the weekly magazine *Börse online*. Following the examples of previous studies, we use three-year averages (1996-1998) for all variables except for the following. The coding of the dummy variables for firm diversification, bank ownership, and the use of hedging substitutes is based on information contained in *Hoppenstedt Aktienführer* (1997), a handbook on listed German corporations. Finally, information on the degree of multinationality is not readily available for German firms. The data was compiled from annual reports of the years 1995 and 1996.

Table 3   Descriptive statistics of independent variables

Variable	n	Mean	Std. Dev.	Median	Minimum	Maximum
Interest Coverage (INT-COV)	73	12.092	40.452	4.229	-1.49	335.66
Equity / Total Capital (LEVER)	74	.315	.124	.308	.04	.63
Book-to-Market Ratio (GROWTH)	74	.814	.234	.814	.11	1.42
Firm Value (SIZE) (m DM)	74	19,187	41,126	2,175	214	224,412
Diversified Firm (y/n) (DIVERS)	74	.473	.503	.000	.000	1.000
Multinationality (MULTI)	70	.439	.264	.467	.000	.852
Return to Equity (PROFIT)	74	.068	.229	.114	-1.57	.37
Bank Ownership (y/n) (BANK)	74	.310	.470	.000	.000	1.000
Hedging Substitutes (SUBSTI)	74	.430	.500	.000	.000	1.000

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16   The questionnaire contained two questions related to taxation. Firstly, respondents were asked to indicate on a scale of 0 (irrelevant) to 4 (very relevant) the importance the desire to reduce the firm's overall tax burden generally had for the firms' risk management. The average score we received was 1.8. Other goals received much higher scores (e.g., "ensuring the survival of the firm": 3.7; "increasing the market value of the firm": 3.0). Secondly, we asked whether the participants agreed or disagreed (4-point-scale; 0 = do not agree at all; 3 = fully agree) with a statement which suggested that the firms' exchange risk management decisions are driven by a desire to reduce taxes by smoothing out the firms' income patterns. The average score of 0.47 indicates that this statement received very little support from the executives. For details, see *Glaum* 2000. For details, see *Glaum* 2000.

17   The author is very grateful to Prof. H.-P. Möller, RWTH Aachen, and to Prof. R. Schmidt, Universität Halle, for supplying the balance-sheet data.

Descriptive statistics for all independent variables are presented in Table 3. Table 4 presents the correlation matrix of the independent variables. The smallest coefficient is -.310 (GROWTH – INT-COV), the largest is .385 (LEVER – INT-COV); the average value of the Pearson correlcation coefficients is .145. Overall, the tests indicate that multicollinearity is present but not severe.

d)   The determinants of risk management strategies: Results

Table 5 presents results from univariate tests of difference between the characteristics of selective hedgers, i.e., firms employing forecast-based, profit-oriented risk management strategies, and non-discriminatory hedgers, i.e., firms that always hedge all, or a fixed portion, of their exposures. Panel A reports results for exchange risk management strategies, Panel B for interest risk management strategies. For each of the variables we report the sub-sample size, the mean, the standard deviation, the expected sign of the mean difference, the mean difference, and the z-statistic from the Wilcoxon Rank Sum test and the p-value. Most of the mean differences have the predicted signs. In particular, in comparison to non-discriminatory hedgers, selective hedgers are larger, they are less highly levered, and they have higher interest coverage. However, the only mean differences which are significantly different from zero are LEVER for exchange risk management and MULTI for interest risk management.

Table 4   Pearson correlation matrix of independent variables

	INT-COV	LEVER	GROWTH	SIZE	DIVERS	MULTI	PROFIT	BANK	SUBSTI
INT-COV	1								
LEVER	0.385 (0.001)	1							
GROWTH	-0.310 (0.008)	-0.179 (0.128)	1						
SIZE	0,047 (0,694)	-0,068 (0,564)	-0,195 (0,096)	1					
DIVERS	-0.072 (0.545)	-0.200 (0.088)	0.128 (0.276)	0,141 (0,229)	1				
MULTI	0.115 (0.349)	0.192 (0.112)	-0.322 (0.007)	0,135 (0,254)	0.025 (0.837)	1			
PROFIT	0.167 (0.159)	0.358 (0.002)	-0.226 (0.053)	0,110 (0,350)	0.052 (0.659)	0.133 (0.273)	1		
BANK	-0.074 (0.536)	-0.070 (0.554)	-0.231 (0.048)	-0,026 (0,827)	0.007 (0.952)	0.034 (0.782)	0.076 (0.521)	1	
SUBSTI	0.068 (0.565)	0.048 (0.686)	0.039 (0.742)	0,101 (0,390)	-0.171 (0.145)	0.125 (0.303)	-0.072 (0.545)	-0.233 (0.046)	1

Table 5   Univariate tests: Selective Hedgers vs. Non-discriminatory Hedgers (non-parametric Wilcoxon Rank Sum Tests)

	Panel A: Exchange Risk Management (n = 65)								
	Selective Hedgers (n = 40)			Non-discriminatory Hedgers (n = 25)			.			
Variable	n	Mean	Std. Dev.	n	Mean	Std. Dev.	expected sign	Diff. in Means	z-statistic	p-value
Interest Coverage (INT-COV)	40	18.125	54.058	24	5.529	4.084	+	12.596	-.291	.771
Equity / Total Capital (LEVER)	40	.350	.125	25	.280	.116	+	.070	-2.481	.013
Book-to-Market Ratio (GROWTH)	40	.783	.267	25	.816	.175	+	-0.033	-.512	.608
Firm Value (SIZE) (m DM)	40	25,864	50,828	25	15,060	27,019	+	10,804	-.499	.618
Diversified Firm (y/n) (DIVERS)	40	.425	.501	25	.560	.507	+	-0.135	-1.052	.293
Foreign Sales / Total Sales (MULTI)	36	.507	.225	25	.477	.239	+	0.030	-.425	.671
Return to Equity (PROFIT)	40	.061	.278	25	.126	.090	+	-0.065	-1.214	.225
Bank Ownership (y/n) (BANK)	40	.380	.490	25	.200	.410	+	0.180	-1.476	.140
Conv. Debt, Pref. Stock (y/n) (SUBSTI)	40	.480	.510	25	.360	.490	+	0.120	-.904	.366

	Panel B: Interest Rate Risk Management (n = 64)								
	Selective Hedgers (n = 50)			Non-discriminatory Hedgers (n = 14)			.			
Variable	n	Mean	Std. Dev.	n	Mean	Std. Dev.	expected sign	Diff. in Means	z-statistic	p-value
Interest Coverage (INT-COV)	50	6.856	9,9296	13	4.991	3.818	+	1.865	-,085	,932
Equity / Total Capital (LEVER)	50	.323	.112	14	.270	.112	+	.053	-1,121	,262
Book-to-Market Ratio (GROWTH)	50	.813	.224	14	.868	.225	+	-.055	-1,169	,242
Firm Value (SIZE) (m DM)	50	21,368	46,118	14	19,348	35,221	+	2,020	-,698	,485
Diversified Firm (y/n) (DIVERS)	50	.460	.504	14	.429	.514	+	.031	-,207	,836
Foreign Sales / Total Sales (MULTI)	47	.487	.259	14	.352	.235	+	.135	-1,784	,074
Return to Equity (PROFIT)	50	.057	.263	14	.116	.134	+	-.059	-,877	,381
Bank Ownership (y/n) (BANK)	50	.300	.460	14	.290	.470	+	.010	-,103	,918
Conv. Debt, Pref. Stock (y/n) (SUBSTI)	50	.460	.500	14	.500	.520	+	-.040	-,263	,793

Given that the different firm characteristics are correlated, multivariate tests are needed in order to test for significant differences in each of them, holding all other attributes constant. Multivariate logistic (logit) regression is used in order to test whether the various proxies together are able to explain the firms' choice of risk management strategies. Logistic regression can be used to predict the presence or absence of an outcome or, more precisely, the likelihood of an event occurring, based on a set of predictors (binary choice model). Like linear regression, the model can reversely be used to test whether proposed predictors do indeed help to predict the observed distribution of outcomes. The model has the following form (for details, see *Hosmer/Lemeshow* 1989):

$$(1) \quad \text{Prob}(y = 1) = \frac{1}{1 + e^{-Z}} \quad \text{with} \quad Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k$$

In order to interpret the coefficients β_i of the logistic regression, it is helpful to rewrite the model in terms of the odds of an event occurring. The odds are defined as the probability of the event occuring divided by the probability that it will not occur.

$$(2) \quad \log\left[\frac{\text{Prob}(y = 1)}{\text{Prob}(y = 0)}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k$$

$$(3) \quad \frac{\text{Prob}(y = 1)}{\text{Prob}(y = 0)} = e^{\beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k}$$

The logistic regression coefficients can now be interpreted as the change in the log odds (logit) associated with a one-unit change in the independent variable. Alternatively, it follows that the odds change by e raised to the power of β_i if the independent variable increases by one unit. The odds of an event occuring will be increased by a unit change in the independent variable if the coefficient β_i is positive. The odds will be decreased if β_i is negative, and they will remain unchanged if it is 0.

We estimate three model specifications for both exchange risk management and interest risk management (see Table 6 and 7). Since our data for the firms' degree of multinationality is incomplete and sample size is a serious concern, we run regressions with and without the variable MULTI. In model 3, we include the variable SUBSTI which contains data on the firms' use of hedging substitutes. The results of the regressions on the firms' choice of exchange risk management strategy are summarized in Table 6. For each explanatory variable the regression coefficient, the z-value from a Wald-test, and the corresponding p-values are given. The estimations are rather robust over the different model specifications. In all three cases, the Chi-Square values are significant and the Pseudo R^2 (Cox & Snell) take on values of around .24. This indicates that the model is relatively well specified, especially considering the small sample size. Adding information about the firms' degree of multinationality or about the use of hedging substitutes does not help to explain the choice between selective hedging and non-discriminatory hedging. The following discussion of results is therefore based on model 1.

Table 6   Logistic regression estimates of the likelihood of firms adopting selective exchange risk hedging strategy

Variable	Model 1	Model 2	Model 3
Constant	-1.589 (.798) [.372]	-1.745 (.870) [.351]	-1.688 (.889) [.346]
Interest Coverage (INT-COV)	.041 (.899) [.343]	.044 (.804) [.369]	.044 (1.013) [.314]
Equity / Total Capital (LEVER)	6.649 (4.139) [.042]	6.444 (3.398) [.065]	6.407 (3.747) [.053]
Book-to-Market Ratio (GROWTH)	-.056 (.001) [.970]	.044 (.001) [.977]	-.126 (.007) [.933]
Firm Value (SIZE) (m DM)	1.30E-08 (2.155) [.142]	1.33E-08 (2.333) [.127]	1.21E-08 (1.896) [.168]
Diversified Firm (y/n) (DIVERS)	-.500 (.613) [.434]	-.617 (.873) [.350]	-.438 (.459) [.498]
Return to Equity (PROFIT)	-6.159 (2.964) [.085]	-6.391 (2.756) [.097]	-6.049 (2.798) [.094]
Bank Ownership (y/n) (BANK)	1.226 (3.119) [.077]	.960 (1.808) [.179]	1.297 (3.369) [.066]
Foreign Sales / Total Sales (MULTI)		.382 (.062) [.803]	
Conv. Debt, Pref. Stock (y/n) (SUBSTI)			.356 (.301) [.583]
n	64	60	64
Pseudo R^2 (Cox & Snell)	.244	.238	.248
Chi-Square	17.919	16.310	18.220
Sig (Chi-Square)	.0123	.0381	.0196

Only three of the independent variables prove to contribute significantly to the explanation of the dependent variable. In one case (PROFIT), the sign of the coefficient is not as predicted. Thus, only two of the nine hypotheses can be confirmed. The results in detail are as follows: of all the explanatory variables, LEVER has the strongest effect. As expected (H-2), highly levered firms tend not to take bets in financial markets; instead, they tend to hedge open exchange rate positions non-discriminantly. This result coincides with the results of *Dolde* (1995) who found a positive relationship between financial hedging and leverage for his sample of US firms. It gives support to the notion that long-term, structural liquidity determines the firms' choice of a risk management strategy. Secondly, in line with the literature on agency problems one can argue that high leverage disciplines management in that it forces them to focus on cash flow and value generating projects rather than on activities which might squander the firm's resources.

The second hypothesis to be confirmed is is H-8, according to which bank bank-controlled German firms are more likely to engage in profit-oriented, forecast-based hedging than other firms. This finding may be a peculiarity of the German corporate governance model. However, it points to a potentially serious agency problem. More detailed, in-depth research is needed in order to analyze the impact of bank ownership on German firms' financial policies.

As already mentioned, PROFIT, the third statistically significant variable, comes out with the wrong sign. While we had expected that high profitability would, ceteris paribus, enable managers to take bets in financial markets, the opposite relationship seems to prevail in reality. The lower the return to equity the more likely a firm is to adopt a selective exchange risk management strategy. Or, in a reverse perspective, firms that follow a selective exchange risk management strategy tend to have a lower return to equity. While it would be interesting to speculate on the direction of the relationship, it has to be pointed out that (logistic) regression analysis can only test for the existence of statistical relationships (i.e. correlations), not causalities.

Our data does not support the hypothesis that liquidity is a determinant of a firms' choice of profit-oriented, speculative risk management strategies; INT-COV comes out insignificant in all three model specifications. It might be argued, however, that interest coverage (or the liquidity ratio and the current ratio, for that matter) are rather crude, short term liquidity measures. As indicated above, leverage might be a more meaningful long-term indicator for a of a firm's financial soundness when analyzing a firm's risk management straregy.

Firm size, which has played an important role in previous research on the determinants of hedging, does not have a decisive impact on the firms' decision to hedge selectively or non-discriminatory. It has to be pointed out, however, that SIZE has the predicted sign and comes relatively close to conventional significance levels in all three equations. Further, the size of the sample firms varies greatly, ranging from more than DM 200 billion to just over DM 200 million. The high variance of the data also explains why despite a rather large mean difference the univariate test fails to detect a significant difference between selective exchange risk hedgers and non-discriminatory exchange risk hedgers: selective exchange risk hedgers have, on average, a market value of DM 25,864 billion while non-discriminatory hedgers have an average value of only DM 15,060 billion (see Table 5).[18]

Finally, GROWTH and DIVERS, our proxies for growth opportunities (and related agency problems) and for firm diversification, also do no significantly influence the choice between forecast-based, profit-oriented exchange risk management strategies and non-discriminatory exchange risk hedging.

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18 We also run our regressions with the natural logarithm of the firms' market value. The overall results were similar; however, the explanatory power of the equations is reduced (for example, the Chi-Square for Model 1 is 15.758, the p-value of Chi-Square is .0274).

Table 7   Logit regression estimates of the likelihood of firms adopting selective
interest rate risk hedging strategy

Variable	Model 1	Model 2	Model 3
Constant	1.254 (.376) [.539]	.182 (.006) [.939]	1.387 (.473) [.491]
Interest Coverage (INT-COV)	.0136 (.0760) [.783]	.046 (.720) [.396]	.006 (.013) [.910]
Equity / Total Capital (LEVER)	8.605 (3.839) [.050]	9.404 (3.634) [.057]	9.422 (4.186) [.041]
Book-to-Market Ratio (GROWTH)	-2.621 (1.892) [.169]	-2.707 (1.409) [.235]	-2.633 (1.922) [.166]
Firm Value (SIZE) (m DM)	3.15E-10 (.002) [.968]	-1.4E-10 (.000) [.985]	1.40E-09 (.028) [.866]
Diversified Firm (y/n) (DIVERS)	.739 (1.066) [.302]	.465 (.344) [.558]	.785 (1.142) [.285]
Return to Equity (PROFIT)	-5.328 (2.144) [.143]	-9.949 (4.098) [.043]	-5.484 (2.168) [.141]
Bank Ownership (y/n) (BANK)	-.289 (.137) [.712]	-.826 (.844) [.359]	-.394 (.242) [.623]
Foreign Sales / Total Sales (MULTI)		3.539 (3.687) [.055]	
Conv. Debt, Pref. Stock (y/n) (SUBSTI)			-.596 (.680) [.409]
n	63	60	63
Pseudo R^2 (Cox & Snell)	.129	.195	.138
Chi-Square	8.680	12.986	9.376
Sig (Chi-Square)	.2764	.1123	.3116

Turning now to the firms' interest risk management strategies, we find that the proposed
equation structure is not able to explain the firms choice between selective and non-
discriminatory hedging (see Table 7). The Chi-Square value, which evaluates the validity of
the regression equation in its entirety, is insignificant for all three specifications, although
coming close to the 10% significance level for model 2. The only variable that consistently
helps to discriminate between selective hedgers and non-discriminatory hedgers in all three
equations is leverage. Again, it appears intuitive that firms with a higher debt-equity ratio,
ceteris paribus, tend to hedge interest rate risks rather than betting on future interest rate
changes.

In model 2, PROFIT also turns out significant. As in the case of exchange risk management, it
has a different sign than predicted. A third variable that comes out significant in model 2 is

MULTI which measures the firms' degree of multinationality. While one would have expected that the degree of multinationality has a stronger impact on a firm's exchange risk strategy it is rather more difficult to explain why it only influences their choice of an interest risk management strategy. All other variables, including firm size, are insignificant.

V.   Conclusions

Previous research on the determinants of corporate hedging has been based on comparisons of firms that use derivatives and firms that do not use them. The former are classified as hedgers, the latter as non-hedgers. However, survey studies on risk management have show that firms in reality follow very heterogenous exchange risk management practices. In particular, a majority of firms follow profit-oriented, forecast-based selective hedging strategies. This behavior is difficult to reconcile with established hedging theories and with the standard procedure for testing them. What appears to be called for is a closer link between the observed risk management behavior and the theories of corporate hedging.

The present paper is based on a survey study on the risk management of large German non-financial firms. Of the 154 companies that were addressed, 74 took part in the survey (response rate: 48 %). it was found that 90% of the firms use derivatives. The firms follow diverse risk management strategies. A majority of firms, however, follow a selective hedging approach, that is, they use forecasts in making hedging decisions. The risk management of these firms thus contains a speculative element. This element is even more pronounced in interest rate management than in exchange rate management.

These results raise the question of how the observed risk management behavior can be explained. It appears most interesting to ask why certain firms follow profit-oriented and forecast-based risk management strategies while other firms hedge risks without recourse to exchange-risk or interest-rate forecasts. In order to answer this question, we adapt the existing hedging theories. Our contention is that the liquidity, leverage, growth options, size, product and geographical diversification, bank ownership (in the context of the German governance system), and the use of hedging substitutes jointly determine whether a firm will try to generate profits in financial markets by forecasting future price changes.

We apply multiple logistic regression analysis in order to test our hypotheses. The results of the regression analysis can be summarized as follows: The proposed model is able to explain the firms' choice of foreign exchange risk strategies reasonably well. In accordance with our predictions, highly levered firms are less likely to take bets in the currency markets. Secondly, firms with significant bank ownership are more likely to a use profit-oriented exchange risk management strategy. Contrary to our expectations, there was a negative correlation between profitability and the likelihood to adapt a selective hedging approach. Finally, there was a tendency (albeit not statistically significant) for larger firms to be more inclined to use forecasts in their exchange risk management decisions.

The proposed model is not able, on the other hand, to explain the choice of the firms' interest rate risk strategies. It remains unclear whether these inconclusive results are due to the fact that our model is misspecified (for instance, because other variables determine the choice between selective and non-discriminatory hedging of interest rate risk) or whether the model performs poorly because of our small sample size and the uneven distribution of cases (only 14 firms are classified as non-discriminatory hedgers of interest rate risk while 50 firms try to gain from forecasting future exchange rate changes).

Like all empirical work on the determinants of risk management, the present paper is fraught with two conceptual problems. Firstly, the paper focuses exclusively on the management of financial risks. What is not considered, in other words, is the fact that firms can also influence the level of risk they face by operational policies such as project choice, long-term contracts or cooperative ventures with competitors, suppliers or customers. Secondly, financial strategies such as decisions on the firm's ownership structure, its debt-equity ratio and its risk management are jointly determined in reality. Without an adequate structural model that simultaneously explains all financial policy choices, this endogeneity problem is impossible to resolve (also see *Dolde* 1995; *Mian* 1996; and *Geczy et al.* 1997 on this point).

Further, it would have been interesting in our study to control for the firms' exposures to financial risk. *Dolde* (1995) demonstrates that controlling for different levels of primitive risk, i.e. risk arising form a firm's operations, mitigates the endogeneity problems and leads to more precise results on the determinants of hedging (also see *Jalilvand* 1999). However, given our small overall sample size, it is not feasible to split our firms into different groups since this would render statistical test meaningless.

As far as possibilities for future research are concerned, more theoretical and empirical research is needed in order to explain the actually observed corporate risk management. The heterogeneity of risk management approaches, and the endogeneity of alternative financial policies, indicate that in-depth case studies may be a fruitful avenue to provide explanations for firms' choices of risk management strategies. Further, as indicated in the present paper, it appears important to incorporate behavioral aspects such as bounded rationality and the effects of organizational decision-making into the models of corporate risk management. Finally, it would be of great interest to analyze the profitability of profit-oriented, forecast-based risk management strategies in order to find out whether the firms' managers are indeed able to "beat the markets" or whether the adoption of such strategies is largely due to illusion of control.

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