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Corporate Risk Management

as a Lever for Shareholder Value Creation

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Abstract

Firm value is influenced in many direct and indirect ways by financial risks, which consist of unexpected changes of foreign exchange rates, interest rates and commodity prices. The fact that a significant number of corporations are committing resources to risk management activities is, however, only an indication of the potential of corporate risk management to increase firm value. This paper presents a comprehensive review of positive theories and their empirical evidence regarding the contribution of corporate risk management to shareholder value. It is argued that because of realistic capital market imperfections, such as agency costs, transaction costs, taxes, and increasing costs of external financing, risk management at the firm level (as opposed to risk management by stock owners) represents a means to increase firm value to the benefit of the shareholders.

Keywords: Risk management, agency cost, hedging, shareholder value, taxes, transaction cost, derivatives

JEL Classification: G3, F4, F3

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1 Introduction and Overview

Due to at times higher volatility in the international financial markets and spectacular cases of derivatives losses, risk management has recently gained increasing attention -- by practitioners as well as in the academic profession. As a matter of fact, the successful management of financial risks has advanced to a crucial competitive advantage for firms in all industrial sectors. Financial risks are typically understood as foreign exchange and interest rate risk. In addition, commodity price risk is sometimes considered in this context as well, as there exist many instruments in the financial markets with commodity prices as underlying assets, which can be used to efficiently transfer commodity price risk to other market participants.

Despite the current popularity of risk management, there is a broad discussion in the academic literature regarding the contribution of risk management to shareholder value. It was triggered by the apparent contradiction between corporate practice, where financial risk management gained more and more interest, and various economic theories stating that risk management was generally redundant or that it could be performed equally well if not better by the shareholders themselves. As a result, this paper analyzes the existing theoretical arguments and empirical evidence of risk management as a means to maximize shareholder value. While the question regarding the relationship between risk management and firm value has been raised for financial institutions as well,[1] the focus of this paper is on nonfinancial corporations.

[1] See e.g. Allen/Santomero (1997), p. 1465.

The paper starts out in Section 2 by reviewing the existing empirical evidence with regard to the risk management activities of nonfinancial firms, in order to gain insight into current corporate practices (e.g. concerning the instruments used or the strategies pursued).

The analysis comprises the management of foreign exchange rate, interest rate and commodity price risk, the development of derivatives markets and the use of these instruments by corporations, as well as organizational aspects of corporate risk management. Subsequently, positive theories that are concerned with why corporate risk management might contribute to shareholder value are presented in Section 3. It is argued that because of realistic capital market imperfections, such as agency costs, transaction costs, taxes, and increasing costs of external financing, risk management at the firm level (as opposed to risk management by stock owners) represents a means to increase firm value to the benefit of the shareholders. The various theoretical arguments are complemented in turn by the existing empirical evidence concerning the link between risk management at the firm level and firm value maximization.

The paper offers a more comprehensive review of the literature than presented in previous work.[2] As a matter of fact, it includes a more inclusive list of references regarding the theoretical arguments and, in particular, with regard to the empirical evidence of the different hedging motives. Moreover, the review is supplemented by an extensive and detailed presentation of the existing international evidence on corporate risk management practices in general and the use of derivatives in particular. Section 4 summarizes and concludes the analysis.

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[2] See e.g. Stulz (2000a), Ch. 3, Raposo (1999), Smithson (1998), Ch. 20, Allen/Santomero (1997), Santomero (1995), Smith (1995), Smith/Smithson/Wilford (1990a).

2 Risk Management Practices of Nonfinancial Corporations

2.1 Derivatives Use and General Risk Management Practices

Comprehensive statistics concerning the use of risk management instruments exist especially for derivatives, which have become increasingly popular risk management tools. As a result, statistics such as trading volume (turnover in number of contracts) or the notional amount outstanding (in USD) document an exponentially increasing use of these instruments since the early 1980s.[3] By these measures, the global derivatives market has grown worldwide almost by a factor of 60 during the period 1986-98 and reached a market value of USD 63 trillion by the end of 1998 (Figure 1). This expansive development, which has been apparent for exchange-traded and -- even stronger -- for OTC instruments, has largely been driven by the growth of interest rate derivatives in both market segments. At the end of 1998, the BIS estimated the OTC market for foreign exchange, interest rate and commodity instruments as having a market value of USD 51 trillion.[4]

[Figure 1]

Interest rate derivatives -- in particular interest rate futures and OTC interest rate swaps -- exhibited the biggest growth (Figure 2). The notional amount outstanding of exchange-traded interest rate instruments increased from USD 516.5 billion in 1986 to more than USD 12.3 trillion in 1998, and the turnover of the number of contracts grew on average by 18% per year (Figure 3). For interest rate swaps, the notional principal outstanding increased even more strongly from USD 1,010

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[3] These developments are also described, for example, in Allen/Santomero (1998), Remolona (1992-93), Saunders (1994), p. 6, Economist (1996), pp. 6-10, and Handelsblatt (1997).

[4] BIS (2000), Remolona (1992-93), p. 28.

billion (1988) to USD 6.2 trillion (1993) and USD 39.8 trillion (1998), or by 44% per year on average. OTC interest rate options were less important in terms of the trading volume, but showed similar growth rates for notional amounts outstanding.

[Figure 2]

In comparison, the number of exchange-traded currency derivatives increased on average by only 5.1% per year over the period 1988-98, except for currency swaps which showed growth rates similar to interest rate instruments. At the same time, the notional amounts outstanding of currency swaps increased between 1988 and 1998 from USD 320 billion to USD 2,470 billion. By the number of contracts, however, interest rate derivatives are still much more important.

[Figure 3]

Hedging instruments for commodity price risk are playing a more important role as well. This observation is documented by, among others, the trading volume of commodity futures and options contracts (Figure 3 and Table 1). At the end of 1999, the notional principal outstanding was estimated at USD 281 billion for commodity price forwards and swaps, and USD 267 billion for commodity price options.[5] The most popular underlyings are energy prices for swaps and metal prices for options. While exchange-traded instruments are often used for base metals, OTC volumes still significantly exceed exchange-traded volumes in precious metals and energy markets. As a result, the presented data on exchange-traded transactions underestimates the growth of these commodities, because a large proportion of market volume is traded over the counter.[6]

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[5] BIS (2000), p. 84.

[6] JPMorgan (1994), p. 12, Global Derivatives Study Group (1993), p. 57.

[Table 1]

The above trading statistics reflect the extended supply of derivatives as well as the increased use of these instruments by market participants. Since derivatives are, however, most likely to be used by financial institutions, it is not possible to draw immediate conclusions from this data regarding the risk management practices of nonfinancial institutions. To illustrate, financial institutions account for 82% of the OTC market volume.[7]

Insights into the use of derivatives in particular and risk management practices in general can be gained to some degree from corporate annual reports as well as risk management survey studies. The analysis of information in annual reports concerning the use of derivatives shows that nonfinancial firms utilize derivatives more often and to a larger degree over time.[8] According to survey results, 50% of U.S. nonfinancial firms used derivatives in 1998. At the same time, derivatives use is positively correlated with firm size: 83% of large companies (total sales > USD 1.2 billion), but only 12% of small companies (total sales < USD 150 million) make use of derivative financial instruments.[9]

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[7] Allen/Santomero (1998), p. 1470.

[8] Hentschel/Kothari (1997), p. 9.

[9] Bodnar/Hayt/Marston (1998), p. 71, Bodnar/Hayt/Marston (1996), p. 114, Bodnar et al. (1995), p. 104, Phillips (1995), p. 117. Other studies find percentages of 37% (Guay (1999), p. 328), 59.1% for large firms (Géczy/Minton/Schrand (1997), p. 1335), 63.2% for all TMA member companies (Phillips (1995), p. 115), 60% for large U.S. firms (Hentschel/Kothari (1997), p. 32), 44% for all S&P companies (Allayannis/Ofek (1996), p. 4), 85.2% for Fortune 500 companies (Dolde (1993b), p. 34) or 57.8% for large U.S. companies (Goldberg et al. (1994), p. 21). Firms in New Zealand exhibit a user rate for derivatives of 48% (Berkman/Bradbury/Magan (1997), p. 69) or 53.1% (Berkman/Bradbury (1996)). In 1997, the percentage of German nonfinancial firms using derivatives was reported to be 77.8% and was therefore significantly higher than for U.S. firms (Bodnar/Gebhardt

Moreover, the use of derivatives varies across industries as well: 68% of primary product producers, 48% of manufacturing companies, and 42% of firms in the service industry employ these instruments. Of the companies that utilize derivatives, changes in interest rates, foreign exchange rates and commodity prices are a relevant source of risk for 83%, 76% and 56%, respectively.[10] Many firms perceive several risks as simultaneously important (Figure 4).[11] At the same time, there is a positive relationship between firm size and the perception of financial risk exposures.

[Figure 4]

With regard to the type of hedging instrument, forwards (72%) and OTC options (37%) are more commonly employed than exchange-traded futures and options (17% and 14%, respectively). While 68% of all U.S. nonfinancial firms use some type of option, the percentage is much higher for large firms (74%) than for small firms (47%).[12] Moreover, there are indications that large multinationals use more complex, exotic derivatives as well (such as knock-out options or quanto swaps), however they do so less frequently and rather with experimental intention. To illustrate, a study by

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(1999), p. 5).

[10] Bodnar/Hayt/Marston (1998), p. 73. A study by the Economist Intelligence Unit results in 92.2% (exchange rate risk), 81.1% (interest rate risk) and 46.0% (commodity price risk) (Corporate Finance (1995), p. 6). According to results of the Group of Thirty, companies use derivatives to hedge foreign exchange rate transaction exposures (69%), foreign exchange translation exposures (33%), interest rate exposure (78%) and commodity price exposure (11%) (Global Derivatives Study Group (1993), pp. 37-38). German firms use derivatives primarily to manage foreign exchange rate risk (95.9%) and interest rate risk (88.8%), while only about 40% use these instruments to manage commodity price risk (Bodnar/Gebhardt (1999), p. 7).

[11] Bodnar/Gebhardt (1999), p. 8, Phillips (1995), p. 116.

[12] Bodnar/Hayt/Marston (1998), p. 82.

the Group of Thirty finds that 4% of the end-users of derivatives use quanto swaps, while another 14% intend to do so in the future.[13]

In general, nonfinancial corporations typically focus their financial risk management with derivatives on short time horizons. Consequently, derivatives are most often employed to target transaction exposures (80%), and to hedge anticipated short-term transactions (77%). Only 16% of nonfinancial firms aim frequently to reduce their economic exposure, another 24% do so occasionally, and anticipated long-term transactions (> 12 months) are hedged with derivatives by only 50% of the firms. 44% of nonfinancial firms still concentrate on accounting exposure, and 43% use derivatives for taking a view, i.e. speculating, in order to reduce funding costs. On the other hand, the most important objective of the hedging strategy consists for 67% of minimizing fluctuations in cash flow, while reducing the volatility of accounting earnings or protecting the appearance of the balance sheet are predominant only for 28% and 5%, respectively. A high percentage (23.9%) of U.S. nonfinancial firms even consider firm value not important as a risk management objective.[14]

2.2 Management of Foreign Exchange Rate Risk

If surveys on risk management practices capture a valid picture of actual firm behavior, their results lead to the conclusion that nonfinancial firms conduct foreign exchange risk management activities primarily to hedge transaction risk and that only few large multinationals try to reduce their economic

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[13] Euromoney (1994).

[14] Bodnar/Hayt/Marston (1996), pp. 116-121, Bodnar et al. (1995), pp. 107-109. In contrast, the most important objective of the hedging strategy for German nonfinancial firms is accounting earnings (55.3%), while cash flows (34.0%) and firm value (11.7%) are less important (Bodnar/Gebhardt (1999), p. 9).

foreign exchange rate risk. Overall, 96% of all firms hedge their transaction exposure completely (35%) or partially (61%), while 52% hedge their economic foreign exchange rate exposure, which only 9% eliminate completely (Figure 5).[15]

[Figure 5]

In contrast to these international results, the economic exposure -- even though still less important than the transaction exposure -- has become more important than the accounting exposure for nonfinancial firms in the U.S.[16] Nevertheless, U.S. firms focus their risk management on near-term, directly observable exposures as well.[17] And even though one third of the firms believe that they face economic exposures, only few conduct sensitivity analysis to investigate the impact of different risk management strategies on corporate performance. Especially in cases in which the exposure is de-

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[15] Price Waterhouse (1995), p. 14. In the study of 36 U.S. multinational firms by Malindretos/Tsanacas (1995), transaction exposures, economic exposures and accounting exposures are perceived as the most important concept by 68%, 27% and 11%, respectively. According to a study of 200 multinationals by the Bank of America, 15% of the firms hedge economic risks, 75% hedge anticipated risks, and 95% hedge their transaction risks (World of Banking 1995). In Australia, the percentage of firms that hedge their economic foreign exchange rate risk is 16.6% (Batten/Mellor/Wan (1993), p. 564). In Switzerland, 28% of the nonfinancial firms aim to protect firm value directly (and firm value is the most important risk management target for only 1%), while 61% hedge individual foreign exchange transactions (Loderer/Pichler (2000), pp. 25-26).

[16] Jesswein/Kwok/Folks (1995), p. 108. An earlier study by Stanley/Block (1978) reports a percentage of 52% of all firms that hedge their accounting exposure, even though 23.2% indicate that this increased their economic exposure.

[17] Bodnar/Hayt/Marston (1998), p. 76.

termined by several economic factors, corporations do not see themselves as being in a position to manage their economic exposure.[18]

The short-term risk management perspective is also reflected in the maturity structure of corporate hedging. Derivatives with a maturity of up to 180 days are most commonly used, and firms apparently concentrate most of their utilization of derivatives on hedging foreign currency exposures over short horizons.[19] Interestingly, most firms use derivatives to hedge only part of the foreign exchange rate exposure they perceive. Similarly, a large number of U.S. nonfinancial firms indicate that they incorporate their market view into the hedging decision: The timing and the size of the hedge is altered at least sometimes by 59% and 61% of U.S. nonfinancial firms, respectively, and 32% actively take positions frequently or occasionally.[20]

Overall, 41.4% of all nonfinancial firms use derivatives to manage foreign exchange rate risk,[21] and there is a positive relationship between the use of derivatives and foreign activities (e.g. foreign

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[18] Price Waterhouse (1995), pp. 14-17.

[19] Bodnar/Hayt/Marston (1998), p. 77.

[20] Bodnar/Hayt/Marston (1998), p. 79. According to results by Bodnar/Gebhardt (1999), p. 17, German firms are even more inclined to take a view on the market, as altering the timing of the hedge (88.8%), adjusting the size of the hedge (84.3%), and actively taking positions (50.6%) at least sometimes appears common practice. 77% of Swiss nonfinancial firms always or often have a view on the market, and 63% use their view as the basis for their hedging decision (Loderer/Pichler (2000), p. 18).

[21] Géczy/Minton/Schrand (1997), p. 1335. Allayannis/Weston (1997), p. 12, report 59% in 1995 with an increasing trend, Goldberg et al. (1994), p. 12, find a percentage of 38.8% of foreign exchange derivatives users. In Switzerland, this percentage is, at 77%, much higher (Loderer/Pichler (2000), p. 26).

sales).[22] Corporations primarily use OTC forward contracts (90%) and spot foreign exchange transactions (83%), but also OTC options and swaps (50%).[23] Mostly large firms take advantage of the tailoring of derivatives contracts in the OTC market. In contrast, exchange-traded contracts such as currency futures and options are used much less often, presumably due to the lower flexibility of these contracts. In addition, foreign currency debt and other internal hedging tools such as matching are employed -- as substitutes for derivatives -- to hedge foreign business activities.[24]

For the hedging of accounting exposures, foreign currency debt and currency forwards supposedly represent by far the most popular risk management instruments. In contrast, the economic foreign exchange rate exposure is managed in smaller firms primarily by matching and netting cash

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[22] Makar/Huffman (1997), Allayannis/Ofek (1996). Similarly, Géczy/Minton/Schrand (1997), p. 1340, find a significant, positive correlation between proxies for the foreign exchange rate exposure (foreign income, foreign currency debt, import penetration) and the use of derivatives. In the same vein, Berkman/Bradbury (1999) provide empirical evidence for foreign exchange derivatives being used to reduce the cash flow exposure of New Zealand firms.

[23] Price Waterhouse (1995), p. 14. Similar results are presented in Bodnar/Gebhardt (1999), p. 15, for U.S. and German nonfinancial firms, as well as in Loderer/Pichler (2000), p. 26, for Swiss corporations. According to a survey by the Group of Thirty, 78% of the firms studied use currency forwards, 64% currency swaps and 31% currency options (Global Derivatives Study Group (1993), pp. 34-36). The survey by Hakkarainen/Kasanen/Puttonen (1994) results in more than 80% of the studied Finnish firms using currency forwards.

[24] Géczy/Minton/Schrand (1997), p. 1324, Hakkarainen/Kasanen/Puttonen (1994), p. 35.

flows, while larger corporations employ derivatives more often as well.[25] Only a few firms use complex foreign exchange rate derivatives (compound options, break forwards, hindsight options, etc.).[26]

2.3 Management of Interest Rate Risk

Based on the results of an international survey of nonfinancial corporations in 1995, the majority of these firms that were surveyed (73%) use interest rate derivatives.[27] The type of instrument used depends on the risk management strategy pursued. Firms who actively manage interest rate risk typically use a much wider variety of derivatives than firms who try to hedge their risk exposure. Nevertheless, even firms who hedge their interest rate risk frequently hedge their exposure only partially (Figure 6). Similarly, many U.S. nonfinancial firms indicate that they alter the timing of a hedge (66%), to adjust the size of a hedge (59%), or actively take positions (41%) depending on their market view.[28]

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[25] Price Waterhouse (1995), p. 14.

[26] Bodnar/Hayt/Marston (1998), p. 82, Bodnar et al. (1995), p. 106, Jesswein/Kwok/Folks (1995), p. 107.

[27] Price Waterhouse (1995), p. 12. Bodnar/Hayt/Marston (1998), p 73, and Bodnar/Hayt/Marston (1996), p. 115, report 76% and 73%, respectively, of U.S. nonfinancial derivatives users employing interest rate derivatives. These results are in stark contrast to the analysis of annual reports of U.S. corporations by the Federal Reserve Bank, which results in a percentage of 9.1% of the firms that use interest rate derivatives (Perlmuth (1996)). This discrepancy can be explained partially by accounting rules. Goldberg et al. (1994), p. 12, report 41.6% of the firms in their study using interest rate derivatives. In 1985, this percentage was only 19.2% (Block/Gallagher (1986), p. 75).

[28] Bodnar/Hayt/Marston (1988), p. 81. As with foreign exchange rate risk, German firms exhibit a higher inclination to design their hedge according to their view of the market, as 91.5% and 90.3% adjust the timing of the hedge

[Figure 6]

In general, for interest rate risk management, (U.S.) nonfinancial firms employ swaps more frequently than other instruments such as caps, futures, forwards or options. Interestingly, the size of the firm does not seem to matter for the use of contracts with option features.[29]

Apparently, interest rate derivates are used more often by transportation, construction and utility companies, as well as by firms with high credit ratings. Moreover, firms with a high proportion of short-term and floating rate debt seem to be frequent users of interest rate derivatives. These instruments are primarily employed to convert floating rate payments into fixed rate payments, and less frequently to swap from fixed to floating, to lock in the rate or spread on new debt issues, or to reduce costs based upon a market view.[30] In contrast, there appears to be no empirical correlation between capital expenditures or annual operating earnings and the use of interest rate derivatives,

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or change the size of the hedge, respectively, while 26.1% actively take positions (Bodnar/Gebhardt (1999), p. 20).

[29] Bodnar/Gebhardt (1999), p. 19, Perlmuth (1996), Bodnar et al. (1995), p. 106, Phillips (1995), p. 119. However, there are discrepancies across countries: Dutch firms use more FRAs and interest rate options than interest rate swaps, while Swedish companies frequently use interest rate futures (82%) (Price Waterhouse (1995), p. 12). A study by the Group of Thirty indicates that 87% of the firms use interest rate swaps and 40% use interest rate options (Global Derivatives Study Group (1993), p. 34).

[30] Bodnar/Gebhardt (1999), p. 18, Bodnar/Hayt/Marston (1998), p. 80, Dayal (1992). This result fits with the observation that the goal of interest rate risk management consists often in stabilizing the cost of capital (Goswami/Shrikhande (1997), p. 21, Dolde (1993a), p. 22). Consequently, nonfinancial institutions typically take the position of fixed rate payers of interest rate swaps (Wall/Pringle (1989), p. 66).

which are primarily employed to reduce the accounting exposure (interest rate risk of liabilities), but not the economic interest rate exposure.[31]

2.4 Management of Commodity Price Risk

Only a few nonfinancial firms (11%) use commodity price derivatives to manage energy or raw material costs.[32] This percentage is, at 77%, much higher however, is much larger (84.6%) for firms in the energy sector (and most likely other commodity-based industries).[33] In general, risk management surveys document no strong preferences or common practices of U.S. nonfinancial firms regarding the use of derivatives to manage commodity price risk. While corporations use a variety of different commodity derivatives, forward contracts are apparently utilized slightly more often than futures, options and swaps: More than 50% of nonfinancial firms employ forwards, futures and swaps, and 45% also use OTC options. Overall, commodity futures are regarded as the most important derivative for commodity price risk management.[34]

In spite of the expansive growth of markets for traded commodities, one has to be taken into account for risk management activities that these markets still do not compare to established financial

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[31] Perlmuth (1996).

[32] Global Derivatives Study Group (1993), p. 38. Hentschel/Kothari (1997) find 4.7% of U.S. nonfinancial firms using commodity price derivatives.

[33] Thornton/Welker (1999).

[34] Bodnar/Gebhardt (1999), p. 20, Bodnar/Hayt/Marston (1996), p. 115, Bodnar et al. (1995), p. 106, Phillips (1995), p. 119. German nonfinancial firms seem to be using primarily commodity price forwards (50%), less than a third use futures and swaps (Bodnar/Gebhardt (1999), p. 21).

markets in terms of liquidity -- especially for contracts with longer maturity. Consequently, the limited depth and breadth of commodity markets possibly represent a constraint for practical risk management purposes.[35] To illustrate, at the end of 1999, the notional principal outstanding amounted to USD 14,344 billion for foreign exchange rate contracts, USD 60,091 billion for interest rate contracts, and USD 548 billion for commodity contracts in the OTC market.[36] By the same token, surveys of financial risk management of U.S. corporations show that the use of commodity price derivatives is less popular compared to currency and interest rate instruments.[37]

Industry-specific studies offer insight into the practices of commodity risk management in selected nonfinancial industry sectors. Several studies investigate the way firms in the North American gold mining industry manage their gold price risk. This analysis is facilitated by the fact that the output of these firms is a globally traded, volatile commodity. Gold mining firms thus exhibit a common and clear exposure, which they can manage with an ample variety of instruments (e.g. forwards, futures, swaps, options, gold loans, spot deferred contracts) and operating decisions. Firms cover 25.6% of their production on average (median 22.9%). Nevertheless, there exist substantial differences in risk

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[35] UNCTAD (1994), p. 22.

[36] BIS (2000), p. 81. With regard to derivative financial instruments traded on organized exchanges, the comparison is not feasible since there are no notional amounts outstanding available for commodity contracts on a global scale. The number of exchange-traded futures (options) contract outstanding at the end of 1999 were 17.5 (5.6) million for interest rate instruments, 0.7 (0.5) million for currency contracts, and 6.5 (3.6) million for commodity contracts. Furthermore, the turnover of futures (options) contracts in 1999 totaled 672.7 (118.0) million for interest rate contracts, 37.1 (6.8) million for currency contracts, and 327.5 (41.4) million for commodity price contracts.

[37] Hentschel/Kothari (1997), p. 11.

management practices within the industry, as 14.6% sell all of their output at spot prices, but 16.8% hedge 40 percent or more of their projected output. Three quarters of firms that manage their gold price risk use options for at least part of their activities, and on average 16.1% of the firms' portfolio delta originates from option positions.[38]

Similarly, the management of commodity price risk is studied in the U.S. natural gas industry, which faced increased gas price risk as the result of the deregulation process. The analysis shows that natural gas companies responded to this development by increasing diversification and use of derivatives. While 19% of the companies used commodity derivatives in 1992, this percentage had increased to 85% by 1995.[39] Alternative hedging strategies consist of holding internal cash and storing gas underground. While these two activities are complements, they are apparently substitutes for employing financial derivatives.[40]

For oil and gas producers, commodity price swaps are the most commonly used derivatives (50.8%). Fixed price contracts (40.4%) and futures/forwards (37.0%) are popular hedging instruments as well. Conversely, options are only rarely used (10.5%). At the same time, there is substantial variation in the fraction of production hedged across firms in this industry.[41]

The power industry faces the challenge that electricity cannot be stored economically. Therefore, inventories cannot be used to smooth supply or demand shocks, and spot prices are quite vola-

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[38] Tufano (1988), Petersen/Thiagarajan (1997), Tufano (1996).

[39] Haushalter (1997) reports a fraction of 58% of oil and gas producers using commodity derivatives in 1994.

[40] Géczy/Minton/Schrand (1999).

[41] Haushalter (1997), p. 16.

tile (and positively skewed). Daytime power prices are typically considerably higher than nighttime delivery prices, and there exist significant seasonal variations as well. Power producing firms and power retailers, however, can hedge their power price risk, for example, with power derivatives (forwards, futures, etc.), taking into account the forecasted output and the properties of power demand (skewness, interaction between local and global power demand, etc.).[42]

2.5 Risk Management Organization

A centralized organizational structure is most frequently implemented for the management of foreign exchange rate risk (89%), interest rate risk (94%), and commodity price risk (67%). Conversely, decentralization -- possibly with centralized coordination -- is not a common risk management approach, except for commodity price risk.[43] The management of foreign exchange rate risk and interest rate risk is typically part of the corporate treasury function. Increasingly, commodity price risk is becoming a responsibility of the treasury as well, although it has traditionally been handled by the purchasing department.[44]

According to survey data, two thirds of multinational firms organize their treasury as a service center, while it is set up less often as a cost center (19%) or a profit center (7%). On the other hand, the majority of these firms (66%) pursue an active risk management, while 28% indicate that they hedge their risks completely. Nevertheless, there exist noticeable national differences: Allegedly more

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[42] Bessembinder/Lemmon (1999).

[43] Bodnar/Hayt/Marston (1998), p. 73.

[44] Price Waterhouse (1995), pp. 6-7.

than half of nonfinancial firms in France and Norway hedge their risks completely, while more than 80% of all firms in Sweden, Finland and Hong Kong actively manage their risks.[45]

In contrast to the management of interest rate and foreign exchange transaction exposure, for which 74% and 87%, respectively, of all firms have formal policies, the management of the economic foreign exchange rate exposure is much less formalized (43%).[46] However, 79% of U.S. nonfinancial firms have a documented corporate policy regarding the use of derivatives. In addition, nearly all firms (96%) have established a policy regarding the counterparty risk for derivatives transactions, with the majority requiring at least on an A rating. Furthermore, 50% of the firms report their derivatives activity to the board of directors in a regular fashion.[47]

For the revaluation of the derivatives portfolio, which takes place at a daily/weekly (28%), monthly (27%), or quarterly (21%) frequency, internal sources are relied upon most.[48] A Value at Risk (VaR) measure is calculated by 44% of nonfinancial firms, and its use is even more common for

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[45] Price Waterhouse (1995), pp. 6-10.

[46] Price Waterhouse (1995), pp. 6-10.

[47] Bodnar/Hayt/Marston (1998), p. 83-84. While German firms are as likely to have documented policies regarding derivatives use as U.S. firms, nonfinancial firms in Germany more often have a set and frequent schedule of reporting to the CFO, the board of directors or the supervisory board. Moreover, German firms typically require a rating of AA or higher of their derivatives counterparty (Bodnar/Gebhardt (1999), p. 22). Swiss nonfinancial firms (with/without listing) almost always inform senior managers (93%/91%) and directors (69%/55%), but less often stockholders (25%/38%) or other investors about their risk management activities (Loderer/Pichler (2000), p. 16).

[48] Bodnar/Hayt/Marston (1998), p. 83-84. As a result of their set reporting schedules, German firms value their derivatives portfolios significantly more often than U.S. firms (Bodnar/Gebhardt (1999), p. 25).

large firms. Stress testing is performed by 45% of nonfinancial derivatives users, and approximately 20% use duration methods (for interest rate derivatives).[49]

In most firms (63.5%), risk management is not a full time activity, while in 13 out of 100 cases three or more employees are responsible for this task. The computer system used for risk management consists typically of PCs (60.8%), LAN networks (14.7%) or mainframes (6.9%). Nevertheless, 17.6% of all firms allegedly do not use computers in the course of their risk management activities.[50]

3 Positive Theories and Empirical Evidence of Corporate Risk Management as a Lever for Shareholder Value Creation

3.1 Capital Market Imperfections as a Basis for Positive Risk Management Theories

The fact that a significant number of corporations are committing resources to risk management activities -- as illustrated in the previous section – is only an indication of the potential of corporate risk management to increase firm value. Consequently, this section presents a comprehensive analysis of positive theories and their empirical evidence regarding the contribution of corporate risk management to shareholder value. Arguments supporting the irrelevance of corporate risk management are based on international parity conditions between currencies, interest rates and commodity prices (real goods prices), especially the International Fisher Effect (IFE) and Purchasing Power Parity

[49] Bodnar/Gebhardt (1999), p. 25, Bodnar/Hayt/Marston (1998), p. 83-84.

[50] Institutional Investor (1994), Dolde (1993a), pp. 25-27.

(PPP). Under the assumption of equilibria between foreign exchange rates, interest rates and prices for real goods, risk management is obsolete since negative effects of one economic factor are compensated instantly by an offsetting development in another risk factor.

Empirical studies, however, indicate that these parity conditions at best hold in the long run, which is why there exists an economic justification for financial risk management in general.[51] But this does not indicate who, from an economic point of view, should perform this task -- corporations or shareholders. Insight on this issue can be derived from the irrelevance theorem by Modigliani/Miller (MM). According to the MM propositions, the capital structure of a firm has no impact on firm value if certain, well-defined assumptions hold (complete capital markets without information asymmetries, taxes, and transaction costs), since shareholders can always replicate the financial policies of the firm with transactions in the capital markets.[52] Therefore, the only possibility to increase firm value consists of the realization of real, positive net present value (NPV) projects. Whether these investment projects are financed with equity or debt, however, is irrelevant, i.e. the financing decision does not increase the value of the firm further.[53]

Applying the logic of the MM propositions to corporate risk management, (financial) risk management as a financial activity would *prima facie* not lend itself to increase shareholder value.[54]

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[51] Alexius (1996), Rhim/Khayum/Kim (1996), Froot/Rogoff (1994), Marston (1994), Abuaf/Jorion (1990), Adler/Lehmann (1983).

[52] Modigliani/Miller (1958), later Stiglitz (1974), Stiglitz (1969). Modigliani/Miller (1959) take dividends into account, Modigliani/Miller (1963) add taxes to the analysis. Miller (1988) gives a summary of these articles.

[53] Copeland/Weston (1988), pp. 439-444.

[54] MacMinn (1987b), pp. 1169-1173. See also Baron (1976), p. 259, and Dumas (1978), p. 1023, with regard to for-

The owners of the firm could perform the management of foreign exchange rate, interest rate and commodity price risk as equally well as management, and due to the effect of portfolio diversification possibly even better. In addition, shareholders have widely differing preferences, which can be accounted for when hedging individually, but not when hedging at the firm level.[55]

Closer inspection, however, reveals that the neoclassic assumptions of the MM propositions do not hold in reality. The existing capital market imperfections are, therefore, the basis for various positive theories about the economic impact of corporate risk management on firm value, which try to explain the prevailing discrepancy between theory and business practice by identifying plausible motives for hedging at the firm level.[56]

Assuming the standard paradigm of maximizing firm value as the corporate objective, corporate risk management has to be assessed on the basis of whether and to what degree it contributes to this goal by raising shareholder value in the presence of realistic market imperfections.[57] Only if the increase in value exceeds the cost of hedging and if the value augmentation cannot be realized through risk management by the shareholders at lower cost, risk management at the firm level is justified on economic grounds. Total firm value (VF), i.e. the value of the assets, is formally defined as the sum of all expected future net cash flows (NCF) discounted at the cost of capital r:

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eign exchange rate risk.

[55] Fite/Pfleiderer (1995), pp. 146-151.

[56] Fite/Pfleiderer (1995), pp. 144, Sercu/Uppal (1995), pp. 456, Smith (1995), pp. 24-27, Culp/Furbush/Kavanagh (1994), pp. 73-77.

[57] For a discussion of various corporate goals in this context, see Hu (1996).

$$VF = \sum_{t=0}^{T} \frac{E(NCF_t)}{(1+r)^t}. \quad (1)$$

The firm value to the shareholders (V) results from the difference between the value of the assets and the market value of debt (entity approach). Alternatively, shareholder value can be calculated as the sum of the free cash flows (flow to equity) discounted at the return on equity (equity approach).[58] Both ways yield the same result if the common assumption of a constant value of debt is made.

According to this formula, firm value can generally be increased by reducing the discount rate and/or by enlarging the cash flows. Although in capital budgeting the aspect of risk is often taken into account in the choice of the discount rate (as the return on an investment in the same risk class), analyses of the impact of corporate risk management on firm value typically look at the expected cash flows of the firm. This is primarily due to the fact that the effect of hedging on cash flows is more intuitive and easier to illustrate.

At the same time, the perspective on cash flows avoids the question of the diversifiability of financial price risk. If exchange rate, interest rate and commodity price changes are unsystematic and thus can be diversified away according to portfolio theory,[59] they are not compensated with a positive risk premium in the capital asset pricing model (CAPM).[60] In this case, the discount rate can

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[58] See e.g. Levi (1994), pp. 38-43.

[59] Markowitz (1991), Markowitz (1952). For a good summary of portfolio theory see chapters 7 and 8 in Brealey/Myers (1996).

[60] The statements by Stulz (1996), p. 12, Smith/Smithson/Wilford (1990a), p. 128, Rawls/Smithson (1990), pp. 9-10, Aggarwal/Soenen (1989), p. 61, Shapiro/Titman (1986), p. 216, Lessard (1985), p. 287, Logue/Oldfield (1977), p.

only be lowered by corporate risk management, if large shareholders (e.g. owners of family businesses or holders of strategic investment positions) exist that cannot -- or only at a higher cost -- diversify their portfolio.[61]

In the case that financial risks are (primarily) systematic, they cannot be diversified through the construction of portfolios by definition.[62] Risk reduction through hedging therefore, entails a reduction in expected return at the same time and, thus, corresponds to a movement on the security market line.[63] The CAPM, however, like the MM propositions, is based on the assumption of perfect capital markets,[64] exactly the assumption whose validity in reality is questioned in the present context. Therefore, it appears more appropriate to account for the impact of corporate risk management in the cash flows rather than in the discount rate.

21, seem to reflect this opinion. The results of some empirical studies could be interpreted in this way as well, e.g. Jorion (1991).

[61] Stulz (1996), p. 13, Fite/Pfleiderer (1995), pp. 146-151, Vermeulen (1994), p. 4, Blake/Mahady (1991), p. 60, Mayers/Smith (1990), p. 22, Smith/Smithson/Wilford (1990b), pp. 357-361, Mayers/Smith (1982), pp. 283 and 293, Booth (1982), p. 36.

[62] The perception of financial risk as systematic factors is proposed e.g. by Oldfield/Santomero (1995), pp. 12-13, and Giddy (1977), p. 602. The empirical studies by Dukas/Fatemi/Tavakkol (1996), pp. 182-185, He/Ng/Wu (1996), pp. 17-22, Chinn/Frankel (1994), p. 12, Choi/Elyasiani/Kopecky (1992), p. 1001, Dominguez (1987), pp. 91-120, Brown/Otsuki (1994), pp. 88-92, seem to support this view. According to results by Drummen/Zimmermann (1992) and Eun/Resnick (1988) only part of the foreign exchange risk can be diversified.

[63] Smith (1995), p. 24, Levi/Sercu (1991), p. 27, Dufey/Srinivasulu (1983), p. 56.

[64] See e.g. Perridon/Steiner (1995), p. 239.

Corporate risk management generally results in a reduction of the volatility of corporate cash flows, which leads to a lower variance of firm value (Figure 7).[65] This not only means that firm value is moving less, but more importantly that low values occur with a smaller probability than without hedging. Positive theories of risk management as a lever for shareholder value creation argue, that firm value is a concave objective function because of capital market imperfections (such as transaction costs (especially cost of financial distress), agency costs, corporate taxes, and costs of external financing). Consequently, a reduced cash flow volatility results in lower costs associated with these capital market imperfections, larger cash flows to the owners of the firm, and thus higher expected firm value (shift to the right), i.e. $E_1(V) < E_2(V)$.[66]

[Figure 7]

In general, a concave corporate objective function is a necessary condition for risk management at the firm level to create value. However, while the concave objective may indeed be a reduced-form representation of capital market imperfections, it may in principle have other reasons as well, such as decreasing returns to scale of the production technology. Thus, the objective function itself may be concave, or it may be concave due to the effect of some feature of the economic environment.[67] In either case, the concave property of the objective function is able to explain risk management practices on the corporate level. The subsequent analysis will focus on different capital mar-

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[65] Similarly Lewent/Kearney (1990), p. 28, Smith/Smithson/Wilford (1990a), p. 127, Smith/Smithson/Wilford (1990b), p. 357, Rawls/Smithson (1990), p. 7.

[66] Culp/Miller (1995), p. 122, Santomero (1995), p. 2. Erroneous reasons to justify corporate risk management are presented e.g. in Sercu/Uppal (1995), p. 462, Levi/Sercu (1991), Dufey/Srinivasulu (1983).

[67] Froot/Stein (1998), Santomero (1995), Froot/Scharfstein/Stein (1993).

ket imperfections since they are widely used in the literature as a basis for risk management rationales.

As a caveat, it is important to note that the various positive theories to explain corporate risk management rely on different corporate objectives (e.g. firm value, cash flows, pretax income) and value systems (market values, cash flows, book values). To illustrate, the corporate tax burden can be reduced by hedging pre-tax income, the cost of financial distress can be lowered by hedging total cash flow, and investment and financing policies can be coordinated by hedging cash flow before investment spending (as will be explained below).

These activities can, but do not necessarily, work in the same direction. In the face of limited hedge accounting for off-balance sheet financial instruments, a risk management activity may, for instance, lead to lower volatility of firm value, but higher volatility of earnings.[68] Or the use of VaR, a common risk management approach, has been shown to lead to undesirable effects such as the realization of larger losses for VaR-risk managers than for non-risk managers in the most adverse states of the world.[69] Consequently, there exists the possibility of conflicts between different corporate targets that have to be taken into account when determining the risk management strategy. They can be avoided through the selection of appropriate hedging instruments that are independent of each other and can thus be employed to hedge different objective values.[70]

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[68] Hu (1996), p. 44.

[69] Basak/Shapiro (1999).

[70] Graham/Smith (1996), p. 11, Smith (1995), p. 27, Froot/Scharfstein/Stein (1993), p. 1640.

3.2 Positive Risk Management Theories and Empirical Evidence

3.2.1 Agency Costs

3.2.1.1 Underinvestment and Asset Substitution Problems

Agency theory has had a strong impact on research in financial economics.[71] The analysis of the relationship between a principal (e.g. a shareholder) and an agent (e.g. a manager) has led, in many ways, to new explanations of economic problems. Central elements of the analysis are the interdependence of different interests, sets of information and alternatives of action for different parties as well as the optimal design of their relationships through incentive structures and contracts. Regarding the contribution of corporate risk management to shareholder value, the agency costs that result from the contractual relationship between shareholders on the one hand and debtholders, managers and employees on the other hand are of foremost interest.

Conflicts of interest between shareholders and debtholders can especially arise when a firm has high financial leverage and when firm value is volatile. While it is in principle optimal to realize investment projects with positive net present value and to reject those with negative NPV, managers who act in the interest of shareholders may not realize all profitable investment projects in the face of high leverage (underinvestment problem or debt overhang problem).[72] This is because firm value is volatile (also due to financial risks), and increases in value generally have to be used to satisfy debtholders first. Therefore, low firm value and high leverage can even lead to the rejection of profitable

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[71] Jensen/Meckling (1976), Eisenhardt (1989), Arrow (1985), Hacket (1985), Jensen/Smith (1985), Pratt/Zeckhauser (1985), Jensen (1983), Fama (1980), Ross (1973).

[72] MacMinn (1987a), p. 670, Myers (1977).

projects, if the success of the investment primarily increases the probability that the debt can be repaid, but does not largely benefit equity holders (as in the case of low leverage and high firm value). This underinvestment problem is more important as more investment projects/growth options are available.[73]

Corporate risk management represents a means to eliminate or alleviate these conflicts of interest and the associated welfare loss resulting from realized value-increasing investments by reducing the volatility of firm value. As a consequence, situations of low firm value, in which the conflict of interest occurs, arise less often, and shareholder value increases due to avoided agency costs. At the same time, benefits from additional tax shields of a higher optimal debt ratio exist which are not completely compensated by higher agency costs.[74]

If hedging is apt to reduce the underinvestment problem, one would expect that risk management activities can be observed more often or to a larger extent for companies with a high debt ratio, many investment projects and growth options. As indicators for the available investment set, various ratios such as R&D/sales, Tobin's q, capital expenditure/total assets, book value of equity/market value of equity, book value of equity/total assets, or the price/earnings ratio can be used. Empirical studies do indeed find evidence for these relationships.[75] Moreover, companies in more regulated

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[73] Numerical examples are presented in Smithson (1998), pp. 510-512, Dobson/Soenen (1993), pp. 37-39, Smith/Smithson/Wilford (1990a), p. 134.

[74] Smith/Smithson/Wilford (1990a), p. 135. Smith/Watts (1992), pp. 269-272, show that companies with large growth options have lower debt ratios and lower dividends.

[75] Graham/Rogers (1999), p. 20, Fehle (1998), p. 15, Howton/Perfect (1998), pp. 117-118, Schrand/Unnal (1998), pp. 1003-1010, Haushalter (1997), pp. 22-30, Samant (1996), p. 52, Dolde (1995), Goldberg et al. (1994), p. 14, Fran-

industries are less likely to hedge since regulation reduces the importance of the underinvestment problem.[76]

The interests of shareholders and debtholders are diverging as well because the shareholders of a leveraged firm have a strong interest in taking on very risky projects (asset substitution problem or risk shifting problem).[77] This phenomenon can be explained by the fact that the residual claims of shareholders can be interpreted as a call option on the assets of the firm.[78] However, in general, there is a positive relationship between the value of an option and the volatility of the underlying asset. Consequently, the realization of risky investment projects increases the value of the shareholders' position (possibly even if the project has a negative NPV) since the volatility of firm value increases. The incentive to pursue this wealth transfer is even stronger when corporations carry excessive

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cis/Stephan (1993), p. 625, Lewent/Kearney (1990), p. 25. Mian (1996), p. 430, finds converse results. The study by Tufano (1996), pp. 1116-1118, shows significant results for the debt ratio, but not for variables representing investment opportunities. The study by Dolde (1993b), p. 35, however, cannot identify significant differences in the debt ratio of users and non-users of derivatives. In the studies by Nance/Smith/Smithson (1993), pp. 273-284, Géczy/Minton/Schrand (1997), pp. 1334-1339, Guay (1999), p. 341-346, investment variables, but not the debt ratio are significant. Berkman/Bradbury (1996), pp. 10-12, find significance for the debt ratio and earnings per share. The study by Allayannis/Weston (1997), p. 17, documents empirical evidence for a positive relationship between firm value and the usage of derivatives. Gay/Nam (1998), pp. 62-66, find evidence for several growth variables. In addition, firms with high growth opportunities hedge more if their cash stock is low.

[76] Mayers/Smith (1982), p. 292, Guay (1999), p. 348, Mian (1996), p. 430, Goldberg et al. (1994), p. 14.

[77] MacMinn (1987a), pp. 672-675, Jensen/Meckling (1976), pp. 334-337.

[78] Similarly, the position of debtholders resembles a combination of a riskless bond and a short put (Mason/Merton (1985), pp. 14-19).

amounts of debt, as the call option of the shareholders has only its time value left (OTM or ATM option).[79]

Agency costs occur in this situation due to the justified attempts of debtholders to block the wealth transfer. Creditors have *ex ante* of two ways to proactively deal with the potential for opportunistic behavior on the part of the shareholders. First, they can demand a higher compensation for supplying debt capital by discounting the underinvestment and/or asset substitution problem into the fair price of debt.[80] Second, they can impose debt covenants in order to put restrictions on the investment and financing policies.[81] Debt covenants are welfare reducing as they limit the degrees of freedom of management and possibly obstruct the realization of profitable, yet risky investment alternatives.[82]

Corporate hedging contributes to the reduction or avoidance of these agency costs if it lowers the riskiness of investment projects. As a result, both groups of suppliers of capital have an interest in realizing the (less risky) investment if the NPV is positive.[83] In this context, it is important to realize that firms have to credibly pre-commit on a hedging strategy in order to achieve the potential benefits of corporate risk management in terms of reduced agency costs. Without the ability to do so, the gains from risk management at the firm level will be smaller. Firms might be able to credibly commit

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[79] For numerical examples refer to Dobson/Soenen (1993), p. 39.

[80] Smith/Smithson/Wilford (1990c), p. 374.

[81] Mayers/Smith (1987), Mayers/Smith (1982), p. 287, Smith/Warner (1979).

[82] Fite/Pfleiderer (1995), pp. 156-158, Smith/Warner (1979), pp. 125-131.

[83] Bessembinder (1991), Campbell/Kracaw (1990), p. 1684.

to a hedge through established reputation (e.g. resulting from a bond rating), or by defining their risk management strategy in debt covenants.[84]

In order to analyze the impact of risk management on the asset substitution problem empirically, the violation of debt covenants in the presence of financial risks can be studied. Empirical tests show that hedging is indeed used to reduce the risk of breaking a covenant.[85] Since convertible debt, preferred stocks or mortgage bonds represent substitutes for risk management with regard to the underinvestment problem and the asset substitution problem, companies using these instruments should be less likely to engage in (other) risk management activities.[86] Nevertheless, there is no empirical evidence supporting this hypothesis.[87]

3.2.1.2 Divergent Risk Preferences and Management Compensation

Another potential source of agency costs consist of the fact that managers, while principally acting in the interest of shareholders whose agents they are, pursue personal goals as well. This aspect is even more relevant since managers typically have a quite undiversified wealth position due to their employment in the firm, the associated contemporary and future income and non-monetary utility com-

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[84] Smithson (1998), pp. 507-513, Smith (1995), Bessembinder (1991).

[85] Géczy/Minton/Schrand (1997), pp. 1328, Francis/Stephan (1993), p. 625.

[86] Smithson (1998), p. 508.

[87] Géczy/Minton/Schrand (1997), pp. 1336-1338, Nance/Smith/Smithson (1993), pp. 273-284. Goldberg et al. (1994), p. 14, find only weak empirical evidence for preferred stock as a substitute for hedging.

ponents such as reputation, awards, promotions etc. Consequently, they are particularly interested in considering their personal preferences towards risk in corporate risk management.[88]

However, it can be argued that the risk preferences of shareholders and managers are not completely different. The former are primarily interested in increases in shareholder value. Since corporate risk management contributes to firm value via reduced cash flow volatility, as postulated in this paper, increases of shareholder value and reduction of risk are still congruent objectives from the perspective of the owners. However, while corporate managers may often be risk averse due to their undiversified personal wealth position, in most cases they cannot sell the stock of their firm short in order to reduce the riskiness of their private portfolio. As a result, they have not only a special interest in the ongoing existence of the firm, but also have an incentive to reduce their personal exposure by means of corporate hedging.[89]

Thus, there is a basis for potential conflicts of interest between shareholders and managers who make corporate risk management or, more generally, the investment and financing policy of the firm subject to their personal attitude towards risk. However, the realization of the managers' risk preferences aims eventually at the reduction of corporate risk in order to avoid bankruptcy. Therefore, this strategy could lead to a hedging strategy and thus to an increase in shareholder value which would have resulted from the exclusive pursuit of shareholders' interests as well.[90] Nevertheless,

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[88] Stulz (1990), Stulz (1984), Mayers/Smith (1982), p. 283.

[89] Santomero (1995), p. 2. Sercu/Uppal (1995), p. 459, and Miller/Reuer (1994), p. 7, note that a personal hedge does not usually have the appropriate duration corresponding to the exposure.

[90] Moreover, corporate hedging of firm value has the advantage that no or only small risk premia have to be paid to managers (and other ill-diversified stakeholders like customers, suppliers, employees) for taking on undiver-

there also exist forms of risk reduction such as operative diversification of businesses (conglomerate diversification) which are associated with a loss in value for the owners and which are thus not in their interest but in that of management only.[91]

In this context, the impact of incentive structures in general and management compensation in particular has to be taken into account as well.[92] If accounting targets are chosen to evaluate the performance of management for want of better, objective criteria, conflicts of interest are possible simply because the use of accounting information induces a short-term perspective. Moreover, it stimulates the pursuit of targets -- apart from or in addition to the objective to avoid bankruptcy -- which may not or only indirectly contribute to the maximization of firm value and the reduction of its exposure.[93] On the other hand, components of management compensation with option features, such as stock options, can lower managers' risk aversion and even induce speculative behavior.

Shareholders can try to resolve management's conflict of interest through suitable incentive structures. By linking the compensation and evaluation of managers appropriately to the stock price, they can insure that corporate policies take shareholder value into account and that risk reducing,

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sified risks (Section 3.2.2.1).

[91] Allayannis/Weston (1997), p. 17, Denis/Denis/Sarin (1997), Berger/Ofek (1995), Comment/Jarrell (1995), Levi/Sercu (1991), p. 32, Amihud/Lev (1981), p. 606.

[92] Han (1996), Campell/Kracaw (1987), Smith/Stulz (1985), pp. 399-403.

[93] Franke (1992), Hacket (1985), p. 167. The fact that management compensation is quite often tied to accounting data is also an explanation for the strong importance accounting exposure still has in business practice, (De-Marzo/Duffie (1995), p. 744). Linking management salaries to market movements/values is a preferred solution from this perspective.

value destroying strategies on part of the management are mostly avoided. Corporate risk management represents, therefore, a means to avoid conflicts of interest between management and shareholders.[94]

Incentive structures, however, are only effective if managers perceive themselves in a position to have an impact on the relevant factors in order to steer the development purposely.[95] Since the origin of financial risks is outside management's control, there often does not exist a clear link between corporate policies and corporate performance, which diminishes the effectiveness of the incentive structures in place. In this context, corporate hedging could create value by eliminating the erratic influence of financial risks, thus increasing the correlation between corporate performance and management strategy, which in turn renders the incentive structures more effective. At the same time, shareholders can more easily distinguish between good and bad management skills. As a consequence, good managers, to which their (good) reputation is an important asset, have a strong incentive to communicate their skills by hedging effectively. Conversely, it can be advantageous for less qualified managers to make a correct assessment of their performance more difficult through the distorting effect of financial risks.[96]

The results of empirical studies support the hypothesis that corporations are less likely to conduct risk management and that they hedge less, the more important stock options are for manage-

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[94] Stulz (1984), p. 136. The holding of stocks of the company they work for, however, worsens the diversification problem of managers.

[95] Smith (1995), p. 26.

[96] Stulz (1996), p. 19, Breeden/Viswanathan (1996), Degeorge/Moselle/Zeckhauser (1996), DeMarzo/Duffie (1995), Ljungqvist (1994).

ment compensation.[97] In addition, there is some evidence for a positive statistical relationship between the equity investment of management in their own company and corporate hedging activities, not withstanding the problem of assessing the relative importance of company stocks for the wealth of managers due to the lack of information on their private financial situation.[98] Moreover, empirical evidence exists for corporate hedging as an indicator for good management skills.[99]

3.2.2 Transaction Costs

3.2.2.1 Costs of Financial Distress

Since the future cash flows of a firm are subject to uncertainty, situations can arise where the liquidity available does not suffice to fulfill all contractually fixed obligations of a period (like wages and interest on debt) that accrue independently of the profitability or solvency of a firm. If payment obligations cannot or are expected not to be met fully and timely, transaction costs of financial distress originate

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[97] Schrand/Unal (1998), pp. 1008-1010, Haushalter (1997), pp. 24-31, Tufano (1996), pp. 1116-1129. Géczy/Minton/Schrand (1997), pp. 1334-1336, and Gay/Nam (1998), pp. 62-66, find a negative relationship between the extent of hedging and stock options held by managers. They explain this result with the fact that certain features of stock options (e.g. long-term, initial at-the-money strike price, tendency to replace out-of-the-money options) make their expected payoffs similar to that of common stocks. See Core/Guay (1999) regarding proxies for the incentive effects of options.

[98] Graham/Rogers (1999), p. 20, Schrand/Unnal (1998), pp. 1003-1010, Tufano (1996), pp. 1116-1129, May (1995), pp. 1302-1304, find indications for a positive relationship; Géczy/Minton/Schrand (1997), pp. 1334-1340, and Haushalter (1997), pp. 25-31, however, do not.

[99] Adam (1997), p. 21, Degeorge/Moselle/Zeckhauser (1996), pp. 21-24.

due to illiquidity.[100] The expected costs of financial distress are generally determined by the actual size of the cost and the probability of getting into a situation of illiquidity.[101]

Regarding the size of the cost of financial distress, both the less obvious indirect as well as the direct costs have to be taken into account. If a corporation encounters liquidity problems, primarily indirect costs will originate at first due to the negative influence on explicit or implicit contracts with customers, suppliers, employees and creditors.[102] If these stakeholders have an important business relationship with the firm, they are particularly dependent on its future existence due to their low degree of diversification (similar to ill-diversified owners e.g. of private businesses).[103]

Financial distress affects the relationship with customers primarily in cases where companies produce goods for which service and warranties are very important. Customers perceive liquidity problems as an indication that these services may not be available with certainty, making them less valuable to them. Liquidity problems are also detrimental to the sale of products whose quality is hard to assess before using them. With these experience goods, often other aspects become crucial factors for the assessment of product quality, and payment problems may reduce customers' trust and thus their willingness to buy a product.[104]

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[100] Myers (1977), p. 148.

[101] Smith/Smithson/Wilford (1990b), pp. 368-370, Rawls/Smithson (1990), p. 10.

[102] Shapiro/Titman (1986).

[103] Stulz (1996), p. 13, Mayers/Smith (1982), pp. 283-288.

[104] Stulz (2000b).

In addition, financial distress has a negative impact on the sourcing of the firm, because suppliers offer less attractive payment conditions to customers with financial problems. Furthermore, suppliers are less willing to adjust their production schedules and capacities to the needs of customers whose distressed financial situation indicates a possibly limited future existence in the market. The resulting costs of financial distress are bigger the smaller the number of potential suppliers is.

Moreover, the threat of bankruptcy induces the employees of a firm to demand a premium from their employer for the risk of losing their job and/or some of their income. By the same token, a higher turnover may result, causing costs for searching and training new workers. Other indirect costs generally arise because the attention of management and employees is distracted from value-increasing activities and profitable investment opportunities.[105] Situations of financial distress can thus lead to a permanent loss of reputation and human capital.[106]

Direct costs of financial distress arise for lawyers' fees and other legal expenses primarily when entering into the stage of bankruptcy. But even before this point, illiquidity can induce higher costs due to, for example, higher financing costs as a result of a lower credit rating.[107]

Corporate risk management does not have an immediate effect on the absolute size of direct and indirect costs of financial distress. Nevertheless, it can significantly reduce the probability of such

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[105] Fite/Pfleiderer (1995), p. 154.

[106] Shapiro/Titman (1986), Warner (1977a).

[107] Stulz (1996), p. 12. Direct bankruptcy costs are the core of the original argument developed by Smith/Stulz (1985), pp. 395-399. Even though these cost of financial distress are more obvious, their empirical importance relative to firm value is rather small, (Weiss (1990), Warner (1977b)).

a situation as companies are more likely to encounter financial distress the higher their fixed payment obligations and the more volatile their cash flows are. Value increasing risk management reduces the probability of financial distress by reducing the volatility of cash flows, thus lowering the expected costs of financial distress, which are the product of the probability of such a situation occurring, and the associated costs (Figure 8).

[Figure 8]

While the reduction of financial distress costs increases firm value already *per se*, it augments shareholder value even further by simultaneously raising the firm's potential to carry debt.[108] This follows from the fact that interest payments of debt (contrary to dividend payments) are generally made out of pre-tax income (tax shields of debt financing). As the sum of payments to shareholders and debtholders increases with higher financial leverage, from this perspective the firm should take on as much debt as possible.[109]

However, the cost of financial distress increases with a higher debt ratio as well, overcompensating the benefit of tax shields from some (optimal) degree of leverage on.[110] As discussed above, corporate risk management lowers the cost of financial distress, which leads to a higher optimal debt ratio (or lower financing costs), and the tax shields of the additional debt capital further increases the value of the firm *V* (Figure 9).

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[108] Ross (1996).

[109] For empirical results on the relationship between taxes and financing decisions refer e.g. to MacKie-Mason (1990a).

[110] Myers (1993), p. 5, Myers (1986), pp. 94-99, Myers (1984), pp. 577-581.

[Figure 9]

Overall, studies of the impact of hedging on firm value support the argument of financial distress cost. Most of them find an empirical relationship between corporate risk management activities and the probability of bankruptcy of a firm, which is measured, for instance, by the variables debt ratio (leverage), interest coverage, or rating.[111] The risk of financial distress is also higher the more volatile the cash flows, the stronger the dependence on business cycles and the greater the operating leverage is.[112] Since the indirect costs of financial distress are disproportional to the size of the firm, they are *ceteris paribus* of higher importance to small firms than to large ones (relative to firm value).[113] This fact is reflected in the result that the extent of hedging and the size of the firm (market value of equity or total assets) are negatively correlated.[114]

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[111] Graham/Rogers (1999), pp. 18-19, Géczy/Minton/Schrand (1999), pp. 39-42, Guay (1999), pp. 341-346, Gay/Nam (1998), pp. 62-66, Howton/Perfect (1998), pp. 117-118, Haushalter (1997), pp. 23-30, Tufano (1996), pp. 1116-1118, Berkman/Bradbury (1996), pp. 9-12, Samant (1996), p. 52, Francis/Stephan (1993), p. 625, Goldberg et al. (1994), p. 14. Géczy/Minton/Schrand (1997), pp. 1334-1336, and Nance/Smith/Smithson (1993), pp. 273-279, do not find unambiguous results; the effects in Dolde (1993b), p. 35, and Block/Gallagher (1986), p. 75, are not statistically significant. Wall/Pringle (1989), p. 68, and Mayers/Smith (1990), p. 38, confirm the negative relationship between rating and hedging.

[112] Guay (1999), p. 341-346, Dolde (1993a), p. 29, Samant (1996), pp. 52-55.

[113] Warner (1977b), p. 345.

[114] Gay/Nam (1998), pp. 62-66, Haushalter (1997), p. 30, Dolde (1995), p. 201, Dolde (1993b), p. 34, Mayers/Smith (1990), p. 38.

3.2.2.2 Cost of Hedging

For corporate risk management to be a value-increasing activity, the resulting benefit (to the shareholders) has to be larger than the cost associated with hedging leading to a net increase in firm value. Nevertheless, even in imperfect and inefficient capital markets, the economic transaction costs of hedging appear often to be almost negligible.[115] They manifest themselves e.g. as transaction costs (bank charges, fees, etc.) or as various opportunity costs.

The higher bid/ask spreads in the forward market compared to the spot market represent hedging costs as well. They are relatively small, though, as only the difference between the transaction costs of a spot and a forward transaction is relevant. The larger size of the bid/ask spreads in the forward market is a result of lower liquidity compared to the spot market because of which open positions cannot be closed out as quickly in the forward market. The risk of an unfavorable change until the position is hedged leads to the larger bid/ask spread (and not potential rate changes over the maturity of the forward contract). Especially for short maturities, however, almost no noticeable differences in the liquidity of both markets exist.[116]

In contrast, the differences between forward and spot exchange rates principally do not represent hedging costs, but reflect the different interest rates in the relevant countries (interest rate parity). In the same vein, according to the unbiased forward rate theorem, the forward rate is equal to the expected spot rate at the maturity of the forward contract, so that deviations of the two rates are determined by chance and will equal out in the long run, or represent risk premia in the case of sys-

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[115] Fite/Pfleiderer (1995), p. 151, Rawls/Smithson (1990), p. 17.

[116] Levi (1996), pp. 366-371, Shapiro (1996), p. 254, Smith (1995), p. 27.

tematic deviations. When using puts and calls, option premia have to be paid to purchase the instrument. The option price, however, does not represent hedging costs since it equals the expected payoff of the option contract. Taking the option premium into account, the expected gain of the option contract is zero. Overall, transaction costs of hedging generally do not seem to be economically significant.

Empirical studies are often able to identify a positive correlation between corporate hedging or the use of derivatives and the size of a firm (market value of equity, total assets).[117] This result can be explained by the fact that -- in addition to or apart from the direct costs of hedging transactions -- fixed costs of corporate risk management for information services, employees and know-how accrue as well, with regard to which large companies can realize economies of scale.[118]

Most benefits of corporate risk management result from its effect on corporate cash flows and can thus not be achieved at all by shareholders hedging on their own accounts. However, if there are benefits of risk management that can be accomplished with hedging by either the firm or investors, hedging on the corporate level has to be the least expensive way to accomplish this effect in order to

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[117] Berkman/Bradbury (1999), p. 17, Graham/Rogers (1999), pp. 17-20, Fehle (1998), p. 15, Géczy/Minton/Schrand (1997), pp. 1336-1338, Guay (1999), p. 346-348, Haushalter (1997), p. 29, Adam (1997), p. 21, Hentschel/Kothari (1997), p. 14, Mian (1996), p. 431, Berkman/Bradbury (1996), pp. 9-12, Goldberg et al. (1994), p. 14, Dolde (1993b), p. 34, Nance/Smith/Smithson (1993), pp. 273-275, Francis/Stephan (1993), pp. 625-364, Block/Gallagher (1986), p. 75, Booth/Smith/Stolz (1984), p. 17.

[118] Géczy/Minton/Schrand (1997), pp. 1331-1333, Haushalter (1997), p. 29, similarly Dolde (1993b), pp. 34-36. This idea is supported also by the observation that the usage of foreign exchange and interest rate derivatives are highly correlated, Goldberg et al. (1994), p. 15.

be justified on economic grounds.[119] This could be the case if corporations have a comparative cost and/or information advantage.

In light of the fact that capital markets are dominated by large institutional investors and not by individual private investors, corporations have neither advantages in the form of economies of scale when implementing a hedge nor generally better access to hedging instruments and markets. Due to their business relationships with other companies, nonfinancial corporations have certain methods of hedging like leading, lagging or transfer pricing.[120] Institutional investors, however, can already achieve hedging through their portfolio selection and realize diversification benefits with regard to unsystematic risk. Private investors can take advantage of these effects at low cost by investing in mutual funds of institutional investors. Therefore, corporations do not seem to have cost advantages regarding the realization of hedging strategies.

Nevertheless, effective and efficient risk management also requires comprehensive and in depth knowledge of the size and structure of the corporate financial exposure. Detailed information on the assets (production and investment planning, current and future prices, costs, sales, etc.) as well as the liabilities (e.g. currency denomination) is a necessary prerequisite for the exposure assessment. Since companies often do not disclose the information necessary to quantify a firm's exposure, information asymmetries between management and investors exist. Investors gain insight into the corporate exposure and risk management activities only by way of constant monitoring, and thus

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[119] Fite/Pfleiderer (1995), p. 144.

[120] Dufey/Srinivasulu (1983), p. 58.

at higher costs. Because of the information advantage of managers, risk management can in most cases be conducted considerably more efficiently at the firm level.[121]

Moreover, since firms typically have important proprietary information, there are benefits of corporate risk management to the shareholders that cannot be achieved by investors hedging on their own. In particular, if shareholders do not have complete information about the risks of a firm, they are not able to construct optimally diversified portfolios. Therefore, corporate hedging can be beneficial to shareholders if it reduces the volatility and thus the noise of a firm's payoff. Consequently, corporate risk management should be aimed at stabilizing the exposure in order to allow investors an optimal portfolio allocation without having to adjust their portfolio permanently at the expense of transaction costs.[122]

The results of empirical studies present weak evidence that companies are more likely to hedge if the information asymmetries are large between management and shareholders. In this context, it is assumed that there is a higher availability of information the larger the proportion of shareholdings with institutional investors and the higher the number of analysts following the firm.[123]

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[121] Fite/Pfleiderer (1995), p. 150, Sercu/Uppal (1995), p. 458. Rawls/Smithson (1990), p. 16, and Hakkarainen/Kasanen/Puttonen (1994), p. 23, note that the data disclosed in annual reports does not suffice to assess the corporate exposure. On this issue, see also Raposo (1996).

[122] Hu (1996), p. 49, Mason (1996), p. 179, Giddy (1994), p. 156. Hedging can be perceived in this context as an (imperfect) substitute for disclosure of corporate exposure as it serves to improve the market's assessment of the firm as well, (DeMarzo/Duffie (1995), pp. 744-746, Fite/Pfleiderer (1995), p. 162, Ljungqvist (1994), DeMarzo/Duffie (1991), p. 263).

[123] Géczy/Minton/Schrand (1997), pp. 1330-1336. Graham/Rogers (1999), p. 17, report converse results.

3.2.3 Coordinating Financing and Investment Policies

Another argument in favor of corporate risk management consists of increases of shareholder value that can be generated in the presence of imperfect capital markets if corporate investment and financing policies are coordinated more efficiently by means of risk management.[124] The underlying idea for this theory is the fact that the value of a firm can be enlarged by realizing investment projects with positive NPV. Profitable projects, however, can only be taken on if their financing is secured. Because of the volatility of corporate cash flows originating from financial risks, the financing of the optimal investment program from internal funds is not guaranteed at every point in time, though.

Consequently, the volatility of cash flows induces volatility to the investment program and/or the external financing. With decreasing marginal return of capital, adjusting the financing to the optimal investment program is generally preferred over modifying the investment schedule. Since there exist, however, increasing marginal costs of external financing due to capital market imperfections, raising additional capital is also disadvantageous. In imperfect capital markets, external debt as well as equity financing is associated with various transaction and agency costs which lead to an increasing marginal cost curve.

The issuance of equity to raise capital is costly primarily because of existing information asymmetries with regard to a fair stock price between the management within the company and the investors in the capital market. Since management has important inside information, investors generally assume that managers who act in the interest of the dd shareholders issue new equity only if they believe the shares to be overvalued, because a wealth transfer from old shareholders to new share-

[124] Froot/Scharfstein/Stein (1994), Froot (1994), Froot/Scharfstein/Stein (1993), Froot/Scharfstein/Stein (1989).

holders would result in the case of an undervaluation.[125] Consequently, the issuance of new shares is typically perceived as a negative signal in the capital market, often leading to a reduction in stock price.[126]

External debt financing -- especially for firms with a credit rating -- is associated with fewer problems with respect to asymmetric information, which is why it is often preferred over issuing new shares. Nevertheless, transaction costs arise in the form of direct and indirect costs of financial distress when raising external debt. Agency costs originating from the relationship between creditors and shareholders can be reduced by means of debt covenants which, however, at the same time limit the degrees of freedom for future financing or investment. These factors lead to increasing marginal cost of debt financing and possibly to limitations of future funding (credit rationing).[127] In addition, transaction costs like bank fees, syndication fees, etc. accrue with both types of external financing.

Due to the increasing marginal cost of external financing, corporations generally choose internal financing over debt financing, and they prefer debt financing to external equity financing.[128] Therefore, a lack of internal liquidity leads to higher cost of capital and/or opportunity costs, because of costly external funding or because of passed up opportunities to increase firm value. In the presence of financial risks causing volatility of corporate cash flows, corporate risk management can create value

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[125] Myers (1993), p. 7, Myers/Majluf (1984), p. 188, Akerlof (1970).

[126] Asquith/Mullins (1986), p. 65, Myers/Majluf (1984), pp. 203-205.

[127] Stiglitz/Weiss (1981).

[128] Myers (1993), p. 7, Fazzari/Hubbard/Petersen (1988), pp. 148-157, Myers (1984), pp. 581-585, Myers/Majluf (1984), pp. 207-209.

to the shareholders by harmonizing the need for and the availability of internal funds. This coordination of investment and financing policies leads to increases in shareholder value, as it guarantees the realization of profitable investment projects while at the same time avoiding higher cost of capital.[129]

The target variable for hedging, in this case, is the cash flow before investment spending. However, it has to be taken into account that not only cash flows, but possibly the need for funds and for investments are influenced by financial risk as well. To illustrate, for oil refining companies the cash flows as well as the attractiveness to explore new oil fields are determined by the price of crude oil. Because of the already existing positive correlation between the need of funds and their availability, hedging is needed to a much lesser degree than for a firm with constant investment requirements/opportunities.[130] In both cases, though, the hedging of cash flows before capital expenditure leads also to a reduction in volatility of the net cash flows and thus of firm value.

To empirically validate the impact of hedging on the coordination of investment and financing policies, the relationship between corporate risk management and liquidity, measured by the quick ratio ([liquid assets + securities + receivables]/short-term debt), the current ratio (short-term assets/short-term debt), or the dividend payout, can be analyzed. The results show that companies with low liquidity (small quick ratio or current ratio) are more likely to hedge than companies with high liquidity.[131] The ambiguous results with regard to dividends may be explained by the fact that on the

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[129] Froot/Scharfstein/Stein (1993), p. 1631, similarly already Lessard (1991), p. 66.

[130] Froot/Scharfstein/Stein (1994), pp. 94-98.

[131] Graham/Rogers (1999), p. 18, Berkman/Bradbury (1999), p. 17, Howton/Perfect (1998), pp. 117-118, Géczy/Minton/Schrand (1997), pp. 1334-1339, Mian (1996), p. 434, Tufano (1996), pp. 1116-1121, Berkman/Bradbury (1996), pp. 10-12, Goldberg et al. (1994), p. 14, Nance/Smith/Smithson (1993), pp. 273-284.

one hand, the payout of high dividends restrains liquidity and thus implies hedging. On the other hand, however, the relationship between growth options and dividend payments is likely to be negative.[132] Moreover, there is empirical evidence for the underlying hypothesis of a negative correlation between investment activity and free cash flow[133] as well as of increasing marginal cost of external financing exhibit empirical evidence as well.[134] By the same token, firms with a strong correlation between cash flow and investment expenses are naturally hedged and thus use less derivatives.[135]

3.2.4 Taxes

Another aspect of capital market imperfection that forms the basis for corporate risk management to increase shareholder value is taxes. If corporate income is subject to a convex tax code, the volatility of pre-tax income can be reduced by risk management, thus cutting the corporate tax bill.[136] A convex tax system exists in cases where the marginal tax rate increases progressively with taxable income. The tax function can also be convex due to various tax rules and regulations. Limits on carry-

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[132] Graham/Rogers (1999), p. 18, Géczy/Minton/Schrand (1999), pp. 39-42, Haushalter (1997), pp. 23-30, Géczy/Minton/Schrand (1997), pp. 1334-1339, Mian (1996), p. 434, Berkman/Bradbury (1996), pp. 10-12, Goldberg et al. (1994), p. 14, Nance/Smith/Smithson (1993), pp. 273-284, Francis/Stephan (1993), pp. 625-364.

[133] Hoshi/Kashyap/Scharfstein (1991), p. 46, Lewent/Kearney (1990), p. 25, Fazzari/Hubbard/Petersen (1988), p. 160.

[134] Hoshi/Kashyap/Scharfstein (1991), p. 46, MacKie-Mason (1990b), pp. 92-98, Wall/Pringle (1989), p. 68, Fazzari/Hubbard/Petersen (1988), pp. 160-183.

[135] Gay/Nam (1998), pp. 62-66.

[136] This effect has been analytically described for the first time by Smith/Stulz (1985), pp. 392-395. For numerical examples refer e.g. to Smith/Smithson/Wilford (1990a), pp. 129-132.

ing losses backward or forward, foreign tax credits, etc. can also (indirectly) induce convex characteristics to the tax function, as they can not (or only later) be benefited from in case of low income or even losses.[137]

In the presence of (directly or indirectly) convex tax regimes, changes in pre-tax income over several periods will lead to a higher corporate tax burden than a more stable income (Figure 10). The effect of risk management is stronger (a) the more convex the tax function, (b) the more volatile corporate income, and (c) the bigger the part of income is that falls into the convex part of the tax schedule.[138] If there are transaction costs associated with hedging, they may not exceed a maximum of H_{max} to make hedging on a net basis a value increasing activity. For the U.S., there are several studies indicating that the tax schedule is convex.[139]

[Figure 10]

The results of empirical studies do not give a clear picture regarding the evidence of the tax argument. On one hand, there is evidence in support of a positive correlation between corporate risk management and tax regulations (investment tax credits, tax losses) as well as the probability of the application of a progressive tax rate.[140] On the other hand, the results of many studies do not give an

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[137] Graham/Smith (1996), p. 3, Smith (1995), p. 26, DeAngelo/Masulis (1980).

[138] Graham/Smith (1996), p. 9, Smith/Smithson/Wilford (1990b), pp. 363-367. Kale/Noe (1990) show, however, that under certain circumstances firm value can be reduced if hedging takes the personal taxation of shareholders into account.

[139] Wilkie (1988), Zimmermann (1983), Siegfried (1974). Santomero (1995), p. 3, states that the convexity of the tax regime has decreased due to changes in the tax regulation. See also Mason (1996), p. 178.

[140] Nance/Smith/Smithson (1993), pp. 275-284. Howton/Perfect (1998), pp. 117-118, find significance for a tax pro-

indication of corporate risk management being a means to increase shareholder value since variables used to capture the convexity property of the tax regime often do not show significance (marginal tax rate, book value of carry forwards/total assets, investment tax credits).[141]

Potential explanations for this result exist in the strong relationship between tax savings and other rationales why hedging increases firm value. There is also some empirical evidence that the tax benefit of increased debt capacity provides a much stronger incentive for firms to hedge than the incentive originating from tax function convexity.[142] The tax argument would also be less important if the different determinants of tax savings were negatively correlated and e.g. corporations with high volatility of income were taxed in a more linear part of the tax function while less volatile income was taxed in a part of the tax function with high convexity.[143]

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gressivity dummy, but not for a tax loss dummy. In the study by Goldberg et al. (1994), p. 14, convexity variables, but not the variable for investment credits and loss carry-forwards exhibit significance. Berkman/Bradbury (1996), pp. 10-12, however, find empirical significance for loss carry-forwards. In the study by Berkman/Bradbury (1999), p 17, the tax loss variable is significant as well.

[141] Graham/Rogers (1999), p. 18, Géczy/Minton/Schrand (1997), pp. 1334-1336, Tufano (1996), p. 1116, find no significance of tax variables, Haushalter (1997), p. 25, Francis/Stephan (1993), pp. 628-634, weak significance of tax variables. In the study by Mian (1996), p. 431, only the variable for foreign tax credits exhibits statistical significance.

[142] Graham/Rogers (1999), p. 26.

[143] Graham/Smith (1996), pp. 9-12.

4 Conclusion

Financial risks, which consist of unexpected changes in foreign exchange, interest rate and commodity price changes, exist, because international parity conditions (Purchasing Power Parity, International Fisher Effect) hold at best in the long run. In principle, shareholders could hedge against these risks on their own account. Nevertheless, statistics on risk management practices indicate not only a significant growth of derivatives markets in general, but also an awareness of many nonfinancial firms with regard to these risks and their effects on corporate performance. As a matter of fact, a large number of firms engage in risk management activities including, but not limited to, the use of derivative financial instruments. Consequently, the question arises whether corporate risk management is consistent with shareholder value maximization.

Several positive theories suggest corporate hedging at the level of the firm as a lever to increase shareholder value on the basis of existing capital market imperfections. First, hedging at the firm level can reduce agency costs associated with underinvestment problems and asset substitution problems. By the same token, differences in the risk preferences of managers and shareholders can cause agency costs as well, which can be alleviated by the means of corporate risk management.

Secondly, corporate hedging can increase shareholder value through the reduction of transaction costs. By lowering the likelihood of bankruptcy, the expected cost of financial distress is reduced and the debt capacity is increased. At the same time, information asymmetries between management and investors may render hedging on the corporate level more effective and efficient due to internal and proprietary information. As the exposure can be managed much more easily and better from inside the company, corporate risk management enables investors to make better portfolio optimization decisions.

Thirdly, capital market imperfections cause the marginal cost of external financing to be increasing -- for debt as well as for equity capital. Consequently, a shortage of internal funds for investment projects results in either higher cost of capital or foregone profitable investment opportunities. Corporate risk management, however, can help coordinate investment and financing policies and thus harmonize the need and availability of funds.

Fourth, risk management at the firm level (as opposed to risk management by stock owners) represents a means to increase firm value to shareholders in the presence of a convex corporate tax regime, because the average tax burden is lower for less volatile pre-tax income. While there is ample and increasing empirical evidence for the theories of agency cost, transaction cost and increasing cost of external financing, only weak empirical support is typically found for the tax argument.

References

Abuaf, N./Jorion, P. (1990): Purchasing Power in the Long Run, Journal of Finance, Vol. 45 (1), pp. 157-174.

Adam, T.R. (1997): Risk Management in the Gold Mining Industry, Hong Kong University Working Paper.

Adler, M./Lehmann, B. (1983): Deviations from Purchasing Power Parity in the Long Run, Journal of Finance, Vol. 38 (5), pp. 1471-1487.

Aggarwal, R./Soenen, L.A. (1989): Managing Persistent Real Changes in Currency Values: The Role of Multinational Operating Strategies, Columbia Journal of World Business, Vol. 24 (3), pp. 60-67.

Akerlof, G.A. (1970): The Market for "Lemons": Quality Uncertainty and the Market Mechanism, Quarterly Journal of Economics, Vol. 84, pp. 488-500.

Alexius, A. (1996): Long Run Real Exchange Rates - A Cointegration Analysis, Stockholm School of Economics Working Paper.

Allayannis, G./Ofek, E. (1996): Exchange Rate Exposure, Hedging, and the Use of Foreign Currency Derivatives, New York University Working Paper.

Allayannis, G./Weston, J.P. (1997): The Use of Foreign Currency Derivatives and Firm Market Value, University of Virginia Working Paper.

Allen, F./Santomero, A.M. (1998): The theory of financial intermediation, Journal of Banking and Finance, Vol. 21 (11), pp. 1461-1485.

Amihud, Y./Lev, B. (1981): Risk Reduction as a Managerial Motive for Conglomerate Mergers, Bell Journal of Economics, Vol. 12 (2), pp. 605-617.

Arrow, K.J. (1985): The Economics of Agency, in: Pratt, J.W./Zeckhauser, R. [eds.]: Principals and Agents: The Structure of Business, Harvard Business School Press (Boston), pp. 37-51.

Asquith, P./Mullins, D.W. Jr. (1986): Equity Issues and Offering Dilution, Journal of Financial Economics, Vol. 15 (1/2), pp. 61-89.

Baron, D.P. (1976): Flexible Exchange Rates, Forward Markets and the Level of Trade, American Economic Review, Vol. 66 (3), pp. 253-266.

Bartram, S.M. 1999. Linear and Nonlinear Foreign Exchange Rate Exposures of German Nonfinancial Corporations, Maastricht University Working Paper.

Basak, S./Shapiro, A. (1999): Value-at-Risk Based Risk Management: Optimal Policies and Asset Prices, Wharton School Working Paper.

Batten, J./Mellor, R./Wan, V. (1993): Foreign Exchange Risk Management Practices and Products Used by Australian Firms, Journal of International Business Studies, Vol. 24 (3), pp. 557-573.

Berger, P.G./Ofek, E. (1995): Diversification's Effect on Firm Value, Journal of Financial Economics, Vol. 37 (1), pp. 39-65.

Berkman, H./Bradbury, M.E. (1996): Empirical Evidence on the Corporate Use of Derivatives, Financial Management, Vol. 25 (2), pp. 5-13.

Berkman, H./Bradbury, M.E. (1999): Are Firms Hedging or Speculating with Currency Derivatives, University of Auckland Working Paper.

Berkman, H./Bradbury, M.E./Magan, S. (1997): An International Comparison of Derivative Use, Financial Management, Vol. 26 (4), pp. 69-73.

Bessembinder, H. (1991): Forward Contracts and Firm Value: Investment Incentive and Contracting Effects, Journal of Financial and Quantitative Analysis, Vol. 26 (4), pp. 519-532.

Bessembinder, H./Lemmon, M.L. (1999): Equilibrium Pricing and Optimal Hedging in Electricity Forward Markets, Arizona State Working Paper.

BIS (1999): Quarterly Review of International Banking and Financial Market Developments, several issues, Bank for International Settlements (Basel).

BIS (2000): *Annual Report*, several issues, Bank for International Settlements (Basel).

Blake, M. /Mahady, N. (1991): How Mid-sized Companies Manage Risk, Journal of Applied Corporate Finance, Vol. 4 (1), pp. 59-65.

Block, S.B./Gallagher, T.J. (1986): The Use of Interest Rate Futures and Options by Corporate Financial Managers, Financial Management, Vol. 15 (3), pp. 73-78.

Bodnar, G.M./Gebhardt, G. (1999): Derivatives Usage in Risk Management by U.S. and German Non-Financial Firms: A Comparative Survey, Wharton Working Paper.

Bodnar, G.M./Hayt, G.S./Marston, R.C. (1996): 1995 Wharton Survey of derivatives usage by U.S. nonfinancial firms, Financial Management, Vol. 25 (4), pp. 113-133.

Bodnar, G.M./Hayt, G.S./Marston, R.C. (1998): 1998 Wharton Survey of Financial Risk Management by US Non-Financial Firms, Financial Management, Vol. 27 (4), pp. 70-91.

Bodnar, G.M./Hayt, G.S./Marston, R.C./Smithson, C.W. (1995): Wharton Survey of Derivatives Usage by U.S. Non-Financial Firms, Financial Management, Vol. 24 (2), pp. 104-114.

Booth, J.R./Smith, R.L./Stolz, R.W. (1984): Use of Interest Rate Futures by Financial Institutions, Journal of Bank Research, Vol. 15 (2), pp. 15-20.

Booth, L.D. (1982): Hedging and Foreign Exchange Exposure, Management International Review, Vol. 22 (2), pp. 26-42.

Brealey, R.A./Myers, S.C. (1996): Principles of Corporate Finance, 5th ed., McGraw-Hill (New York, NY).

Breeden, D./Viswanathan, S. (1996): Why Do Firms Hedge? An Asymmetric Information Model, Duke University Working Paper.

Brown, S.J./Otsuki, T. (1994): Exchange Rate Volatility and Equity Returns, in: Amihud, Y./Levich, R.M. [eds.]: Exchange Rates and Economic Performance, Irwin (New York, NY), pp. 75-96.

Campbell, T.S./Kracaw, W.A. (1987): Optimal Managerial Contracts and the Value of Corporate Insurance, Journal of Financial and Quantitative Analysis, Vol. 22 (3), pp. 315-328.

Campbell, T.S./Kracaw, W.A. (1990): Corporate Risk Management and Incentive Effects of Debt, Journal of Finance, Vol. 45 (5), pp. 1673-1686.

Chinn, M.D./Frankel, J.A. (1994): More Survey Data on Exchange Rate Expectations, University of California Working Paper.

Choi, J.J./Elyasiani, E./Kopecky, K.J. (1992): The Sensitivity of Bank Returns to Market, Interest and Exchange Rate Risk, Journal of Banking and Finance, Vol. 16 (5), pp. 983-1004.

Comment, R./Jarrell, G.A. (1995): Corporate Focus and Stock Returns, Journal of Financial Economics, Vol. 37 (1), pp. 67-87.

Copeland, T./Weston, F.J. (1988): Financial Theory and Corporate Policy, 3rd ed., Addison-Wesley (Reading, MA).

Core, J./Guay, W.R. (1999): Estimating the value of stock option portfolios and their sensitivities to price and volatility, Wharton School working paper.

Corporate Finance (1995): Companies keep faith in hedging instruments, Corporate Finance, Iss. 149, pp. 6-8.

Culp, C.L./Furbush, D./Kavanagh, B.T. (1994): Structured Debt and Corporate Risk Management, Journal of Applied Corporate Finance, Vol. 7 (3), pp. 73-84.

Culp, C.L./Miller, M.H. (1995): Hedging in the Theory of Corporate Finance: a Reply to our Critics, Journal of Applied Corporate Finance, Vol. 8 (1), pp. 121-127.

Dayal, A. (1992): Firm Participation in the Interest Rate Swap Market, Brown University Working Paper.

DeAngelo, H./Masulis, R.W. (1980): Optimal Capital Structure Under Corporate and Personal Taxation, Journal of Financial Economics, Vol. 8 (1), pp. 3-29.

Degeorge, F./Moselle, B./Zeckhauser, R. (1996): Hedging and Gambling: Corporate Risk Choice when Informing the Market, Centre for Economic Policy Research Working Paper.

DeMarzo, P.M./Duffie, D. (1991): Corporate Financial Hedging with Proprietary Information, Journal of Economic Theory, Vol. 53 (2), pp. 261-286.

DeMarzo, P.M./Duffie, D. (1995): Corporate Incentives for Hedging and Hedge Accounting, Review of Financial Studies, Vol. 8 (3), pp. 743-771.

Denis, D.J./Denis, D.K./Sarin, A. (1997): Managerial Incentives and Corporate Diversification Strategies, Bank of America Journal of Applied Corporate Finance, Vol. 10 (2), pp. 72-80.

Dobson, J./Soenen, L. (1993): Three Agency-Cost Reasons for Hedging Foreign Exchange Risk, Managerial Finance, Vol. 19 (6), pp. 35-44.

Dolde, W. (1993a): Use of Foreign Exchange and Interest Rate Risk Management in Large Firms, University of Connecticut Working Paper.

Dolde, W. (1993b): The Trajectory of Corporate Financial Risk Management, Continental Bank Journal of Applied Corporate Finance, Vol. 6 (3), pp. 33-41.

Dolde, W. (1995): Hedging, Leverage and Primitive Risk, Journal of Financial Engineering, Vol. 4 (2), pp. 187-216.

Dominguez, K.M.E. (1987): Exchange-Rate Efficiency and the Behavior of International Asset Markets, UMI (Ann Arbor, MI).

Drummen, M./Zimmermann, H. (1992): Portfolioeffekte des Währungsrisikos, Finanzmarkt und Portfolio Management, Vol. 6 (1), pp. 81-103.

Dufey, G./Srinivasulu, S.L. (1983): The Case for Corporate Management of Foreign Exchange Risk, Financial Management, Vol. 12 (4), pp. 54-62.

Dukas, S.P./Fatemi, A.M./Tavakkol, A. (1996): Foreign Exchange Exposure and the Pricing of Exchange Rate Risk, Global Finance Journal, Vol. 7 (2), pp. 169-189.

Dumas, B. (1978): The Theory of the Trading Firm Revisited, Journal of Finance, Vol. 33 (3), pp. 1019-1030.

Economist (1996): Survey on Corporate Risk Management, Economist, February 10, 1996, pp. 3-22.

Eisenhardt, K.M. (1989): Agency Theory: An Assessment and Review, Academy of Management Review, Vol. 14 (1), pp. 57-74.

Eun, C.S./Resnick, B.G. (1988): Exchange Rate Uncertainty, Forward Contracts, and International Portfolio Selection, Journal of Finance, Vol. 43 (1), pp. 197-215.

Euromoney (1994): What's off the corporate shopping list?, Euromoney, Iss. 304, pp. 32-34.

Fama, E.F. (1980): Agency Problems and the Theory of the Firm, Journal of Political Economy, Vol. 88 (2), pp. 288-307.

Fazzari, S.M./Hubbard, R.G./Petersen, B.C. (1988): Financing Constraints and Corporate Investment, Brookings Papers on Economic Activity, No. 1, pp. 141-195.

Fehle, F. (1998): A Cross-Sectional Study of Corporate Hedging, University of Texas Working Paper.

FIA (1999): Monthly Volume Report, various issues, Futures Industry Association (New York, NY).

Fite, D./Pfleiderer P. (1995): Should Firms Use Derivatives to Manage Risk?, in: Beaver, W./Parker, G. [eds.]: Risk Management: Problems and Solutions, McGraw Hill (New York, NY), pp. 139-169.

Francis, J./Stephan, J. (1993): Characteristics of Hedging Firms: An Empirical Examination, in: Schwartz, R.J./Smith, C.W. Jr. [eds.]: Advanced Strategies in Financial Risk Management, New York Institute of Finance (Engle wood Cliffs, NJ), pp. 615-635.

Franke, G. (1992): Uncertain Perception of Economic Exchange Risk and Financial Hedging, Managerial Finance, Vol. 18 (3/4), pp. 53-70.

Froot, K.A. (1994): Comments on Exchange Rates and Corporate Strategic Management, in: Amihud, Y./Levich, R.M. [eds.]: Exchange Rates and Corporate Performance, Irwin (New York, NY), pp. 253-255.

Froot, K.A./Rogoff, K. (1994): Perspectives on PPP and Long-Run Real Exchange Rates, National Bureau of Economic Research Working Paper.

Froot, K.A./Scharfstein, D.S./Stein, J.C. (1989): LDC Debt: Forgiveness, Indexation, and Investment Incentives, Journal of Finance, Vol. 44 (5), pp. 1335-1350.

Froot, K.A./Scharfstein, D.S./Stein, J.C. (1993): Risk Management: Coordinating Corporate Investment and Financing Policies, Journal of Finance, Vol. 48 (5), pp. 1629-1658.

Froot, K.A./Scharfstein, D.S./Stein, J.C. (1994): A Framework for Risk Management, Harvard Business Review, Vol. 72 (6), pp. 91-102.

Froot, K.A./Stein, J.C. (1998): Risk management, capital budgeting, and capital structure policy for financial institutions: an integrated approach, Journal of Financial Economics, Vol. 40 (47), pp. 55-82.

Gay, G.D./Nam, J. (1998): The underinvestment problem and corporate derivatives use, Financial Management, Vol. 27 (4), pp. 53-69.

Géczy, C./Minton, B.A./Schrand, C. (1997): Why Firms Use Currency Derivatives, Journal of Finance, Vol. 52 (4), pp. 1323-1354.

Géczy, C./Minton, B.A./Schrand, C. (1999): Choices Among Alternative Risk Management Strategies: Evidence from the Natural Gas Industry, Wharton School Working Paper.

Giddy, I.H. (1977): A Note on Macroeconomic Assumptions of International Financial Management, Journal of Financial and Quantitative Analysis, Vol. 12 (4), pp. 601-605.

Giddy, I.H. (1994): Exchange Rate Volatility, Hedging, and the Cost of Capital, in: Amihud, Y./Levich, R.M. [eds.]: Exchange Rates and Corporate Performance, Irwin (New York, NY), pp. 155-162.

Global Derivatives Study Group (1993): Derivatives: Practices and Principles, Group of Thirty (Washington, DC).

Goldberg, S.R./Godwin, J.H./Kim, M.-S./Tritschler, C.A. (1994): On the Determinants of Corporate Hedging with Financial Derivatives, Purdue University Working Paper.

Goswami, G./Shrikhande, M. (1997): Interest Rate Swaps and Economic Exposure, Federal Reserve Bank of Atlanta Working Paper.

Graham, J.R./Rogers, D.A. (1999): Is Corporate Hedging Consistent with Value Maximization? An Empirical Analysis, Duke University Working Paper.

Graham, J.R./Smith, C.W. Jr. (1996): Tax Incentives to Hedge, University of Rochester Working Paper.

Guay, W.R. (1999): The impact of derivatives on firm risk: An empirical examination of new derivatives users, Journal of Accounting and Economics, Vol. 26, pp. 319-351.

Hacket, J.T. (1985): Concepts and Practice of Agency Theory within the Corporation, in: Altman, E.I./Subrahmanyam, M.G. [eds.]: Recent Advances in Corporate Finance, Irwin (Homewood, IL), pp. 163-171.

Hakkarainen, A./Kasanen, E./Puttonen, V. (1994): Exchange Rate and Interest Rate Risk Management in Major Finnish Firms, Helsinki School of Economics and Business Administration (Helsinki).

Han, L.-M. (1996): Managerial Compensation and Corporate Demand for Insurance, Journal of Risk and Insurance, Vol. 63 (3), pp. 381-404.

Handelsblatt (1997): Umsatzrekord im Handel mit Derivaten, Handelsblatt, April 4, 1997.

Haushalter, G.D. (1997): The Role of Corporate Hedging: Evidence from Oil and Gas Producers, University of Oregon Working Paper.

He, J./Ng, L./Wu, X. (1996): Foreign Exchange Exposure, Risk and the Japanese Stock Market, University of Hong Kong Working Paper.

Hentschel, L./Kothari, S.P. (1997): Are Corporations Reducing or Taking Risks With Derivatives?, University of Rochester Working Paper.

Hoshi, T./Kashyap, A./Scharfstein, D. (1991): Corporate Structure, Liquidity, and Investment: Evidence from Japanese Industrial Groups, Quarterly Journal of Economics, Vol. 106 (1), pp. 33-60.

Howton, S.D./Perfect, S.B. (1998): Currency and interest-rate derivatives use in U.S. firms, Financial Management, Vol. 27 (4), pp. 111-121.

Hu, H.T.C. (1996): Behind the Corporate Hedge: Information and the Limits of "Shareholder Wealth Maximization", Bank of America Journal of Applied Corporate Finance, Vol. 9 (3), pp. 39-51.

Institutional Investor (1994): Managing Risk: Spreadsheets vs. the Black Box, Institutional Investor, Vol. 28 (8), pp. 36-37.

Jensen, M.C. (1983): Organization Theory and Methodology, Accounting Review, Vol. 58 (2), pp. 319-339.

Jensen, M.C./Meckling, W.H. (1976): Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure, Journal of Financial Economics, Vol. 3, pp. 305-360.

Jensen, M.C./Smith, C.W. Jr. (1985): Stockholder, Manager, and Creditor Interests: Application of Agency Theory, in: Altman, E.I./Subrahmanyam, M.G. [eds.]: Recent Advances in Corporate Finance, Irwin (Homewood, IL), pp. 93-131.

Jesswein, K./Kwok, C.C.Y./Folks, W.R. Jr. (1995): What new currency risk products are companies using, and why?, Bank of America Journal of Applied Corporate Finance, Vol. 8 (3), pp. 103-114.

Jorion, P. (1991): The Pricing of Exchange Rate Risk in the Stock Market, Journal of Financial and Quantitative Analysis, Vol. 26 (3), pp. 363-376.

JP Morgan [ed.] (1994): The JPMCI - a commodity benchmark, J.P. Morgan (New York, NY).

Kale, J.R./Noe, T.H. (1990): Corporate Hedging under Personal and Corporate Taxation, Managerial and Decision Economics, Vol. 11 (3), pp. 199-205.

Lessard, D.R. (1985) [ed.]: International Financial Management: Theory and Application, 2nd ed., Ch. 18, John Wiley & Sons (New York).

Lessard, D.R. (1991): Global Competition and Corporate Finance in the 1990s, Journal of Applied Corporate Finance, Vol. 3 (4), pp. 59-72.

Levi, M.D. (1994): Exchange Rates and the Valuation of Firms, in: Amihud, Y./Levich, R.M. [eds.]: Exchange Rates and Corporate Performance, Irwin (New York, NY), pp. 37-48.

Levi, M.D. (1996): International Finance, 3rd ed., McGraw-Hill (New York, NY).

Levi, M.D./Sercu, P. (1991): Erroneous and Valid Reasons for Hedging Foreign Exchange Rate Exposure, Journal of Multinational Financial Management, Vol. 1 (2), pp. 25-37.

Lewent, J.C./Kearney, A.J. (1990): Identifying, Measuring, and Hedging Currency Risk at Merck, Continental Bank Journal of Applied Corporate Finance, Vol. 2 (4), pp. 19-28.

Ljungqvist, L.G.M. (1994): Asymmetric Information: A Rationale For Corporate Speculation, Journal of Financial Intermediation, Vol. 3 (2), pp. 188-203.

Loderer, C./Pichler, K. (2000): Firms, do you know your currency risk exposure?, Survey results, Bern University Working Paper.

Logue, D.E./Oldfield, G.S. (1977): Managing Foreign Assets When Foreign Exchange Markets Are Efficient, Financial Management, Vol. 6 (2), pp. 16-22.

MacKie-Mason, J.K. (1990a): Do Taxes Affect Corporate Financing Decisions?, Journal of Finance, Vol. 45 (5), pp. 1471-1493.

MacKie-Mason, J.K. (1990b): Do Firms Care Who Provides Their Financing?, in: Hubbard, G.R. [ed.]: Asymmetric Information, Corporate Finance, and Investment, Chicago University Press (Chicago, IL), pp. 63-103.

MacMinn, R.D. (1987a): Insurance and Corporate Risk Management, Journal of Risk and Insurance, Vol. 54 (4), pp. 658-677.

MacMinn, R.D. (1987b): Forward Markets, Stock Markets, and the Theory of the Firm, Journal of Finance, Vol. 42 (5), pp. 1167-1185.

Makar, S.D./Huffman, S.P. (1977): Foreign Currency Risk Management Practices in U.S. Multinationals, Journal of Applied Business Research, Vol. 13 (2), pp. 73-86.

Malindretos, J./Tsanacas, D. (1995): Hedging Preferences and Foreign Exchange Exposure Management, Multinational Business Review, Vol. 3 (2), pp. 56-66.

Markowitz, H.M. (1952): Portfolio Selection, Journal of Finance, Vol. 7, pp. 77-91.

Markowitz, H.M. (1991): Foundations of Portfolio Theory, Finanzmarkt und Portfolio Management, Vol. 5 (3), pp. 205-211.

Marston, R.C. (1994): Tests of Three Parity Conditions: Distinguishing Risk Premia and Systematic Forecast Errors, National Bureau of Economic Research Working Paper.

Mason, S.P. (1996): The Allocation of Risk, in: Crane, D.B./Froot, K.A./Mason, S.P. [eds.]: The Global Financial System, Harvard University Press (Cambridge, MA), pp. 153-195.

Mason, S.P./Merton, R.C. (1985): The Role of Contingent Claims Analysis in Corporate Finance, in: Altman, E.I./Subrahmanyam, M.G. [eds.]: Recent Advances in Corporate Finance, Irwin (Homewood, IL), pp. 7-54.

May, D.O. (1995): Do Managerial Motives Influence Firm Risk Reduction Strategies?, Journal of Finance, Vol. 50 (4), pp. 1291-1308.

Mayers, D./Smith, C.W. Jr. (1982): On the Corporate Demand for Insurance, Journal of Business, Vol. 55 (2), pp. 281-296.

Mayers, D./Smith, C.W. Jr. (1987): Corporate Insurance and the Underinvestment Problem, Journal of Risk and Insurance, Vol. 54 (1), pp. 45-54.

Mayers, D./Smith, C.W. Jr. (1990): On the Corporate Demand for Insurance: Evidence from the Reinsurance Market, Journal of Business, Vol. 63 (1), pp. 19-40.

Mian, S.L. (1996): Evidence on Corporate Hedging Policy, Journal of Financial and Quantitative Analysis, Vol. 31 (3), pp. 419-439.

Miller, K.D./Reuer, J.J. (1994): Firm Strategy and Economic Exposure to Foreign Exchange Rate Movements, Purdue University Working Paper.

Miller, M.H. (1988): The Modigliani-Miller Propositions After Thirty Years, Journal of Economic Perspectives, Vol. 2 (4), pp. 99-120.

Modigliani, F./Miller, M.H. (1958): The Cost of Capital, Corporation Finance, and the Theory of Investment, American Economic Review, Vol. 48 (3), pp. 261-297.

Modigliani, F./Miller, M.H. (1959): The Cost of Capital, Corporation Finance and the Theory of Investment: Reply, American Economic Review, Vol. 49 (4), pp. 655-669.

Modigliani, F./Miller, M.H. (1963): Corporate Income Taxes and the Cost of Capital: A Correction, American Economic Review, Vol. 53 (3), pp. 433-443.

Myers, S.C. (1977): Determinants of Corporate Borrowing, Journal of Financial Economics, Vol. 5, pp. 147-175.

Myers, S.C. (1984): The Capital Structure Puzzle, Journal of Finance, Vol. 39 (3), pp. 575-592.

Myers, S.C. (1986): The Search for Optimal Capital Structure, in: Stern, J.M./Chew, D.H. Jr. [eds.]: The Revolution in Corporate Finance, Basil Blackwell Ltd. (New York, NY), pp. 91-99.

Myers, S.C. (1993): Still Searching for Optimal Capital Structure, Continental Bank Journal of Applied Corporate Finance, Vol. 6 (1), pp. 4-14.

Myers, S.C./Majluf, N.S. (1984): Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have, Journal of Financial Economics, Vol. 13 (2), pp. 187-221.

Nance, D.R./Smith, C.W. Jr./Smithson, C.W. (1993): On the Determinants of Corporate Hedging, Journal of Finance, Vol. 48 (1), pp. 267-284.

Oldfield, G.S./Santomero, A.M. (1995): The Place of Risk Management in Financial Institutions, Wharton Financial Institutions Center Working Paper.

Perlmuth, L. (1996): Defense mechanism, Institutional Investor, Vol. 30 (5), pp. 35.

Perridon, L./Steiner, M. (1995): Finanzwirtschaft der Unternehmung, 8th ed., Vahlen (München).

Petersen, M.A./Thiagarajan, S.R. (1997): Risk Measurement and Hedging, Kellogg Working Paper.

Phillips, A.L. (1995): 1995 Derivatives Practices and Instruments Survey, Financial Management, Vol. 24 (2), pp. 115-125.

Pratt, J.W./Zeckhauser, R. (1985): Principals and Agents: An Overview, in: Pratt, J.W./Zeckhauser, R. [eds.]: Principals and Agents: The Structure of Business, Harvard Business School Press (Boston), pp. 1-35.

Price Waterhouse [ed.] (1995): Corporate Treasury Control and Performance Standards, Price Waterhouse (Frankfurt a.M.).

Raposo, C.C. (1996): Corporate Risk Management and Optimal Hedging Disclosure, London Business School Working Paper.

Raposo, C.C. (1999): Corporate Hedging: What have we learnt so far? Derivatives Quarterly, Vol. 5 (3), pp. 41-51.

Rawls, S.W. III/Smithson, C.W. (1990): Strategic Risk Management, Continental Bank Journal of Applied Corporate Finance, Vol. 2 (4), pp. 6-18.

Remolona, E.M. (1992-93): The Recent Growth of Financial Derivative Markets, Federal Reserve Bank of New York Quarterly Review, Vol. 17 (4), pp. 28-43.

Rhim, J.C./Khayum, M.F./Kim, Y.H. (1996): Causes of Deviations from Purchasing Power Parity, Multinational Business Review, Vol. 4 (1), pp. 112-121.

Ross, M.P. (1996): Corporate hedging: What, why and how?, University of California working paper.

Ross, S.A. (1973): The Economic Theory of Agency: The Principal's Problem, American Economic Review, Vol. 63 (2), pp. 134-139.

Samant, A. (1996): An Empirical Study of Interest Rate Swap Usage by Nonfinancial Corporate Business, Journal of Financial Services Research, Vol. 10 (1), pp. 43-57.

Santomero, A.M. (1995): Financial Risk Management: The Whys and Hows, Financial Markets, Institutions & Instruments, Vol. 4 (5), pp. 1-14.

Saunders, A. (1994): Current Research in Risk Management, Quaderni di economia e finanza, Vol. 2 (3), pp. 5-14.

Schrand, C.M./Unal, H. (1998): Hedging and Coordinated Risk Management: Evidence from Thrift Conversions, Journal of Finance, Vol. 53 (3), pp. 979-1013.

Sercu, P./Uppal, R. (1995): International Financial Markets and the Firm, Chapman & Hall Ltd. (London).

Shapiro, A.C. (1996): Multinational Financial Management, 5th ed., Prentice Hall, Inc. (Upper Saddle River, NJ).

Shapiro, A.C./Titman, S. (1986): An Integrated Approach to Corporate Risk Management, in: Stern, J.M./Chew, D.H. Jr. [eds.]: The Revolution in Corporate Finance, Basil Blackwell (New York, NY), pp. 215-229.

Siegfried, J.J. (1974): Effective Average U.S. Corporation Income Tax Rates, National Tax Journal, Vol. 27 (2), pp. 245-259.

Smith, C.W. Jr. (1995): Corporate Risk Management: Theory and Practice, Journal of Derivatives, Vol. 2 (4), pp. 21-30.

Smith, C.W. Jr./Smithson, C.W./Wilford, D.S. (1990a): Financial Engineering: Why Hedge?, in: Smith, C.W. Jr./Smithson, C.W. [eds.]: The Handbook of Financial Engineering, Harper Business Books (Grand Rapids), pp. 126-137.

Smith, C.W. Jr./Smithson, C.W./Wilford, D.S. (1990b): Managing Financial Risk, in: Smith, C.W. Jr./Smithson, C.W. [ed.]: The Handbook of Financial Engineering, Harper Business Books (Grand Rapids), pp. 33-68.

Smith, C.W. Jr./Smithson, C.W./Wilford, D.S. (1990c): Managing Financial Risk, Harper Business Books (Grand Rapids).

Smith, C.W. Jr./Warner, J.B. (1979): On Financial Contracting: An Analysis of Bond Contracting, Journal of Financial Economics, Vol. 7 (2), pp. 117-161.

Smith, C.W. Jr./Watts, R.L. (1992): The Investment Opportunity Set and Corporate Financing, Dividend, and Compensation Policies, Journal of Financial Economics, Vol. 32 (3), pp. 263-292.

Smith, C.W./Stulz, R.M. (1985): The Determinants of Firms' Hedging Policies, Journal of Financial and Quantitative Analysis, Vol. 20 (4), pp. 391-405.

Smithson, C.W. (1998): Managing Financial Risk, 3rd ed., Irwin (Chicago).

Smithson, C.W./Smith, C.W. Jr./Wilford, D.S. (1995): Managing Financial Risk, Irwin (Chicago).

Stanley, M.T./Block, S.B. (1978): Response by United States Financial Managers to Financial Accounting Standard No. 8, Journal of International Business Studies, Fall, pp. 89-99.

Stiglitz, J.E. (1969): A Re-Examination of the Modigliani-Miller Theorem, American Economic Review, Vol. 59 (2), pp. 784-793.

Stiglitz, J.E. (1974): On the Irrelevance of Corporate Financial Policy, American Economic Review, Vol. 64 (6), pp. 851-866.

Stiglitz, J.E./Weiss, A. (1981): Credit Rationing in Markets with Imperfect Information, American Economic Review, Vol. 71 (3), pp. 393-410.

Stulz, R.M. (1984): Optimal Hedging Policies, Journal of Financial and Quantitative Analysis, Vol. 19 (2), pp. 127-140.

Stulz, R.M. (1990): Managerial Discretion and Optimal Financing Policies, Journal of Financial Economics, Vol. 26 (1), pp. 3-27.

Stulz, R.M. (1996): Rethinking Risk Management, Bank of America Journal of Applied Corporate Finance, Vol. 9 (3), pp. 8-24.

Stulz, R.M. (2000a): Derivatives, Risk Management, and Financial Engineering, Southwestern Publishing Co. (Cincinnati), forthcoming.

Stulz, R.M. (2000b): Diminishing the threats to shareholder wealth, Financial Times, Series Mastering Risk, April 25, 2000, pp. 8-10.

Thornton, D.B./Welker, M. (1999): Impact of market risk disclosures on stock price sensitivity to oil and gas prices, Queens University Working Paper.

Tufano, P. (1996): Who Manages Risk? An Empirical Examination of the Risk Management Practices in the Gold Mining Industry, Journal of Finance, Vol. 51 (4), pp. 1097-1137.

Tufano, P. (1998): The Determinants of Stock Price Exposure: Financial Engineering and the Gold Mining Industry, Journal of Finance, Vol. 53 (3), pp. 1015-1052.

UNCTAD (1994): A Survey of Commodity Risk Management Instruments, Report by the UNCTAD secretariat, United Nations Conference on Trade and Development.

Vermeulen, E.M. (1994): Corporate Risk Management, Thesis Publishers (Amsterdam).

Wall, L.D./Pringle, J.J. (1989): Alternative Explanations of Interest Rate Swaps: A Theoretical and Empirical Analysis, Financial Management, Vol. 18 (2), pp. 59-73.

Warner, J.B. (1977a): Bankruptcy, Absolute Priority, and the Pricing of Risky Debt Claims, Journal of Financial Economics, Vol. 4, pp. 239-276.

Warner, J.B. (1977b): Bankruptcy Costs: Some Evidence, Journal of Finance, Vol. 32 (2), pp. 337-347.

Weiss, L.A. (1990): Bankruptcy Resolution: Direct Costs and Violation of Priority of Claims, Journal of Financial Economics, Vol. 27 (2), pp. 285-314.

Wilkie, P.J. (1988): Corporate Average Effective Tax Rates and Inferences About Relative Tax Preferences, Journal of American Taxation Association, Vol. 4, pp. 75-88.

World of Banking (1995): Survey of Foreign Exchange Risk Management in U.S., World of Banking, Vol. 14 (4), pp. 28.

Zimmermann, J.L. (1983): Taxes and Firm Size, Journal of Accounting and Economics, Vol. 5, pp. 119-149.

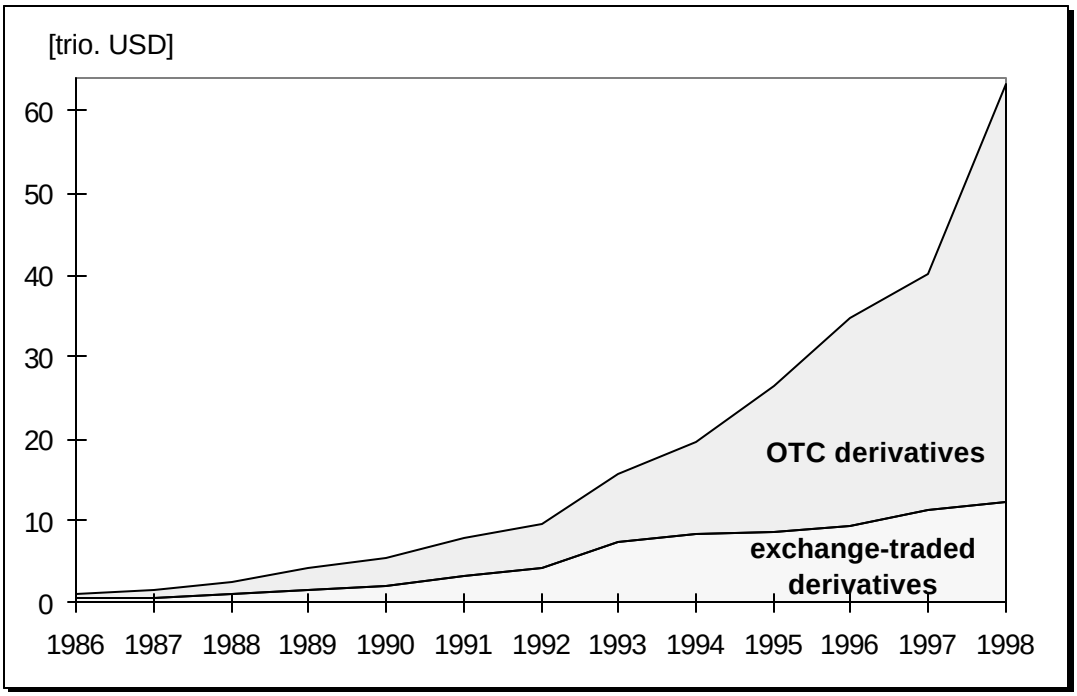
Table 1: Annual Volume and Open Interest of Commodity Futures and Options

Volume (in 1000)	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Futures														
Agricultural commodities								102,579	112,618	232,478	176,798	137,518	122,096	115,397
Energy products	12,903	22,052	28,959	35,402	42,355	41,947	47,764	116,870	63,711	61,527	62,367	67,402	83,071	97,616
Non-precious metals								34,140	46,570	45,917	46,924	55,981	54,151	63,054
Precious metals	9,576	12,863	11,738	12,786	16,663	11,393	10,213	49,118	34,709	33,723	32,968	40,704	47,563	51,412
Options														
Agricultural commodities								12,119	16,193	19,230	19,950	19,326	18,426	19,310
Energy products	135	3,268	5,622	6,412	6,352	6,729	9,742	20,486	8,138	7,195	8,847	10,463	12,525	14,010
Non-precious metals								2,465	4,040	3,887	3,026	4,042	2,669	4,195
Precious metals	1,745	2,629	3,349	8,811	8,152	8,999	9,978	26,794	12,174	6,306	3,759	3,288	2,977	3,919

Open Interest (in 1000)	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Futures														
Agricultural commodities								33,096	36,551	74,450	40,735	42,982	40,005	38,702
Energy products								9,183	9,340	8,165	8,497	9,961	11,930	19,292
Non-precious metals								7,284	9,088	7,746	7,499	7,847	9,030	10,844
Precious metals								11,368	13,824	13,817	14,676	14,086	13,718	15,261
Options														
Agricultural commodities								12,034	18,312	19,545	15,406	15,909	16,985	17,769
Energy products								6,223	5,376	5,439	7,791	9,453	10,633	14,113
Non-precious metals								3,599	5,552	5,550	3,932	3,769	2,866	3,815
Precious metals								9,243	10,775	7,311	5,569	6,052	6,322	7,914

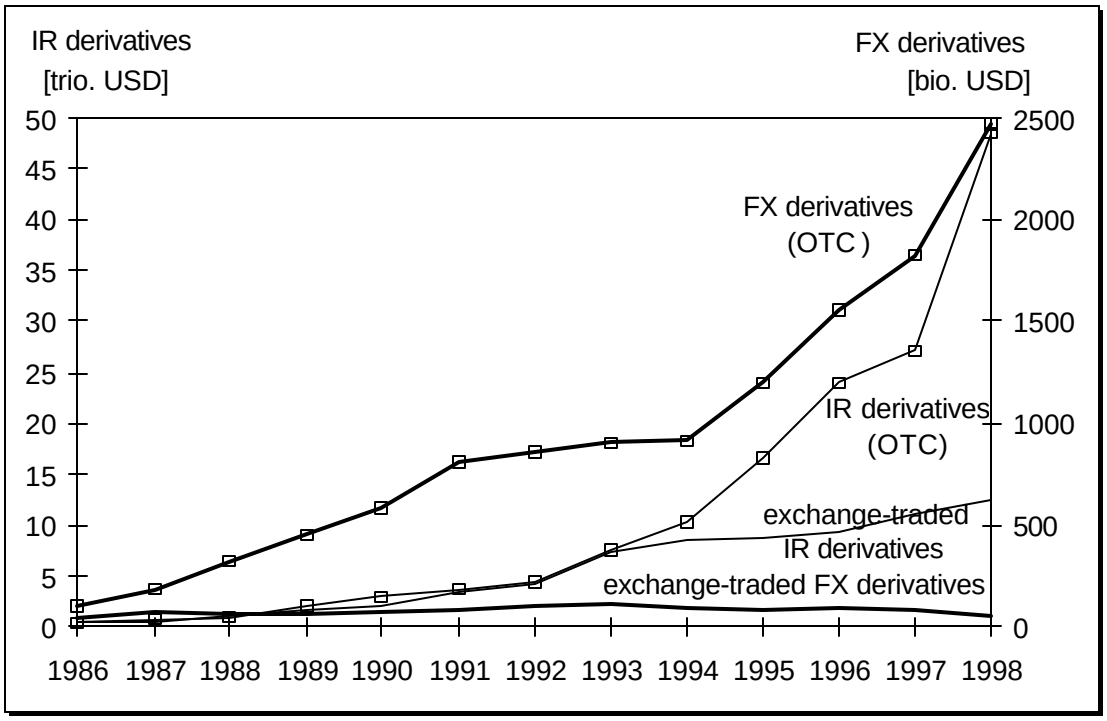
Source: BIS (2000)

Figure 1: Notional Amounts Outstanding of Financial Derivatives by Market Segment



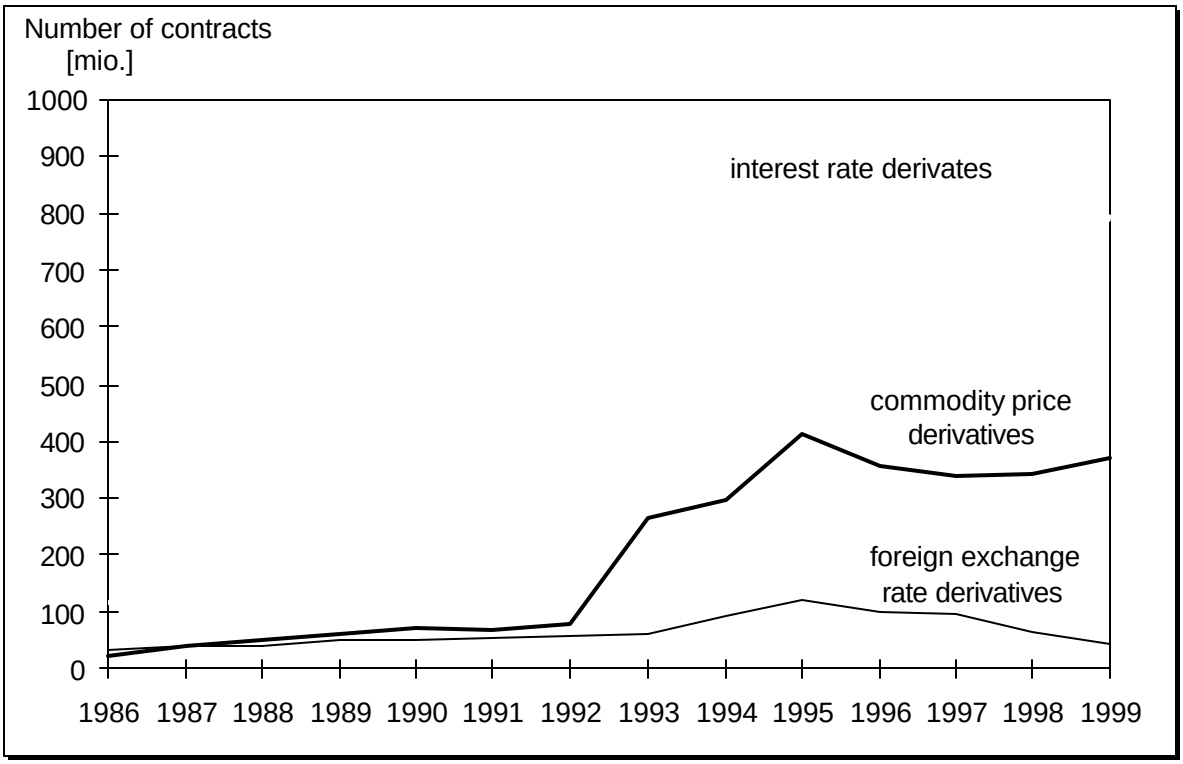
Source: BIS (1999). Data are as of year-end. OTC instruments are interest rate swaps, currency swaps (adjusted for reporting both currencies; including cross-currency interest rate swaps) and interest rate options (caps, collars and swaptions). Exchange-traded instruments are interest rate futures and options as well as currency futures and options.

Figure 2: Notional Amounts Outstanding of Foreign Exchange and Interest Rate Derivatives



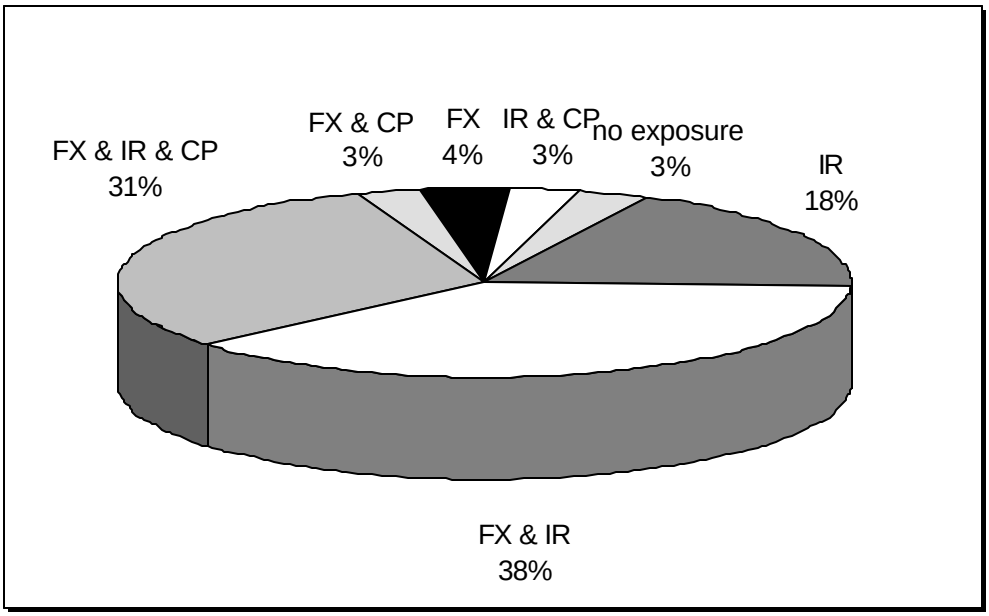
Source: BIS (1999). Data are as of year-end. OTC instruments are interest rate swaps, currency swaps (adjusted for reporting both currencies; including cross-currency interest rate swaps) and interest rate options (caps, collars and swaptions). Exchange-traded instruments are interest rate futures and options as well as currency futures and options.

Figure 3: Annual Turnover of Currency, Interest Rate and Commodity Price Derivatives



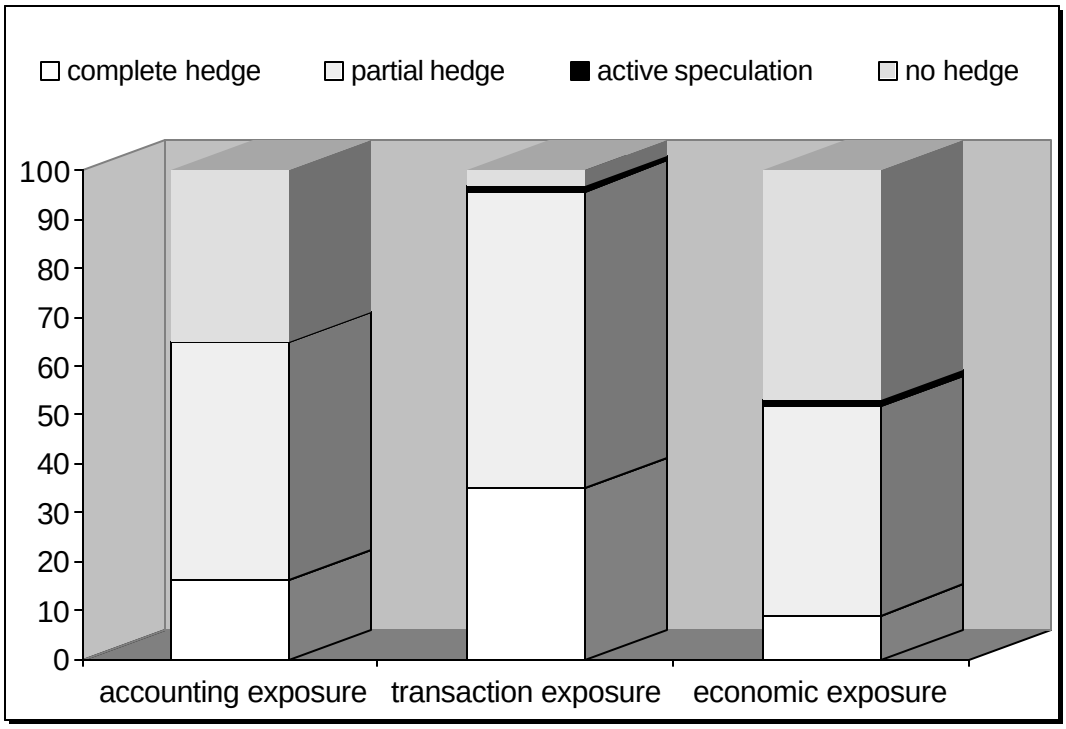
Source: FIA (1999). The data refers to options and futures contracts.

Figure 4: Perceived Risk Sources of U.S. Nonfinancial Firms



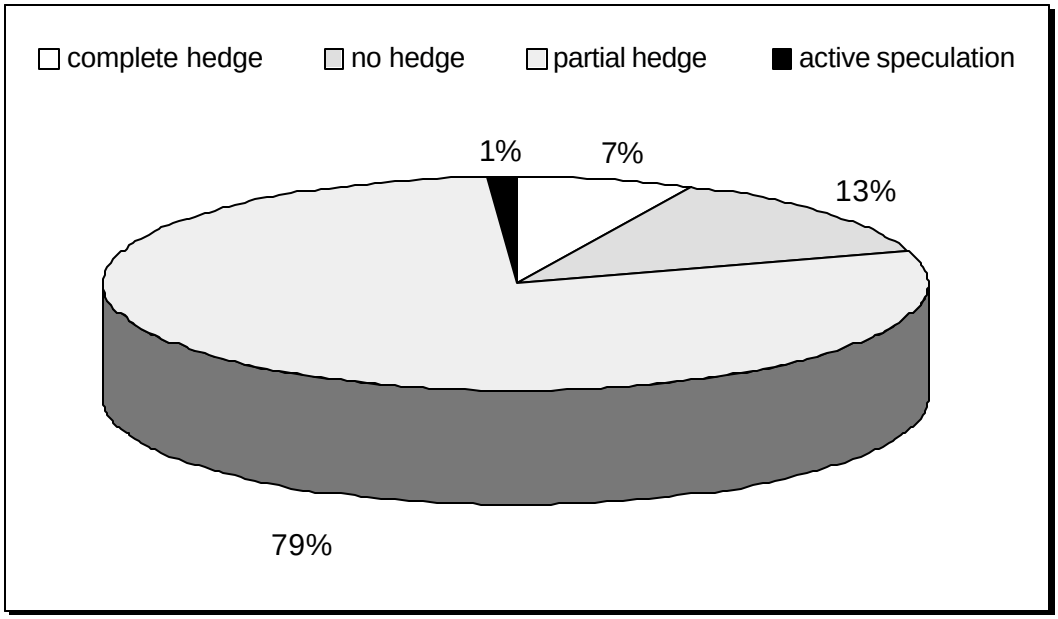
Source: Phillips (1995), p. 117. FX = foreign exchange rate risk, IR = interest rate risk, CP = commodity price risk.

Figure 5: Management of Foreign Exchange Risk



Source: Price Waterhouse (1995), p. 14.

Figure 6: Management of Interest Rate Risk



Source: Price Waterhouse (1995), p. 12.

Figure 7: The Effect of Hedging on Firm Value

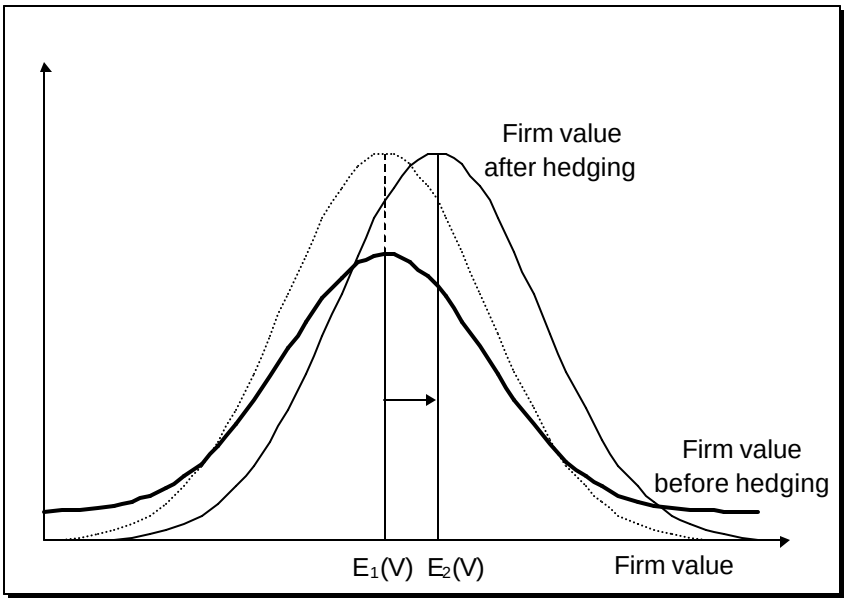


Figure 8: The Impact of Hedging on the Cost of Financial Distress

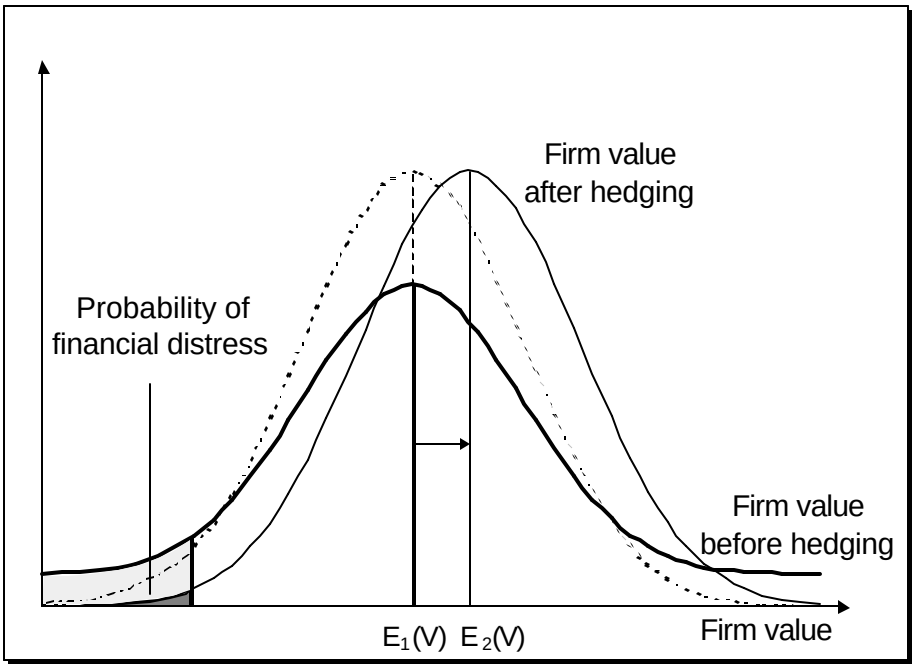


Figure 9: Increasing the Optimal Debt Ratio by Hedging

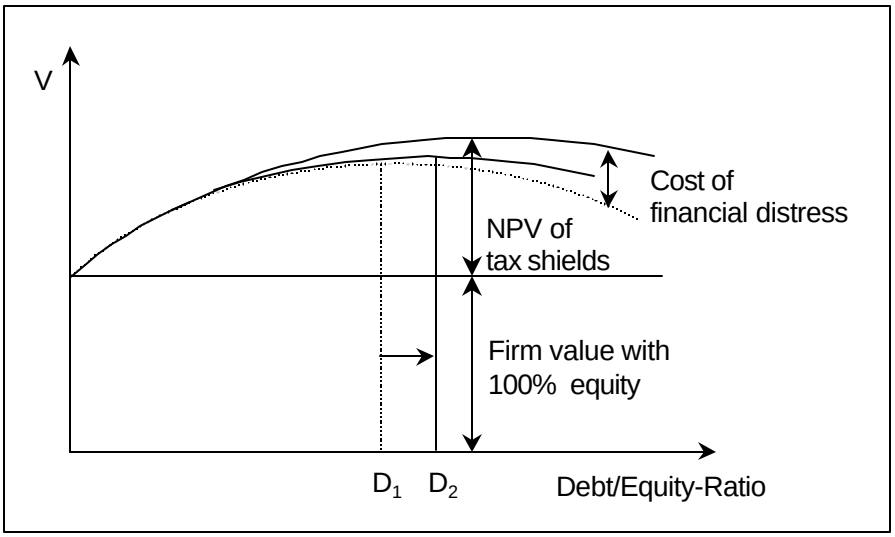
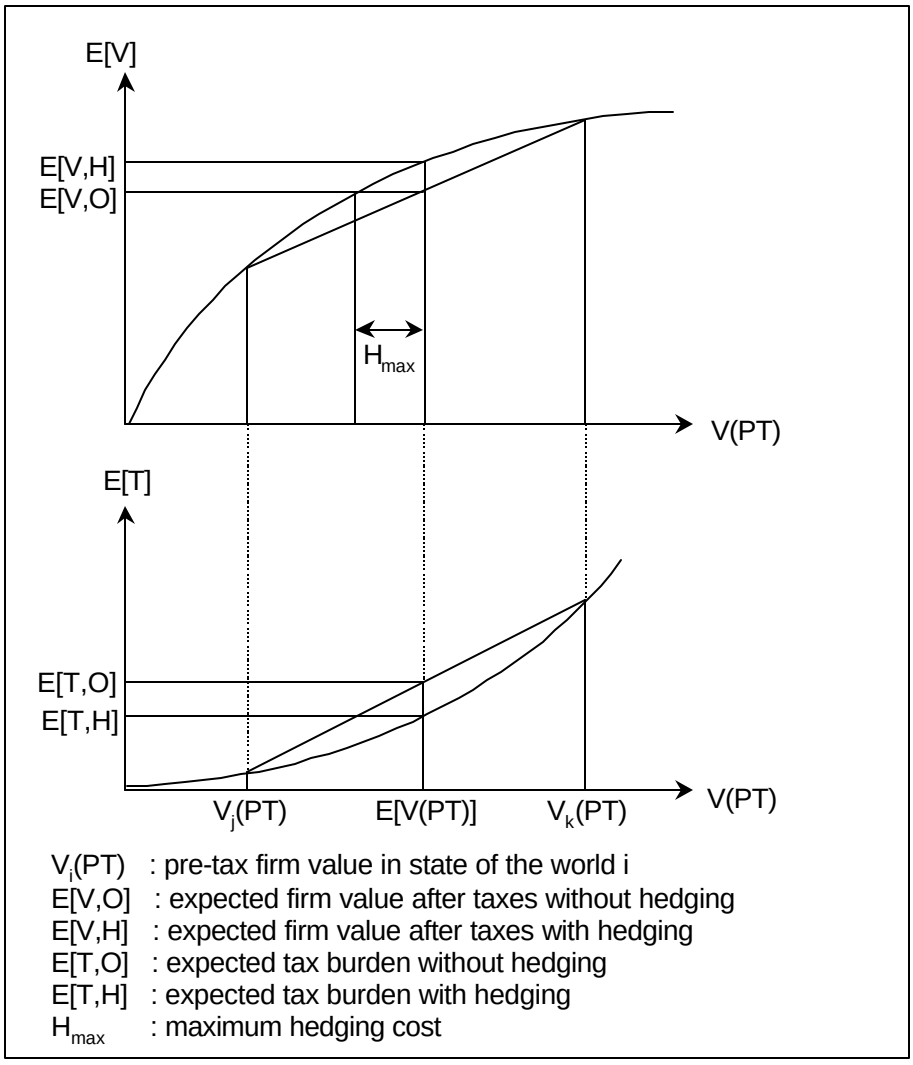


Figure 10: Impact of Hedging on the Corporate Tax Burden



V_i(PT) : pre-tax firm value in state of the world i
E[V,O] : expected firm value after taxes without hedging
E[V,H] : expected firm value after taxes with hedging
E[T,O] : expected tax burden without hedging
E[T,H] : expected tax burden with hedging
H_{max} : maximum hedging cost

Source: Smith/Stulz (1985), p. 393.

Biography of the Author

Söhnke M. Bartram studied Business Administration at the Universität des Saarlandes (Saarbrücken, Germany) and the University of Michigan Business School (Ann Arbor, MI) (1989-94) with a fellowship by the Lucia Pfohe Foundation. He majored in Corporate Finance, Computer and Information Systems, Operations Management and Operations Research. During the semester breaks, he worked for several industrial companies and accounting firms in Great Britain, France, Spain and Germany. In 1994, he obtained the Diplom-Kaufmann (MBA equivalent) with high distinction.

Subsequently, he spent four years at WHU Koblenz (Vallendar, Germany) and partially at the University of Michigan Business School for his doctoral studies. His dissertation comprises an empirical investigation of the impact of foreign exchange rate, interest rate, and commodity price risk on the value of German nonfinancial corporations. The analysis includes linear and nonlinear financial exposures as well as their determinants. Gunter Dufey, Professor of International Business and Finance at the University of Michigan and Professor of International Corporate Finance at WHU Koblenz, chaired his dissertation committee.

After obtaining the *Doctor rerum politicarum* (Ph.D. Finance equivalent) at the end of 1998, he was invited by René M. Stulz, Everett D. Reese Chair of Banking and Monetary Economics, to spend 12 months as a Visiting Scholar at the Charles A. Dice Center for Research of Financial Economics at the Fisher College of Business/Ohio State University (Columbus, OH). This postdoctoral year was supported by the German National Merit Foundation, the German Academic Exchange Service, the German Federal Department of Commerce and Technology, and the Charles A. Dice Center for Research in Financial Economics.

Currently, he is an Assistant Professor of Finance at the Limburg Institute of Financial Economics (LIFE) at Maastricht University (Maastricht, The Netherlands). The Maastricht Research School of Economics of Technology and Organizations (METEOR) recently granted financial support for his research activities in the area of international and corporate finance, especially financial risk management.