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JAN-MIKAEL VON GERICH and JOUKO KARJALAINEN

Interest Rate Risk Management in Large Finnish Non-financial Companies

ABSTRACT

Financial risk management is an essential function in every company although it does not always receive the attention it deserves. This study examines an important area of financial risk management, namely interest rate risk management, and provides insight into the interest rate risk management practices of large Finnish non-financial companies. The results show that most large companies take a systematic approach to interest rate risk management, but the risk assessment is largely concentrated on the financial position of the company, although interest rate risk has a much wider scope as well. The paper also suggests a model of the factors affecting the approach a company takes towards interest rate risk management. The best explanatory variables are the size of the company's loan portfolio and the existence of a written interest rate risk management policy. Additionally, the determinants of the perceived success of interest rate risk management have been studied, and it seems that low hedging degree and non-cyclicity of the industry are associated with higher perceived success.

Key words: *Interest rates, financial risk management, Finnish non-financial companies, hedging, derivatives*

JAN-MIKAEL von GERICH, M.Sc. (Tech.)
Nordea Markets Copenhagen, Quantitative Research • e-mail: jgerich@cc.hut.fi,
jan.vongerich@nordea.com
JOUKO KARJALAINEN, D.Sc. (Tech.)
Helsinki University of Technology, Dept. of Industrial Engineering and Management
• e-mail: jouko.karjalainen@tkk.fi

1. INTRODUCTION

Financial risks play an important part in today's business world, and like other sources of risk, these risks need to be managed too; otherwise the consequences for a company can be detrimental. The goal of financial risk management is usually quoted to be the reduction of fluctuations in the market value or profits of a company (Stulz, 1996). The rationale behind this goal is the argument that the volatility in the firm's value or profits has adverse effects on the company. Financial risks are usually seen to cover foreign exchange risk, interest rate risk, commodity price risk and security holding risk (Kasanen et al., 1997, p. 27). Interest rate risk, the focus of this study, arises from the fact that the assets and liabilities of a firm usually react differently to interest rate movements (Triantis, 1999). Although interest rates represent at least an equally important source of risk as foreign exchange, most studies on interest rate exposure have been limited to financial institutions (Bartram, 2002). This study tries to help in filling this gap by focusing on the interest rate risk management in major Finnish non-financial companies.

The study has several important objectives. On the one hand, the objective is to describe and analyze the practice of interest rate risk management in major Finnish non-financial companies. On the other hand, the goal is to find out whether the interest rate risk management practice a company undertakes is determined by broad variables, like the size of the company or the size of the company's loan portfolio. In this context, we have also examined the factors associated with the perceived success of interest rate risk management among Finnish companies.

The paper is structured in the following way. A literature review is offered in Section 2 and the methodology and data of the study in Section 3. In Section 4, we present the results of the study, and in Section 5, we discuss their reliability and validity. In the final section, we present the conclusions of the study.

2. LITERATURE REVIEW

Interest rate risk management has been targeted to some extent in previous research. The most comprehensive study of Finnish companies was made by Hakkarainen et al. (1997). They studied exchange rate and interest rate risk management in major Finnish nonfinancial firms in the spring of 1994. They contacted 100 companies, and 84 agreed to take part in the survey. The firms were chosen based on their turnover in the financial year of 1992. The participants were mailed a questionnaire, which they then filled and returned. Hakkarainen et al. found out the following:

- 28% of the companies did not perform interest rate risk assessment at all.
- The main goals firms had in their interest rate risk management policies were minimizing the effect of interest rate movements on the firm's income, and minimizing net interest rate expenses.

- Duration analysis and average interest rate period were the main methods used in interest rate risk assessment.
- Interest rate swaps were the most commonly used hedging instrument, followed by forward rate agreements.
- Firms mainly assessed having been fairly successful in their interest rate risk management.
- The main way of assessing the success of the policy was comparing interest rate expenses to market rates.

Harju and Martikainen (1997) studied the management of foreign exchange and interest rate risk among small and medium-sized Finnish companies. Their original sample consisted of 64 companies, of which only 23 returned the mailed questionnaire. Their results, as well as their final sample, were quite limited regarding interest rate risk management.

Fatemi (2000) studied the risk management practices of large German non-financial firms. His sample consisted of all the non-financial firms listed in the Frankfurt Stock Exchange, with minimum sales of DM 400 million in 1997. He used a mailed questionnaire, and 71 firms out of the 153 included in the original sample returned the questionnaire. Fatemi's results indicated the following:

- 36% of the companies performed active interest rate risk management, whereas 29% did no regular assessment of interest rate risk.
- 88% of the companies used derivatives: currency forward contracts were the most often-used instrument, but interest rate swaps followed in second place.
- The majority of firms periodically measured the success of their interest rate risk management process.

The global financial service company Ernst & Young (2004) carried out a study on the treasury operations of British companies. The respondents were members of the Association of Corporate Treasurers (ACT), the leading global provider of treasury education. The sample consisted of roughly 50 large companies, of which 60% had their parent companies in the UK, the rest elsewhere in Europe. The survey was carried out with a questionnaire. The most important results included the following:

- Interest rate risk management was seen as the second most important financial risk management function while cash and liquidity management was seen as the most important function.
- 77% of the respondents managed their interest rate exposure via a fixed-to-floating target ratio or range for their debt

- 94% of the respondents had a formal policy on managing interest rate risk
- 92% of the companies used derivative instruments in the management of interest rate risk

The factors affecting the approach a company takes towards its risk management have not been studied much directly. Kasanen et al. (1997, pp. 46, 54) suggest that at least the firm's size and structure, the firm's attitude towards risk, and the existence of a written risk management policy affect the company's risk management. Additionally, they conclude (p. 220) that the sensitivity of a company's financial profit to a rise in interest rates is a factor that should be taken into consideration. Shapiro and Titman (1985), on the other hand, point out that the debt structure of the firm is an important determinant. Further, if the goal of financial risk management is to minimize the fluctuations in income, as often pointed out in literature (e.g. Stulz, 1996), the cyclicity of the industry should not be forgotten either. These observations have been utilized in this study in the construction of the model for the determinants of the companies' approach towards interest rate risk management. The constructed model is presented later in Figure 6.

3. RESEARCH DESIGN

Methodology

The primary data gathering instrument was a web-based survey. The questions of the survey were designed in co-operation with interest rate risk management experts of a well-known financial organization. The questionnaire was piloted by three specialists in the area of corporate risk management and interest rate derivative products.

The questionnaire had 29 questions. Four of the questions were open questions, two of which had answers in numerical form. The rest of the questions were multiple-choice questions, with most of them having also a comment field available. In the open questions, the answers were classified into suitable categories, and frequencies were calculated for the categories. In the open questions involving numerical answers, arithmetic averages were used.

The companies were selected based on a list maintained by Talouselämä, a major Finnish magazine in the area of finance. Talouselämä lists the 500 biggest companies in Finland each year, based on their turnover. Thus, 150 of the biggest non-financial companies in the financial year of 2003 were selected to take part in the survey. In case a company had gone through a merger after 2003, the merged company was included in the study. A few companies, on the other hand, had incorporated some parts of their businesses. In these cases, only the company forming the core of the old firm was selected as part of the study. A link to the web-based questionnaire was sent to the person responsible for interest rate risk management, usually the chief

financial officer (CFO). Finally, some of the companies that had not responded to the questionnaire were approached with telephone to yield a better response ratio. These companies were selected randomly to avoid bias to the results. The data was collected in October–November, 2004.

The total number of responses was 67, yielding a response rate of roughly 45%. The original goal was to reach a response rate of 40%. All the respondents did not give answers to all the questions, but the missing answers centered mainly on the open questions while the multiple-choice questions were seldom left unanswered. Therefore, the bias resulting from non-response is likely to have been small.

Cross tabulation was the most important tool in the search for relationships between the selected variables. The χ^2-test, a non-parametric test, was the statistical test used. In other words, the relationship between two variables was studied at a time. The amount of data would not have been extensive enough for the use of multivariate methods. The χ^2-test suited the sample best, since the variables were mostly categorized on a nominal scale, ruling out the use of parametric tests (Järvenpää and Kosonen, p. 46).

Data

The sample of companies selected for the study all shared the following characteristics:

- They belonged to the biggest Finnish companies at the end of 2003.
- They were non-financial.

All the companies had a turnover of well above 200 MEUR in 2003 (Talouselämä, 2003). More specific background information of the responding companies is presented in Table 1 below. The data of this study should be comparable to the study of Hakkarainen et al. (1997), since the same criteria were used for the selection of the companies.

TABLE 1. Background information on the responding companies

Turnover / MEUR		Solvency ratio		Loan portfolio size / MEUR		Industry cyclicity	
>250	7.5 %	**<20%**	7.5 %	**<250**	70.1 %	**cyclic**	28.4 %
250-500	25.4 %	**20-40%**	26.9 %	**250-500**	9.0 %	**non-cyclic**	44.8 %
500-1000	23.9 %	**40-60%**	50.7 %	**500-1000**	11.9 %	**neither clearly cyclic nor non-cyclic**	26.9 %
1000-2000	25.4 %	**60-80%**	11.9 %	**1000-3000**	4.5 %		
>2000	17.9 %	**>80%**	3.0 %	**>3000**	4.5 %		

Notes: The cyclicity of the industry was based on a subjective assessment made by the respondent, without further specifying the criteria for a cyclic industry. The table presents the percentage distribution of the companies between the different categories. The number of companies was 67.

Table 1 illustrates, among other things that only a few companies run their business solely with equity and without significant liabilities. Interest rate risk is perhaps most visible precisely in liabilities, so Table 1 in itself gives some indication of the interest rate risk present in most companies.

4. RESULTS

Importance and Goals of Interest Rate Risk Management

The importance of interest rate risk management was inquired by asking the respondents to rate different risk management functions in their companies. A function was considered important in our analysis, if it was rated among the top three in the respondent's ranking. According to the results, operational risk management was quite clearly the most important risk management function in Finland (in top three for 68% of companies). It was followed by cash flow and liquidity management, and foreign exchange risk management. Interest rate risk management ranked fourth in this study (in top three for 44% of companies). In the Ernst & Young (2004) study, on the other hand, interest rate risk management was second (with 58%) and operational risk management was not at all among the most important risk management functions. One explanation for the differences between the two studies could be the inclusion of financial companies in the Ernst & Young study.

Since interest rate risk management is an important function, one would expect that most companies addressed it in their risk management policy. Indeed, systematic interest rate risk management appears to prevail in today's major companies, which is illustrated by the fact that 64% of the companies (N=67) surveyed had a written interest rate risk management policy. Companies without a written policy usually assessed interest rate risk as well, but probably in a less systematic or controlled way. Four companies stated that they do not have an interest rate risk management policy at all.

The goals companies have in their interest rate risk management can vary a lot. In this survey, the companies were asked to state the goals of their interest rate risk management, and if they had several goals, rate them in the order of importance. The most common primary goal mentioned was minimizing fluctuations in income, followed by minimizing interest rate expenses or maximizing interest rate income. The results appear to give some support for the proposition often presented in literature that minimizing the fluctuations in income or firm value would be the ultimate goal of financial risk management.

Scope of Interest Rate Risk Assessment

According to the respondents' assessment, some changes have taken place in the interest rate exposure assessment of companies during the last ten years. Below, Figure 1 compares the results

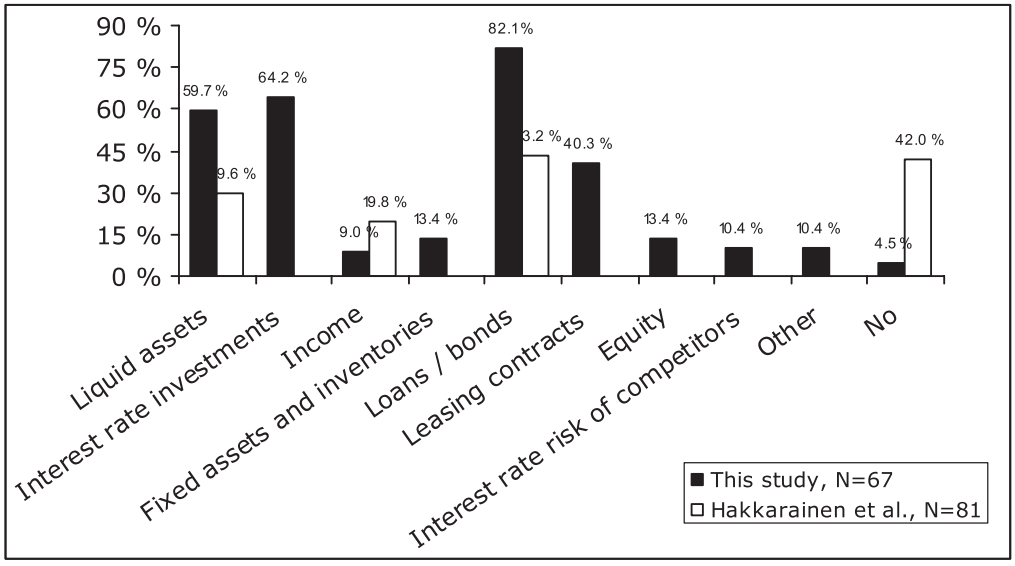

FIGURE 1. The scope of interest rate risk assessment in this study versus a study conducted in 1994

Notes: The figure presents the percentage of respondents assessing the interest rate risk of the specified item. The answer categories of Hakkarainen et al. were liquid assets, loans, net income and none of the items. The difference between the categories liquid assets and interest rate investments deserves further explanation here, since there can be overlaps between the two groups. Liquid assets here mean mainly cash and cash equivalents (items that can be easily converted into cash, including accounts receivable). Interest rate investments, on the other hand, cover various financial instruments that are acquired in an investment sense, i.e. to make a profit (e.g. a government bond).

of this survey to the one carried out by Hakkarainen et al. (1997). The results of the two studies are not fully comparable since the answer choices were narrower in the study of Hakkarainen et al.

Interest rate risk assessment seems to have become more common in the last 10 years. This can be seen by looking at the proportion of companies not assessing the interest rate risk of any element, and the portion of companies assessing the risk of loans or bonds (Bonds mean the bonds issued by the company whereas bonds bought as an investment fall into the category *interest rate investments*). A point to note is that the study of Hakkarainen et al. did not list bonds at all as an alternative. However, this hardly changes the basic message that interest rate risk assessment appears to have become a more common practice in major Finnish firms.

Assessing the interest rate risk of liquid assets seems to have gained in importance. Also investments and leasing contracts are often considered as sources of interest rate risk. On the contrary, the interest rate risk of income seems to be assessed less frequently today than before. This appears to be in a slight contradiction with the often-mentioned goal of interest rate risk

management, i.e. minimizing fluctuations in income. Fixed assets and inventories, equity, and the interest rate risk of competitors seem to be categories less often considered in interest rate risk management. Consequently, the basic message conveyed in Figure 1 is that although interest rate risk is considered in nearly all the major companies in Finland, its assessment is largely limited to the financial position. This might be justifiable for some companies, but it seems that there are plenty of companies that should at least consider a wider scope in their interest rate risk management.

Effect of Rate Changes

When interest rates change, the financial result of a non-financial company is often affected by the change. This is illustrated in Figure 2, where the effect of a rise in interest rates on the financial results of the company is examined.

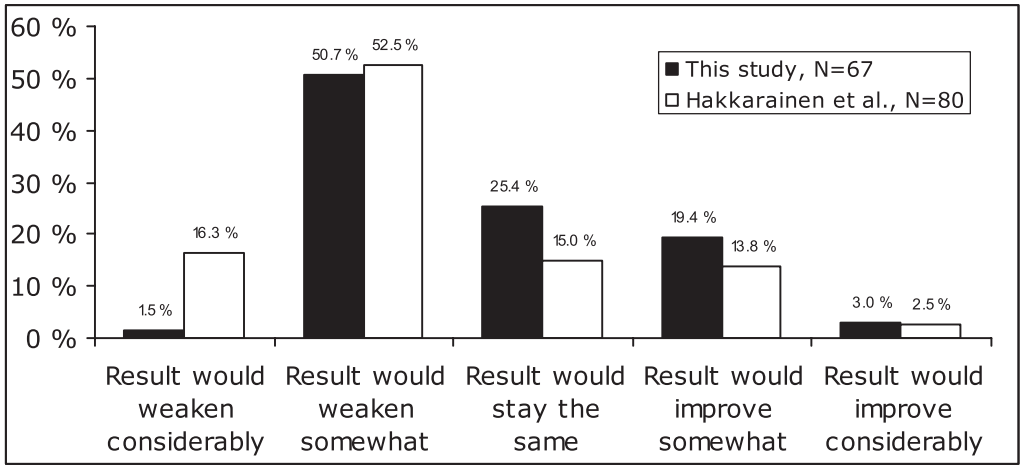

FIGURE 2. The effect of a rate rise on the financial result of the company

Notes: The estimation of the outcome was based on a subjective assessment of the respondent without further defining what is meant by *considerably* or *somewhat*. Instead of the financial result, Hakkarainen et al. (1997) asked the companies, how their operating income would be affected.

Figure 2 implies that a rise in interest rates affects the majority of companies negatively, although this phenomenon seems to have moderated somewhat in the last ten years. It seems that companies have become more resistant to an increase in interest rates since fewer companies today would be severely affected by a rate rise. Nevertheless, the subjectivity of the measure makes it impossible to draw hard conclusions. These results are in accordance with the fact that interest rates were considerably lower at the time of this study, compared to the timing of the

study of Hakkarainen et al. Consequently, also relative interest rate expenses were lower at the time of this study. To give an example of the relative interest rate expenses, the 6-month floating rate was around 2.2% at the time of this study, whereas it stood around 5.5% at the time of the study of Hakkarainen et al. Thus, roughly speaking, interest rate expenses were some 150% higher in the spring of 1994 compared to the autumn of 2004.

Not all companies are affected negatively by a rise in interest rates, but there appear to be many companies actually benefiting from a rate rise. One possible explanation for this is that the business operations of some companies benefit from higher rates (e.g. the price of the company's products rises with interest rates, like in the pulp and paper sector). Another explanation is that the company has negative net debt and floating rate interest rate investments benefiting from a rise in rates.

Methods Used in Measuring Interest Rate Risk

A variety of methods are available for measuring the exposure to interest rate risk. These methods differ in their complexity as well as in their informational value and usefulness for interest rate risk management. Figure 3 presents the most often used methods in the companies of this study, and compares the commonality of the different methods to the study of Hakkarainen et al. (1997).

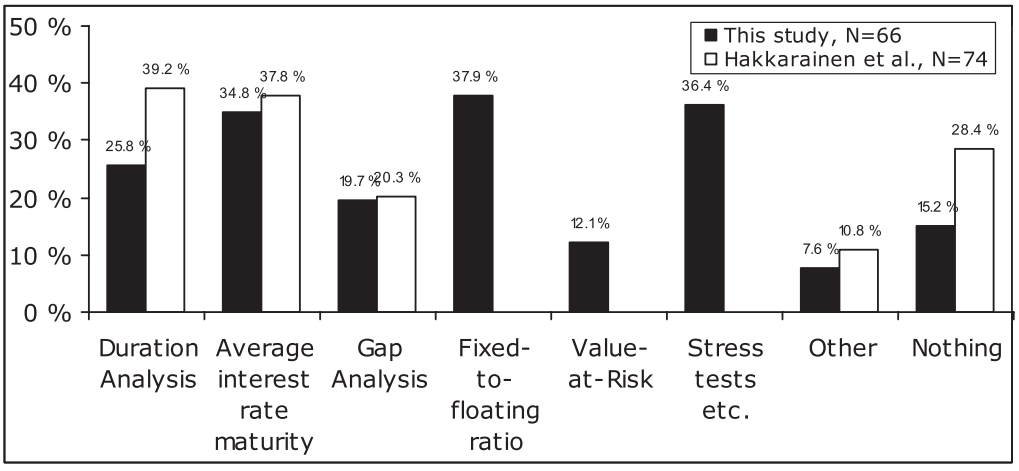

FIGURE 3. Methods used in interest rate risk management

Notes: The average interest rate maturity and fixed-to-floating ratio methods refer to the loans of the company, and the group stress tests etc. includes sensitivity and scenario analysis as well. It is also notable that one company can use several methods, so the percentages presented do not add up to 100. The alternatives of Hakkarainen et al. included *Duration analysis, Average interest period, Simulation analysis (28 % of respondents indicated using this method; not included in Figure 3), GAP analysis, Other* and *None*.

Figure 3 implies that the simpler methods, the average interest rate maturity and the goal for fixed-to-floating ratio for loans, are used quite often. Earlier research supports the use of these simple methods as well. In the Ernst & Young (2004) study, 77% of the companies studied used fixed-to-floating target ratio in the management of their interest rate risk.

Figure 3 also supports the proposition that interest rate risk management has become more common in the last ten years. *Duration analysis* seems to have lost its importance in interest rate risk management, but the group *stress tests, sensitivity analysis, and scenario analysis* appears to have a wide user-group. This group was not among the alternatives of the study conducted by Hakkarainen et al., nor was the goal for *fixed-to-floating ratio* for loans or *value-at-risk analysis*. However, simulation analysis can be considered to be quite close to the methods from the group *stress tests etc.*, and 28% of the respondents in the study of Hakkarainen et al. indicated to use this method. Of all the specified categories, methods commonly used together were *value-at-risk* and *stress tests etc.* (62,5% of the companies used both methods), *duration analysis* and *stress test etc.* (53%), and *average interest rate maturity of loans* and the goal for the *fixed-to-floating ratio* of loans (52%).

The companies were also asked to evaluate the suitability of the different methods for measuring their interest rate risk exposure on a scale from 1 to 5, with 1 indicating very suitable and 5 indicating not suited at all. Most respondents evaluated only some of the methods, thus implying that they did not estimate the suitability of such methods they were not familiar with. The results from the evaluations are presented in Figure 4. Along with the number of different answers for each grade, an average grade is also presented at the lower part of the figure.

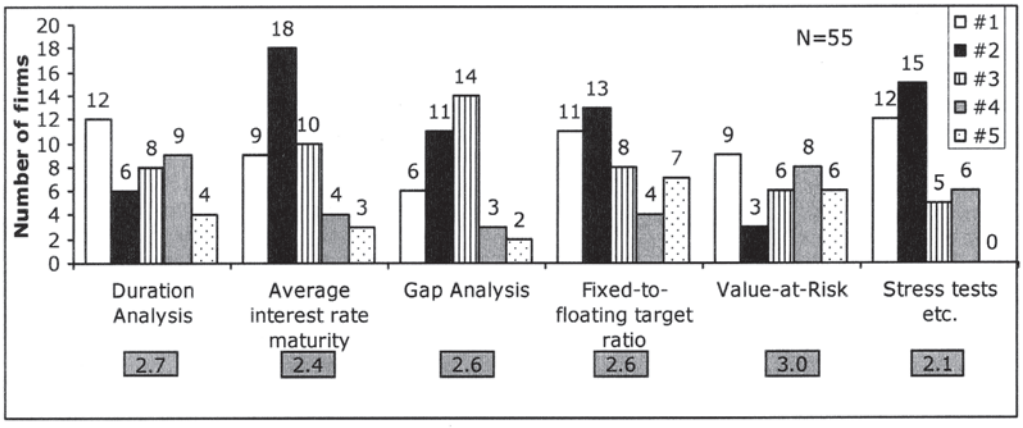

FIGURE 4. Evaluation of the suitability of different interest rate risk measurement methods

Notes: Evaluation on a scale from 1 to 5; 1 meaning the best, 5 the worst; number of companies giving a certain grade for the specified method. Average grades are in the shaded boxes below the category name. Note that the lower the grade, the better the suitability of the method was seen. The evaluation of the suitability of a method was based on the subjective assessment of the respondent.

When looking at Figure 4, it can be clearly seen that there is considerable spread in the answers for one method. This can be interpreted as follows: since companies differ in their interest rate risk management practices, there is not a single interest rate risk measurement method, which would suit all companies. Rather, it seems that every method has a bunch of companies seeing the method very suitable, but then again the same method can be considered totally unsuitable in other companies. Another possible explanation for the spread is that the respondents gave good grades to methods they used themselves, and worse grades to methods they had not tested.

Based on the average grades, the group *stress tests etc.* received the best grade, followed by *average interest rate maturity* of loans. It seems that despite its simplicity, the *average interest rate maturity* is seen as a good method in interest rate risk management. All the averages were between 2 and 3, indicating there were no considerable differences between the suitability of the different methods.

Hedging

Since companies differ in their interest rate risk management practices, it is no surprise that there are considerable differences in the hedging degrees of different firms as well. The hedging degree here was defined as a percentage of the companies' loans that was hedged against a rise in interest rates (either fixed-rate loans or hedged with the help of derivatives) Somewhat surprisingly, more than 40% of the companies surveyed hedged less than 20% of their loans against a rise in interest rates.

The companies seemed to differ a lot with respect to the average maturities of their loan portfolios as well. Some companies appeared to consider floating rates more suitable whereas others preferred fixed rates. This observation is consistent with the theory suggesting that the nature of the firm's industry and the nature of its business operations are important determinants of the average interest rate maturity for the company (Kasanen et al, 1997, p. 218). The main reason companies kept a considerable part of their loans tied to floating rates was the fact that they considered floating rates to be lower, on the average. In other words, they speculated that this approach would lead to lower interest expenses. Floating rates also suited the cash flows of a number of companies better, while others considered interest rate risk to be insignificant.

Companies can use a variety of instruments for hedging against interest rate risk. Figure 5 compares our findings to a recent study on the use of financial derivatives by Bartram et al. (2004), as well as to the study of Hakkarainen et al. (1997). The sample of Bartram et al. consisted of 7 263 non-financial firms from 48 countries; 105 of the firms were Finnish. The study was based purely on the financial reports of the companies from the years 2000 and 2001, and it utilized both electronic and manual searches. Therefore, the uniformity of the data is unlikely to have been great.

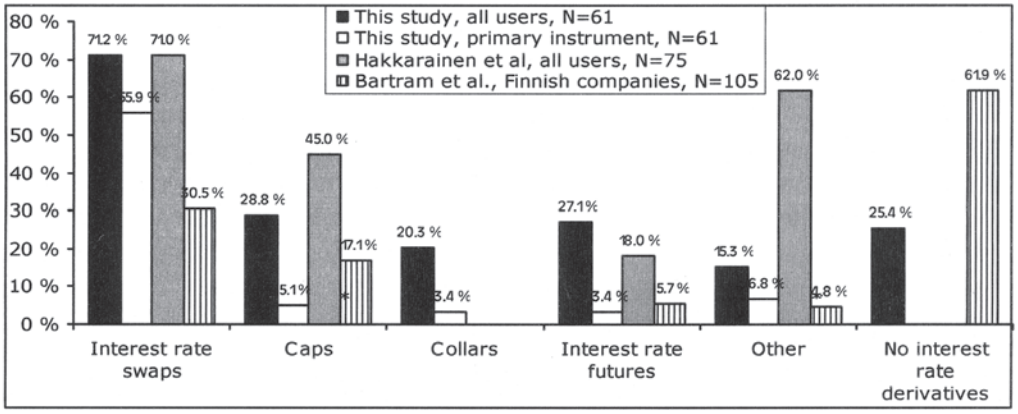

FIGURE 5. Companies' use of interest rate derivatives by instrument type

Notes: The categories for interest rate derivatives in the Bartram et al. study were *forward rate agreements, futures, swaps and options*. Hakkarainen et al. on the other hand, asked how often (*never, rarely, often, continuously*) firms used instruments from different groups. In Figure 5, the company was considered a user, if it had responded using the instrument *rarely* or more often. The alternatives of Hakkarainen et al. were *standardized interest rate futures contracts, banks tailored products (used in 34 % of the companies; not included in Figure 5), OTC (over-the-counter i.e. not traded in an exchange) options, forward rate agreements* and *swaps*. The *Caps* category in the figure includes all interest rate options and the *Other* category *forward rate agreements* in both the results of Hakkarainen et al. and Bartram et al. It is also notable that Hakkarainen et al. did not distinguish the companies not using any derivatives.

The results of this study imply that clearly more companies use interest rate derivatives than according to the study conducted by Bartram et al. Based on the results of this study and the study of Hakkarainen et al., it seems the results of Bartram et al. are too conservative. Since their report did not include the average size of the company, measured by turnover, it is possible that their sample was composed of smaller companies, on the average. Another possible explanation is that because of their data gathering method, part of actual derivatives usage was omitted. This may be because the way the use of derivatives is disclosed in the financial reports of companies may vary considerably, since the Finnish law does not state explicitly, how derivatives usage should be recorded.

It needs to be noted that in the results of Hakkarainen et al., 33% of the companies used interest rate swaps rarely, whereas only 38% often or continuously. The large part of companies choosing the alternative *rarely* was apparent with the other instruments as well. Since this study only asked the companies, which derivates they used in hedging their interest rate risk, it is totally possible that a company having answered *rarely* in the study of Hakkarainen et al., would have answered negatively to derivative usage in this study. Therefore, one cannot automatically draw the conclusion that derivative usage would not have become more common in the last ten years.

It seems obvious, though, that interest rate swaps appear to be clearly the most commonly used instrument in hedging interest rate risk. Nearly all the companies using derivatives use interest rate swaps. The importance of interest rate swaps becomes even more obvious when looking at the primary hedging instruments. Although interest rate options, futures, and other hedging instruments are often used in addition to interest rate swaps, their use as a primary hedging instrument appears to be limited.

Forward rate agreements (FRA) were not listed explicitly as a category, when asking about the use of derivatives, since it was assumed major Finnish companies rarely use them nowadays. This assumption was based on the sales data from a well-known financial company. The assumption seemed to be correct, since none of the companies selecting the *Other* category mentioned forward rate agreements, when specifying their answers. Still ten years ago, according to the study of Hakkarainen et al. (1997), almost 40% of companies said they used FRAs often or continuously. It seems then that the use of FRAs in interest rate risk management has declined considerably.

Determinants of Interest Rate Risk Management in Practice

At least in theory, many determinants affect the interest rate policy a company decides to pursue (see e.g. von Gerich, 2005; Kasanen et al, 1997). This section tries to model some of the important relationships between firm characteristics and the resultant interest rate risk management policy. First, a hypothetical model was built with the help of existing theory, as presented in the *Literature Review* section. The model was constructed so that its validity could be tested with the data from the survey conducted. It was built with the help of an expert in corporate risk management. The initial model is presented in Figure 6.

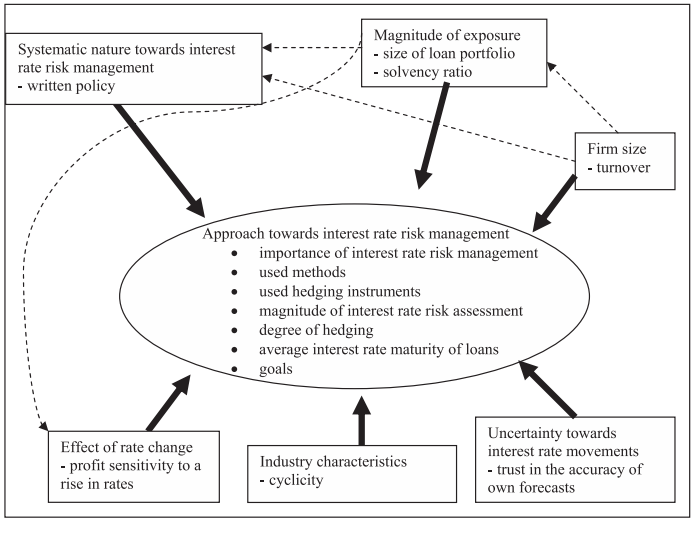

FIGURE 6. A hypothetical model for the determinants of interest rate risk management policy.

Notes: The variables of the model were selected on the basis of subjective assessment and existing literature. The arrows illustrate assumed causal relationships. Dashed arrows illustrate relationships between the independent variables and normal arrows the relationships between an independent and one of the dependent variables.

The model can be interpreted as follows: The approach towards interest rate risk management is placed in an oval in the middle of the figure, along with its major components. The determinants assumed to affect the approach are placed in rectangles around the oval, and arrows are used to illustrate the cause-effect relationship. A dashed arrow between two rectangles illustrates a relationship between two determining factors. Although some connections were expected to exist between the determining factors, these connections were not assumed to be strong enough to distort the findings. Consequently, all the determining factors were presumed to be independent. The model was tested by examining the relationships between the variables in pairs and using the chi-square test. The responses concerning each independent and dependent variable were divided into two or three categories. The number of categories was chosen so that the preconditions of using the chi-square test could be met. When choosing the categories, attention was paid to having approximately an even number of companies in the different classes. The independent and dependent variables are described next.

Independent Variables

The systematic approach towards interest rate risk management was measured with the existence of a written interest rate risk management policy. The natural categories in this case were that either the company had a written policy (43 companies) or it did not (24 companies).

The magnitude of exposure was measured with two variables: the absolute size of the company's loan portfolio and the solvency ratio. For the size of the loan portfolio, the categories composed of companies having loans worth 500 MEUR or less, and companies having more than that. The number of companies in the categories was 47 and 20, respectively. As far as the solvency ratio was concerned, the dividing mark was 40%. The number of companies with a solvency ratio of lower or equal to 40% was 23, and the number of companies having a higher solvency ratio was 44.

The measure of the firm size was its turnover in 2003. The companies, whose turnover was 500 MEUR or less in 2003, formed the first category (22 companies) and the companies with a higher turnover constituted the second category (45 companies).

The uncertainty towards interest rate movements was measured by the confidence the company had in its own forecasting capabilities. The companies estimated the accuracy of their forecasts on a horizon of less than a year and over a year. The average of these answers was calculated, giving more weight to the longer-term forecast, and the answers were then divided into two categories. The first category was composed of companies more confident in their forecasting capabilities (30 companies), and the second one of companies less confident (37 companies).

The model included one variable concerning the industry-specific characteristics. This variable was selected to be the cyclicity of the industry. To better distinguish the companies in this,

only the firms regarding themselves as cyclic (19 companies) or non-cyclic (30 companies) were included. The ones stating that their industry was neither clearly cyclic nor non-cyclic were thus not considered in this variable.

The final independent variable measured the sensitivity of the company to rate changes. The measure chosen was how a company estimated that its profits would be affected by a rise in rates. In this variable, the classes were *the result would weaken* (35 firms), *the result would stay the same* (17 firms), *or the result would improve* (15 firms).

Dependent Variables

The relative importance of interest rate risk management was based on the respondents' ranking of interest rate risk management among the functions of corporate risk management. Class one consisted of companies ranking interest rate risk management among the top two of their risk management functions, class two of companies ranking it third or fourth, and class three of companies ranking it fifth or lower. The number of companies in the categories was 17, 20 and 26 respectively.

The hedging instruments were divided into five categories: interest rate swaps, caps, collars, interest rate futures and other. We measured how many different categories of hedging instruments were included in the company's instrument portfolio. This variable did not measure the magnitude of derivatives usage but only the variety of instruments used. The usage was then divided into two classes. Companies that used instruments from a single category or no instruments at all constituted one class, and companies using instruments from 2 or more categories formed the other class. The number of companies in each class was 30.

The responses concerning the number of different methods used in interest rate risk assessment were divided into three classes, with class one consisting of companies using 0 or 1 method, class two of companies using 2 methods, and class three of firms utilizing 3 to 4 methods (no company used more than 4 methods). The number of companies in the classes was 26, 26 and 15, in that order.

The scope of interest rate risk management was measured with a three-class scale, with class one consisting of companies assessing the interest rate risk of 0 or 1 of the categories, class two of 2 categories, and class three of 3 or more categories. The categories, i.e. the aspects of interest rate risk management, have been identified in Figure 1. The number of companies falling to each of the classes was 26, 26 and 15, respectively.

The degree of hedging was categorized into two classes: a hedging degree of 40% or less formed the first category, and the companies hedging more than 40% of their loans constituted the second category. Companies that did not have any loans were not considered in this variable, since their number was quite small, only 5. The number of companies in the categories was 35 and 27, in that order.

For the interest rate maturity of loans, the dividing mark between the two categories used was one year, with companies having an average maturity of less than a year forming the first category. The number of companies in the categories was 33 and 34, respectively.

The goals of interest rate risk management were considered one at a time, since measuring the number of different goals would not have been reasonable. If a certain goal was ranked among the top three in a company, the goal was considered important for the company, and otherwise it was not. In other words, a two-class categorization was used for each goal.

Actual Relationships

The relationships between the independent variables are presented in Table 2. As expected, there was a connection between firm size and the size of its loan portfolio. Although this relationship was strong, firm size and the size of the loan portfolio were considered to measure sufficiently different characteristics of a firm, justifying the inclusion of both variables in the model. Also as expected, companies with bigger loan portfolios seemed to have more often a written interest rate risk management policy. However, slightly contrary to expectations, there did not seem to be a connection between the size of the company's loan portfolio, and the effect a rise in rates would have on the company's profit level. Somewhat surprising was also the implication that there was a connection between firm size and the uncertainty towards interest rate movements: larger companies expressed more uncertainty than smaller ones. One possible explanation for this is that the larger companies realize better, how hard forecasting rate movements really is, whereas smaller companies may more easily be under the expression that they can anticipate in what

TABLE 2. The found relationships between the independent variables of this study

	Size of loan portfolio		Profit sensitivity to a rate rise		Industry cyclicity		Written interest rate risk manag. policy		Turnover		Uncert. over future rates	
	χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value
Solvency ratio	0.006	0.938	0.744	0.689	0.355	0.551	0.016	0.899	0.629	0.428	0.132	0.716
Uncert. over future rates	0.236	0.627	1.383	0.501	0.587	0.444	0.146	0.702	4.712	0.030		
Turnover	6.741	0.009	0.644	0.725	0.567	0.451	1.322	0.250				
Written interest rate risk manag. policy	5.376	0.020	1.604	0.448	0.049	0.825						
Industry cyclicity	2.200	0.138	0,840*	0.657								
Profit sensitivity to a rate rise	0.726	0.696										

* the requirements of the χ^2-test not met

95% or higher confidence level

Notes: The results of Table 2 are given with the help of χ^2 and p-values. The variables were compared pair wise with the χ^2-test, and the resulting values are shown in the table. The number of observations was 67 for the variables *Solvency ratio, Uncertainty over future rates, Turnover, Written interest rate risk management policy, Profit sensitivity to a rate rise,* and *Size of the loan portfolio*; and 49 for *Industry cyclicity*. The number of observations in comparing two variables is determined by the lower number of the observations concerning the compared variables. The companies were divided between 2–3 categories within each variable, depending on the variable.

direction the rates will move. Additionally, it has to be remembered that the uncertainty was measured on a subjective scale.

On the average, the independent variables of the model explained inadequately the interest rate risk management of a company. Although the variables managed to offer some explanations to the approach taken towards interest rate risk management, generally these relationships existed only between an independent variable and some of the dependent variables. For example, the *average interest rate maturity* did not seem to be determined by any of the independent variables examined. Furthermore, such variables as *uncertainty towards interest rate movements*, *solvency ratio* and *industry cyclicity* did not seem to have a clear relationship with any dependent variable. The χ^2 and p-values of the dependencies between the independent and the dependent variables are presented in Table 3.

TABLE 3. Dependencies between the independent and the dependent variables

	Size of loan portfolio		Profit sensitivity to a rate rise		Industry cyclicity		Written interest rate risk manag. policy		Turnover		Uncert. over future rates		Solvency ratio	
	χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value
Used methods	4.612	0.100	2,437	0.487	0.072	0.965	9.070	0.011	2,229	0.328	3,756	0.153	2.636	0.268
Scope of interest rate risk assessment	1.543	0.462	3,788	0.285	0.423	0.809	1.450	0.484	6,287	0.043	0,269	0.874	1.469	0.480
Hedging degree	3.250	0.071	2,933	0.087	0.000	1.000	1.348	0.246	1,575	0.209	0,495	0.482	0.577	0.447
Interest rate maturity of loans	0.977	0.323	0,901	0.343	0.032	0.858	0.175	0.676	2,177	0.140	0,362	0.547	0.467	0.494
Hedging instruments	13.017	0.000	8,313	0.040	0.376	0.540	2.857	0.091	1,270	0.260	0,271	0.603	0.000	1.000
Importance of interest rate risk management	11.980	0.003	1,207	0.547	0.558	0.757	3.758	0.153	3,169	0.205	4,442	0.109	0.507	0.776
							95% or higher confidence level							

Notes: The results of Table 3 are given with the help of χ^2 and p-values. The variables were compared pair wise with the χ^2-test, and resulting values are shown in the table. The number of observations was 67 for the variables Solvency ratio, Uncertainty over future rates, Turnover, Written interest rate risk management policy, Profit sensitivity to a rate rise, and Size of the loan portfolio; and 49 for Industry cyclicity. For the dependent variables, the number of observations was 67 for Used Methods, 67 for Scope of interest rate risk assessment, 60 for Hedging degree, 67 for Interest rate maturity of loans, 60 for Hedging instruments and 63 for Importance of interest rate risk management. The number of observations in comparing two variables is determined by the lower number of the observations concerning the compared variables. The companies were divided between 2–3 categories within each variable, depending on the variable.

As can be seen in Table 3, the best independent variable, measured by explanatory power, was the size of the company's loan portfolio. It is understandable that the size of the loan portfolio plays a major role, since a large loan portfolio in itself exposes a company to considerable interest rate risk. This is also illustrated by its relation to the importance of interest rate risk management. Additionally, with a strong confidence level, there seemed to be a connection between the size of the loan portfolio and the variety of used hedging instruments. This implies that the companies with a lot of debt think that no single instrument group alone is sufficient in hedging their position, and consider using a variety of different instruments more effective.

The effect that a rise in rates would have on the company's profit level seemed to affect the number of different categories of hedging instruments used. The companies using the widest variety

of hedging instruments appeared to be the ones, whose result would be negatively affected by a rise in rates. This is understandable, since at the time of the study, the rates were at a historically low level. Hedging against falling rates is probably not very common in these kinds of circumstances.

The existence of a written policy for interest rate risk management appeared to lead to a wider scope of methods applied in measuring risk exposure. This implies that as companies take a more systematic stance towards interest rate risk management, they also use a wider variety of methods in their risk management. The results further implicate that no single method alone is sufficient in the assessment of interest rate risk, so several complementary methods are needed; or alternatively, different methods are used to assess different elements of interest rate risk.

Another significant relationship was found between the firm size and the scope of interest rate risk management. One explanation for this can be that larger companies have a large number of different kinds of assets, so each group of assets constitutes a considerable source of interest rate risk. These results are supported by the findings of Hakkarainen et al. (1997), who found that larger firms more often assessed their interest rate risk (with a p-value 0.002).

As far as the individual goals were concerned, *minimizing the fluctuations in income* seemed to be the goal of most companies with a written interest rate risk management policy (p=0.0003), whereas it was a considerably less common goal for companies without one. *Minimizing fluctuations in income* was more common as a goal in larger companies than it was in smaller ones (p=0.045). Additionally, companies with a higher solvency ratio appeared to consider *minimizing fluctuations in income* more important (p=0.022), whereas companies with a lower solvency ratio were more concerned with *meeting the requirements of the financier* (p=0.025). Besides these relationships, no other connections between the independent variables and the individual goals existed at 95% confidence.

The connections of the independent variables were tested with more specific factors as well. Companies with a written interest rate risk management policy seemed to assess the interest rate risk of *loans and bonds* more often than companies without a written policy (p=0.014). Firms with bigger loan portfolios seemed to use *duration analysis* more often than companies with smaller portfolios (p=0.016), while companies with a written interest rate risk management policy used *average interest rate maturity* (p=0.023) and *gap analysis* (p=0.018) more often than companies without a written policy. Larger companies, on the other hand, used *duration analysis* (p=0.006) and *stress tests, sensitivity analysis and scenario analysis* (p=0.008) more often than smaller ones. The view of a more frequent use of duration analysis in bigger companies is supported Hakkarainen et al. (1997) (p=0.000). Conversely, they also reported more frequent use of gap analysis in larger companies (p=0.000 versus p=0.631 for this relationship in this study). Companies with bigger loan portfolios were more active users of *interest rate swaps* (p=0.003), *collars* (p=0.002) and *interest rate futures* (p=0.008) than companies with smaller debt portfolios. Also firms with

a written interest rate risk management policy seemed to use *interest rate swaps* considerably more often than companies without a written policy (p=0.001). Companies that were negatively affected by a rise in rates appeared to be more active in changing their *hedging degree* than companies not suffering from a rise (p=0.013). Finally, companies more confident in their capability of forecasting future rate development appeared to adjust their hedging degree more often than companies less certain of their forecasting abilities (p=0.024). This study did not find significant relationships between firm size and the use of the different instruments, whereas Hakkarainen et al. (1997) concluded that bigger firms used more often interest rate swaps (p=0.001), FRAs (p=0.000) and OTC options (p=0.004).

Success in Interest Rate Risk Management

Most of the companies (95%) expressed having been satisfied with their success in interest rate risk management (17% estimated having done *very well*, 65% *fairly well*, 18% *satisfactorily*), and only 5% indicated dissatisfaction. However, there might be a slight bias in the results since there is probably always some reluctance to admit failure.

The companies differed a lot in the way they measured the success of their interest rate risk management policy. There were 15 (23%, N=65) companies that did not measure success at all. The measurement of success was inquired in the form of an open question, and the most commonly mentioned methods were the following:

- Against a separately defined benchmark, e.g. a benchmark portfolio having certain characteristics (10 companies).
- By setting goals, e.g. a budget for interest rate expenses, and measuring how well they have been achieved (10 companies).
- Following the development of interest rate expenses (8 companies).

Additionally, there were several methods used in only one or a few companies. These results were roughly consistent with the results of Hakkarainen et al. (1997) although the use of a benchmark seems to be a new method, which was not widely used yet ten years ago. It seems that many companies consider their interest rate risk policy successful, if it simply leads to lower interest rate expenses compared to a market portfolio At least 28% of the companies in this study used an approach of this kind or a variation of it. This kind of an approach can easily lead to different results for success from year to year, and it is very responsive to the development of interest rates. This is not the right approach, since the goal of interest rate risk management should not be making a profit. Interest rate risk management, like financial risk management in general, should aim at minimizing the fluctuation in company income (Stulz, 1996) and guaranteeing the continuance of the business operations of the company (Kasanen et al., 1997, pp. 30–31).

The factors affecting the success were also studied with the help of the χ^2-test. Table 4 presents the findings. The answers for the perceived success were divided into three categories. The first category consisted of companies that estimated their success to have been *very good* (11 companies). The second category of companies estimated their success *fairly good* (41 companies), and the third category of companies indicated their success to have been *satisfactory* or not *completely satisfactory* (15 companies).

TABLE 4. Identification of the factors affecting the perceived success in interest rate risk management

	Perceived Success in interest rate risk management	
	χ^2	p-value
Hedging degree	9.850	0.007
Industry cyclicity	9.809	0,007*
The use of interest rate futures	7.039	0,030*
Scope of interest rate risk assessment	8.014	0,091*
The use of stress tests, scenario analysis or sensitivity analysis	5.385	0.068
Solvency ratio	3.112	0.211
Importance of interest rate risk management	2.911	0,573*
Scope of used hedging instruments	2.353	0.308
Number of methods used in interest rate risk management	2.224	0,695*
Profit sensitivity to a rate rise	1.351	0,853*
Turnover	1.334	0.513
Written interest rate risk management policy	1.167	0.558
Interest rate maturity of loans	1.090	0.580
Uncertainty over future rates	0.719	0.698
Size of loan portfolio	0.302	0.860
* the requirements of the χ^2-test not met	95% or higher confidence level	

Notes: The strength of the relationships was measured with the help of χ^2-test and p-values. 67 companies estimated their success in interest rate risk management. The number of observations was 60 for *Hedging degree*, 49 for *Industry cyclicity*, 60 for *the use of interest rate futures*, 60 for *the use of stress tests, scenario analysis and sensitivity analysis*, 63 for *Importance of Interest rate risk management*, 60 for *Scope of used hedging instruments*, and 67 for the other variables of Table 4.

As can be seen in Table 4, there did not appear to be very strong relationships between the explanatory variables and the perceived success. Nevertheless, some factors affecting the success were identified.

Somewhat surprisingly, companies hedging a smaller portion of their loans appeared to perceive their success in interest rate risk management to have been better than companies with a higher hedging degree. However, these results should not be interpreted so that hedging per se would lead to worse success in interest rate risk management. A more likely explanation is that since interest rates were at a historically low level at the time of the study, companies may have thought in those circumstances that their view on interest rate development should have guided

them towards a lower hedging degree. This, of course, assumes that the company adjusts its hedging degree based on its interest rate view. If this proposition is true, it implies that the lower perceived success would be either due to forecasting future rates erroneously, or to a failure to adjust the hedging degree according to the interest rate view. It would be interesting to know how the results would change, if interest rates were on a higher level. Anyway, based on the results of this study, it cannot be stated for certain why companies with a higher hedging degree considered their success in interest rate risk management to have been worse.

Most of the companies in non-cyclic industries estimated their success in interest rate risk management to have been *fairly good*. In cyclic industries, on the other hand, there appeared to be more deviation in the answers, with a considerable part of the companies estimating their success to have been *very good*, while others only *satisfactory* or *not completely satisfactory*. The bigger deviation in the answers of cyclic companies implies that interest rate risk management is somewhat more challenging in cyclic industries, but a successful interest rate risk management policy can also lead to good results.

When comparing the use of different hedging instruments to the perceived success in interest rate risk management, there was one notable relationship. Compared to the nonusers of futures, the users of futures appeared to perceive, on the average, that their success in interest rate risk management had been better. However, only 16 companies used futures, and there is no further evidence that the use of interest rate futures would contribute to better success in interest rate risk management.

A wider scope in interest rate risk assessment seemed to lead to better perceived success, but no statistical certainty for this proposition could be established. The use of more methods in interest rate risk management, on the other hand, did not appear to affect the perceived success. However, from the individual methods, the use of *stress tests, scenario analysis* or *sensitivity analysis* appeared to lead to better perceived success. This is consistent with the results of Figure 4, where the group of stress tests etc. received the best grade among the different methods for interest rate risk management.

It was somewhat surprising that the use of a written interest rate risk management policy did not lead to better success. This implies that more systematic interest rate risk management does not guarantee better success. It could also mean that interest rate risk management can be carried out successfully without a written interest rate risk management policy. Another explanation for the finding could be that, since the perceived success was based on a subjective estimate, companies with written interest rate risk management policies may simply have set their targets higher.

5. DISCUSSION ON THE VALIDITY AND RELIABILITY OF THE RESULTS

The reliability analysis is divided into the assessment of reliability and validity. After the reliability and validity have been evaluated, the generalizability of the results is assessed.

Reliability

Salant and Dillman (1994, pp. 205–206) divide the sources of error in surveys to coverage, overall non-response and sampling error. Aaker et al. (2001, p. 223) add the inaccuracy in the received answers to this list.

Since the persons answering to the questionnaire were busy executives, the existence of hastily given answers cannot be ruled out. However, when examining the results, very little inconsistencies or clearly erroneous answers were found. Most respondents had a very positive attitude to the survey, which supports the assumption that companies aimed at giving truthful answers. If a company was not interested in the survey, it most likely simply did not take part in it. Even if there were errors in the answer, their number is likely to have been small, and their effect on the final results very limited.

The average size of the respondents was somewhat larger than the average company size in the sample. The χ^2-test was used to examine, whether the responding companies represented a random sample of all the companies within the scope of the study. The resulting p-value was 0.035, implying that the responding companies did not represent a random sample. Specifically, the category of companies having a turnover of 250–500 MEUR was underrepresented. However, since the goal was to examine large Finnish companies in particular, this was not considered to cause bias to the results.

The goal set for the response ratio was exceeded, and most respondents gave answers to all, or nearly all the questions. Thus, non-response was not considered a source of error. Subjective answering alternatives were used in several questions, which makes the reliability of the answers to those questions somewhat more vague. However, the use of subjective alternatives was justified considering the nature of the data sought in those questions.

Validity

The validity of the questionnaire is supported by several facts. The questionnaire was first designed with the help of several experts in the area of interest rate risk management, and then other specialists in the area tested the questionnaire. Although most questions had comment fields available, they were seldom used by the respondents, and the options offered seemed to cover the most common alternatives. Furthermore, only one company criticized the applicability of the survey. This critique was targeted only at an individual question. In this case, the practice used

in the company seemed to be quite unique. With the help of the comment field, the company was able to answer to this question as well.

The question that inquired about the effect a rise in rates would have on the financial result of the company was formulated somewhat ambiguously, and therefore, some companies may have understood the question differently than others. Although it was not explicitly stated in the question, the goal of the question was to examine the profit sensitivity of a company to a rise in interest rates without the effect of hedging instruments. However, the formulation of the question allows interpreting the question also so that the effect of hedging is taken into consideration when estimating the effect of a rise in rates. The chance of this kind of interpretation cannot be ruled out when examining the findings based on this question.

When the results of our study and the one by Hakkarainen et al. (1997) are compared, the differences in the economic environment should be taken into consideration. Hakkarainen et al. carried out their study in the spring of 1994, when interest rates were decreasing. Conversely, at the end of 2004, the time of this study, rates were extremely low, and the next move was expected to be upwards. Furthermore, today the single currency euro is used in the Euro zone, and the European Central Bank decides for the monetary policy of the entire area. On the contrary, in 1994, the Bank of Finland conducted independent monetary policy and a national currency, the Finnish markka, was in use.

The validity of the model presented (see Figure 6) for the determinants of interest rate risk management was tested with a statistically reliable method, but the possibility that the model itself is imperfect remains. One may disagree with the factors presented in the model, and another researcher may come up with a different model. Therefore, based on the results of this study, there is no certainty that the model identifies all the significant factors affecting interest rate risk management.

Generalizability of the Results

Since the companies studied were large, and size seemed to be a factor affecting the interest rate risk management practice to at least some extent, one should be very careful in generalizing the results to small or mid-sized companies. Therefore, finding out about the interest rate risk management practices of small and mid-sized companies is a task for further research.

Compared to earlier research done in other countries, there seemed to be both similarities and dissimilarities in the results. Therefore, the results should not be generalized to other countries, at least not without caution. Within the Euro zone, the economic environment between different countries is comparable to some extent, and the results can probably be generalized with caution. However, especially outside the Euro area, the risk management practices of companies can differ a lot from the practices of Finnish companies.

Finally, since interest rate risk has a totally different meaning for financial companies, these results should not be used to portray their interest rate risk management behavior. The main application area of the results of this study is thus within large Finnish non-financial companies.

6. CONCLUSIONS

Most companies take a systematic view on interest rate risk management, which is best illustrated by the fact that the majority of firms have a written interest rate risk management policy. This is in accordance with the results of Ernst & Young (2004) on the interest rate risk management of mostly British companies, as well as with the results of Bodnar et al. (1998) on U.S. non-financial firms. Interest rate risk management is mostly centered on the financial position of companies, and assessing at least the interest rate risk of loans and bonds seems to be common practice. Although interest rate risks related to income, fixed assets, working capital and equity are assessed in some companies, their interest rate risk assessment in general appears to be largely on a theoretical level. Generally, the assessment of interest rate risk seems to be more widespread according to the results of this study than according to the results of Hakkarainen et al. (1997). This implies interest rate risk is assessed more often in Finnish companies today than ten years ago. The small portion of companies not assessing their interest rate risk at all is consistent with the results of the Ernst & Young (2004), whereas Fatemi (2000) found interest rate risk management to be less common among large German companies. The results of Fatemi (2000) thus suggest that interest rate risk would be assessed somewhat less often in German firms.

There seems to be no consensus about the optimal scope of interest rate risk management among the studied companies. It seems that most companies are satisfied with assessing only the interest rate risk of their financial items. For companies, whose financial position forms the majority of their total assets, this kind of approach may well be sufficiently accurate. However, the results of this study imply that there are plenty of companies, which should at least consider widening the scope of their interest rate risk assessment.

The assessment of interest rate risk should start from examining the effects that changes in interest rates would have on the business operations of the company. However, it seems that in many companies, the approach taken to interest rate risk management, and the estimation of its success, is based on the development of interest rate expenses. This finding is in line with the results of Hakkarainen et al. (1997). A company using this kind of an approach should consider, whether it really is in accordance with the goals of its interest rate risk management.

A wide variety of methods are available for managing interest rate risk, all with their own strengths and weaknesses. The widespread use of the methods *target for fixed-to-floating ratio of loans* and *average interest rate maturity* seems to indicate that many companies consider them

adequate for their needs. This supports the findings of Ernst & Young (2004) and Hakkarainen et al. (1997). These methods are simple to use, their use does not require sophisticated data systems or extensive resources, and they are easy for the investors to understand. Other companies, however, considered their use totally insufficient, and thought that they cover only a small part of the total interest rate risk. Therefore, other methods should be used at least to complement the simpler ones.

The companies find no considerable differences in the suitability of the different methods for interest rate risk management. Every method examined in this study appears to have companies preferring its use, while others find the same method unsuitable. On the average, the group of *stress tests, sensitivity analysis* and *scenario analysis* is considered most suitable. The use of a method from this group also seems to lead to better results, as far as the perceived success in interest rate risk management is concerned.

In accordance with the results of Hakkarainen et al. (1997), most companies use derivatives in hedging their interest rate risk. Correspondingly, Fatemi's (2000) and Ernst & Young's (2004) results implied that derivatives usage is very common in large German and British companies. These studies showed more frequent derivative use than the results of Bartram et al. (2004). However, the results of Bartram et al. may be somewhat distorted by their choice of research method. According to our findings, interest rate swaps are the most commonly used hedging instrument. This is in line with Hakkarainen et al. (1997), Bartram et al. (2004) and Bodnar et al. (1998).

In the framework constructed to model the determinants of companies' interest rate risk management behavior, the relationships between the explanatory variables and the resulting interest rate risk management policy were weaker than anticipated. None of the explanatory variables alone did a great job of explaining the interest rate risk management behavior of Finnish firms. Among the chosen explanatory variables, the existence of a systematic approach towards interest rate risk management, and the magnitude of exposure appeared to be the best determinants. This result implies that interest rate risk management is very complex, and the risk management policy a company chooses to pursue is not determined by a few broad variables alone. This proposition is supported by Brown and Chew (1999, p. xiv), who state that corporate risk management is inherently complex. Another possible explanation is that all the most important variables simply were not identified in this study. The scope of the study, together with keeping the questionnaire within a reasonable length, limited the examination of a larger number of variables. Enhanced analysis of the determinants of interest rate risk management could be a subject for further research.

The magnitude of exposure was most strongly connected with the use of interest rate swaps, the scope of used hedging instruments and the importance of interest rate risk management. Since most companies considered the financial position to constitute the main source of interest rate

risk, it is natural that the magnitude of exposure in this position is an important determinant for how the companies approach interest rate risk, and how important they consider it to be. Further, it is understandable that companies having the largest exposure are also more active users of hedging instruments. In contrast, Hakkarainen et al. (1997) did not find any significant association between the degree of leverage and the use of hedging instruments. However, this can be explained by the fact that they measured leverage with the help of the solvency ratio, and the associations in this study were to the absolute size of the loan portfolio. This study did not find any notable associations between the solvency ratio and use of hedging instruments.

According to the results of this study, a systematic approach towards interest rate risk seems to affect especially the use of interest rate swaps, the number of different methods used in interest rate risk management, and having minimizing fluctuations in income as an important goal. Since most companies require that a systematic approach is taken towards the use of derivatives, it is understandable that the companies being more active users of interest rate swaps are the companies having a systematic approach also towards interest rate risk. The same applies to the number of used methods since the simultaneous use of different methods most likely requires a lot of documentation and attention paid to their use.

The companies appear to be, on the average, satisfied with the success of their interest rate risk management policies. These results are broadly in line with the results of Hakkarainen et al. (1997). They asked companies to estimate the success on a 7-step scale, and 62.7% of the answers indicated top-three grades. The respondents of our study typically measure the success against a separately defined benchmark or by explicitly setting goals and measuring their achievement. Following interest rate expenses is often used as a measure as well, which was also concluded by Hakkarainen et al. (1997). However, the use of a benchmark seems to considerably more common than in the results of Hakkarainen et al., suggesting that this method has become more popular. The wide variety of used methods implies that there is no single method that would be considered clearly superior to the other ways of measuring the success. On the other hand, 23% of the companies do not measure success at all. This is in slight contradiction with the results of Hakkarainen et al. (1997), who found measuring success to be considerably more common. This implies that although interest rate risk management seems to have become more common in the past ten years, measuring its success has become less common. One possible explanation is that there are now more companies, who perform interest rate risk management on a small scale, but do not consider the area important enough to measure its success.

There is some indication that a wider scope of interest rate risk assessment and the use of a method from the group of *stress tests, scenario analysis and sensitivity analysis* could lead to better perceived success in interest rate risk management. It seems then that a wider scope of interest rate risk management would pay off, at least according to the self-assessment of the compa-

nies. It also appears that *stress tests*, *scenario analysis* and *sensitivity analysis* are good methods for measuring interest rate exposure. These methods have a lot of similar characteristics, which is why they have been combined to a single category in this study. Still, it would be possible to study the matter further by distinguishing these methods from each other, and trying to find out, whether one of these methods is superior to the others.

Companies hedging less of their loans appear to perceive their success in interest rate risk management to have been better. However, one explanation for this may be that since interest rates were at historically low levels at the time of the study, a low hedging degree in those conditions may seem to have been the best choice. Industry cyclicity seems to affect the perceived success as well. The companies in non-cyclic industries estimate most often their success in interest rate risk management to have been fairly good. In cyclic industries, on the other hand, there is more deviation in the answers, with many companies estimating their success to have been very good, while others only satisfactory or not completely satisfactory. Somewhat surprisingly, the existence of a written interest rate risk management policy does not seem to affect the perceived success.

The results of this study bring new knowledge in the area of interest rate risk management in large Finnish non-financial companies. Although the results are limited in some aspects, they serve as a portrayal of how interest rate risk is managed today in large non-financial companies in Finland. ■

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