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# How do Croatian Companies make Corporate Risk Management Decisions: Evidence from the Field

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**Abstract**

According to the Capital Asset Pricing Model and the Modigliani-Miller theorem, corporate risk management is irrelevant to the value of the firm. However, it is apparent that managers are constantly engaged in hedging activities that are directed at the reduction of corporate risks. As an explanation for this clash between theory and practice, imperfections in the capital market are used to argue for the relevance of corporate risk management function. This paper analyses corporate risk management practices and decision to hedge in large Croatian non-financial companies. It explores if decision to hedge corporate risks in the analysed companies is a function of several firm's characteristics that have been proven as relevant in making risk management decisions.

**Keywords**

corporate risk management decision, hedging rationales, shareholder value maximisation, managers' private utility maximisation, large Croatian non-financial companies

**JEL classification**

G320, G390

## 1. Introduction

For a long time it was believed that corporate risk management[1] is irrelevant to the value of the firm and the arguments in favour of the irrelevance were based on the Capital Asset Pricing Model (Sharpe, 1964; Lintner, 1965; Mossin, 1966) and the Modigliani-Miller theorem (Modigliani and Miller, 1958). One of the most important implications of CAPM is that diversified shareholders should care only about the systematic component of total risk. This implies that managers of firms who are acting in the best interests of shareholders should be indifferent about hedging of risks that are unsystematic. Miller and Modigliani's proposition supports CAPM findings. The conditions underlying MM propositions also imply that decisions to hedge corporate exposures to interest rates, exchange rates and commodity prices are completely irrelevant because stockholders already protect themselves against such risks by holding well-diversified portfolios.

Despite the fact that, in the basic MM world, hedging does not alter firm value, markets where derivatives are traded are dominated by corporations and institutions, not by individuals trading for their personal accounts. In the real world, financial managers and treasurers give a great deal of thought to matters of capital structure and securities design. Additionally, the corporate use of derivatives in hedging different kinds of corporate risks (e.g. interest rate, currency or commodity price risks) is widespread and growing. As an explanation for this clash between theory and practice, imperfections in the capital market are used to argue for the relevance of corporate risk management function. Research in the 1980s and 1990s has extended the knowledge on risk management by examining the unique characteristics of large, widely held corporations. Based on work by Mayers and Smith (1982) in the area of the corporate demand for insurance, scholars such as Stulz (1984), Smith and Stulz (1985) and Shapiro and Titman (1998) have examined why large, well-diversified firms actively engage in hedging activities. The authors demonstrated several theories of hedging which overcome the irrelevancy arguments of modern portfolio and corporate finance theory. Most of these theories rely on the introduction of frictions into the MM model, and argue that market imperfections enable firms to add value through hedges that can not be exactly duplicated by individual investors.

## 2. Literature review

Scholars have constructed two classes of explanations or determinants for management concern with hedging of non-systematic risk, which overcome the irrelevancy arguments of modern portfolio and corporate finance theory. The first class of explanations focuses on risk management as a mean to maximise shareholder value, and the second focuses on risk management as a mean to maximise managers' private utility.

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. The first theory suggests that, by reducing the volatility of cash flows, firms can decrease costs of financial distress (Mayers and Smith, 1982; Myers, 1984; Stulz, 1984; Smith and Stulz, 1985; Shapiro and Titman, 1998). In the MM world, financial distress is assumed to be costless. Hence, altering the probability of financial distress does not affect firm value. If financial distress is costly, firms have incentives to reduce its probability, and hedging is one method by which a firm can reduce the volatility of its earnings. By reducing the variance of a firm's cash flows or accounting profits, hedging decreases the probability, and thus the expected costs, of financial distress. Additionally, Smith and Stulz (1985) have argued that, while the reduction of financial distress costs increases firm value, it augments shareholder value even further by simultaneously raising the firm's potential to carry debt. Corporate risk management lowers the cost of financial distress, which leads to a higher optimal debt ratio and the tax shields of the additional debt capital further increases the value of the firm. This theory has been empirically proven by, among others, Campbell and Kracaw, 1987; Bessembinder 1991; Dolde, 1995; Mian, 1996 and Haushalter 2000.

The second hedging rationale suggests that, by reducing the volatility of cash flows, firms can decrease agency costs (see: Jensen and Meckling, 1976). According to Dobson and Soenen (1993) there are three sound reasons based on agency costs why management should hedge corporate risk. First, hedging reduces

[1] In this paper, financial risk is equated with the corporate risk, and the analysis includes interest-rate, exchange-rate and commodity price risk management.

uncertainty by smoothing the cash flow stream thereby lowering the firm's cost of debt. Since the agency cost is borne by management, assuming informational asymmetry between management and bondholders, hedging will increase the value of the firm. Therefore, management will rationally choose to hedge. Second, given the existence of debt financing, cash flow smoothing through exchange risk hedging will tend to reduce the risk-shifting as well as the underinvestment problems (see Jensen and Smith, 1985). Finally, hedging reduces the probability of financial distress and thereby increases duration of contractual relations between shareholders. By fostering corporate reputation acquisition, hedging contributes directly to the amelioration of the moral-hazard agency problem. Results of MacMinn (1987), MacMinn and Han (1990), Bessembinder (1991), Minton and Schrand (1999) and Haushalter, Randall and Lie (2002) support this hedging rationale.

Another theory that focuses on risk management as a mean to maximise shareholder value argue that, by reducing the volatility of cash flows, firms can decrease expected taxes. This rationale is put forward by Smith and Stulz (1985) who have argued that the structure of the tax code can make it beneficial for the firms to take positions in futures, forward, or option markets. If a firm faces a convex tax function, then the after-tax value of the firm is a concave function of its pre-tax value. If hedging reduces the variability of pre-tax firm values, then the expected tax liability is reduced and the expected post-tax value of the firm is increased, as long as the cost of the hedge is not too large. By reducing the effective long run average tax rate, activities which reduce the volatility in reported earnings will enhance shareholder value. More convex the effective tax schedule is, the greater is the reduction in expected taxes. This rationale has been supported by Zimmerman (1988), Froot, Scharfstein and Stein (1993), Nance, Smith and Smithson (1993), Mian (1996) and Graham and Smith (1996).

In addition, reducing cash flow volatility can improve the probability of having sufficient internal funds for planned investments eliminating the need either to cut profitable projects or bear the transaction costs of obtaining external funding. The main hypothesis is that, if access to external financing (debt and/or equity) is costly, firms with investment projects requiring funding will hedge their cash flows to avoid a shortfall in their funds, which could precipitate a costly visit to the capital markets. An interesting empirical insight based on this rationale is that firms which have substantial growth opportunities and face high costs when raising funds under financial distress will have an incentive to hedge more of their exposure than the average firm. This rationale has been explored by numerous scholars, among others by Smith and Stulz (1985), Stulz (1990), Lessard (1990), Shapiro and Titman (1998), Hoshi, Kashyap and Scharfstein (1991), Froot, Scharfstein and Stein (1993), Getzy, Minton and Schrand (1997), Gay and Nam (1998), Graham and Rogers (1999), Minton and Schrand (1999), Haushalter (2000), Mello and Parsons (2000), Allayannis and Ofek (2001) and Haushalter, Randall and Lie (2002).

Other line of reasoning that differs from the shareholders value maximisation hypothesis refers to the managerial utility maximisation hypothesis. It has been argued that firm managers have limited ability to diversify their own personal wealth position, associated with stock holdings and the capitalisation of their career earnings associated with their own employment position. Therefore, they will have an incentive to hedge their own wealth on the expense of the shareholders. Usually that kind of hedging is not conducted to improve value of company's stockholders but to improve managers own wealth. To avoid this problem, managerial compensation contract must be designed so that when managers increase the value of the firm, they also increase their expected utility. This can usually be obtained by adding option-like provisions to managerial contracts. This rationale was firstly proposed by Stulz (1984) and has been further explored by Smith and Stulz (1985). Results of some empirical studies have confirmed this hypothesis (e.g. see: Tufano, 1996; Gay and Nam, 1998) while, in contrast, Geczy, Minton and Schrand (1997) and Haushalter (2000) have not found evidence that corporate hedging is affected by managerial shareholdings.

A very different managerial theory of hedging, based on asymmetric information, has been presented by Breeden and Viswanathan (1990) and DeMarzo and Duffie (1992), who have focused on managers' reputations. In both of these models, it is argued that managers may prefer to engage in risk management activities in order to better communicate their skills to the labour market. Breeden and Viswanathan (1990) and DeMarzo and Duffie (1992) have argued that younger executives and those with shorter tenures have less developed reputations than older as well as longer-tenure managers. Therefore, they are more willing to embrace new concepts like risk management with the intention to signal their management quality. Tufano (1996) has tested these assumptions and found that there is no meaningful relationship between CEO and CFO age and the extent of risk management activity. However, he has proven that firms whose

CFOs have fewer years in their current job are more likely to engage in greater risk management activities, confirming the hypothesis that newer executives are more willing to engage in risk management activities than are their counterparts with long-tenures. Thus, the results can be seen as consistent with Breeden and Viswanathan (1996) and DeMarzo and Duffie (1992) theory.

Results of empirical studies have also proven that benefits of risk management program depend to the size of the company. Nance, Smith and Smithson (1993), Dolde (1995), Mian (1996), Getzy, Minton and Schrand (1997) and Hushalter (2000) have argued that larger firms are more likely to hedge. One of the key factors in the corporate risk management rationale pertains to the costs of engaging in risk-management activities. The cost of hedging includes the direct transaction costs as well as the agency costs of ensuring that managers transact appropriately. Transaction costs of hedging include the costs of trading, as well as the substantial costs of information systems needed to provide the data necessary to decide on the appropriate hedging positions to take. The agency costs that such activities bring include the costs of the internal control systems to run the hedging program. These costs are associated with the opportunities for speculation that participation in derivative markets allows. The assumption underlying this rationale is that there are substantial economies of scale or economically significant costs related to hedging. Indeed, for many firms (particularly smaller firms), the marginal benefits of a hedging program may be exceeded by the marginal costs. These facts suggest there may be sizable set-up costs related to operating a corporate risk-management program. Thus, numerous firms may not hedge at all, even though they are exposed to financial risks, simply because it is not an economically worthwhile activity. On the basis of the empirical results, it can be argued that only large firms with sufficiently large risk exposures are likely to benefit from a formal hedging program.

## 3. Corporate Risk Management in Croatian Companies

### 3.1. Methodology and Data Collection

Empirical research was conducted on the largest Croatian non-financial companies because these companies should have a developed risk management programme. Companies needed to meet two out of three conditions required by the Croatian Accounting Law[2] that relate to large companies to be selected in the sample - 1) a value of total assets higher than 108 million kuna, (2) income in the last 12 months higher than 216 million kuna, and/or (3) annual number of employees higher than 250. A list of the largest 400 Croatian companies in the year 2005[3] has been used and 157 companies that have met the required criteria were selected in the sample. The primary advantage of this sample is that the evidence can be generalised to a broad class of firms in different industries. Financial firms were excluded from the sample because most of them are also market makers, hence their motivation in using risk management instruments (e.g. derivatives) may be different from the motivations of non-financial firms.

The greatest challenge of this research was to find an appropriate data set, because the analysed companies have not been very public about their risk management activities. Data were collected from two sources: from annual reports and notes to the financial statements for the fiscal year 2005, and through the survey. We relied more on the survey data than on the annual reports due to the fact that not all of the analysed Croatian companies were obliged to report risk management activities in notes to the financial statements. This obligation refers only to those companies that are listed on the stock-exchange, while many companies in our sample are not public joint-stock companies.

The questionnaire was mailed at the beginning of September 2006 to the firm's chief financial officer or, if there was no such position, to the financial controller or the treasurer. The implicit assumption was that these are the persons most likely to have the relevant information. The questionnaires were addressed to a specific individual. It should be emphasised that the problem with a survey is that the person who fills in the questionnaire out does not necessarily have the relevant information or the motivation to provide careful and truthful answers. Moreover, questions are not always interpreted correctly. We tried to gauge accuracy in different ways. First, we wanted to make sure that the people who completed the questionnaire had the information we were interested in. This is why the questionnaire was sent to the chief financial

[2] In Croatian: Zakon o računovodstvu, Narodne novine 146/05.
[3] The list has been published by the special edition of Privredni vjesnik (Business Herald).

officer or to the controller and the treasurer of the firm. Then we asked firms to tell us who actually filled out the questionnaire. In the vast majority of the cases (more than 90 per cent), the answering person was indeed, at least apparently, the CFO, the treasurer or the controller. Unless people who complete the questionnaire are dishonest or careless, we should therefore have received accurate information.

In order to encourage willingness to participate, the respondents were promised a copy of the summarised results. Only 19 companies answered by the end of September, so a follow-up letter was sent to the non-respondents. Sending a follow-up letter encouraged a response rate from 12 to 31 per cent. An adequate response rate is the problem that has been often raised in research based on a survey. We believe that the accomplished response rate is satisfactory for statistical generalisation (e.g. the response rate of the 1998 Wharton survey of derivate usage, as reported in Bodnar, Hayt and Marston (1998) is 21 per cent). However, it is important to mention that the inability to compare the survey results to the data of non-responding companies should be treated as a limitation of this research.

Survey data were statistically analysed by using both univariate and multivariate analysis. We have used the independent sample t-test to calculate the differences between means for Croatian hedgers and nonhedgers. Independent sample t-test enables a calculation of statistically significant differences between small and mutually unrelated parametric samples (Bryman and Cramer, 1997). Croatian research sample was small, unrelated and parametric. In addition, research data were of a non-categorical nature (interval/ratio data), therefore t-test was found as the most suitable for univariate analysis. Additionally, correlation analysis was conducted by calculating Pearson's correlation coefficient as it is the most common measure of linear correlation when variables are of interval/ratio nature.

Regarding the multivariate analysis, binominal logistic regression was estimated to distinguish between the possible explanations for the decision to hedge corporate risks. Binomial (or binary) logistic regression has been selected because it is a form of regression that is used when the dependent variable is a dichotomy (limited, discrete and not continuous) and the independents are of any type[4] (Hosmer and Lemeshow, 1989; Rice, 1994; Allison, 1999; Menard, 2002). In our research the dependent variable was binary, while explanatory variables which were used to test research hypothesis were discrete as well as continuous, so the logistic regression model was a justified choice.

### 3.2. Research Hypotheses

Based on the arguments that arise from the presented literature survey, several hypotheses have been proposed in this paper. First we argue that hedging can increase the value of the firm by reducing the costs associated with financial distress, the agency costs of debt, expected taxes and capital market imperfections. These premises are known as the shareholder maximisation hypothesis and are tested in the following assumptions. The argument of reducing the costs of financial distress implies that the benefits of hedging should be greater the larger the fraction of fixed claims in the firm's capital structure. The agency cost of debt argument implies that the benefits of hedging should be greater the higher the firm's leverage and asymmetric information problem. The argument of costly external financing implies that the benefits of hedging should be greater the more growth options are in the firm's investment opportunity set. The tax hypothesis suggests that the benefits of hedging should be greater the higher the probability that the firm's pre-tax income is in the progressive region of the tax schedule, and the greater the value of the firm's tax loss carry-forwards, investment tax credits and other provisions of the tax code. Additionally, the informational and transactional scale economies argument implies that larger firms will be more likely to hedge. Therefore, a positive relation between decision to hedge and a company's size, leverage, asymmetric information problem, investment (growth) opportunities and expected taxes has been predicted.

The next group of assumptions regards the managerial utility maximisation hypothesis. We argue that, due to the fact that a firm's managers have limited ability to diversify their own personal wealth position associated with the stock holdings and the capitalisation of their career earnings, they have strong incentives to hedge. We test the hypothesis that managers with greater stock ownership would prefer more

[4] With a categorical dependent variable, discriminant function analysis is usually employed if all of the predictors are continuous and nicely distributed; logit analysis is usually employed if all of the predictors are categorical; and logistic regression is often chosen if the predictor variables are a mix of continuous and categorical variables and/or if they are not nicely distributed (logistic regression makes no assumptions about the distributions of the predictor variables).

risk management, while those with greater option holdings would prefer less risk management. Additionally, firms with younger managers and those whose managers have shorter tenures on the job would be more inclined to manage risk.

### 3.3. Research Variables

A dependent variable has been created in the form of a binary (dichotomous) measure and was coded as "1" for those firms that hedge corporate risks and "0" for those firms that do not hedge corporate risks. In the group of companies named "hedgers" we included not only companies that use derivatives instruments as an instrument of corporate risk management, but also companies that use other types of hedging strategies like operational hedging, natural hedging, international diversification of business etc. The majority of the earlier empirical studies on risk management such as Nance, Smith and Smithson (1993), Mian (1996), Geczy, Minton and Schrand (1997), Allayannis and Weston (2001) and Cummins, Phillips and Smith (2001) have used a dichotomous variable that equalled one if a firm has used derivatives and zero if it has not. Because of the decision to include all corporate risk management activities, our dichotomous variable should not be subject to the inaccurate categorisation of functionally-equivalent financial position. This has allowed us to disentangle derivatives activity from risk management activity, which is a major advantage of our approach.

To examine the hypothesis regarding the reduction of the financial distress cost and the informational and transactional scale economies argument, the size of the company and the firm's leverage have been employed. The size of a company was measured by using two alternative proxies - the book value of assets (Haushalter, 2000; Hoyt and Khang, 2000; Allayannis and Weston, 2001; Allayannis and Ofek, 2001) and the book value of total sales revenues (Allayannis and Weston, 2001). Leverage was also used as a proxy for the impact of fixed claims on the decision to hedge. Three different measures were constructed for the degree of a firm's financial leverage. First, financial leverage was defined as the ratio of the book value of long-term debt to the book value of assets (Tufano, 1996; Nance, Smith and Smithson, 1993; Geczy, Minton and Schrand, 1997), while the other measures were the ratio of the book value of long-term debt to the book value of equity (Hoyt and Khang, 2000; Allayannis and Weston, 2001; Mian, 1996) and the interest cover ratio defined as earnings before interest and taxes to the total interest expense (Geczy, Minton and Schrand, 1997; Nance, Smith and Smithson, 1993). The coefficients on all variables presented were predicted to be positive.

A binary variable was used to indicate whether a firm is rated by the rating agencies, what was a proxy for asymmetric information problem. The variable was coded as "1" for companies that have credit rating and "0" otherwise. Everything else being equal, firms with credit rating have undergone more capital market scrutiny and are thus assumed to face fewer informational asymmetries than ones with no rated debt (Barclay and Smith, 1995b). Therefore, firms with a credit rating are predicted to hedge less extensively, while firms with greater informational asymmetry will benefit greatly from risk management activity (DeMarzo and Duffie, 1991; Haushalter, 2000). The coefficient on this variable was predicted to be negative.

Investment (growth) opportunities were measured as the ratio of investment expenditures to the book value of assets (Haushalter, 2000; Froot, Scharfstein and Stein, 1993; DeMarzo and Duffie, 1991; Geczy, Minton and Schrand, 1997; Smith and Stulz, 1985). Investment opportunities are also measured as the ratio of investment expenditures to the value of total sales (DeMarzo and Duffie, 1991; Froot, Scharfstein and Stein 1993; Geczy, Minton and Schrand, 1997; Smith and Stulz, 1985; Dolde, 1995). The coefficients on these variables were predicted to be positive.

To examine the tax hypothesis, we have used several measures of the firm's effective tax function - total value of the tax loss carry-forwards and tax-loss carry-backs (Nance, Smith and Smithson, 1993), total value of the tax loss carry-forwards plus tax-loss carry-backs to the total assets (Smith and Stulz, 1985; Geczy, Minton and Schrand, 1997; Tufano, 1996), investment tax credits used to offset income tax payable (Nance, Smith and Smithson, 1993) and finally a dummy variable that is equal to 1 if a firm has tax loss carry-forwards, tax-loss carry-backs or investment tax credits, and 0 otherwise (Allayannis and Ofek, 2001). The coefficients on all variables were predicted to be positive.

The level of a manager's firm-specific wealth is represented in two ways - by the book value of the firm's equity owned by officers and directors (Tufano, 1996; Geczy, Minton and Schrand, 1997) and by the fraction of the firm's outstanding shares held by officers and directors (Hoyt and Khang, 2000; Haushalter, 2000). The incentives for managers to hedge should be increasing in both these variables (Smith and Stulz, 1985), therefore the coefficients were predicted to be positive. The extent to which options are used in managers' compensation is gauged using a binary variable that equals one if managers of a firm own stock options and zero otherwise. We have predicted this proxy to be negatively related with the extent of hedging. We have employed two additional measures that proxy for risk aversion of the manager - manager age and tenure or human capital vested in the firm (Tufano, 1996). We have predicted that younger managers and those whose managers have shorter tenures on the job would be more inclined to manage risk.

## 3.4. Research Results

In this section we present the results of univariate and multivariate analysis. According to a mean comparison test conducted for the sub-sample of hedgers/nonhedgers (see: tables 1 and 2), our univariate analysis has discovered that hedgers are not statistically different from nonhedgers with respect to the cost of financial distress, agency cost of debt, investment (growth) opportunities, tax preference items or managerial utility. Correlation analysis has also shown no relation between tested variables. In other words, on the basis of the univariate results, we should reject all research assumptions regarding the shareholder maximisation hypothesis and the managerial utility maximisation hypothesis.

Table 1. Group statistics Croatian hedgers/non-hedgers

| | **Hedgers/Nonhedgers** | **N** | **Mean** | **Std. Deviation** | **Std. Error Mean** |
|---|---|---|---|---|---|
| Total assets | Companies that do not manage financial risks | 13 | 116,660.15 | 169,885.68 | 47,117.81 |
| | Companies that manage financial risks | 36 | 314,742.00 | 687,747.11 | 114,624.52 |
| Total sales revenues | Companies that do not manage financial risks | 13 | 58,597.77 | 44,758.38 | 12,413.74 |
| | Companies that manage financial risks | 36 | 154,467.42 | 243,697.19 | 40,616.20 |
| Debt rating | Companies that do not manage financial risks | 13 | 7.692E-02 | .2774 | 7.692E-02 |
| | Companies that manage financial risks | 36 | .2500 | .4392 | 7.319E-02 |
| Long-term debt-to-assets ratio | Companies that do not manage financial risks | 13 | .227984 | .177947 | 4.93537E-02 |
| | Companies that manage financial risks | 35 | .213244 | .186513 | 3.15264E-02 |
| Long-term debt-to-equity ratio | Companies that do not manage financial risks | 13 | 1.855125 | 4.423624 | 1.226892 |
| | Companies that manage financial risks | 35 | 1.494286 | 3.997587 | .675716 |
| Interest cover ratio | Companies that do not manage financial risks | 13 | 14.194680 | 27.878622 | 7.732139 |
| | Companies that manage financial risks | 31 | 8.193411 | 21.920321 | 3.937006 |
| Investment expenditures-to-assets ratio | Companies that do not manage financial risks | 13 | 4.55073E-02 | 4.59472E-02 | 1.27435E-02 |
| | Companies that manage financial risks | 36 | .104053 | .116531 | 1.94218E-02 |
| Investment expenditures-to-sales ratio | Companies that do not manage financial risks | 13 | 5.22958E-02 | 5.73013E-02 | 1.58925E-02 |
| | Companies that manage financial risks | 36 | .293079 | .701630 | .116938 |
| Total value of tax loss carry-forward and carry backs | Companies that do not manage financial risks | 13 | 86,849.3077 | 271,609.6296 | 75,330.9574 |
| | Companies that manage financial risks | 36 | 24,927.7222 | 93,360.1516 | 15,560.0253 |
| Total value of tax loss carry-forward and carry backs-to-total assets | Companies that do not manage financial risks | 13 | 2.474096 | 8.627105 | 2.392728 |
| | Companies that manage financial risks | 36 | 7.86145E-02 | .300018 | 5.00030E-02 |
| Investment tax credits | Companies that do not manage financial risks | 13 | 743.0769 | 2,679.2019 | 743.0769 |
| | Companies that manage financial risks | 35 | 133.1143 | 474.5025 | 80.2056 |
| Tax incentives-dummy | Companies that do not manage financial risks | 13 | .5385 | .5189 | .1439 |
| | Companies that manage financial risks | 36 | .3056 | .4672 | 7.786E-02 |

| | | | | | |
|---|---|---|---|---|---|
| Value of equity owned by managers | Companies that do not manage financial risks | 13 | 3,354.685 | 5,429.100 | 1,505.761 |
| | Companies that manage financial risks | 36 | 8,330.786 | 21,300.245 | 3,550.041 |
| Share of the company owned by management | Companies that do not manage financial risks | 13 | .34574 | .44983 | .12476 |
| | Companies that manage financial risks | 36 | .13734 | .27567 | 4.5945E-02 |
| Managers ownership of stock options | Companies that do not manage financial risks | 12 | 8.33E-02 | .29 | 8.33E-02 |
| | Companies that manage financial risks | 36 | .11 | .32 | 5.31E-02 |
| Managers age | Companies that do not manage financial risks | 13 | 3.31 | .95 | .26 |
| | Companies that manage financial risks | 36 | 3.28 | .91 | .15 |
| Managers tenure | Companies that do not manage financial risks | 13 | 15.15 | 9.21 | 2.55 |
| | Companies that manage financial risks | 36 | 11.33 | 10.69 | 1.78 |

*Source:* Croatian survey data

Table 2. Independent samples t-test Croatian hedgers/non-hedgers

| | | **Levene's Test for Equality of Variances** | | **t-test for Equality of Means** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **F** | **Sig.** | **t** | **df** | **Sig. (2-tailed)** | **Mean Difference** | **Std. Error Difference** | **95% Confidence Interval of the Difference** | |
| | | | | | | | | | Lower | Upper |
| Total assets | Equal variances assumed | 1.928 | .171 | -1.021 | 47 | .313 | -198,081.85 | 194,037.16 | -588,434.26 | 192,270.57 |
| | Equal variances not assumed | | | -1.598 | 44.151 | .117 | -198,081.85 | 123,930.90 | -447,824.09 | 51,660.40 |
| Total sales revenues | Equal variances assumed | 2.835 | .099 | -1.401 | 47 | .168 | -95,869.65 | 68,439.64 | -233,552.44 | 41,813.15 |
| | Equal variances not assumed | | | -2.257 | 40.806 | .029 | -95,869.65 | 42,470.89 | -181,653.75 | -10,085.55 |
| Debt rating | Equal variances assumed | 10.376 | .002 | -1.324 | 47 | .192 | -.1731 | .1307 | -.4361 | 8.994E-02 |
| | Equal variances not assumed | | | -1.630 | 34.007 | .112 | -.1731 | .1062 | -.3889 | 4.271E-02 |
| Long-term debt-to-assets ratio | Equal variances assumed | .014 | .906 | .246 | 46 | .807 | 1.47397E-02 | 5.98659E-02 | -.105764 | .135244 |
| | Equal variances not assumed | | | .252 | 22.471 | .804 | 1.47397E-02 | 5.85637E-02 | -.106567 | .136046 |
| Long-term debt-to-equity ratio | Equal variances assumed | .685 | .412 | .270 | 46 | .788 | .360839 | 1.335894 | -2.328176 | 3.049853 |
| | Equal variances not assumed | | | .258 | 19.743 | .799 | .360839 | 1.400663 | -2.563334 | 3.285011 |
| Interest cover ratio | Equal variances assumed | 1.480 | .231 | .764 | 42 | .449 | 6.001269 | 7.856053 | -9.852887 | 21.855425 |
| | Equal variances not assumed | | | .692 | 18.531 | .498 | 6.001269 | 8.676749 | -12.190565 | 24.193103 |
| Investment expenditures-to-assets ratio | Equal variances assumed | 3.763 | .058 | -1.753 | 47 | .086 | -5.854539E-02 | 3.33946E-02 | -.125727 | 8.63598E-03 |
| | Equal variances not assumed | | | -2.520 | 46.491 | .015 | -5.854539E-02 | 2.32293E-02 | -.105290 | -1.180053E-02 |
| Investment expenditures-to-sales ratio | Equal variances assumed | 2.783 | .102 | -1.228 | 47 | .226 | -.240784 | .196139 | -.635365 | .153797 |
| | Equal variances not assumed | | | -2.040 | 36.269 | .049 | -.240784 | .118013 | -.480064 | -1.503154E-03 |
| Total value of tax loss carry-forward and | Equal variances assumed | 4.667 | .036 | 1.202 | 47 | .235 | 61,921.5855 | 51494.2900 | -41,671.5640 | 165,514.7349 |
| | Equal variances not assumed | | | .805 | 13.038 | .435 | 61,921.5855 | 76,921.1774 | -104,207.7188 | 228,050.8898 |
| Total value of tax loss carry-forward and | Equal variances assumed | 12.825 | .001 | 1.695 | 47 | .097 | 2.395482 | 1.413014 | -.447136 | 5.238100 |
| | Equal variances not assumed | | | 1.001 | 12.010 | .337 | 2.395482 | 2.393251 | -2.818459 | 7.609423 |
| Investment tax credits | Equal variances assumed | 8.352 | .006 | 1.315 | 46 | .195 | 609.9626 | 463.7890 | -323.5962 | 1,543.5215 |
| | Equal variances not assumed | | | .816 | 12.281 | .430 | 609.9626 | 747.3930 | -1,014.3489 | 2,234.2741 |
| Tax incentives-dummy | Equal variances assumed | 2.018 | .162 | 1.497 | 47 | .141 | .2329 | .1556 | -8.0139E-02 | .5460 |
| | Equal variances not assumed | | | 1.423 | 19.482 | .170 | .2329 | .1636 | -.1090 | .5748 |
| Value of equity owned by managers | Equal variances assumed | 2.627 | .112 | -.827 | 47 | .412 | -4,976.101 | 6,013.516 | -17,073.735 | 7,121.533 |
| | Equal variances not assumed | | | -1.290 | 44.523 | .204 | -4,976.101 | 3,856.178 | -12,745.138 | 2,792.936 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Share of the company owned by management | Equal variances assumed | 10.182 | .003 | 1.957 | 47 | .056 | .20839 | .10646 | -5.78067E-03 | .42257 |
| | Equal variances not assumed | | | 1.567 | 15.379 | .137 | .20839 | .13295 | -7.43788E-02 | .49117 |
| Managers ownership of stock options | Equal variances assumed | .297 | .588 | -.267 | 46 | .790 | -2.78E-02 | .10 | -.24 | .18 |
| | Equal variances not assumed | | | -.281 | 20.683 | .781 | -2.78E-02 | 9.88E-02 | -.23 | .18 |
| Managers age | Equal variances assumed | .101 | .752 | .100 | 47 | .921 | 2.99E-02 | .30 | -.57 | .63 |
| | Equal variances not assumed | | | .099 | 20.619 | .922 | 2.99E-02 | .30 | -.60 | .66 |
| Managers tenure | Equal variances assumed | .003 | .955 | 1.143 | 47 | .259 | 3.82 | 3.34 | -2.91 | 10.55 |
| | Equal variances not assumed | | | 1.227 | 24.528 | .232 | 3.82 | 3.11 | -2.60 | 10.24 |

*Source:* Croatian survey data

In the employed logistic regression we have tested the hypothesis that the decision to hedge or not is a function of the following factors - financial distress costs, size, agency cost of debt, costly external financing, tax incentives to hedge and managerial utility. The variables tested in our multivariate regression model are based on the determinants we have presented in the literature review as the key rationales of corporate hedging decisions. The relationship between the decision to hedge and its potential determinants can be expressed in the format of a general function as follows:

$$Hedge = f(S, FC, AC, CEF, T, MU) \quad (1)$$

where:

- Hedge - binary variable which takes on a value of "1" if the firm hedges and "0" if the firm does not hedge with these instruments
- S – size of the company
- FC - the firm's probability of financial distress or bankruptcy
- AC – the agency costs of debt facing the firm
- CEF - costly external financing and investment (growth) opportunities
- T - the convexity of the firm's tax function
- MU – managerial utility

Table 3 reports multivariate analysis results relating the probability of hedging to the determinants of hedging. The predetermined independent variables include total sales revenues as a proxy for size, long-term debt to assets ratio as a proxy for financial distress costs, debt rating as a proxy for agency cost of debt, investment expenditures to assets as a proxy for costly external financing, total value of tax loss carry-forwards and carry-backs as a proxy for tax incentives and share of the company value owned by management as a proxy for managerial utility. The underlined variables represent those independent variables which appear to be the most consistent in reporting statistically significant *t*-values, and which appear to be most consistent and relevant in the stepwise construction of logistic model. Apart from the model discussed here, as we have created multiple proxies available to measure some firm characteristics, we have estimated separate logistic regressions using all possible combinations of variables representing each predicted construct.

Inclusion of all relevant variables in the regression model is very important due to the fact that, if relevant variables are omitted, the common variance they share with included variables may be wrongly attributed to those variables, or the error term may be inflated. Additionally, we excluded from our analysis the variables that that have not contributed to the strengths of the logistic model in predicting the decision to hedge (measured by the –2 Log Likelihood statistics and Goodness of fit tests). Exclusion of all irrelevant variables is very important because their presence in the model can cause the common variance they share with included variables to be wrongly attributed to the irrelevant variables. The greater the correlation of the irrelevant variable(s) with other independents, the greater the standard errors of the regression coefficients for these independents (see: www2.chass.ncsu.edu/garson/pa765/logistic.htm).

The model can be expressed as:
Hedge = f (Total sales revenues, Long-term debt to assets, Debt rating, Investment expenditures to assets, Total value of tax loss carry-forwards and carry backs, Share of the company value owned by management)

Table 3. Multivariate results Croatian hedgers/nonhedgers

```
      Total number of cases:      49 (Unweighted)
      Number of selected cases:   49
      Number of unselected cases: 0

      Number of selected cases:                 49
      Number rejected because of missing data:  1
      Number of cases included in the analysis: 48

Dependent Variable Encoding:

Original       Internal
Value          Value
       0       0
       1       1

Dependent Variable..   HEDGERS    Hedgers/Nonhedgers

Beginning Block Number  1.  Method: Enter

Variable(s) Entered on Step Number
1..       SIZE2     Total sales revenues
          FINCOST4  Long-term debt-to-assets ratio
          AGCOST1   Debt rating
          CMI2      Investment expenditures-to-assets ratio
          TAX1      Total value of tax loss carry-forward and carry backs
          MNGUTIL2  Share of the company owned by management

Estimation terminated at iteration number 7 because
Log Likelihood decreased by less than ,01 percent.

 -2 Log Likelihood       28,177
 Goodness of Fit         29,926
 Cox & Snell - R^2         ,441
 Nagelkerke - R^2          ,640

                     Chi-Square    df Significance

 Model                   27,895     6        ,0001
 Block                   27,895     6        ,0001
 Step                    27,895     6        ,0001
```

---------- Hosmer and Lemeshow Goodness-of-Fit Test----------

HEDGERS = Companies that d HEDGERS = Companies that m

| Group | Observed | Expected | Observed | Expected | Total |
|---|---|---|---|---|---|
| 1 | 5,000 | 4,708 | ,000 | ,292 | 5,000 |
| 2 | 4,000 | 3,262 | 1,000 | 1,738 | 5,000 |
| 3 | 1,000 | 2,254 | 4,000 | 2,746 | 5,000 |
| 4 | 2,000 | 1,680 | 3,000 | 3,320 | 5,000 |
| 5 | ,000 | ,790 | 5,000 | 4,210 | 5,000 |
| 6 | 1,000 | ,250 | 4,000 | 4,750 | 5,000 |
| 7 | ,000 | ,046 | 5,000 | 4,954 | 5,000 |
| 8 | ,000 | ,009 | 5,000 | 4,991 | 5,000 |
| 9 | ,000 | ,000 | 5,000 | 5,000 | 5,000 |
| 10 | ,000 | ,000 | 3,000 | 3,000 | 3,000 |

| | Chi-Square | df | Significance |
|---|---|---|---|
| Goodness-of-fit test | 5,5172 | 8 | ,7011 |

Classification Table for HEDGERS
The Cut Value is ,50

| | | Predicted: Companies that d | Predicted: Companies that m | Percent Correct |
|---|---|---|---|---|
| Observed | | | | |
| Companies that d | 0 | 9 | 4 | 69,23% |
| Companies that m | 1 | 1 | 34 | 97,14% |
| | | | Overall | 89,58% |

---------- Variables in the Equation ----------

| Variable | B | S.E. | Wald | df | Sig | R |
|---|---|---|---|---|---|---|
| SIZE2 | 1,56E-05 | 1,140E-05 | 1,8704 | 1 | ,1714 | ,0000 |
| FINCOST4 | -,5861 | 2,8927 | ,0411 | 1 | ,8394 | ,0000 |
| AGCOST1 | 8,2391 | 4,3615 | 3,5685 | 1 | ,0589 | ,1673 |
| CMI2 | 40,1737 | 19,9344 | 4,0614 | 1 | ,0439 | ,1917 |
| TAX1 | -1,3E-06 | 6,376E-06 | ,0418 | 1 | ,8380 | ,0000 |
| MNGUTIL2 | -8,1630 | 4,0624 | 4,0376 | 1 | ,0445 | -,1906 |
| Constant | -1,5248 | 1,3305 | 1,3133 | 1 | ,2518 | |

| | | 95% CI for Exp(B) | |
|---|---|---|---|
| Variable | Exp(B) | Lower | Upper |
| SIZE2 | 1,0000 | 1,0000 | 1,0000 |
| FINCOST4 | ,5565 | ,0019 | 161,3385 |
| AGCOST1 | 3786,1021 | ,7339 | 19530794 |
| CMI2 | 2,800E+17 | 3,0134 | 2,602E+34 |
| TAX1 | 1,0000 | 1,0000 | 1,0000 |
| MNGUTIL2 | ,0003 | ,0000 | ,8181 |

1 new variables have been created.

| Name | Contents |
|---|---|
| ZRE_54 | Standardized Residual |

No outliers found. No casewise plot produced.

*Source:* Croatian survey data

From the regression model presented in table 3, it can be seen that the corporate decision to hedge is related to company's investment expenditures-to-assets ratio and share of the company owned by

management. Other variables that tested the research hypothesis are not statistically significant in the model; therefore they do not influence the decision to hedge or not to hedge corporate risks in the analysed Croatian companies. Investment expenditures-to-assets ratio is a proxy for capital market imperfections and costly external financing. This variable tests the prediction that hedgers are more likely to have larger investment (growth) opportunities (e.g. see: Froot, Scharfstein and Stein (1993) for theoretical arguments, or Dobson and Soenen (1993), Nance, Smith and Smithson (1993), Getzy, Minton and Schrand (1997) and Allayannis and Ofek (2001) for empirical evidence). Bessembinder (1991) has also shown that hedging activities are predicted to be greater in firms where growth opportunities constitute a larger proportion of firm value, because reductions in agency costs are most valuable for these firms. Therefore, we argue that the firm's decision to hedge is predicted to be positively correlated with measures for investment (growth) opportunities. The results of our logistic model support our prediction and show a statistically significant positive relation between the decision to hedge and investment expenditures-to-assets ratio. When we conducted a robustness test regarding this result by employing other variable that was used as a proxy for costly external financing hypothesis, it was not statistically significant in the model. These findings suggest that the association between hedging and the investment (growth) opportunities is not robust.

The second variable that is statistically significant in our model is the fraction of the firm's outstanding shares held by the company's management. We have argued that, due to the fact that firm's managers have limited ability to diversify their own personal wealth position associated with stock holdings and their earnings' capitalisation, they have strong incentives to hedge. The managerial utility maximisation hypothesis predicts that managers with greater stock ownership would prefer more risk management, while those with greater option holdings would prefer less risk management. This rationale was firstly proposed by Stulz (1984) and has been further explored by Smith and Stulz (1985). The results of some empirical studies have confirmed this hypothesis (e.g., see Tufano, 1996; Gay and Nam, 1998), while, in contrast, Geczy, Minton and Schrand (1997) and Haushalter (2000) have not found evidence that corporate hedging is affected by managerial shareholdings. Our results show a negative relation between the decision to hedge and the share of the company owned by management, which leads to the conclusion that firms that have a greater fraction of outstanding shares held by the company's management have less incentives to hedge. This is contrary to our prediction and to the findings of Tufano (1996), who has found that firms whose managers have more wealth invested in the firm's stocks manage more corporate risk. Other variables that were employed as proxies for the managerial utility hypothesis (value of company share owned by management, managers' ownership of stock options, manager's age and tenure) were not statistically significant in the model. Therefore we should reject the hypothesis regarding managerial utility maximisation.

Table 4. Pearson correlation coefficients for independent variables in the regression

| | | Long term debt-to-assets ratio | Total sales revenues | Debt rating | Investment expenditures-to-assets ratio | Total value of tax loss carry-forward and carry backs | Share of the company owned by managers |
|---|---|---|---|---|---|---|---|
| Long term debt-to-assets ratio | Pearson Correlation | 1.000 | -.084 | .093 | .208 | -.061 | -.044 |
| | Sig. (2-tailed) | . | .601 | .567 | .191 | .710 | .786 |
| | N | 41 | 41 | 40 | 41 | 40 | 41 |
| Total sales revenues | Pearson Correlation | -.084 | 1.000 | -.187 | .064 | -.060 | .168 |
| | Sig. (2-tailed) | .601 | . | .249 | .693 | .712 | .293 |
| | N | 41 | 41 | 40 | 41 | 40 | 41 |
| Debt rating | Pearson Correlation | .093 | -.187 | 1.000 | .224 | .128 | .121 |
| | Sig. (2-tailed) | .567 | .249 | . | .164 | .436 | .457 |
| | N | 40 | 40 | 40 | 40 | 39 | 40 |
| Investment expenditures-to-assets ratio | Pearson Correlation | .208 | .064 | .224 | 1.000 | -.097 | -.032 |
| | Sig. (2-tailed) | .191 | .693 | .164 | . | .552 | .841 |
| | N | 41 | 41 | 40 | 41 | 40 | 41 |
| Total value of tax loss carry-forward and carry backs | Pearson Correlation | -.061 | -.060 | .128 | -.097 | 1.000 | -.031 |
| | Sig. (2-tailed) | .710 | .712 | .436 | .552 | . | .849 |
| | N | 40 | 40 | 39 | 40 | 40 | 40 |
| Share of the company owned by managers | Pearson Correlation | -.044 | .168 | .121 | -.032 | -.031 | 1.000 |
| | Sig. (2-tailed) | .786 | .293 | .457 | .841 | .849 | . |
| | N | 41 | 41 | 40 | 41 | 40 | 41 |

*Source:* Croatian survey data

To test the non-existence of multicollinearity as one of the important assumptions of logistic regression, we have calculated Pearson correlation coefficients between the independent variables employed (see: table 4). To the extent that one independent is a linear function of another independent, the problem of multicollinearity will occur in logistic regression. As the independents increase in correlation with each other, the standard errors of the logit (effect) coefficients will become inflated. Multicollinearity does not change the estimates of the coefficients, only their reliability (see: www2.chass.ncsu.edu/garson/pa765/logistic.htm). From the data presented in the table 4, it could be concluded that there is no correlation between variables, therefore the calculated logit coefficients in our model should be reliable.

## 4. Discussion and Conclusion

On the basis of the research results it could be concluded that the explored hedging rationales have little predictive power in explaining corporate risk management decisions in Croatian companies. The evidence based on multivariate empirical relations between the decision to hedge in Croatian non-financial companies and financial distress costs, size, agency cost of debt, costly external financing, taxes and managerial utility fails to provide any support for any of the tested hypotheses but one - costly external financing measured by investment expenditures-to-assets ratio. Our multivariate analysis has shown that hedgers have a statistically higher value of this ratio, suggesting that there is a positive relation between the value of a company's investment and the decision to hedge. This result is consistent with our prediction that the benefits of hedging should be greater the more growth options there are in the firm's investment opportunity set and to the findings of Bessembinder (1991), Dobson and Soenen (1993), Nance, Smith and Smithson (1993), Getzy, Minton and Schrand (1997) and Allayannis and Ofek (2001).

Regarding this result, we need to emphasise that the association between hedging and costly external financing is not robust to the other variable employed as a proxy for testing this hypothesis. Also, the result has not been supported by univariate analysis; therefore it should be interpreted with care.

Moreover, our analysis has revealed statistically significant relation between the decision to hedge and managerial utility maximisation hypothesis but this relation is contrary to the predicted sign. Multivariate analysis has revealed that the corporate decision to hedge is negatively related to the share of the company owned by management, suggesting that Croatian companies where managers have more wealth invested in company stocks are less likely to hedge. This result is inconsistent to the results of previous studies cited in our paper and to our own prediction. However, we need to emphasise that the inability to use variables employed in other studies (e.g. see: Smith and Stulz, 1985; Tufano, 1996; Geczy, Minton and Schrand, 1997; Gay and Nam, 1998; Haushalter, 2000) as proxies for the extent to which options are used in managers' compensation plans[5], has prevented us from testing whether managerial option holdings in Croatian companies has an impact on the result that managers who own company's shares do not act in a risk averse manner and have less incentive to hedge corporate risks. Managerial option holdings are not available as public information in the case of Croatian companies and managers were not willing to reveal this information in the survey questionnaire.

We believe a negative relation between the decision to hedge and share of the company owned by management can be explained by the fact that, apart from stock holdings, Croatian managers also have option-like provisions. It has been proven (Tufano, 1996; Gay and Nam, 1998) that managers with greater option holdings would prefer less risk management. The theoretical explanation for this is offered by Smith and Stulz (1985) who claimed that managers' compensation plans can influence their hedging choices. They have argued that the expected utility of managerial wealth has the shape of a convex function of the firm's expected profits when managers own unexercised options. Therefore, the more option-like features there are in the compensation plans, the less managers will hedge. In this case, managers can choose to increase the risk of the firm in order to increase the value of their options. Yet, further research among the analysed Croatian companies should be conducted to confirm this argument as it is based only on our opinion, not on empirical evidence.

Directions for further research stem from our research findings as well as from missed opportunities that indicate avenues for future research. The advantage of our work is that it provides an impetus for further research to move beyond the existing hedging theories, which have proven inadequate in explaining risk management decisions in the large Croatian companies.

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[5] Like the total option holdings held by officers and directors or the market value of shares that could be owned by managers and directors by exercising their options.

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