

*Review paper*

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## RISK MANAGEMENT AND CORPORATE VALUE

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The paper presents a theoretical framework for assessing the impact of risk management on corporate value. As the relevant factors that determine this impact, the paper analyzes market imperfections and investors' risk aversion. The results of the present research indicate that risk management contributes to an increase in corporate value if, under the influence of market imperfections, corporate risk exposure is concave. As an expression of market imperfections, the paper analyzes the costs of financial distress, agency costs, and taxation. The results of the research also indicate that the risk management policy should not aim to minimize, but rather optimize risk exposure, by taking into account the costs of risk management, investors' risk aversion and the competitive advantage a corporation has on the relevant market.

**Keywords:** risk management, corporate value, risk exposure, market imperfections, risk aversion

JEL Classification: G14, G32

### INTRODUCTION

Financial risk can be defined as the volatility or uncertainty of the future cash flows of a firm, or the probability of the occurrence of an adverse outcome. It can be caused by different factors, although the financial literature usually analyzes the impact of unexpected changes in market prices (exchange rates, interest rates, commodity prices etc.) on the cash flows of a firm. Risk management includes an assessment of the risks that affect the cash flows of a firm and the implementation of appropriate strategies to control these risks. The objective of risk management, depending on the degree of investors' and managers' risk aversion, can be defined as maintaining cash-

flow changes within a certain range or minimizing these changes. Risk management strategies can be financial, if they involve the use of financial derivatives (forwards, futures, options etc.); or operational, if they involve the development of business flexibility and diversification. Risk management is financially justified if it contributes to an increase in firm value, determined by discounting the expected free cash flow of a firm.

Empirical studies show that firms usually manage risk, and invest most of the efforts in the management of foreign-exchange and interest rate risks (Bodnar & Gebhardt, 1999; Brown, Crabb & Haushalter, 2006; Aretz & Bartram, 2010). Firms usually manage risks of current transactions and use financial derivatives, paying less attention to risks of future transactions, so that they rarely use operational risk management

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strategies (Stulz, 1996; Joseph, 2000). However, it should be borne in mind that risk management is often not a matter of choice or a strategic orientation of a firm, but rather a response to requirements set out in guidelines of international organizations (for example, Organization for Economic Cooperation and Development, 2015) and capital markets (for example, The New York Stock Exchange, 2013), as well as in legal regulations (for example, Sarbanes-Oxley Act of 2002). These requirements are a reflection of efforts made to protect investors' interests, whereby no account is taken of financial effects of risk management. Accordingly, although empirical data on the prevalence of risk management could be interpreted as a reflection of the belief that risk management contributes to an increase in firm value, it is possible that firms manage risk for other reasons.

The subject of the theoretical research presented in this paper is the impact of risk management on corporate value. Following the previous research (Smith & Stulz, 1985; Fatemi & Luft, 2002; Meulbroek, 2002), the paper analyzes market imperfections and investors' risk aversion as the relevant factors that determine this impact. The paper specifically addresses the problem of defining the optimal (acceptable) level of risk exposure, which has been the subject of several theoretical and empirical studies (Shin & Stulz, 2000; Nocco & Stulz, 2006).

The aim of the paper is to review and analyze the conclusions of previous theoretical studies in order to indicate the complexity of the problem of the financial assessment of risk management decisions at the corporate level and create a basis for the development of guidelines that will help managers to make informed decisions concerning risk management.

Based on the findings of the previous theoretical research, the following two research hypotheses were established:

- H1: Risk management can contribute to an increase in corporate value only if corporate value is the concave function of market prices.
- H2: Risk management can contribute to maximizing corporate value if it keeps risk exposure at an

optimal level, where benefits are greater than costs of risk management.

The research will be conducted through a qualitative analysis of the results of the previous theoretical research, which will allow drawing conclusions through theoretical generalization.

The paper is structured as follows: the first part of the paper presents the evolution of theoretical views on financial effects of risk management at the corporate level. In the second part, the influence of the form of the relationship between corporate value and market prices on the financial effects of risk management is the subject of the analysis, while in the third part the focus is put on expected effects (benefits) of risk management. In the fourth part of the paper, the problem of defining an optimal level of risk exposure is considered, while in the fifth part, the conclusions and the directions for future research are presented.

## THE EVOLUTION OF THEORETICAL VIEWS ON RISK MANAGEMENT

From the early twentieth century to the 1970s, the dominant view in financial theory was that corporations did not need to manage risks of their operations since they had a large number of owners who had a small ownership stake and bore a small part of the total corporate risk. If they had diversified their investment portfolio, i.e. if they invested available funds in several investment alternatives with a negative correlation of expected cash flows (returns), investors would have been able to manage risk more successfully than corporations. A. A. Berle and G. C. Means (1932, 340-344) argued that risk management was financially justified only in firms owned by a single person (entrepreneur), who invested his/her own capital and was entitled to net income as a compensation for risk management and risk taking. These authors claimed that corporations were created so that entrepreneurs could transfer their risks to a large number of small investors, and that corporations did not need to manage risk, but rather investors themselves should have managed risk according to their preferences. Investors had to be compensated

for the risk taken when they invested their capital in a corporation, which was analogous to salaries that employees received for the supplying of labor.

The explained logic was theoretically formulated by F. Modigliani and M. H. Miller (1958), in the theorem which laid the foundation of modern corporate finance. Starting from the assumption of the absence of market imperfections, they claimed that the value was created by investments with a positive operating cash flow, whereby it was irrelevant how these investments were financed - from a debt or equity. In other words, financial decisions, including those concerning risk management, did not contribute to corporate value creation, but rather only determined the manner in which corporate value was distributed among investors (shareholders and creditors). Their view was that corporations did not need to manage risks because rational investors on an efficient market could do that more successfully by themselves. A similar view was expressed by W. Sharpe (1964) who developed the CAPM (Capital Asset Pricing Model) on the assumption that the corporation did not need to manage its business risks (unsystematic risks), but rather investors themselves needed to reduce the risk of their investment portfolio to the desired level by using diversification. Corporations needed to make decisions by taking into account only systematic (market) risk, i.e. the risk that could not be influenced (could not be reduced by risk management instruments), which determined a risk premium for investments in a corporation. Other authors, who independently developed their own versions of the CAPM (J. Traynor, J. Lintner, J. Mosin, and F. Black) by relying on H. Markowitz's portfolio theory, had a similar attitude.

It should be noted that theories advocating that corporations should not manage risks are built on the assumption that the market is efficient and investors are rational. When an analysis takes into account factors inherent to the real business environment, i.e. market imperfections (for example, taxation, financial distress, agency costs) and real investors, such a view is hard to justify. Five years after the publication of their theorem, F. Modigliani and M. H. Miller (1963) admitted that, if an analysis took account of only one market imperfection - corporate income tax, the capital structure was no longer irrelevant, nor was risk

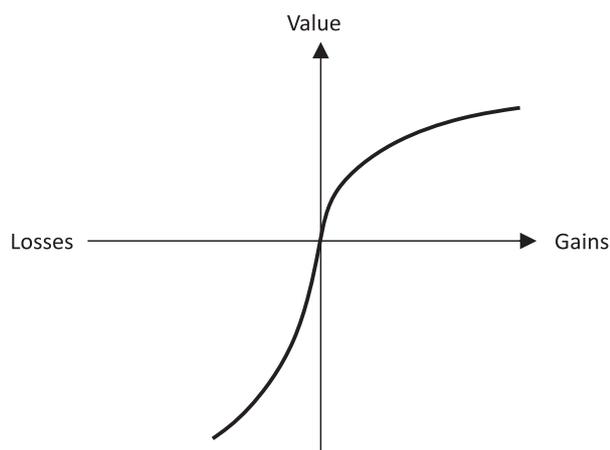
management. S. C. Myers (1974) and S. C. Myers and N. Majluf (1984) pointed out that corporations with a high level of a risky debt and a high probability of financial distress (debt overhang) might face problems in obtaining additional capital to fund a new investment, especially in conditions of a high uncertainty. Risk management can contribute to an increase in corporate value by reducing the volatility of cash flows and the probability of financial distress, because a corporation will be able to obtain external sources of funding under more favorable terms and increase total investments.

The assumption of rational investors was developed within the framework of the expected utility theory, which explains individuals' decision-making process under risk and uncertainty, which lies in the basis of a number of important financial theories (for example, H. Markowitz's portfolio theory, the CAPM model). This theory is normative because it describes the rules that every rational and fully-informed individual should follow when making decisions. It is assumed that individuals have a uniformly concave utility function (an expression of risk aversion), representing their risk preferences, and always choose an alternative (for example, investment), with the highest expected utility (Jaksic, 2012). The expected utility theory eventually became the subject of criticism, the most famous of which was presented in the prospect theory by D. Kahneman and A. Tversky (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992). This theory is descriptive because it describes how real individuals make decisions in a real business environment using available information. Having started from the assumption that individuals focused their attention on possible changes in wealth (the outcomes of their decisions) rather than on the total wealth, D. Kahneman and A. Tversky replaced the utility function of an individual's total wealth with the value function, defined on deviations of possible outcomes from the reference point (a *status quo*)

D. Kahneman and A. Tversky have shown that individuals react asymmetrically to gains and losses - their risk aversion is higher in relation to gains than losses. If they have to choose between a probable and a certain gains, most individuals choose a certain gain, even when the expected value of this alternative is lower. This choice is consistent with the expected

utility theory, because it expresses a concave utility (value) function of an individual, i.e. risk aversion (the first quadrant in Figure 1). When they need to choose between a probable and a certain loss, most individuals prefer a probable loss, even when the expected value of this alternative is lower. This means that individuals are risk-takers when it comes to losses, i.e. their utility (value) function is convex in relation to losses (the third quadrant in Figure 1). D. Kahneman and A. Tversky have also noticed that the utility (value) function of individuals is steeper for losses than gains (individuals are more sensitive to losses than to gains), which is the expression of investors' loss aversion (Figure 1). If these findings are applied to corporations, it can be expected that the demand for shares of a corporation that offers a more certain return will be greater than the demand for shares of a corporation that offers a less certain return, even when the expected return of the latter option is higher (Stephens, 2001, 38-39).

Different theoretical views on the role of the financial policy in the process of value creation and on investors' attitudes towards risk brought about the development of a modern paradigm of financial management. It relies on the basic Modigliani-Miller claim that corporations create value by investments with a positive net present



**Figure 1** The value function according to prospect theory

Source: Kahneman & Tversky, 1979

value of the expected cash flow from operations. This claim is supplemented by the view that the financial policy is a critical factor that indirectly contributes to an increase in corporate value because it allows a corporation to undertake investments that create value by providing less expensive funds. The role of the risk management policy, as a segment of the corporate financial policy, is to monitor and control the impact of changes in market prices (interest rates, foreign exchange rates etc.) and other factors on corporate cash flows and provide the stable financing of investments with a positive net present value (Froot, Scharfstein & Stein, 1994). Risk management at the corporate level is even more significant, given the fact that individuals cannot be equally successful in risk management as corporations can, because they have less information (information asymmetry), must pay relatively higher costs of hedging, and are unable to reduce the risk and costs of bankruptcy (financial distress).

## RISK EXPOSURE AND RISK MANAGEMENT

B. Dumas (1978) argued that risk exposure should be defined in terms of „what one has at risk“. More specifically, risk exposure can be defined as the sensitivity of the value (book, market etc.) of a firm or certain items (assets, liabilities, income, costs, cash flows etc.) to random changes in some market prices (commodity prices, exchange rates, the interest rate etc.) at a certain point in the future. This means that risk exposure can be expressed as follows (Adler & Dumas, 1984):

$$V_p = E(\partial V / \partial p_i) \quad (1)$$

Formula (1) defines risk exposure ( $V_p$ ) as the current expectation ( $E$ ) with respect to the partial sensitivity of the value of a firm or an item ( $V$ ) to future values of the price  $i$  ( $p_i$ ) ( $V$  is exposed to a number of prices). Exposure  $V_p$  can be viewed as the slope of the curve that represents the relationship of  $V$  and  $p_i$  (the higher the exposure, the greater the slope of the curve). A positive (negative) value of  $V_p$  indicates that  $V$  increases with an increase (decrease) in  $p_i$ . Since risk exposure can be non-linear (convex or concave), the second-

order partial derivative of the function  $V$  enables an assessment of the form of the relationship between  $V$  and  $p_i$ :

$$V_{pp} = E(\partial^2 V / \partial p_i^2) \quad (2)$$

A positive (negative) value of  $V_{pp}$  indicates that  $V_p$  is the convex (concave) function of  $p_i$ . When  $V_{pp} = 0$ , then the relationship between  $V$  and  $p_i$  is linear. The generic types of concave exposure are: the quadratic function, the cubical function and the sinus hyperbolicus, and of convex exposure: the cubical root function and the inverse sinus hyperbolicus. The degree and form of risk exposure is usually evaluated by using regression models, i.e. by the assessment of partial regression coefficients (Adler & Dumas, 1984; Bartram, 2004).

An impact of the form of the relationship between  $p$  and  $V$  on financial effects of risk management can be explained by using Jensen's inequality (Smith & Stulz, 1985; MacKay & Moeller, 2007). In its simplest form, this inequality proves that the convex (concave) function of the expected value of a random variable is smaller (greater) than the expected value of the convex (concave) function of a random variable. Accordingly, risk management does not increase firm value (risk exposure increases firm value) if  $V_{pp} < 0$ , given that  $V(\bar{p}) \leq E[V(p)]$ , where  $V(\bar{p})$  is firm value if expected prices are realized (a secure outcome), and  $E[V(p)]$  is firm value if the realized prices depart from expected prices (risk exposure). Risk management is justified if  $V_{pp} > 0$ , given that  $V(\bar{p}) \geq E[V(p)]$ . In this regard, P. MacKay and S. B. Moeller (2007) point out the fact that the value of risk management ( $VUR$ ) can be determined as follows:

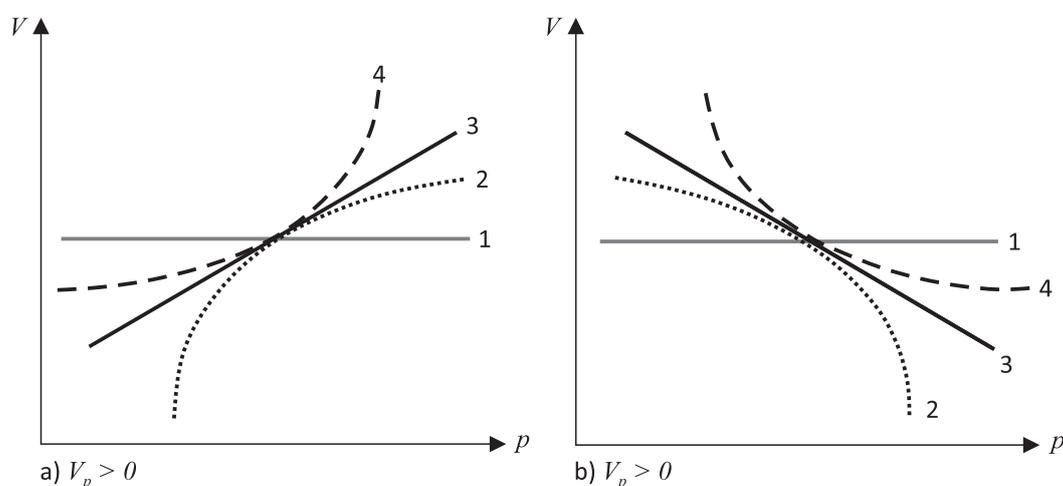
$$\begin{aligned} VUR &= V(\bar{p}) - E[V(p)] = \\ &= V(\bar{p}) - (V(\bar{p}) + \frac{1}{2} V_{pp} \sigma_{pp}) = -\frac{1}{2} V_{pp} \sigma_{pp} \end{aligned} \quad (3)$$

where  $\sigma_{pp}$  is the standard deviation of the price  $p_i$ .  $E[V(p)]$  is determined by the value  $V(\bar{p})$  and changes in  $V$  (additional gains or losses), caused by unexpected changes of  $p_i$ . Formula (3) indicates that  $VUR$  has a positive value if  $V_{pp} < 0$  (it always applies that  $\sigma_{pp} \geq 0$ ), and that  $VUR$  increases with an increase in the concavity of the function  $V(p)$  and the increased volatility of  $p_i$ . Given the fact that  $V$  depends on a range of prices  $p_i$ ,

it is necessary to estimate the form of each function  $V(p_i)$ . Furthermore, since firm value is determined by expected cash inflows and outflows, whose relationship with changes in  $p$  is positive (inflows and outflows increase with an increase in prices), it can be concluded that the impact of risk on  $E[V(p)]$  will be positive (negative) if inflows are the convex (concave), and outflows the concave (convex) function of market prices.

The impact of the form of the relationship between  $V$  and  $p$  on financial effects of risk management can be further graphically explained. Figure 2 presents the basic forms of the relationship between changes in  $p$  and  $V$ , where Figure 2 a) presents relationships under the assumption that  $V_p$  has a positive value, and Figure 2 b) relationships under the assumption that  $V_p$  has a negative value. What follows is the analysis of the relationships in Figure 2 a) only, since the relationships in Figure 2 b) differ only in the direction of the slope, rather than in the form of the relationship.

Line 3 in Figure 2 a) represents a linear risk exposure, which indicates that  $V$  increases with an increase in  $p$  to the same degree to which it decreases with a decrease in  $p$  (a firm gains under favorable conditions as much as it loses under unfavorable conditions). Corporate value is determined by changes, rather than the volatility of  $p$  (exposure equals one), so it can be concluded that risk management does not affect corporate value. R. Friberg (1999, 28-29), however, argues that an analysis of the impact of linear risk exposure on financial effects of risk management should include investors' attitudes towards risk. If a firm has only one owner, who is indifferent to risk (zero risk aversion), risk management will not contribute to an increase in firm value if exposure is linear. If the owner is risk averse, then he/she will be less satisfied with favorable outcomes, rather than unsatisfied with unfavorable ones. A risk-averse owner always favors a certain return against an uncertain return (if they are of an equal value), and risk management can contribute to an increase in firm value when exposure is linear (the owner prefers horizontal exposure). If a firm has a large number of owners, each of whom can diversify his/her own portfolio, risk management is again justified because firms have much more information



**Figure 2** The basic relations between market prices and firm value

Source: Author, according to Friberg, 1999, 58

about risk exposure than investors do (asymmetric information). R. Friberg concludes that firms with linear risk exposure should manage risk, except in cases when their value is very large in comparison to their risk exposure (the total value of items exposed to risk).

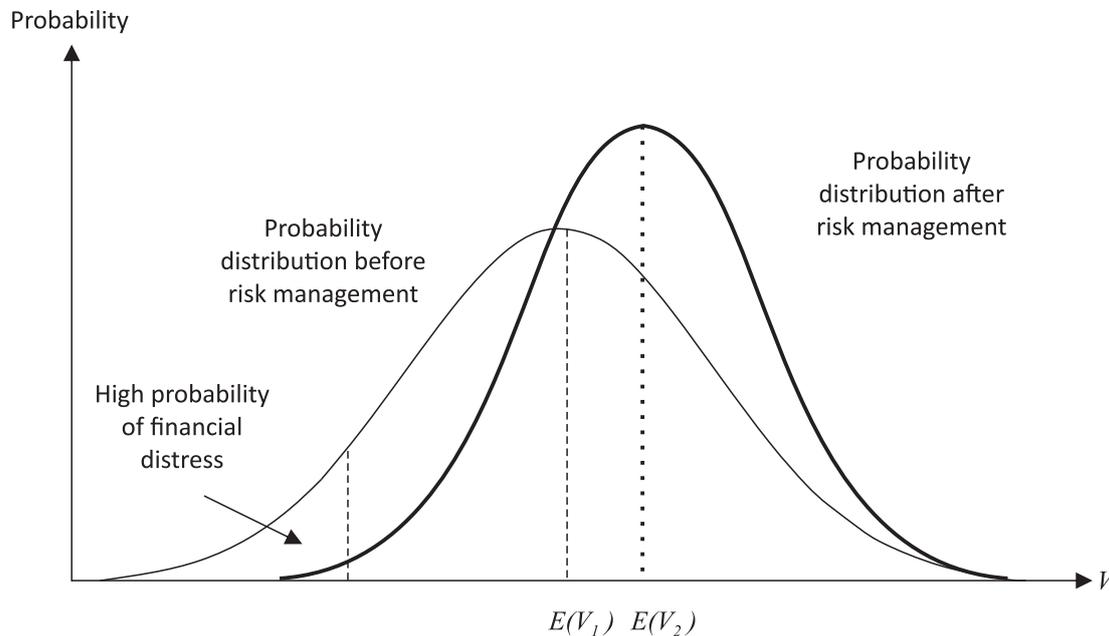
Line 2 in Figure 2 a) represents the concave relationship between  $V$  and  $p$ , which is most often the result of market imperfections (costs of financial distress, agency costs and taxation), whose influence on  $V$  increases with an increase in the volatility of  $V$ . A concave relationship may also be the result of factors such as the declining utility of technology or an increasing marginal cost of production (Friberg, 1999, 26-28; Bartram, 2000). A concave relationship indicates that  $V$  increases with an increase in  $p$  to a lesser degree than it decreases with a decrease in  $p$ . In other words, in accordance with Jensen's inequality,  $V$  decreases with an increase in the volatility of  $p$ , so that risk management may result in an increase in  $V$ .

As is shown in Figure 3, risk management increases the expected firm value from  $E(V_1)$  to  $E(V_2)$  and reduces the probability of financial distress (the left end of the distribution), due to the shifting of the probability distribution to the right and reducing the variations of  $V$  (increasing the kurtosis).

The horizontal line 1 in Figure 2 a) represents a situation of the zero exposure of a firm ( $V_p = 0$ ), which means that changes in  $p$  have no influence on  $V$ . Line 4 in Figure 2 a) represents the convex relationship of  $V$  and  $p$ , which indicates that  $V$  increases with an increase in  $p$  to a higher degree than it decreases with a decrease in  $p$ . This relationship limits the negative impact of unfavorable changes in  $p$ , so that  $V$  increases with an increase in the volatility of  $p$  (similar to financial options). A convex relationship may be caused by different factors, although it is usually caused by managerial flexibility (for example, a real option of expanding capacities), which allows the correction of past decisions or strategies in line with new circumstances. It can be concluded that risk management aims to stabilize cash flows and corporate value in order to reduce costs caused by market imperfections and replace concave exposure with a linear one, or increase managerial flexibility in order to achieve convex exposure.

## EFFECTS OF RISK MANAGEMENT

If a market is not fully efficient (there are market imperfections), so that risk exposure is concave, risk



**Figure 3** The influence of risk management on the expected firm value

Source: Adapted from Bartram (2000)

management can contribute to an increase in corporate value by reducing (Froot *et al*, 1994; Fatemi & Luft, 2002; Graham & Rogers, 2002):

- the cost of financial distress (including bankruptcy costs),
- agency costs and
- tax liabilities.

Strong and unpredictable changes in the value of a firm's cash flows caused by changes in market prices can cause financial distress, particularly in firms with a high financial leverage, low profitability and low liquidity. If the net cash flow of a firm decreases so much that the firm cannot timely and in full amount settle its obligations towards its creditors, a free transfer of assets from the owners to the creditors will occur on an efficient market. On an inefficient market, financial distress creates costs of a conflict between the owners and the creditors of the firm, customers' and suppliers' resentment towards cooperation with the firm, an increase in the cost of external funds (which increases

opportunity costs due to the inability to finance investments), and the dissatisfaction of employees and managers (they lose motivation, demand higher salaries, leave the firm etc.) (Smith & Stulz, 1985; Nance, Smith & Smitson, 1993; Aretz, Bartram & Dufey, 2007). If it causes bankruptcy, financial distress creates costs of bankruptcy proceedings and fees to third parties (lawyers, experts etc.).

Efficient risk management can either reduce or eliminate costs of financial distress and increase corporate value by reducing the variability of expected cash flows and the probability of a significant reduction in corporate value (Figure 3). If risk management eliminates a possibility of financial distress, then it will increase corporate value by the present value of expected costs of financial distress under the assumption that a corporation does not manage risk, calculated as the product of costs of financial distress and the probability that the corporation will encounter financial distress (Nance *et al*, 1993). By reducing the probability of encountering financial distress, risk management increases the debt capacity

of the corporation, which enables it to borrow on more favorable terms and realize tax savings (interest expenses decrease taxable income) (Froot, Scharfstein & Stein, 1993; Damodaran, 2008, 325-326). The increased debt capacity and a debt price reduction decrease the weighted average cost of capital (investment criteria), so that more investment alternatives can contribute to an increase in corporate value.

On an inefficient market, characterized by imperfect contracts and asymmetric information, agency costs mainly arise in connection with two problems:

- underinvestment and asset substitution, as an expression of a conflict between shareholders and creditors, and
- risk aversion on the managers' part and high management compensation, as an expression of a conflict between shareholders and managers.

The underinvestment problem occurs when shareholders give up on investments with a positive net present value if such investments primarily benefit bondholders (Myers, 1977). This problem is inherent to corporations with risky debt outstanding and a low value of total assets, whose shareholders are left with little or no free cash flow at all after the settlement of fixed liabilities towards creditors. Given the fact that the rearrangement of loans and a decrease in the financial leverage can be expensive (additional contractual clauses, a loss of tax savings etc.), risk management can be a less expensive solution to this problem. Risk management reduces the volatility of corporate value and the probability that it will fall below the level that will encourage shareholders to forgo investments with a positive net present value (Nance *et al*, 1993). It reduces the volatility of internal funds and the risk that they will not be sufficient to finance investments with a positive net present value. A lack of internal funds leads to an increase in an opportunity cost if the corporation decides to forgo investments, or an increase in the weighted average cost of capital if the corporation decides to use external (own and borrowed) funds (internal sources are less expensive than external sources of funding, especially when the corporation is exposed to high costs of financial distress and agency costs) (Froot *et al*, 1993).

Conflicts of interest between shareholders and creditors can also occur if shareholders give priority to very risky investments in comparison to less risky ones, even when their net present value is negative (asset substitution) (Myers, 1977). The shareholders' residual claim on the cash flows of the firm (shareholders are entitled to the cash flows of the firm when the firm settles its liabilities towards other stakeholders) has the characteristics of a call option on the firm assets, whose exercise price equals the value of the total debt. Since the value of an option increases with the riskiness of the underlying asset, shareholder value will increase if less risky investments are replaced with riskier ones. If shareholders are expected by creditors to behave in this manner, they may demand higher returns or stricter debt covenants, which increases agency costs and decreases corporate value. Risk management reduces the volatility of corporate value and the likelihood that shareholders will undertake risky investments (it is less likely that the value of debts will be greater than corporate value), so creditors will be willing to offer more favorable debt terms to the corporation. As there is no guarantee that the corporation that is currently managing risk will be doing so in the future, creditors may offer a lower interest rate only to those corporations that simultaneously arrange their debt and risk management programs (Aretz & Bartram, 2010).

A conflict between managers and shareholders may occur if managers, in order to maximize their own welfare, undertake such activities that may not be in accordance with shareholders' interests, or with the aim of corporate value maximization. Such a conflict is pronounced when managers with high risk aversion have a high ownership stake, so that the occurrence of financial distress can cause them to lose everything - current and future benefits (salary, dividends and a capital gain), reputation and promotions (Meulbroek, 2002). To reduce their risk exposure and increase their well-being, managers can undertake activities with a negative net present value (for example, a conglomerate diversification and selection of a suboptimal capital structure), which cause a decrease in the welfare of shareholders. In order to align managers' interests with their own, shareholders will have to intensify monitoring over managers' activities and increase

their salaries and bonuses, which causes the growth of agency costs and further reduce corporate value.

Risk management can reduce agency costs and increase corporate value if it reduces the riskiness of profitable investments, i.e. aligns preferences (risk aversion) and interests of managers and shareholders. Managers will then require lower compensation and be less inclined to undertake costly strategies to reduce risks which they are exposed to (Bartram, 2000). A reduced risk of investing in a corporation will also encourage shareholders to increase their ownership stakes (ownership concentration), which will increase the effectiveness of their monitoring over the activities carried out by managers. Shareholders will also require lower rates of return, which will directly reflect in an increased corporate value. Shareholders can adjust the degree of managers' aversion towards risk by using different managerial compensation schemes (Geczy, Minton & Schrand, 1997; Coles, Daniel & Naveen, 2006). Management ownership programs and tying managers' compensation to share prices result in a concave expected utility function of managers' welfare in comparison to the expected corporate value (the expression of managers' risk aversion), so that managers may be inclined to excessively reduce corporate risk exposure. Managers' compensation in the form of call options on shares of stock results in a convex expected utility function of managers' welfare (the expression of managers' risk seeking attitude), so that they may be inclined to increase corporate risk exposure in order to maximize the value of their call options and well-being.

When income tax is a convex function of taxable income (a tax liability grows faster than income, and decreases more slowly than income), then corporate value is a concave function of taxable income (corporate value grows more slowly than income, and decreases faster than income). In states characterized by very high income, the convexity in a tax liability can be caused by progressive statutory tax rates because a tax liability increases more than proportionally with the growth of income. In states characterized by losses or low income, convexity can be caused by time limits to carrying losses forward and using tax credits (for investment spending or income tax paid abroad). Thus, a corporation may be unable to fully use these

tax benefits and decrease a tax liability in a short term (the present value of unused tax benefits decreases with the passage of time, as well as the effects of their use) (Geczy *et al*, 1997). When a tax liability is convex, a more volatile income stream leads to a higher average tax liability than it is the case with a less volatile income stream, given the fact that very high income increases a tax liability, and very low income limits the use of tax benefits. Risk management can limit income changes to a specific optimal range without extreme values, and reduce a tax liability (Froot *et al*, 1993; Graham & Rogers, 2002). If a firm smooths its taxable income, savings due to less tax paid in periods of high income will be greater than losses due to more tax paid in periods of lower income. Risk management can also reduce a tax liability by increasing the debt capacity, which is explained as the effect of reducing the costs of financial distress.

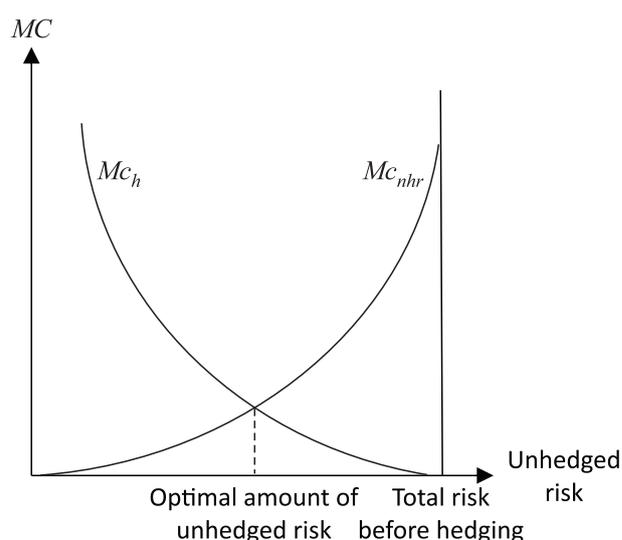
## OPTIMAL RISK EXPOSURE

If the corporate value function is concave, investors may expect managers to completely eliminate or minimize risk exposure, which is in line with the view that they are very risk averse (aversion tends to infinity). However, given the very high cost of such an approach, it is more likely that investors will expect managers to reduce the overall risk exposure to an optimal level (it can be zero exposure), which allows the maximizing of corporate value. The optimal or acceptable risk exposure is often determined by using the desired corporate bond rating, which reflects the probability that a corporation will encounter financial distress (Nocco & Stulz, 2006). If the management expects that a decline in the bond rating will cause a significant increase in the cost of the debt and a decrease in corporate value, they may decide to increase risk management efforts in order to reduce the likelihood of such an outcome. In other words, the management can determine the size of the investment in risk management, so as to reach a certain credit rating of bonds, and maximize corporate value. The size of an investment increases if a corporation has more development opportunities, which it will not be able to realize if the cost of the debt increases. A mature corporation with fewer development

opportunities will invest less in risk management, because such a corporation can create greater shareholder value by increasing the leverage and using tax savings. Since the share of equity in the capital structure also significantly determines the bond rating, the management can reduce investment in risk management if they increase the share of equity (the share of equity and risk management are substitutes). Such a decision is financially justified if the cost of risk management decreases in an amount bigger than an increase in the cost of capital (equity is more expensive than a debt).

To determine the optimal amount of corporate risk exposure, H. Shin and R. M. Stulz (2000) take into consideration the cost of bearing unhedged risk ( $C_{nhr}$ ) and the cost of hedging ( $C_h$ ). Unhedged risk is the risk that remains after hedging, i.e. risk management. The cost  $C_h$  arises in connection with the use of financial derivatives (forwards, futures, options etc.), whose transaction costs are relatively low. Given the fact that some risks are more difficult to eliminate, after a certain level, a further incremental reduction in unhedged risk becomes very expensive. The total cost of bearing unhedged risk ( $TC_{nhr}$ ) is equal to the sum of  $C_{nhr}$  AND  $C_h$ . H. Shin and R. M. Stulz conclude that the optimal amount of unhedged risk is reached when a firm minimizes  $TC_{nhr}$ , i.e. when it equalizes the marginal cost of bearing unhedged risk ( $MC_{nhr}$ ) and the marginal cost of hedging ( $MC_h$ ). It should be noted that  $MC_{nhr}$  is the increasing, and  $MC_h$  the decreasing function of unhedged risk (Figure 4). H. Shin and R. M. Stulz further analyze the value of firms with the same  $MC_h$  functions, but different  $MC_{nhr}$  functions. They conclude that a firm with a higher  $MC_{nhr}$  has a lower level of unhedged risk and a lower value due to a higher  $TC_{nhr}$ , which means that it is possible for a firm with more unhedged risk to be capable of having a higher value. If the impact of an exogenous factor causes an increase in unhedged risk, the  $MC_h$  function will move to the right (the cost of marginal risk reduction remains unchanged), whereas the  $MC_{nhr}$  function remains unchanged. Then,  $TC_{nhr}$  will rise causing a reduction in firm value and an increase in the optimal amount of unhedged risk.

In accordance with the analysis conducted by H. Shin and R. M. Stulz, it can be concluded that risk management at the corporate level makes sense as long as it causes benefits (a decrease in costs of market imperfections) bigger than costs. As a typical explicit cost of risk management, A. Damodaran (2008, 320-321) considers the insurance premium, which firms pay in order to ensure themselves against various risks. This cost is higher if insurance provides more complete risk coverage and if the probability of the occurrence and the expected impact of risk is higher. Firms that use financial options pay the explicit cost of premium (the option price). Companies do not pay the explicit cost, but rather face a possible implicit cost of using financial forwards and futures. If a firm buys futures to protect itself against a decrease in prices of its products, it will have to give up higher income (the implicit cost) if the price rises. The financial literature points out that costs of risk management are diverse, but relatively low, even on very inefficient markets (Bartram, 2000; Stephens 2001, 27). It is, therefore, unlikely that costs will exceed benefits of risk management at high levels of risk, which would be a sufficient reason for a firm to accept the total risk. J. J. Stephens (2001, 27) warns that the acceptance of the total or a high level of risk is a speculative strategy, which requires a careful



**Figure 4** The optimal amount of unhedged risk

Source: Shin & Stulz, 2000

evaluation of information and forecasts before its adoption, as well as constant monitoring after such adoption, so that a corrective action could be taken in the event that the situation does not develop as expected.

R. M. Stulz (1996) introduced the comparative advantage of a firm in bearing certain financial risks in order to explain reasons for selective risk management. A firm has a comparative advantage if, in relation to investors and other firms, it has better access to market information important for predicting changes in certain market prices. Thus, if a firm has a comparative advantage in bearing foreign currency risk, the management can increase the exposure of the firm to such a risk because they can promptly and effectively respond to adverse changes (for example, by using currency forwards) and take advantage of favorable (by taking an unhedged position) changes in exchange rates. Simultaneously, it will increase investments in the management of other risks to reduce the likelihood of their adverse impact on firm value. The management should carefully evaluate the comparative advantage of the firm in order to reduce the probability of losses resulting from selective risk management. If a firm has a large market share and a high turnover on the foreign exchange market, the likelihood that the firm will have a comparative advantage on that market increases, and the probability of losses decreases. It should be noted that the comparative advantage of the firm provides flexibility to the management decision-making process (real options), so that exposure to a certain risk becomes convex.

## CONCLUSION

Starting from the basic theoretical assumptions about market efficiency and investors' risk aversion, the paper has analyzed the theoretical arguments on the impact of risk management on corporate value. If it is assumed that a market is perfectly efficient and investors fully rational, then risk management at the corporate level is not financially justified because investors can effectively eliminate the risk of their investment by using diversification. However, if one takes into account market imperfections and choices

that investors really make in situations of uncertainty, then conclusions about risk management change. Market imperfections, such as the cost of financial distress, agency costs and taxation can cause the development of concave risk exposure. In view of Jensen's inequality, risk management will cause a reduction in the cost of market imperfections and help increase corporate value when risk exposure is concave. If investors' risk aversion is pronounced, risk management at the corporate level may be effective even when risk exposure is linear. Therefore, the conclusion is that the first hypothesis set out in this paper should not be rejected.

The financial literature often analyzes the problem of determining the optimal amount of corporate risk exposure. A solution to this problem is mainly determined by investors' risk aversion, the cost of risk management and the competitive advantage of a corporation on the relevant market. While it is possible that a corporation will completely eliminate the exposure of some items to a certain risk, it will probably not completely eliminate the exposure of all items to the same risk. A corporation will seek to reduce exposure to a particular risk to a level where the total cost of risk management is minimal, i.e. the level at which the marginal cost of bearing unhedged risk equals the marginal cost of risk management. Given the fact that costs of risk management are relatively low and potential benefits of risk management are high, it is unlikely that a corporation will make a decision not to manage the risk at all, i.e. to accept the total risk of changes in a certain market price. Finally, a corporation will make a decision to accept a higher level of certain risk if it has a comparative advantage in bearing of this risk, although it should be noted that, then, the exposure of the corporation becomes convex. The paper lists the arguments supporting the view that the management can maximize corporate value if they optimize corporate risk exposure, so the second hypothesis set out in this paper should not be rejected, either.

There are two contributions of this paper. First, the conducted theoretical research contributes to the further development of theoretical and empirical models for the impact of risk exposure on financial effects of risk management at the corporate level (Smith

& Stulz, 1985; MacKay & Moeller, 2007). The paper has developed a general approach to evaluating effects of risk management, which takes into account the level, shape and direction of the relationship between the value (of a firm, assets, liabilities etc.) and various risk factors, as well as the level of investors' risk aversion. Second, by including the cost of risk management and the cost of unhedged risk in the analysis of financial effects of risk management, this paper contributes to the further development of theoretical views on the optimal level of risk exposure. By emphasizing the comparative advantage of a corporation on a relevant market, the analysis has indirectly taken into consideration real options as the representation of operational risk management strategies. The theoretical approach developed in this paper represents a solid basis for a future theoretical and empirical research, but has a limited practical value because it does not explain the specific models for the evaluation of financial effects of risk management. However, this approach can serve as the basis for the development of guidelines and models that will help managers make informed decisions in a real business environment.

Theoretical research commonly assumes that corporations manage risk by using financial derivatives, while neglecting the importance of operational risk management strategies. This problem has only been implied in this paper by emphasizing the fact that a firm's exposure to risk may become convex if the management increases the level of the business flexibility of the firm through the development of real options. A firm with real options can mitigate the impact of adverse changes and take advantage of favorable changes in market prices in order to maximize value. Therefore, future research should focus on an analysis of the impact of operational risk management strategies on corporate value. Empirical research on the impact of financial risk management strategies on corporate value in developed countries does not always provide support to theoretical conclusions (Graham & Rogers, 2002; Aretz *et al*, 2007). The reasons for such empirical findings should partially be sought in inadequately developed empirical models which only analyze one aspect of risk management (i.e. only the cost of financial distress).

Therefore, future empirical research, especially in economies with underdeveloped markets, should recognize the complexity of risk exposure and risk management in order to allow a reliable assessment of theoretical conclusions.

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