Rationales for Corporate Risk Management - A Critical Literature Review

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Rationales for Corporate Risk Management: a critical literature review

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ABSTRACT

This paper describes theoretical motivations for corporate risk management activities and empirical evidence provided by different scholars on such rationales. These theoretical considerations can be extended also to the new risk management practices such as enterprise risk management. Based on modern financial theory's assumption that markets are perfectly efficient, organizations should not implement risk management practices since they cannot contribute to add firm value. However, in the presence of market imperfections, risk management, stabilizing firm's earnings, can benefit companies in the following manners: reducing transaction costs especially the expected costs of bankruptcy, lowering corporate taxes, aligning financing and investment policies and reducing costs associated with agency problems and asymmetric information.

Keywords: Risk Management, Hedging, Market imperfections

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1. INTRODUCTION

This paper describes the theoretical rationales for corporate risk management, i.e. how risk management can create and sustain firm value. Papers cited in this paper refer mainly to traditional risk management that is based on the purchase of insurance and the use of derivatives to manage risk categories individually.

The utility of risk management has been widely studied in literature. Modern financial theory, which has been developed since the late 1950s, implied that financial decisions, such as hedging, do not affect firm's market value. In particular, the Capital Asset Pricing Model and Modigliani (CAPM) and Miller's theorem are the main pillars of the irrelevancy argument of risk management. According to the CAPM and Modigliani and Miller's Propositions, a firm is not able to enhance firm value by reducing its exposure to risks because investors can easily diversify away these risks through their own personal accounts and can costlessly replicate any hedging decision made by the firm.

2. IRRELEVANCE OF RISK MANAGEMENT ARGUEMENT

In 1958, Modigliani and Miller publish an article entitled "The cost of capital, corporation finance and the theory of investment", which will be later known as the Modigliani and Miller's theorem (M&M's theorem). This states that, under certain assumptions, the value of a firm is unaffected by a firm's capital structure decisions. The assumptions are the following ones:

- there are no taxes, bankruptcy costs, agency costs, transaction costs and asymmetric information;
- the investor's cost of borrowing money is the same as that of the firm;
- the borrowing rate is equal to the lending rate;
- there are no arbitrage opportunities;
- there no barriers preventing access to financial markets;
- there are no restrictions on financial policy.

The basic idea behind this proposition is that firms cannot create value with capital structure decisions that investors can reverse or copy on personal account since shareholders can always replicate the financial policies of the firm with transactions in the capital markets. Therefore, the only possibility to increase firm value consists of the realization of real, positive net present value projects. Whether these investment projects are financed with equity or debt, however, is irrelevant, i.e. the financing decision does not increase the value of the firm further. The theorem is made up of two propositions. The proposition I states that the value of two firms which are identical except for their financial structures is the same, while, according to proposition II, as leverage increases, the cost of capital r_a stays constant because the investment policy does not change, whereas the return on equity r_e increases (if $r_a > r_d$), because of the higher risk involved for equity-holders in a company with debt. Thus this theorem establishes the irrelevance of the capital structure, but it also implies that, since the assumptions, which it is based on, are not met in the real world, capital structure does matter. The M&M's theorem is then extended considering taxes and dividend policy by the same authors. Applying the logic of the M&M's propositions to corporate risk management, risk management as a financial activity does not enhance firm value.

The Capital Asset Pricing Model (CAPM) has been introduced by Treynor (1961), Sharpe (1964), Lintner (1965) and Mossin (1966) independently, building on the earlier work of Markowitz (1952) portfolio theory. Markowitz assumes that an asset's return is normally distributed and defines risk as the standard deviation of return. He also models a portfolio as a weighted combination of assets, so that the portfolio return can be expressed as the proportion-weighted combination of the constituent assets' returns while portfolio volatility is

a function of the correlations of the component assets. As a result, Markowitz observe that, by combining different assets whose returns are not perfectly positively correlated, investors can obtain a diversified portfolio which have less risk than the weighted average risk of its constituent assets, and often less risk than the least risky of its constituents. Moreover, in the Markowitz model, among all possible portfolios composed by different risky assets, it can be identified a set of portfolios, that represents the efficient frontier, characterized by the lowest risk for a given level of expected return or, equivalently, the maximum possible expected return for given risk level. Thus, a risk averse investor (i.e. an investor who, between two portfolios that offer the same expected return, prefers the less risky one) will choose the optimal portfolio among those lying on the efficient frontier and will select among them the one that fits better investor's degree of risk aversion. Tobin (1958) extends Markowitz's work by introducing the possibility of investing in fixed interest bonds that offer a risk-free return equal to R_f. Thus, investors can construct portfolios composed by both risky assets and risk-free securities. Considering these two possible investments, there is not a series of best portfolios like in the Markowitz's model but there is only one optimal stock portfolio for all investors. This portfolio is often referred to as the *market portfolio* and can be defined as a widely diversified portfolio which includes all assets in the economy. This portfolio is on the efficient frontier and lies on the tangency line drawn from the risk free asset, which represents the new efficient frontier, called capital market line. The conclusion of Tobin's argument is summarized in the so-called *Separation theorem*, i.e. the choice of the optimal portfolio can be reduce to a two-steps process: firstly investors have to find the market portfolio, secondly they have to allocate their wealth between the risk-free asset and this market portfolio according to their risk preference. Returning to the CAPM, it aims to study how the prices of all assets in the market settle down to reach the equilibrium defined by the market portfolio. In order to determine the required expected return for a correctly priced asset some assumptions are made:

- asset returns conform to the normal distribution and investors are only concerned about mean and variance;
- investors are rational, risk averse and utility-maximizing;
- investors are price takers, i.e., they cannot influence prices;
- there are homogeneous expectations among investors about asset returns;
- there are no taxes and transaction costs;
- securities are all infinitely divisible;
- there exists only a single-period horizon for all investors;
- investors are broadly diversified across a range of investments;
- risk-free rates exist with limitless borrowing and lending capacity;
- all information is available at the same time and cost to all investors;
- short selling restrictions do not exist;
- the risk-free borrowing and lending rates are equal.

Sharpe demonstrates that the correct risk premium of an asset depends on the contribution of the asset to the risk of the portfolio. As the number of assets in the market portfolio increases, a given asset's contribution to the risk of the portfolio depends almost entirely on its covariance with other assets in the portfolio and its weight in the portfolio, while the contribution of the asset's variance to the risk of the portfolio diminishes. Considering the Separation theorem mentioned before, the CAPM can be expressed as $E(R_i)=R_f+\beta_i(E(R_m)-R_f)$ where the $E(R_i)$ is the expected rate of return on the asset i, R_f is the risk-free rate, $E(R_m)$ is the expected return on the market portfolio and β_i represents the sensitivity of the asset price to movement in the market portfolio's value, which analytically is equal to the covariance between the return on asset i and the market

return divided by the variance of the market return. The CAPM indicates that the required rate of return is equal to the sum of two terms: the risk free return and the compensation for taking the asset's risk. This compensation can be expressed as sensitivity of exposure to the systematic risk (β) multiplied by the market risk premium ($E(R_m)-R_f$). Thus, the CAPM shows that investors obtain a return commensurate only with the systematic risk and not with total risk. After the CAPM was developed, many empirical tests are conducted to test its accuracy in predicting asset values.

The CAPM is criticized by some scholars like Fama and French, who show the existence of other factors that explain stock prices besides systematic risk, like firm size and book-to-market value ratio. However, the CAPM is still widely used into financial markets. As to risk management, the CAPM implies that shareholders can manage risk on their own through diversification so that hedging can be even a firm value-destroying activity. In addition, shareholders have widely differing preferences, which can be accounted for when hedging individually, but not when hedging at the firm level.

It is important to explore the irrelevance proposition of financing decisions, because the conditions required to make risk management irrelevant clearly indicate where to look for rationales of corporate risk management. Consequently, more recent research has extended the previous analysis further by examining why firms actively engage in hedging activities. Scholars introduce several theories of hedging which overcome the irrelevancy arguments of modern financial theory. The most recent studies rest on the argument that capital markets are not perfect and demonstrate that market imperfections enable firms to enhance their market value through risk management in a way that cannot be exactly duplicated by individual investors. In these theories it is assumed that the main objective pursued by all stakeholders is the maximization of firm value, measured as the discounted value of its expected future net cash flows, where the discount rate reflects the investors' required rate of return on an equivalent risky asset traded in the financial market. Thus, risk management has to be assessed considering if it contributes to this goal by raising shareholders value in the presence of market imperfections: only if the increase in value exceeds the cost of hedging and if the value augmentation cannot be realized by investors on their own accounts, risk management at the firm level is justified. According to the above definition, firm value can generally be increased by reducing the discount rate and/or by increasing the cash flows, but analyses of the impact of corporate risk management on firm value typically focus only on the expected cash flows of the firm. This is primarily due to the fact that the effect of hedging on cash flows is more intuitive and easier to understand. At the same time, the perspective on cash flows avoids the question of the diversifiability of financial risks. Last but not the least, in order to study the impact of risk management on the discount rate it is necessary to refer to the CAPM whose assumptions are just those questioned in these theories. Therefore, it appears more appropriate to consider the impact of corporate risk management in the cash flows rather than in the discount rate. From this point of view, as shown in figure 1, corporate risk management generally determines a reduction of the volatility of corporate cash flows which, as a result, leads to a lower variance of firm value (Lewent and Kearney, 1990; Rawls and Smithson, 1990; Smith, Smithson and Wilford, 1990). However, it should be noted that it is not the reduction in the variance of corporate cash flows that generates directly an increase in the market value of the firm: the main ways that a firm can increase its value via hedging are through the indirect effects of reduced cash flow variability. In particular, companies will hedge in order to reduce the variance of cash flow for the following primary reasons: 1) to reduce transaction costs, especially the expected costs of bankruptcy, 2) to reduce costs associated with agency problems and asymmetric information, 3) to reduce corporate taxes, 4) to reduce costs of external financing. Consequently, a reduced cash flow volatility results in lower costs associated with these capital market imperfections, larger cash flows to the owners of the firm, and thus higher expected firm value (Culp and Miller, 1995; Santomero, 1995).

Figure 1 provides an overview of the main capital market imperfections used in the literature as a basis for risk management rationales that will be explained in detail in the following sections. Finally, it is important to specify that the various positive theories to explain corporate risk management rely on different corporate objectives (e.g. firm value, cash flows, pre-tax income). For instance, the corporate tax burden can be reduced by hedging pre-tax income, the cost of financial distress can be lowered by hedging total cash flow, and investment and financing policies can be coordinated by hedging cash flow before investment spending (as will be explained below). Nevertheless, these activities sometimes do not work in the same direction , that is, they can reduce the volatility of some variables but simultaneously increase the volatility of others. Consequently, there exists the possibility of conflicts between different corporate targets that have to be taken into account when determining the risk management strategy. They can be avoided through the selection of appropriate hedging instruments that are independent of each other and can thus be employed to hedge different objective values (Froot, Scharfstein and Stein, 1993; Graham and Smith, 1999; Smith, 1995).
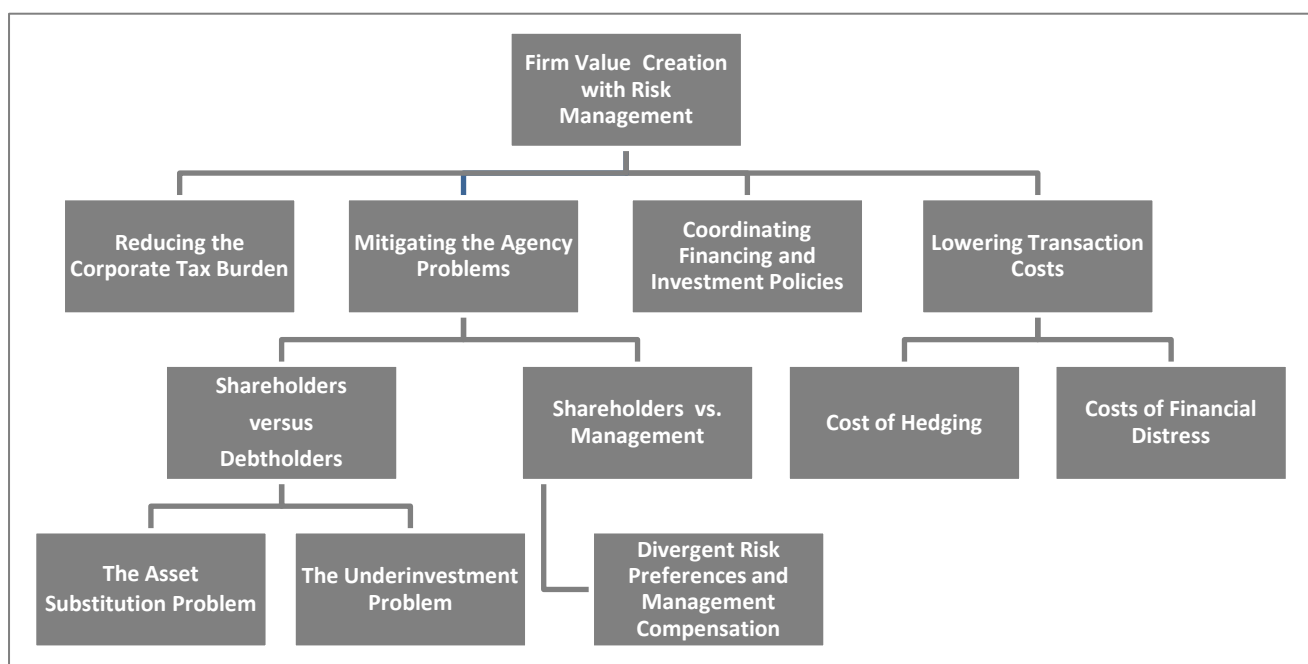

Figure 1- Rationales for corporate risk management

3. MITIGATING THE AGENCY PROBLEMS

Agency theory is the study of the agency relationship and the associated problems, particularly the dilemma that the principal and agent, while nominally working toward the same goal, may not always share the same interests. The theory has been developed by several scholars (Arrow, 1985; Eisenhardt, 1989; Fama, 1980; Hacket, 1985; Jensen, 1983; Jensen and Meckling, 1976; Jensen and Smith, 1985; Pratt and Zeckhauser, 1985; Ross, 1973). The literature largely focuses on methods and systems, and their consequences, that arise to try to align the interests of the principal and the agent. In 1976, Jensen and Meckling define an agency relationship as a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some services on their behalf, thus delegating some decision making authority to the agent. A simple agency model suggests that, as a result of information asymmetries, self-interest and incomplete contracts, the agent will not always act in the best interests of the principal. Information asymmetry leads to two market problems: adverse selection and moral hazard. Arrow (1985) equates these two terms with hidden information and hidden action, respectively. The concept of adverse selection refers to situations where, before entering the contract, the agent has an information advantage upon the principal. Moral hazard arises

after signing the contract, when the action undertaken by the agent is unobservable and has a differential value to the agent as compared to the principal. There are two ways, called *signalling* and *screening*, that can be used to associate unobservable types of the agents with their observable actions and thus to resolve the problem of adverse selection. In the first case, the agent is required to send a costly and credible signal which reveals some of the hidden information of the agent to the principal. In the second situation, the principal offers different types of contracts so that the agent himself reveals his type by choosing one of the contracts. The principal needs to design the contracts opportunely, such that each contract targets a specific type of agent and maximizes the profit of the principal. On the other hand, moral hazard can be solved by associating the agent's unobservable actions with observable outcomes. There exist two types of solutions, *pre-contract* solutions and *post-contract* solutions which take place before and after hiring the agent respectively. The main post-contract solutions are based on monitoring and performance evaluation even if they can prove costly and time consuming. The pre-contract solutions include job design and contract design. The first one means that the work should be structured in such a way that it reveals the maximum amount of information to principal at the lowest cost and facilitates the use of contract design schemes. These regard mainly how managers are compensated for their efforts and are an effective instrument to align the agent's incentives with the principal's ones. Jensen and Meckling define the costs resulting from the principal-agent relationship as the sum of the monitoring expenditures by the principal, the bonding expenditures by the agent and the residual loss. Monitoring costs are expenditures paid by the principal to control agent's behaviour. They may include the cost of audits, writing executive compensation contracts and also the cost of firing managers. Given that agents ultimately bear monitoring costs, they are likely to set up structures to guarantee that they will not take certain actions which would harm the principal or to ensure that the principal will be compensated if they do take such actions. The cost of establishing and adhering to these systems are known as bonding costs. They may include the cost of additional information disclosures to shareholders, bonding against malfeasance, contractual limitations on agent's power, which limits his ability to take full advantage of profitable opportunities, foregoing certain non-pecuniary benefits, etc. However, despite monitoring and bonding, there is still some divergence between the agent's decisions and those decisions which would maximize the welfare of the principal. These agency losses are known as residual loss. Regarding the contribution of corporate risk management to firm value, the agency costs that result from the contractual relationship between shareholders and managers on the one hand, shareholders and debtholders on the other hand are of foremost interest.

3.1 SHAREHOLDERS VERSUS DEBTHOLDERS

Agency conflicts between shareholders and bondholders arise from the different nature of their claims: bondholders receive a fixed amount or, if the company is bankrupt, the whole value of the company. Shareholders, on the other hand, are residual claimants. They receive the market value remaining after bondholders are paid. Managers, who protect the interests of ownership, are better informed than bondholders and, therefore, have incentives to take decisions which transfer wealth from bondholders to shareholders. This conflict arises only when the probability of default exists. In the case of profitable companies with abundant cash flows, the interests of these two classes of the company's owners would appear to be relatively similar. However, the higher the probability of financial distress, the more interests of shareholders and bondholders may diverge. The relationship between shareholders and debtholders causes these two principal debt agency problems. One is the risk-shifting or asset substitution problem, first identified by Jensen and Meckling (1976). In their views, equity can be seen as a call option on the firm and call values increase with the volatility of the underlying asset. This creates an incentive for equity holders to shift the

firm's investments into high risk projects. The other one is the underinvestment or debt overhang problem. Myers (1977) argues that, when a firm's leverage increases, equity holders have an incentive to under-invest in positive net present value (NPV) projects. This occurs because equity holders bear the costs of investment but capture only part of the net benefit, and the rest accrues to bondholders.

The Asset Substitution Problem. Galai and Masulis (1976) and Jensen and Meckling (1976) introduce the risk-shifting problem as one of the conflicts of interest between shareholders and debtholders. Managers, after having contracted a debt and while acting in ownership interest, have incentives to take on riskier projects (even with negative net present value), especially when leverage is high and firm value is low (MacMinn, 1987a). These projects are characterized by very high payoffs if successful even if they have a very low probability of success. If they turn out well, shareholders receive most of the benefits; if they turn out badly, the debtholders bear most of the costs because shareholders can count on equity's limited liability. In fact, the equity in a firm is a residual claim, that is, equity holders lay claim to all cash flows left over after other financial claim-holders have been paid off. If a firm is liquidated, the same rule applies, but the principle of limited liability protects equity investors because even if the value of the firm is less than the value of the outstanding debt they cannot lose more than their investment in the firm.

When trying to understand why the presence of risky debt can create incentives for risk shifting, the literature often refers to studies developed by Merton (1974) and Mason and Merton (1985). Their research is based on the option pricing theory framed by Black and Scholes (1973). According to Merton's study, the firm's equity can be seen as a European call option on the firm's assets with a strike price equal to the book value of the firm's liabilities. The "option-like" property of the firm's equity derives from stockholders being residual claimants with limited liability. This limited liability gives the shareholders the right, but not the obligation, to pay off the debtholders and to take over the remaining assets of the firm. Assuming that all liabilities are due on the same date, namely at the maturity of the option (T), if the market value of the firm's assets is greater than the book value of liabilities at the maturity of the debt, the shareholders have an in-the-money call option. In this case, the shareholders pay off the debtholders and the firm continues to operate. If the market value of the firm's assets is lower than the book value of liabilities, the option will expire implying that the equity value is zero and the firm declares bankruptcy. In this case the liquidation value is transferred to the debtholders. Therefore, in the Merton framework, the value to the shareholders at the date of maturity of debt is defined by the following condition: $E_T = \max[A_T-D,0]$ where E_T is the market value of the firm's equity, A_T is the market value of total assets and D is the book value of liabilities. This is exactly the payoff function of a call option with strike price D that matures on T and where underlying is represented by firm's assets. E_T can be also written as $A_T + \max[D-A_T, 0] - D$. The second term is equal to the payoff function of a put option with strike price D that matures on T. Hence, the equity holder of a company can be viewed as either having a call option on the asset value of the firm or having the firm, a put option and a debt. It is easy to recognize the put-call parity expression. At any time before expiration it is: $c_0(D)=A_0+p_0(D)-De^{-rT}$ where $c_0(D)$ and $p_0(D)$ represent the current value respectively of a call option and a put option with strike price D and maturity T, A_0 is the market value of total assets at time 0, r is the free-risk rate and De^{-rT} is the discounted book value of liabilities. Regarding the market value of the debt at maturity, it can be viewed as a portfolio of a risk-free bond and a short-put option: $D_T = \min[A_T,D] = A_T-E_T = A_T - \max[A_T-D,0]= D - \max[D-A_T,0] = D + \min[A_T-D,0]$. Before expiration, the bondholders' position is: $A_0 - c_0(D) = De^{-rT} - p_0(D)$. Therefore, debtholders are either the owners of the firm and writers of a call to shareholders or holders of a riskless bond and writers of a put to shareholders. In terms of capital structure this implies that equity holders own assets, borrow the debt, and also hold a put option, which enables them to sell the asset for the borrowed amount. Analogously, the debtholders write a put option to the equity holders in recognition of the possibility of

default. Therefore, if default occurs, the equity holders would prefer to exercise the put option or to let the call option expire. Figure 2 shows the value of firm equity E_T and the value of firm debt D_T as a function of the asset value A_T at maturity of the debt.

In brief, bondholders, lending money to the firm, hold fixed claims on the firm, while stockholders are residual claimants. They have claims whose value is equivalent to a call option on the assets of the firm, since they have the right to take over the firm by paying what is due to debtholders at the expiry date. Just this analogy with options explains the root of the risk-shifting problem. The holders of a call option cannot lose more than what they pay for the option. If the price of the underlying falls, they will not exercise the option. Thus, unlike a futures contract, potential loss is limited. For a call option, a big rise in the underlying price can generate a big gain. However, an equally large drop in the underlying price only means that the option expires worthless and the holder pay only the cost of the option.
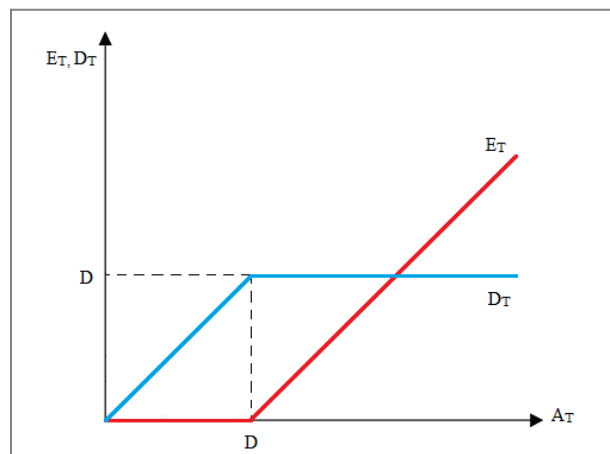

Figure 2 - Payoff at maturity for the holders of debt and equity

Because of the asymmetric payoff, options are worth more when the underlying has prices that are highly volatile. Hence, as with any other option, the value of the shareholders' equity increases when the underlying asset's volatility grows, that is, an increase in the volatility of the firm's cash flows will rise the option value and thus equity value. Therefore, shareholders have an incentive to replace safe assets characterized by low variance with risky assets characterized by high variance. High risk investment projects show a broader distribution of the yields probability than the one usually applied by the firm. The shareholders hope to be able to take advantage of the positive side of probability distribution, since their responsibilities, and thus the sum total of their losses, are limited to the firm's capital. At the same time, though, shareholders are residual claimants, or subjects that have the right to receive everything that is left other once the debtholders have been paid. In this sense, once the debt has been taken care of, they have no limits on how they appropriate created value. This behaviour increases the value of the shareholders' claims while reducing the value of the fixed claims. This will basically not only transfer wealth from debtholders to shareholders, but will also be typically not beneficial to the firm as a whole. The incentive for asset substitution is even stronger when firm is close to distress, because shareholders have a chance to restore the value of their equity by taking large risks. If the risk taking does not work out, then shareholders are not worse off, since their equity had little or no value anyway. This could go as far as accepting negative NPV projects with large upside potential, because any gains flow to the shareholders, but any losses are borne by the debtholders. Rational bondholders, however, understand that after the bonds are issued, any action which increases the wealth of the stockholders will be taken and, thus, anticipate this opportunistic behaviour. They can protect themselves against the expected losses due to this wealth transfer in two ways. First, they can require higher yields for supplying debt capital

by discounting the asset substitution problem anticipately (Smith, Smithson and Wilford, 1990). Second, they can impose debt covenants in order to put restrictions on the investment and financing policies (Mayers and Smith, 1982 and 1987; Smith and Warner, 1979). A bond covenant is a provision which restricts the firm from engaging in specified actions after the bonds are sold. Debt covenants are welfare reducing as they limit the degrees of freedom of management and possibly block the realization of profitable, yet risky investment projects (Fite and Pfleiderer, 1995; Smith and Warner, 1979). They can also issue convertible debt or other options to participate in the value increase of the equity. However, these restrictions can lead as well to a suboptimal investment policy and can eliminate the flexibility needed to take advantage of new investment opportunities, increasing the agency costs of debt. Additionally, since the shareholder incentive to opportunistic behaviour increases as the firm is closer to distress, firms may find it difficult in general to raise external funds to finance valuable investment projects.

All these possibilities create additional costs that reduce firm value, whereas corporate risk management can help to reduce or avoid agency costs from risk shifting by balancing conflicting interests. Stabilizing the cash flow of the firm, it may prevent firm value from dropping off to levels at which there are strong incentives to shift towards riskier assets, which is normally at low firm value and high leverage, where the wealth transfer from bondholders to shareholders is largest (Campbell and Kracaw, 1990; Smith, 1995; Bessembinder, 1991). In this context, it is important to notice that firms have to credibly pre-commit on a hedging strategy in order to achieve the potential benefits of corporate risk management in terms of reduced agency costs. Without the ability to do so, the gains from risk management at the firm level will be smaller. Firms might be able to credibly commit to a hedge through established reputation (for example, resulting from a bond rating), or by defining their risk management strategy in debt covenants (Bessembinder, 1991; Smith, 1995; Smithson, 1998). In order to analyze the impact of risk management on the asset substitution problem empirically, the violation of debt covenants in the presence of financial risks can be studied. Empirical tests show that hedging is indeed used to reduce the risk of breaking a covenant (Géczy, Minton and Schrand, 1997; Francis and Stephan, 1993). However, it is difficult for a company to credibly guarantee the continuing existence of corporate hedging, as it might consider discontinuing risk management, if it winds up in a situation in which taking on more risky projects is very beneficial (Stulz, 2001). Nevertheless, Morellec and Smith (2007) show that shareholders will typically benefit from negotiating the issuance of debt and the hedging strategy simultaneously, since lenders will provide the same funds at a lower rate. Consistent with this result, many firms appear to arrange credit lines as well as hedging programs through the same financial institution, which enables the bank to monitor the borrowers' hedging programs. Consequently, other financial institutions or contracting parties may also offer more favourable terms to companies that establish lines of credit and hedge positions with the same bank.

The Underinvestment Problem. The underinvestment problem derives from the agency relationship between shareholders and debtholders. If managers act in line with shareholders' interests, they may forgo value-enhancing projects, if the gains of accepting these projects accrue mostly to bondholders. This situation occurs typically when a firm is highly levered and firm value is low, as bondholders are reimbursed before shareholders, and thus valuable projects might not benefit shareholders. Myers (1977) demonstrates that firms with high leverage and information asymmetries could not have optimal investment behaviour. He characterizes firms' potential investment opportunities as options and shows that, if fixed payment obligations are high, taking a positive net present value project can reduce shareholders' wealth if the gains primarily benefit the firm's debtholders. Let assume that a firm has to decide whether to invest I, that is whether to exercise its option. If it invests, additional shares must be issued to raise the requirement investment and the firm will obtain an asset worth V(s), where s is the state of nature. If it does not invest then no additional

shares are issued, the investment opportunity expires and has no value to the firm. The decision to accept or reject the project is undertaken after the state of nature is revealed. Obviously, in the absence of agency conflicts the investment will be made only if $V(s) \geq I$ as shown in Figure 3 (a). For states displayed to the right of s_a, ($s \geq s_a$,), the investment is made. For states $s < s_a$, the project will be rejected. Thus, when trying to maximise firm value, managers should use all investment options that have a positive net present value. Then Myers analyzes the situation of a company that gets into debt to reduce the required initial equity investment. If the debt matures after the firm's investment option expires then outstanding debt will change the firm's investment decision in some states. In the presence of agency costs, for managers acting in the best interest of shareholders, the option is worth exercising only if $V(s)$ exceeds the sum of I and P, the promised payment to the firm's creditors (interest on debt). If $V(s) < I+P$, that is if $s < s_b$, the investment is not made. The new situation is shown in Figure 3 (b). This implies that underinvestment occurs in the region between s_a and s_b. The loss is shown by the shaded triangle in Figure 3 (b). A high P (that occurs when leverage is high) implies a larger triangle and a lower V. In fact, if P is set high enough, $V(s)$ will be less than I+P in most of states. Thus, the presence of risky debt creates, ex post, potential situations where management can serve shareholders' interests only by making suboptimal investment decisions.

This underinvestment problem can be alleviated by rewriting or renegotiating debt contracts, shortening the maturity of outstanding debt, or issuing less debt, but these remedies create additional costs. On the contrary, corporate hedging allows a firm to stabilize its cash flows and thereby ensures that the gains from the project are less often below initial investment plus fixed obligations that are the situations in which the underinvestment problem occurs (Bessembinder, 1991; Mayers and Smith, 1987; Smith 1995; Smith, Smithson and Wilford, 1990). Consequently, situations in which the conflict of interest occurs arise less often, and shareholder value increases due to avoided agency costs. As a result, while the underinvestment problem can be alleviated by reducing outstanding debt, corporate risk management can achieve the same goal without sacrificing the tax benefits of debt, even if sometimes benefits from additional tax shields of a higher optimal debt ratio cannot exceed higher agency costs: Smith, Smithson and Wilford (1990) and Smith and Watts (1992) show that companies with large growth options have lower debt ratio.

Underinvestment is more important for firms with high growth opportunities, as the value of these firms would suffer most from failing to invest into the available profitable projects, and high leverage, as these firms are more likely to end up in states in which these conflicts can occur. As a result, high growth opportunities and high leverage should increase the incentives for corporate hedging.
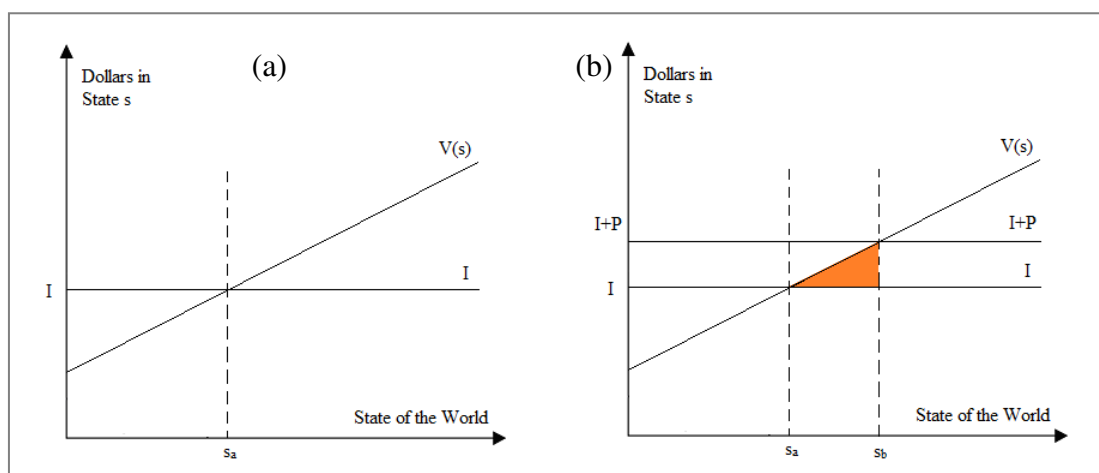

Figure 3 - The underinvestment problem

Proxies which measure the existence and magnitude of available growth opportunities include research and development (R&D) expenditures, property, plant, and equipment (PP&E) expenditures, the asset growth rate, and attempted acquisition activities. Other proxies that measure the availability of positive NPV projects in a more indirect way are the price-to-earnings ratio, the market-to-book ratio, Tobin's q and firm's cumulative abnormal returns (CARs). A rationale for using the market-to-book-value ratio is that it measures the likelihood that a firm will have positive-NPV projects or growth opportunities. This is based on the idea that market value represents both the values of a firm's assets in place and future growth opportunities, while book value captures the value of assets in place. Thus, the ratio provides a relative measure of a firm's growth opportunities. As one alternative to the market-to-book-value ratio, financial economists often use Tobin's q as a measure of a firm's investment opportunities, where Tobin's q is the ratio of the market value of the firm to the replacement cost of its assets. The price-earnings ratio is also used to measure a firm's future opportunities because higher price to earnings ratios are typically associated with firms with higher growth prospects. The last growth variable is a firm's market-adjusted cumulative abnormal return (CAR). Using CAR as a growth variable supports the view that a firm's stock price reflects the value of its future earnings both from assets in place and growth opportunities. Therefore, increases in a firm's growth opportunities should lead to an abnormal positive movement in the firm's stock price.

Empirical studies provide mixed support for the underinvestment hypothesis. Some studies find evidence for the relation between growth opportunities and corporate risk management (Allayannis and Ofek, 2001; Dolde, 1995; Fok, Carroll and Chiou 1997; Gay and Nam, 1998; Géczy, Minton and Schrand, 1997; Howton and Perfect, 1998; Knopf, Nam and Thornton, 2002; Lin and Smith, 2007; Nance, Smith and Smithson, 1993). On the contrary, Fehle (1998), Francis and Stephan (1993), Goldberg et al. (1994), Graham and Rogers (1999), Lewent and Kearney (1990), Mian (1996), Samant (1996), Schrand and Unnal (1998), find converse results. The study by Tufano (1996) shows significant results for the debt ratio, but not for variables representing investment opportunities. The study by Dolde (1993), however, cannot identify significant differences in the debt ratio of users and non -users of derivatives. In the studies by Géczy, Minton and Schrand (1997), Guay (1999a), and Nance, Smith and Smithson (1993), investment variables, but not the debt ratio are significant. Berkman and Bradbury (1996) find significance for the debt ratio and earnings per share. The study by Allayannis and Weston (1997) documents empirical evidence for a positive relationship between firm value and the usage of derivatives. Gay and Nam (1998) find evidence for several growth variables. In addition, firms with high growth opportunities hedge more if their cash stock is low. There are also some differences depending on the proxy used to estimate growth opportunities. The coefficients of PP&E expenditures, the asset growth rate, and the value of attempted acquisitions never reach significance levels. Only Rajgopal and Shevlin (2002) find the predicted relation between high exploration activities (in the gold mining industry) and derivatives' use, while the evidence in other studies is either insignificant or in the opposite direction (Dionne and Triki, 2005; Haushalter, 2000; Tufano, 1996), which may be due to the relation between growth options and corporate hedging being not as simple as supposed in these empirical studies (Morellec and Smith, 2007). With regards to the more indirect measures of growth opportunities, the earnings-to-price ratio, which is mainly used in earlier studies, offers some support for the agency cost hypothesis in multivariate tests (Gay and Nam, 1998; Berkman and Bradbury, 1996). Moreover, while hypotheses related to book-to-market are often not validated, CARs associate with corporate hedging at significant levels in the right direction (Gay and Nam, 1998). Finally, there is strong evidence suggesting that firms in regulated industries face lower incentives to have recourse to corporate hedging (Rogers, 2002; Mian, 1996; Mayers and Smith, 1982; Guay, 1999a; Goldberg et al., 1994). Regulated industries are often characterized by lower levels of information asymmetries than other industries (Mian, 1996). Therefore, it is

easier for bondholders to control the behaviour of managers, and thus to inhibit them from turning down profitable investment projects. Furthermore, it can be argued that regulated industries in general, first, do not have the same growth opportunities as unregulated industries and, second, operate in more stable environments (Smith and Watts, 1992). It can thus be hypothesized that firms in regulated industries have a lower demand for corporate hedging than firms in unregulated industries.

3.2 SHAREHOLDERS VERSUS MANAGEMENT

A typical principal-agent relationship originates when shareholders (i.e. the principals) hire managers (i.e. the agents) to act on their behalf. The stockholders, that own the company, decide the set of objectives that must be achieved, while managers, that, on the other hand, control the firm, are supposed to allocate the company's resources in the best way in order to attain these goals. However, there are three factors that disturb this relationship. The first problem is that, since managers, who run the company as agents on behalf of shareholders, are more involved in the daily activities of the firm, they enjoy an information advantage over their principals. The second factor is uncertainty in the outcome, that is, the outcome might not only depend on the agent's efforts and decisions, but it can be influenced by exogenous elements. Finally, there is a conflict in goals as agents are autonomous and will try to maximize their own utility. In fact, if managers, who should act in the interest of shareholders, are left alone, they could make decisions that maximize their wealth but are not optimal for firm's shareholders. Given that both groups may not share common goals, conflicts can arise since it is typically not possible to prevent non-value maximizing behaviour via perfect contracts. Thus, some mechanisms are needed to discourage managers from diverging from the best interests of the principals they represent. Auditing is one agency cost principals incur in order to monitor the activities of managers but also performance-based pay systems can be designed in order to mitigate agency problems. Moreover, managers are often rewarded with stock options or shares of the company just to limit the scope of opportunistic behaviour towards the ownership. Finally, it is important to note that all these actions aiming at reducing the conflict of interest between managers and shareholders determine further costs. Thus, the extent to which they are implemented depends not only on the benefits brought but also on the associated costs.

Divergent Risk Preferences and Management Compensation. A result of the Capital Asset Pricing Model (CAPM) is that the total risk associated with an asset can be split up in two components: systematic (non-diversifiable) and unsystematic (diversifiable, firm-specific or idiosyncratic) risk. If the number of assets included in the portfolio is high and these assets are not perfectly correlated, the unsystematic component of the portfolio risk diminishes. The CAPM shows that investors only get compensated for holding systematic risk, since the firm-specific component of risk can be eliminated through diversification. Ahimud and Lev (1981) and Stulz (1984) argue that, while shareholders fit the model well, managers generally do not. Thus, agency problems between shareholders and managers arise just because managers face total risk (systematic risk as well as business risk), whereas shareholders face only the systematic component of total risk, since they can diversify away the firm-specific risk of their positions. In particular, managers' limited ability to diversify their own personal wealth position is due to the close relationship between managers and the firm, which is expressed by managers' proportion of wealth invested in the firm, years worked for the firm, specific asset expertise, non-monetary utility components such as reputation, awards, promotions etc. (May, 1995). Therefore, relative to shareholders, managers have a higher demand for firm-specific risk reduction because the manager's portfolio of human and investment capital is tied to firm performance while shareholders' investments are well diversified. Without the ability to diversify their holdings, managers find that the value of their personal wealth fluctuates with their company's value. Hence, the risk associated with managers' income is closely related to the firm's risk. Actually, a firm's failure to achieve predetermined performance

targets, or in the extreme case the occurrence of bankruptcy, will result in managers' losing their current employment and seriously hurting their future employment and earnings potential. Such "employment risk" cannot be effectively diversified by managers in their personal portfolios, since unlike many other sources of income such as stocks, human capital cannot be traded in competitive markets. Thus, managers must be considered undiversified investors given that a considerable portion of their wealth consists of human capital. Two important conclusions follow from this argument. Firstly, managers are likely to be more risk averse than shareholders since they have to face total risk rather than only systematic risk like the owners of the firm. Secondly, shareholders are exposed to moral hazard risk since managers have the possibility and the incentive to use their control over the firm's investment, operating and financing policies to manage their personal income risk. Managers consider their personal attitudes towards risk when choosing the company's level of risk, which may not perfectly match shareholders' preferences (May, 1995; Smith and Stulz, 1985). As a result, there is a basis for potential conflicts of interest between shareholders and managers who make corporate risk management or, more generally, the investment and financing policy of the firm subject to their personal attitude towards risk. This so-called risk preference problem can cause managerial decisions, such as excessive diversification outside of the areas of core competence (conglomerate diversification), over-investment in low-value/low-risk projects as well as suboptimal debt-to-equity ratios, which benefit managers, as they lower the risk attached to their wealth positions, while they are not beneficial to shareholders (Allayannis and Weston, 1997; Amihud and Lev, 1981; Berger and Ofek, 1995; Bodnar, Tang and Weintrop, 1997; Comment and Jarrell, 1995; Denis, Denis and Sarin, 1997; Levi and Sercu, 1991). Agency costs arise in this situation through shareholders' efforts to reduce non-maximizing behaviour, for example through close monitoring (Fite and Pfleiderer, 1995; Mayers and Smith, 1982 and 1990; Stulz, 1984 and 1990). While active monitoring can prevent managers from behaving in non-maximizing ways, no single shareholder has strong incentives to engage in monitoring, as the gains accrue to all other investors in case ownership is widely dispersed and monitoring is costly (free-rider problem). Large shareholders, however, such as institutional investors, have higher incentives to carefully control managers' behaviour, since they are not only bearing the costs, but also obtain a significant part of the benefits. Still, there are disadvantages to holding large blocks of shares in one company, such as foregone diversification benefits (Markowitz, 1952). Thus, conflicts of interest between the owners and the managers can provide a basis for the corporate demand for hedging. Corporate risk management can reduce the associated agency costs, as it lowers the risk of profitable growth opportunities and consequently the variability of firm value and thus reduce the risk faced by undiversified managers who have now fewer incentives to engage in non-value maximizing management decisions arising through differences in risk preferences (Stulz, 2002).

Moreover, risk management, reducing the risk of managers' human capital, determines that managers require a lower risk premium on their compensation (DeMarzo and Duffie, 1995). Actually, managers holding a large fraction of their wealth in their firms bear the total risk of the firm, including its non-systematic risk component that would normally be diversified away in an efficient portfolio. Risk-averse managers will thus require compensation for bearing this non-systematic risk that ordinary investors do not face. Thus, managers will require a higher return for holding the firm's equity and will apply a larger discount rate to the expected future earnings of the firm in privately valuing their holdings. That is, they will typically estimate their holdings of the firm less than the corresponding market value of the shares. This difference between the market price and managers' private valuation is the cash cost to the firm for this compensation policy. For risk-averse managers, the larger the volatility of the firm, the larger the managers' private discount rate, and the larger the component of non-systematic risk, the greater the value gap. Therefore, a firm with a large portion of its compensation based on pay-for-performance may be able to reduce the cost of that

compensation by implementing a risk management policy that reduces the total risk of the firm without reducing the net present value of its projects. Therefore, risk management of the total risk of the firm increases firm value by reducing the risks faced by its non-diversified investors, not only managers but also customers, suppliers, employees who will ask no or only small risk premium for taking on business risks.

The risk-preference problem is more likely to appear in firms where management does not hold significant stock or option positions. Thus, it is important to study the impact of incentive structures and management compensation (Campell and Kracaw, 1987; Han, 1996; Smith and Stulz, 1985). The performance of managers can be evaluated through accounting targets. However, this kind of performance indicators can cause further agency problems between managers and stockholders. This because they induce a short-term perspective and lead managers to pursue objectives which may not or only indirectly contribute to the maximization of firm value and the reduction of its exposure (Franke, 1992; Hacket, 1985). Therefore, linking management salaries to market values is a better solution from this point of view. Furthermore, components of management compensation with option features, such as stock options, can lower managers' risk aversion and even induce speculative behaviour. Thus, shareholders can try to solve this agency problem due to different risk preferences through risk management as well as suitable incentive structures. By linking the compensation and evaluation of managers appropriately to the stock price, they can insure that corporate policies take shareholder value into account and that risk reducing, value destroying strategies on part of the management are mostly avoided. On the other hand, the holding of stocks of the company they work for, however, worsens the diversification problem of managers analyzed before. In essence, the exposure to firm-specific risk that is essential for aligning managers' incentives with those of shareholders also imposes a cost on managers by leading them to hold poorly diversified portfolios.

Moreover, incentive structures are only effective if managers perceive themselves in a position to have an impact on the relevant factors which represent important determinant of their compensation (Smith, 1995). Since the origin of some risks is related to general market conditions and, thus, outside management's control, there often does not exist a clear link between some managerial decisions and corporate performance, which decreases the effectiveness of the incentive structures in place. In this context, corporate hedging could create value by eliminating the erratic influence of financial risks, thus strengthening the correlation between corporate performance and management strategy, which in turn makes the incentive programs more effective tools for stimulating managers to focus on shareholder value.

Smith and Stulz (1985) are among the first to discuss managerial risk aversion as a possible explanation of risk management. They have argued that managers' compensation plans can influence their hedging choices. If the manager's utility is a convex function of the firm value, the manager's utility will have a higher expected value if the firm is not hedge at all. Specifically, the incorporation of option-like provisions in managers' compensation makes the manager's utility a more convex function of the value of the firm. Therefore, they have concluded that managers with important holdings in options are expected to hedge less and seek more risk than the ones with no, or small options holdings. In this case, actually, managers can choose to increase the risk of the firm in order to increase the value of their options. Therefore, executive stock option programs should be negatively associated with corporate risk management, as corporate hedging decreases the volatility of firm value, and therefore the value of stock options. Also bonus plans that make a payment to managers only if accounting earnings exceed some target number will induce managers to hedge less since this payment is a convex function of accounting earnings. On the other hand, compensation packages that lead to a concave function between the manager's expected utility and the firm value will encourage managers to hedge more. Consequently, managers holding a significant fraction of the firm's shares would search more hedging and thus these two variables are expected to be positively correlated. A lot

of empirical studies investigate the effect of management compensation packages on corporate hedging policies by analyzing the amount of shares and options held either by the CEO or by all directors and managers. The results of empirical studies support the hypothesis that corporations hedge less, the more important stock options are for management compensation. Guay (1999b) reports results confirming that options compensation significantly increases the convexity of the relation between manager's wealth and the firm value. Gay and Nam (1998), and Géczy, Minton and Schrand (1997) find a negative relationship between the extent of hedging and stock options held by managers. Also, Rajgopal and Shelvin (2002) and Rogers (2002), Schrand and Unal (1998), and Tufano (1996), show that hedging level is a decreasing function of managers' options holdings. In addition, there is some evidence for a positive statistical relationship between the equity investment of management in their own company and corporate hedging activities. Graham and Rogers (1999), May (1995), Schrand and Unnal (1998), and Tufano (1996), find indications for a positive relationship, while Gay and Nam (1998), and Géczy, Minton and Schrand (1997), however, do not. These results seem to confirm the robustness of the Smith and Stulz (1985) models. However, Carpenter (2000) argues that option compensation does not automatically lead to more risk seeking. Under some conditions, giving risk averse managers more options incite them to reduce the firm value volatility and thus adopt higher levels of risk management. According to Carpenter (2000), stock options create two opposing effects on managerial wealth. The first effect is that manager wealth becomes more important as the volatility of the stock return increases and options payoffs become more important. This effect should cause managers to hedge less. The second effect is that payoff from options becomes less important as the stock price decreases. This should cause risk-averse managers to increase their hedging to avoid a drop in the share price. If the second effect is more important than the first one, managers will hedge more when they are paid with stock options. This conjecture is confirmed by results reported in Knopf, Nam and Thornton (2002). It seems also that mainly firms with weak corporate governance use derivatives for managerial reasons (Lel, 2006).

A different managerial theory of hedging, based on asymmetric information, is proposed by Breeden and Viswanathan (1998) and DeMarzo and Duffie (1995), who focus on managers' reputation. As discussed above, when management compensation is tied to the stock price, changes in compensation are sometimes unrelated to managers' decisions, but are due to general market fluctuations, thus exposing managers to uncontrollable systematic risk. Thus, the distinction between high and low qualified managers becomes blurred when management performance is distorted by non-core business risks. Corporate hedging can eliminate the background noise of such exogenous factors and alleviate the impact of market fluctuations on firm value. Consequently, the first beneficial effect of risk management is to increase the correlation between corporate performance and mangers' decisions and as a result to make the compensation program more effective so that shareholders and managers' goals are more aligned. At the same time, competent managers can distinguish themselves from incompetent ones by credibly signalling their quality type to shareholders that, thus, can more easily distinguish between good and bad management skills. As a consequence, good managers, to which their good reputation is an important asset, have a strong incentive to communicate their skills by hedging effectively and eliminating background noise. On the other hand, inefficient and low qualified managers benefit from the fact that non-business risks distort the relation between corporate performance and management skills. They have incentives to avoid corporate risk management because it allows a more correct assessment of their performance. Empirical evidence exists for corporate hedging as an indicator for good management skills (Breeden and Viswanathan, 1998; Degeorge, Moselle and Zeckhauser, 1996; DeMarzo and Duffie, 1995; Ljungqvist, 1994; Stulz, 1996) have argued that managers may prefer to engage in risk management so as to better communicate their skills to the labour market. They have argued that younger executives are more willing to embrace risk management, than are their older colleagues.

Managerial tenure might play a similar role, because it is possible that short-tenure financial managers would have less developed reputations than longer-tenure managers. Therefore, they would have an incentive to signal their quality through hedging. To the extent these assumptions are correct, firms with younger managers, and those whose managers have shorter tenures on the job would be more willing to manage risk. Contrary to Breeden and Viswanathan (1998) predictions regarding the managers tenure, May (1995) has argued that managers years with the firm should be positively related to the extent of hedging. This is because managerial skills become more firm-specific as time spent with the firm increases. Thus, given that hedging reduces human capital risk, firms whose CEOs have more years vested are more likely to pursue hedging strategies. Tufano (1996) 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 (1998) theory. However, their model finds no meaningful relationship between the tenure of the CEO and the extent of risk management activity. Overall, Tufano's (1996) finding supports the general contention that managerial motives may be relevant in creating corporate risk management policy.

4. LOWERING TRANSACTION COSTS

Risk management represent an important lever for firm value because it is able to reduce two main types of transaction costs: the cost of implementing a hedging program and the costs associated with the possibility of encountering financial distress.

4.1 Cost of financial distress

When the future cash flows of a firm are subject to variability and/or its leverage is high, situations can arise where the liquidity available is not sufficient to fulfil all contractually fixed obligations of a period that accrue independently of the profitability or solvency of a firm. For example, interest on debt and wages constitute obligations to which bondholders and employees are legally entitled respectively. Consequently, if payment obligations cannot or are expected not to be met fully and timely due to a lack of liquidity, the company may experience financial distress and, ultimately, is forced into bankruptcy (Myers, 1977). In a perfect capital market world, bankruptcy leads to a costless renegotiation of the firm's assets, which normally ends in a transfer of assets from stockholders to bondholders. In reality, however, bankruptcy and also the possibility of future bankruptcy creates substantial costs for the firm which have a negative impact on firm value (Smith and Stulz, 1985). The expected costs of financial distress are generally determined by the actual size of the cost and the probability of getting into a situation of illiquidity (Smith, Smithson and Wilford, 1990; Rawls and Smithson, 1990). Bankruptcy costs can be categorised into direct and indirect costs.

Direct costs of financial distress are related to the costs faced in the bankruptcy proceeding and they include lawyers' charges, legal expenses, administrative and accounting fees, expenses for expert witnesses, management's labour spent on the bankruptcy procedure and so on. Direct bankruptcy costs are the core of the original argument developed by Smith and Stulz (1985). Even though these cost of financial distress are more obvious, their empirical importance relative to the market value of the firm is rather moderate, (Warner, 1977b; Weiss, 1990) examines the magnitude of the direct bankruptcy costs for a sample of railroad firms. He finds that, while these direct costs appear huge in absolute terms, they are usually only 1-3 percent of total firm value. Expected direct costs of financial distress years before bankruptcy are even much lower.

In addition to these direct costs of administration and reorganization, Baxter (1967) argues that there are some potentially more relevant indirect costs. The existing empirical evidence suggests that the indirect costs

are substantially larger than the direct costs, since they can reach 20 percent of company value (Cutler and Summers, 1989). Moreover, for indirect costs there is a continuum of costs that increases at an accelerating rate as exposure to financial distress increases. For instance, companies might face considerable interference from the bankruptcy court with their investment and operating decisions and such interference has the potential to cause significant reductions in the ongoing operating value of the firm. Other indirect costs consist of lost sales, lost profits, costs associated with restrictions on the firm's borrowing and higher compensation that managers demand because of higher probability of unemployment. In brief, indirect costs are all those costs not directly related to the bankruptcy procedure but that arise as soon as stakeholders perceive that there is a realistic chance of bankruptcy in the future. If a bad turn of events creates uncertainty about firm's continuing ability to compete and operate, customers, suppliers, employees and debtholders may become reluctant to keep dealing with the company as they cannot be ensured that their unsettled claims will be honoured, worsening the impact of the initial negative shock. If these stakeholders have an important business relationship with the firm, they are particularly dependent on its future existence due to their low degree of diversification (Mayers and Smith, 1982; Stulz, 1996). Thus, primarily, indirect costs originate due to the negative influence of liquidity problems on explicit or implicit contracts with customers, suppliers, employees and creditors (Shapiro and Titman, 1986). Financial distress affects the relationship with customers primarily in cases where companies produce goods for which service and warranties are very important. Customers perceive liquidity problems as an indication that these services may not be available with certainty, making them less valuable to them. Liquidity problems are also detrimental to the sale of products whose quality is hard to assess before using them. With these experience goods, often other aspects become crucial factors for the assessment of product quality, and payment problems may reduce customers' trust and thus their willingness to buy a product (Stulz, 2000). In addition, financial distress has a negative impact on the sourcing of the firm, because suppliers offer less attractive payment conditions to customers with financial problems. Furthermore, suppliers are less willing to adjust their production schedules and capacities to the needs of customers whose distressed financial situation indicates a possibly limited future existence in the market. The resulting costs of financial distress are larger the smaller the number of potential suppliers. Moreover, the threat of bankruptcy induces the employees of a firm to demand a premium from their employer for the risk of losing their job and/or some of their income. Key employees may leave for a more stable environment. Therefore, a higher turnover may result, causing costs for searching and training new workers. Other indirect costs generally arise because the attention of management and employees is distracted from value-increasing activities and profitable investment opportunities (Fite and Pfleiderer, 1995). Situations of financial distress can thus lead to a permanent loss of reputation and human capital (Shapiro and Titman, 1986; Warner, 1977a). Finally, as a company becomes weaker financially, it becomes more difficult for it to raise funds. At some point, the cost of outside funding, if available at all, may become so great that management chooses to pass up profitable investments. This "underinvestment problem" experienced by companies when facing the prospect of default (or, in some cases, just a downturn in earnings) represents an important cost of financial distress.

The expected costs of financial distress are the product of the probability of default and the associated bankruptcy costs. The probability of financial distress is positively correlated to leverage and volatility of cash flow. In fact, if the amount of debt is near to firm value, there are high chances that in the next period the value of assets will not be enough to meet fixed obligations. However, even if leverage is not particularly high, a significant volatility of cash flows can cause such a shortfall to bring the market value near to the value of debt, causing a situation of financial distress. Corporate risk management does not have an immediate effect on the absolute size of direct and indirect costs of financial distress but, lowering the volatility of cash flows, it

can significantly reduce the probability of default. As a result, risk management can increase the value of the firm by lowering the expected costs of financial distress (Dolde, 1993; Mayers and Smith, 1982; Raposo, 1999; Rawls and Smithson, 1990; Santomero, 1995; Smith and Stulz, 1985; Stulz, 1996). Consider an extreme case: if a costless risk management program is able to reduce the variability of cash flows to the degree that default is no longer possible, it will increase the value of the firm's equity by an amount roughly equal to bankruptcy costs multiplied by the probability of bankruptcy if the firm remains unhedged. In general, risk management does not reduce the probability of default to zero so that the increase of firm value will be equal to the difference between the expected financial distress costs before and after hedging.

The benefits of risk management, however, vary from firm to firm according to the extent of financial distress costs, probability of default and costs of hedging. The value of a company in a cyclical industry may be more volatile than non-cyclical industries, and its probability of distress higher. However, before implementing a costly risk management program, such a firm also needs to evaluate its costs once in distress. If financial distress would not be too disruptive to the business, a firm may choose to accept the expected financial distress costs without hedging. At the other end of the distress cost spectrum are those financial firms with large customer liabilities like insurance companies and banks. Risk management is central to their operation. Their probability of financial distress may be low because their assets are often closely matched to their liabilities, but the costs of financial distress in such credit-sensitive businesses are enormous. No matter how favourable terms are offered, a consumer is reluctant to buy financial products from an insurance company or a bank that is perceived as vulnerable to financial distress. In this case, probably it is worth implementing risk management even if it is costly. In addition to the reduction of financial distress costs, corporate risk management enables a firm to increase its debt capacity due to the lower volatility of future cash flows. Thus, since interest payments of debt, contrary to dividend payments, are generally made out of pre-tax income, firm can get greater tax benefits thanks to the tax shields of debt financing and hereby enhance firm value beyond the reduction in financial distress costs (Graham and Rogers, 2002; Leland, 1998; Ross, 1997). However, the cost of financial distress increases with a higher debt ratio as well, overcompensating the benefit of tax shields from some optimal degree of leverage on (Myers, 1984, 1986 and 1993).

To sum up, risk management increases firm value because it is able to reduce cash flows volatility. This, in the first place, cause a reduction of the probability of default and so a reduction of expected costs of financial distress. In the second place, hedging enhance firm value because it enables firm to carry more debt and thus benefit by debt tax shield.

Given that corporate risk management can lower the present value of bankruptcy costs, firms with a high probability of default and/or high financial distress costs, both direct and indirect, should have greater incentives to engage in corporate hedging. The probability of bankruptcy is linked to the company's variability of cash flows and to the extent of firm's fixed claims relative to its value; the higher these two factors, the more likely the firm is to encounter financial distress. Several proxies can be used to estimate the existence of financial constraint. Gearing ratio is a possible measure of the probability of financial distress, indicating the degree to which a firm's activities are funded by owner's funds versus creditor's funds. The best known examples of gearing ratios include the debt-to-equity ratio (total debt / total equity), the interest coverage ratio (EBIT / total interest), equity ratio (equity / assets), and debt ratio (total debt / total assets). A firm with high leverage has higher payment obligations, and should therefore be more likely to run into difficulties in honouring these commitments. It thus might have stronger incentives to hedge. Equally, the interest coverage ratio should be negatively associated with corporate hedging, since a low interest coverage ratio indicate limited interest expenses and thus a stable financial situation. Nevertheless, the use of gearing ratio is not without controversy. A higher probability of financial distress implies higher expected costs of financial

distress, assuming that exogenous bankruptcy costs are constant across firms. This supposition is limiting because it does not consider that, if financial distress costs are influence not only by a firm's debt-to equity ratio, but also by other industry-specific, exogenous factors (such as the level of competition, rivalry, etc.), a firm with high bankruptcy costs might have a low debt ratio, and still face high incentives to hedge. Some scholars suppose that firms within specific industries have a common exposure to financial distress and, therefore, use an industry-adjusted gearing ratio. The industry-adjusted gearing ratio is calculated by subtracting the industry's median leverage ratio from the firm's leverage ratio. Géczy, Minton and Schrand (1997) derive a similar variable calculated as the difference between a firm's long-term debt ratio and the median long-term debt ratio for the industry. Companies with gearing above (below) the average for their industry will have an industry adjusted gearing ratio greater (less) than 1. Thus, a debt ratio above-industry level would indicate a high probability of distress (Géczy, Minton and Schrand, 1997). Furthermore, gearing measures could be an inaccurate indicator of the probability of financial distress because it is often calculated using total debt or long-term debt and thus ignoring the possibility that some firms might have plenty of available cash at the same time as high amount of debt. Since cash and marketable securities can be used to cover financial obligations, particularly short-term liabilities, higher short-term liquidity should result in a lower need for hedging. This implies that a firm shows a greater degree of capital constraint when it is both highly geared and it has low cash balances. It is, therefore, more proper to take account of a firm's cash position to avoid an excessive negative view of leverage. A more appropriate measure of the financial constraint facing a firm is the ratio of net debt to firm value to give a net gearing ratio where net debt is defined as total debt minus cash and short-term investments. Haushalter (2000) uses an indicator of a firm's financial constraint similar to that just described. He uses a binary variable that is set equal to one if a firm's gearing ratio is above the sample median and its current ratio (current assets/current liabilities) is below the sample median. Finally, it is important to include short-term loans and overdrafts in the definition of debt, as many short-term debts are rolled over continuously to provide long-term finance. Similarly, companies that are paying high dividends have few incentives to hedge, as it can be argued that only highly liquid firms can commit themselves to paying out dividends. In contrast, if firms exhaust their liquidity by paying dividends, they might have incentives to hedge. Preferred stock and convertible debt may constrain firms financially and thus create greater distress costs (Géczy, Minton and Schrand, 1997). Alternatively, they could be a means to control the firm's agency conflicts and could thus act as substitutes for corporate risk management (Nance, Smith and Smithson, 1993), so that the direction of the relation of these variables with derivatives use is an empirical question. As important problems exist with regards to financial leverage and derivatives use, since high leverage might induce more hedging, but hedging also allows for a larger debt ratio with concomitant increases in tax shields, a potentially better, more forward looking proxy for the default risk of a firm would consist of the default probability implied in the firm's stock or option price (Bartram, Brown and Hund,, 2007; Vassalou and Xing, 2004; Merton, 1974). Other market participants' assessment of a firm's survival chances might also help to proxy for the probability of bankruptcy and financial distress. More specifically, credit ratings and the credit risk spread, i.e. the yield difference between a firm's bonds and 10-year Treasury notes, contain important information about a firm's financial risk. Firms with low credit ratings and high credit risk spreads should face a higher probability of distress, and they should thus be more inclined to use corporate hedging. By the same token, a firm's profitability might also be a determinant of its corporate hedging policy, since less profitable companies likely have more difficulties in meeting their fixed payment obligations and thus run a higher risk of insolvency. As a result, these firms will hedge more than more profitable firms. Common measures of profitability are gross margin, sales, and the return on assets (ROA). Since the presence of tax-loss carry-forwards indicates the existence of net losses during at least one of the last

years, tax-loss carry-forwards should also be positively associated with corporate risk management. Furthermore, production costs can be used to make inferences about the likelihood of financial distress, since, as a rule of thumb, for many firms financial distress becomes serious when prices drop below production costs, which is more likely to happen for firms with high production costs (Tufano, 1996). The risk of financial distress is also higher the more volatile the cash flows, the stronger the dependence on business cycles and the greater the operating leverage (Dolde, 1993, p. 29; Guay, 1999a; Samant, 1996, pp. 52-55). With regard to financial distress costs, they can be defined as a function of the extent of intangible assets. Since tangible assets can be easily sold in case of bankruptcy, firms with a high proportion of tangible assets should have a lower level of financial distress costs than firms with significant intangible assets. Similarly, firms with large advertising and selling, general, and administrative (SG&A) expenses often have more unique products that are harder to liquidate quickly. Finally, since the costs of financial distress are less than proportional to firm size (Warner, 1977b), they are ceteris paribus of higher importance to small firms than to large ones (relative to firm value). Thus, the reduction in expected bankruptcy costs is greater for the small firm implying that the benefits from hedging risk are expected to be greater for small firms than for large firms. Thus, small firms are more likely to hedge. However, increasing scale economies in the transactions costs associated with the derivatives markets makes the relation between firm size and derivatives use an empirical issue.

The long-term debt ratio and the interest coverage ratio are widely used to analyze the relationship between risk management and expected financial distress costs. Despite the discussed potential problems which accompany the use of this proxy, most studies obtain a significant positive relation between the long-term debt ratio and corporate hedging (Bartram, Brown and Fehle, 2009; Berkman and Bradbury, 1996; Dionne and Triki, 2005; Fok, Carroll and Chiou, 1997; Gay and Nam, 1998; Graham and Rogers, 2002; Guay, 1999a; Haushalter, 2000; Howton and Perfect, 1998; Mian, 1996). This association, however, seems to be only significant for firms with strong corporate governance structures (Lel, 2006). As different risk levels could distort the hypothesized relation between corporate hedging and the long-term debt ratio, it might be important to control for risk exposure (Dolde, 1995). After sorting sample firms into groups of similar primitive risk, the evidence strongly supports the predicted relation between corporate hedging and debt levels. The evidence also strongly suggests that users of derivatives exhibit lower short-term liquidity than those without derivatives (Allayannis et al., 2003; Dionne and Garand, 2003, Fok, Carroll and Chiou, 1997; Géczy et al., 1997; Lin and Smith, 2007; Tufano, 1996). With respect to dividends, however, no clear pattern emerges, i.e. while many studies obtain significant results, the relation varies across analyses (Bartram, Brown and Fehle, 2009; Berkman and Bradbury, 1996; Dionne and Garand, 2003; Haushalter, 2000; Mian (1996). Similarly inconclusive results obtain for preferred stock and convertible debt, as these proxies are often insignificant at conventional levels (Fok, Carroll and Chiou, 1997; Gay and Nam, 1998). Finally, although the sign is sometimes in the predicted direction, the interest coverage ratio is often insignificant at conventional levels (Berkman and Bradbury, 1996; Fok, Carroll and Chiou, 1997; Howton and Perfect, 1998). The remaining variables generate mixed results. For example, the evidence on credit ratings and production costs is always significant with the correct sign (Dionne and Garand, 2003; Dionne and Triki, 2004, Haushalter, 2000). Mayers and Smith (1990), and Wall and Pringle (1989), confirm the negative relationship between rating and hedging. In univariate analyses, all three profitability measures indicate that, counter to theory, more profitable companies hedge more, while they are sometimes positively and sometimes negatively associated with derivatives use in multivariate tests. The evidence on tax-loss carry forwards is mixed. With regards to the size of financial distress costs, firms using derivatives show lower ratios of tangible assets to total assets than firms not using derivatives (Howton and Perfect, 1998). In contrast, the evidence for variables proxying for the uniqueness of a firm's products appears weak (Dolde, 1995). Moreover, the

evidence suggests that large firms face stronger incentives to hedge than small firms, and thus seems to indicate that corporate hedging exhibits significant economies of scale. However, there exists some evidence that the extent of corporate hedging and firm size (market value of equity or total assets) are negatively related, i.e. for firms having a risk management program in place small firms hedge more than large firms (Allayannis and Ofek, 2001; Dolde, 1993 and 1995; Gay and Nam, 1998; Graham and Rogers, 2002; Haushalter, 2000; and Mayers and Smith, 1990). In summary, there is some evidence suggesting that financial distress costs are important rationale for risk management, but the evidence is not entirely unambiguous.

4.2 Cost of hedging

Enterprise risk management contributes to increase firm value only if the resulting benefits exceed the associated transaction costs. Carter and Sinkey (1998) point out that transaction costs can be explicit in the form of fees or margin requirements or implicit in the form of higher liquidity or capital requirements. Some scholars try to test if hedging at firm level is less expensive than shareholders hedging on their own accounts.

Géczy, Minton and Schrand (1997) suggest that the costs of implementing a risk management program exhibit economies of scale related to the amount of risk managed (the effective hedging costs per unit of exposure fall as the size of exposure being hedged increases). Given that larger firms have higher levels of absolute exposure they are more likely to reach the threshold where the benefits of hedging outweigh the costs. Thus, transaction costs savings of hedging can result from scale effects. Firms face lower spreads and brokerage fees since they acquire hedge contracts of larger lots and have better access to derivative instruments than the firm's fragment owners. Moreover, in addition to the direct costs of hedging transactions, fixed costs of corporate risk management for development of the internal control and IT systems, qualified personnel, and know-how accrue as well, with regard to which large companies can realize economies of scale (Dolde, 1993; Géczy, Minton and Schrand, 1997). Therefore, it can be expected that the willingness to hedge is positively related to firm size as well as the general ability to hedge. There are also several studies that show empirically a positive correlation between risk management and the size of a firm measured by market value of equity or total assets (Berkman and Bradbury, 1996 and 1999; Block and Gallagher, 1986; Booth, Smith and Stolz, 1984; Dolde, 1993; Fehle, 1998; Francis and Stephan, 1993; Géczy, Minton and Schrand, 1997; Goldberg et al., 1994; Graham and Rogers, 1999; Guay. 1999a; Hentschel and Kothari, 1997; Mian, 1996; Nance, Smith and Smithson, 1993). It must however be noted that while this argument may be relevant in a context of fragmented minority ownership, it lost importance in a situation where the majority of outstanding stock is owned by institutional investors whose aggregate holdings and aggregate exposures in some cases far exceed the value of the typical investment target. Nevertheless, there are also competing arguments which suggested a negative relation between firm size and hedging. For example, it was argued that small firms were more likely to hedge, ceteris paribus, because of the inverse relation between firm size and direct bankruptcy costs (Warner, 1977a and 1977b). The Froot et al. (1993) model predicted firms for which external financing is more costly would be more likely to hedge. If smaller firms have greater information asymmetries implying costly external financing then it would be expected an inverse relationship between firm size and hedging. Also the fixed transaction costs associated with external financing activities are likely to make financing more expensive for smaller firms, therefore, again leading to the prediction that smaller firms are more likely to hedge. Finally, it was argued that the owners of closely held firms tend to hold non-diversified portfolios with most of their wealth tied up in the fortunes of the one firm. The owners of this type of firm therefore have an incentive to hedge to protect their non-diversified personal wealth. Given that concentrated ownership is more likely to occur in smaller firms this suggests a negative relationship between firm size and hedging. Thus there are competing arguments for either a positive or negative relation between firm size and hedging activity.

Even if firms may be able to obtain risk coverage at more favourable terms than individual investors because of their institutional form, considering that capital markets are dominated by large institutional investors and not by individual private investors, firms do not seem to have cost advantages regarding the realization of hedging strategies. However, it may be argued that corporate risk management can be justified by the investors' inability to identify the firm's risk exposure (DeMarzo and Duffie, 1991). Effective and efficient risk management requires a deep knowledge of firm's assets and liabilities in order to assess the corporate financial exposure. Companies, though, often do not disclose the information necessary to quantify a firm's exposure because it may enable rivals to compete more effectively. Thus, asymmetric information between management and investors causes a situation where shareholders do not have complete information about the risks of a firm and thus are not able to construct optimally diversified portfolios. Shareholders need to monitor the firm's net exposure to optimize their own portfolio strategy and these efforts determine higher costs. Given that risk management reduces the volatility of firm's performance, hedging can be beneficial to shareholders. Actually, corporate risk management, stabilizing the firm's exposure, allows investors an optimal portfolio allocation without having to support monitoring and portfolio rebalancing costs (Giddy, 1994; Hu, 1996; Mason, 1996). Hedging can be perceived in this context as an imperfect substitute for disclosure of corporate exposure as it serves to improve the market's assessment of the firm (DeMarzo and Duffie, 1991 and 1995; Fite and Pfleiderer, 1995; Ljungqvist, 1994). Thus, because of the information advantage of managers, risk management can in most cases be conducted considerably more efficiently at the firm level. The results of empirical studies present weak evidence that companies are more likely to hedge if the information asymmetries are large between management and shareholders. In this context, it is assumed that there is a higher availability of information the larger the proportion of shareholdings with institutional investors and the higher the number of analysts following the firm. Empirical support for transaction costs as a hedging motive has been provided, among others, by Block and Gallagher (1986), Booth et al. (1984), Colquitt and Hoyt (1997), Cumming and Hirtle (2001), Géczy, Minton and Schrand (1997) and Howton and Perfect (1998).

5. COORDINATING FINANCIAL AND INVESTMENT POLICIES

Corporate risk management can also contribute to create firm value through a better alignment of investment and financing policies in the presence of imperfect capital markets. The underlying idea for this theory is the fact that the value of a firm can be enlarged by making investment projects characterized by positive net present value. Sound projects, however, can only be taken on if their financing is secured. As future cash flows are uncertain, internal funds that are used to finance growth opportunities often vary significantly so that the financing of the optimal investment program from internal funds is not guaranteed at every point in time. Thus, firms may face cash surpluses or shortages with regard to their planned investment schedule if cash flows and investment expenditures are not perfectly matched. As a result, in situations in which internal funds are insufficient to finance all profitable projects, a firm is either forced to cut back on its investment plan or to raise external equity or debt. External financing, however, is costly in imperfect capital markets because of transaction costs and agency conflicts, leading to increasing marginal financing costs.

The issuance of equity to raise capital is costly primarily because of existing information asymmetries relative to a fair stock price between the management within the company and the investors in the capital market. Since management has important inside information, investors generally assume that managers who act in the interest of the old shareholders issue new equity only if they believe the shares to be overvalued, because a wealth transfer from old shareholders to new shareholders would occur in the case of an undervaluation (Akerlof,1970; Myers, 1993; Myers and Majluf, 1984). Consequently, potential investors may view equity offerings as a signal that the share price is overvalued. As an empirical result, equity offerings normally cause

a firm's stock price to decline significantly (Asquith and Mullins, 1986), as investors anticipate incentives of management to issue new stock when it is overvalued.

External debt financing, especially for firms with a credit rating, is associated with fewer problems with respect to asymmetric information, which is why it is often preferred over issuing new shares. Nevertheless, transaction costs arise in the form of direct and indirect costs of financial distress when raising external debt. In fact, since creditors incorporate their expectations about bankruptcy and financial distress costs into their lending decisions, they might demand higher yields on the capital provided when the issuance of additional debt leads to a higher probability of bankruptcy and financial distress. Although this enables them to obtain a fair value from their investment, it increases the firm's cost of debt and thus decreases firm value (Myers, 1993 and 1984). Another way to protect their claims consists of debt covenants which restrict managerial degrees of freedom with regard to financing and investment policies. These covenants can, however, also reduce firm value if they lead managers to reject profitable investment projects (Bartram, 2000). If covenants are chosen rationally, however, this cost is expected to be less than the expected benefits of controlling debt-related costs (Smith and Warner, 1979). These factors lead to increasing marginal cost of debt financing and possibly to a limitation of future funding that is called credit rationing (Stiglitz and Weiss, 1981). In addition, transaction costs like bank fees, syndication fees, etc. accrue with both types of external financing.

Therefore, a lack of internal funds leads to opportunity costs because of costly external funding or because of passed up opportunities to increase firm value. In the presence of financial risks causing cash flows volatility, corporate risk management can create value for the shareholders by ensuring that the firm has steady cash flows to fund growth opportunities and, thus, harmonizing the need for and the availability of internal funds. This coordination of investment and financing policies leads to increases in shareholder value, as it guarantees the realization of profitable investment projects while at the same time avoiding higher cost of capital. In fact, a firm adopting risk management tools that can ensure stable cash flows which allow it to pursue its optimal investment plan; internal corporate cash flows and investment expenditures are aligned by reducing the cash flow surplus when cash flows exceed investment expenditures and providing cash when cash flows are below investment expenditures (Chidambaran et al. 2001; Copeland and Copeland, 1999; Froot, Scharfstein and Stein, 1993 and 1994; Lewent and Kearney, 1990; Mello and Parsons, 1999 and 2000; Minton and Schrand, 1999; Moore, Culver and Masterman, 2000; Santomero, 1995).

To sum up, if internal corporate cash flows are not sufficient to finance all profitable investment projects, firm value is not maximized due to the rejection of some value-enhancing investment projects or the cost associated with external financing. Because of the high costs of external capital, firms more often cut back on their investment expenditures than turn to financial markets, thereby foregoing profitable investment projects. In fact, the empirical evidence suggests that higher cash flow volatility may lead to permanent cutbacks in investment. Minton and Schrand (1999) show that higher cash flow volatility is associated with lower average levels of investment in capital expenditures, R&D, and advertising. This association implies that firms do not use external capital markets to fully cover cash flow shortfalls but rather permanently forgo investment. They underline that cash flow volatility also is associated with higher costs of accessing external capital. Thus, cash flow volatility not only increases the likelihood that a firm will need to access capital markets, it also increases the costs of doing so. The focus for hedging, in this case, is on the cash flow before investment spending. However, it has to be taken into account that not only cash flows, but possibly the need for funds and for investments are influenced by financial risk as well. Thus, firms, exhibiting a strong association between the availability of and need for internal funds, face generally lower incentives to hedge (Copeland and Copeland, 1999; Fite and Pfleiderer, 1995; Lewent and Kearney, 1990; Mello and Parsons, 1999; Moore, Culver and Masterman, 2000; Santomero, 1995; Spanò, 2001). In fact, it may not be necessary for these firms to

completely hedge financial risks, if, even in the absence of corporate hedging, the availability of their internal cash flows match the need for investment funds. In both cases, however, the hedging of cash flows before capital expenditure leads also to a reduction in volatility of the net cash flows and thus of firm value.

The relationship between investment policy and firm cash flows has been examined in the literature: Fazzari, Hubbard, and Petersen (1988) and Hoshi, Kashyap, and Scharfstein (1991) find that corporate investment is influenced by the size of internal cash flows. Froot, Scharfstein and Stein (1993) describe closely how risk management enhances the firm's ability to internally-fund valuable new investments. They develop a work for arguing that if capital market imperfections make externally obtained funds more expensive than those generated internally, they can generate a rationale for risk management. Their risk-management paradigm rests on three assumptions. First, firms create shareholder value by investing in positive net-present-value (NPV) projects. Second, an important key for supporting good investments is internal generation of sufficient cash to fund those investments.

According to pecking order theory (Myers and Majluf, 1984), internal funds cost less and companies would use it to raise capital first. When firms do not generate sufficient cash flow, they tend to cut investments below the optimal level because of costly external financing. Third, internally generated cash flow, which is critical to the investment process, can be adversely affected by changes in interest rates, commodity prices, and foreign exchange rates. Under this framework, they show that a firm's hedging activity can increase value to the extent that it ensures that a firm has sufficient internal funds available to take advantage of attractive investment opportunities. They argue in this way. If a firm does not hedge, there will be some variability in the internal cash flow that must result in either variability in the amount of funds raised externally or variability in the amount of investment. Variability in investment will generally be negative because of decreasing marginal returns to investment (i.e., the extent that output is a concave function of investment).

If the supply of external finance were perfectly elastic, the optimal ex post solution would thus be to leave investment plans unaltered and offset variations in internal cash flow by changing the quantity of outside money raised. Unfortunately, this approach no longer works well if the marginal cost of funds goes up with the amount raised externally. Thus a shortfall in cash may be met with some increase in costly outside financing, but also some decrease in investment. Therefore cash flow variability affects both investment and financing plans in a way that decreases firm value. This is because by decreasing planned investment the firm is foregoing positive net present value projects and also since it has insufficient internal funds the firm is forced to raise costly external finance. To the extent that hedging can reduce this variability in cash flows, it enables the firm to avoid unnecessary fluctuations in either investment spending or external financing and so enhances firm value. Moreover, the Froot et al. model predicts that hedging is more likely for firms with higher expected growth, for firms that are not in a regulated utilities industry and for small firms. It is argued that managers of firms in regulated industries are likely to have less discretion in their choice of investment policies. Regulation also makes it easier for fixed claim holders to observe managerial action. Therefore firms in regulated industries face lower contracting costs and hence have less of an incentive to hedge. They also show that the benefits of internal funding vary from firm to firm and that the larger the information gap between managers and investors, the greater the potential for agency conflicts. Larger firms are more likely to have greater analyst coverage than smaller firms, perhaps reducing the probability of asymmetric information problems. Larger firms are also less likely than smaller firms to be capital constrained. Consequently, the value of using risk management to secure internal funding might be greater for smaller, more specialized firms. Other studies, including Lessard (1990) and Stulz (1990), Smith, Smithson, and Wilford (1990c), and Smith and Stulz (1985), develop rationales for hedging similar to Froot, Scharfstein and Stein (1993).

Therefore, corporate hedging can ensure that firms have sufficient internal funds to finance their profitable growth opportunities without having to raise outside capital. Internal funding, however, can be a double-edged sword. External funding of an investment project will ordinarily entail an outside review and assessment of the firm's investment project. This "extra" review can sometimes provide managers with useful information about the future investment's prospects. In some cases, the discipline of an outside review that accompanies external capital raising will prevent the firm from proceeding with a bad project. Firms that rely upon internal funding of investment projects escape the extra hurdle that accompanies external funding. This interpretation of the market's role in investment decisions would imply that risk management, reducing this form of market discipline, can have the perverse effect of decreasing firm value (Chang, 2000).

Tufano (1998) suggests that the absence of capital market scrutiny for new investments leads to the acceptance of sub-optimal projects as well. Another potential but unintended consequence of risk management for the purpose of generating internal funding is that risk management can increase the disparity between internal and external funding costs. If a firm manages risk, and therefore has sufficient internal funding for a particular project, but chooses instead to use external funding, one would expect outside investors to be even more suspicious about providing equity for that project. The outside investors will know that the firm has sufficient internal funds, but chooses to raise them externally, leading the outside investors to lower their estimates of the project's value, thereby increasing their required return.

Similar to the asset substitution and the underinvestment problem, the coordinated financing and investment hypothesis depends upon the existence of cash flow constraints and available growth opportunities in the presence of capital market frictions. As a result, the same proxies can be employed to test this hypothesis. Geczy, Minton, and Schrand (1995) find that use of derivatives is positively related to measures of the firm's investment opportunity set proxied for by R&D expenditures and related to the firms interest coverage ratio (ratio of pre-tax income plus interest expense to interest expense plus capitalized interest) and the long-term debt ratio (ratio of book value of long-term debt to market value of the firm) that are used to measure firm's financial constraints. This result suggests that firms might use derivatives to reduce cash flow variation that might otherwise preclude firms from investing in valuable growth opportunities. They claim that these findings are consistent with the Froot, Scharfstein and Stein underinvestment explanation for corporate use of derivatives. Gay and Nam (1998) extends findings of Froot, Scharfstein and Stein (1993) by closely examining the relation between firm's investment opportunities, cash stock, and internally generated funds to more clearly distinguish the role of the underinvestment hypothesis in the determination of corporate hedging policy. First, they find consistent evidence that associates various proxies for a firm's investment opportunity set with derivatives use. These various proxies include a measure of the firm's cumulative abnormal returns (CARs), research and development expenses, Tobin's q, the market-to-book-value ratio, and the price-earnings ratio. Second, when Gay and Nam analyze the interaction effects between a firm's cash stock and its investment opportunities, they find that firms with enhanced investment opportunity sets use derivatives more when they also have relatively lower levels of cash. Their third main finding indicates that the correlation between internally generated cash flows and investment outlays also influences a firm's derivatives use. They find a negative relation between a firm's derivatives use and this correlation. This supports the argument that a higher correlation acts to alleviate a firm's underinvestment problem because the firm is, in some sense, naturally hedged. The results support that the need to avoid possible underinvestment problems is associated with the use of financial derivatives. Carter, Rogers and Simkins (2006) investigate the fuel hedging behaviour of firms in the US airline industry during 1994-2000 to examine whether such hedging is a source of value for these companies. They find a positive relation between hedging and value increases in capital investment. In particular, large airlines are typically in the best position to buy distressed airlines (or

part of them). Hedging future jet fuel purchases allows these firms a means to manage a significant source of variation in cash flows. Given that jet fuel price increases often coincide with distress in the airline industry, hedging provides an additional source of cash for making acquisitions during these periods. Their results show that the value increase from hedging increases with capital investment. This result implies that investors value hedging more in airlines where they expect hedging to protect the ability to invest in bad times. This result is consistent with the assertion that the principal benefit of jet fuel hedging by airlines comes from reduction of underinvestment costs. It also conforms well to the theoretic framework of Froot, Scharfstein and Stein (1993).

To empirically validate the impact of hedging on the coordination of investment and financing policies, the relationship between corporate risk management and liquidity, measured by the quick ratio ([liquid assets + securities + receivables]/short-term debt), the current ratio (short-term assets/ short-term debt) or the dividend payout, can be analyzed. The results show that companies with low liquidity (small quick ratio or current ratio) are more likely to hedge than companies with high liquidity (Berkman and Bradbury, 1996; Géczy, Minton and Schrand, 1997; Goldberg et al., 1994; Graham and Rogers, 1999; Howton and Perfect, 1998; Mian, 1996; Nance, Smith and Smithson, 1993; Tufano, 1996). The ambiguous results with regard to dividends may be explained by the fact that on the one hand, the payout of high dividends restrains liquidity and thus implies hedging. On the other hand, however, the relationship between growth options and dividend payments is likely to be negative (Berkman and Bradbury, 1996; Francis and Stephan, 1993; Géczy, Minton and Schrand, 1997 and 1999; Goldberg et al., 1994; Graham and Rogers, 1999; Mian, 1996; Nance, Smith and Smithson, 1993). Moreover, the hypothesis of a correlation between investment activity and free cash flow is also shown empirically by Fazzari, Hubbard and Petersen (1988), Hoshi, Kashyap and Scharfstein (1991), and Lewent and Kearney (1990). There is also empirical evidence of the increasing marginal cost of external financing (Fazzari, Hubbard and Petersen, 1988; Hoshi, Kashyap and Scharfstein, 1991; MacKie-Mason, 1990; Wall and Pringle, 1989). Finally, it can be investigated whether companies with a greater correlation between available and needed funds hedge less frequently than companies with a lower correlation because they are naturally hedged. The existing evidence strongly supports this hypothesis (Gay and Nam, 1998). Likewise, there is strong support for the hypothesis that companies using derivatives exhibit a lower sensitivity of investment to pre-hedging cash flows (Allayannis and Mozumdar, 2004).

6. REDUCING THE CORPORATE TAX BURDEN

Another aspect of capital market imperfection that forms the basis for risk management to increase firm value is taxes. We can distinguish two different kind of benefit. In the first place having a risk framework in place allows a firm to increase its debt capacity or reduce its required capital and thus benefit from the tax shield associated with the tax deductibility of the interest payments on the debt. In the second place a progressive tax structure gives firms an incentive to smooth earnings to minimize taxes, and risk management enables such smoothing. The progressivity or the "convexity" of tax codes means that a company's effective tax rate rises along with increases in pre-tax income. By reducing fluctuations in taxable income, risk management can lead to lower tax payments by ensuring that, over a complete business cycle, the largest possible proportion of corporate income stays consistently in the lower tax-rate region. When the tax function of a firm is convex, the volatility of pre-tax income can be reduced by risk management, thus the firm would be able to cut the corporate tax burden and generate greater firm value. This effect was analytically described for the first time by Smith and Stulz (1985). They show that if effective marginal tax rates are an increasing function of the firm's pre-tax income, the after-tax firm value is a concave function of its pre-tax value. Besides, if hedging reduces the variability of pre-tax values, then the expected tax burden is reduced and the

expected post-tax value of the firm is increased, as long as the cost of hedging is not too large. These conclusions are synthesized in the following figure. The graph shows that, if the tax schedule is convex, the firm incurs a higher expected tax burden in the case of volatile pre-tax income than in case of stable pre-tax income. Numerical examples are reported in Smith, Smithson and Wilford (1990). Results presented by Smith e Stulz (1985) find support in Bartram (2000), Kale and Noe (1990), Mayers and Smith (1990), Rawls and Smithson (1990), Santomero (1995), Stulz (2001).

Smith and Stulz notice also that the effect of risk management is stronger the more convex the tax function, the more volatile corporate income, and the bigger the part of income is that falls into the convex part of the tax schedule. Excess-profits taxes or investment-tax credits, increasing the convexity of the tax function, would induce firms more incline to hedge. Conversely, allowing trading in tax credits reduces the convexity of the tax function and reduces the tax benefits of hedging. The convexity of tax schedules can not only be caused by marginal tax rates increasing progressively with taxable income but additionally by various tax rules and regulations. For example, limits on carrying losses backward or forward, foreign tax credits, etc. can also (indirectly) induce convex characteristics to the tax function, as they cannot (or only later) be benefited from in case of low income or even losses (MacKie-Mason, 1990).

Results in Graham and Smith (2000) suggest that the indirect effects of these factors are small, however. In the presence of (directly or indirectly) convex tax regimes, changes in pre-tax income over several periods will lead to a higher corporate tax burden than a more stable income. DeAngelo and Masulis (1980), Graham and Smith (1999), Smith (1995), described this effect. Graham and Smith (1999) use simulation method rather than survey or regression analysis because they suffer from potential problems. In the case of surveys, some executives might consider the information requested in a survey proprietary or might be reluctant to admit in a survey that their companies use derivatives to speculate rather than hedge. As for regression methods, the fact that researchers are forced to use "proxies" for a firm's tax status and other characteristics often complicates the interpretation of the findings. They analyze more than 80,000 firm-year observations and find approximately 50 percent of corporations face convex tax functions while 25 percent have a linear tax function, making them indifferent to hedging. The remaining firms face effective tax functions that are generally regressive over the relevant region, thus providing a tax-based disincentive to hedge. Among firms facing convex tax functions, roughly one-quarter of the firms have potential tax savings from hedging that appear material. And in the extreme cases, firms can save expected tax liability exceed 40 percent. Despite employed different methods, this paper also reports the same results with Smith and Stulz (1985). For firms facing tax-function convexity, hedging lowers expected tax liabilities, thereby providing an incentive to hedge. Graham and Smith also considers four features of the tax code that have been proposed as affecting the progressivity of the tax function: (1) statutory progressivity, especially the asymmetric treatment of gains and losses, (2) the tax treatment of net operating loss carrybacks and carryforwards, (3) the investment tax credit (ITC) and (4) the alternative minimum tax (AMT). They find that much of the progressivity stems from the asymmetric treatment of profits and losses in the tax code, that is, positive tax rates on profits but a tax rate of zero on losses. Carryback and carryforward provisions allow firms to smooth losses, thereby reducing the "curvature" of the tax function. The alternative minimum tax and investment tax credits have only modest effects on the curvature of the tax function. DeAngelo and Masulis (1980) show that the existence of non-debt corporate tax shields such as depreciation deduction or investment tax credits influence the corporate advantage of tax liability's reduction. The results of empirical studies do not give a clear picture regarding the evidence of the tax argument. On one hand, there is evidence in support of a positive correlation between corporate risk management and tax regulations (investment tax credits, tax losses) as well as the probability of the application of a progressive tax rate. Howton and Perfect (1998), and Nance, Smith and Smithson (1993)

find significance for a tax progressivity dummy, but not for a tax loss dummy. In the study by Goldberg et al. (1994) convexity variables, but not the variable for investment credits and loss carry-forwards exhibit significance. Berkman and Bradbury (1996), however, find empirical significance for loss carry-forwards and for the tax loss variable. On the other hand, the results of many studies do not give an indication of corporate risk management being a mean to increase shareholder value since variables used to capture the convexity property of the tax regime often do not show significance (marginal tax rate, book value of carry forwards/total assets, investment tax credits). Géczy, Minton and Schrand (1997), Graham and Rogers (1999), Tufano (1996) find no significance of tax variables, while Francis and Stephan (1993) weak significance of tax variables. In the study by Mian (1996) only the variable for foreign tax credits exhibits statistical significance. Potential explanations for this result exist in the strong relationship between tax savings and other rationales why hedging increases firm value. The tax argument would also be less important if the different determinants of tax savings were negatively correlated and corporations with high volatility of income were taxed in a more linear part of the tax function while less volatile income was taxed in a part of the tax function with high convexity as Graham and Smith (1999) underline.

The second benefit of taxation is that risk management can also reduce the firm's taxes by increasing its debt capacity as described above in the section relative to the costs of financial distress. In particular, a firm that increases its optimal debt level could increase its after-tax expected income by the amount of the marginal tax shield of debt. By holding cash flow constant, risk management makes just such a debt increase possible. Debtholders care about total firm volatility, because it is the total volatility and not just the systematic-risk component of that volatility that determines whether the debt holder will be repaid. The larger the total risk, the higher the probability that the firm will default (ceteris paribus). Likewise, the lower a firm's total risk, the lower the probability that the firm will default. If risk management can reduce the firm's total risk without reducing the net present value of its operations, then its application can increase the firm's debt capacity. With lower risk, a firm can support a greater debt-to-equity ratio, and a higher debt capacity means that the firm can capture a greater tax shield. The value of the incremental tax shield created by increased debt capacity will vary by firm. Many start-up firms, for example, have negative profits during their early years. Even if the risk of start-up firms can be reduced enough for them to carry some debt, on the margin these firms cannot capture the tax benefits of debt until they have used their net operating losses. Of course, even if a start-up firm is unable to increase its debt capacity enough to generate significant tax savings, managers of a start-up firm may well decide to manage risk for other reasons. Two compelling motives for managing risk are the ability to decrease financial distress costs and to reduce the overall level of risk faced by important non-diversified investors. In contrast, risk management techniques and instruments might present an opportunity for an established, profitable firm to reconfigure its capital structure. A target debt ratio that was appropriate in the past may no longer be optimal; the ability to manage risk may mean that managers can safely increase that target. Indeed, in the oil and gas industry, such a transformation seems to be occurring: Haushalter (2000) shows that oil and companies with greater financial leverage manage price risks more extensively. Using data less detailed than that available for oil and gas companies, Dolde (1995) finds that after controlling for primitive risk exposure, hedging and leverage are positively related. There is also some empirical evidence (Graham and Rogers (1999, 2002)) that the tax benefit of increased debt capacity provides a much stronger incentive for firms to hedge than the incentive originating from tax function convexity. They find that tax is a factor for firms to hedge because hedging can lead to larger debt capacity and tax deduction. Furthermore, they find no evidence support the relation between hedging and tax convexity. Leland (1998), Ross (1997), and Stulz (1996) show that, by reducing the volatility of income and/or reducing the probability of financial distress, hedging increases debt capacity. If firms add leverage in response to greater debt capacity,

the associated increase in interest deductions reduces tax liabilities and increases firm value. Thus, the ability to increase debt capacity provides a tax incentive to hedge. Miller (1977), building on the analysis of Farrar and Selwyn (1967), Black (1973), argues that the tax advantage of debt is exaggerated by considering the corporate profits tax in isolation from personal income taxes. He argues that the corporate tax advantage of debt is offset by personal tax rates on investors' debt income that are higher than tax rates on investors' equity income. In addition, Graham and Smith (1999), Kale and Noe (1990), Smith, Smithson and Wilford (1990), show that under certain circumstances firm value can be reduced if hedging takes the personal taxation of shareholders into account. Brennan and Schwartz (1978) also argue that the corporate tax advantage of debt is lower because the interest tax shield is lost if the firm goes through bankruptcy and liquidation.

7. CONCLUSION

This paper reviews the theoretical and empirical studies on the rationales for corporate risk management, illustrating how and under which circumstances it increases firm value.

First of all, it is illustrated that corporate risk management does not add value in a perfect market, where shareholders are able to costlessly diversify their risk away; however perfect markets do not exist in practice, and market imperfections create different problems that pose different justifications for hedging.

The literature review illustrated in this paper reveals that the effectiveness of corporate risk management derives from its ability to reduce cash flow volatility, which in turn has positive effects on firm value because it: 1) reduces the costs associated with the agency problem, 2) reduces transaction costs, 3) aligns financing and investment policies, thus reducing costs of external financing, 4) reduces corporate tax burden.

Corporate risk management is the preferred solutions to mitigate the agency problem: while other possibilities reduce some costs but at the same time create additional costs, corporate risk management eliminates or reduces agency costs by stabilizing cash flows and therefore keeping firm value high enough to avoid the asset substitution problem. The ability of corporate risk management to stabilize cash floes make it the preferred solution also to the underinvestment problems as it ensures that expectations on gains from the investments are met. It is effective also to mitigate the risk-preference problem by lowering the risk associated with profitable growth opportunities, thus making managers less prone to pursue non-value maximizing projects, and by reducing the risk of managers' human capital and therefore lowering the risk premium managers require on their compensation. As for the expected costs of financial distress, they are the product of the probability of default and the associated bankruptcy costs. Corporate risk management does not have effects on the costs of bankruptcy, but it can have a significant effect on the reduction of the probability of default by lowering the volatility of cash flows. For this reason, corporate risk management benefits more the firms with a higher value of the financial distress costs. Finally, corporate risk management can align cash flows and investment expenditures. In fact, by reducing cash flow volatility, it makes sure that the firm has enough internal cash flows to finance available profitable projects without having to raise expensive outside capital and, at the same, time avoids firms from keeping excess non-invested cash. Both these two aspects increase firm value by reducing the cost of capital used to discount the corporate cash flows.

It is important to highlight that actions related to the different objectives of corporate risk management do not always work in the same direction, but trying to reduce the volatility of some variables may have a contrary effect on others. These effects need to be carefully taken into consideration when designing the firm risk management strategy.

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