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Effective risk management outcomes: exploring effects of innovation and capital structure

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Abstract

Purpose – The purpose of this paper is to argue that strategic responsiveness is of paramount importance for effective risk management outcomes and to introduce an empirical study to demonstrate this.

Design/methodology/approach – Real options logic is adopted to explain how effective risk management capabilities improve performance and how innovation and financial slack enhance this effect. The propositions are examined across 896 companies using two-stage least square regressions.

Findings – The study reveals that risk management effectiveness combines both the ability to exploit opportunities and avoid adverse economic impacts, and has a significant positive relationship to performance. This effect is moderated favorably by investment in innovation and lower financial leverage.

Research limitations/implications – The analysis is based on a sample of large firms, which may affect the generalizability of results. Nonetheless, the study shows that effective risk management capabilities differentiate the firms and determine success and failure. It further underscores the importance of combined innovation policy and capital structure decisions as firms deal effectively with risk and uncertainty.

Practical implications – The findings indicate that corporate management must consider commitments for innovation and financial slack to enhance positive risk management effects. This result is in dire contrast to traditional beliefs that tighter resource management and higher financial leverage lead to better economies.

Originality/value – This is one of few studies to explicitly consider strategic responsiveness as instrumental for effective risk management outcomes while investigating the economic effects associated with the ability to combine generation of upside gains and downside loss avoidance.

Keywords Financial risk, Innovation, Strategic management, Risk management, Response flexibility

Paper type Research paper

Introduction

Economic turmoil, competitive moves, technology shifts, global rivalry and other strategic risks are foremost in the minds of executive decision makers and constitute central concerns in strategy. In line with this, strategic management scholars have become increasingly cognizant of the need for dynamic managerial capabilities in the face of changing environmental conditions (Adner and Helfat, 2003; Bettis and Hitt, 1995; Teece *et al.*, 1997). The turbulent business environments paired with intense publicity around corporate scandals have imposed a risk management focus on policy makers and corporate executives alike (Power, 2005, 2007). This attention devoted to risk concerns is reflected in various legislative initiatives and the introduction of enterprise-wide risk management (ERM) approaches aimed to deal with operational, economic, and strategic exposures (DeLoach, 2000; Doherty, 2000; Lam, 2003).

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The implied risk management activities are typically not conceived as integral to the strategic management process but are more often seen as specific efforts to establish buffers that can absorb economic shocks or to transfer exposures and impose controls that will circumvent extreme losses[1] (Culp, 2002; Merton, 1995; Moelbroek, 2002). To the extent formal risk management practices consider strategy it is typically related to the implementation of pre-planned targets. Hence, a predominant ERM framework sees risk management as the means to assure that corporate objectives are achieved (COSO, 2004; Moeller, 2007). That is, the handling of changing conditions is not depicted in these frameworks as part of a dynamic strategy-making process. Nevertheless, the strategic responsiveness of the firm seems essential for effective risk management outcomes given that strategic risks constitute some of the most significant corporate exposures (Slywotzky and Drzik, 2005). This means that risk management not only should serve to limit downside losses but also seek to identify, develop, and exploit opportunities (Andersen, 2006 pp. 398; Slywotzky, 2007). Hence, we contend that strategic response capabilities are essential to deal with corporate exposures and achieve beneficial risk management outcomes. We further argue that these capabilities are enhanced by innovation and financial slack. The current study analyzes these risk management relationships on a cross sectional dataset comprising 896 firms.

The paper is structured as follows. First, there is a brief overview of recent developments in risk management including enterprise-wide approaches and dynamic managerial capabilities followed by a discussion of effective risk management considering the role of innovation and capital structure from a real options perspective. This leads to the development of central hypotheses that are tested subsequently in an empirical study. Then the methodology of the study is outlined, the results are presented, and the implications of findings discussed.

Extending the scope of risk management

Corporate exposures are imposed by a range of factors spanning from environmental hazards and market-related volatilities to operational disruptions and strategic risks, such as, changing demand, competitive moves, technology leaps, etc. (Miller, 1998). Different disciplines have developed a variety of professional techniques to deal with particular exposures including financial hedging, insurance, auditing, compliance, etc. The market-related and insurable risks can be quantified based on price data and event records that provide a basis for various risk diversification instruments whereas internal process-related risks typically are handled by different monitoring and control practices (Culp, 2001; Smithson and Simkins, 2005).

However, many risks are truly exogenous to the firm imposed by social, technological, and economic factors beyond managerial influence that are hard to quantify and foresee (Bettis and Hitt, 1995; Meyer, 1982). A number of enterprise risk management (ERM) frameworks propose to deal with all of the associated operational, economic, and strategic exposures (COSO, 2004; DeLoach, 2000; Lam, 2003; Liebenberg and Hoyt, 2003). These ERM proponents claim to link risk management with strategy but the frameworks are conceived as potentially centralized, formal, and bureaucratic, which makes them unable to capture the intricacies of dynamic strategy-making (Henriksen and Uhlenfeldt, 2006; Power, 2007).

Exposures associated with the firm's strategic risk factors are more difficult to quantify because the implied changes often are irregular, abrupt, and unique and

unfold in ways that are hard to foresee. Furthermore, strategic exposures are conditioned by specific corporate structures and market positions and, therefore, also require responses that are unique to the individual firm. This puts limitations on the use of standardized instruments, risk-transfer techniques, and formalized risk management practices in dealing with strategic risks. So, there is arguably a need for firm-specific dynamic managerial capabilities to respond effectively to changing conditions (Bettis and Hitt, 1995; Teece *et al.*, 1997). While some scholars claim these are embedded in identifiable processes and describe them as routines (Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Winter, 2003), they often turn out to be highly complex comprising many managerial aspects (Helfat *et al.*, 2007). Accordingly, Teece (2007) argues that dynamic capabilities are construed by distinct skills, processes, procedures, organizational structures, decision rules, and disciplines that enable the firm to sense change, seize opportunities, and reconfigure. The related concept of strategic responsiveness refers to "the ability to assess the environment, identify firm resources, and mobilize them in effective responsive actions" (Andersen *et al.*, 2007).

One way to enhance strategic response capabilities is to establish alternative action choices for the firm by identifying opportunities and turning them into viable business propositions that constitute strategic options (Bowman and Hurry, 1993; McGrath, 1997, 1999). Commanding such a portfolio of real options can extend the strategic action space available to the firm and thereby improve flexibility and corporate maneuverability (Barney, 2002; Luehrman, 1998; McGrath *et al.*, 2004). As Kogut and Kulatilaka (2001, p. 745) argue: "A real option is the investment in physical and human assets that provides the opportunity to respond to future contingent events". Hence, a conscious innovation policy supporting development of new opportunities that form strategic options can provide management with a set of alternative business propositions to pursue when environmental conditions change. That is, the firm can enhance its ability to respond to various strategic risks and thus avoid the negative effects from threats that arise while exploiting gains from emerging opportunities. As a consequence the corporate earnings development should display a relatively steady path of economic growth despite ongoing volatilities in external market conditions caused by a variety of exogenous events.

Innovation, financial slack, and capital structure

A responsive organization encourages the generation of new ideas and produces a multitude of suggestions on how to do things differently. That is, organizational adaptation is reflected in an ability to innovate and use new ideas, devices, systems, policies, programs, processes, products, and services in ways that make the firm more compliant with current conditions (Damanpour, 1991; Scott and Bruce, 1994). New ways of doing things can be conceptualized as a type of experimentation where the effects of different combinations of technical and organizational elements are explored (Kogut and Kulatilaka, 2001). The resulting innovations can relate to product development and new technologies but may also include changes in organizational processes, administrative practices, management approaches (Damanpour and Evan, 1984). This corresponds to a common definition of innovation referring to the "generation of new or improved products, processes, and services" (National Science Board, 2006). Hence, innovation is conceived here as an internal adaptive process of renewal and transformation rather than variation in outcomes as proposed by decision

theory (Berglund, 2007; Boyne, 2003). As such, innovation can be seen to drive responsive actions that make it possible for the firm to modify business activities in ways that accommodate changes in customer demands, technological requirements, economic conditions, etc. The associated strategic response capabilities, or dynamic capabilities, are considered a fundamental source of competitive advantage (Bettis and Hitt, 1995; Teece *et al.*, 1997; Teece, 2007). Hence, a conscious focus on corporate innovation that modifies the way business activities are carried out across the organization can arguably lead to better dynamic managerial capabilities and improved strategic responsiveness.

However, it takes more than creativity, new ideas, and good intensions to generate innovative initiatives and shape them into a set of viable business propositions. Innovation is an attempt to develop new product, process, and service propositions and bring them to fruition and practical use (Fagerberg, 2004). That is, innovation relates to concrete actionable possibilities not just idea generation and a state of creativity. Hence, conscious development efforts must be supported by dedicated resources that allow organizational members to devote time and effort towards the exploratory activities. All the while, the effect of available resources may be curvilinear as some organizational slack can foster experimentation whereas too much slack can lead to loss of project discipline that causes waste and inefficiencies (Nohria and Gulati, 1996). Similarly, excessive financial slack may lead management to pursue own objectives in questionable and suboptimal investments (Jensen, 1986; Stulz, 1990). Yet, the firms must have sufficient financial means to implement the business propositions and bring them to actual use once they have been developed. As such, financial slack constitutes a cushion of resources that allow the organization to modify its business activities in view of changing conditions (Bourgeois, 1981). In sum, firms with slack resources are more likely to develop and adopt new strategic options as environmental conditions evolve (Bowman and Hurry, 1993). These adaptive corporate activities are said to assume an "offensive mode" when strategic options are created to gain benefits from new opportunities and a "defensive mode" when corrective measures are taken to avoid downside loss events (Evans, 1991; Greenley and Oktemgil, 1998).

The literature distinguishes between "generated" slack that makes financial resources available to pursue strategic options and "invested" slack where resources are committed for specific development purposes (Chakravarthy, 1986). A firm's financial leverage expresses a capacity to raise loan financing and depicts an important source of generated slack where low leverage, e.g. reflected in a low debt-equity ratio, indicates that slack resources are available for investment in new business propositions. That is, low financial leverage, corresponding to a position with high capital reserves, makes potential resources available for launch and implementation of various development projects. Consequently, firms pursuing a conscious innovation strategy seem to have lower financial leverage (O'Brien, 2003). Investment in innovation, for example indicated by expenditures for products and process development purposes, constitutes a form of invested slack. This kind of resource commitment captures a conscious focus on innovation and reflects an intended allocation of resources towards development of new business propositions.

It is argued that the contemporary global business environments are exposed to hypercompetitive conditions characterized by continuous innovation and ongoing technological advancements (D'Aveni, 1994; Thomas, 1996). Under these

circumstances firms must invest in business development to persevere and gain sustainable competitive advantage by deploying valuable, rare, inimitable, and firm-specific resources (Barney, 1991, 2002). However, this approach requires that a certain level of organizational resources is made available to experiment with new innovative ideas and support their development into viable business propositions (Andersen, 2006; O'Brien, 2003). That is, corporate capital structure decisions should consider the allocation of financial resources for ongoing development and execution of responsive strategic options.

Hypotheses development

Effective risk management capabilities enable the firm to counter adverse effects caused by various environmental risks and furnish a steady stream of business opportunities that altogether will reduce variability in corporate earnings. The resulting improvement in performance predictability should reduce expected bankruptcy costs and provide comfort to key stakeholder groups that the firm is a reliable long-term business partner (Smith, 1995; Smith and Stulz, 1985). A lower likelihood of financial distress should induce lenders and investors to provide funding on more favorable terms thus reducing the average cost of capital and transactional premiums charged by commercial counterparts (Miller, 1998; Miller and Chen, 2003; Modigliani and Miller, 1963; Myers and Majluf, 1984). A lower average cost of capital should impose lower hurdle rates in corporate investment decisions and thereby extend the number of economically viable business propositions (Myers, 1977; Myers and Majluf, 1984). This may also eliminate under-investment problems caused by potential debt overhang (Myers, 1984; Froot *et al.*, 1993, 1994). Smoother periodic earnings may also lead to lower effective corporate tax rates in economies with progressive tax regimes (Culp, 2001; Smith, 1995). Furthermore, lower earnings volatility reduces the likelihood of periodic cash shortfalls and may thereby free up financial resources for investment in other value-adding activities (Minton and Schrand, 1999; Merton, 2005). Finally, stable earnings projections can increase confidence among important stakeholders and thereby encourage investment in value-creating firm-specific relationships (Andersen, 2008; Wang *et al.*, 2003). These arguments lead to the following hypothesis.

H1. Firms demonstrating higher levels of risk management effectiveness compared to their industry peers are associated with higher performance outcomes.

The pursuit of innovative initiatives and their development into viable business propositions, or strategic options, constitute an essential investment in innovation. It implies that organizational resources are committed towards the development of products, processes, and services that correspond better to current environmental requirements and thereby improve the firm's ability to respond to changing conditions (Andersen, 2006; O'Brien, 2003). The development efforts support the creation of alternative business propositions that enhance possible strategic choices and form growth options with future economic value (Myers, 1977). Consequently, investment in research and development efforts should facilitate the creation of effective risk responses with positive performance outcomes. However, while invested slack may foster experimentation, excessive levels of slack can also lead to loss of control that causes economic inefficiencies and waste (Chakravarthy, 1986; Nohria and Gulati,

1996). Hence, the positive influence of innovation on corporate responsiveness may show diminishing economic effects the more slack the firm commits to investment for this purpose. Nonetheless, the generated slack in capital reserves made available through lower financial leverage makes it possible to execute the business propositions once they have been developed and may thus enhance the positive risk management effects of innovation (Andersen, 2006; O'Brien, 2003). These arguments lead to the following three hypotheses.

H2.1. The positive association between higher levels of risk management effectiveness and performance outcomes is positively moderated by investment in innovation

H2.2. The positive association between investment in innovation and the effect of risk management effectiveness on performance is non-linear and decreasing for higher levels of investment in innovation

H2.3. The positive association between investment in innovation and the effect of risk management effectiveness on performance is enhanced by lower financial leverage

The ability to pursue responsive initiatives and effectuate alternative strategic options requires that a certain amount of financial resources are readily available for investments necessary to implement the related commercial opportunities (McGrath and Nerkar, 2004; O'Brien, 2003). As distinct from financial options, real options typically require some initial project investments when the underlying business propositions are executed (Andersen, 2006; Dixit and Pindyck, 1994). In other words, the corporation should make a certain level of capital reserves available by maintaining low financial leverage to exploit the strategic options and enable their exercise when conditions suggest that it is advantageous to do so (Miller, 1998; Luehrman, 1998). However, retaining excessive levels of corporate earnings and equity capital may provide too much leeway for management so they heed their own preferences at the expense of shareholder interests (Jensen, 1986; Stulz, 1990). Consequently, while low financial leverage will enhance the positive effects of risk management effectiveness, financial leverage can also become excessively low and thereby lead to diminishing outcomes on the responsive investment propositions. That is, as the degree of financial leverage moves towards excessively low levels, it may increasingly permit management to engage in questionable investments that impose adverse performance effects on the responsive risk management solutions. Nonetheless, it is still essential that sufficient slack be invested in ongoing development efforts. This allows new business opportunities to evolve as the basis for creating a portfolio of strategic options that, in turn, extends the available action space and thereby enhances the negative risk management effect of financial leverage (McGrath and Nerkar, 2004; O'Brien, 2003). These arguments lead to the following three hypotheses.

H3.1. The positive association between higher levels of risk management effectiveness and performance outcomes is negatively moderated by financial leverage.

H3.2. The negative association between financial leverage and the effect of risk management effectiveness on performance is non-linear and decreasing for lower levels of financial leverage.

H3.3. The negative association between financial leverage and the effect of risk management effectiveness on performance is enhanced by investment in innovation.

The proposed model with indications of the hypothesized relationships is shown in Figure 1. The subsequent section describes the empirical study devised to test the hypotheses.

Methodology

Data and measures

The empirical study is based on the 1,000 largest companies in Compustat determined by their market capitalization[2]. The firms operate in different manufacturing industries comprising household goods, electronics, industrial machinery, etc. (SIC: 2000-3999), trading (SIC: 4000-4999), transportation, telecommunication and energy distribution (SIC: 5000-5999), and various service industries including data programming, software, and business services (SIC: 7000-8999). The period 1996-2000 was used to analyze the risk management effects during a turbulent increasingly global and technology driven competitive environment (Bettis and Hitt, 1995; Caldart and Ricart, 2006). This provided a total sample of 896 companies where a complete dataset for all variables was available from the Compustat database.

Investment in innovation (II) was captured by research and development (R&D) intensity calculated as expenditures committed to new product and service development as a percentage of the firm's net sales. Firms failing to report R&D expenditures were registered as having zero investments consistent with common practice (Opler *et al.*, 1999; Minton and Schrand, 1999).

Financial leverage (FL) was measured as total long-term debt divided by shareholders' equity consisting of paid-in capital and retained earnings. The debt-equity ratio has been adopted in a variety of studies as a measure of financial slack (Bromiley, 1991; Hambrick and D'Aveni, 1988; McArthur and Nystrom, 1991).

Performance (PER) was measured as return on assets and growth in market value. The return ratio indicates realized economic results for the period where market value captures investors' expectations about the firm's future earnings potential. Reported economic results and market return measures are included to consider diverse

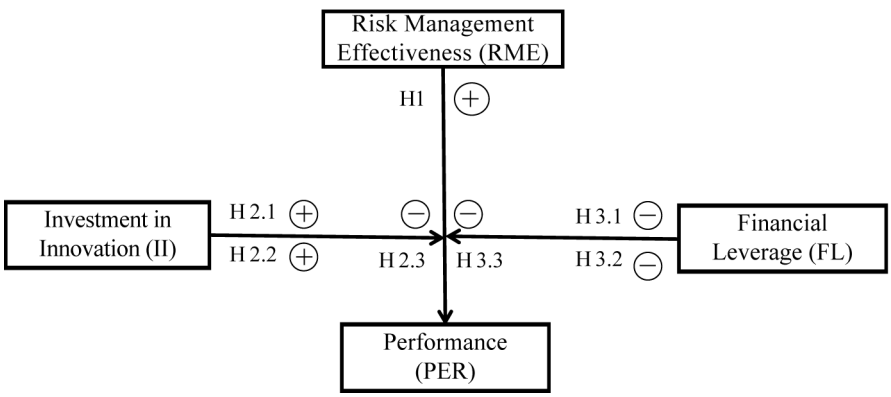

Figure 1.
A dynamic strategic risk management model

performance indicators and assess the robustness of analytical results. Return on assets was calculated as the firm's annual net income divided by average assets over the period determined as the simple mean of total assets at the beginning of the year and at yearend. The growth in market value was calculated as the annual change in the firm's market-to-book ratio as a percentage of the market-to-book ratio for the previous year. The market-to-book ratio (MB) was calculated as the firm's market capitalization, determined as the market value of outstanding shares by end of year, divided by the total book value, determined as total assets minus total liabilities at year-end.

Risk management effectiveness (RME) was conceived as the firm's ability to cope with environmental risks and uncertainties that could affect variability in net sales and thereby influence the stability of the corporate earnings development[3]. This comprises activities that enable the organization to reduce variation in corporate earnings including financial hedging, process controls, enterprise-wide risk management, strategic responsiveness. Accordingly, the RME construct was calculated as the standard deviation of annual net sales divided by the standard deviation of return on assets over the period (Andersen, 2008).

The variability in corporate sales can be affected by many exogenous risk factors including financial rates, commodity prices, shifts in demand, technological inventions, competitive moves, etc. Consequently, high variability in sales captures influences from market events that are beyond corporate control and indicates the extent to which the firm has been directly affected by these risks. The variability in economic return captures the effect these risk events have on earnings after the firm has responded to them. Hence, the RME construct indicates the organization's ability to adapt to exogenous market influences and thereby reduce the volatility of corporate earnings[4]. Since net profit, and hence return on assets (ROA), is influenced by developments in net sales and total expenditures, a high RME level indicates that the firm has been good at adapting its cost base to changes in revenues[5]. Conversely, a low RME level indicates that the firm has been relatively poor in adapting its cost base, e.g. unable to reduce costs when sales are dropping.

The performance, innovation, and leverage measures were averaged over the five-year period to eliminate spurious effects (Reuer and Leiblein, 2000; Simerly and Li, 2000). Subsequently, the performance, innovation, leverage, and risk management measures were standardized across two-digit SIC codes to eliminate industry specific effects (McGrath and Nerkar, 2004; O'Brien, 2003).

Control variables. The ability to manage corporate exposures effectively is likely to be affected by the size of the organization. Organizational size captures previous business success and the associated creation of organizational slack that may allow the firm to better cope with external shocks and withstand periods of adverse earnings development (Aldrich, 1999). Expanding the organization's activities to a certain size may also capture a degree of business and geographical diversity that makes performance outcomes less sensitive to changes in environmental conditions (Hitt *et al.*, 1997; Kim *et al.*, 1993; Qian, 1996). The size of the organization is typically indicated by the firm's total sales or total assets but both datasets often display skewed datasets. Hence, organizational size (OS) was measured as the natural logarithm of total assets.

The failure or inability to establish appropriate governance structures may affect risk management effectiveness. Strategic responsiveness reflects an organizational ability to observe environmental change and mobilize firm resources around viable

business initiatives that constitute effective responses (Andersen *et al.*, 2007). This depicts an idealized construct where numerous organizational obstacles can prevent effective responses from being realized. Hence, there are a number of potential impediments to effective risk management. These include cognitive biases that limit environmental observance and understanding (Bazerman, 2005; Schwenk, 1984), structural flaws that limit effective communication and coordination (Daft, 1982), agency problems and conflicts of interest that impede collaborative responses (Eisenhardt, 1989), excessive transaction costs in improper management setups (Williamson, 1982), and so forth. Accordingly, governance failure (GF) was captured by a variable indicating effects caused by agency conflicts, transaction costs, ineffective investment decisions, and other types of mismanagement. The dummy variable identifies organizations with average annual returns on capital below −2.5 and growth in capital reserves below 25 per cent and was assigned a value of 1 for firms that fulfill these criteria while all others were given a value of 0. Firms belonging to this subgroup have not been able to create returns in excess of the cost of capital during the period and are, therefore, likely to represent managerial inefficiency costs (Balakrishnan and Fox, 1993; Harris and Raviv, 1991; Simerly and Li, 2000).

Investment in innovation may be related directly to risk management effectiveness. There is no guarantee that new initiatives will work, i.e. they constitute risky experimentation with alternative ways of doing things that may impose immediate costs while making risk management outcomes vulnerable. Pursuing an innovation policy implies that resources are committed in attempts to generate viable responses to changing environmental conditions without knowing the actual outcomes (O'Brien, 2003).

Financial leverage may also have a direct effect on effective risk management outcomes. Maintaining low financial leverage ensures that more capital reserves are retained in the firm as a buffer to absorb adverse economic impacts from various risk events and constitutes a classical precaution to counter environmental uncertainty (Muelbroek, 2002; Saunders and Cornett, 2003). The debt-equity ratio may also be associated with firm performance (Bodie *et al.*, 2001; Modigliani and Miller, 1963; Myers and Majluf, 1984).

Finally, the market-to-book ratio may have a direct relationship to performance outcomes. The market-to-book ratio indicates the firm's intellectual capital and has been identified as a significant predictor of performance (Fama and French, 1992, 1993). The market-to-book ratio was standardized across two-digit SIC codes to eliminate potential industry effects. The measures of organizational size and governance failure were not standardized because they are considered universal phenomena without particular industrial specificities.

Analyses

Risk measures and effective risk management. Since we introduce a new construct for risk management effectiveness, it is reasonable to consider the measure in more detail and compare it to alternative risk indicators discussed in the literature. The aggregate exposures imposed on the corporation by various exogenous and endogenous factors are reflected in different risk indicators. The standard deviation in corporate net sales over a period of time is influenced by changes in general market conditions. For example, when customer demand is affected by changes in fiscal policies,

socio-political events, international price relationships, the business cycle, etc., it may have a direct effect on corporate sales. Similarly, the introduction of competing products and services or the adoption of new efficient production, sales, and distribution processes by competitors can influence the ability to retain current sales levels. Hence, the measure provides a rough indication of the aggregate effects imposed by major market exposures. However, corporate sales often develop along a certain growth path and, therefore, the standard deviation in error terms around annual sales forecasts for the period, e.g. determined through linear regression, may be considered a better indicator of general market uncertainty (Dess and Beard, 1984).

Different measures of firm risk have been advanced in other studies where the standard deviation in return on assets over time has emerged as a common indicator (e.g. Miller and Bromiley, 1990). This indicator has also shown to be correlated with income stream uncertainty determined on the basis of analysts' forecasts on firm income (Wiseman and Bromiley, 1996). Downside risk is a more recent addition to the list of possible corporate risk indicators. This measure reflects the firm's propensity to achieve results below a certain industry target. It is determined here as the second order root lower partial moment calculated on ROA using the annual mean in the two-digit SIC code industry as target level (Miller and Reuer, 1996; Miller and Chen, 2003; Reuer and Leiblein, 2000).

We have argued that the standard deviation in sales captures the effects of various exogenous market events whereas the standard deviation in returns reflects the firm's ability to adapt to these market risks, environmental hazards, and operational disruptions. However, one might suggest that the associated risk management measure should be based on coefficients of variation calculated as the standard deviation of corporate sales over average sales divided by the standard deviation of return on assets over average return to eliminate possible size effects. For the same reason, an alternative measure of the risk management construct is based on the standard deviation of the error terms around the linear sales forecasts over average sales during the period divided by the standard deviation of return on assets over average return. In the following we assess the differences between the alternative measures of risk management effectiveness and how they affect the robustness of analytical results.

When analyzing the relationships between the different measures of performance, market risk, and firm risk, we observe high and positive within group correlations (Table I). Similarly, the correlation coefficients between the alternative risk management measures are high, positive, and significant. Furthermore, all the risk management measures are negatively correlated with the market risk and firm risk measures. Both the market risk and firm risk measures are negatively correlated with performance. However, all the risk management measures are positively correlated with performance. That is, the risk management measures have a positive association with performance even though these measures are derived as market risk over firm risk indicators both of which are negatively related to performance. Hence, these analyses provide both convergent and divergent validity to the risk management measures adopted in the study.

Hypotheses testing. The hypotheses were tested in two-stage least square regressions with interaction terms due to the nature of the model relationships where investment in innovation and financial leverage affect risk management

Table I. Correlations between performance, risk, and risk management measures

	1	2	3	4	5	6	7	8
1 Return on assets								
2 Growth in market value	0.244**							
3 Firm risk (downside)	−0.689**	−0.140**						
4 Firm risk (SD – ROA)	−0.169**	0.030	0.303**					
5 Market risk (SD – net sales)	−0.182**	−0.001	0.317**	0.963**				
6 Market risk (SD – forecast error)	−0.190**	−0.001	0.324**	0.989**	0.991**			
7 Risk management effectiveness	0.203**	0.366**	−0.408**	−0.114**	−0.138**	−0.141**		
8 Risk management (coefficients of variation)	0.507**	0.261**	−0.379**	−0.063*	−0.090**	−0.101**	0.379**	
9 Risk management (forecast error)	0.447**	0.205**	−0.359**	−0.096**	−0.121**	−0.132**	0.337**	0.780**

Notes: $^{*}p < 0.05$; $^{**}p < 0.01$; $n = 896$ (all risk and risk management measures are standardized by two-digit SIC-code industries)

effectiveness (RME) directly while interacting with RME to influence performance. Two-stage least square (2SLS) regression is appropriate when independent variables may be correlated with the error terms of the dependent variable because ordinary least square regressions in these cases can lead to biased parameter estimates (Theil, 1971). 2SLS regression incorporates predicted data for the causal variables based on relationships determined in preceding regressions to circumvent estimation biases. Hence, risk management effectiveness is first predicted by organizational size, governance failure, investment in innovation, and financial leverage. Then performance is regressed on the predicted values of risk management effectiveness and observed values on investment in innovation, financial leverage, their squared values and the interactions between RME and these variables as well as the market-to-book ratio (see Appendix for an overview of the complete set of regression equations).

The regressions were also performed using alternative risk management measures based on coefficients of variation and errors around sales forecast but no material changes in results were observed. Hence, the reported results appear robust across alternative measures of the risk management construct. The regressions were tested for possible outlier effects and multicollinearity. No problems with multicollinearity were registered with VIF factors below 3.5 well within proposed threshold levels (Kleinbaum *et al.*, 1998). We also analyzed the hypothesized relationships in simple multiple regressions using organizational size and governance failure as direct control variables on performance. These analyses displayed comparable results.

Results

Descriptive statistics and correlation coefficients on all variables used in the 2SLS regression analyses are reported in Table II.

The results from the two-stage least square regressions are shown in Table III. The analyses indicate that the direct performance effect of risk management effectiveness remains strong after controlling for influences of organizational size, governance problems, investment in innovation, and financial leverage. This provides support for *H1*. The interaction term between risk management effectiveness and investment in innovation is positive and statistically significant on both return on assets and growth in market value, which supports *H2.1*. Hence, effective risk management is associated with superior performance and the positive effect is enhanced among firms that commit resources to innovation. Figures 2 and 3 illustrate how the performance association with risk management effectiveness is enhanced among firms with a high level of investment in innovation[6]. The low and high levels are determined as one standard deviation below and above the average value respectively as proposed by Cohen and Cohen (1983). The interactive effect between risk management effectiveness and financial leverage is negative and shows statistical significance on return on assets in models (2.3) and (2.4) and on growth in market value in models (2.2) and (2.3). This provides some support *H3.1*. That is, the positive risk management effects seem to be enhanced among firms that maintain low financial leverage. Figures 4 and 5 illustrate how the performance association with risk management effectiveness is enhanced among firms with a lower level of financial leverage. Both the dependent and independent variables have been normalized in this analysis to avoid potential problems with industry biases and multicollinearity associated with interaction terms.

Table II.
Descriptive statistics and correlation coefficients

	Mean	SD	1	2	3	4	5	6	7
1 Return on assets	4.499	6.02							
2 Growth in market value	8.416	23.29	0.244**						
3 Organizational size	7.623	1.48	0.065*	0.256**					
4 Governance failure	0.101	0.30	−0.151**	−0.103**	−0.085**				
5 Market-book ratio	2.949	7.99	0.479**	0.381**	−0.193**	−0.124**			
6 Investment in innovation	2.035	2.49	−0.019	0.107**	0.036	−0.040	0.269**		
7 Financial leverage	97.643	198.21	−0.220**	−0.084*	0.131**	−0.101**	−0.264**	−0.093**	
8 Risk management effectiveness	5.220	1.80	0.203**	0.366**	0.584**	−0.145**	−0.102**	−0.151**	0.079*

Notes: $^{*}p < 0.05$; $^{**}p < 0.01$; $n = 896$

Table III.
Two-stage least square regressions [Coefficient estimates (t-values)]

Model:	Risk management effectiveness (1)	Return on assets (2.1)	(2.2)	(2.3)	(2.4)	Growth in market value (2.1)	(2.2)	(2.3)	(2.4)
Organizational size	0.392**** (20.96)	–	–	–	–	–	–	–	–
Governance failure	−0.365**** (−4.29)	–	–	–	–	–	–	–	–
Investment in innovation	−0.161**** (−5.36)	−0.126**** (−4.20)	−0.092*** (−3.01)	−0.115*** (−3.19)	−0.117*** (−3.24)	0.070* (2.20)	0.095*** (2.93)	0.071* (1.83)	0.076* (1.98)
Investment in innovation^2	–	–	–	0.025* (1.68)	0.015* (1.72)	– (−0.90)	– (−0.99)	−0.015	−0.016
Financial leverage	−0.036 (−1.24)	−0.125**** (−4.32)	−0.120**** (−4.20)	−0.119**** (−3.59)	−0.122**** (−3.68)	−0.014 (−0.46)	−0.009 (−0.29)	−0.023 (−0.65)	−0.013 (−0.37)
Financial leverage^2	–	–	–	−0.024* (−2.04)	−0.023* (−1.94)	–	–	0.019 (1.53)	−0.016 (−1.29)
Market/book ratio	–	0.566**** (18.59)	0.580**** (19.21)	0.572**** (18.98)	0.570***** (18.89)	0.397**** (12.34)	0.407**** (12.70)	0.413**** (12.74)	0.417**** (12.85)
Risk management effectiveness	–	0.252**** (6.84)	0.248**** (6.82)	0.145*** (2.83)	0.132*** (2.52)	0.394**** (10.09)	0.390**** (10.08)	0.550**** (9.83)	0.574**** (10.16)
Risk management effectiveness *Investment in innovation	–	–	0.124**** (4.66)	0.099* (2.41)	0.094* (2.32)	–	0.082*** (2.90)	0.208**** (4.80)	0.216**** (4.98)
Risk management effectiveness *Investment in innovation ^{2}	–	–	–	0.024 (1.49)	0.031* (1.76)	–	–	−0.069**** (−4.02)	−0.089**** (−4.73)

(*continued*)

Table III.

Model:	Risk management effectiveness (1)	Return on assets (2.1)	(2.2)	(2.3)	(2.4)	Growth in market value (2.1)	(2.2)	(2.3)	(2.4)
Risk management effectiveness *Financial leverage	–	–	−0.035 (−1.17)	−0.086* (−2.30)	−0.088* (−2.37)	–	−0.085*** (−2.71)	−0.067* (−1.68)	−0.059 (−1.48)
Risk management effectiveness *Financial leverage^2	–	–	–	0.042*** (3.17)	0.048*** (3.23)	–	–	−0.021 (−1.43)	−0.037* (−2.28)
Risk management effectiveness *Investment in innovation *Financial leverage	–	–	–	–	0.042 (1.00)	–	–	–	−0.118*** (2.63)
Multiple R^2	0.365	0.340	0.358	0.369	0.370	0.231	0.247	0.258	0.262
Adjusted R^2	0.363	0.337	0.354	0.362	0.362	0.228	0.241	0.250	0.253
$F-$ significance	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$; $^{****}p < 0.001$; $n = 896$

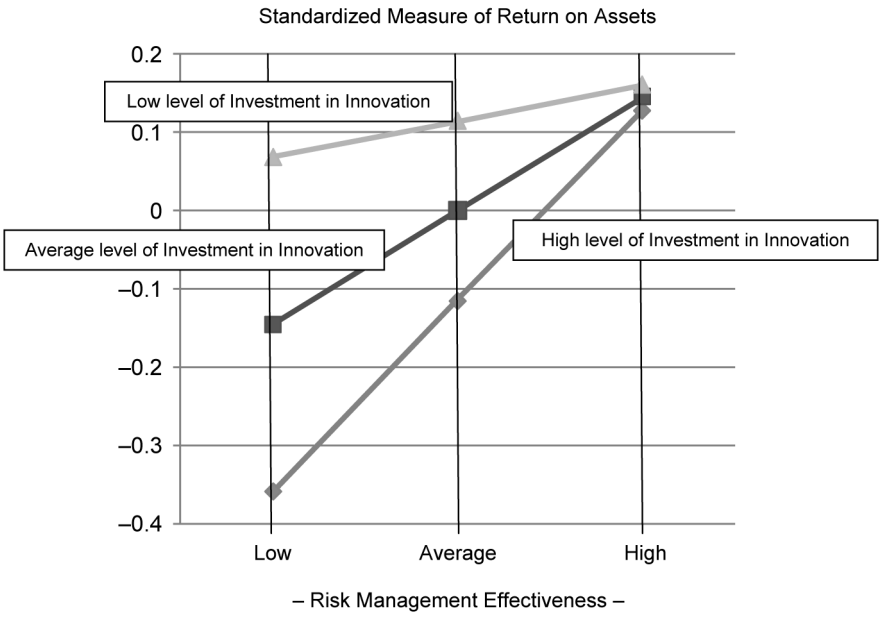

Figure 2.
The moderating effect of investment in innovation (return on assets)

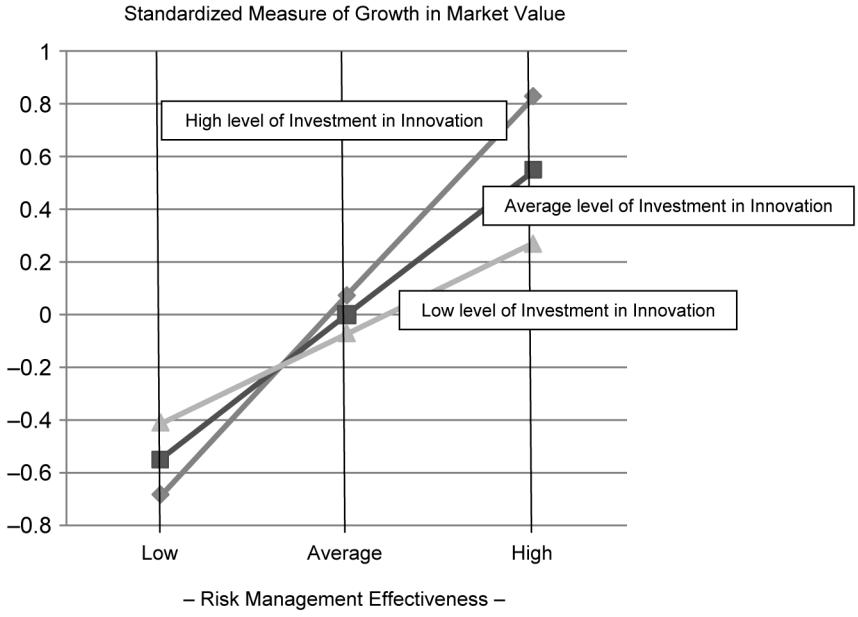

Figure 3.
The moderating effect of investment in innovation (growth in market value)

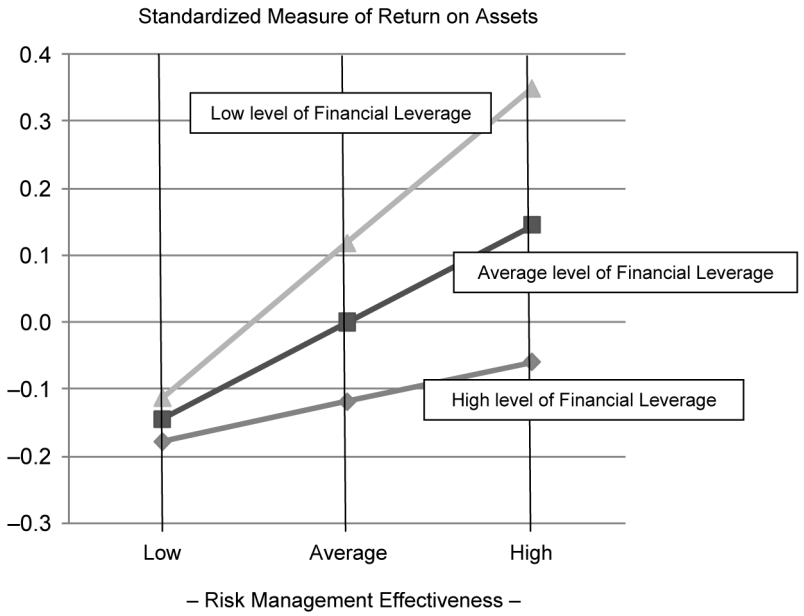

Figure 4.
The moderating effect of financial leverage (return on assets)

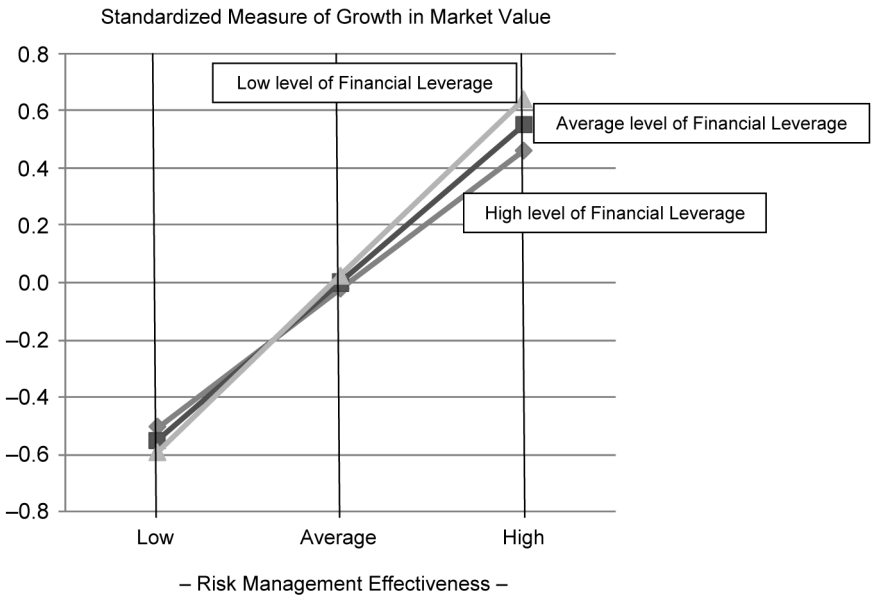

Figure 5.
The moderating effect of financial leverage (growth in market value)

In this case, the unstandardized coefficients from the regressions correspond to the appropriate standardized interaction terms found in normal linear regressions (Aiken and West, 1991) and comply with the procedure proposed by Friedrich (1982).

The curvilinear moderating effects of investment in innovation and lower financial leverage on the positive performance relationship between risk management effectiveness and performance are tested by incorporating the squared terms of these variables and their interactions with RME in the regressions (Aiken and West, 1991). Regressing the interaction term between RME and investment in innovation on return on assets shows a positive coefficient and it remains positive on the interaction between RME and investment in innovation squared. Regressing the interaction term between RME and investment in innovation on growth in market value similarly shows a positive coefficient but it turns negative on the interaction between RME and investment in innovation squared. That is, the hypothesized diminishing interaction effect of innovation on risk management effectiveness does not seem to apply in the case of realized economic returns but only to changes in market valuation. Regressing the interaction term between RME and financial leverage on return on assets shows a negative coefficient, which turns positive on the interaction between RME and financial leverage squared. However, the coefficients on the interaction term remain negative in the regression on growth in market value. That is, the hypothesized diminishing interaction effect of financial leverage on risk management effectiveness seems to only apply to realized economic results. These results indicate some diminishing moderating effects of investment in innovation and financial leverage on the performance relationship of risk management effectiveness and provide partial support for *H2.2* and *H3.2*. However, these relationships display distinct differences where innovation shows diminishing effects with regard to market valuation and financial leverage shows diminishing effects with regard to realized economic returns.

The three-way interaction effect on corporate performance between risk management effectiveness, investment in innovation, and financial leverage is done in full regressions including all first and second order terms. The results indicate a significant negative coefficient in the regression on growth in market value and thus provide partial support for *H2.3* and *H3.3*. That is, there seems to be some recognition among investors in the market that the combination of innovation and financial slack will enhance the expected future performance effect of effective risk management capabilities.

Discussion

The reported results support the arguments that effective risk management capabilities reflected in the ability to reduce effects of various risk events on the variability of corporate earnings leads to superior performance outcomes. The extended regression analyses indicate that these positive risk management effects are further enhanced among firms with higher levels of investment in innovation and lower levels of financial leverage compared to their industry peers. Yet, there are some signs that innovation and financial slack may have diminishing effects, i.e. excessive resource commitments to innovation and financial slack may eventually have marginal contributions with limited economic effects. Nonetheless, committing sufficient resources to ongoing innovation and development efforts seems essential for the creation of business opportunities that increase the number of strategic options and

thereby facilitate corporate maneuverability. Similarly, maintaining a certain level of financial slack seems to ensure that the business opportunities, or strategic options, can be enacted through responsive investments once they have been developed.

From a risk management perspective, the capital reserves made available through low financial leverage are typically seen as a cushion to absorb adverse economic outcomes and provide assurance for essential stakeholders about the viability of the firm as a going concern (Muelbroek, 2002; Saunders and Cornett, 2003). Engaging in insurance contracts, financial derivatives, and other risk-transfer instruments to cover for downside risk events can similarly be seen as complementary sources of financial capital (Culp, 2002; Shimpi, 1999). However, this perspective of using capital structure as the means to establish a financial buffer and maintain a reservoir of funding reflects a rather conventional and defensive risk management mode. In contrast, the results of this study suggest that low financial leverage in conjunction with pursuit of a conscious innovation policy have positive risk management effects because it facilitates a proactive and more offensive risk management mode. From this alternative perspective, effective risk management outcomes to a large extent derive from an ability to create innovative business opportunities that allow the firm to circumvent emerging threats and exploit new possibilities. It also indicates that some of the most important risks are of a strategic nature in turbulent environments and points to strategic responsiveness as an essential element of effective risk management.

The positive performance effects of effective risk management associated with low financial leverage and investment in innovation may be somewhat at odds with parts of the finance literature that makes different predictions about the relationship between financial leverage and performance. Firm value is supposedly related to capital structure when interest is tax deductable and transaction and bankruptcy costs prevail, in which case firm value should increase with financial leverage (Modigliani and Miller, 1958, 1963)[7]. Conversely, simple economic rationales argue that reinvesting corporate earnings can create value as long as returns on the internal business propositions exceed the average cost of capital (Bodie *et al.*, 2001; Sharpe *et al.*, 1999), which may predict the inverse relationship between performance and leverage[8]. However, these assessments do not take strategic responsiveness into account or consider how high financial leverage can limit the firm's ability to develop effective responsive actions in the face of unexpected changes in the environment.

Assuming an agency theoretical perspective does not provide more definitive answers. Agency theory would argue that debt should be used as a disciplinary tool to ensure that managers give preference to the creation of shareholder wealth (Jensen, 1986, 1989). Here, lenders are the prime governance constituents as debt service payments and restrictive covenants would make it difficult for managers in indebted firms to engage in peripheral business activities. At the other extreme, excessive financial leverage can lead to under-investment as high debt service commitments reduce the ability to engage in new initiatives and invest in good projects (Myers, 1977). That is, it may reduce the number of strategic options created and exercised by the firm, which can make it more difficult to maneuver under uncertainty. In other words, debt can also become too restrictive for firms operating in business environments that require ongoing development of new viable business propositions.

By comparison, a transaction cost economics (TCE) perspective would argue that deployment of firm-specific assets requires managerial intervention to coordinate

transactions effectively. Hence, the higher the asset specificity, as is the case in organizations pursuing ongoing innovation, the more economical internal hierarchical coordination should be compared to market clearance of transactions (Williamson, 1988, 1991). Lower financial leverage supports internal hierarchical control whereas a higher debt load imposes market discipline on managerial decisions (Harris and Raviv, 1991; Jensen, 1986, 1989). This means, that equity and retained earnings should be a preferred source of funding when firms try to create competitive advantage through innovation supported by firm-specific assets (Balakrishnan and Fox, 1993; Simerly and Li, 2000). These arguments imply that firms competing through innovative business development efforts should reduce financial leverage to a level that economizes on transaction cost.

In sum, adopting a combination of finance, agency, and transaction cost rationales does not provide a finite answer to the best combination of innovation investment and financial leverage for optimal risk-return outcomes. However, these theoretical perspectives suggest that there are fundamental trade-offs at play where there can be too little as well as too much of "a good thing". The underlying reasoning might be used as a foundation to uncover specific agency and transaction cost structures that determine the optimal maneuverability positions. Hence, future research efforts may be able to outline conditions for effective innovation and capital structure decisions and describe the optimal corporate risk-return relationships in more detail. Nonetheless, using a real options logic is helpful in explaining how the performance outcomes from risk management effectiveness are affected by innovation investment and financial leverage.

The direct relationships between risk management effectiveness and performance illustrates that the ability to reduce the earnings sensitivity to fluctuations in various risk factors is a major strategic differentiator with significant performance effects. That is, the ability to respond better to changes in environmental conditions compared to industry peers is associated with higher earnings while the riskiness of the earnings flow is lower at the same time. Andersen *et al.* (2007) have shown that heterogeneity in response capabilities among firms can lead to such an inverse relationship between variability in earnings and the average level of earnings. In this context, the reported results suggest that effective risk management outcomes arise from other sources than pure hedging and risk-transfer activities and are significantly affected by good corporate governance and strategic response capabilities. These sources to effective risk management outcomes can be conceptualized and explained around a real options logic. Accordingly, slack resources invested in innovative efforts drive the creation of strategic options and the availability of financial slack makes it possible to execute the strategic options as and when the environmental conditions dictate this. Therefore, it is essential for corporate management to consider making sufficient organizational slack available in support of the creation and execution of a real options portfolio (Dixit and Pindyck, 1994; Luehrman, 1998).

This further suggests that positive risk management effects depend on an ability to create alternative strategic options as the means to enhance corporate response capabilities. That is, real options reasoning can extend the corporate risk management perspective to also include firm-specific strategic exposures and thereby go beyond the market-based risk focus of financial derivatives (Andersen, 2006; Allayannis and Weston, 2001). According to this logic, the role of financial leverage as a risk management tool differs from a conventional defensive view on capital reserves as a financial buffer to bolster the corporation against adverse performance impacts[9].

Instead, capital reserves make financial slack available to launch opportunities and invest in alternative business propositions when market conditions require this. This demonstrates that effective risk management is facilitated by investing in innovative efforts and maintaining low financial leverage. As a consequence, positive risk management outcomes will be influenced by the conscious capital structure decisions and corporate innovation policies promoted in the executive board rooms.

These findings are interesting in the context of previous risk management research. In a study of 26 US firms announcing appointments between 1997 and 2001, Liebenberg and Hoyt (2003) found that greater financial leverage made the appointment of chief risk officers (CROs) more likely. This appears consistent with our results for a comparable period in the sense that firms with higher financial leverage should display poorer risk management outcomes and, therefore, conceivably need to improve their risk management capabilities by appointing a CRO. Conversely, it might suggest that CROs are being employed primarily to be able to economize on capital and increase financial leverage. At worst, this could reflect a disregard for the role of invested and generated slack for the development and execution of strategic options as necessary precursors for effective risk management outcomes.

Hence, we contend that corporate risk management activities interpreted through options reasoning can extend the ability to cope with enterprise-wide risks that count harder-to-quantify economic, political, and strategic risk factors among the most important exposures (Andersen, 2006; Slywotzky and Drzik, 2005). That is, a real options logic can explain how effective risk management can deal with firm-specific strategic exposures and how capital structure and innovation policies affect these efforts. The development of alternative business propositions, or strategic options, improves maneuverability and corporate risk management outcomes when supported by appropriate capital structure and innovation policies. This also means that practicing managers should be sensitive to the fact that investment in innovation combined with a relatively low level of financial leverage is associated with positive risk management outcomes.

Conclusions

Based on a large cross-sectional corporate sample this study finds a significant positive relationship between risk management effectiveness and performance. The positive performance effect of risk management is found to be enhanced by investment in innovation and low financial leverage. These results are important as they constitute one of the first comprehensive empirical studies demonstrating the positive performance effect of risk management effectiveness. Furthermore, the findings confirm the importance of innovation policies and capital structure decisions in dealing effectively with environmental risk and uncertainty. For practicing managers this specifically implies that one should be conscious about the positive risk management effects associated with investment in innovation combined with low financial leverage.

Notes

1. Nonetheless, risk has been an essential element of strategy research for decades (e.g. Baird and Thomas, 1985; Bettis, 1982; Bettis and Thomas, 1990; Bromiley, 1991; Miller and Bromiley, 1990) and some strategy textbooks give explicit attention to risk issues, e.g. McGee *et al.* (2005) devote an entire chapter to this.

2. This group of firms includes most of the Fortune 500 companies and more or less coincides with the Stern-Stewart Performance Top 1000 companies.
3. We may refer to the underlying process as "true" strategic risk management reflecting the capacity to deal with all types of risk including market volatilities, environmental hazards, operational disruptions, and strategic factors realizing that the term "strategic risk management" has been used previously to depict financial risk management strategies (e.g. Rawls and Smithson, 1990).
4. Incidentally, RME will also capture the adverse impacts from various endogenous risk events, such as, one-time losses from operational disruptions, mistakes, fraud, and the like.
5. Simple statistical theory suggests that var(ROA) $\approx$ var(Profits) = var(Sales) + var(Cost) – 2*cov(Sales, Cost). That is, to the extent sales and cost co-vary, the lower will be the variance in profits and hence returns.
6. All the calculations are based on the regression coefficients derived from model (2.3) in Table III.
7. According to these arguments an optimal capital structure is then determined by a trade-off between increasing bankruptcy costs from higher debt load and the tax shield gained from deductible interest payments.
8. Furthermore, when information asymmetries exist between internal managers, debt holders, and equity investors there may be a tendency to use internal financial sources for attractive projects only, which may lead to a negative relationship between performance and financial leverage (Myers and Majluf, 1984).
9. Incidentally, the initial regression equation (1) does not reveal any significant direct effect on risk management effectiveness from low levels of financial leverage that corresponds to high capital reserve positions.

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Appendix. Two-stage least regression equations

$$\mathrm{RME} = \alpha + \beta_1 \mathrm{OS} + \beta_2 \mathrm{GD} + \beta_3 \mathrm{II} + \beta_4 \mathrm{FL} + \varepsilon \tag{1}$$

$$\mathrm{PER} = \alpha + \beta_1 \mathrm{II} + \beta_2 \mathrm{FL} + \beta_3 \mathrm{MB} + \beta_4 \mathrm{RME} + \varepsilon \tag{2.1}$$

$$\mathrm{PER} = \alpha + \beta_1 \mathrm{II} + \beta_2 \mathrm{FL} + \beta_3 \mathrm{MB} + \beta_4 \mathrm{RME} + \beta_5 \mathrm{RME}^{*} \mathrm{II} + \beta_6 \mathrm{RME}^{*} \mathrm{FL} + \varepsilon \tag{2.2}$$

$$\mathrm{PER} = \alpha + \beta_1 \mathrm{II} + \beta_2 \mathrm{II}^2 + \beta_3 \mathrm{FL} + \beta_4 \mathrm{FL}^2 + \beta_5 \mathrm{MB} + \beta_6 \mathrm{RME} + \beta_7 \mathrm{RME}^{*} \mathrm{II} + \beta_8 \mathrm{RME}^{*} \mathrm{II}^2 + \beta_9 \mathrm{RME}^{*} \mathrm{FL} + \beta_{10} \mathrm{RME}^{*} \mathrm{FL}^2 + \varepsilon \tag{2.3}$$

$$\mathrm{PER} = \alpha + \beta_1 \mathrm{II} + \beta_2 \mathrm{II}^2 + \beta_3 \mathrm{FL} + \beta_4 \mathrm{FL}^2 + \beta_5 \mathrm{MB} + \beta_6 \mathrm{RME} + \beta_7 \mathrm{RME}^* \mathrm{II} + \beta_8 \mathrm{RME}^* \mathrm{II}^2 + \beta_9 \mathrm{RME}^* \mathrm{FL} + \beta_{10} \mathrm{RME}^* \mathrm{FL}^2 + \beta_{11} \mathrm{RME}^* \mathrm{II}^* \mathrm{FL} + \varepsilon \quad (2.4)$$

RME = Risk management effectiveness
PER = Performance (return on assets, growth in market value)
OS = Organizational size
GD = Governance dummy
I I = Investment in innovation
FL = Financial leverage
MB = Market-to-book ratio
X*Y = two-way interaction term between variables X and Y
X*Y*Z = three-way interaction term between variables X, Y and Z
α = intercept of regressions
β = regression coefficients
ε = error terms

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