Risk management and firm value: recent theory and evidence

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Abstract

Purpose – This paper aims to provide an update to the risk management literature, as it compiles a survey of 65 recent theoretical and empirical studies on the topic.

Design/methodology/approach – This is a survey paper that summarizes recent theoretical and empirical research regarding the relationship between risk management and firm value.

Findings – Recent empirical evidence provides support for theoretical propositions in the literature that risk management increases firm value and returns, while reducing return and cash flow volatility. The results are largely consistent with early findings, and there have been significant empirical advances that address concerns regarding the endogeneity of risk management practices relative to corporate financial decisions. The literature has become broader and deeper, as there are now studies with larger sample sizes across more industries and geographic areas.

Practical implications – Firms that use sound risk management practices obtain higher valuations, achieve better financial performance and experience diminished costs of financial distress. Recent research has emerged regarding enterprise risk management and its potential for value creation and risk reduction.

Originality/value – The paper provides a new compilation and synthesis of recent theoretical and empirical research in risk management that addresses many of the limitations of prior research.

Keywords Risk management, Derivatives, Firm value, Enterprise risk management

Paper type Literature review

1. Introduction

The relationship between risk management (RM) and firm value has been explored to a significant extent in the finance, accounting and information management literature. Several influential articles (Stulz, 1984; Smith and Stulz, 1985; Froot *et al.*, 1993) explore the potential implications of this relationship and provide suggestions for further research, garnering over 6,000 citations in the process. The purpose of the current study is to review and synthesize the research conducted since the latest survey of empirical

RM studies (Smithson and Simkins, 2005) to summarize the empirical and theoretical advances that have been made in this area over the past decade.

To provide context for the recent empirical and theoretical studies that we survey, a brief recap of the early RM theory literature is appropriate. Stulz (1984) provides the first attempt to explain optimal firm hedging problems in a continuous-time theoretical setting. His model posits that firms should implement active hedging strategies to maximize firm value, not necessarily hedging 100 per cent of every firm exposure. Smith and Stulz (1985) construct a model to demonstrate that firms' hedging decisions should be made in concert with other financing decisions. They find that firms hedge for three reasons: to reduce taxes; to reduce the costs of financial distress; and managerial risk aversion. Stulz (1996) summarizes the results of these papers in a practitioner-friendly, accessible way, providing an examination of the broad theory of RM that is based on comparative advantage in risk-bearing. He argues that RM benefits three aspects of firm value: by reducing the variability of cash flows and the potential costs of bankruptcy, by reducing the cost of capital and by reducing taxes. While academics focus on the variance reduction aspects of RM, he notes that practitioners seem to focus on the avoidance of "lower-tail outcomes". Additionally, managerial compensation structures should be configured such that companies only take advantage of RM opportunities that increase shareholder value. Finally, if executives are going to place bets due to their comparative advantage in RM, managerial performance should be evaluated on a risk-adjusted basis. As a further follow-up, Stulz (2013) sets out the "first principles" of RM that emphasize firms' comparative advantages in risk-bearing, the use of RM in an integrated fashion to avoid crippling outcomes, its role as a substitute for equity and the importance of communication in the implementation of RM systems. Stulz (2015) applies these prescriptions specifically to financial institutions, given their importance to the health of the financial system. He notes that better RM should lead to better risk-taking, and not simply a reduction in risk.

Froot et al. (1993), in their seminal theoretical study, bring an additional perspective to the discussion, as they consider the benefits of hedging relative to external sources of finance. One of the implications of their paper is that an optimal hedging strategy does not completely insulate the firm from marketable price risks, consistent with Stulz (1984 and 1996). Another implication is that firms should hedge less when their cash flows are highly correlated with future investment opportunities. They also note the importance of non-linear hedging instruments such as options as more precise instruments to coordinate investment and financing plans. They also find that optimal hedging strategies should also consider the hedging strategies of a firm's competitors and the nature of product market competition. Finally, in a fashion similar to Stulz (1996); Froot et al. (1994) provides a practitioner-oriented discussion of the main implications of Froot et al. (1993).

Given the normative theoretical prescriptions of early RM theory, Smithson and Simkins (2005) survey the empirical work that seeks to answer the question of whether or not RM contributes to firm value. They find that company share prices do reflect the value of interest rate RM in financial institutions, but the results are less clear when examining industrial companies. With regard to variance minimization, the evidence is strong that firms using RM tools do experience lower return and cash flow volatility. Finally, the survey examines a group of papers that

proxy for firm value using Tobin's q. These papers find that, in general, interest rate and foreign currency (FX) RM results in higher firm value. The results are mixed when looking at commodity price RM, however, as higher firm value only seems to accrue to commodity consumers (e.g. airlines) as opposed to commodity producers (e.g. gold miners). The results of these papers are largely consistent with the early RM theory literature, although the survey authors do not explicitly relate the specific empirical results to existing theory.

The empirical results of the present study and recent theory build on these theoretical foundations, and are largely consistent with these findings, although there have been significant advances in addressing concerns regarding the endogeneity of RM practices relative to other corporate financial decisions. The literature has become broader and deeper, as there are now studies with larger sample sizes and across more industries and geographic areas. Also, there is a nascent developing literature surrounding the practice of enterprise risk management (ERM) that seeks to address "best practices" for firms trying to implement a more "holistic" and less "siloed" approach to RM. In each of these analyses, we link the updated empirical results to established and newly published theory in the literature. The broad theme of the study is that efforts toward better RM result in greater firm value through reductions in cash flow and earnings volatility, lower costs of financial distress, lower cost of capital, lower taxes and reduced agency costs.

2. Recent developments in risk management theory
While this article is largely devoted to examining the evidence compiled in the empirical studies undertaken since Smithson and Simkins (2005), we would like to devote some space to recent theoretical advances in RM. As noted by Hunter and Smith (2002) and others, Modigliani and Miller (1958) provide the first references to financial RM as a tool for value creation, although it is largely dismissed, as investors can "home brew" their own leverage and risk appetites via individual leverage decisions. Smithson and Simkins (2005) provide a survey of the subsequent RM literature up until 2006, so we limit our discussion largely to subsequent studies.

Adam (2002) provides a model of how financially constrained firms should hedge, extending the work of Froot *et al.* (1993). He finds that firms in a stable financial position should focus on avoiding cash shortfalls, while less creditworthy firms should focus on generating liquidity for current investments. The predictions of his model are consistent with the diverse RM practices of the gold mining industry that are explored empirically by Adam and Fernando (2006) that will be discussed in Section 3 below. MacMinn (2002) reviews the work of Adam (2002) in terms of the corporation being viewed as a "nexus of risks", where the job of management is to select and manage risks in a way that enhances shareholder value, a view that is fully consistent with the views presented by Stulz (1996). He also examines Breuer (2002), who points out the dangers inherent in off-balance-sheet leverage that should be converted into cash market equivalents for RM purposes. Only in this manner can the relation between risk and leverage be disentangled to determine adequate capital ratios. He suggests a methodology to assess off-balance-sheet activities and to map derivatives contracts into equity and debt components, allowing for the calculation of a modified capital adequacy ratio that would more accurately measure risk as compared to traditional capitalization ratios.

Fehle and Tsyplakov (2005, p. 3) explore the theoretical aspects of dynamic RM in an:

> […] infinite-horizon, continuous-time model of a firm that can dynamically adjust the use of risk management instruments which seek to reduce product price uncertainty and thereby mitigate financial distress losses and reduce taxes.

Their model recognizes firms' ability to adjust hedges as well as the tradeoff between the optimal hedge ratio and transaction costs. The authors also account for the fact that most hedging instruments are short-term in nature, while the firm's horizon is ostensibly infinite. Their model suggests a "non-monotonic relation between measures of financial distress and risk management activity […]". Similarly, Mackay and Moeller (2007) apply the theoretical approach of Smith and Stulz (1985, p. 1,380) to the real side of the firm and "derive the value of corporate risk management by directly relating firm revenues and costs to output and input prices". They show that RM adds value if revenues and costs are non-linearly related to input prices.

Morellec and Smith (2007) focus on agency conflicts and RM, addressing manager–stockholder conflicts as well as the traditional stockholder–debtholder conflict. They address some empirical findings that large, profitable firms tend to hedge more, when prior theory suggests that underinvestment incentives should drive firms with more growth opportunities to hedge more often. The key result of the paper is that the overinvestment problems are largely due to manager–stockholder conflicts, such that larger firms will actually hedge more than previously suggested. They demonstrate that both financing and hedging decisions affect the manager–shareholder relationship by limiting free cash flow. Purnanandam (2008) develops a theory of RM that links leverage, financial distress costs and project maturity to managerial incentives. His theory is based on a tradeoff between shareholder incentives given limited liability and their desire to avoid the risks and costs generated by financial distress. In similar fashion to Fehle and Tsyplakov (2005, p. 733), the model predicts "a non-monotonic relation between leverage and hedging and a U-shaped relation between financial distress costs and hedging". More specifically, he predicts a positive relation between leverage and hedging that becomes negative for extremely levered firms, and he tests these predictions in an empirical study that is discussed in Section 3 below.

Amaya et al. (2015) focus on cash flows as opposed to the costs of financial distress, and develop a model that reaches substantially the same conclusions regarding an optimal RM strategy. For low leverage firms, they postulate that firms fully hedge their cash flows due to the convexity of the cost of capital. But when leverage reaches extreme levels, firms cease hedging activities and "gamble" for resurrection. Additionally, the firm manages its capital structure via dividend payments and investments in growth opportunities. When leverage is low, these investments are high and the company pays dividends, but as leverage increases, dividends cease to continue investment. Eventually (at a debt threshold of about 80 per cent), the firm is unable to invest and ceases to hedge on a "bet" that it will eventually be rescued by market conditions.

Focusing on the importance of liquidity in corporate decision-making, Bolton et al. (2011) develop an important model of dynamic RM that extends beyond the use of derivatives, and is related to many of the empirical papers studied below as well as the seminal RM literature. They find that optimal investment depends on the ratio of marginal q to the marginal value of liquidity and that optimal financing and payout decisions are defined by the firm's ratio of cash to capital. Their model incorporates cash

management and derivatives hedging as complementary RM tools. Following on this research, Gamba and Triantis (2014) also analyze the value added by a comprehensive RM strategy (ERM) that also includes liquidity management, derivatives hedging and operating flexibility. As in the work by Fehle and Tsyplakov (2005) and Purnanandam (2008), they find that the avoidance of financial distress costs is the strongest motivation to use derivatives. However, they also find that the marginal value of derivatives hedging is not large, contrary to some empirical studies, and offer some explanations. In their framework, liquidity is the most important driver of the RM process, and they suggest that empirical studies linking higher valuations to higher levels of derivatives use reflect endogenous factors such as governance practices that are not solely related to the use of derivatives. Importantly, Bolton et al. (2011) and Gamba and Triantis (2014) represent the only theoretical research we find regarding ERM, which is discussed in Section 4 below.

Aabo (2015) proposes an elementary theoretical game that highlights the tradeoffs involved in the goals of avoiding costly "lower-tail" outcomes and variance minimization. As corporate risk managers vary in their approach and the goals of RM in their firms, RM strategies should be designed to meet their specific desired outcomes. Adam-Müller and Panaretou (2009) build a much more complex theoretical model to study the joint effects of liquidity and price risk created by mark-to-market procedures in futures and options markets. As hedging with futures creates liquidity risk due to changing margin requirements, a strategy that combines futures and options may optimal in their two-period framework.

The accounting literature contributes to this subject, as Faupel and Michels (2014) develop a model to evaluate the costs and benefits of RM. They seek to identify the appropriate level of investment in RM that maximizes firm value. They note that it is not immediately clear that RM activities increase firm value, but that RM increases firm value at a decreasing rate, similar to the results of Purnanandam (2008) and Amaya et al. (2015).

Finally, the application of RM theory has been important to managers for decades (Froot et al., 1993), and it continues to be implemented into industry standard practices. The International Standards Organization has published guidelines for "best practices" in RM in ISO 31000 (2009), providing a framework for these guidelines that largely reflect theoretical developments in the field. This framework can be accessed here: www.iso.org/obp/ui/#iso:std:iso:31000:ed-1:v1:en. Leitch (2010, p. 887) provides a discussion of its provisions, and unfortunately he finds it "frustratingly hard to pin down". So although the practice of RM still faces challenges, practitioners do recognize its value and continue to take steps to implement sound RM practices. The importance of this topic, however, is emphasized by the teaching of financial statement risk assessment in the Committee of Sponsoring Organizations of the Treadway Commission, as noted by Premuroso and Houmes (2012).

Further advances in RM theory may contribute to more clarity, although many papers cited in this survey indicate that there is no "one size fits all" RM prescription. That being said, the theoretical literature has made some significant advances over the past decade, as the initial prescriptions in the seminal RM literature have been explored in further detail. The analysis has become more "granular" as more specific practices, such as off-balance-sheet financing, non-linear relations between costs, financial distress (often proxied by leverage ratios) and RM activity, have been studied. Agency

conflicts have also been brought into the discussion, and we explore recent empirical evidence on the topic in the next section (ISO, 2009).

3. Recent empirical evidence in risk management
3.1 General studies of risk management
All of the RM theory papers presented in the previous section, to one extent or another, follow the work of Stulz (1984); Smith and Stulz (1985) and Froot *et al.* (1993) that propose RM as a useful tool for value creation. The empirical evidence generally supports this proposition, although there are exceptions. For most of the empirical papers that we discuss below, we mention the recent theory paper(s) that are most closely related. To support this exposition, Table I presents a comprehensive summary of the empirical papers and the established and recent theory papers to which they are most relevant. Most of the empirical results are related in some way to the seminal research that occurs prior to the turn of the century, and some duplication occurs in the table, as a few of the papers are related to more than one theory paper. Where a theory paper is not included in the table, there does not exist an empirical paper that explores that particular theory, providing potential opportunities for future research. This section of the paper presents recent evidence that picks up where Smithson and Simkins (2005) leave off.

In a separate survey of the RM literature, Aretz and Bartram (2010) find only limited evidence of the value-enhancing properties of hedging programs, although they do recognize that corporate hedging can reduce agency costs. They find mixed results in the literature of the 1990s and early 2000s, and suggest caution in the interpretation of these findings. In particular, they are concerned with potential endogeneity and identification problems that may be present in much of the literature, as hedging decisions are inextricably linked to capital structure, firm size and other firm characteristics. Most of the studies detailed below attempt to address these issues in one form or another.

Rogers (2002) is one of the first studies to recognize the endogenous nature of risk-taking and firm value. Through the use of simultaneous equations, he finds a strong negative relationship between CEO risk-taking incentives and the firm's use of derivatives, and his study is the first to find this result for a large cross-section of firms as opposed to prior single-industry studies. The negative relation is strong when CEO risk-taking incentives are measured using both stock and options, but not when only options are considered. Additionally, when the simultaneous nature of decisions regarding RM and CEO incentives is ignored, the associations between hedging and risk-taking incentives are attenuated. Nelson *et al.* (2005) find that only 21.6 per cent of publicly traded US corporations hedge financial risks with derivatives contracts. However, they find that the firms that do hedge interest rate and currency risks outperform non-hedging firms by 4.3 per cent per year over their sample period (1995-1999). This over-performance is entirely related to large firms that hedge currency risk, however, and they find no abnormal returns related to hedging either interest rates or commodity prices.

Purnanandam (2008) models a large sample of more than 2,000 non-financial firms to test the prediction of his theory of a positive relation between leverage and hedging activity. This supposition is confirmed relative to foreign currency and commodity hedging, but the relationship becomes negative for very highly leveraged firms, consistent with his theoretical model. Clark and Judge (2009) examine 412 of the largest

Time period	Theory paper	Major implications	Related paper(s)	Implications/findings	Supports/challenges theory
Pre-2000 risk management theory papers	Stulz (1984)	Continuous time model that proposes "active hedging" to maximize firm value	Fehle and Tsyplakov (2005)	Dynamic risk management, tradeoff between optimal hedge ratio and transaction costs	Supports
			Nelson et al. (2005)	Firms that hedge outperform by 4.3 per cent from 1995 to 1999	Supports
	Smith and Stulz (1985)	Model explains hedging to reduce taxes and the costs of financial distress, as well as managerial risk aversion	Mackay and Moeller (2007)	Non-linear relations between costs and revenues present opportunities to create value through RM	Supports
			Morellec and Smith (2007)	Agency conflicts lead to overinvestment problems	Challenges
			Rogers (2002)	Strong negative relationship between CEO risk-taking incentives and the firm's use of derivatives	Supports
			Aabo (2015)	Tradeoffs between "lower-tail outcomes" and variance minimization	Supports
			Bartram et al. (2009)	Non-financial firms do not use derivatives according to traditional theory, but rather to complement financial and operating decisions	
			Gay et al. (2011)	RM reduces firms' cost of capital, especially small firms that hedge FX and interest rate risks	Supports
	Froot et al (1993)	Hedging should be considered in relation to external financing sources, and selective hedging is appropriate. Non-linear hedging instruments are especially useful	Fehle and Tsyplakov (2005)	Dynamic risk management, tradeoff between optimal hedge ratio and transaction costs	Supports
			Mackay and Moeller (2007)	Non-linear relations between costs and revenues present opportunities to create value through RM	Supports
			Purnanandam (2008)	Tradeoffs between shareholder incentives and financial distress create a U-shaped relation between financial distress costs and hedging	Supports

(continued)

Table I.
Linking risk management theory and empirical results of broad RM studies

Time period	Theory paper	Major implications	Related paper(s)	Implications/Findings	Supports/Challenges theory
			Amaya et al. (2015)	When extreme leverage levels are reached, firms "gamble" on resurrection	Supports
			Bolton et al. (2011)	Comprehensive study of liquidity, hedging and the effect on Tobin's q	Supports
			Adam-Müller and Panaretou (2009)	Liquidity and price risk	Supports
			Bartram et al. (2009)	Non-financial firms do not use derivatives according to traditional theory, but rather to complement financial and operating decisions	Supports
Post-2000 risk management theory papers			Gay et al. (2011)	RM reduces firms' cost of capital	Supports
	Fehle and Tsyplakov (2005)	Dynamic risk management, tradeoff between optimal hedge ratio and transaction costs	Purnanandam (2008)	Tradeoffs between shareholder incentives and financial distress create a U-shaped relation between financial distress costs and hedging	Supports
	Mackay and Moeller (2007)	Non-linear relations between costs and revenues present opportunities to create value through RM	Mackay and Moeller (2007)	Empirical results support previously presented RM theory	Supports
	Morellec and Smith (2007)	Agency conflicts lead to overinvestment problems	Aretz and Bartram (2010)	Corporate hedging can reduce agency costs	Challenges
			Rogers (2002)	Strong negative relationship between CEO risk-taking incentives and the firm's use of derivatives	Supports
			Bartram et al. (2009)	Non-financial firms do not use derivatives according to traditional theory, but rather to complement financial and operating decisions	Challenges
			Rajgopal and Shevlin (2002)	Stock option incentives lead to overinvestment	Challenges

(*continued*)

Table I.

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Time period	Theory paper	Major implications	Related paper(s)	Implications/Findings	Supports/Challenges theory
	Purnanandam (2008)	Tradeoffs between shareholder incentives and financial distress create a U-shaped relation between financial distress costs and hedging	Faupel and Michels (2014)	Evaluate costs and benefits of risk management	Supports
			Purnanandam (2008)	Empirical results support previously presented RM theory	Supports
	Amaya et al. (2015)	When extreme leverage levels are reached, firms "gamble" on resurrection	Faupel and Michels (2014)	Evaluate costs and benefits of risk management to maximize firm value	Supports
	Bolton et al. (2011)	Comprehensive analysis of liquidity, hedging, and their effects on Tobin's q	Adam-Müller and Panaretou (2009)	Liquidity and price risk	Supports
			Clark and Judge (2009)	Use of both derivatives and FX debt create a value premium of up to 24 per cent	Supports
			Belghitar et al. (2008)	Strong relation between FX hedging and value in the UK that is stronger than previous studies in the USA	Mixed
			Khediri and Folus (2010)	FX hedging helpful in hedging non-US dollar exposure and US dollar appreciations, but not US dollar declines	Mixed
			Bartram et al. (2011)	Find value premium to hedging, in contrast to Bartram et al. (2009)	Supports
			Allayannis et al. (2012)	Significant value premium, but only for firms with high standards of corporate governance	Supports
			Fauver and Naranjo (2010)	Value premium for firms with low agency costs, monitoring problems and strong corporate governance	Supports
			Lel (2012)	International study finds value premium to strong corporate governance	Supports

Table I.

Time period	Theory paper	Major implications	Related paper(s)	Implications/Findings	Supports/Challenges theory
			Aebi et al. (2012)	Finds no evidence of value premium to corporate governance in financial firms during crisis	Challenges
			Panaretou (2014)	Finds value premium for UK firms, especially for FX exposure	Supports
			Belghitar et al. (2013)	No value premium for 211 French firms	Challenges
			Hagelin et al. (2007)	Significant value premium that decreases when managers hedge personal stock options, no support for financial distress argument	Mixed
	Adam-Müller and Panaretou (2009)	Study of the joint effects of liquidity and price risk	Purnanandam (2008)	Tradeoffs between shareholder incentives and financial distress create a U-shaped relation between financial distress costs and hedging	Supports
			Amaya et al. (2015)	When extreme leverage levels are reached, firms "gamble" on resurrection	Supports
	Faupel and Michels (2014)	Evaluate costs and benefits of risk management to maximize firm value	Gay et al. (2011)	RM reduces firms' cost of capital	Supports
			Panaretou (2014)	Stronger accounting standards experience less volatile earnings and analysts' forecast error and dispersion decrease	Supports

Table I.

non-financial firms in the UK as of the end of 1995. They examine whether or not firms hedge their foreign currency and/or foreign currency debt exposure. This distinction is important, as the former is generally used to hedge short-term exposures, while the latter is used to hedge long-term exposures, and they are complementary. The authors observe that firms using foreign currency hedges tend to have higher leverage and may thus be limited in their use of foreign currency debt hedges due to their long-term nature. Also, more liquid firms are able to manage their currency mix using swaps as opposed to debt. Their most important contribution, however, is to demonstrate that different foreign currency hedges make different contributions to firm value. When used alone, foreign currency derivatives seem to create a 14 per cent positive contribution to firm value, but there is no value premium for debt hedging. When both are used in concert, a 12 per cent value premium exists, but when firms are able to use foreign currency swaps in their hedging mix, these premiums more than double. Belghitar *et al.* (2008) examine the same sample of firms as in the work by Clark and Judge (2009) to study the valuation and debt capacity effects for foreign currency and interest rate hedging. They find a significant positive relation between the hedging of these exposures and Tobin's q. The results are much stronger than prior studies of US firms, and the authors suggest that this is due to the inclusion of firms that use non-derivative hedging strategies in their samples. They also posit that the differences in results may be due to differences in bankruptcy codes that provide greater benefits to hedging in the UK. Additionally, they find that UK firms hedging interest rate risk are rewarded with higher values than those that hedge foreign currency risk, consistent with the results of Smithson and Simkins (2005). Finally, based on debt capacity results and those from Tobin's q, the authors find that "derivative hedging generates more value than non-derivative hedging" (p. 43) and that "derivative only hedging is generally superior to other types of hedging" (p. 47). In contrast, Khediri and Folus (2010) find a negative relationship between derivatives use and Tobin's q for a sample of 320 non-financial firms in France, but their study encompasses just one year of data (2001). Clark and Mefteh (2011) study the relationships among stock returns, exchange rate risk and foreign currency derivatives use in a sample of 176 large non-financial French firms. They demonstrate that foreign currency exposure is not homogeneous, as exposures differ with respect to the US dollar and cross-currency rates. While the use of foreign currency derivatives significantly reduces exposure to non-US dollar rate movements and USD depreciations, it does not have the same effect on US dollar appreciations.

Bartram *et al.* (2009) examine a large international sample of non-financial firms with respect to derivatives usage. Because their sample is larger with greater cross-sectional variability in virtually every variable, they conclude that their tests obtain greater statistical power. The authors examine the use of foreign exchange, interest rate and commodity price derivatives by over 7,000 global firms. Using the simultaneous equations approach that is popular in the literature to deal with the endogeneity problem, they find no evidence that non-financial firms use derivatives to lower the costs of financial distress, address the underinvestment problem and/or resolve agency conflicts between managers and shareholders, consistent with the theory presented by Morellec and Smith (2007). Rather, they show that the use of derivatives is inextricably linked to other financial and operating decisions. Specifically, derivatives usage "helps determine the level and maturity of debt, dividend policy, holdings of liquid assets, and international operating hedging". However, two of the authors of this paper complete a

contrasting study in the work by Bartram *et al.* (2011). Using substantially the same database, the authors find that users of derivatives generally have higher exposures to price risk. They apply a matching technique to similar derivatives users and non-users based on propensity scores for derivatives usage. They find that users of derivatives experience substantially lower cash flow volatility, return volatility and betas than non-users. Additionally, Tobin's q is substantially higher for firms that hedge with derivatives than for those that do not, a result that validates the value premium to hedging. Also implied in their results is a lower cost of capital for derivatives users due to a reduction in systematic risk (beta).

Gay *et al.* (2011) also address how the use of financial derivatives can lower the cost of equity in a large sample of non-financial firms. Using the Fama and French (1993) three-factor framework to study risk-adjusted returns, they find a reduction of between 24 and 78 basis points in the cost of capital for firms that utilize derivatives versus those that do not. They also find that firms' cost of capital declines at the outset of a derivatives hedging program, and the results are robust to specifications that address potential issues of endogeneity. Further, the authors find that a lower cost of equity is related to both lower equity market beta and the small minus big (SMB) factor. These results suggest that corporate hedging reduces financial distress risk that has a systematic component. The reductions in the cost of equity tend to be greatest for smaller firms and those that hedge currency and interest rate risks. Similarly, Allayannis *et al.* (2012) examine the effects of currency derivatives use on firm value for a sample of roughly 1,500 international firms that have cross-listed American Depository Receipts (ADRs). They find that the use of derivatives is strongly associated with high standards of corporate governance that lead to significant value premiums as well. The value premium does not appear in firms with weak corporate governance. In the same vein, Fauver and Naranjo (2010) find that firms with greater agency costs, monitoring problems and weaker corporate governance demonstrate a negative relation between the use of derivatives and Tobin's q. In their sample of 1,746 US firms, the valuation discount is 8.4 per cent. The authors apply several alternative specifications to account for endogeneity problems as well as sample selection biases. Lel (2012, p. 221) hypothesizes that "weakly governed firms use derivatives for managerial reasons and selective hedging on average, and strongly governed firms use derivatives for other reasons" that are more related to RM theory. He examines roughly 1,000 international firms and uses proxies for both firm-level and country-level measures of corporate governance, finding similar results. Consistent with his hypothesis, he finds that strongly governed firms tend to use currency derivatives to reduce price exposure and reduce the costs of external financing, while the executives of weakly governed firms use derivatives for managerial reasons. However, Aebi *et al.* (2012) study 573 US financial institutions during the financial crisis, finding that standard corporate governance variables are unrelated to performance (stock returns and return on equity (ROE)) during this period. They do find, however, that firms in which the chief risk officer (CRO) reports directly to the Board (as opposed to the CEO) perform significantly better during the financial crisis. They attribute this to the supposition that the CEO and the CRO may have conflicting interests during a crisis such that the firm's risk agenda may not receive the appropriate attention.

Panaretou (2014) examines a large sample of UK non-financial firms and their use of foreign currency and interest rate derivatives. He also finds a statistically and

economically significant value premium associated with financial hedging activities, although the results are stronger for users of currency derivatives. He finds no value premium for operational RM activities. In contrast to these findings, Belghitar *et al.* (2013) find that although currency derivatives use does reduce FX exposure, there is no significant value premium. However, their study uses only four years of data for 211 French firms, and the results are consistent with Khediri and Folus (2010), who also examine a small sample of firms in France. Hagelin *et al.* (2007) examine a sample of 308 Swedish firms and find a significant value premium (as measured by Tobin's *q*) for firms that hedge financial risks using derivatives. They also link hedging activity to managerial behaviors, as they find evidence that firm value significantly decreases when managers are hedging their personal stock options. However, they do not provide support for the position that firms use derivatives to decrease the possibility of financial distress, as they find no relation between hedging activities and firm liquidity (as proxied by firm current ratios). Their paper is related to the earlier work of Rajgopal and Shevlin (2002), who find that stock option incentives induce CEOs to undertake increased exploration in the oil and gas industry. Additionally, the amount of CEO stock options granted has a negative relationship with oil price hedging programs, a similar result to that of Hagelin *et al.* (2007).

Panaretou *et al.* (2013) examine accounting for derivatives as prescribed by recently introduced standards in the International Financial Reporting Standards (IFRS), and the authors hypothesize that the new standards decrease information asymmetry. Their sample consists of non-financial FTSE 350 firms over the period 2003-2008. They show that firms that qualify for and use the hedge accounting regime experience more predictable and less volatile earnings, as analysts' forecast error and dispersion decrease significantly. These effects begin in the year of adoption and continue in the years following. The study also provides weak evidence that firms using derivatives and that do not qualify for the hedge accounting standards experience lower analyst forecast accuracy. They leave the question of the effect of hedge accounting on firm value to future research.

The evidence in this section, which examines fairly large samples of heterogeneous firms, seems to strongly confirm the benefits of financial RM. In general, these studies confirm many aspects of established and recent RM theory. Notwithstanding potential concerns regarding endogeneity in the empirical work that has been addressed to a significant degree, the use of RM tools is generally related to higher firm values, lower costs of capital and increased firm performance. Strong corporate governance that attenuates the practice of unwarranted, unproductive selective hedging also enhances these results.

3.2 Industry- and commodity-specific studies of risk management
While the papers in the previous section examine various samples (and sizes) of non-financial firms mostly relative to foreign currency and interest rate risk, there is also a strand of literature that focuses on firms that face specific risks from the commodities they either produce and/or consume. These papers follow largely from the earlier examples in the RM literature that are surveyed by Smithson and Simkins (2005). As in the first part of this section, we categorize the empirical papers that follow by relating them to recently published theoretical papers. As all of these studies are in some way related to the initial theories of Stulz (1984); Smith and Stulz (1985) and Froot *et al.* (1993), we only present the relationships of recent empirical and theoretical papers in Table II.

Time period	Theory paper	Major implications	Related paper(s)	Implications/findings	Supports/ challenges theory
Post-2000 risk management theory papers	Adam (2002)	Stable firms should avoid cash shortfalls, while less strong firms should focus on liquidity	Adam and Fernando (2006)	Find that gold mining firms realize gains in cash flow from the use of derivatives with an increase in shareholder value	Supports
	Breuer (2002)	Off-balance-sheet leverage should be considered in capital adequacy ratios			
	Fehle and Tsyplakov (2005)	Dynamic risk management, tradeoff between optimal hedge ratio and transaction costs	Fehle and Tsyplakov (2005)	Find non-linear relationship between leverage and risk management for 36 gold mining companies	Mixed
			Rampini et al. (2014)	Financially constrained firms hedge less and use limited risk management	Supports
	Mackay and Moeller (2007)	Non-linear relations between costs and revenues present opportunities to create value through RM	Mackay and Moeller (2007)	Empirical study of oil refiners confirms theoretical model and finds a value premium	Supports
	Purnanandam (2008)	Tradeoffs between shareholder incentives and financial distress create a U-shaped relation between financial distress costs and hedging	Fehle and Tsyplakov (2005)	Find non-linear relationship between leverage and risk management for 36 gold mining companies	Mixed
			Rampini et al. (2014)	Financially constrained firms hedge less and use limited risk management	Supports
			Gilje and Taillard (2014)	Value premium due to reduction in financial distress costs in oil industry	Supports
	Amaya et al. (2015)	When extreme leverage levels are reached, firms "gamble" on resurrection	Rampini et al. (2014)	Financially constrained firms hedge less and use limited risk management	Supports
	Bolton et al. (2011)	Comprehensive analysis of liquidity, hedging, and their effects on Tobin's q	Fehle and Tsyplakov (2005)	Find non-linear relationship between leverage and risk management for 36 gold mining companies, but no effect on value	Mixed
			Adam and Fernando (2006)	Find that gold mining firms realize gains in cash flow from the use of derivatives with an increase in shareholder value	Supports

(*continued*)

Table II.
Linking risk
management theory
and empirical results
of industry- and
commodity-specific
RM studies

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Time period	Theory paper	Major implications	Related paper(s)	Implications/Findings	Supports/Challenges theory
			Brown et al. (2006)	Gold mining firms implement selective hedging but do not experience economically significant gains	Mixed
			Fang et al. (2007)	Fueling hedging gold production results in higher stock returns	Supports
			Pérez-González and Yun (2013)	Utilize introduction of weather derivatives to find substantial value premium in utilities industry	Supports
			Scordis and Steinorth (2012)	Insurance industry study finds the purchase of reinsurance adds value, especially for small firms	Supports
			Cornaggia (2013)	Focuses on insurance aspects of risk management to document higher firm values due to increases in productivity	Supports
			Mancini (2009)	Case study of Southwest Airlines hedging program that allowed it to continue investing activity	Supports
			Treanor et al. (2014b)	Documents a value premium to airlines that consistently hedge, but not for those that use selective hedging	Supports
	Gamba and Triantis (2014)	Comprehensive (ERM) risk management strategy is appropriate	Treanor et al. (2014b)	Airline industry study finds greater value from operational RM than from financial RM	Supports
			Berghofer and Lucey (2014)	International airline study finds no value premium to either operational or financial RM	Challenges
	Rampini et al. (2014)	Theoretical model of the tradeoff between financing and risk management	Rampini et al. (2014)	Financially constrained firms hedge less and use limited risk management	Supports

Table II.

Fehle and Tsyplakov (2005) apply their theoretical model to a study of 36 gold producers in the USA and Canada from 1993 to 1999. While they do not directly link RM activities to firm value, they do find a non-linear relationship between leverage and RM, consistent with their theoretical model as well as that of Purnanandam (2008). Adam and Fernando (2006), however, find that gold mining firms are able to consistently realize gains in cash flow from the use of derivatives with a subsequent increase in shareholder value. Additionally, these gains in value come with no offsetting adjustment to the firms' systematic risk. Although the authors find considerable evidence of "selective hedging" as suggested by Stulz (1996), the cash flow gains from these activities appear to be small at best. Brown *et al.* (2006) also examine the gold mining industry and find evidence of selective hedging. Contrary to RM theory, they find that firms tend to reduce their hedging activities as gold prices fall. This phenomenon supports the finding that managers take views on market prices when implementing financial risk policies. However, consistent with Adam and Fernando (2006), the authors find that the gains from selective hedging are economically small and do not translate into substantial increases in shareholder value. Fang *et al.* (2007) find that gold mining firms in Australia that fully hedge their price exposure experience significantly higher stock returns (up to 8.22 per cent per year) than those that do not hedge at all. Their study is limited, however, as it examines 49 firms during the severe correction in gold prices from 1995 to 2000.

Mackay and Moeller (2007) apply their theoretical model to a sample of 34 oil refiners, finding evidence that confirms the non-linear nature of costs and revenues. They find that Tobin's q is enhanced when concave revenues are hedged and concave costs are not, represented by a value premium of 2 to 3 per cent for firms that hedge oil price risk (using Tobin's q). Thus firms are rewarded for value-enhancing hedging and penalized for hedging that destroys value. Additionally, they find that firms are rewarded for increased hedging as the costs of financial distress rise, and the results are consistent with their theoretical model. Gilje and Taillard (2014) study exogenous variation in hedging effectiveness that is induced by changes in the basis risk of oil futures contracts due to a breakdown in the correlation of Canadian light oil prices relative to West Texas Intermediate crude oil. They find that this reduction in correlation and therefore hedging effectiveness leads to reduced investment activity, especially among firms with high leverage. These results are consistent with the theory that RM affects firm value by reducing the costs of financial distress. They also note that the constraints on financial innovation imposed by the Dodd–Frank law that pushes for standardized exchange traded contracts as opposed to over-the-counter derivatives may lead to unintended negative consequences.

In spite of the papers presented so far and those that follow, Pérez-González and Yun (2013, p. 2,143) state that "we know surprisingly little about the causal effect of risk management on value". This statement is based on the previously discussed "endogeneity problem", and they examine the introduction of weather derivatives as an exogenous shock to firms' ability to hedge weather risks. The authors focus on electric and gas utilities, as these firms "provide a near ideal laboratory for determining the importance of weather risk exposures because heating and cooling demands are tightly linked to changes in weather conditions" (p. 2,144). To avoid the endogeneity problem, the authors use pre-1997 (when weather derivatives were introduced) weather exposures as instrumental variables in the estimation of the use of weather derivatives

after 1997, and they apply a powerful difference-in-differences approach to the problem. They find that utilities that are most exposed to weather volatility risk are valued at approximately 4 per cent less than comparable firms with less weather risk. They also demonstrate that pre-1997 weather risk is an important determinant of weather derivative use in the post-1997 period. Weather-exposed firms are two to three times as likely to use the newly introduced weather derivatives. But most importantly, they show that the use of weather derivatives is positively related to statistically robust increases in firm value as well as more aggressive financing policies and higher investment levels, consistent with Froot *et al.* (1993). They also provide some evidence on the value of quantity risk insurance that has historically been difficult to quantify, as noted by Brockett *et al.* (2005). Scordis and Steinorth (2012) analyze the insurance industry directly and find that the use of reinsurance increases firm value in terms of returns and price to book ratios, especially for small firms. The authors posit that this may be a result of the practice of smaller insurance firms using reinsurance as a less-expensive substitute for capital, thus creating value for shareholders.

Cornaggia (2013) brings a unique perspective to the discussion, as he does not examine large publicly traded firms with easily obtainable information regarding financial results and the use of derivatives. Instead, he also uses the difference-in-differences approach to examine "shifts in the supply of risk management instruments available to agricultural producers to reveal a positive relation between risk management and productivity" (p. 419). His paper provides positive evidence of the relation between real firm outcomes and the interaction of access to financing opportunities and firms' RM choices. The data used in his study are US county-level variables for nine major US farm program crops, most notably crop yields provided by the US Department of Agriculture. He then uses the availability of crop management insurance programs as independent variables to explain productivity. He utilizes four measurements of RM to reach the conclusion that firm value is associated with greater productivity that is enabled by RM. His results indicate that RM is particularly important for business owners that are not able to easily diversify away systematic risk. Additionally, unlike most of the papers cited here that are based on the use of derivatives, Cornaggia (2013) focuses on the insurance aspects of these RM techniques that are only useful for hedging and cannot be used for speculation, thus removing the aspect of "selective hedging" that has been a part of the discussion to date. Thus the decision to purchase insurance is a decision to manage risk only without an "opinion" as to future price moves. Finally, the results indicate that producers that hedge are better able to access traditional channels of finance, which they can use to finance positive NPV investment opportunities. This result is consistent with Bessembinder (1991, p. 439), and "should generalize to the corporate setting".

While the papers in the preceding paragraphs address a variety of industries, the issue of corporate hedging has been examined most extensively in the airline industry. The airline industry is a natural setting for the examination of RM, as it is necessary for significant numbers of large, publicly held firms to purchase the same commodity on a continual basis. As noted by Smithson and Simkins (2005); Carter *et al.* (2006, p. 13) "find a positive relation between the use of fuel price derivatives and firm value (Tobin's *q*)". They find a value premium attributable to hedging of approximately 5-10 per cent. Froot *et al.* (1993) propose that firms facing potential costs of financial distress may choose to under-invest, and that hedging provides a way to alleviate this problem. Carter *et al.* (2006) confirm this

supposition, and suggest that the airline industry is the perfect setting in which to examine these issues. Mancini (2009) examines the specific case of Southwest Airlines in detail and finds similar results. He notes that the company has consistently been able to maintain its investment activities in spite of fluctuating oil prices, while other companies were cutting capacity. While the airline industry, in general, hedges about 50 per cent of its fuel price exposure, the Southwest hedging program was covering up to 95 per cent of its price exposure at times. Interestingly, the company reduced its program drastically during 2014 when oil prices fell from $100 per barrel to $50 per barrel, an action that significantly improved its financial results for the year.

Four recent papers also examine hedging programs in the airline industry. Treanor *et al.* (2014b) investigate the US airline industry in terms of both operational and financial RM, finding them both to be important tools in the mitigation of volatile jet fuel prices. They find that a 1 per cent increase in the amount of fuel costs that are hedged leads to 1 per cent reduction in the elasticity of an airlines value with respect to the price of jet fuel. However, they find operating RM strategies such as diversifying fleet composition and aircraft age to be more economically important (2.3 and 11.0 per cent, respectively, for the same 1 per cent increase in fuel costs). The use of derivatives to hedge is seen as "fine tuning" the firm's overall RM policy. Treanor *et al.* (2014a) extend their results in a follow-up study where they further examine these time-varying exposure coefficients. They demonstrate that airline exposures to fuel price volatility are higher when prices are high and/or rising, finding that airlines increase their hedging activity in response to higher fuel price levels, rising fuel prices and higher levels of exposure to fuel prices. They also confirm the value premium to hedging that is first documented by Carter *et al.* (2006), but find that those firms that hedge more due to higher fuel price exposures do not experience a value premium as compared to airlines that choose more "stable" hedging policy. Finally, in contrast to these studies, Berghöfer and Lucey (2014) find some conflicting results. They expand the literature by examining a diverse sample of 64 airlines that includes companies from Asia and Europe, finding less significant exposure coefficients than the Treanor *et al.* (2014a, 2014b) papers. Using a fixed-effects model, they conclude that neither financial nor operational hedging decreases risk exposure. They posit that this may be the result of decreased fuel price volatility during recent years, making financial hedging less effective. In addition, the authors find that operational hedging via fleet diversity actually *increases* risk exposure, as global airlines have actually reduced their fleet diversity between 2002 and 2012, especially among European airlines. Rampini *et al.* (2014) develop a theoretical dynamic model to simulate the tradeoff between financing and RM, showing that financially constrained firms hedge less and use limited RM, consistent with Purnanandam (2008) and Fehle and Tsyplakov (2005). Using a sample of 23 US airlines from 1996 to 2009, they generally confirm their model's predictions, as airlines' fuel price RM averages 30 per cent of annual fuel costs two years prior to financial distress. In the year the airlines reach a state of distress, this figure drops to less than 5 per cent, consistent with the theoretical predictions of Amaya *et al.* (2015).

Generally, the studies in this section examine smaller, less diversified samples of firms and the results are somewhat less consistent than those in Section 3. And though there are some exceptions, the results are largely similar to the somewhat more comprehensive studies in the prior section. Non-linear relationships between leverage and RM are confirmed and derivatives use is generally associated with increases in

shareholder value. There are exceptions here, however, as several studies find no significant value premium. In perhaps what is the most "clean" study relative to issues of endogeneity, Pérez-González and Yun (2013) confirm the value of RM in terms of firm value, the underinvestment problem and the value of quantity risk. Cornaggia (2013) provides another unique study that removes the effects of selective hedging, and several papers regarding the airline industry provide largely consistent results: hedging jet fuel prices increases firm value, improves operating results and reduces the potential costs of financial distress.

4. Recent empirical evidence in enterprise risk management

One theme that emerges in many of the papers in the previous sections is the improved effectiveness of financial RM in the presence of other RM tools, especially by firms with a history of good corporate governance (Alayannis *et al.*, 2012; Lel, 2012). In this section, we conduct a survey of recent studies on ERM, which embraces a more holistic approach to RM as opposed to "siloed" RM by function and/or risk.

The "theory" of ERM revolves around the supposition that the risks that firms face should be viewed in a holistic manner. Drew and Kendrick (2005) identify the "five pillars" of corporate RM and governance, emphasizing the importance of a strong organizational structure to link RM to strong corporate governance. This structure can be used by parent companies to add value to business units, as well as to manage existing core competencies and to become a source of competitive advantage. Fraser and Simkins (2007) describe ten common misconceptions regarding ERM that they learn during conversations with corporate executives. In an examination of two multinational banks' RM control and systems, Mikes (2009) suggests an ERM framework that revolves around four themes: risk quantification, risk aggregation, risk-based performance measurement and the management of non-quantifiable risks. Eckles *et al.* (2014) provide a theoretical model of ERM that hypothesizes "greater risk reduction per dollar spent" for ERM-adopting firms and that these firms have profit maximizing incentives to reduce risk. In an empirical study of 354 US insurance companies over 18 years, they find that firms adopting ERM are:

> […] able to better recognize the benefits of natural hedging, prioritize hedging activities towards the risks that contribute most to the total risk of the firm, and optimize the evaluation and selection of available hedging instruments (p. 27).

In short, they confirm their theoretical propositions, as firms that implement ERM systems experience reduced stock price volatility as well as stronger operating profits per unit of risk (ROA/return volatility), consistent with Hoyt and Liebenberg (2015). Unfortunately, only Eckles *et al.* (2014) and the previously mentioned studies of Bolton *et al.* (2011) and Gamba and Triantis (2014) apply an analytical approach to ERM, and this area may prove fruitful for future research. As these are the only theoretical efforts that have been made in this area, we do not provide an analog to Tables I and II that links the empirical evidence to current RM theory. Many of the empirical studies cited here may prompt future research into the theoretical underpinnings of the results.

Gatzert and Martin (2015) provide a survey of much of the empirical research in this area to date. They find that company size and institutional ownership are important in determining whether or not a firm uses ERM. They also find the general result that the use of ERM has a significant and positive effect on firm value and financial results.

However, because many of the studies they examine are limited to specific industries and/or geographic areas, they caution against more general interpretations of the findings. Additionally, they note the difficulty of obtaining data as to the extent to which ERM is being implemented, and note that further research should be undertaken regarding the determinants of ERM use and its value. They further point to the financial services industry as a potential proving ground for ERM practices, as these firms are subject to changing risk-based regulatory requirements. The survey of Gatzert and Martin (2015) includes a review of Hoyt and Liebenberg (2011), who find a positive relation between Tobin's q and ERM for a sample of 177 US insurance companies. Subsequently, Hoyt and Liebenberg (2015) provide anecdotal evidence of several insurance firms that have adopted ERM practices since their earlier paper. They conclude that ERM has provided a major shift in RM practices, as it leads to decreases in price volatility that become stronger over time, as well as an increase in profits per unit of risk.

Gatzert and Martin (2015) review 15 papers in their survey, but there is significant additional evidence on the topic. Baxter *et al.* (2013) take advantage of the new Standard and Poor's ratings of ERM quality. These ratings assess the effective communication of RM strategy throughout the firm, project selection and the improvement of risk-adjusted market returns. The authors use these ratings for a sample of financial firms during the financial crisis to show that companies with "superior ERM programs are more complex, have greater financial resources, and better corporate governance as measured by publicly available proxies" (p. 1,291). They also find that firms with high-quality ERM programs experience superior accounting returns and higher values of Tobin's q. Finally, while there is not an association between stock returns and ERM quality during the crisis, the relationship becomes strongly positive in the period immediately following the crisis (March through October 2009). Thus it seems that a "fog of war" was created during the financial crisis that did not discriminate in the sell-off of virtually all firms along with market indices. But once this fog cleared, investors bid up firms with solid ERM practices more rapidly than those without them.

Quon *et al.* (2012), however, find that differences in the extent of firm ERM implementation do not explain firm performance following the financial crisis. They construct their own ERM proxy using annual reports for 156 North American non-financial firms, and find that it has no explanatory power for changes in sales, EBIT or Tobin's q. Similarly, Lin *et al.* (2012) examine 105 property and casualty insurers from 2000 to 2007 and find a *negative* relation between ERM and Tobin's q and return on assets. They attribute this observation to the changes in "individual" RM practices (such as reductions in the purchase of reinsurance) that occur when ERM programs are announced. They also state that the market may view ERM as costly and complicated to implement and thus avoid this uncertainty.

Ai *et al.* (2014) study a sample of 6,782 listed Chinese non-financial firms as well as a subset of 1,317 state-owned enterprises (SOEs) that became subject to a government regulation in 2006 that requires the implementation of ERM. They find a strong and significant positive relation between the introduction of ERM and firm value for the SOEs, and a similar but weaker result for the whole sample. Kommunuri *et al.* (2014) conduct an analysis of the firms in the S&P/ASX 200 Index, finding a similar value-enhancing effect of ERM on firm value (as proxied by ROA and Tobin's q). They find that the effectiveness of corporate governance is enhanced and performance

improved in the post-financial crisis period, consistent with the theoretical predictions of Bolton *et al.* (2011) and Gamba and Triantis (2014), as well as the empirical results of Baxter *et al.* (2013); Allayannis *et al.* (2012); Fauver and Naranjo (2010) and Lel (2012). Ajit *et al.* (2014) use an event study methodology to examine whether firms experience abnormal stock returns following the announcement of ERM implementation. They find abnormal risk-adjusted returns of 1.12 per cent during the three-day window surrounding such announcements.

Farrell and Gallagher (2015) examine 225 North American and Australian firms from 2006 to 2011 to assess the value of ERM "maturity", i.e. how developed are firms' ERM practices. They find significant evidence of a value premium for companies with greater ERM maturity. For firms that obtain their highest ranking of ERM maturity (five on a scale from one to five), the value premium is as much as 25 per cent. Further, they find that the "strongest valuation effects are associated with ongoing performance management, process management, the corporate approach to ERM, root cause discipline, and the efficacy of uncovering risks, respectively" (p. 28). Risk appetite management, business resilience or sustainability does not contribute to the value premium. They note that less than half of the firms in their sample have progressed to the upper levels (four or five on their scale) of ERM maturity. Beasley *et al.* (2013) use survey data for 766 US firms to develop a measure of ERM maturity that assesses the quality of firms' ERM programs. They find that reporting and management procedures regarding ERM are stronger for more mature ERM programs. ERM maturity is also positively related to formal RM statements and/or a written RM policy. Finally, they note the value of frequent updating of risk "inventories" that is an important part of ERM maturity and that ERM can become an important part of firms' strategic planning process to achieve competitive advantage. Lundqvist (2014) uses exploratory and confirmatory factor analysis of corporate survey data to provide four factors common to ERM in 153 Nordic companies. She identifies four factors: the general RM culture/ environment, control activities, formal RM structures and risk identification and assessment of specific risks. The implication of these results is that researchers should focus on the study of which of these factors is value-creating and companies should focus their RM efforts in these areas.

In related studies that do not directly bear on the topic of ERM but are relevant to aspects of strong corporate governance that have been shown above to support RM effectiveness, recent research has examined the effects of managing reputational risk. Premuroso and Bhattacharya (2008) demonstrate that voluntary adopters of XBRL exhibit stronger corporate governance characteristics. Yoon *et al.* (2011) show that XBRL leads to reduced information asymmetry in the stock market for Korean firms. However, Liu *et al.* (2014) examine the introduction of mandatory XBRL adoption in China and find an increase in firms' cost of capital and transaction costs. Hogan and Lodhia (2011) examine a case study that provides insight on the corporate governance value of sustainability reporting for reputation RM. Khanin and Mahto (2012) study the effects of regulatory risk and conclude that firms' attitudes toward risk may be used to detect fraud and assess managerial and bankruptcy risks. Finally, Baker and Al-Thuneibat (2011) show that the equity risk premium increases (thereby increasing firms' cost of capital) as audit tenure increases, suggesting the need for audit firm rotation as a means to better corporate governance that may lead to better RM and enhancements to firm value as suggested previously.

While the literature on ERM is still in the developmental stage, it seems to be clear that it has a significant and positive effect on firm valuations and operating performance. But this supposition is not a strong one, given the difficulty in obtaining information regarding the use and/or quality of ERM practices, and there is some conflicting evidence. Most of the current studies of ERM use and effectiveness are limited by the small sample sizes that are currently available, so this area may prove to be a productive area for research in the future as more firms adopt these practices.

5. Conclusion with suggestions for future research

This study examines 70 studies in the recent RM literature. The evidence has become increasingly clear that there is value in corporate RM, in spite of previous empirical criticisms of studies that may or may not suffer from endogeneity problems. These problems have largely been addressed in the recent literature, and the evidence points to the benefits of RM in the creation of firm value, lower costs of capital and decreased potential costs of financial distress.

But there is still much to do. Treanor *et al.* (2014b, p. 170) suggest "further study of operational hedging and its effects on risk exposures in other industry settings". Berghofer and Lucey (2014) suggest a more comprehensive analysis of fleet diversity in the airline industry, while Brockett *et al.* (2005) suggest that researchers should seek to determine the role of weather derivatives in hedging with both price and volume/quantity risks in the corporate hedging environment. Further, Farrell and Gallagher (2015) propose the use of more independent measures of ERM than have previously been examined. Gilje and Taillard (2014) recommend the further study of the unintended consequences of regulation in derivatives markets. Panaretou *et al.* (2013) suggest the further study of the effects of IFRS hedge accounting on the cost of capital, liquidity and firm value as more firms adopt the new standards. Finally, Gatzert and Martin (2015) suggest further study of the relationship between ERM and firm value, especially as it relates to financial institutions. As RM practices continue to evolve in an increasingly complicated regulatory framework, further refinements to the empirical and theoretical study of these practices should become apparent, and there still seems to be a broad landscape for future researchers. The implications of several of the theory papers mentioned in this article have yet to be explored, and the increased use of ERM and its relation to reputational risk provide just one of the many possible opportunities.

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