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The Value of Enterprise Risk Management

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Abstract

Enterprise risk management (ERM) has been the topic of increased media attention in recent years. The objective of this study is to measure the extent to which specific firms have implemented ERM programs and, then, to assess the value implications of these programs. We focus our attention in this study on U.S. insurers in order to control for differences that might arise from regulatory and market differences across industries. We simultaneously model the determinants of ERM and the effect of ERM on firm value. We estimate the effect of ERM on Tobin's Q, a standard proxy for firm value. We find a positive relation between firm value and the use of ERM. The ERM premium of roughly 20 percent is statistically and economically significant.

Introduction

Interest in enterprise risk management (ERM) has continued to grow in recent years.[1] Increasing numbers of organizations have implemented or are considering ERM programs, consulting firms have established specialized ERM units, rating agencies have begun to consider ERM in the ratings process,[2] and universities have developed ERM-related courses and research centers. Unlike traditional risk management where individual risk categories are separately managed in risk "silos," ERM enables firms to manage a wide array of risks in an integrated, enterprise-wide fashion. Academics and industry commentators argue that ERM benefits firms by decreasing earnings and stock price volatility, reducing external capital costs, increasing capital efficiency, and creating synergies between different risk management activities (Miccolis and Shah, 2000; Cumming and Hirtle, 2001; Lam, 2001; Meulbroek, 2002; Beasley, Pagach, and Warr, 2008). More broadly, ERM is said to promote increased risk

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[1] ERM is synonymous with integrated risk management (IRM), holistic risk management, enterprise-wide risk management, and strategic risk management. For consistency, we use the acronym ERM throughout this study.

[2] In December 2006, S&P reported in announcing its decision to upgrade the rating of Munich Reinsurance from A− to AA− that in part the upgrade "reflected a robust enterprise risk management framework."

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awareness that facilitates better operational and strategic decision making. Despite the substantial interest in ERM by academics and practitioners and the abundance of survey evidence on the prevalence and characteristics of ERM programs (see, e.g., Miccolis and Shah, 2000; Hoyt, Merkley, and Thiessen, 2001; CFO Research Services, 2002; Kleffner, Lee, and McGannon, 2003; Liebenberg and Hoyt, 2003; Beasley, Clune, and Hermanson, 2005), there is an absence of empirical evidence regarding the impact of such programs on firm value.[3] The absence of clear empirical evidence on the value of ERM programs continues to limit the growth of these programs. According to one industry consultant, Sim Segal of Deloitte Consulting, corporate executives are "justifiably uncomfortable making a deeper commitment to ERM without a clear and quantifiable business case."

The objective of this study is to measure the extent to which specific firms have implemented ERM programs and, then, to assess the value implications of these programs. Although ERM activities by firms in general would be of interest, we focus our attention in this study on U.S. insurers in order to control for differences that might arise from regulatory and market differences across industries. We also focus on publicly traded insurers so that we have access to market-based measures of value and because we are more likely to observe public disclosures of ERM activity among publicly traded firms. Our primary sources of information on the extent of ERM implementation by each insurer come from a search of LexisNexis for the existence of a CRO/Risk Management Committee and a review of SEC filings for evidence of an ERM framework. We augment this with a general search of other public announcements of ERM activity for each of the insurers in our sample.

The study is structured as follows. First, we provide a brief summary of the literature regarding the determinants of two traditional risk management activities—insurance and hedging. We then discuss the forces that have driven the popularity of ERM and the perceived benefits of using an ERM approach, and why in theory ERM may add value. Third, we develop a set of indicators of ERM activity that we use to assess the degree to which individual insurers have implemented ERM programs. Fourth, we describe our sample, data, empirical methodology, and results. Finally, we conclude by summarizing our results and discussing avenues for further research.

DETERMINANTS OF TRADITIONAL RISK MANAGEMENT ACTIVITIES

Although little academic literature exists on the motivations for ERM, the determinants of traditional risk management activities such as hedging and corporate insurance purchases are well documented. Corporate insurance demand by firms with well-diversified shareholders is not driven by risk aversion. Since sophisticated shareholders are able to costlessly diversify firm-specific risk, insurance purchases at actuarially unfair rates reduce stockholder wealth. However, when viewed as part of the firm's financing policy corporate insurance may increase firm value through its effect on investment policy, contracting costs, and the firm's tax liabilities (Mayers and Smith, 1982). Thus, the theory suggests that firms should purchase insurance because it potentially reduces: (1) the costs associated with conflicts of interest between

[3] Two exceptions are the recent studies related to chief risk officer appointments by Beasley, Pagach, and Warr (2008) and Pagach and Warr (2010).

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owners and managers[4] and between shareholders and bondholders,[5] (2) expected bankruptcy costs, (3) the firm's tax burden, and (4) the costs of regulatory scrutiny.[6] A number of studies find general support for these theoretical predictions (see Mayers and Smith, 1990; Ashby and Diacon, 1998; Hoyt and Khang, 2000; Cole and McCullough, 2006).[7]

As with corporate insurance purchases, corporate hedging reduces expected bankruptcy costs by reducing the probability of financial distress (Smith and Stulz, 1985). Furthermore, the hedging literature suggests that, much like corporate insurance, this form of risk management potentially mitigates incentive conflicts, reduces expected taxes, and improves the firm's ability to take advantage of attractive investment opportunities (see Smith and Stulz, 1985; MacMinn, 1987; Campbell and Kracaw, 1990; Bessembinder, 1991; Froot, Scharfstein, and Stein, 1993; Nance, Smith, and Smithson, 1993). Empirical evidence generally supports these theoretical predictions (see Nance, Smith, and Smithson, 1993; Colquitt and Hoyt, 1997).

WHY ERM SHOULD ADD VALUE TO THE FIRM?

This section provides theoretical arguments for the value relevance of ERM. Profit-maximizing firms should consider implementing an ERM program only if it increases expected shareholder wealth. Although the individual advantages of different risk management activities are clear, there are disadvantages to the traditional "silo" approach to risk management. Managing each risk class in a separate silo creates inefficiencies due to lack of coordination between the various risk management departments. Proponents of ERM argue that by integrating decision making across all risk classes, firms are able to avoid duplication of risk management expenditure by exploiting natural hedges. Firms that engage in ERM should be able to better understand the aggregate risk inherent in different business activities. This should provide them with a more objective basis for resource allocation, thus improving capital efficiency and return on equity. Organizations with a wide range of investment opportunities are likely to benefit from being able to select investments based on a more accurate risk-adjusted rate than was available under the traditional risk management approach (Meulbroek, 2002).

Although individual risk management activities may reduce earnings volatility by reducing the probability of catastrophic losses, there are potential interdependencies

[4] As discussed by Jensen and Meckling (1976).

[5] Such as Myers' (1977) underinvestment problem. Mayers and Smith (1987) provide a model that describes the effect of corporate insurance on the underinvestment problem.

[6] Mayers and Smith (1982) describe other benefits of corporate insurance not discussed here, such as real service efficiencies and comparative advantage in risk bearing.

[7] Some recent empirical studies of corporate insurance demand find mixed support for the aforementioned theoretical predictions. For example, Regan and Hur (2007), using a sample of Korean nonfinancial firms, find mixed support for the relation between bankruptcy probability and insurance demand. Contrary to theory, they find a positive (negative) relation between liquidity (leverage) and insurance demand. Similarly, for a sample of Chinese firms, Zou and Adams (2008) find that while the cost of debt is positively related to insurance demand for their sample of Chinese firms, high leverage alone does not appear to result in greater insurance demand.

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between risks across activities that might go unnoticed in the traditional risk management model. ERM provides a structure that combines all risk management activities into one integrated framework that facilitates the identification of such interdependencies. Thus, although individual risk management activities can reduce earnings volatility from a specific source (hazard risk, interest rate risk, etc.), an ERM strategy aims to reduce volatility by preventing aggregation of risk across different sources. A further potential source of value from ERM programs arises due to improved information about the firm's risk profile. Outsiders are more likely to have difficulty in assessing the financial strength and risk profile of firms that are highly financially and operationally complex. ERM might enable these opaque firms to better inform outsiders of their risk profile and should serve as a signal of their commitment to risk management. By improving risk management disclosure, ERM is likely to reduce the expected costs of regulatory scrutiny and external capital (Meulbroek, 2002).

Additionally, for insurers the major ratings agencies have put increasing focus on risk management and ERM specifically as part of their financial review. This is likely to provide additional incentives for insurers to consider ERM programs, and also suggests a potential value implication to the existence of ERM programs in insurers. As an example of this interest from the rating agencies in the implications of ERM, in October 2005 Standard & Poor's announced that with the emergence of ERM, risk management will become a separate, major category of its analysis. In February 2006, A.M. Best released a special report describing its increased focus on ERM in the rating process.

Empirical Evidence on the Value Relevance of Risk Management

Smithson and Simkins (2005) provide a thorough review of the literature regarding the value relevance of risk management. Although their study examines four specific questions, their focus on the relationship between the use of risk management and the value of the firm is most relevant to our study. Of the studies examined by Smithson and Simkins, one considers interest rate and foreign exchange (FX) risk management by financial institutions, five consider interest rate and FX risk management by industrial corporations, one considers commodity price risk management by commodity users, and three consider commodity price risk management by commodity producers. Although this series of prior studies considers these specific types of hedging activity, no prior study considers the value relevance of a firm's overall or enterprise-wide risk management practices. Although many of these prior studies find evidence of a positive relationship between specific forms of risk management and the value of the firm, others such as Guay and Kothari (2003) suggest that corporate derivatives positions in general are far too small to account for the valuation premiums reported in some of these studies (e.g., Allayannis and Weston, 2001). In contrast to the prior studies of the value relevance of risk management, we focus not on assessing the potential value relevance of specific forms of hedging or risk management but on the overall risk management posture of the firm at the enterprise level. In other words, is the firm pursing an ERM program or not, and if it is, what is the value associated with such a program?

Sample, Data, and Empirical Method

In order to control for differences that might arise from regulatory and market differences across industries, we have elected to focus our attention in this study on U.S.

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insurers. We also have elected to focus on publicly traded insurers so that we have access to market-based measures of value and because we are more likely to observe public disclosures of ERM activity among publicly traded firms.[8] Our initial sample is drawn from the universe of insurance companies (SIC codes between 6311 and 6399) in the merged CRSP/Compustat database for the period 1995–2005. This sample is composed of 275 insurance firms that operated in any year during the 11-year period.

We then attempt to identify ERM activity for each of these firms. Because firms are not required to report whether they engage in ERM, we perform a detailed search of financial reports, newswires, and other media for evidence of ERM activity.[9] More specifically, we use Factiva, Thomson, and other search engines to perform separate keyword searches for each insurer. Our search strings included the following phrases, their acronyms, as well as the individual words within the same paragraph; "enterprise risk management," "chief risk officer," "risk committee," "strategic risk management," "consolidated risk management," "holistic risk management," and "integrated risk management." We chose these particular search strings because the second and third phrases are prominent methods for the implementation and management of an ERM program, and the other phrases are synonymous with ERM (Liebenberg and Hoyt, 2003). Each search "hit" was manually reviewed within its context in order to determine that each recorded successful hit related to ERM adoption or engagement as opposed to, for example, the sale of ERM products to customers. Each successful hit was then dated and coded to record which key words generated the hit.[10] All potential hits were reviewed in reverse date order in order to locate the single, earliest evidence of ERM activity for each firm.

Because the earliest evidence of ERM activity is in 1998 we limit our data collection to the 8-year period from 1998 to 2005 and exclude firms with missing Compustat values for sales, assets, or equity, and American Depository Receipts. We then use the Compustat Segment database to identify the distribution of each firm's income

[8] Although we restrict our analysis to publicly traded insurers we are still able to cover a substantial proportion of the U.S. insurance market. For example, we were able to link 129 publicly traded insurers to the NAIC database for the year 2004. These 129 insurers accounted for 1,114 subsidiaries (834 property–liability, 280 life–health), or roughly one-third of all firms licensed in the U.S. insurance industry. In terms of direct premiums written, these publicly traded insurers accounted for almost half of all premiums written by licensed insurers ($482 billion out of $1.04 trillion).

[9] An alternative approach would be to survey firms to determine whether or not they are currently engaged in ERM activity. However, we prefer the implicit validation associated with public disclosures of specific ERM activity. The only objective measure of which we are aware is Standard & Poor's (2007) published opinion of ERM practices in insurance firms. Unfortunately, the published opinion provides ERM opinions for only 37 commercial property–casualty insurers—many of which are not publicly traded. Of these 37 insurers, only 17 of the 118 publicly traded insurers in our sample have published ERM opinions. Further, the opinions lack cross-sectional variation. S&P reports that 81 percent of all insurers evaluated since 2005 have "adequate ERM," 3 percent have "weak ERM," 11 percent have "strong ERM," and 5 percent have "excellent ERM." Of the insurers in our sample that are reviewed by S&P, 13 are evaluated as adequate (we classify only two of these as ERM users), three are evaluated as strong (we classify all three as ERM users), and one is evaluated as weak (we do not classify it as an ERM user).

[10] Please see the Appendix for examples.

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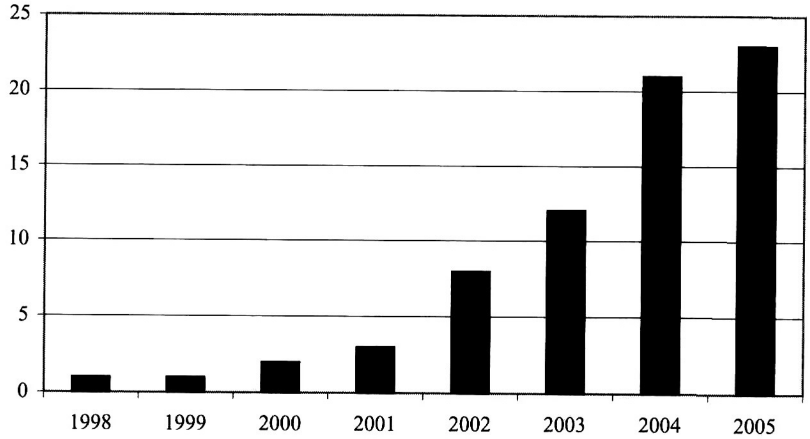
FIGURE 1
Cumulative Number of Sample Insurers Engaged in ERM by Year



Note: ERM classification is based on a search of SEC filings, annual reports, newswires, and other media.

across various business segments and exclude firms that are not primarily involved in the insurance industry. Consistent with Zhang, Cox, and Van Ness (2009), we use a cutoff of 50 percent to determine whether a firm is primarily an insurer.[11] Next, we eliminate firms that have missing or invalid ownership data in Compact Disclosure SEC, firms with only 1 year of sales data on Compustat, and firms with insufficient stock return data from the CRSP monthly stock database. Finally, we match these firms to the statutory accounting data and eliminate firms that cannot be matched to the NAIC Infopro data. Our final sample consists of 117 firms, or 687 firm-year observations. Figure 1 shows the cumulative number of sample firms that are deemed to engage in ERM, by the earliest year of identifiable ERM activity.

In the empirical analysis that follows we use a dummy variable, *ERM*, to indicate whether an insurer engaged in ERM in any given year during the period 1998–2005. *ERM* is set equal to 1 for firm-years beginning with and subsequent to the first evidence of ERM usage, and equal to 0 for firm-years prior to the first observed ERM usage. So a firm that adopts ERM in 2004 is assigned $ERM = 1$ for firm-years 2004 and 2005 and $ERM = 0$ for firm-years 1998–2003.

The primary objective of our empirical analysis is to estimate the relation between ERM and firm value. Consistent with the general practice in the corporate finance literature, we use Tobin's Q as a proxy for firm value. Tobin's Q is a ratio that compares the market value of a firm's assets to their replacement cost. It has been used to measure the value effects of factors such as board size (Yermack, 1996), inside ownership (Morck, Schleifer, and Vishny, 1988), and industrial diversification (Servaes, 1996). Lang and Stulz (1994) explain that Tobin's Q dominates other performance measures

[11] Specifically, we calculate the ratio of insurance sales (NAICS code 5241) to total sales and exclude firms for which the ratio is below 0.5.

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(e.g., stock returns and accounting measures) because, unlike other measures, Tobin's Q does not require risk adjustment or normalization. Furthermore, because Tobin's Q reflects market expectations, it is relatively free from managerial manipulation (Lindenberg and Ross, 1981).

In their review of empirical studies on the value relevance of risk management, Smithson and Simkins (2005) report that the majority of studies use Tobin's Q to proxy for firm value. Consistent with Cummins, Lewis, and Wei (2006), we define Tobin's Q as the market value of equity plus the book value of liabilities divided by the book value of assets.[12] Cummins, Lewis, and Wei contend that this approximation of Tobin's Q is appropriate for insurance companies because the book value of their assets is a much closer approximation of replacement costs than would be the case for nonfinancial firms. In our context, Tobin's Q is particularly useful as a value measure because it is a prospective performance measure. Unlike a historical accounting performance measure, such as ROA, Tobin's Q reflects future expectations of investors. This is important because the benefits of ERM are not expected to be immediately realized. Rather, we expect there to be some lag between ERM implementation and benefit realization.[13]

One approach to our analysis would be to simply model Tobin's Q as a function of ERM and other value determinants. The disadvantage of such an approach is that it ignores potential selectivity bias that arises due to the likely endogeneity of ERM choice. In other words, some of the factors that are correlated with the firm's choice to adopt ERM may also be correlated with observed differences in Q. To deal with this potential endogeneity bias, we use a maximum-likelihood treatment effects model that jointly estimates the decision to engage in ERM and the effect of that decision (or treatment) on Q in a two-equation system.[14] Importantly, the maximum-likelihood method of estimating the system enables the adjustment of standard errors

[12] This formulation has been widely used in the general finance literature (see e.g., Smith and Watts, 1992; Shin and Stulz, 1998; Palia, 2001), in the banking literature (see e.g., Allen and Rai, 1996; Cyree and Huang, 2006), and in the insurance literature (Elango, Ma, and Pope, 2008; Liebenberg and Sommer, 2008). Chung and Pruitt (1994) find that this simple measure is remarkably similar to more sophisticated formulations. Recent evidence in the hedging and firm value context corroborates Chung and Pruitt's finding. Allayannis and Weston (2001, p. 266, Table 8) construct a table that compares their selected Q formulation (the Lewellen and Badrinath Q) to other two other popular formulations—the Perfect and Wiles Q and the measure that we use, the "simple Q." The correlation between the Lewellen and Badrinath Q and the simple Q is 93 percent. Further, the hedging premium based on these two measures is almost identical—for the Lewellen–Badrinath formulation it is 5.26 percent and for the simple Q it is 5.21 percent.

[13] In unreported regressions, we test the relationship between ERM and ROA. We use the same treatment effects methodology as is used for our regressions of Tobin's Q on ERM, but replace Q with ROA. Two specifications are estimated, the first is identical to the Q model reported in Table 5 and the second adds an accounting-based risk measure (CV(EBIT)). Results, available upon request, suggest that ERM is associated with significantly higher ROA. We concentrate our analysis on an economic value measure such as Tobin's Q rather than ROA since the latter is subject to managerial discretion and reflects historical accounting performance rather than future expectations of investors.

[14] For a different finance application of the maximum-likelihood treatment effects model, see Ljungqvist, Jenkinson, and Wilhelm (2003) or Bharath et al. (2008).

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for firm-level clustering. Petersen (2009) explains that failure to correct for firm-level clustering results in overstated significance of coefficient estimates (overstated t-statistics due to understated standard errors). Given that we have up to eight repeated observations per firm, it is important to adjust standard errors for clustering to avoid underestimating the standard errors of our coefficient estimates.

The treatment effects model estimates the effect of ERM_{it} (an endogenous, binary treatment) on Q_{it} (an observed continuous variable), conditional on other determinants of Q.[15] The primary equation of interest is:

$$Q_{it} = X_{it}\beta + \delta ERM_{it} + \varepsilon_{it}, \tag{1}$$

where ERM_{it} indicates whether the ERM treatment is assigned to the ith firm in year t (1 = yes, 0 = no) and X_{it} is a vector of control variables that are hypothesized to explain variation in firm value. The binary decision to engage in ERM (or obtain the treatment) in year t is modeled as the outcome of an unobserved latent variable ERM^*_{it}. We assume that ERM^*_{it} is a linear function of the coefficient vector w_{it} that is composed of hypothesized determinants of ERM engagement.

$$ERM^*_{it} = w_{it}\gamma + u_{it}. \tag{2}$$

The observed decision to engage in ERM in a particular year is expressed as follows:

$$ERM_{it} = \begin{cases} 1 & \text{if } ERM^*_{it} > 0 \\ 0 & \text{otherwise.} \end{cases} \tag{3}$$

In Equations (1) and (2) ε_{it} and u_{it} are assumed bivariate normal with mean 0 and the following covariance matrix:

$$\begin{bmatrix} \sigma\rho \\ \rho 1 \end{bmatrix}. \tag{4}$$

We estimate Equations (1) and (2) simultaneously using maximum-likelihood estimation. The likelihood function for the model is given in Maddala (1983, p. 122). If ε_{it} and u_{it} are correlated, then ordinary least squares (OLS) estimates of the impact of ERM on firm value will be biased because the equations are not independent. A likelihood-ratio test is used to determine whether Equations (1) and (2) are independent (the null hypothesis is that $\rho = 0$). The ERM determinants (contained in the vector w_{it}) and the Q determinants (contained in the vector X_{it}) are listed in the functional forms below

[15] Our discussion of the maximum-likelihood treatment effects model draws heavily on Maddala (1983) and Greene (2000).

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and are discussed subsequently.

$$Q = f(ERM \mid Size, Leverage, Salesgrowth, ROA, Div\_Int, Div\_Ind, Dividends, Insiders, InsidersSq, Life, Beta). \quad (5)$$

$$ERM = f(Size, Leverage, Div\_Int, Div\_Ind, Life, Opacity, Div\_Ins, Institutions, \mathrm{Rei}nsuse, Slack, CV(EBIT), lag \ln sdret, ValueChange). \quad (6)$$

Discussion of Q Determinants

Size: There is some evidence that large firms are more likely to have ERM programs in place (Colquitt, Hoyt, and Lee, 1999; Liebenberg and Hoyt, 2003, Beasley, Clune, and Hermanson, 2005). Thus, it is important to control for size in our analysis because our ERM indicator may proxy for firm size. We use the log of the book value of assets to control for size-related variation in Tobin's Q. Lang and Stulz (1994) and Allayannis and Weston (2001) find a significantly negative relation between size and firm value.

Leverage: To control for the relation between capital structure and firm value we include a leverage variable that is equal to the ratio of the book value of liabilities to the market value of equity. The predicted sign on this variable is ambiguous. On the one hand, financial leverage enhances firm value to the extent that it reduces free cash flow that might otherwise have been invested by self-interested managers in suboptimal projects (Jensen, 1986). On the other hand, excessive leverage can increase the probability of bankruptcy and cause the firm's owners to bear financial distress costs.

SalesGrowth: Allayannis and Weston (2001) control for the effect of growth opportunities on Tobin's Q using the ratio of R&D expenditure to sales, or capital expenditure to assets. These data are missing for the majority of our sample firms. Accordingly, we use historical (1-year) sales growth as a proxy for future growth opportunities.

ROA: Profitable firms are likely to trade at a premium (Allayannis and Weston, 2001). To control for firm profitability, we include return on assets (ROA) in our regressions. ROA is calculated as net income divided by total assets. We expect a positive relation between ROA and Tobin's Q.

Div_Ind: Several insurers in our sample belong to conglomerates that operate in other industries. Theory suggests that industrial diversification is associated with both costs and benefits. On the one hand, diversification may be performance enhancing due to benefits associated with scope economies, larger internal capital markets, and risk reduction (Lewellen, 1971, Teece, 1980). On the other hand, diversification may reduce performance if it exacerbates agency costs and leads to inefficient cross-subsidization of poorly performing businesses (Easterbrook, 1984; Berger and Ofek, 1995). The vast majority of empirical studies find that conglomerates trade at a discount relative to undiversified firms (Martin and

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Sayrak, 2003).[16] To control for the effect of industrial diversification on firm value, we use a dummy variable (*Div_Ind*) equal to 1 for firms that report sales in SIC codes greater than 6399 or less than 6311 on the Compustat Segment Files. We expect a negative relation between industrial diversification and Tobin's Q.

Div_Int: The theoretical predictions described for industrial diversification apply equally to international diversification. As is the case with industrial diversification, international diversification is associated with costs that stem from unresolved agency conflicts and benefits that result from scope economies and risk reduction. The empirical evidence on the relation between international diversification and firm value is mixed. Although some studies have found a discount (e.g., Denis, Denis, and Yost, 2002), others have found a premium (e.g., Bodnar, Tang, and Weintrop, 1997). International diversification is measured using a dummy variable (*Div_Int*) set equal to 1 for firms with nonzero foreign sales, and 0 otherwise. Foreign sales are defined as sales outside of the United States and are calculated using Compustat segment data.

Dividends: Following Allayannis and Weston (2001) and Lang and Stulz (1994), we include in our model a dividend payment indicator (*Dividends*) equal to 1 if the firm paid a dividend in the current year. The expected sign is ambiguous. On the one hand, investors may view a disbursement of cash in the form of a dividend as a sign that the firm has exhausted its growth opportunities. If this holds then the payment of dividends will negatively affect firm value. On the other hand, to the extent that dividends reduce free cash flow that could be used for managerial perquisite consumption, the payment of dividends is expected to positively affect firm value.

Insiders: There is a large body of research that links insider share ownership to firm value. We use the percentage of shares owned by insiders to control for variation in Tobin's Q that is due to cross-sectional differences in managerial incentives. The literature predicts that low levels of insider ownership are effective in aligning managerial and shareholder interests. However, high levels of ownership have the opposite effect on firm value (McConnell and Servaes, 1990). Accordingly, we expect Tobin's Q to be positively related to the percentage of insider ownership (*Insiders*), but negatively related to the square of the percentage of insider ownership (*InsidersSq*). Data for insider ownership are from Compact Disclosure SEC.

Life: To control for potential differences in Q that are related to the industry sector in which firms operate we include a dummy variable, *Life*, that is equal to 1 for insurers that are primarily life insurers, and 0 otherwise. Firms with a primary SIC code of 6311 are defined as being primarily life insurers.

[16] There is a recent literature that suggests that the well-documented diversification discount is an artifact of measurement error, managerial discretion in segment reporting, and endogeneity bias (e.g., Campa and Kedia, 2002; Graham, Lemmon, and Wolf, 2002; Villalonga, 2004).

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Beta: To control for variation in Q that is due to greater volatility we include firm beta as an independent variable in the Q model. Each firm's annual beta is calculated using the prior 60 months' excess returns. Excess returns are calculated as monthly returns less the lagged risk free rate, where the risk free rate is equal to the return on a 3-month Treasury bill.[17]

Finally, year dummies are included in the Q equation to control for time variation in Q over the sample period.

Discussion of ERM Determinants

Size: Survey evidence suggests that larger firms are more likely to engage in ERM because they are more complex, face a wider array of risks, and have the institutional size to support the administrative cost of an ERM program. (see, e.g., Colquitt, Hoyt, and Lee, 1999; Hoyt, Merkley, and Thiessen, 2001; Beasley, Clune, and Hermanson, 2005; Standard & Poor's, 2005). We use the natural log of the book value of assets as a proxy for firm size.

Leverage: Firms engaging in ERM may have lower financial leverage if they have decided to lower their probability of financial distress by decreasing financial risk. However, firms may decide that as a result of ERM they are able to assume greater financial risk. Accordingly, Pagach and Warr (2010) posit that the relation between ERM adoption and leverage is unclear. Liebenberg and Hoyt (2003) find that firms with greater financial leverage are more likely to appoint a chief risk officer. *Leverage* is defined as the ratio of the book value of asset to the book value of liabilities.

Opacity: Liebenberg and Hoyt (2003) argue that firms that are relatively more opaque should derive greater benefit from ERM programs that communicate risk management objectives and strategies to outsiders. Pottier and Sommer (2006) explain that relatively "opaque" firms are those that are harder for outsiders to evaluate. Pagach and Warr (2010) hypothesize that ERM adoption is related to the opacity of a firm's assets because assets that are relatively more opaque are more difficult to liquidate in order to avert financial distress. We follow Pagach

[17] Specifically, annual Beta for the ith firm is calculated as follows:

$$Beta_i = \frac{\mathrm{Cov}(R_i, R_m)}{\sigma_m^2},$$

where

$$\mathrm{Cov}(R_i, R_m) = \frac{\sum_{t=1}^{n}(R_{it} - \bar{R}_i)(R_{mt} - \bar{R}_m)}{n-1}$$

and

$$\sigma_m^2 = \frac{\sum_{t=1}^{n}(R_{mt} - \bar{R}_m)^2}{n-1};$$

R_i is the monthly return for firm i, R_m is the monthly market (CRSP value-weighted) return, and $n = 60$.

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and Warr and measure opacity as the ratio of intangible assets to the book value of total assets.[18]

Div_Int, Div_Ind, Div_Ins: According to Standard & Poor's (2005), insurers that are relatively more complex are likely to benefit more from the adoption of ERM programs. Although firm size captures a good deal of complexity, other factors such as industrial and international diversification are also likely to affect whether a firm adopts an ERM program. We use dummy variables to indicate international and industrial diversification status. *Div_Int* reflects international diversification and takes on a value of 1 for firms with geographic segments outside of the United States, and 0 otherwise. *Div_Ind* reflects industrial diversification and takes on a value of 1 for firms with income from non-insurance operating segments, and 0 otherwise. Finally, we use a continuous measure, *Div_Ins*, to capture firm complexity that results from intraindustry (insurance business) diversification. *Div_Ins* is calculated as the complement of the Herfindahl index of premiums written across all lines of business. All three forms of diversification are expected to be positively related to ERM engagement because diversified firms face a more complex range of risks than do undiversified firms.[19]

Institutions: Pressure from external stakeholders is regarded as an important driving force behind the adoption of ERM programs (Lam and Kawamoto, 1997; Miccolis and Shah, 2000; Lam, 2001). Regulatory pressure is likely to have a similar impact on all competitors within a given industry whereas shareholder pressure may differ depending on the relative influence of different shareholder groups for each firm. Institutions are relatively more influential than individual shareholders and may be able to exert greater pressure for the adoption of an ERM program. Therefore, we expect that firms with higher percentage of institutional share ownership will be more likely to engage in ERM.

Life: We include a dummy variable equal to 1 for firms that are primarily life insurers (SIC code 6311), and 0 otherwise, to account for potential differences in the likelihood of ERM engagement across sectors of the insurance industry.

Reinsuse: Insurers use reinsurance contracts to hedge underwriting risk. Colquitt and Hoyt (1997) and Cummins, Phillips, and Smith (2001) examine the relation between reinsurance use and the decision to hedge with financial derivatives. They explain that, given their shared objective of reducing income volatility, these two risk management methods may serve as substitutes. However, they may be complements if firms that hedge underwriting risk via reinsurance are also more predisposed to hedging other sources of risk. In a similar vein, firms

[18] We recognize that this measure captures only one aspect of opacity. Other variables included in our model (such as *Size*, *Div_Ins*, *Div_Ind*, and *Div_Int*) capture opacity that may stem from greater operational complexity.

[19] Additionally, internationally diversified firms that operate in the United Kingdom and Canada, where regulated corporate governance regarding risk management control and reporting historically has been more stringent, should be more likely to adopt an ERM program (Liebenberg and Hoyt, 2003). Similarly, Beasley, Clune, and Hermanson (2005) find that U.S.-based firms are less likely to be in advanced stage of ERM than are their international counterparts.

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that hedge more risk using reinsurance may be more predisposed to engaging in ERM, or alternatively, they may have less need for ERM if their reinsurance strategy sufficiently reduces income volatility. Following Colquitt and Hoyt (1997), Cummins, Phillips, and Smith (2001), and the bulk of subsequent studies, we measure the extent of reinsurance use as reinsurance ceded divided by direct premiums written plus reinsurance assumed.[20]

Slack: Pagach and Warr (2010) include a measure of financial slack in their CRO appointment determinants model. They argue that ERM users may have higher levels of financial slack due to an emphasis of risk management on reducing the probability of financial distress. However, they also note that ERM users may be able to reduce the level of financial slack because of improved risk management. *Slack* is measured as the ratio of cash and marketable securities to total assets.

CV(EBIT), laglnsdret: Liebenberg and Hoyt (2003) and Pagach and Warr (2010, 2011) hypothesize a relation between CRO appointments (or ERM adoption) and the volatility of earnings or stock returns. As with *Leverage* and *Slack*, the direction of the relation is ambiguous. Firms that are relatively more volatile are likely to benefit from the effects of an ERM program. However, firms that have adopted ERM programs are likely to experience lower volatility of stock returns or earnings. *CV(EBIT)* is the coefficient of variation of earnings before interest and taxes and *laglnsdret* is the natural logarithm of the standard deviation of monthly stock returns for the prior year.

ValueChange: Pagach and Warr (2011) argue that ERM adoption might be related to sharp declines in shareholder value if firms feel pressure to convey to shareholders that they are taking corrective steps to prevent continued value reduction. *ValueChange* is measured as the 1-year percentage change in market value of the firm where market value is calculated as the multiple of year-end shares outstanding and closing stock price.

Finally, year dummies are included in the ERM equation to control for time variation in the propensity of firms to engage in ERM.

All variables are further defined in Table 1 and summary statistics are reported in Table 2. A few variables are noteworthy. ERM users account for 8.5 percent of all firm-years. The mean and median values of Q for our sample are 1.089 and 1.036, respectively. These estimates are similar to those reported by Cummins, Lewis, and Wei (2006)—who report mean and median values of Q equal to 1.2 and

[20] Recall that we aggregate statutory data for affiliates/subsidiaries at the group level and that many insurance groups are composed of property–casualty subsidiaries as well as life–health subsidiaries. Powell and Sommer (2007) note the importance of accounting for intragroup reinsurance cession, which does not reduce underwriting risk for the overall group. Property–casualty insurers are required to separately report internal (to affiliates) and external (to nonaffiliates) reinsurance cessions. Life insurers do not provide similar data. We therefore calculate the numerator of *Reinsuse* as total reinsurance ceded by life–health subsidiaries plus reinsurance ceded to nonaffiliates by property–casualty subsidiaries. Like Pottier and Sommer (2006), we also use an alternative formulation of *Reinsuse* where the numerator reflects total reinsurance cession from property–casualty operations. We find that our core results are qualitatively unchanged when using this alternative formulation.

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TABLE 1
Variable Definitions

Variable Name	Definition	Source
Q	(Market value of equity + Book value of liabilities)/Book value of assets	Compustat ([data24 ×data25 + data6 −data60)/data6)
ERM	= 1 for firm −years > = year of first identifiable ERM activity, 0 otherwise	LexisNexis, SEC filings, other media
Size	ln (Book value of assets)	Compustat (data6)
Leverage	Book value of liabilities/Market value of equity	Compustat ([data6 − data60]/data24 × data25)
ROA	Net income/Book value of assets	Compustat (data18/data6)
Div_Int	= 1 if positive sales outside of North America, 0 otherwise	Compustat Segment database
Div_Ind	= 1 if positive sales in noninsurance SIC codes (< 6311, > 6399), 0 otherwise	Compustat Segment database
Dividends	= 1 if firm paid dividends in that year, 0 otherwise	Compustat (data21 > 0)
Insiders	Percentage of outstanding shares owned by insiders	Compact Disclosure SEC
Insiders_Sq	= Insiders × Insiders	Compact Disclosure SEC
Institutions	Percentage of outstanding shares owned by institutions	Compact Disclosure SEC
Salesgrowth	$(\text{Sales}_t - \text{Sales}_{t-1})/\text{Sales}_{t-1}$	Compustat $([\text{data12}_t - \text{data12}_{t-1}] / \text{data12}_{t-1})$
Life	= 1 if primary SIC code = 6311, 0 otherwise	Compustat Segment database
Reinsuse	Reinsurance ceded/(direct premiums written + reinsurance assumed)	NAIC Infopro L/H and P/C
Div_Ins	1 – Herfindahl index of premiums written across all lines of insurance	NAIC Infopro L/H and P/C
Slack	Cash and short-term investments/ Book value of assets	Compustat (data1/data6)
Opacity	Intangible assets/Book value of assets	Compustat (data33/data6)
ValueChange	Firm value in year t – firm value in year $t-1$ / firm value in year $t-1$	Compustat $(\text{data24}_t \times \text{data25}_t - \text{data24}_{t-1} \times \text{data25}_{t-1})$
CV(EBIT)	Coefficient of variation of earnings before interest and taxes	Compustat data23
Beta	Covariance(firm excess returns, market returns)/Variance(market returns)	CRSP monthly stock files, Federal Reserve Board
laglnsdret	Lag(ln[standard deviation of monthly returns])	CRSP monthly stock files

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TABLE 2
Summary Statistics ($N = 687$)

	1st Quartile	Mean	Median	3rd Quartile
Q	0.974	1.089	1.036	1.144
ERM	0.000	0.087	0.000	0.000
Size	6.586	8.039	7.908	9.372
Leverage	1.622	6.270	2.983	6.735
ROA	0.005	0.015	0.017	0.034
Div_Int	0.000	0.058	0.000	0.000
Div_Ind	0.000	0.271	0.000	1.000
Dividends	0.000	0.722	1.000	1.000
Insiders	0.350	13.326	2.505	16.110
Institutions	11.755	42.010	40.635	68.645
Salesgrowth	0.601	13.791	8.743	20.406
Life	0.000	0.176	0.000	0.000
Reinsuse	0.050	0.171	0.117	0.227
Div_Ins	0.457	0.606	0.682	0.830
Slack	0.041	0.094	0.071	0.119
Opacity	0.000	0.021	0.005	0.025
ValueChange	−0.147	0.161	0.061	0.323
CV(EBIT)	0.119	0.203	0.326	0.837
Beta	0.256	0.502	0.453	0.673
laglnsdret	−4.010	−3.716	−3.746	−3.428

Notes: Q is used as a proxy for firm value and is calculated as ([Market value of equity + Book value of liabilities]/Book value of assets). *ERM* is a dummy variable equal to 1 for firm-years greater than, or equal to, the first year of identifiable ERM activity, 0 otherwise. ERM classification is based on a search of SEC filings, annual reports, newswires, and other media. *Size* is equal to the natural log of the book value of assets. *Leverage* is equal to the ratio of the book value of liabilities to the market value of equity. *ROA* reflects accounting performance and is equal to net income divided by the book value of assets. *Div_Int* reflects international diversification and is a dummy variable equal to 1 for firm-years with sales outside of North America, 0 otherwise. *Div_Ind* reflects industrial diversification and is a dummy variable equal to 1 for firm-years with positive sales in noninsurance SIC codes (< 6311, > 6399), 0 otherwise. *Dividends* is a dummy variable equal to 1 for firm-years in which dividends are paid, 0 otherwise. *Insiders* is equal to the percentage of outstanding shares owned by insiders. *Institutions* is equal to the percentage of outstanding shares owned by institutions. *Salesgrowth* is equal to $(\text{Sales}_t - \text{Sales}_{t-1})/\text{Sales}_{t-1}$. Life is an indicator variable equal to 1 for firms whose primary SIC code is 6311, 0 otherwise. *Reinsuse* is equal to (reinsurance ceded/[direct premiums written + reinsurance assumed]). *Div_Ins* is equal to the complement of the Herfindahl index of premiums written across all lines of insurance. *Slack* is equal to cash and short-term investments divided by the book value of assets. *Opacity* is equal to intangible assets divided by the book value of assets. *ValueChange* is equal to $(\text{firm value}_t - \text{firm value}_{t-1})/\text{firm value}_{t-1}$. *CV(EBIT)* is equal to the coefficient of variation of earnings before interest and taxes. *Beta* reflects return volatility and is equal to the covariance between firm excess returns and market excess returns, divided by the variance of market returns. *laglnsdret* is equal to the prior year's natural log of the standard deviation of monthly stock returns. Accounting and market data are from the Compustat Industrial and Compustat Segments databases. Firm and market returns are taken from the CRSP monthly stock database. Ownership data are taken from Compact Disclosure SEC. Statutory insurance data are from the NAIC Infopro database.

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1.06, respectively, for their sample of insurers in 2002. The median level of institutional ownership for our sample (40.6 percent) is similar to the 42.5 percent level reported by Shortridge and Avila (2004) for their sample of P/L insurers over the period 1995–1997. Finally, the mean beta for our sample (0.5) is quite close to the mean beta (0.58) reported by Cummins and Phillips (2005).

The correlation matrix of Tobin's Q and its determinants appears in Table 3. The general lack of high correlation coefficients between the independent variables that are used in the Q equation suggests that multicollinearity should not be a problem in our regression analysis.

RESULTS

Table 4 reports differences in the means and medians of key variables between firm-years with an identifiable ERM program (*ERM* = 1) and those without (*ERM* = 0). Several differences are noteworthy. First, the univariate results support the contention that ERM enhances firm value. Both the mean and median values of Tobin's Q are significantly higher for firms with ERM programs. On average, insurers with ERM programs are valued approximately 4 percent higher than other insurers. Second, ERM users are systematically different from nonusers. Specifically, in terms of their financial characteristics, the average ERM user is larger, less leveraged, less opaque, has less financial slack, and lower return volatility than the average nonuser. Furthermore, in terms of ownership, ERM users tend to have higher levels of institutional ownership than nonusers. Finally, the average ERM user relies less on reinsurance than the average nonuser and the median change in value is greater for ERM users than for nonusers.

Table 5 reports the results of the maximum-likelihood treatment effects model in which the ERM and Q equations are estimated jointly. The first column reports results for the ERM equation. Consistent with our univariate results, *Size*, *Leverage*, *Opacity*, *Institutions*, *Reinsuse*, and *ValueChange* are significantly related to ERM engagement. *Div_Int* and *Life* are also significant predictors of ERM use. The second column of Table 5 reports estimation results for the ERM equation. Most importantly, the coefficient on *ERM* is positive and significant. The coefficient estimate indicates that insurers engaged in ERM are valued roughly 20 percent higher than other insurers, after controlling for other value determinants and potential endogeneity bias. Regarding our control variables, we find some evidence consistent with prior research on nonfinancial industries of a quadratic relation between *Insiders* and firm value. We also find a positive relation between *Dividends* and firm value, consistent with the notion that the dividend payments are a valuable method of reducing the agency costs associated with free cash flow. None of our other explanatory variables is statistically significant. The Wald test for independent equations rejects the null hypothesis that the residuals from Equations (1) and (2) are uncorrelated and supports their joint estimation.

Robustness: Alternative Specifications of the ERM Equation

Table 6 reports results for various specifications of the ERM determinants equation, holding the Q equation constant at the specification reported in Table 5. Our first specification (ERM1) includes only the variables that were significant in Liebenberg and

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TABLE 3
Pearson Correlation Coefficients for *Q* Determinants ($N = 687$)

	Q	*ERM*	*Size*	*Leverage*	*ROA*	*Salesgrowth*	*Di_Ind*	*Div_Int*	*Dividends*	*Insiders*	*InsidersSq*	*Life*
Q	1											
ERM	0.0801**	1										
Size	0.1730**	0.3481**	1									
Leverage	−0.0468	−0.0204	−0.0077	1								
ROA	0.1766**	0.0323	0.0955**	−0.1159**	1							
Salesgrowth	0.0099	−0.0056	0.0281	−0.0181	0.0712	1						
Div_Ind	0.073	0.0414	0.1149**	−0.0429	0.0549	−0.0299	1					
Div_Int	0.0879**	0.0332	0.2712**	−0.0105	−0.0042	−0.0104	0.0983**	1				
Dividends	0.2050**	0.1762**	0.4007**	−0.1140**	0.1288**	−0.0502	0.1371**	0.0248	1			
Insiders	−0.0974**	−0.1840**	−0.2901**	−0.016	−0.0048	−0.0246	−0.0139	−0.0818**	−0.1131**	1		
InsidersSq	−0.1136**	−0.1264**	−0.1788**	−0.0248	0.0043	−0.0416	−0.0343	−0.0693	−0.0727	0.9427**	1	
Life	0.0453	0.0591	0.1095**	−0.0013	−0.0776**	−0.0872**	0.0164	0.0386	−0.0196	−0.1094**	−0.0956**	1
Beta	−0.0986**	0.0059	0.1818**	0.0019	−0.0304	−0.0489	0.0933**	0.0972**	0.0223	−0.0962**	−0.0743	−0.0897**

Notes: *Q* is used as a proxy for firm value and is calculated as ([Market value of equity + Book value of liabilities]/Book value of assets). *ERM* is a dummy variable equal to 1 for firm-years greater than, or equal to, the first year of identifiable *ERM* activity, 0 otherwise. *ERM* classification is based on a search of SEC filings, annual reports, newswires, and other media. *Size* is equal to the natural log of the book value of assets. *Leverage* is equal to the ratio of the book value of liabilities to the market value of equity. *ROA* reflects accounting performance and is equal to net income divided by the book value of assets. *Salesgrowth* is equal to $(\text{Sales}_t - \text{Sales}_{t-1})/\text{Sales}_t$. *Div_Ind* reflects industrial diversification and is a dummy variable equal to 1 for firm-years with positive sales in noninsurance SIC codes (< 6311, > 6399), 0 otherwise. *Div_Int* reflects international diversification and is a dummy variable equal to 1 for firm-years with sales outside of North America, 0 otherwise. *Dividends* is a dummy variable equal to 1 for firm-years in which dividends are paid, 0 otherwise. *Insiders* is equal to the percentage of outstanding shares owned by insiders. *InsidersSq* is the square of Insiders. *Life* is an indicator variable equal to 1 for firm-years in which more than 50% of premiums are attributable to life insurance, 0 otherwise. *Life* is an indicator variable equal to 1 for firms whose primary SIC code is 6311, 0 otherwise. *Beta* reflects return volatility and is equal to the covariance between firm excess returns and market excess returns, divided by the variance of market returns. Accounting and market data are from the Compustat Industrial and Compustat Segments databases. Firm and market returns are taken from the CRSP monthly stock database. Ownership data are taken from Compact Disclosure SEC. Statutory insurance data are from the NAIC Infopro database. ** denotes significance at the 5% level or lower.

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TABLE 4
Univariate Differences Across *ERM* Status (1998–2005)

	(1) *ERM* = 1		(2) *ERM* = 0		Difference (1) − (2)	
Variable	Mean	Median	Mean	Median	Mean	Median
Q	1.128	1.078	1.085	1.028	0.043*	0.051***
Size	10.315	10.227	7.827	7.703	2.488***	2.524***
Leverage	4.485	2.760	6.436	3.002	−1.951**	−0.242
Opacity	0.014	0.008	0.021	0.004	−0.007**	0.004
Div_Int	0.083	0.000	0.056	0.000	0.027	0.000
Div_Ind	0.333	0.000	0.266	0.000	0.068	0.000
Div_Ins	0.621	0.755	0.604	0.675	0.016	0.080
Institutions	55.097	73.590	40.790	39.199	14.307***	34.391***
Life	0.183	0.000	0.175	0.000	0.008	0.000
Reinsuse	0.116	0.105	0.176	0.117	−0.060***	−0.012
Slack	0.071	0.069	0.096	0.071	−0.025***	−0.003
CV(EBIT)	0.321	0.308	0.192	0.326	0.129	−0.018
laglnsdret	−3.997	−3.991	−3.690	−3.722	−0.307***	−0.268***
ValueChange	0.163	0.095	0.160	0.049	0.002	0.046*
No. of firm-year obs.	60		627			

Notes: *ERM* is a dummy variable equal to 1 for firm-years greater than, or equal to, the first year of identifiable ERM activity, 0 otherwise. ERM classification is based on a search of SEC filings, annual reports, newswires, and other media. *Q* is used as a proxy for firm value and is calculated as ([Market value of equity + Book value of liabilities]/Book value of assets). *Size* is equal to the natural log of the book value of assets. *Leverage* is equal to the ratio of the book value of liabilities to the market value of equity. *Opacity* is equal to intangible assets divided by the book value of assets. *Div_Int* reflects international diversification and is a dummy variable equal to 1 for firm-years with sales outside of North America, 0 otherwise. *Div_Ind* reflects industrial diversification and is a dummy variable equal to 1 for firm-years with positive sales in noninsurance SIC codes (< 6311, > 6399), 0 otherwise. *Div_Ins* is equal to the complement of the Herfindahl index of premiums written across all lines of insurance. *Institutions* is equal to the percentage of outstanding shares owned by institutions. *Life* is an indicator variable equal to 1 for firms whose primary SIC code is 6311, 0 otherwise. *Reinsuse* is equal to (reinsurance ceded/[direct premiums written + reinsurance assumed]). *Slack* is equal to cash and short-term investments divided by the book value of assets. *CV(EBIT)* is equal to the coefficient of variation of earnings before interest and taxes. *laglnsdret* is equal to the prior year's natural log of the standard deviation of monthly stock returns. *ValueChange* is equal to (firm value$_t$ − firm value$_{t-1}$)/firm value$_{t-1}$. Accounting and market data are from the Compustat Industrial and Compustat Segments databases. Firm and market returns are taken from the CRSP monthly stock database. Ownership data are taken from Compact Disclosure SEC. Statutory insurance data are from the NAIC Infopro database. ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively. Statistical significance of difference in means is based on a *t*-test. Statistical significance of difference in medians is based on a nonparametric Wilcoxon rank sum test.

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TABLE 5
Full Maximum-Likelihood Treatment Effects Estimates

	ERM (Equation 2)		*Q* (Equation 1)
ERM			0.19884 (0.05031)***
Size	0.37912 (0.11279)***		−0.00031 (0.00836)
Leverage	−0.09579 (0.03973)**		−0.00004 (0.00011)
Salesgrowth			−0.00001 (0.00014)
ROA			0.32591 (0.32539)
Div_Int	−0.80753 (0.45220)*		0.05242 (0.05930)
Div_Ind	0.18514 (0.27978)		0.00136 (0.02864)
Dividends			0.04985 (0.02896)*
Insiders			0.00214 (0.00141)
InsidersSq			−0.00003 (0.00002)**
Life	0.43295 (0.30998)		−0.04798 (0.03329)
Beta			0.0105 (0.02609)
Opacity	−8.08611 (4.98017)		
Div_Ins	−0.39761 (0.38319)		
Institutions	0.01887 (0.00753)**		
Reinsuse	−3.18867 (1.45578)**		
Slack	−0.64388 (1.41135)		
CV (EBIT)	0.00004 (0.00380)		
LagInsdret	0.19784 (0.20080)		
ValueChange	0.32285 (0.16541)*		
Constant	−3.64765 (1.13572)***		1.0137 (0.07571)***
No. of observations		687	
No. of clusters		117	
Log pseudolikelihood		120.81	
Wald test of independent equations		8.33***	

Notes: *Q* is used as a proxy for firm value and is calculated as ([Market value of equity + Book value of liabilities]/Book value of assets). *ERM* is a dummy variable equal to 1 for firm-years greater than, or equal to, the first year of identifiable ERM activity, 0 otherwise. ERM classification is based on a search of SEC filings, annual reports, newswires, and other media. *Size* is equal to the natural log of the book value of assets. *Leverage* is equal to the ratio of the book value of liabilities to the market value of equity. *Salesgrowth* is equal to $(\text{Sales}_t - \text{Sales}_{t-1})/\text{Sales}_{t-1}$. *ROA* reflects accounting performance and is equal to net income divided by the book value of assets. *Div_Int* reflects international diversification and is a dummy variable equal to 1 for firm-years with sales outside of North America, 0 otherwise. *Div_Ind* reflects industrial diversification and is a dummy variable equal to 1 for firm-years with positive sales in noninsurance SIC codes (< 6311, > 6399), 0 otherwise. *Dividends* is a dummy variable equal to 1 for firm-years in which dividends are paid, 0 otherwise. *Insiders* is equal to the percentage of outstanding shares owned by insiders. *InsidersSq* is the square of Insiders. *Life* is an indicator variable equal to 1 for firms whose primary SIC code is 6311, 0 otherwise. *Beta* reflects return volatility and is equal to the covariance between firm excess returns and market excess returns, divided by the variance of market returns. *Opacity* is equal to intangible assets divided by the book value of assets. *Div_Ins* is equal to the complement of the Herfindahl index of premiums written across all lines of insurance. *Institutions* is equal to the percentage of outstanding shares owned by institutions. *Reinsuse* is equal to (reinsurance ceded / [direct premiums written + reinsurance assumed]). *Slack* is equal to cash and short-term investments divided by the book value of assets. *CV(EBIT)* is equal to the coefficient of variation of earnings before interest and taxes. *lagInsdret* is equal to the prior year's natural log of the standard deviation of monthly stock returns. *ValueChange* is equal to $(\text{firm value}_t - \text{firm value}_{t-1})/\text{firm value}_{t-1}$. Accounting and market data are from the Compustat Industrial and Compustat Segments databases. Firm and market returns are taken from the CRSP monthly stock database. Ownership data are taken from Compact Disclosure SEC. Statutory insurance data are from the NAIC Infopro database. Year dummies for 1999–2005 are included in both equations but are not reported. Standard errors are adjusted for firm-level clustering, and appear in brackets. ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

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TABLE 6
Sensitivity of the ERM Premium to Alternative Specifications of the *ERM* Equation

Panel A. *ERM* Equation Results

Coefficient in *Q* equation	0.23977	0.23838	0.23496	0.20527	0.20593	0.2107	0.21004	0.20986	0.19575	0.19884
Size	0.32419	0.3245	0.3761	0.34994	0.34176	0.36719	0.36695	0.36601	0.38163	0.37912
	(0.08639)***	(0.08656)***	(0.09446)***	(0.11122)***	(0.11222)***	(0.10629)***	(0.10722)***	(0.10682)***	(0.11301)***	(0.11279)***
Leverage	−0.09839	−0.09735	−0.09601	−0.08329	−0.09339	−0.0904	−0.09087	−0.09049	−0.09549	−0.09579
	(0.04554)**	(0.04589)**	(0.04170)**	(0.04286)*	(0.04709)**	(0.03973)**	(0.03966)**	(0.03969)**	(0.04119)**	(0.03973)**
Opacity		−4.84986	−5.12111	−7.68358	−7.40106	−8.64467	−8.30744	−7.90267	−8.31627	−8.08611
		(3.19819)	(3.29924)	(4.28199)*	(4.22202)*	(4.31210)**	(4.84334)*	(5.14802)	(5.18191)	(4.98017)
Div_Int			−0.6993	−0.75331	−0.75319	−0.80635	−0.80596	−0.8021	−0.82477	−0.80753
			(0.39964)*	(0.40882)*	(0.40779)*	(0.42885)*	(0.42936)*	(0.42856)*	(0.45686)*	(0.45220)*
Div_Ind			−0.00363	0.15975	0.12302	0.15059	0.15137	0.14534	0.17274	0.18514
			(0.24738)	(0.24885)	(0.26143)	(0.27877)	(0.27931)	(0.27800)	(0.28148)	(0.27978)
Div_Ins			−0.68607	−0.42095	−0.40534	−0.43208	−0.4302	−0.43507	−0.38289	−0.39761
			(0.34073)**	(0.36021)	(0.35552)	(0.37534)	(0.37340)	(0.37319)	(0.40180)	(0.38319)
Institutions				0.01493	0.01576	0.01833	0.01839	0.01815	0.01956	0.01887
				(0.00667)**	(0.00651)**	(0.00700)***	(0.00707)***	(0.00708)**	(0.00771)**	(0.00753)**
Life					0.23534	0.41653	0.41167	0.41218	0.45519	0.43295
					(0.28106)	(0.29622)	(0.30041)	(0.30043)	(0.31991)	(0.30998)
Reinsuse						−3.09614	−3.08644	−3.08008	−3.17598	−3.18867
						(1.43043)**	(1.44953)**	(1.44127)**	(1.47600)**	(1.45578)**
Slack							−0.19544	−0.15437	−0.31946	−0.64388
							(1.37180)	(1.36579)	(1.43906)	(1.41135)
CV(EBIT)								0.00058	0.0007	0.00004
								(0.00467)	(0.00497)	(0.00380)
lagInsdret									0.22394	0.19784
									(0.20871)	(0.20080)
ValueChange										0.32285
										(0.16541)*
Constant	−3.14651	−3.07964	−3.10932	−4.25696	−4.25151	−4.33365	−4.32356	−4.30171	−3.60761	−3.64765
	(0.74225)***	(0.71152)***	(0.68275)***	(1.27090)***	(1.23909)***	(1.17529)***	(1.19449)***	(1.18999)***	(1.13960)***	(1.13572)***
Observations	701	701	701	701	701	701	701	691	687	687

(*Continued*)

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TABLE 6
(Continued)

Panel B. *Q* Equation Results

Dependent Variable / *ERM Specification*	*Q* *ERM1*	*Q* *ERM2*	*Q* *ERM3*	*Q* *ERM4*	*Q* *ERM5*	*Q* *ERM6*	*Q* *ERM7*	*Q* *ERM8*	*Q* *ERM9*	*Q* *ERM10*
ERM	0.23977	0.23838	0.23496	0.20527	0.20593	0.2107	0.21004	0.20986	0.19575	0.19884
	(0.04737)***	(0.04647)***	(0.04609)***	(0.04726)***	(0.04667)***	(0.04742)***	(0.04910)***	(0.04930)***	(0.05046)***	(0.05031)***
Size	−0.00425	−0.00423	−0.00493	−0.00326	−0.00309	−0.0029	−0.00286	−0.00303	−0.00017	−0.00031
	(0.00843)	(0.00839)	(0.00832)	(0.00866)	(0.00855)	(0.00825)	(0.00829)	(0.00842)	(0.00844)	(0.00836)
Leverage	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	−0.00004	−0.00004
	(0.00037)	(0.00038)	(0.00037)	(0.00038)	(0.00038)	(0.00038)	(0.00038)	(0.00038)	(0.00011)	(0.00011)
Salesgrowth	−0.00002	−0.00002	−0.00001	−0.00001	−0.00002	0.00001	0.00002	0.00001	0.00002	−0.00001
	(0.00014)	(0.00014)	(0.00014)	(0.00014)	(0.00014)	(0.00014)	(0.00015)	(0.00015)	(0.00015)	(0.00014)
ROA	0.33799	0.33767	0.33365	0.32453	0.32422	0.32035	0.32013	0.31871	0.32389	0.32591
	(0.33202)	(0.33187)	(0.32742)	(0.32393)	(0.32312)	(0.32005)	(0.32016)	(0.31925)	(0.32488)	(0.32539)
Div_Int	0.02967	0.02667	0.0613	0.05874	0.05895	0.05875	0.05868	0.05815	0.05236	0.05242
	(0.04818)	(0.04878)	(0.05800)	(0.05754)	(0.05789)	(0.05752)	(0.05751)	(0.05883)	(0.05935)	(0.05930)
Div_Ind	0.00402	0.00758	0.00162	0.00075	0.00109	0.00153	0.00155	0.002	0.00153	0.00136
	(0.02472)	(0.02450)	(0.02899)	(0.02842)	(0.02847)	(0.02852)	(0.02853)	(0.02899)	(0.02857)	(0.02864)
Dividends	0.05269	0.05232	0.05455	0.05642	0.05559	0.0523	0.05219	0.05185	0.04972	0.04985
	(0.02799)*	(0.02807)*	(0.02779)**	(0.02837)**	(0.02833)**	(0.02829)*	(0.02836)*	(0.02895)*	(0.02903)*	(0.02896)*
Insiders	0.00151	0.00145	0.00157	0.00202	0.002	0.00202	0.00202	0.00189	0.00213	0.00214
	(0.00134)	(0.00134)	(0.00135)	(0.00142)	(0.00142)	(0.00141)	(0.00141)	(0.00142)	(0.00142)	(0.00141)
InsidersSq	−0.00003	−0.00003	−0.00003	−0.00003	−0.00003	−0.00003	−0.00003	−0.00003	−0.00003	−0.00003
	(0.00002)*	(0.00002)	(0.00002)*	(0.00002)**	(0.00002)*	(0.00002)*	(0.00002)*	(0.00002)*	(0.00002)**	(0.00002)**
Life	−0.0437	−0.04505	−0.04756	−0.04434	−0.04844	−0.0483	−0.0483	−0.04914	−0.04817	−0.04798
	(0.03186)	(0.03180)	(0.03097)	(0.03231)	(0.03311)	(0.03301)	(0.03301)	(0.03366)	(0.03329)	(0.03329)
Beta	0.01134	0.01105	0.00964	0.00757	0.00799	0.00682	0.00698	0.00774	0.00908	0.0105
	(0.02386)	(0.02409)	(0.02322)	(0.02469)	(0.02458)	(0.02450)	(0.02418)	(0.02579)	(0.02609)	(0.02609)
Constant	1.0389	1.03934	1.04638	1.03675	1.03624	1.03615	1.03585	1.03802	1.01404	1.0137
	(0.07413)***	(0.07410)***	(0.07462)***	(0.07575)***	(0.07541)***	(0.07415)***	(0.07411)***	(0.07597)***	(0.07623)***	(0.07571)***
Observations	701	701	701	701	701	701	701	691	687	687

Notes: In Panel A, the dependent variable is *ERM*. In Panel B, the dependent variable is *Q*. All variables are defined in Table 1. Year dummies are included in each regression. Standard errors are adjusted for firm-level clustering and appear in brackets below each coefficient estimate. ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

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Hoyt (2003)— *Size* and *Leverage*. ERM2—ERM10 iteratively add other hypothesized determinants of ERM use. In Panel A, we report the ERM results plus the coefficient of *ERM* in the Q equation. In Panel B, we report the results of the Q equation for each of the ERM specifications. Our results are robust to all of these alternative specifications of the ERM determinants equation.

Robustness: Alternative Specifications of the Q Equation

Table 7 tests the robustness of the ERM premium to various specifications of the Q equation, holding the determinants equation constant at the most comprehensive specification (ERM10). Our first specification (Q1) includes three variables that commonly appear as control variables in Q models—*Size*, *Leverage*, and *ROA* (e.g., Allen and Rai, 1996; Allayannis and Weston, 2001; Anderson, Duru, and Reeb, 2009). We then successively add other control variables that are often used in Tobin's Q models. In the next specification, Q2, we add *Salesgrowth*, a measure of firm growth opportunities. The third specification, Q3, adds an industrial diversification indicator (*Div_Ind*). Q4 adds a geographic diversification indicator (*Div_Int*). Q5 adds an indicator of whether the firm paid dividends (*Dividends*). Q6 adds insider ownership variables (*Insiders, InsidersSq*). Q7 adds *Beta* and Q8 adds an industry sector variable (*Life*). Our results are robust to all of these alternative specifications of the Q equation.[21]

CONCLUSION AND RECOMMENDATIONS FOR FUTURE RESEARCH

Our study provides initial evidence on the value relevance of ERM for insurance companies. One of the major challenges facing researchers is how to identify firms that engage in ERM. Absent explicit disclosure of ERM implementation, we perform a detailed search of financial reports, newswires, and other media for evidence of ERM use. An indicator variable is used to classify firms as ERM users beginning with the first year in which evidence of ERM activity exists. We use a maximum-likelihood treatment effects model to jointly estimate the determinants of ERM, and the relation between ERM and firm value. By focusing on publicly traded insurers we are able to calculate Tobin's Q, a standard proxy for firm value, for each insurer in our sample. We then model Tobin's Q as a function of ERM use and a range of other determinants. We find a positive relation between firm value and the use of ERM for a variety of alternative specifications of our treatments effects model. The ERM premium is statistically and economically significant. To our knowledge, ours is one of the first studies to document the value relevance of ERM.

Our analysis provides a starting point for additional research into ERM in the insurance industry. The vast majority of extant research takes the form of surveys. These studies are valuable as a source of descriptive information regarding ERM use but do not answer the fundamental question of whether ERM enhances shareholder wealth. Our study addresses this question using a well-established methodology and, except for our ERM proxy, data that are readily available to most researchers. Limitations of our analysis include the relatively small sample size and our inability to measure the intensity of ERM usage. These factors may reduce the extent to which our results

[21] In other unreported robustness tests, we estimate our model as an instrumental variables panel model with firm fixed effects and find that our results are robust to the inclusion of firm fixed effects.

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TABLE 7
Sensitivity of *ERM* Premium to Alternative Specifications of the *Q* Equation

	Q1	*Q2*	*Q3*	*Q4*	*Q5*	*Q6*	*Q7*	*Q8*
ERM	0.21773	0.21791	0.21762	0.21906	0.2121	0.20719	0.20493	0.19884
	(0.05143)***	(0.05170)***	(0.05242)***	(0.05255)***	(0.05153)***	(0.04971)***	(0.04964)***	(0.05031)***
Size	0.00202	0.00202	0.00182	0.00022	−0.00455	−0.00212	−0.00232	−0.00031
	(0.00721)	(0.00721)	(0.00704)	(0.00785)	(0.00779)	(0.00775)	(0.00776)	(0.00836)
Leverage	−0.00005	−0.00005	−0.00005	−0.00005	−0.00001	−0.00002	−0.00004	−0.00004
	(0.00011)	(0.00011)	(0.00011)	(0.00011)	(0.00010)	(0.00010)	(0.00011)	(0.00011)
ROA	0.3304	0.33105	0.32918	0.3329	0.31116	0.31205	0.33611	0.32591
	(0.32509)	(0.32614)	(0.32695)	(0.32822)	(0.31736)	(0.31442)	(0.33250)	(0.32539)
Salesgrowth		−0.00001	−0.00001	−0.00001	0.00002	−0.00001	0.00001	−0.00001
		(0.00016)	(0.00016)	(0.00016)	(0.00014)	(0.00014)	(0.00014)	(0.00014)
Div_Ind			0.00823	0.00664	0.00203	−0.00198	−0.0019	0.00136
			(0.02872)	(0.02905)	(0.02852)	(0.02875)	(0.02888)	(0.02864)
Div_Int				0.04689	0.05677	0.05064	0.04987	0.05242
				(0.05566)	(0.05660)	(0.05459)	(0.05534)	(0.05930)
Dividends					0.053	0.05	0.05256	0.04985
					(0.03009)*	(0.02923)*	(0.02963)*	(0.02896)*
Insiders						0.00218	0.0022	0.00214
						(0.00142)	(0.00142)	(0.00141)
InsidersSq						−0.00003	−0.00003	−0.00003
						(0.00002)**	(0.00002)**	(0.00002)**
Beta							0.01552	0.0105
							(0.02663)	(0.02609)
Life								−0.04798
								(0.03329)
Constant	1.03025	1.03036	1.03007	1.0437	1.04795	1.02602	1.01553	1.0137
	(0.05848)***	(0.05857)***	(0.05860)***	(0.06543)***	(0.06612)***	(0.07071)***	(0.07323)***	(0.07571)***
Observations	690	690	690	690	690	690	687	687
Clusters/firms	118	118	118	118	118	118	117	117
Log pseudolikelihood	104.89	104.9	105.03	106.09	110.76	116.07	117.63	120.81
Wald test of indep eq	10.95***	10.68***	10.62***	10.98***	10.80***	10.12***	9.74***	8.33***

Notes: The dependent variable is *Q*. The *ERM* determinants equation is held constant at the most comprehensive specification (*ERM10*). All variables are defined in Table 1. Year dummies are included in each regression. Standard errors are adjusted for firm-level clustering and appear in brackets below each coefficient estimate.
***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

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may be generalized. Accordingly, additional research using larger samples and more refined ERM measures would represent an important contribution to the emerging literature on ERM. Another promising area for future research is the identification of specific ways in which ERM contributes to firm value.

APPENDIX: EXAMPLES OF ERM SEARCH "HITS"

Example 1— Successful Hit

"The Company also has begun to use Enterprise Risk Management ("ERM") in evaluating its risk. This involves reviewing its consolidated and interdependent credit risk, market or funding risk, currency risk, interest rate risk, operational risk, and legal risk across all of its businesses, and the development of risk-adjusted return on capital models where the measure of capital is based on economic stress capital."

Example 2— Successful Hit

"Through Enterprise Risk Management initiatives, we have identified and managed three separate risk categories that we believe could impair our Company's ability to grow profitably. Those major risk categories include:

(1) Underwriting Risk: Failure to grow earned premium and earn a GAAP 96 Combined Ratio;

(2) Investment Risk: Failure to maintain a liquid diversified investment portfolio.

(3) Financing Risk: Failure to maintain flexibility and earn the cost of equity capital.

We believe that the best way to maximize shareholder value is consistently to achieve our financial objectives by actively managing identifiable risks."

Example 3— Successful Hit

"... the Audit Committee is responsible for reviewing the Company's risk management processes in a general manner and for oversight of enterprise risk as defined by the Committee of Sponsoring Organizations (COSO) ..."

Example 4— NOT a Successful Hit

"Structured financial and alternative risk transfer products cover complex financial risks, including property, casualty and mortality insurance and reinsurance, and business enterprise risk management products."

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