The Value of Enterprise Risk Management: Evidence from the U.S. Insurance Industry

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Abstract

Enterprise risk management (ERM) has been the topic of increased media attention in recent years. Many organizations have implemented ERM programs; consulting firms have established specialized ERM units; and universities have developed ERM-related courses and research centers. Despite the heightened interest in ERM by academics and practitioners, there is an absence of empirical evidence regarding the impact of such programs on firm value. 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 use a maximum-likelihood treatment effects framework to simultaneously model the determinants of ERM and the effect of ERM on firm value. In our ERM-choice regression we find ERM usage to be positively related to firm size and institutional ownership, and negatively related to reinsurance use and leverage. By focusing on publicly traded insurers we are able to 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 is statistically and economically significant and approximately 17 percent of firm value.

1. 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, 2006). More broadly, ERM is said to promote increased risk awareness, which 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, for example, 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. While 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 Lexis-Nexis 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

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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."

[3] An exception is the recent event-study of chief risk officer appointment announcements by Beasley, Pagach and Warr (2006).

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.

2. Determinants of Traditional Risk Management Activities

While 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: (i) the costs associated with conflicts of interest between owners and managers[4] and between shareholders and bondholders;[5] (ii) expected bankruptcy costs; (iii) the firm's tax burden; and (iv) the costs of regulatory scrutiny.[6] A number of studies have found general support for these theoretical predictions (see Mayers and Smith, 1990; Ashby and Diacon, 1998; Hoyt and Khang, 2000).

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, 1985; Campbell and Kracaw, 1987; 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).

3. Why ERM Adds Value to the Firm

Profit-maximizing firms should consider implementing an ERM program only if it increases expected shareholder wealth. While 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. 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 are able to better understand the aggregate risk inherent in different business activities. This provides them with a more objective basis for resource allocation, thus improving capital efficiency and return on equity. Organizations with a

[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.

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).

While individual risk management activities may reduce earnings volatility by reducing the probability of catastrophic losses, there are potential interdependencies 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, while individual risk management activities can reduce earnings volatility from a specific source (hazard risk, interest rate risk, etc.), an ERM strategy reduces volatility by preventing aggregation of risk across different sources. A further 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 enables these financially opaque firms to better inform outsiders of their risk profile and also serves 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. Most recently, in February 2006, A.M. Best released a special report describing its increased focus on ERM in the rating process.

4. 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. While 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 (2005), one considered interest rate and FX risk management by financial institutions; five considered interest rate and FX risk management by industrial corporations; one considered commodity price risk management by commodity users; and three considered commodity price risk management by commodity producers. While this series of prior studies has considered these specific types of hedging activity, no prior study has considered the value-relevance of a firm's overall or enterprise-wide risk management practices. While many of these prior studies have found 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?

5. 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. 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.[7] 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 to 2005. This sample is comprised 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 enterprise risk management, we perform a detailed search of financial reports, newswires and other media for evidence of ERM activity.[8] 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 enterprise risk management (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."[9] All potential "hits" were reviewed in reverse date order in order to locate the single, earliest evidence of ERM activity for each firm. The earliest evidence of ERM activity is in late 1999 and all of the remaining hits occur between 2000 and 2005.[10]

Based on the concentration of ERM activity between 2000 and 2005, we apply the sample selection criteria summarized in Table 1. First, we limit our data collection to the six-year period from 2000 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

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[7] 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).

[8] 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.

[9] Please see Appendix I for examples.

[10] Our results are not overly sensitive to the time period chosen. We performed our full analysis on the seven-year period 1999-2005, as well as the four-year period 2002-2005. Our key results are similar to those reported.

identify the distribution of each firm's income across various business segments and exclude firms that are not primarily involved in the insurance industry. Consistent with Zhang, Cox and Van Ness (2005), 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 and firms with only one year of sales data. 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 125 firms, or 549 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.

TABLE 1
Sample Selection

Action	Observations	Firms	Data Souce
Initial Sample	1598	275	Merged CRSP/Compustat
Search for ERM use	1598	275	Factiva, Thomson, Edgar
1. Delete if year < 2000 and missing sales, assets, or equity	1000	218	Merged CRSP/Compustat
2. Delete American Depository Receipts	955	208	Merged CRSP/Compustat
3. Delete where insurance segment sales < 50% ot total	863	187	Compustat Segment Database
4. Delete where ownership data are missing or invalid	781	160	Compact Disclosure SEC
5. Delete where one-year sales growth data are missing	747	159	
6. Merge with statutory return data	549	125	NAIC Infopro Database
Final Sample	549	125	

[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.

FIGURE 1
Cumulative Number of Sample Insurers Engaged in ERM

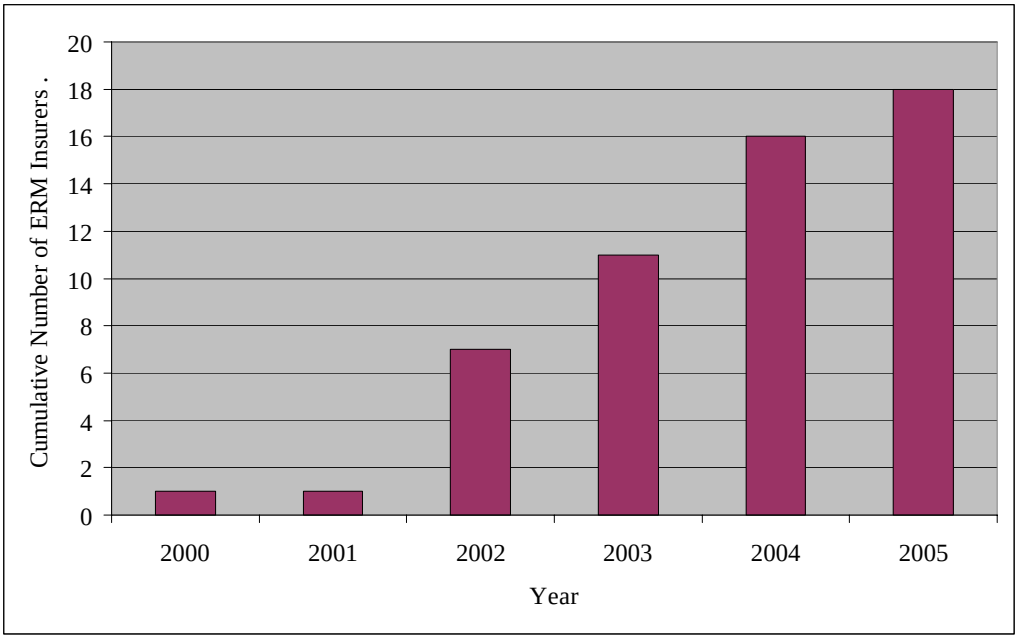

Table 2 summarizes the frequency with which various key words, or phrases, yielded the first evidence of an ERM program. It is evident from Table 2 that most of the evidence suggesting ERM engagement is related to the existence of a chief risk officer. Of the 24 unique "hits" for ERM, 15 were for the keyword "chief risk officer" (or "CRO"). Of these 15 CRO-related "hits," eight were announcements of CRO appointments. These announcements generally indicate the implementation of an ERM program. For the remaining seven CRO "hits," as well as the nine non-CRO "hits," we do not have any indication of the date when the ERM program was implemented or adopted. Accordingly, we are unable to use a time-series approach in our empirical analysis. We are, however, able to distinguish between insurers that engaged in ERM at some point during a given period, and those that did not. In the empirical analysis that follows, we use a dummy variable, "ERM," to indicate whether an insurer engaged in ERM (ERM=1) or did not engage in ERM (ERM=0) at any point during the period 2000-2005.

TABLE 2
ERM Activity by Market Segment (2000-2005)

SIC Code	Segment Name	# firms with identifiable ERM activity	# firms where ERM activity is existence of CRO*	# firms in sample	% firms with identifiable ERM activity
6311	Life	7	5 (1)	25	28%
6321	Accident & Health	1	0	10	10%
6331	Fire, Marine, and Casualty	11	7 (5)	73	15%
6351	Surety	5	3 (2)	15	33%
6361	Title	0	0	2	0%
Total		24	15 (8)	125	19%

* Number of cases where the appointment date of the chief risk officer is known appears in parentheses.

The primary objective of our empirical analysis is to estimate the relation between ERM and firm value. One approach to this analysis is to simply model firm value 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 firm value. 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 firm value in a two-equation system.[12] This technique is the maximum likelihood analog of the Heckman "two-step" selection correction model. We prefer the maximum-likelihood method of estimating the system to the two-step method because it enables the adjustment of standard errors for firm-level clustering.[13] Given that we have up to six repeated observations per firm it is important to adjust standard errors for clustering to avoid underestimating the standard errors of our coefficient estimates.

In the first equation, we model the choice to engage in ERM. Our ERM engagement model sheds light on some of the determinants of ERM activity among insurance firms. Equation (1) is as follows:

$$\textit{ERM Engagement} = f(\textit{Size, Institutional Ownership, Diversification, Industry, etc.}) \qquad (1)$$

The dependent variable is a dummy variable equal to one for firms that exhibited evidence of ERM engagement during the period 2000 to 2005, and zero otherwise. Survey evidence suggests that larger firms are more likely to engage in ERM because they are more complex, face a wider array of risks, have the institutional size to support the administrative cost of an ERM program, etc. (see, for example: Colquitt, Hoyt and Lee, 1999; Hoyt et al., 2001; Beasley et al., 2005; and Standard and Poor's, 2005). We use the natural log of the *book value of assets* as a proxy for firm size.

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).

[12] For a different finance application of the maximum-likelihood treatment effects model, see Ljungqvist, Jenkinson and Wilhelm (2003).
[13] See Peterson (2006) for a discussion of the importance of adjusting for firm-level clustering.

Regulatory pressure is likely to have a similar impact on all competitors within a given industry while 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 are 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.

According to Standard and Poor's (2005), insurers that are relatively more complex are likely to benefit more from the adoption of ERM programs. While 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 diversification status. The *industrial diversification dummy* takes on a value of one for firms with income from non-insurance operating segments, and zero otherwise. The *international diversification dummy* takes on a value of one for firms with geographic segments outside of the United States, and zero otherwise. Both 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.[14] *Intra-industry diversification*, calculated as the complement of the Herfindahl index of premiums written across all lines of business, further captures firm complexity.

We include a dummy variable equal to one for firms that are primarily life insurers (SIC Code 6311), and zero otherwise, to account for potential differences in the likelihood of ERM engagement across sectors of the insurance industry. Finally, *book-value of assets/book-value of liabilities* reflects the effect of capital structure on ERM-engagement, and *reinsurance use* (calculated as reinsurance ceded/direct premiums written plus reinsurance assumed) relates the ERM-decision to the extent to which an insurer reduces underwriting risk via reinsurance contracts.

$$\textit{Firm Value} = f\,(\textit{ERM engagement} \mid \textit{other value determinants}) \qquad (2)$$

In the second equation of the treatment effects framework, firm value is modeled as a function of ERM and other value-determinants. Consistent with the general practice in the corporate finance literature, we use the natural logarithm of *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 (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).

[14] Additionally, internationally diversified firms that operate in the UK 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 et al (2005) find that US-based firms are less likely to be in advanced stage of ERM than are their international counterparts.

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. Cummins et al. (2006) 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 non-financial firms. In our context, Tobin's Q is particularly useful as a value measure because it is a prospective performance measure. Unlike historical accounting performance measures such as ROA or ROE, 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.

To isolate the relationship between market value and ERM we need to control for other factors that could influence firm value. *Size:* There is some evidence that large firms are more likely to have ERM programs in place (Colquitt et al., 1999; Liebenberg and Hoyt, 2003; Beasley et al., 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 which 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.

Profitability: 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.

Industrial diversification: 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 Sayrak, 2003).[15] To control for the effect of industrial diversification on firm value, we use a dummy variable equal to one for firms that report sales in SIC codes greater than 6399 or less than 6311

[15] We are aware of the 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; and Villalonga, 2004).

on the Compustat Segment Files. We expect a negative relation between industrial diversification and Tobin's Q.

International diversification: 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. While some studies have found a discount (e.g., Denis, Denis and Yost, 2002), others have found a premium (e.g., Bodnar, Tang and Weintrop, 1999). International diversification is measured using a dummy variable set equal to one for firms with non-zero foreign sales, and zero otherwise. Foreign sales are defined as sales outside of the United States and are calculated using Compustat segment data.

Dividend policy: Following Allayannis and Weston (2001) and Lang and Stulz (1994) we include in our model a dividend payment indicator, equal to one 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.

Insider ownership: 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, but negatively related to the square of the percentage of insider ownership. Data for insider ownership are from Compact Disclosure SEC.

Growth opportunities: 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 (one-year) sales growth as a proxy for future growth opportunities.

The correlation matrix of Tobin's Q, ERM and their determinants appears in Table 3. The general lack of high correlation coefficients between the independent variables that are used in the second equation of the treatment effects regression suggests that multicollinearity should not be a problem in our regression analysis.[16]

[16] Since the first-stage probit regression is primarily useful as a prediction model we are less concerned about multicollinearity issues in this model. We further investigate whether multicollinearity is an issue in our second-stage OLS model by inspecting variance inflation factors in our regression diagnostics. The general rule is that multicollinearity may be a problem if variance inflation factors exceed 10 (Belsley, Kuh and Welsch, 1980). Our highest variance inflation factor of 1.4 confirms that multicollinearity is not a problem in our sample.

TABLE 3
Sample Pearson Correlation Coefficients (N=549)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Tobin's Q	1.000												
(2) ERM	0.164												
	0.000												
(3) ln(Book Value of Assets)	0.152	0.559											
	0.000	<.0001											
(4) BV Liabilities/BV Equity	-0.118	-0.054	-0.047										
	0.005	0.208	0.272										
(5) Return on Assets	0.115	0.052	0.131	-0.172									
	0.007	0.223	0.002	<.0001									
(6) International Diversification Dummy	0.097	0.213	0.299	-0.019	-0.007								
	0.023	<.0001	<.0001	0.663	0.877								
(7) Industrial Diversification Dummy	0.074	0.082	0.144	-0.095	0.060	0.153							
	0.082	0.055	0.001	0.027	0.164	0.000							
(8) Dividend Dummy	0.196	0.309	0.415	-0.229	0.143	0.025	0.100						
	<.0001	<.0001	<.0001	<.0001	0.001	0.565	0.019						
(9) Insider Ownership	-0.033	-0.277	-0.316	-0.027	-0.024	-0.075	-0.013	-0.135					
	0.435	<.0001	<.0001	0.535	0.580	0.080	0.768	0.002					
(10) Institutional Ownership	0.224	0.485	0.573	-0.180	0.096	0.072	0.005	0.297	-0.362				
	<.0001	<.0001	<.0001	<.0001	0.024	0.094	0.913	<.0001	<.0001				
(11) One-year sales growth	0.066	-0.002	0.009	-0.192	0.142	0.004	0.001	-0.013	0.010	0.023			
	0.121	0.966	0.841	<.0001	0.001	0.934	0.977	0.756	0.819	0.597			
(12) Life Insurer Dummy	-0.144	0.063	0.215	0.087	-0.019	0.167	0.102	0.064	-0.110	-0.088	-0.070		
	0.001	0.142	<.0001	0.041	0.663	<.0001	0.017	0.135	0.010	0.040	0.103		
(13) Reinsurance Use	-0.051	-0.116	-0.092	0.177	-0.108	0.058	0.046	-0.160	0.019	-0.048	0.080	-0.030	
	0.232	0.006	0.031	<.0001	0.011	0.177	0.285	0.000	0.664	0.259	0.062	0.486	
(14) Intra-Industry diversification	-0.107	0.047	0.217	-0.009	0.044	0.076	-0.150	0.218	0.084	-0.028	0.053	-0.085	-0.151
	0.012	0.273	<.0001	0.835	0.303	0.075	0.000	<.0001	0.050	0.519	0.215	0.046	0.000

Note: P-values correspond to the correlation coefficient immediately above. Tobin's Q is used as a proxy for firm value and is calculated as (market vale of equity + book value of liabilities) / (book value of assets). ERM is a dummy variable equal to one for firms that engage in enterprise risk management, zero otherwise. ERM classification is based on a search of SEC filings, annual reports, newswires and other media. Return on Assets is equal to net income/total assets. Foreign Sales is defined as sales outside of North America. Industrial Diversification Dummy is equal to one for firms with positive sales in non-insurance SIC codes (>6399, <6311). Dividend Dummy is equal to one for firms that pay dividends, zero otherwise. Life Insurer Dummy is equal to one if the insurer writes more than 50 percent of premiums in life insurance, zero otherwise. Reinsurance usage is calculated as reinsurance ceded / (direct premiums written plus reinsurance assumed). Intra-Industry diversification is 1 minus the Herfindahl index of premiums written across all lines of insurance. Accounting and market data are from the Compustat Industrial and Compustat Segments databases. Statutory insurance data are from the NAIC Infopro database.accounting and market data are from the Compustat Industrial and Compustat Segments databases.

6. Results

Table 4 reports summary statistics for the overall sample as well as differences in the means and medians of key variables between insurers with an identifiable ERM program (ERM=1) and those without (ERM=0). Three 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 6 percent higher than other insurers. Second, ERM users are systematically different from non-users. Specifically, in terms of their financial characteristics, ERM users are larger, more internationally and industrially diversified and less capital-constrained than non-users. Furthermore, in terms of ownership, they tend to have higher

levels of institutional and insider ownership than non-users. Finally, they are more prevalent in the life insurance industry than in the property-casualty insurance industry.

TABLE 4
Summary Statistics and Univariate Differences (2000-2005)

Variable	All Insurers		ERM=1		ERM=0		Difference			
	Mean	Median	Mean	Median	Mean	Median	Mean		Median	
ERM	0.202	0.000								
Book Value of Assets	27,947	3,610	93,487	34,114	11,338	2,023	82,150	***	32,092	***
Book Value of Liabilities	24,506	2,378	83,402	27,255	9,581	1,558	73,822	***	25,697	***
Market Value of Equity	6,156	817	19,813	8,141	2,695	505	17,118	***	7,635	***
Tobin's Q	1.085	1.039	1.138	1.075	1.072	1.023	0.066	***	0.052	***
BV Liabilities/MV Equity	6.654	3.050	5.170	3.002	7.030	3.077	-1.860	**	-0.075	
Return on Assets	1.3%	1.5%	2.4%	1.4%	1.0%	1.5%	1.4%	**	-0.1%	
International Diversification	0.087	0.000	0.207	0.000	0.057	0.000	0.150	***	0.000	***
Industrial Diversification	0.295	0.000	0.369	0.000	0.276	0.000	0.093	*	0.000	*
Dividend Dummy	0.714	1.000	0.991	1.000	0.644	1.000	0.347	***	0.000	***
Institutional Ownership	50%	49%	79%	81%	43%	41%	36%	***	40%	***
Insider Ownership	14%	40%	2%	1%	17%	6%	-15%	***	-6%	***
One-Year Sales Growth	13.933	9.528	13.831	9.917	13.959	9.516	-0.128		0.401	
Life Insurer Dummy	0.186	0.000	0.234	0.000	0.174	0.000	0.061		0.000	*
Reinsurance Use	0.171	0.124	0.131	0.123	0.181	0.124	-0.051	***	0.000	
Intra-Industry Diversification	0.609	0.675	0.633	0.755	0.603	0.648	0.031		0.107	*
Number of Firm-Year Observations	549		111		438					

Note. All values are in millions of dollars. Tobin's Q is used as a proxy for firm value and is calculated as (market vale of equity + book value of liabilities) / (book value of assets). ERM is a dummy variable equal to one for firms that engage in enterprise risk management, zero otherwise. ERM classification is based on a search of SEC filings, annual reports, newswires, and other media. Return on Assets is equal to net income/total assets. Foreign Sales is defined as sales outside of North America. Industrial Diversification Dummy is equal to one for firms with positive sales in non-insurance SIC codes (>6399, <6311). Dividend Dummy is equal to one for firms that pay dividends, zero otherwise. Life Insurer Dummy is equal to one if the insurer writes more than 50 percent of premiums in life insurance, zero otherwise. Reinsurance use is calculated as reinsurance ceded / (direct premiums written plus reinsurance assumed). Intra-Industry Diversification is 1 minus the Herfindahl index of premiums written across all lines of insurance. Accounting and market data are from the Compustat Industrial and Compustat Segments databases. 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 non-parametric Wilcoxon rank sum test.

Table 5 reports the results of the ERM-decision model. Consistent with survey evidence, larger firms are more likely to engage in ERM than are smaller firms. The positive coefficient on institutional ownership supports the contention that pressure from institutional owners is an

important determinant of ERM adoption. International diversification, industrial diversification and life insurance dummy are significant only when firm size is omitted from the regression. Thus, while these factors appear to be significant in classifying between ERM-users and non-users they are likely reflecting the tendency for larger insurers to be more diversified and for life insurers to be larger than non-life insurers. Leverage and reinsurance use are both negatively related to ERM-engagement.

TABLE 5
Full Maximum-Likelihood Treatment Effects Estimates: ERM Determinants

Dependent Variable: ERM		
Intercept	-4.344	***
	(0.889)	
Institutional Ownership	0.020	***
	(0.005)	
ln(Book Value of Assets)	0.337	***
	(0.095)	
Industrial Diversification Dummy	-0.123	
	(0.299)	
International Diversification Dummy	-0.275	
	(0.400)	
Life Insurance Dummy	0.403	
	(0.247)	
BV Liabilities/BV Equity	-0.092	**
	(0.041)	
Intra-industry diversification	-0.405	
	(0.328)	
Reinsurance Use	-3.708	**
	(1.502)	

Note: The dependent variable is ERM. ERM is a dummy variable equal to one for firms that engage in enterprise risk management, zero otherwise. ERM classification is based on a search of SEC filings, annual reports, newswires and other media. International Diversification Dummy is equal to one for firms with sales in segments outside of the United States. Industrial Diversification Dummy is equal to one for firms with positive sales in non-insurance SIC codes (>6399, <6311). Life Insurer Dummy is equal to one for firms that write the majority of their premium income in the life insurance industry. Intra-industry diversification is 1 minus the Herfindahl index of premiums written across all lines of business. Reinsurance use is calculated as reinsurance ceded / (reinsurance assumed + direct premiums written). Accounting and market data are from the Compustat Industrial and Compustat Segments databases. Ownership data are from Compact Disclosure SEC. Insurer statutory data are from the NAIC Infopro database. Standard errors are adjusted for firm-level clustering, and appear in parentheses. ***, ** and * denote statistical significance at the 1, 5 and 10 percent levels respectively.

Estimation results of the value-determinants equation are reported in Table 6. Most importantly, the coefficient on ERM is positive and significant. The coefficient estimate of 0.167 indicates that insurers engaged in ERM are valued 16.7 percent higher than other insurers, after controlling for other value determinants and potential endogeneity bias. Regarding our control variables, we find evidence consistent with prior research on non-financial industries of a

quadratic relation between insider ownership and firm value. We also find a positive relation between dividend payment 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.

TABLE 6
Full Maximum-Likelihood Treatment Effects Estimates: Effect of ERM on Tobin's Q

Dependent Variable: ln(Tobin's Q)		
Intercept	0.040	
	(0.058)	
ERM	0.167	***
	(0.034)	
ln(Book Value of Assets)	-0.003	
	(0.007)	
International Diversification Dummy	0.032	
	(0.047)	
Industrial Diversification Dummy	0.010	
	(0.024)	
Dividend Dummy	0.046	*
	(0.025)	
Insider Ownership	0.002	*
	(0.001)	
Insider Ownership Squared	-0.00003	**
	(0.000)	
BV Liabilities/BV Equity	0.000	
	(0.001)	
One-Year Sales Growth	0.000	
	(0.000)	
Return on Assets	0.119	
	(0.155)	
Log-pseudolikelihood	183.89	
Wald test of independent equations	8.41	***
Number of firm-year observations	549	

Note: The dependent variable is ln(Tobin's Q). Tobin's Q is used as a proxy for firm value and is calculated as (market vale of equity + book value of liabilities) / (book value of assets). ERM is estimated in the model reported in Table 5. International Diversification Dummy is equal to one for firms with sales in segments outside of the United States. Industrial Diversification Dummy is equal to one for firms with positive sales in non-insurance SIC codes (>6399, <6311). Dividend Dummy is equal to one for firms that pay dividends, zero otherwise. Return on Assets is equal to net income/total assets. Accounting and market data are from the Compustat Industrial and Compustat Segments databases. Ownership data are from Compact Disclosure SEC. All regressions include year dummies. Standard errors are adjusted for firm-level clustering, and appear in parentheses. ***, ** and * denotes statistical significance at the 1, 5 and 10 percent levels respectively.

7. Conclusion and Recommendations for Future Research

Our study provides some 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 distinguish between ERM users and non-users. We use a maximum-likelihood treatment effects model to jointly estimate the determinants of ERM, and the relation between ERM and firm value. In our ERM-choice model we find ERM usage to be positively related to firm size and institutional ownership, and negatively related to financial leverage and reinsurance use. 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. The ERM premium is statistically and economically significant and approximately 17 percent of firm value. 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. We recommend that future researchers extend our study by applying a similar methodology to other industries and by finding more robust measures of ERM use.

Our proxy for ERM implementation could be refined with the use of surveys that might indicate the extent of ERM use, as well as the length of time that an ERM program has been in place. Further, an ERM measure that identifies the time at which ERM was implemented would allow for an *ex post* analysis of the effects of ERM on organizations. A weakness of our measure is that we are unable to identify the point in time when ERM was implemented and thus cannot perform a before-and-after comparison. However, to the extent that we are able to distinguish between firms that engage in ERM and those that do not, we are able to provide some evidence on the relation between ERM and firm value.

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Appendix I

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"

"… 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 3—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."