Enterprise Risk Management and the Cost of Capital

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Abstract

Enterprise Risk Management (ERM) is a process that manages all risks in an integrated, holistic fashion by controlling and coordinating offsetting risks across the enterprise. This research investigates whether the adoption of the ERM approach affects firms' cost of equity capital. We restrict our analysis to the U.S. insurance industry to control for unobservable differences in business models and risk exposures across industries. We simultaneously model firms' adoption of ERM and the effect of ERM on the cost of capital. We find that ERM adoption significantly reduces firm's cost of capital. Our results suggest that cost of capital benefits are one answer to the question how ERM can create value.

JEL classification: G22; G23; G30; G31; G32

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Introduction

Enterprise Risk Management (ERM) is a holistic approach to risk management. Traditionally, corporations managed risks arising from their business units separately in each unit. ERM improves on this traditional "silo" based approach by coordinating and controlling offsetting risks across the enterprise. A number of surveys document how firms implement ERM programs to achieve such synergies between different risk management activities (see, e.g., Colquitt, Hoyt, and Lee, 1999; Kleffner, Lee and McGannon, 2003; Beasley, Clune and Hermanson, 2005; Altuntas, Berry-Stölzle, and Hoyt, 2011), a number of studies on firms' decision to start an ERM program provide evidence that firms adopt ERM for direct economic benefits (see, e.g., Liebenberg and Hoyt, 2003; Pagach and Warr, 2011), and a limited number of studies provide evidence that ERM is associated with improvements in firm performance and increases in firm value (see, e.g., Grace et al., 2010; Hoyt and Liebenberg, 2011; Eckles, Hoyt, and Miller, 2012). While this prior literature argues that ERM can create value by creating synergies between different risk management activities, increasing capital efficiency, avoiding the underinvestment problem in financially constrained firms, and by reducing the cost of external financing, there is a lack of empirical evidence supporting these claims.

The goal of our research is to shed some light on the fundamental question of *how* ERM can create value. We specifically focus on the relationship between ERM adoption and firms' cost of external financing, and investigate whether ERM adoption is negatively associated with the cost of equity capital. Such a research design allows us to evaluate whether cost of capital benefits are one mechanism for value creation by the ERM approach. In addition, such a research design provides evidence on whether stockholders of firms view ERM as a beneficial and value enhancing activity or not.

To avoid possible spurious correlations caused by unobservable differences in business models and risk exposures across industries, we restrict our analysis to a single industry. An industry that is almost tailor-made for an empirical analysis of ERM programs and their cost of capital implications: the U.S. insurance industry. The insurance industry embraced the ERM approach, and a substantial fraction of insurers adopted an ERM program, providing the necessary variation for an empirical analysis. In addition, the U.S. insurance industry is the only insurance industry worldwide with a substantial number of publicly traded stock companies, providing the necessary stock price data for cost of equity capital calculations.

Our cost of capital measure is based on the Gebhardt, Lee and Swaminathan (2001) implied cost of capital model, which equates the firm's market value of equity with its discounted future cash flow estimates, and solves for the required internal rate of return. We use an implied cost of capital measure because such measures better explain variations in expected stock returns than realized stock returns (see, e.g., Gebhardt, Lee and Swaminathan, 2001; Pástor, Sinha, and Swaminathan, 2008; Li, Ng, and Swaminathan, 2013). Following the procedure suggested by Beasly, Pagach, and Warr (2008), Hoyt and Liebenberg (2011), and Pagach and Warr (2011), we systematically search newswires and other media, as well as financial reports, for evidence of ERM program adoption by our sample insurance companies. We then use two procedures to test whether ERM adoption is actually accompanied by a decrease in firms' cost of capital. First, we use an event study methodology, and test for an abnormal reduction in the cost of capital around the year of ERM adoption. Second, we explicitly model the determinants of ERM program adoption and estimate a two-equation treatment effects model to assess the effect of ERM use on firms' cost of capital. For ERM adopters, the ERM indicator variable in this model is coded equal to one in the year of ERM adoption and all following years; the variable is equal to zero in the years prior to

ERM adoption. For firms that do not adopt ERM during our sample period, the ERM indicator is equal to zero for all firm-year observations.

In both the event study as well as the treatment effects model, we find that ERM adoption is significantly associated with a reduction in firms' cost of equity capital. Overall, our results suggest that cost of capital benefits are one answer to the question how ERM can create value.

The paper proceeds as follows. In the next section, we discuss related literature and the conceptual background of our research design. This is followed by a description of the data and methodology used, and a section containing the results. The final section concludes.

Literature and Conceptual Background

ERM Literature

The literature on ERM follows three main themes. The first strand of the literature is mainly descriptive and focuses on the question how firms implement ERM programs in practice (see, e.g., Colquitt, Hoyt, and Lee, 1999; Kleffner, Lee and McGannon, 2003; Beasley, Clune and Hermanson, 2005; Altuntas, Berry-Stölzle, and Hoyt, 2011). Kleffner, Lee, and McGannon's (2003) survey includes a question on why firms implement an ERM program; the top three reasons are the "influence of the risk managers," "encouragement from the board of directors," and "compliance with the Toronto Stock Exchange guidelines."

The second strand of the literature examines the relationship between firm-specific characteristics and the firms' decision to adopt the ERM approach. Liebenberg and Hoyt (2003) find that firms with greater financial leverage are more likely to appoint a Chief Risk Officer (CRO); they interpret their result as evidence that firms start ERM programs to reduce information asymmetries regarding the firm's risk profile. Pagach and Warr (2011) document that a firm's likelihood to adopt ERM is determined by firm size, volatility, institutional ownership, and the

CEO's risk taking incentives. For their subsample of banks, Pagach and Warr also document that banks with lower levels of Tier 1 capital are more likely to start an ERM program. Overall, Pagach and Warr's results support the notion that firms engage in ERM for direct economic benefit and not just to comply with regulation. In addition, Altuntas, Berry-Stölzle, and Hoyt (2012) point out that managerial career concerns provide incentives for managers to adopt ERM after periods of poor performance. Consistent with that view, their results document that negative changes in past firm performance increase a firm's probability to adopt ERM.

A third strand of the literature investigates the value implications of ERM adoption. Grace et al. (2010) use the detailed Tillinghast Towers Perrin ERM survey of the insurance industry, and provide evidence that ERM improves firms' operating performance. More precisely, they document that firms with ERM programs experience higher levels of cost efficiency and return on assets. The authors also find that life insurers benefit more from the development and use of economic capital models than property-casualty insurers. Hoyt and Liebenberg (2011) examine the value implications of ERM program adoption in a two-equation treatment effects model, in which the first stage equation describes firms' selection of the ERM approach. Using Tobin's Q as a proxy for firm value, they document a positive relationship between firm value and ERM adoption. Eckles, Hoyt, and Miller (2012) find that firms with ERM programs experience a reduction in stock return volatility, which becomes stronger over time. They also find that firms' operating profits per unit of risk increase after ERM adoption. To explain the positive relationship between firm performance and ERM adoption, these papers argue that ERM creates value by creating synergies between different risk management activities, increasing capital efficiency, avoiding the underinvestment problem in financially constrained firms, and by reducing the cost of capital. The goal of our paper is to examine the effect of ERM on firms' cost of capital in more detail.

ERM and its Impact on the Cost of Capital

ERM is a structured approach to managing all risks faced by the enterprise in a holistic way. Hence, one benefit of an ERM program is simply a better risk identification process. A structured approach to identify all risks faced by a firm may screen for risks outside the standard risk "silos" or business units and identify previously overlooked threats to the firm. Improved risk identification allows firms to choose the most effective tool to manage the identified risks instead of passively retaining them. In addition, ERM emphasizes the identification and management of interdependencies between different types of risks. Such an approach allows firms to coordinates risk management activities across all business units of a firm and to exploit natural hedges. Thus, ERM allows firms to avoid unforeseen accumulation of risks from different sources (e.g., fire risk, operational risk, commodity price risk, etc.). Since large unforeseen operating losses limit a firm's ability to invest in positive net present value projects, ERM helps to mitigate this underinvestment problem (Froot, Scharfstein, and Stein, 1993). Alternatively, a firm can raise external funds to address its financing constraints. Due to information asymmetries between managers and outside investors, however, external sources of funds are more expensive than internal sources (Myers and Majluf, 1984); investors assume that only firms with less advantages investment opportunities issue new capital and demand a substantial discount on the price of new shares. Therefore, firms that have to raise external funds face an increase in their cost of capital. Since ERM focuses on reducing the probability of large losses and capital shocks, we argue that ERM adoption should reduce a firm's cost of capital.[1]

In addition, ERM should decrease firms' cost of capital through reducing firms' systematic risk. While the conventional view in the literature is that risk management in general can only reduce idiosyncratic risk and not systematic risk, there is recent empirical evidence that is contrary

[1] Campbell, Dhaliwal and Schwartz (2012) use a similar argument to explain why mandatory contribution to corporate pension plans should increase firms' cost of capital. Their empirical results are consistent with this view.

to this view. Hann, Ogneva, and Ozbas (2013) examine the relationship between corporate diversification and the cost of capital; they find that diversified firms have a lower cost of capital than matched portfolios of stand-alone firms. They also document that the reduction in the cost of capital is more pronounced for firms with less correlated segment cash flows; this finding is consistent with a coinsurance effect. Hann, Ogneva, and Ozbas (2013) argue that coinsurance is associated with a reduction in the cost of capital because coinsurance can reduce systematic risk through the avoidance of countercyclical deadweight costs. When firms experience low cash flow realizations, in other words low or negative earnings, they incur certain deadweight losses. Such deadweight losses include, among others, the high cost associated with raising external capital, the loss of valuable personnel, suppliers or customers, price discounts demanded by risk sensitive customers, and the direct costs associated with financial distress. Since such deadweight losses tend to be higher during economic downturns and get further amplified through asset fire sales and rising financing costs, these deadweight losses are at least partially countercyclical and increase systematic risk. Similar to Hann, Ogneva, and Ozbas' (2013) argument that coinsurance reduces systematic risk, we argue that ERM reduces systematic risk through mitigating countercyclical deadweight costs and, hence, ERM adoption should reduce a firm's cost of capital.

An additional benefit of an ERM program is that it improves the information available to the firm about its risk profile. This information can be shared with investors, leading to an increase in transparency about the firm's future earnings distribution. Improved disclosures of risk profiles are especially important for firms with complex operations because such firms are difficult to evaluate from the outside. Thus, improved disclosures and information sharing with investors can help to mitigate information asymmetries. A recent model developed by Lambert, Leuz, and Verrecchia (2007) demonstrates how the quality of information disclosed by a firm can reduce its cost of capital. Lambert, Leuz, and Verrecchia's model is consistent with the Capital Asset Pricing

Model and incorporates multiple securities with correlated cash flows. In their model, investors' beliefs about the covariances of a firm's cash flows with the cash flows of other firms depend on the quality of information disclosed by the firm. Most importantly, this effect of information quality is not diversifiable and, hence, directly impacts the firm's cost of capital. Consistent with that view, a number of empirical studies show that less reliable accounting information is associated with a higher cost of capital (see, e.g., Franics, LaFond, Olsson, and Schipper, 2005; Francis, Khurana, and Pereira, 2005; Ashbaugh-Skaife, Collins, Kinney, and Lafond, 2009). In an alternative model based on a market microstructure framework, Easley and O'Hara (2004) also come to the conclusion that increasing the amount of reliable information available to investors reduces the cost of capital. Their model includes both informed and uninformed investors. While informed investors receive all information, uninformed investors only receive a fraction of the released information. Thus, uninformed investors demand a higher return in exchange for the information risk they face. Supporting this view, Easley, Hvidjkaer, and O'Hara (2002) use a measure of information risk from a structural microstructure model and show that information risk is a determinant of stock returns. Again, we argue that ERM improves the information available about a firm's risk profile and, hence ERM adoption should reduce a firm's cost of capital.[2]

It is important for firms to have a strong financial strength rating. Standard & Poor's as well as other rating agencies explicitly evaluate companies' ERM program as part of the rating process. Following its announcement in October 2005 that ERM would "become a separate, major category" of its analysis for insurers, Standard & Poor's declared in May 2008 that it would add an additional dimension to its "ratings process for nonfinancial companies through an ERM review."[3] In February 2006, A.M. Best, the major rating agency in the insurance industry, followed Standard

[2] Consistent with our argument, Wade, Hoyt, and Liebenberg (2013) document that ERM adoption is associated with a decrease in firms' bid-ask spread, indicating that the ERM approach increases transparency for outside investors.

[3] Standard & Poor's Rating Services published the ERM rating criteria for insurance companies and industrial firms in 2005 and 2008, respectively. The most recent updates were released in May 2013 and November 2012, respectively.

& Poor's example and released a special report describing its increased focus on ERM in the rating process. Therefore, a well-functioning ERM program positively impacts a firm's rating, which is used by outside investors as a signal of financial strength. This direct link between ERM programs and financial strength ratings creates an additional channel through which ERM adoption should lead to a lower cost of capital. In summary, we can state the following testable hypothesis for ERM adopting firms:

Hypothesis**:** *ERM adoption reduces firms' cost of equity capital.*

Data and Methodology

Sample

Our initial sample includes all publicly traded insurance companies in the merged CRSP/Compustat database for the years 1996 to 2012. We identify insurance companies based on the Standard Industrial Classification System (SIC) codes and keep all firms with SIC codes between 6311 and 6399. This initial sample consists of 371 unique firms. Our first screen excludes American Depository Receipts and firms with missing Compustat data for sales, assets, or equity. Following Zhang, Cox, and Van Ness (2009), we calculate the fraction of firms' sales revenue from insurance operations based on the Compustat Segment database and exclude firms with less than 50% of their sales in insurance. Next, we remove firms with insufficient stock return data from the CRSP monthly stock database. We then match the sample firms to the I/B/E/S database and eliminate firms that do not have analyst earnings forecasts in I/B/E/S; as explained in more detail below, we need analyst earnings forecasts to calculate firms' implied cost of capital. This first set of screens reduces our sample to 250 firms, or 1587 firm-year observations. We then classify all firms in the sample as ERM adopters or non-adopters using the method outlined in the next section. The resulting sample is the sample we used for our event study. Thus, we will refer to this sample as the event study sample throughout the paper.

Our regression analysis includes a number of additional insurance specific control variables. We merge the firms in the sample with statutory accounting data filed with the National Association of Insurance Commissioners (NAIC), and we drop firms for which neither a property and casualty, a life, nor a health statement is available. We also eliminate firms for which a statement is available, but reported net premiums written are zero or negative. Note that we aggregate statutory statements filed for individual subsidiaries of an insurance group to the group level, controlling for double counting of intragroup shareholdings. Our final sample for the regression analysis consists of 132 firms, or 761 firm-year observations.

ERM Adoption Indicator

We follow the previous ERM literature and use a four-step procedure to classify firms as ERM adopter or non-adopters (see, e.g., Hoyt and Liebenberg, 2011; Pagach and Warr, 2011; Eckles, Hoyt, and Miller, 2012). In the first step, we conduct a comprehensive search of newswires and other news media for statements about an ERM program; the search includes Factiva, LexisNexis, Google, and other search engines. In the second step, we search firms' financial reports, filings with the U.S. Securities and Exchange Commission (SEC), and data libraries including Thomson One and Mergent Online. Our search strings consist of ERM-related key phrases and their abbreviations in conjunction with the individual firm names. The key phrases used in the search include "enterprise risk management," "chief risk officer," "risk committee," "strategic risk management," "consolidated risk management," "holistic risk management," and "integrated risk management" in different variations. In the third step, we manually review each search result to determine whether it is a true hit and the firm actually adopts an ERM program, or whether the search hit just mentions ERM in a different context. Such out-of-context search hits, as for example ERM product sales to clients, are ignored. Finally, we identify the earliest evidence of ERM adoption for each insurer based on the previous three steps and construct an *ERM* indicator variable. To be consistent with our cost of capital measure described in the next section, we code the *ERM* indicator for the current year equal to one if a firm adopts ERM between July 1st of the previous year and June 30th of the current year. The *ERM* indicator is set to zero for years prior to ERM adoption, and set to one for all years after ERM adoption. Our event study sample consists of 112 firms that have adopted ERM by the end of 2012, and 138 firms that have not. Our regression sample includes 89 firms that have adopted ERM by 2012, and 43 firms that have not. Figure 1 shows the cumulative number of sample firms with an ERM program over time. The black bars represent the number of ERM adopters in the event study sample, and the grey bars show the number of adopters in the regression sample.

Implied Cost of Equity Capital Measure

The cost of equity capital is the rate of return required by the shareholders of a company on their investment. To measure that required or expected rate of return, we use the Gebhardt, Lee and Swaminathan (2001) implied cost of capital model because implied cost of capital measures better explain variations in expected stock returns than realized stock returns (see, e.g., Gebhardt, Lee and Swaminathan, 2001; Pástor, Sinha, and Swaminathan, 2008; Li, Ng, and Swaminathan, 2013).[4]

[4] Another relatively crude measure of *ex ante* expected returns used in the literature is the average of *ex post* realized returns (see, e.g., Cummins and Rubio-Misas, 2006). However, that approach has been widely criticized for producing very noisy estimates of expected returns (see, e.g., Blume and Friend, 1973; Sharpe, 1978; Froot and Frankel, 1989; Elton, 1999). Elton (1999), for example, shows that average realized returns can diverge substantially from expected returns over lengthy periods of time. Alternatively, expected returns can be estimated using asset pricing models such as the CAPM and the Fama and French (1993) three-factor model (FF3). However, cost of capital estimates based on asset pricing models are still based on realized returns, and Fama and French (1997) show that such estimates are imprecise and have huge standard errors. In their study, Fama and French (1997) use the CPAM and the FF3 to estimate the cost of capital for 48 different industries, excluding the financial services sector. There are also two recent studies using an asset pricing model based approach to investigate the cost of capital specifically for the insurance industry. Cummins and Phillips (2005) estimate the cost of equity for property-liability insurance companies using the CAPM and FF3 models, and then further decompose companies' overall cost of capital by line of business using the full-information industry beta (FIB) method. Their results show that the cost of equity estimates based on the FF3 model are substantially higher than cost of capital estimates based on the CAPM, and that cost of capital estimates vary

The model is derived from the dividend discount model and basically equates the firm's market value of equity with its discounted future cash flow estimates. Solving for the discount rate that balances the equation gives the implied cost of capital. The following paragraphs briefly summarize the model; we refer to Gebhardt, Lee, and Swaminathan (2001) for further details.

The dividend discount model describes the price per share of common stock P_t at the end of year t as

$$P_t = \sum_{i=1}^{\infty} \frac{E_t(D_{t+i})}{(1+r_{icc})^i} \quad (1)$$

where $E_t(D_{t+i})$ = expected future dividends per share for period $t+i$, conditional on the information available at time t, and

r_{icc} = cost of equity capital at time t.

Assuming "clean surplus" accounting that requires all gains and losses affecting firms' book value to be included in earnings, the book value B_t at the end of year t can be expressed as the book value at the end of the previous year plus earnings minus dividends, i.e. $B_t = B_{t-1} + NI_t - D_t$. Using that relationship, Equation (1) can be rewritten in a way such that the price per share of common stock is expressed in terms of standard accounting numbers:

$$P_t = B_t + \sum_{i=1}^{\infty} \frac{E_t[(ROE_{t+i} - r_{icc})B_{t+i-1}]}{(1+r_{icc})^i} \quad (2)$$

where B_t = book value per share at the end of period t,

NI_{t+i} = net income per share for period $t+i$, and

ROE_{t+i} = after-tax return on book equity for period $t+i$.

significantly across lines of business. Wen et al. (2008) compare the estimates of property-liability insurers' cost of capital based on the CAPM with estimates from the Rubinstein-Leland (RL) model. Their major finding is that the estimates based on the RL model are significantly higher than CAPM estimates for insurers with asymmetric return distributions and for small insurers. Thus, Wen et al. argue that insurers with asymmetric return distributions and small insurers should use the RL model to estimate their cost of capital

Equation (2) is based on an infinite series. Gebhardt, Lee, and Swaminathan (2001) then slice that infinite series into three parts for practical purposes. For the first three years, explicit earnings forecasts of financial analysts from the I/B/E/S database are used. From year t+4 to year t+12, earnings are implicitly forecasted by mean reverting the third period ROE to the twelfth period ROE which is assumed to be the industry median ROE. Note that we treat the life insurance industry and the non-life insurance industry as separate industries in this context.[5, 6] The simple linear interpolation between the year t+3 ROE and the industry median ROE is used for the mean reversion process. For year t+12 and beyond, the value is estimated by calculating year 12's present value of the residual income as a perpetuity. Such a modeling approach assumes that firms cannot sustain earnings above the industry mean in a competitive market, and that abnormally high earnings will return to the industry median in the long run.[7] The exact specification of the model is as follows:

$$P_t = B_t + \frac{FROE_{t+1} - r_{icc}}{(1+r_{icc})} B_t + \frac{FROE_{t+2} - r_{icc}}{(1+r_{icc})^2} B_{t+1} + TV_t, \qquad (3)$$

where the terminal value TV is defined as

$$TV_t = \sum_{i=3}^{T-1} \frac{FROE_{t+i} - r_{icc}}{(1+r_{icc})^i} B_{t+i-1} + \frac{FROE_{t+T} - r_{icc}}{r_{icc}(1+r_{icc})^{T-1}} B_{t+T-1},$$

and $FEPS_{t+i}$ = forecasted earnings per share for year $t + i$. More precisely, $FEPS_1$ and $FEPS_2$ are equal to the one- and two-year-ahead consensus earnings per share (EPS) forecasts, $FEPS_3$ is equal to the three-year-ahead consensus EPS

[5] Following Gebhardt, Lee, and Swaminathan (2001), loss firms are excluded when calculating the industry median ROE.

[6] The classification of life versus non-life insurers is based on NAICS codes. We classify insurers with NAICS code of 524113 as life insurers and all others as non-life insurers.

[7] The 12 year time period after which firms earnings return to the industry median is chosen arbitrarily by Gebhardt, Lee, and Swaminathan (2001). However, they also present robustness checks and conclude that the "results are very similar" if a 6, 9, 15, 18, or 21 year time period is used.

forecast when available, and $FEPS_2 \cdot (1 + LTG)$ when not available, and LTG is the long-term growth EPS forecast,

$FROE_{t+i}$ = forecasted return on equity (ROE) for period $t + i$. For years one through three, this variable is equal to $FEPS_{t+i} / B_{t+i-1}$. Beyond year three, $FROE_{t+i}$ is the linear interpolation between $FROE_{t+3}$ and the industry median ROE for the prior 5 years (excluding loss firm-years) on a rolling window basis,

$B_{t+i} = B_{t+i-1} + FEPS_{t+i} \cdot (1 - k)$,

k = current dividend payout ratio, which is the ratio of the actual dividends from the most recent fiscal year divided by earnings over the same time period for firms with positive earnings, or divided by 0.06*total assets for firms with negative earnings, and

T = forecast horizon, $T = 12$.

Solving Equation (3) for r_{icc} gives the implied cost of equity capital (ICC) for a specific firm and year. Consistent with the previous literature, we collect analysts' forecasts from the I/B/E/S database as of June of the following year, and we calculate the ICC as of June of that year (see, e.g., Gebhardt, Lee, and Swaminathan, 2001; Dhaliwal, Heitzman, and Li, 2006; Pástor, Sinha, and Swaminathan, 2008). Following prior studies (see, e.g., Campbell, Dhaliwal, and Schwartz, 2012), we winsorize the calculated ICC measure from above at 0.5. Figure 2 presents the annual median cost of equity capital over the 1996 through 2012 period for all insurance companies in our sample, as well as for the two subsamples of life and non-life insurers. The graph is based on ICC measures from 250 firms, or 1587 firm-year observations.

Changes in Firms' Cost of Capital around the Adoption of ERM

To test whether ERM adoption reduces firm's cost of capital, we first employ an event study methodology similar to the approach used by Lee, Mayers, and Smith (1997). We adjust for industry-wide trends in the cost of capital over time by subtracting the industry average from the ICC measure of each firm. We then test for significant changes of this industry-adjusted ICC measure in the (*t*-1) to (*t*+1) event window around the year of ERM adoption.

More precisely, we compute the industry-adjusted change in firm *i*'s implied cost of capital in the event window as

$$\Delta AdjICC_i = AdjICC_{i,t+1} - AdjICC_{i,t-1}, \tag{4}$$

where $AdjICC_{i,t} = ICC_{i,t} - IndustryAverage_{i,t}$ represents firm *i*'s industry-adjusted cost of capital, $ICC_{i,t}$ denotes firm *i*'s firm-specific cost of capital, and $IndustryAverage_{i,t}$ is the average cost of capital across all sample firms in the industry. Note that we use three alternative ways to calculate the $IndustryAverage_{i,t}$. First, we use the entire insurance industry to calculate the industry average cost of capital for each year. Second, we distinguish between life insurers and non-life insurers based on the North American Industry Classification System (NAICS) and calculate the industry average separately for life insurers (NAICS code of 524113) and non-life insurers.[8] Third, we distinguish between five sectors defined by NAICS codes and calculate separate industry average cost of capitals for them; we classify the NAICS code of 524113 as the life insurance sector, 524114 as the health insurance sector, 524126 and 524128 as the property-casualty sector, 524127 as the title insurance sector, and 524130 as the reinsurance sector. Finally, we use the *t*-test and the Wilcoxon signed-ranks test to analyze whether the industry-adjusted change in firms' cost of

[8] Following the standard in the literature (see, e.g., Fama and French, 1997; Wen et al., 2008; Hoyt and Liebenberg, 2011), we use the SIC codes to define the insurance industry when pulling data from Compustat, CRSP, and I/B/E/S. However, the Compustat Segment database on corporate sales is based on NAICS codes. Thus, we use NAICS codes to define different segments or sectors *within* the insurance industry.

capital around the adoption of an ERM program as defined in Equation (4) differs significantly from zero.

Regression Model

Model Specification and Econometric Considerations

Our second test of ERM's impact on firms' cost of equity capital is based on a regression model. We follow the prior literature and model the cost of capital as a function of firm-specific characteristics (see, e.g., Botosan and Plumlee, 2005; Hail and Leuz, 2006; Dhaliwal, Heitzman, and Li, 2006; Pástor, Sinha, and Swaminathan, 2008; Campbell, Dhaliwal, and Schwartz, 2012; Hann, Ogneva, and Ozbas, 2013); we then extend this baseline model to include the ERM adoption indicator. Since firms self-select to implement an ERM program and some of the factors affecting the selection decision may also impact the firms' cost of capital, we use a two-equation maximum-likelihood treatment effects model that jointly estimates firms' decision to adopt an ERM program and the effect of that decision (or treatment) on the firms' cost of capital. We adjust standard errors for clustering at the firm level. The specification of the model is as follows:

$$ICC_{i,t+1} = X_{it}\beta + \delta ERM_{it} + \varepsilon_{it}, \tag{5}$$

where ICC_{it} is firm *i*'s implied cost of equity capital in year *t*, ERM_{it} is an indicator variable coded equal to 1 if firm *i* has adopted an ERM program in year *t*, 0 otherwise, X_{it} is a vector of control variables, and ε_{it} is the error term. A firm's choice to adopt an ERM program is then modeled as the outcome of an unobservable latent variable ERM_{it}^{*} which is a linear function of firm characteristics:

$$ERM_{it}^{*} = \omega_{it}\gamma + u_{it}, \tag{6}$$

where ω_{it} is a vector of firm characteristics, and u_{it} is the error term. Assuming that the decision to adopt ERM is observed if and only if the latent variable is positive, and assuming that the two error terms are bivariate normal with mean zero and a specific covariance matrix, then the two equations can be estimated with the maximum-likelihood method; see Maddala (1983) for details. The following sections discuss the firm specific variables included as explanatory variables in Equations (5) and (6).

Variables Included in the Cost of Capital Equation

Our selection of explanatory variables for the firms' cost of capital model (Equation (5)) is based on the previous literature (see, e.g., Gebhardt, Lee, and Swaminathan, 2001; Campbell, Dhaliwal, and Schwartz, 2012; Hann, Ogneva, and Ozbas, 2013). The CAPM suggests a positive link between a stock's market beta and the corresponding firm's cost of equity capital and, hence, we include beta as an explanatory variable in our model. We estimate each firm's beta based on the market model using the value-weighted CRSP (NYSE/AMEX) index and a minimum of twenty-four monthly returns over the prior sixty months.

We expect firm size to be inversely related to the cost of capital because information on larger firms is more readily available than information on smaller firms. Consistent with this view there is substantial empirical evidence on a negative relationship between firms' size and cost of capital (see, e.g., Gebhardt, Lee, and Swaminathan, 2001; Hou, van Dijk, and Zhang, 2012). We use the natural logarithm of the book value of assets to measure firm size.

Modigliani and Miller (1958) theorize that a firm's cost of equity, unlike its average cost of capital, is positively associated with the debt proportion in its capital structure, or in other words with the firm's leverage. Fama and French (1992) empirically demonstrate that the *ex post* mean stock returns are an increasing function of firms' leverage. More recently, a number of studies also document a positive relation between implied cost of equity capital measures and leverage (see, e.g., Dhaliwal, Heitzman, and Li, 2006). To capture differences in leverage across firms, we include a measure of leverage in our model. The *Leverage* variable is calculated as the ratio of the total book value of liabilities to the market value of equity.

We include the ratio of book to market value of equity in the model to controls for differences in growth opportunities across firms. Prior research (see, e.g., Fama and French, 1992, 1993; Berk, Green, and Naik, 1999; Petkova and Zhang, 2005) points out that stocks with a high book to market ratio, indicating relatively low growth opportunities, have relatively high systematic risk and time-varying risk, resulting in a high risk premium. Consistent with that view, a number of empirical studies (see, e.g., Fama and French, 1992, 1993; Dhaliwal, Krull, Li, and Moser, 2005) provide evidence of a positive link between the book to market ratio and cost of capital. Thus, we expect a positive sign for the *BooktoMkt* variable. Following Campbell, Dhaliwal, and Schwartz (2012) we include firms' mean long-term growth forecasts from I/B/E/S as an additional control variable for growth opportunities in our model.

Forecasts from different analysts provide different views on a firm's earnings prospects. The dispersion of forecasts reflects analysts' uncertainty about the firm's expected earnings and, hence, can be interpreted as a measure of information asymmetry between managers and outside analysts and investors (Madden, 1998; Botosan and Plumlee, 2005; Zhang, 2006). We include the standard measure of analysts' forecast dispersion in our model; *Foredispers* is calculated as the natural logarithm of the standard deviation of analyst earnings forecasts for the next year divided by the consensus earnings estimate for the same period.

DeAngelo, DeAngelo, and Stulz (2006) provide evidence that a firm's dividend policy is related to its life cycle; more mature firms are more likely to pay dividends. Baker and Wurgler (2004) on the other hand argue that firms' dividend policy caters to time-varying investor demand for dividend payers; firms pay dividends when investors put higher prices on payers. Hence, dividend payments should be relevant to share prices and firms' cost of capital, but in different directions at different times. To control for any effect of dividend payments on firms' cost of capital, we include the *Dividend* indicator variable in our model. This indicator is coded equal to 1 if a firm pays a dividend in year *t*, 0 otherwise.

In addition, we control for differences in the cost of equity capital across the life, health, and property-casualty sectors of the insurance industry, by including the mean for each sector as a control variable in the model. Firms with an NAICS code of 524113 are classified as life insurers, firms with an NAICS code of 524114 as health insurers, and firms with an NAICS code of 524126, 524127, 524128, or 524130 as property-casualty insurers, respectively. Finally, we include year dummies in the model to control for variations in the cost of capital over time.

Variables Included in the ERM Equation

Our selection of explanatory variables for the ERM model (Equation (6)) is also based on the previous literature (see, e.g., Hoyt and Liebenberg, 2011; Pagach and Warr, 2011). A substantial number of studies find evidence that ERM adoption is more likely among larger firms (see, e.g., Colquitt, Hoyt, and Lee, 1999; Hoyt, Merkley, and Thiessen, 2001; Beasley, Clune, and Hermanson, 2005; Standard & Poor's, 2005). Explanations for the positive relationship between firm size and ERM adoption include the arguments that larger firms are more complex and face a wider spectrum of heterogeneous risks and may, hence, benefit more from a holistic approach towards risk identification, and that larger firms can spread the fixed costs of running an ERM program over multiple business units. To control for differences in size across firms, we include the natural logarithm of the firms' book value of assets in our model.

Liebenberg and Hoyt (2003) argue that firms with greater financial leverage should benefit more from reducing earnings volatility by managing their risks in an enterprise wide fashion, and their empirical results support that view. On the other hand, the implementation of an ERM program requires a substantial initial investment, and firms with higher levels of capital or lower levels of leverage may find it easier to start a new ERM program. To capture any possible effect of leverage on firms' ERM adoption decision, our model includes the ratio of the total book value of liabilities to the market value of equity as a measure of firm leverage.

Firms with a high book-to-market ratio are usually large, established firms with substantial franchise value, whereas those with a low book-to-market ratio have most of their growth opportunities still ahead. Thus, we expect ERM implementation to be more valuable to firms with a high book-to-market ratio, since ERM adoption allows these firms to protect their franchise value. To control for differences in the book-to-market ratio across firms, we include the *BooktoMkt* variable in our model; this variable is calculated as the ratio of the book value of equity to the market value of equity.

Implementing an ERM program is a challenging task that requires substantial resources. If a company is involved in merger and acquisition (M&A) activities, it may not be able to devote additional resources to the implementation of an ERM program. Therefore, we expect a negative relationship between recent M&A activities and a firm's probability of starting an ERM program. To control for differences in M&A activities across firms, we add a *RecentM&A* measure to our model; it is calculated as the ratio of intangible assets to the book value of total assets. A merger or an acquisition usually results in a significant amount of goodwill and other intangible assets for companies (see, e.g., Caves, 1989; Dubin, 2007; Boone and Mulherin, 2008).[9] Hence, the fraction of intangible assets relative to the total assets can be interpreted as a measure of recent M&A activities.[10]

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[9] Boone and Mulherin (2008) study 308 U.S. corporate takeovers during an 11-year period, and find that the ratio of intangible assets to the total assets of the target firms averages 65% across the sample at the time of M&As.

[10] To examine whether our measure really captures M&A activities, we sort our sample firm-year observations into deciles with respect to the ratio of intangible assets to total assets. We then specifically examine the 10-K reports of the companies in the largest decile. We find strong evidence linking firms' intangible assets to their recent merger and acquisition activities. Three representative examples include Wellpoint, Inc., UnitedHealth Group, Inc., and Fidelity National Financial, Inc. Specifically, on page 32 of Wellpoint's 2008 10-K, there is the statement that "Due largely to our past mergers and acquisitions, goodwill and other intangible assets represent a substantial portion of our assets.

If an insurance company belongs to a conglomerate with firms from other industries, the board may include members without insurance specific expertise. For such a conglomerate, ERM with its focus on identifying, measuring, aggregating, and communicating risk across the entire corporation may be especially helpful to ensure that all board members, regardless of insurance specific expertise, understand the firm's risk profile. Thus, we include the indicator variable *OthIndus* in our model; this variable is coded equal to one for firms with positive sales outside the insurance industry (NAICS codes less than 524100 or greater than 524199), and zero otherwise.

Insurers' lines of business diversification may also impact the ERM adoption decision. However, the direction of this effect is unclear. On the one hand, more diversified insurers are more complex and may, hence, benefit more from an ERM program than their more focused counterparts. On the other hand, more diversified insurers should already benefit from a substantial coinsurance effect and, hence, additional expected benefits from an ERM program may be marginal and hardly worth the investment, especially if implementation cost is increasing in the number of lines an insurer writes. To capture any effect of line of business diversification on ERM adoption, we include the *Divers* variable in our model. This variable is calculated as one minus the Herfindahl index of net premiums written across all 47 P/C, life and health insurance lines.[11]

Goodwill and other intangible assets were approximately $22.3 billion as of December 31, 2008, representing approximately 46% of our total assets and 104% of our consolidated shareholders' equity at December 31, 2008. If we make additional acquisitions it is likely that we will record additional intangible assets on our consolidated balance sheets." On page 40 of UnitedHealth Group's 2005 10-K form, there is the statement that "Due largely to our recent acquisitions, goodwill and other intangible assets represent a substantial portion of our assets. Goodwill and other intangible assets were approximately $18.2 billion as of December 31, 2005, representing approximately 44% of our total assets. If we make additional acquisitions it is likely that we will record additional intangible assets on our books." On page 27 of Fidelity National Financial's 2001 10-K form there is the following statement: "We have made acquisitions in the past that resulted in recording a significant amount of goodwill. As of December 31, 2001, cost in excess of net assets acquired, net, was $808.6 million, of which $762.3 million relates to goodwill recorded in connection with the Chicago Title merger in 2000."

[11] The by line Herfindahl index is calculated across 47 business lines. For P/C insurance business, we collect the Net Premiums Written (NPW) by line from the Underwriting and Investment Exhibit (Part 1B – Premiums Written) in the NAIC annual statements. Note that we aggregate some lines as follows: Fire and Allied lines is calculated as the sum of "Fire" and "Allied lines;" Accident and Health is calculated as the sum of "Group Accident and Health," "Credit Accident and Health," and "Other Accident and Health;" Medical Malpractice is calculated as the sum of "Medical Malpractice–Occurrence" and "Medical Malpractice–Claims Made;" Products Liability is calculated as the sum of

We include three indicator variables in the model to control for the potential heterogeneity in the likelihood of ERM adoption across the three insurance industry sectors. The three indicators *PCPrem, LifePrem,* and *HlthPrem* are coded equal to one if firms have positive net premiums written in the P/C, life, or health insurance segments respectively, and zero otherwise. We expect P/C insurers to be more likely to adopt ERM because the models used to aggregate risks within an ERM framework are closely related to those models employed in the actuarial pricing of P/C insurance contracts (Wang and Faber, 2006), reducing the cost of ERM adoption for P/C insurance companies.[12]

Given the common goal of reducing income volatility, reinsurance and ERM may act as substitutes (see, e.g., Cole and McCullough, 2006). If the volatility is effectively controlled by reinsurance use, the additional benefits from an ERM program may be minimal, resulting in a decreased likelihood of ERM adoption. To control for differences in reinsurance use across insurers, we include the *Reinsuse* variable in the model. This variable is calculated as the ratio of

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"Products Liability–Occurrence" and "Products Liability–Claims Made;" Auto is calculated as the sum of "Private Passenger Auto Liability," "Commercial Auto Liability," and "Auto Physical Damage;" Reinsurance is calculated as the sum of "Nonproportional Assumed Property," "Nonproportional Assumed Liability," and "Nonproportional Assumed Financial Lines." The resulting 25 P/C lines used to calculated the Herfindahl index are Accident and Health, Aircraft, Auto, Boiler and Machinery, Burglary and Theft, Commercial Multi-Peril, Credit, Earthquake, Farmowners, Financial Guaranty, Fidelity, Fire and Allied lines, Homeowners, Inland Marine, International, Medical Malpractice, Mortgage Guaranty, Ocean Marine, Other, Other Liability, Products Liability, Reinsurance, Surety, Workers' Compensation, and Warranty. For life insurance business, we collect the NPW by line from the Exhibit -1 Part 1 – Premiums and Annuity Considerations for Life and Accident and Health Contracts in the NAIC annual statements. The 10 life insurance lines used in the calculation of the Herfindahl index are Industrial Life, Ordinary Life Insurance, Ordinary Individual Annuities, Credit Life (Group and Individual), Group Life Insurance, Group Annuities, Group Accident and Health, Credit Accident and Health (Group and Individual), Other Accident and Health, and Aggregate of All Other Lines of Life Business. For health insurance business, we collect the NPW by line from the Underwriting and Investment Exhibit (Part 1 – Premiums) in the NAIC annual statements. The 12 health insurance lines unsed in the calculation of the Herfindahl index are Comprehensive (Hospital and Medical), Dental Only, Disability & Long-Term Care & Stop Loss and Other, Disability Income, Federal Employee Health Benefits Plan, Long-Term Care, Medicare Supplement, Other Health, Stop Loss, Title XIX Medicaid, Title XVIII Medicare, and Vision Only.

[12] In addition, there is more guidance for P/C insurers how to implement an ERM program. In May 2013 Standard & Poor's published an ERM rating criteria guide for insurers. The ERM rating guidelines are very detailed for P/C insurers, less so for health insurers and life insurers.

reinsurance ceded to direct premiums written plus reinsurance assumed (see, e.g., Cummins, Phillips, and Smith, 2001; Berry-Stölzle et al., 2012).[13]

Pagach and Warr (2011) argue that financial slack may be correlated with ERM adoption. If a firm's risk management program focuses on reducing the probability of bankruptcy the firm may hold additional funds *and* adopt an ERM program to achieve its goal. To capture the effect of slack on ERM adoption, we include the fraction of cash and marketable securities to total assets in our model.

ERM adoption should also be correlated with firms' earnings volatility (see, e.g., Liebenberg and Hoyt, 2003; Hoyt and Liebenberg, 2011; Pagach and Warr, 2011). One of the goals of an ERM program is to stabilize earnings. Therefore, firms with more volatile earnings can benefit more from adopting ERM and should be more likely to actually start an ERM program. To control for differences in earnings volatility across firms, we include the *CV(EBIT)* variable in our model. This variable is calculated as the coefficient of variation of the quarterly earnings before interest and taxes (EBIT) for the previous three years.

Altuntas, Berry-Stölzle, and Hoyt (2012) argue that managerial career concerns about keeping their job influences the decision to adopt ERM. An ERM program reduces the volatility of earnings and, hence, improves the informativeness of earnings as a signal of the CEO's ability. In a career concern model it is optimal for a CEO with high initial reputation to only adopt ERM after a period of poor performance. Consistent with that view, Altuntas, Berry-Stölzle, and Hoyt (2012) document a positive relation between firms' likelihood to adopt ERM and adverse changes in past performance for a sample of German insurance companies. We include firms' 1-year percentage

[13] More precisely, given the inclusion of the P/C, life, and health insurance sectors, the numerator of *Reinsuse* is calculated as the sum of reinsurance ceded by life subsidiaries, by health subsidiaries, and to non-affiliates by P/C subsidiaries; the denominator is computed as the sum of total direct premiums written by P/C, life, and health subsidiaries, and total reinsurance assumed by life subsidiaries, by health subsidiaries, and from non-affiliates by P/C subsidiaries.

change in market value in our model to capture any effect of changes in past performance on ERM adoption.[14]

Lastly, we include year dummies in the *ERM* equation to control for time variation in firms' probability to implement an ERM programs. Table 1 summarizes the definitions of all variables.

Results

Changes in Firms' Cost of Capital around the Adoption of ERM

To examine whether ERM adoption leads to a significant decrease in firms' implied cost of capital, we apply two methodologies. First, we use an event study approach similar to Lee, Mayers, and Smith (1997), adjust the firm-specific ICC measure for the industry-wide time trend, and test for significant changes of the adjusted measure around the adoption of ERM programs. Table 2 presents the results from t-tests and Wilcoxon signed-ranks tests of the null hypotheses that the mean and median of the change in the industry-adjusted implied cost of capital as defined in Equation (4) are zero. There are three versions of the test presented in Table 2. The baseline test uses the entire sample of insurance companies to calculate the industry adjustment, test version two uses different industry adjustments for life insurers and non-life insurers, and test version three distinguishes between five sectors within the insurance industry when calculating the industry adjustments. In all three versions of the test, the mean and median of the changes in the industry-adjusted implied cost of capital are negative and significantly different from zero at the five percent level. Overall these results indicate that ERM adoption leads to a reduction in firms' cost of capital. The average reduction in firm's cost of capital one year after ERM adoption ranges from 1.054 to 1.272 percentage points.

Treatment Effects Model

[14] Firms' market value is calculated as the product of the year-end closing stock price and the number of shares outstanding.

The second methodology used to examine whether ERM adoption reduces firms' cost of capital is the multivariate treatment effects model. We use additional insurance specific control variables to estimate that model. Table 3 presents the descriptive statistics for all variables used in the treatment effects regression. The average implied cost of capital across our sample is 12.824% and the median cost of capital is 12.191%. Noteworthy is also that we have a more recent sample that includes substantially more ERM firms than previous studies; over 47% of the firm-year observations in our sample are from firms with an ERM program.[15]

Table 4 reports differences in the means and medians of the variables across ERM adoption status. ERM adopters differ substantially from non-adopters. Contrary to our hypothesis, ERM adopters have, on average, a higher implied cost of capital than non-adopters. However, when interpreting this result, it is import to keep in mind that a univariate analysis does not control for other factors that may also affect firms' cost of capital. On average, ERM adopters tend to have a larger market beta, higher leverage, and a higher book-to-market ratio, and more ERM adopters than non-adopters pay dividends. All these characteristics may also contribute to a higher cost of capital. To control for those firm-level characteristics, a multivariate analysis is needed.

Table 5 presents the results of the maximum-likelihood treatment effects model that simultaneously estimates Equations (5) and (6). The estimation results for Equation (5), which models firms' implied cost of capital as a function of the ERM adoption indicator and other firm-specific control variables, are reported in the first column. Most importantly, the coefficient of the *ERM* indicator is negative and significant at the 1% level. This negative coefficient indicates that firms with an ERM program have on average a 1.8% lower cost of capital than firms without an ERM program, after controlling for other firm-level determinants of the cost of capital as well as firms' self-selection of an ERM program. Consistent with the theoretical predictions, a number of

[15] In Hoyt and Liebenberg's (2011) sample, for example, ERM users account for only 8.5% of the firm-year observations.

our control variables are also significantly related to firms' cost of capital. The coefficient of the *Beta* variable is positive and significant, indicating that firms' with larger systematic risk face a higher cost of capital. The coefficient of the *Size* variable is negative and significant, indicating that larger firms have a lower cost of capital than smaller firms. We find a positive relationship between the *Leverage* variable and firms' cost of capital, supporting Modigliani and Miller's (1958) prediction. The *BooktoMkt* variable is positively associated with firms' cost of capital, consistent with the notion that firms with a high book to market ratio are relatively mature firms with relatively low growth opportunities and, hence, high systematic risk. Consistent with models under asymmetric information, firms with a greater dispersion in analyst forecasts seem to have a significantly higher cost of capital. The Wald test for independent equations rejects the null hypothesis that the error terms of the two equations are uncorrelated and, hence, justifies a joint estimation. The fact that a number of firm characteristics are significantly related to firms' ERM adoption decision further supports a two-equation model. More precisely, the results of the ERM equation provide evidence that *Size*, *Leverage*, *RecentM&A*, *OthIndust*, *Divers*, *PCPrem*, *LifePrem* and *HlthPrem* are significantly associated with firms' use of ERM.

Robustness: Survival Dataset

The use of binary choice models for studying the determinants of ERM adoption has been criticized in the literature (see, e.g., Pagach and Warr, 2011). The estimation of a logit or probit model assumes that all the observations of a firm are independent and that the firm makes a separate ERM adoption decision every year, or in other words that the firm can switch back and forth between having and not having an ERM program every year. However, starting an ERM program requires a substantial investment and firms making that initial investment commit to the ERM approach long-term. Therefore, a model of the determinants of ERM adoption should just focus on the one time decision to adopt ERM. Hazard models and dynamic binary choice models based on so-called survival datasets have such a focus on the determinants of one-time events (Shumway, 2001). The main characteristic of a survival dataset is that it includes firm-year observations of firms before a firm-specific event (e.g., ERM adoption) occurs, that it includes observations of firms in the year the event occurs, but that observations of firms after the occurrence of the event are dropped from the sample.

Since our treatment effects model specification basically uses a binary choice model for the first-stage ERM equation, it is subject to the same criticism as stand-alone models on ERM adoption. To show the robustness of our results, we therefore create a survival dataset by removing firm-year observations of ERM adopting firms in the years after ERM adoption from the sample. We then re-estimate the treatment effects model with this survival dataset. The downside of such an approach is a further reduction in sample size and, hence, statistical power. The survival dataset consists of 100 firms, or 449 firm-year observations.

Table 6 reports the results of the treatment effects model with the survival dataset. The coefficients and signs are very similar to those in the full sample. Most importantly, we still find the significantly negative relation between *ICC* and the *ERM* indicator. The difference in the cost of capital between ERM users and non-users is 2.712 percentage points and, hence, slightly larger than the estimate in the full sample (1.834 percent points).

Robustness: Alternative Specifications of the ERM Equation

Table 7 shows the results for different specifications of the *ERM* equation, while holding the specification of the *ICC* equation constant. The first specification of the *ERM* equation presented in Table 7 only includes the identifying variables from the baseline model (see Table 5), namely *RecentM&A*, *PCPrem*, *LifePrem*, and *HlthPrem*. The other specifications stepwise add the remaining *ERM* determinant. Note that specifications with fewer explanatory variables have a slightly larger sample size. The most important result for the purpose of our study is that the coefficient of the *ERM* indicator variable is negative and significant in all ten regressions, indicating that the negative relationship between ERM adoption and a firm's cost of capital is robust to alternative specifications of the ERM equation.

Robustness: Alternative Specifications of the ICC Equation

We also conduct a robustness check with eight alternative specifications of the *ICC* equation, leaving the *ERM* equation unchanged. The results are reported in Table 8. The first *ICC* equation specification only includes the *size* variable in addition to the ERM indicator. We then iteratively add additional control variable. Again, the negative relationship between ERM adoption and a firm's cost of capital is robust to all of these alternative specifications.

Conclusion

ERM is a process that manages all risks faced by the firm in an integrated, holistic fashion. It has been argued that the resulting synergies between the different risk management activities, the focus on maintaining the probability of large negative cash flows within acceptable limits, and the improved transparency about the firm's risk profile lead to a reduction in the firm's cost of external financing, which increases firm value. To provide the first empirical support for this argument, our research directly examines the relationship between ERM adoption and firms' cost of equity capital.

Our analysis is based on the sample of publicly traded U.S. insurance companies; focusing on just one industry avoids possible spurious correlations caused by unobservable differences across industries. We calculate firm's cost of capital by equating the firm's market value of equity with its discounted future cash flow estimates and solving for the required internal rate of return. We then test for an abnormal reduction in the cost of capital around the year of ERM adoption, and estimate a two-equation treatment effects model to assess the effect of ERM on firms' cost of capital. In both tests, ERM adoption is significantly associated with a reduction in firms' cost of capital. Overall, our results indicate that cost of capital benefits are one answer to the question how ERM can create firm value.

References

Altuntas, M., T. R. Berry-Stölzle, and R. E. Hoyt, 2011, Implementation of Enterprise Risk Management: Evidence from the German Property-Liability Insurance Industry, *The Geneva Papers on Risk and Insurance—Issues and Practice*, 36: 414-439.

Altuntas, M., T. R. Berry-Stölzle, and R. E. Hoyt, 2012, Dynamic Determinants of Enterprise Risk Management Adoption, Working Paper, University of Georgia.

Ashbaugh-Skaife, H., D. W. Collins, W. R. Kinney Jr., and R. Lafond, 2009, The Effect of SOX Internal Control Deficiencies on Firm Risk and Cost of Equity, *Journal of Accounting Research*, 47: 1- 43.

Baker, M., and J. Wurgler, 2004, A Catering Theory of Dividends, *Journal of Finance*, 59: 1125-1165.

Beasley, M. S., R. Clune, and D. R. Hermanson, 2005, Enterprise Risk Management: An Empirical Analysis of Factors Associated with the Extent of Implementation, *Journal of Accounting and Public Policy*, 24: 521-531.

Beasley, M. S., D. Pagach, and R. Warr, 2008, Information Conveyed in Hiring Announcements of Senior Executives Overseeing Enterprise-Wide Risk Management Processes, *Journal of Accounting, Auditing and Finance*, 23: 311-332.

Berk, J., R.C. Green, and V. Naik, 1999, Optimal Investment, Growth Options, and Security Returns, *Journal of Finance*, 54: 1553-1607.

Berry-Stölzle, T. R., A. P. Liebenberg, J. S. Ruhland, and D. W. Sommer, 2012, Determinants of Corporate Diversification: Evidence from the Property-Liability Insurance Industry, *Journal of Risk and Insurance*, 79: 381-413.

Blume, M., and I. Friend, 1973, A New Look at the Capital Asset Pricing Model, *Journal of Finance*, 28: 19-33.

Boone, A. L., and J. H. Mulherin, 2008, Do Auctions Induce a Winner's Curse? New Evidence from the Corporate Takeover Market, *Journal of Financial Economics*, 89: 1-19.

Botosan, C., and M. Plumlee, 2005, Assessing Alternative Proxies for the Expected Risk Premium, *The Accounting Review*, 80: 21-53.

Campbell, J. L., D. S. Dhaliwal, and W. C. Schwartz, 2012, Financing Constraints and the Cost of Capital: Evidence from the Funding of Corporate Pension Plans, *Review of Financial Studies*, 25: 868-912.

Caves, R. E., 1989, Mergers, Takeovers, and Economic Efficiency, *International Journal of Industrial Organization*, 7: 151-174.

Cole C. R., and K. A. McCullough, 2006, A Reexamination of the Corporate Demand for Reinsurance, *Journal of Risk and Insurance*, 73: 169-192.

Colquitt, L. L., R. E. Hoyt, and R. B. Lee, 1999, Integrated Risk Management and the Role of the Risk Manager, *Risk Management and Insurance Review*, 2: 43-61.

Cummins, J. D., and R. D. Phillips, 2005, Estimating the Cost of Equity Capital for Property-Liability Insurers, *Journal of Risk and Insurance*, 72: 441-478.

Cummins, J. D., Phillips, R. D., and Smith, S. D., 2001, Derivatives and Corporate Risk Management: Participation and Volume Decisions in the Insurance Industry, *Journal of Risk and Insurance*, 68: 51-92.

Cummins, J. D., and M. Rubio-Misas, 2006, Deregulation, Consolidation, and Efficiency: Evidence from the Spanish Insurance Industry, *Journal of Money, Credit, and Banking*, 38: 324-355.

DeAngelo, H., L. DeAngelo, and R. M. Stulz, 2006, Dividend Policy and the Earned/Contributed Capital Mix: A Test of the Life-Cycle Theory, *Journal of Financial Economics*, 81: 227-254.

Dhaliwal, D., S. Heitzman, and O. Z. Li, 2006, Taxes, Leverage, and the Cost of Equity Capital, *Journal of Accounting Research*, 44: 691-723.

Dhaliwal, D., L. Krull, O. Z. Li, and W. Moser, 2005, Dividend Taxes and Implied Cost of Equity Capital, *Journal of Accounting Research*, 675–708.

Dubin, J. A., 2007, Valuing Intangible Assets with a Nested Logit Market Share Model, *Journal of Econometrics*, 139: 285–302.

Easley, D., S. Hvidjkaer, and M. O'Hara, 2002, Is Information Risk a Determinant of Asset Returns? *Journal of Finance*, 57: 2185-2222.

Easley, D., and M. O'Hara, 2004, Information and the Cost of Capital, *Journal of Finance*, 59: 1553-1583.

Eckles, D. L., R. E. Hoyt, and S. M. Miller, 2012, The Impact of Enterprise Risk Management on the Marginal Cost of Reducing Risk: Evidence from the Insurance Industry, Working Paper, University of Georgia.

Elton, E., 1999, Expected Return, Realized Return, and Asset Pricing Tests, *Journal of Finance*, 54: 1198-1220.

Fama, E., and K. French, 1992, The Cross-Section of Expected Stock Returns, *Journal of Finance*, 47: 427-465.

Fama, E., and K. French, 1993, Common Risk Factors in the Returns on Stocks and Bonds, *Journal of Financial Economics*, 33: 3-56.

Fama, E., and K. French, 1997, Industry Costs of Equity, *Journal of Financial Economics*, 43:153-193.

Francis, J. R., I. K. Khurana, and R. Pereira, 2005, Disclosure Incentives and Effects on Cost of Capital around the World, *The Accounting Review*, 80: 1125-1162.

Francis, J., R. LaFond, P. Olsson, and K. Schipper, 2005, The Market Pricing of Accruals Quality, *Journal of Accounting and Economics*, 39: 295-327.

Froot, K., and J. Frankel, 1989, Forward Discount Bias: Is It an Exchange Risk Premium? *Quarterly Journal of Economics*, 104: 139-161.

Froot, K. A., D. S. Scharftstein, and J. C. Stein, 1993, Risk Management: Coordinating Corporate Investment and Financing Policies, *Journal of Finance*, 48: 1629-1658.

Gebhardt, W., C. Lee, and B. Swaminathan, 2001, Toward an Implied Cost of Capital, *Journal of Accounting Research*, 39: 135-76.

Grace, M. F., J. T. Leverty, R. D. Phillips, and P. Shimpi, 2010, The Value of Investing in Enterprise Risk Management, Working paper, Georgia State University.

Hail, L., and C. Leuz, 2006, International Differences in the Cost of Equity Capital: Do Legal Institutions and Securities Regulation Matter? *Journal of Accounting Research*, 44: 485-531.

Hann, R. N., M. Ogneva, and O. Ozbas, 2013, Corporate Diversification and the Cost of Capital, *Journal of Finance*, 68: 1961-1999.

Hou, K., van Dijk, M., Zhang, Y., 2012, The Implied Cost of Capital: A New Approach, *Journal of Accounting and Economics*, 53: 504–526.

Hoyt, R. E., and A. P. Liebenberg, 2011, The Value of Enterprise Risk Management, *Journal of Risk and Insurance*, 78: 795-822.

Hoyt, R. E., B. M. Merkley, and K. Thiessen, 2001, A Composite Sketch of a Chief Risk Officer, The Conference Board of Canada, Toronto, September.

Kleffner, A. E., R. B. Lee, and B. McGannon, 2003, The Effect of Corporate Governance on the Use of Enterprise Risk Management: Evidence from Canada, *Risk Management and Insurance Review*, 6: 53–73.

Lambert, R., C. Leuz, and R. Verrecchia, 2007, Accounting Information, Disclosure, and the Cost of Capital, *Journal of Accounting Research*, 45: 385-420.

Lee, S. J., D. Mayers, and C. W. Smith, 1997, Guaranty Funds and Risk-Taking: Evidence from the Insurance Industry, *Journal of Financial Economics*, 44: 3-24.

Li, Y., D. T. Ng, and B. Swaminathan, 2013, Predicting Market Returns Using Aggregate Implied Cost of Capital, *Journal of Financial Economics*, 110: 419-436.

Liebenberg, A. P., and R. E. Hoyt, 2003, Determinants of Enterprise Risk Management: Evidence From the Appointment of Chief Risk Officers, *Risk Management and Insurance Review*, 6: 37-52.

Maddala, G. S., 1983, *Limited-Dependent and Qualitative Variables in Econometrics* (Cambridge, UK: Cambridge University Press).

Madden, B. J., 1998, *CFROI Valuation: A Total System Approach to Valuing the Firm* (Chicago, IL: Holt Value Associates).

Modigliani, F., and M. Miller, 1958, The Expected Cost of Equity Capital, Corporation Finance, and the Theory of Investment, *American Economic Review*, 6: 261-297.

Myers, S. C. and N. S. Majluf, 1984, Corporate Financing and Investment Decisions when Firms Have Information that Investors Do Not Have, *Journal of Financial Economics*, 13: 187-221.

Pagach, D., and R. Warr, 2011, The Characteristics of Firms That Hire Chief Risk Officers, *Journal of Risk and Insurance*, 78: 185-211.

Pástor, L., M. Sinha, and B. Swaminathan, 2008, Estimating the Intertemporal Risk-Return Trade-off Using the Implied Cost of Capital, *Journal of Finance*, 63:2859-2897.

Petkova, R., and L. Zhang, 2005, Is Value Riskier than Growth? *Journal of Financial Economics*, 78: 187-202.

Sharpe, W., 1978, New Evidence on the Capital Asset Pricing Model: Discussion, *Journal of Finance*, 33: 917-920.

Shumway, T., 2001, Forecasting Bankruptcy More Accurately: A Simple Hazard Model, *Journal of Business*, 74: 101-24.

Standard & Poor's, 2005, Criteria | Insurance | General: Evaluating the Enterprise Risk Management Practices of Insurance Companies, October 17.

Standard & Poor's, 2008, Criteria | Corporates | General: Standard & Poor's to Apply Enterprise Risk Analysis to Corporate Ratings, May 8.

Standard & Poor's, 2012, Methodology: Management and Governance Credit Factors for Corporate Entities and Insurers, November 13.

Standard & Poor's, 2013, Criteria | Insurance | General: Enterprise Risk Management, May 7.

Wade, C., R. E. Hoyt, and A. P. Liebenberg, 2013, Does Enterprise Risk Management Increase Transparency? Working Paper, Mississippi State University.

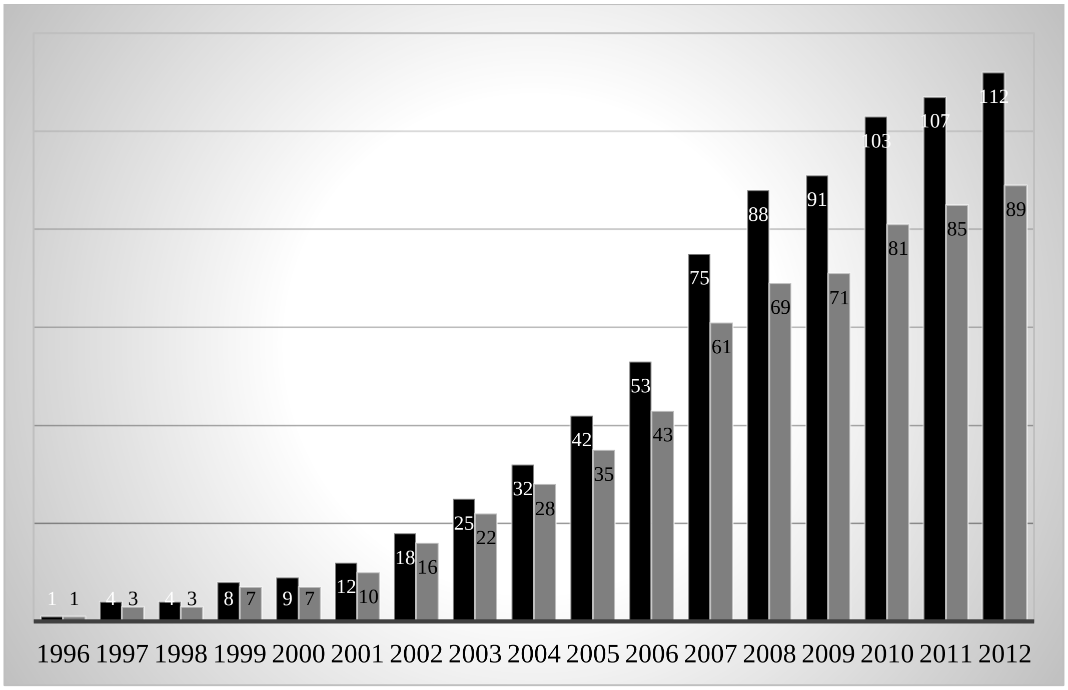
Wang, S., and R. Faber, 2006, Enterprise Risk Management for Property-Casualty Insurance Companies, Joint Sponsored research Project, Casualty Actuarial Society and Society of Actuaries.

Wen, M., A. D. Martin, G. Lai, and T. J. O'Brien, 2008, Estimating the Cost of Equity for Property-Liability Insurance Companies, *Journal of Risk and Insurance*, 75, 1: 101-124.

Zhang, T., L. A. Cox, and R. A. Van Ness, 2009, Adverse Selection and the Opaqueness of Insurers, *Journal of Risk and Insurance*, 76: 295-321.

Zhang, X. F, 2006, Information Uncertainty and Stock Returns, *Journal of Finance*, 61:105–37.

Figure 1. Cumulative Numbers of Sample Insurers Engaged in ERM by Year



Notes: Each black bar represents the cumulative number of ERM adopters in the event study sample, and each grey bar represents the cumulative number of adopters in the regression sample. We classify firms as ERM users based on a comprehensive search of SEC filings, annual reports, newswires, and other media.

Figure 2. Insurers' Median Implied Cost of Equity Capital over Time

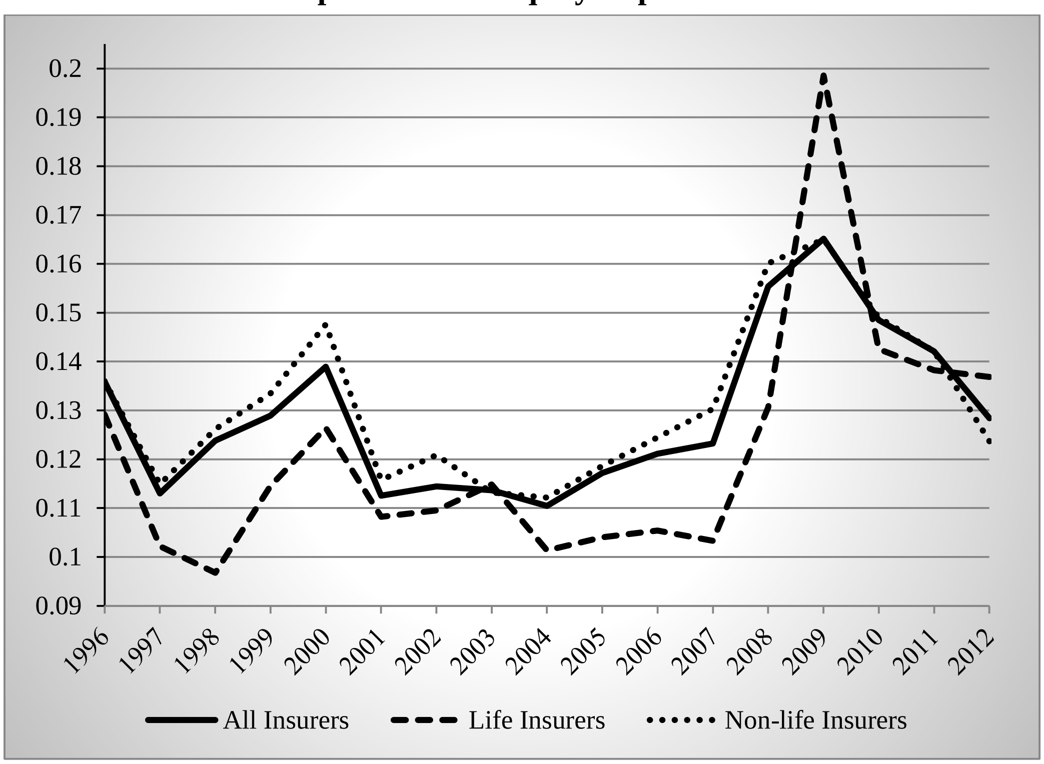


Table 1. Variable Definitions

Variable Name	Definition	Data Source
ICC	Firm's *ex ante* implied cost of equity capital calculated as in Gebhardt, Lee, and Swaminathan (2001)	I/B/E/S, Compustat, and CRSP
ERM	= 1 for firm-years > = year of first identifiable ERM activity, 0 otherwise	LexisNexis, Factiva, SEC filings, and other media
Beta	Beta estimated with the market model based on a minimum of twenty-four monthly returns over the sixty prior months, using a value-weighted market index	CRSP monthly stock files, Federal Reserve Board
Size	ln (Book value of assets)	Compustat (AT)
Leverage	Book value of liabilities / Market value of equity	Compustat ([AT − CEQ] / [PRCC × CSHO])
BooktoMkt	Book value of equity / Market value of equity	Compustat (CEQ / [PRCC × CSHO])
Foredispers	Ln (standard deviation of analysts' estimates for next period's earnings / the consensus forecast for next period's earnings)	I/B/E/S
LongGrow	Firm's mean long-term growth forecast available in I/B/E/S	I/B/E/S
Dividend	= 1 if firm paid dividends in that year, 0 otherwise	Compustat (DVC > 0)
Sector_ICC	Average implied cost of equity capital in three different insurance sectors. We classify the NAICS code of 524113 as the life sector, 524114 as the health sector, and 524126, 524127, 524128, and 524130 as the property-casualty sector.	I/B/E/S, Compustat, and CRSP
RecentM&A	Intangible assets / Book value of assets	Compustat (INTAN / AT)
OthIndus	= 1 if positive sales in noninsurance industry NAICS code (<524100 or >524199), 0 otherwise	Compustat Segment database
Divers	1 – Herfindahl index of net premiums written across the different lines of insurance	NAIC Statutory Statements for P/C, Life, and Health
PCPrem	= 1 if positve net premiums written in P/C insurance sector, 0 otherwise	NAIC Statutory Statements for P/C, Life, and Health
LifePrem	= 1 if positve net premiums written in life insurance sector, 0 otherwise	NAIC Statutory Statements for P/C, Life, and Health
HlthPrem	= 1 if positve net premiums written in health insurance sector, 0 otherwise	NAIC Statutory Statements for P/C, Life, and Health
Reinsuse	Reinsurance ceded/(direct premiums written + reinsurance assumed)	NAIC Statutory Statements for P/C, Life, and Health
Slack	Cash and short-term investments / Book value of assets	Compustat (CHE / AT)
CV(EBIT)	Coefficient of variation of quarterly earnings before interest and taxes in the past three years	Compustat (OIADPQ)
ValueChange	Firm value in year t – firm value in year $t-1$ / firm value in year $t-1$	Compustat ($PRCC_t \times CSHO_t - PRCC_{t-1} \times CSHO_{t-1}$)

Table 2. Changes in Firms' Cost of Capital around the Adoption of ERM

	Event Window	No. of Firms	Changes in *ICC*	
			Mean	*Median*
Industry Adjustment Based on Insurance Industry as a Whole	(*t* -1, *t* +1)	64	-0.01272***	-0.00692***
			(0.010)	(0.002)
Separate Industry Adjustments for Life Insurers and Non-life Insurers	(*t* -1, *t* +1)	64	-0.01221**	-0.00341***
			(0.017)	(0.009)
Separate Industry Adjustments for Five Sectors Defined by NAICS Codes	(*t* -1, *t* +1)	64	-0.01054**	-0.00516**
			(0.034)	(0.036)

Notes: The null hypotheses are that the mean and/or median of the changes in the industry-adjusted implied cost of equity capital as specified in Equation (4) are zero. Firm *i*'s industry-adjusted *ICC* is the difference between the firm's *ICC* in a particular year and the industry average *ICC* in that year. The table presents three test versions that differ with respect to the industry adjustment. The first test uses the entire insurance industry to calculate the industry average cost of capital for each year. The second test calculates the industry average separately for life insurers (NAICS code of 524113) and non-life insurers. The third test distinguishes between five sectors and calculates separate industry average cost of capitals for them: The life insurance sector (NAICS code = 524113), the health insurance sector (NAICS code = 524114), the property-casualty sector (NAICS code = 524126 or 524128), the title insurance sector (NAICS code = 524127), and the reinsurance sector (NACIS code = 524130). Changes in the industry-adjusted implied cost of equity capital are calculated by subtracting the value one year prior to ERM adoption from the value one year after ERM adoption. P-values for the difference of the mean from zero are based on a *t*-test, and p-values for the difference of the median from zero are based on the Wilcoxon signed-ranks test. P-values appear in parentheses. ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 3. Summary Statistics

	N	Mean	Std. Dev.	1st Quartile	Median	3rd Quartile
ICC	761	0.12824	0.03924	0.10526	0.12191	0.14390
ERM	761	0.47175	0.49953	0.00000	0.00000	1.00000
Beta	761	0.82310	0.58532	0.44587	0.70595	1.01302
Size	761	9.19088	1.79084	7.79654	9.04347	10.48114
Leverage	761	4.84371	7.07440	1.39090	2.61211	5.04246
BooktoMkt	761	0.80906	0.39535	0.54894	0.73445	0.98261
Foredispers	761	-3.87537	1.06388	-4.59006	-3.94481	-3.34739
LongGrow	761	11.57272	3.54004	10.00000	11.25000	13.28000
Dividend	761	0.76610	0.42359	1.00000	1.00000	1.00000
Sector_ICC	761	0.13945	0.00824	0.13294	0.14475	0.14475
RecentM&A	761	0.03438	0.07153	0.00073	0.00954	0.03073
OthIndus	761	0.00394	0.06270	0.00000	0.00000	0.00000
Divers	761	0.56476	0.28146	0.43451	0.67175	0.77588
PCPrem	761	0.78581	0.41053	1.00000	1.00000	1.00000
LifePrem	761	0.50197	0.50032	0.00000	1.00000	1.00000
HlthPrem	761	0.12221	0.32774	0.00000	0.00000	0.00000
Reinsuse	761	0.15103	0.16204	0.04797	0.10605	0.20473
Slack	761	0.10605	0.11810	0.04135	0.07267	0.11264
CV(EBIT)	761	0.21067	9.25970	0.22984	0.39504	0.75419
ValueChange	761	0.14932	0.44329	-0.09233	0.08809	0.31962

Notes: *ICC* is firm's *ex ante* implied cost of equity capital calculated as in Gebhardt, Lee, and Swaminathan (2001). *ERM* is an indicator variable coded equal to 1 for the year of ERM adoption and all following years, and 0 otherwise. ERM classification is based on a comprehensive search of SEC filings, annual reports, newswires, and other media. *Beta* is the capital market beta based on the market model; *Beta* is estimated with a minimum of twenty-four monthly returns over the sixty prior months and the value-weighted market index. *Size* is measured as the natural logarithm of the book value of assets. *Leverage* is the ratio of the book value of liabilities to the market value of equity. *BooktoMkt* is defined as the ratio of the book value of equity to market value of equity. *Foredispers* is calculated as the natural logarithm of the standard deviation of the analyst earnings forecasts for the next year divided by the consensus earnings estimate for the same period. *LongGrow* is the firm's mean long-term growth rate from I/B/E/S. *Dividend* is an indicator coded equal to 1 if a firm paid dividends in a particular year, and 0 otherwise. *Sector_ICC* is the average implied cost of equity capital in the following three sectors of the insurance industry: The life sector (NAICS code = 524113), the health sector (NAICS code = 524114), and the property-casualty sector (NAICS code = 524126, 524127, 524128, or 524130). *RecentM&A* is equal to the ratio of intangible assets to the book value of assets. *OthIndus* is an indicator variable coded equal to 1 for firm-years with positive sales outside the insurance industry (NAICS code <524100 or >524199), and 0 otherwise. *Divers* is equal to the complement of the Herfindahl index of net premiums written across the different lines of insurance. *PCPrem*, *LifePrem*, and *HlthPrem* are indicators coded equal to one if a firm has positive net premiums written in the P/C, life, and health insurance sector, respectively. *Reinsuse* is equal to the ratio of reinsurance ceded to the sum of direct premiums written and reinsurance assumed. *Slack* is the ratio of cash and short-term investments to the book value of assets. *CV(EBIT)* is the coefficient of variation of quarterly earnings before interest and taxes of the previous three years. *ValueChange* is defined as (firm value$_t$ − firm value$_{t-1}$) / firm value$_{t-1}$. Accounting and market data are collected from the Compustat Industrial, and the Compustat Segments databases. Insurance specific accounting data are from statutory filings of insurance companies with the National Association of Insurance Commissioners. Firm and market returns are taken from the CRSP monthly stock database. Analysts' forecasts are collected from I/B/E/S.

Table 4. Univariate Differences across ERM Status

Variable	(1) ERM = 1 Mean	(1) ERM = 1 Median	(2) ERM = 0 Mean	(2) ERM = 0 Median	Difference (1) - (2) Mean		Difference (1) - (2) Median	
ICC	0.13267	0.12809	0.12429	0.11628	0.00838	***	0.01181	***
Beta	0.99946	0.79669	0.66560	0.63897	0.33386	***	0.15772	***
Size	9.92030	9.75175	8.53949	8.26865	1.38081	***	1.48310	***
Leverage	5.90125	2.82631	3.89930	2.32549	2.00194	***	0.50082	***
BooktoMkt	0.91349	0.82789	0.71579	0.64767	0.19769	***	0.18022	***
Foredispers	-3.85042	-3.90399	-3.89764	-3.97029	0.04722		0.06630	
LongGrow	10.93942	10.50000	12.13828	12.00000	-1.19887	***	-1.50000	***
Dividend	0.83287	1.00000	0.70647	1.00000	0.12640	***	0.00000	
Sector_ICC	0.13948	0.14475	0.13943	0.14475	0.00005		0.00000	
RecentM&A	0.03469	0.00913	0.03410	0.01072	0.00059		-0.00159	
OthIndus	0.00557	0.00000	0.00249	0.00000	0.00308		0.00000	
Divers	0.57394	0.69443	0.55657	0.65921	0.01737		0.03522	*
PCPrem	0.80501	1.00000	0.76866	1.00000	0.03636		0.00000	
LifePrem	0.48468	0.00000	0.51741	1.00000	-0.03273		-1.00000	
HlthPrem	0.14763	0.00000	0.09950	0.00000	0.04813	**	0.00000	**
Reinsuse	0.14700	0.10563	0.15463	0.10702	-0.00763		-0.00139	
Slack	0.10518	0.08268	0.10683	0.06304	-0.00165		0.01964	***
CV(EBIT)	0.22917	0.45363	0.19415	0.34625	0.03501		0.10738	***
ValueChange	0.07051	0.04591	0.21970	0.16539	-0.14919	***	-0.11948	***
No. of firm-year obs.	359		402					

Notes: *ICC* is firm's *ex ante* implied cost of equity capital calculated as in Gebhardt, Lee, and Swaminathan (2001). *ERM* is an indicator variable coded equal to 1 for the year of ERM adoption and all following years, and 0 otherwise. ERM classification is based on a comprehensive search of SEC filings, annual reports, newswires, and other media. *Beta* is the capital market beta based on the market model; *Beta* is estimated with a minimum of twenty-four monthly returns over the sixty prior months and the value-weighted market index. *Size* is measured as the natural logarithm of the book value of assets. *Leverage* is the ratio of the book value of liabilities to the market value of equity. *BooktoMkt* is defined as the ratio of the book value of equity to market value of equity. *Foredispers* is calculated as the natural logarithm of the standard deviation of the analyst earnings forecasts for the next year divided by the consensus earnings estimate for the same period. *LongGrow* is the firm's mean long-term growth rate from I/B/E/S. *Dividend* is an indicator coded equal to 1 if a firm paid dividends in a particular year, and 0 otherwise. *Sector_ICC* is the average implied cost of equity capital in the following three sectors of the insurance industry: The life sector (NAICS code = 524113), the health sector (NAICS code = 524114), and the property-casualty sector (NAICS code = 524126, 524127, 524128, or 524130). *RecentM&A* is equal to the ratio of intangible assets to the book value of assets. *OthIndus* is an indicator variable coded equal to 1 for firm-years with positive sales outside the insurance industry (NAICS code <524100 or >524199), and 0 otherwise. *Divers* is equal to the complement of the Herfindahl index of net premiums written across the different lines of insurance. *PCPrem*, *LifePrem*, and *HlthPrem* are indicators coded equal to one if a firm has positive net premiums written in the P/C, life, and health insurance sector, respectively. *Reinsuse* is equal to the ratio of reinsurance ceded to the sum of direct premiums written and reinsurance assumed. *Slack* is the ratio of cash and short-term investments to the book value of assets. *CV(EBIT)* is the coefficient of variation of quarterly earnings before interest and taxes of the previous three years. *ValueChange* is defined as (firm value_t − firm value_{t-1}) / firm value_{t-1}. Accounting and market data are collected from the Compustat Industrial, and the Compustat Segments databases. Insurance specific accounting data are from statutory filings of insurance companies with the National Association of Insurance Commissioners. Firm and market returns are taken from the CRSP monthly stock database. Analysts' forecasts are collected from I/B/E/S. 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. ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 5. Full Maximum-Likelihood Treatment Effects Estimates

	ICC (Equation 5)		*ERM* (Equation 6)	
ERM	-0.01834	(0.00454)***		
Beta	0.00514	(0.00293)*		
Size	-0.00572	(0.00149)***	0.67800	(0.08328)***
Leverage	0.00070	(0.00033)**	-0.03339	(0.01375)**
BooktoMkt	0.03425	(0.00609)***	0.10892	(0.35602)
Foredispers	0.00452	(0.00194)**		
LongGrow	-0.00038	(0.00040)		
Dividend	0.00852	(0.00530)		
Sector_ICC	0.34237	(0.21741)		
RecentM&A			-4.52230	(1.60875)***
OthIndust			1.95296	(0.39776)***
Divers			-0.99107	(0.45803)**
PCPrem			1.16379	(0.32318)***
LifePrem			-0.80652	(0.28973)***
HlthPrem			1.53842	(0.50661)***
Reinsuse			0.44138	(0.67036)
Slack			-1.41203	(1.10130)
CV(EBIT)			-0.00331	(0.00892)
ValueChange			-0.21058	(0.15592)
Constant	0.11597	(0.03721)***	-4.23503	(0.96896)***
No. of observations		761		
No. of clusters		132		
Log pseudolikelihood		1383.80		
Wald test for independent equations		6.95***		

Notes: *ICC* is firm's *ex ante* implied cost of equity capital calculated as in Gebhardt, Lee, and Swaminathan (2001). *ERM* is an indicator variable coded equal to 1 for the year of ERM adoption and all following years, and 0 otherwise. ERM classification is based on a comprehensive search of SEC filings, annual reports, newswires, and other media. *Beta* is the capital market beta based on the market model; *Beta* is estimated with a minimum of twenty-four monthly returns over the sixty prior months and the value-weighted market index. *Size* is measured as the natural logarithm of the book value of assets. *Leverage* is the ratio of the book value of liabilities to the market value of equity. *BooktoMkt* is defined as the ratio of the book value of equity to market value of equity. *Foredispers* is calculated as the natural logarithm of the standard deviation of the analyst earnings forecasts for the next year divided by the consensus earnings estimate for the same period. *LongGrow* is the firm's mean long-term growth rate from I/B/E/S. *Dividend* is an indicator coded equal to 1 if a firm paid dividends in a particular year, and 0 otherwise. *Sector_ICC* is the average implied cost of equity capital in the following three sectors of the insurance industry: The life sector (NAICS code = 524113), the health sector (NAICS code = 524114), and the property-casualty sector (NAICS code = 524126, 524127, 524128, or 524130). *RecentM&A* is equal to the ratio of intangible assets to the book value of assets. *OthIndus* is an indicator variable coded equal to 1 for firm-years with positive sales outside the insurance industry (NAICS code <524100 or >524199), and 0 otherwise. *Divers* is equal to the complement of the Herfindahl index of net premiums written across the different lines of insurance. *PCPrem*, *LifePrem*, and *HlthPrem* are indicators coded equal to one if a firm has positive net premiums written in the P/C, life, and health insurance sector, respectively. *Reinsuse* is equal to the ratio of reinsurance ceded to the sum of direct premiums written and reinsurance assumed. *Slack* is the ratio of cash and short-term investments to the book value of assets. *CV(EBIT)* is the coefficient of variation of quarterly earnings before interest and taxes of the previous three years. *ValueChange* is defined as (firm value$_t$ − firm value$_{t-1}$) / firm value$_{t-1}$. Accounting and market data are collected from the Compustat Industrial, and the Compustat Segments databases. Insurance specific accounting data are from statutory filings of insurance companies with the National Association of Insurance Commissioners. Firm and market returns are taken from the CRSP monthly stock database. Analysts' forecasts are collected from I/B/E/S. Year dummies are included in both equations, but not reported. Standard errors are adjusted for firm-level clustering, and are reported in parentheses. ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 6. Full Maximum-Likelihood Treatment Effects Estimates (Survival Dataset)

	ICC (Equation 5)		*ERM* (Equation 6)	
ERM	-0.02712	(0.01270)**		
Beta	0.00055	(0.00528)		
Size	-0.00852	(0.00179)***	0.45508	(0.07958)***
Leverage	0.00133	(0.00059)**	-0.03187	(0.01597)**
BooktoMkt	0.04713	(0.00974)***	0.64680	(0.40110)
Foredispers	0.00216	(0.00208)		
LongGrow	0.00048	(0.00069)		
Dividend	0.00703	(0.00657)		
Sector_ICC	0.20011	(0.32498)		
RecentM&A			-2.84968	(1.41318)**
OthIndust			-2.86315	(0.00000)
Divers			-0.81611	(0.35789)**
PCPrem			0.44205	(0.32530)
LifePrem			-0.42883	(0.28029)
HlthPrem			0.61007	(0.42330)
Reinsuse			0.39629	(0.51669)
Slack			-0.97929	(1.05913)
CV(EBIT)			0.01080	(0.00861)
ValueChange			0.15568	(0.20525)
Constant	0.12245	(0.05536)**	-3.72671	(1.07359)***
No. of observations		449		
No. of clusters		100		
Log pseudolikelihood		827.76		
Wald test for independent equations		2.84*		

Notes: The survival dataset is created by removing firm-year observations of ERM adopting firms in the years after ERM adoption from the sample. The data, hence, just includes the first year in which a firm adopts ERM as well as all observations with ERM=0. *ICC* is firm's *ex ante* implied cost of equity capital calculated as in Gebhardt, Lee, and Swaminathan (2001). *ERM* is an indicator coded equal to 1 for the year of ERM adoption and all following years, and 0 otherwise. ERM classification is based on a comprehensive search of SEC filings, annual reports, newswires, and other media. *Beta* is the capital market beta based on the market model; *Beta* is estimated with a minimum of twenty-four monthly returns over the sixty prior months and the value-weighted market index. *Size* is measured as the natural logarithm of the book value of assets. *Leverage* is the ratio of the book value of liabilities to the market value of equity. *BooktoMkt* is defined as the ratio of the book value of equity to market value of equity. *Foredispers* is calculated as the natural logarithm of the standard deviation of the analyst earnings forecasts for the next year divided by the consensus earnings estimate for the same period. *LongGrow* is the firm's mean long-term growth rate from I/B/E/S. *Dividend* is an indicator coded equal to 1 if a firm paid dividends in a particular year, and 0 otherwise. *Sector_ICC* is the average implied cost of equity capital in the following three sectors of the insurance industry: The life sector (NAICS code = 524113), the health sector (NAICS code = 524114), and the property-casualty sector (NAICS code = 524126, 524127, 524128, or 524130). *RecentM&A* is equal to the ratio of intangible assets to the book value of assets. *OthIndus* is an indicator coded equal to 1 for firm-years with positive sales outside the insurance industry (NAICS code <524100 or >524199), and 0 otherwise. *Divers* is equal to the complement of the Herfindahl index of net premiums written across the different lines of insurance. *PCPrem*, *LifePrem*, and *HlthPrem* are indicators coded equal to one if a firm has positive net premiums written in the P/C, life, and health insurance sector, respectively. *Reinsuse* is equal to the ratio of reinsurance ceded to the sum of direct premiums written and reinsurance assumed. *Slack* is the ratio of cash and short-term investments to the book value of assets. *CV(EBIT)* is the coefficient of variation of quarterly earnings before interest and taxes of the previous three years. *ValueChange* is defined as (firm value$_t$ − firm value$_{t-1}$) / firm value$_{t-1}$. Accounting and market data are collected from the Compustat Industrial, and the Compustat Segments databases. Insurance specific accounting data are from statutory filings of insurance companies with the National Association of Insurance Commissioners. Firm and market returns are taken from the CRSP monthly stock database. Analysts' forecasts are collected from I/B/E/S. Year dummies are included in both equations, but not reported. Standard errors are adjusted for firm-level clustering, and are reported in parentheses. ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 7. Sensitivity of the Cost of Capital Difference between ERM Adopters and Non-Adopters to Alternative Specifications of the *ERM* Equation

Panel A

ICC Equation Results

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ERM	-0.01369**	-0.01581***	-0.01586***	-0.01588***	-0.01577***	-0.01816***	-0.01827***	-0.01794***	-0.01879***	-0.01834***
	(0.00660)	(0.00533)	(0.00553)	(0.00558)	(0.00557)	(0.00584)	(0.00601)	(0.00604)	(0.00450)	(0.00454)
Beta	0.00499	0.00478	0.00495	0.00495	0.00497	0.00536	0.00539	0.00529	0.00521*	0.00514*
	(0.00346)	(0.00341)	(0.00342)	(0.00342)	(0.00342)	(0.00346)	(0.00347)	(0.00349)	(0.00291)	(0.00293)
Size	-0.00818***	-0.00686***	-0.00668***	-0.00669***	-0.00670***	-0.00649***	-0.00651***	-0.00655***	-0.00568***	-0.00572***
	(0.00192)	(0.00172)	(0.00169)	(0.00169)	(0.00169)	(0.00161)	(0.00162)	(0.00163)	(0.00149)	(0.00149)
Leverage	0.00108***	0.00107***	0.00096***	0.00096***	0.00096***	0.00094***	0.00093**	0.00094***	0.00070**	0.00070**
	(0.00037)	(0.00036)	(0.00036)	(0.00036)	(0.00036)	(0.00036)	(0.00036)	(0.00036)	(0.00033)	(0.00033)
BooktoMkt	0.03181***	0.03109***	0.03131***	0.03115***	0.03115***	0.03119***	0.03131***	0.03133***	0.03422***	0.03425***
	(0.00610)	(0.00599)	(0.00602)	(0.00629)	(0.00628)	(0.00633)	(0.00636)	(0.00635)	(0.00609)	(0.00609)
Foredispers	0.00617***	0.00642***	0.00645***	0.00645***	0.00645***	0.00631***	0.00627***	0.00623***	0.00455**	0.00452**
	(0.00222)	(0.00223)	(0.00223)	(0.00224)	(0.00224)	(0.00221)	(0.00222)	(0.00222)	(0.00194)	(0.00194)
LongGrow	-0.00010	-0.00008	-0.00008	-0.00008	-0.00008	-0.00010	-0.00011	-0.00011	-0.00038	-0.00038
	(0.00041)	(0.00041)	(0.00041)	(0.00041)	(0.00041)	(0.00041)	(0.00041)	(0.00041)	(0.00040)	(0.00040)
Dividend	0.00928	0.00882	0.00893	0.00895	0.00893	0.00904	0.00909	0.00925	0.00847	0.00852
	(0.00619)	(0.00605)	(0.00606)	(0.00604)	(0.00604)	(0.00604)	(0.00608)	(0.00610)	(0.00530)	(0.00530)
Sector_ICC	0.25036	0.31472	0.30905	0.30954	0.30848	0.32710	0.32841	0.32989	0.34492	0.34237
	(0.22333)	(0.21869)	(0.21784)	(0.21819)	(0.21829)	(0.21979)	(0.21991)	(0.22012)	(0.21798)	(0.21741)
Constant	0.15080***	0.13306***	0.13251***	0.13269***	0.13285***	0.12981***	0.12960***	0.12931***	0.11569***	0.11597***
	(0.04195)	(0.03906)	(0.03880)	(0.03872)	(0.03874)	(0.03865)	(0.03867)	(0.03877)	(0.03727)	(0.03721)
No. of obs.	834	834	834	834	834	834	832	832	761	761
No. of clusters	145	145	145	145	145	145	144	144	132	132
Log pseudolikelihood	1275.93	1356.14	1359.69	1359.72	1359.99	1367.07	1362.52	1363.85	1383.25	1383.80
Wald test	4.81**	12.26***	11.45***	11.13***	11.17***	11.71***	11.60***	11.68***	7.38***	6.95***

(*Continued*)

Panel B

ERM Equation Results

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ERM coefficient in *ICC* equation	-0.01369**	-0.01581***	-0.01586***	-0.01588***	-0.01577***	-0.01816***	-0.01827***	-0.01794***	-0.01879***	-0.01834***
Size		0.57874***	0.61537***	0.61313***	0.61296***	0.66728***	0.66588***	0.65124***	0.68227***	0.67800***
		(0.07723)	(0.07869)	(0.08047)	(0.08032)	(0.07617)	(0.07606)	(0.07753)	(0.08396)	(0.08328)
Leverage			-0.02640**	-0.02490*	-0.02523*	-0.03291**	-0.03302**	-0.03290**	-0.03367**	-0.03339**
			(0.01060)	(0.01353)	(0.01363)	(0.01442)	(0.01434)	(0.01452)	(0.01407)	(0.01375)
BooktoMkt				-0.05849	-0.04841	0.13644	0.14061	0.14891	0.15170	0.10892
				(0.35416)	(0.35719)	(0.33890)	(0.33586)	(0.33473)	(0.35604)	(0.35602)
OthIndust					1.87965***	1.88382***	1.88271***	1.84286***	1.98574***	1.95296***
					(0.33966)	(0.34542)	(0.35651)	(0.37137)	(0.40666)	(0.39776)
Divers						-0.90522**	-0.91687**	-0.89533**	-1.00252**	-0.99107**
						(0.46089)	(0.45745)	(0.44868)	(0.45645)	(0.45803)
Reinsuse							0.02846	0.05639	0.39633	0.44138
							(0.66386)	(0.64357)	(0.67177)	(0.67036)
Slack								-1.24869	-1.51554	-1.41203
								(1.18106)	(1.11260)	(1.10130)
CV(EBIT)									-0.00051	-0.00331
									(0.00896)	(0.00892)
ValueChange										-0.21058
										(0.15592)
Identifying Variables										
RecentM&A	-3.30086*	-3.88851**	-4.33419**	-4.30370**	-4.33714**	-4.71276***	-4.66337***	-4.78828***	-4.46336***	-4.52230***
	(1.74649)	(1.74109)	(1.78376)	(1.77825)	(1.78330)	(1.76506)	(1.74998)	(1.75155)	(1.58423)	(1.60875)
PCPrem	0.50549*	0.79781***	0.71756***	0.72834**	0.72302**	0.92277***	0.92239***	0.91848***	1.15737***	1.16379***
	(0.28139)	(0.28371)	(0.27694)	(0.28344)	(0.28417)	(0.31301)	(0.31030)	(0.31355)	(0.32301)	(0.32318)
LifePrem	0.28164	-0.94563***	-0.86797***	-0.86557***	-0.86845***	-0.70899**	-0.70716**	-0.74835***	-0.80457***	-0.80652***
	(0.24770)	(0.30205)	(0.30228)	(0.30028)	(0.30032)	(0.29278)	(0.29195)	(0.28670)	(0.29065)	(0.28973)
HlthPrem	0.32700	1.01978**	0.92928**	0.91842*	0.91873*	1.09744**	1.08992**	1.45365***	1.54112***	1.53842***
	(0.42673)	(0.45839)	(0.46695)	(0.47279)	(0.47304)	(0.45855)	(0.45631)	(0.52641)	(0.49887)	(0.50661)
Constant	1.23432***	-3.79961***	-3.88687***	-3.82083***	-3.84426***	-4.23746***	-4.22831***	-3.96170***	-4.31632***	-4.23503***
	(0.43477)	(0.78015)	(0.76164)	(0.91712)	(0.91538)	(0.84149)	(0.84228)	(0.85897)	(0.97600)	(0.96896)
No. of obs.	834	834	834	834	834	834	832	832	761	761
No. of clusters	145	145	145	145	145	145	144	144	132	132
Log pseudolikelihood	1275.93	1356.14	1359.69	1359.72	1359.99	1367.07	1362.52	1363.85	1383.25	1383.80
Wald test	4.81**	12.26***	11.45***	11.13***	11.17***	11.71***	11.60***	11.68***	7.38***	6.95***

Notes: In Panel A, the dependent variable is *ICC*. In Panel B, the dependent variable is *ERM*. All variables are defined in Table 1. Year dummies are included in both equations, but not reported. Standard errors are adjusted for firm-level clustering, and are reported in parentheses. ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 8. Sensitivity of the Cost of Capital Difference between ERM Adopters and Non-Adopters to Alternative Specifications of the *ICC* Equation

ICC Equation Results

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ERM	-0.03565***	-0.01851**	-0.01705**	-0.01679***	-0.01333**	-0.01368**	-0.01627***	-0.01834***
	(0.00813)	(0.00754)	(0.00861)	(0.00468)	(0.00558)	(0.00553)	(0.00538)	(0.00454)
Size	-0.00118	-0.00298**	-0.00416***	-0.00431***	-0.00547***	-0.00572***	-0.00628***	-0.00572***
	(0.00153)	(0.00126)	(0.00130)	(0.00114)	(0.00129)	(0.00134)	(0.00144)	(0.00149)
BooktoMkt		0.04707***	0.04371***	0.04087***	0.03557***	0.03575***	0.03627***	0.03425***
		(0.00419)	(0.00416)	(0.00517)	(0.00550)	(0.00545)	(0.00543)	(0.00609)
Beta			0.00844**	0.00613**	0.00396	0.00411	0.00466	0.00514*
			(0.00342)	(0.00293)	(0.00287)	(0.00287)	(0.00294)	(0.00293)
Foredispers				0.00489**	0.00500**	0.00481**	0.00508***	0.00452**
				(0.00199)	(0.00201)	(0.00200)	(0.00192)	(0.00194)
Leverage					0.00064**	0.00057**	0.00053*	0.00070**
					(0.00027)	(0.00027)	(0.00027)	(0.00033)
LongGrow						-0.00062	-0.00038	-0.00038
						(0.00043)	(0.00040)	(0.00040)
Dividend							0.00945*	0.00852
							(0.00509)	(0.00530)
Sector_ICC								0.34237
								(0.21741)
Constant	0.17781***	0.12043***	0.12512***	0.14739***	0.16024***	0.16955***	0.16781***	0.11597***
	(0.01577)	(0.01316)	(0.01267)	(0.01585)	(0.01673)	(0.01860)	(0.01816)	(0.03721)
No. of obs.	884	884	883	776	776	761	761	761
No. of clusters	137	137	137	132	132	132	132	132
Log pseudolikelihood	1341.76	1449.53	1453.51	1391.20	1394.89	1376.17	1381.77	1383.80
Wald test	12.54***	4.77**	3.29*	6.64***	3.74*	4.06**	4.77**	6.95***

Notes: The dependent variable is *ICC*. The ERM equation is held constant at the baseline specification (see Table 5), and is not reported. All variables are defined in Table 1. Year dummies are included in both equations, but not reported. Standard errors are adjusted for firm-level clustering, and are reported in parentheses. ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.