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Implied cost of equity capital in the U.S. insurance industry

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Abstract

This study derives and evaluates estimates of the equity risk premium inferred from the stock prices and analysts' earnings forecasts of U.S. insurance companies. During most of the sample period, April 1983 through September 2012, the quarterly median implied equity risk premium (IERP) of U.S. insurers was relatively stable, fluctuating mildly around an average value of 5.5%. However, during the financial crisis of 2007-2009, the median IERP reached unprecedented levels, exceeding 15% in the first quarter of 2009. Following the financial crisis, the IERP declined substantially but it remained at historically high levels, exceeding 9% on average. In spite of significant differences in operations and financial profile, the median IERP of Life and Health insurers was similar to that of Property and Casualty insurers during most of the sample period. However, during the financial crisis the median IERP of Life and Health insurers was substantially larger than that of Property and Casualty insurers, consistent with the higher sensitivity of Life and Health insurers to fluctuations in financial markets. The differences in the IERP across the insurance sub-industries remained substantial after the crisis, indicating a structural change in the pricing of Life and Health insurers. Consistent with investors demanding relatively high rates of return in periods of poor economic performance or high uncertainty, the IERP is positively related to the credit spread, term spread, and inflation, and negatively related to the 10-year Treasury yield. The relations with firm-specific risk factors are similarly consistent with expectations: the IERP is positively related to market beta, and negatively related to size and the equity-to-assets ratio. These risk-factor sensitivities are generally higher for Life and Health insurers as well as during the financial crisis. Finally, consistent with the strong correlations between the IERP and the macro and firm-specific risk factors, the IERP performs well in predicting subsequent excess stock returns. One implication of the results is that the current trend in accounting regulation to eliminate accounting differences across insurance operations may not be desirable.

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Introduction

When pricing equity securities, investors discount expected flows (e.g., dividend, free cash flow, residual income) using required rates of return commensurate with the riskiness of those flows. Consequently, given price and estimates of expected flows to equity holders, one can invert an equity valuation model to obtain an estimate of the average required rate of return used by investors in pricing the stock. From the company's perspective, this estimate reflects the cost of equity capital and is accordingly referred to as the implied cost of equity capital (ICEC). From investors' perspective, the ICEC is an estimate of the expected return on their investment. In this study I derive and evaluate estimates of the implied cost of equity capital for U.S. insurance companies.²

The ICEC is useful in various settings. Analysts, investors, and other stakeholders may use it to estimate expected returns, to price risk factors, or to calculate intrinsic equity value. For example, if an analyst perceives his/her expectations of future earnings to be different from the "consensus" earnings forecasts, he/she may estimate the ICEC using the stock price and the consensus forecasts by inverting an equity valuation model that discounts earnings forecasts, and then estimate intrinsic equity value by discounting his/her forecasts of future earnings using the ICEC. Creditors and regulators may use the ICEC as a market-based proxy for the riskiness of the company. Academics and practitioners may correlate the ICEC with firm characteristics to quantify the risk pricing of those attributes. The ICEC may also be used to estimate the expected rate of return on an equity investment, or to derive ex-ante estimates of the market risk premium [Claus and Thomas (2001), Fama and French (2002)].

While ICEC estimates are relevant in many settings and for essentially all companies, studying their properties for insurance companies is particularly important, given the fundamental role of risk in that industry. The primary purpose of insurance is the spreading of risks. Insurance is valuable because the risks

associated with different policies are not perfectly correlated, and so the total risk of a portfolio of policies is smaller than the sum of the policies' risks. Thus, insurance functions as a mechanism to diversify insurable risks, similar to the role of mutual funds in diversifying investment risks. In fact, because insurers accumulate substantial funds in conducting their business, they also diversify investment risks for their stakeholders by investing in diversified portfolios. Yet, insurers' ability to reduce portfolio risks through diversification is limited. Some risks are not fully diversifiable (e.g., catastrophes, longevity/mortality, market risks) and, for various reasons (e.g., size, cost, management skills, line or geographic concentration, speculation), insurers may retain some diversifiable risks.³ To the extent that such residual risks are priced by investors, they should be reflected in insurers' ICEC. Thus, unlike other industries where operating risks are primarily industry-specific, insurers' ICEC may reflect the pricing of all insurable risks.⁴

Focusing on insurers' ICEC estimates is relevant for two additional reasons. First, the insurance industry – primarily its life segment – experienced unprecedented volatility during the financial crisis of 2007-2009, and thus studying changes in insurers' ICEC during that period may yield interesting insights. Second, for reasons discussed later, insurers' ICEC estimates are likely to be more precise than those of most other companies and may therefore facilitate a better understanding of the time-series and cross-sectional determinants of equity risk premiums in general.

The precision of an ICEC estimate depends on the accuracy of the valuation model that implies that estimate. While equity valuation models that discount dividends, free cash flows, or residual earnings are well-grounded in theory, their empirical counterparts are often very "noisy." In discounted dividends or free cashflows valuations, a large portion of equity value is captured by a "terminal value" calculation, which measures the

2 Over the last decade, the implied cost of capital has been the focus of, or a primary variable in, many studies, including Botosan (1997), Botosan and Plumlee (2002, 2005), Claus and Thomas (2001), Dhaliwal et al. (2005), Easton and Monahan (2005), Easton and Sommers (2007), Easton et al. (2002), Fama and French (2002), Francis et al. (2005), Gebhardt et al. (2001), Gode and Mohanram (2003), Hail and Leuz (2006), and Hribar and Jenkins (2004). As discussed later, an important difference between the current study and prior work is the focus on an industry where the model used to reverse-engineer the cost of equity capital is likely to perform relatively well.

3 Beside diversification, insurers may mitigate some risks by engaging in asset-liability management, reinsuring some exposures, using capital market solutions (for example, catastrophe bonds, contingent capital), or employing other techniques. However, these activities are also limited due to the same factors that constrain diversification, including size, cost, and management skills.

4 Insurance companies are unique in another way that affects risk. In most industries, the cost of the product or service provided is known at the time of sale or soon after the sale. In contrast, for insurance companies – primarily property and casualty insurers that specialize in long-tail lines such as medical malpractice – the ultimate cost of insurance is unknown until long after the sale. This characteristic is a main source of uncertainty and risk.

present value of all cashflows subsequent to the explicit forecast period. The terminal value is estimated using either a constant growth formula, an empirical multiple applied to a forecasted fundamental, or some other highly stylized calculation that is likely to contain considerable measurement error. Under the residual income model, the equivalent of the terminal value calculation captures the value of *abnormal* (residual) steady-state profitability and is therefore relatively small. Still, for companies whose book value fails to capture important assets, primarily internally developed intangible assets, steady-state abnormal profitability may be substantial.

For insurance companies, the residual income model and the corresponding ICEC estimate are likely to perform relatively well, because book value and explicit forecasts of earnings capture most of the modeled value, and “steady state” residual income (and hence the “terminal value”) are relatively small. The insurance industry is highly competitive and thus any abnormal earnings are likely to fade away within a relatively short horizon. In addition, although the reporting of insurance contracts involves some distortions, insurers’ financial statements are, overall, less conservatively biased than other industries.⁵ This is due to the relatively small magnitude of economic intangibles and to the financial nature of most assets and liabilities, which are generally reported at amounts close to fair values (for example, available for sale securities, some insurance reserves). Indeed, the average price-to-book ratio of insurance companies is close to one, while for most other industries it is substantially greater than one. With relatively small steady-state residual income, reported book value and explicit earnings forecasts capture most of the modeled value [Nissim (2013a)], and the imprecise terminal value has a less significant role.

The residual income model is likely to perform well in valuing insurance companies also, because the book value of equity, which anchors residual income valuation, is particularly important in this industry. Due to regulation, insurers’ ability to write premiums and generate income is directly related to their surplus, which is a regulatory proxy for equity capital. Relatedly, insurers are required by regulators to maintain minimum equity capital at levels commensurate with the levels and riskiness of their assets,

liabilities, and activities; this requirement makes book equity a relatively useful measure of the scale of insurers’ operations.

Consequently, to obtain ICEC estimates for insurance companies, this study uses the residual income model with individual analysts’ earnings forecasts used as proxies for market expectations of future earnings as of the earnings forecasts’ announcement date. The valuation model utilizes the term structure of risk-free interest rates and thus focuses on the implied equity risk premium (IERP), the risk premium component of the implied cost of equity capital. An analysis of the IERP estimates yields the following findings.

During most of the sample period, which spans April 1983 through September 2012, the quarterly median implied equity risk premium was relatively stable, fluctuating mildly around an average value of about 5.5%. However, during the financial crisis of 2007-2009, the median IERP reached unprecedented levels, exceeding 15% in the first quarter of 2009. Following the financial crisis, the IERP declined substantially but it remained at historically high levels, exceeding 9% on average.

In spite of significant differences in operations and financial profile, the median IERP of Life and Health (LH) insurers was similar to that of Property and Casualty (PC) insurers during most of the sample period. However, during the financial crisis the median IERP of LH insurers was substantially larger than that of PC insurers, reaching 25% in the first quarter of 2009 compared to 11% for PC insurers. The large increase in the IERP of LH insurers is consistent with their high sensitivity to fluctuations in financial markets. The differences in the IERP across the industry groups remained substantial post the crisis, indicating a structural change in the pricing of LH insurers. Apparently, investors are now better aware of the high sensitivity of LH insurers to financial markets and price this sensitivity.

The IERP is strongly related to macro risk factors in a way suggesting that investors demand relatively high returns in periods of poor economic performance or high uncertainty. In particular, the IERP is positively related to the credit spread, term spread, and inflation, and negatively related to the 10-year Treasury yield. The cross-sectional correlations between the IERP and firm-specific risk factors are similarly consistent with expectations: the IERP is positively related to market beta, and negatively related to size and the equity-to-assets ratio. These

⁵ The primary bias is the reporting of most property and casualty loss reserves undiscounted. This bias is particularly large for insurers who specialize in long-tail liability lines.

sensitivities are generally larger for LH insurers and during the financial crisis. Finally, consistent with its strong correlations with macro- and firm-specific risk factors, the IERP performs well in predicting stock returns.

The paper proceeds as follow. The next section describes the residual income model used in deriving the implied equity risk premium. The following section contains the empirical analysis, and the final section summarizes and concludes. Appendix A discusses implementation issues.

The residual income model

The value of any financial claim is the present value of expected net flows to the owners of that claim. Accordingly, the value of common equity (Equity Value or EV) is the present value of expected net flows to common equity holders (Net Equity Flow or NEF):

$$EV_0 = \frac{E[NEF_1]}{1+r_1^e} + \frac{E[NEF_2]}{(1+r_2^e)^2} + \dots = \sum_{t=1}^{\infty} E[NEF_t] \times (1+r_t^e)^{-t} \quad (1)$$

Where r_t^e is the risk-adjusted discount rate for cash flows to be received in year t , and NEF include dividends, share repurchases and noncash distributions, net of share issuance.

Valuation model (1) can be restated in terms of comprehensive income available to common equity holders (comprehensive income or CI) and the book value of common equity (common equity or CE) by substituting the following relation for NEF_t :

$$NEF_t = CI_t - CE_t + CE_{t-1} \quad (2)$$

This relation postulates that changes in common equity are due to either comprehensive income or net equity flows. Given the definitions of NEF (discussed above) and CI (net income plus other comprehensive income), equation (2) accounts for essentially all changes in shareholders' equity, and it therefore provides a reasonable approximation for the actual relationship between net equity flows, earnings, and book value.

The resulting valuation model (called residual income model) expresses intrinsic equity value as the sum of current book value and the present value of expected residual income in all future years, where residual income ($CI_t - f_t^e \times CE_{t-1}$) is earnings (CI) in excess of the return required by common equity investors given

the amount (CE) and cost (f^e) of common equity capital:⁶

$$EV_0 = CE_0 + \sum_{t=1}^{\infty} \frac{E[CI_t - f_t^e \times CE_{t-1}]}{\prod_{i=1}^t (1+f_i^e)} \quad (3)$$

Where f_t^e is the time zero one-year risk-adjusted forward discount rate for year t , i.e., =

$$f_t^e = \frac{(1+r_t^e)^t}{(1+r_{t-1}^e)^{t-1}} - 1$$

To demonstrate the residual income model, consider the following example. At time $t = 0$ (current time), a firm with a book value of \$10 is expected to exist for two years (i.e. until $t = 2$), and pay dividends of \$1 in year 1 and \$14 in year 2 (liquidating dividend). Expected earnings for year 1 are \$2, and so, expected earnings for year 2 are \$3 (= liquidating dividend minus year 1 book value, or $14 - (10 + 2 - 1)$). The price of a zero coupon one-year risk-free bond is \$0.90909 per dollar of par value, and the price of a zero coupon two-years risk-free bond is \$0.75757. These bond prices imply that the spot rate for one year is 10% (= $1/0.90909 - 1$), the spot rate for two years is 14.89% (= $[1/0.75757]^{0.5} - 1$), and the one year forward rate for year 2 is 20% (= $1.1489^2 / 1.1 - 1$). Assuming that investors are risk-neutral and that dividends are paid at the end of each year, stock value can be calculated using the dividend discount model (equation (1)) as $1/1.1 + 14/[1.1489^2] = 11.515$. Equivalently, value can be calculated using the residual income model. To do so, note that book value is expected to be \$11 at time 1 (= $10 + 2 - 1$), and residual earnings are expected to be \$1 in year 1 (= $2 - 0.1 \times 10$) and \$0.8 in year 2 (= $3 - 0.2 \times 11$). Using equation (3), therefore, price should equal \$11.515 (= $10 + 1/1.1 + 0.8/[1.1489^2]$).

Unlike the above example, investors are not risk-neutral. I, therefore, model the risk-adjusted forward discount rates (f_t^e) as the sum of the corresponding risk-free forward rate (f_t) and a risk premium (prem). While there is some evidence that the term structure of equity risk premiums is not flat,⁷ for tractability I assume a constant risk premium, i.e., $f_t^e = f_t + \text{prem}$. Therefore,

$$EV_0 = CE_0 + \sum_{t=1}^{\infty} \frac{E[CI_t - (f_t + \text{prem}) \times CE_{t-1}]}{\prod_{i=1}^t (1+f_i + \text{prem})} \quad (4)$$

6 For a derivation of the model, see Ohlson (1995) and Nissim (2013b).
7 See, for example, Campbell et al. 1997, Chapter 8.

equation (4) provides the theoretical foundation for the derivation of the IERP. However, its empirical implementation necessarily involves several assumptions and approximations. I use the same approach as in Nissim (2013b), and describe the assumptions and calculations in Appendix A. The following is a “big picture” depiction of the methodology. For each date on which an analyst provides a set of earnings forecasts for a given insurance company, I estimate the IERP associated with those forecasts by substituting the earnings forecasts and the closing stock price on that day for comprehensive income (CI) and intrinsic equity value (EV_0), respectively. To measure future book values (CE_t), I adjust current book value (CE_0) by adding forecasted earnings and subtracting expected dividends, where future dividends are estimated assuming that current dividends will grow at the forecasted long-term earnings growth rate. For values post the explicit forecast period (i.e., for $t > 5$), I assume that residual income (i.e., $CI_t - (f_t + \text{prem}) \times CE_{t-1}$) will grow at a rate equal to the expected long-term economy-wide growth rate. I measure the forward risk-free rates (f_t) on the forecasts announcement date. As a robustness check, I re-estimate the IERP using alternative assumptions regarding the evolution of residual income post the explicit forecast period and report the results below.

Empirical analysis

Sample and data

The sample used in this study includes all insurance companies with data available in the intersection of three databases: IBES, CRSP, and COMPUSTAT. Insurance companies are identified using the Global Industry Classification (GIC) system (industry GIC 403010), which is obtained from COMPUSTAT. COMPUSTAT is also the source of reported accounting data, including book value, total assets, and other variables. Market-related data (price, stock returns, dividends, shares, and adjustment factors) are extracted from CRSP. Economy-wide variables (interest rates, inflation, VIX, etc.) are obtained from the Federal Reserve Bank of St. Louis (<http://research.stlouisfed.org/>) and Yahoo! Finance.

Most insurance companies specialize in either property and casualty (PC) or life and health (LH), but some have significant operations in both segments. In addition, while many insurers underwrite reinsurance policies (insurance sold to insurers), some focus on reinsurance as their core activity. Insurers increasingly offer products and services that involve little or no insurance protection, such as investment products and fee-based services.

The industry also includes companies that provide insurance brokerage services (sourcing of insurance contracts on behalf of customers). Reflecting this variation in activities, the GIC system classifies insurance companies as either Life and Health Insurers (LH, 40301020, for example, MetLife, Prudential, AFLAC), Property and Casualty Insurers (PC, 40301040, for example, Berkshire Hathaway, Allstate, Progressive), Multi-line Insurers (ML, 40301030, companies with diversified interests in life, health, and property and casualty insurance such as AIG, Hartford, and Lowes), reinsurers (Re, 40301050, for example, Reinsurance Group of America, Everest Re Group, PartnerRe), or insurance brokers (IB, 40301010, for example, AON, Marsh & McLennan, Willis). Because each of the last three sub-industries includes a relatively small number of firms, I treat these sub-industries as one group, and thus classify insurance companies into three groups: LH, PC, and “Other”.

Each sample observation corresponds to a set of EPS forecasts (typically EPS for the current and subsequent year and long-term EPS growth), provided by an analyst for a given insurer on a certain (announcement) date. These forecasts are matched with COMPUSTAT and CRSP to derive the estimated IERP as described in Appendix A. The resulting sample includes 13,916 observations (330 different firms) during the period April 1983 through September 2012. This sample is augmented with economy-wide and firm-specific variables (described below) that are likely to affect or be correlated with the IERP. Finally, to mitigate the effects of outliers, extreme values of the firm-specific variables are trimmed.⁸

IERP over time

Table 1 presents summary statistics for the IERP, the 10-year Treasury yield, the sum of these two variables (a proxy for the ICEC), and the other analysis variables. The mean IERP across all observations is 6.9%, while the mean 10-year Treasury yield

⁸ For each variable, I calculate the 1st and 99th percentiles of the empirical distribution (P1 and P99 respectively) and trim observations outside the following range: P1 - (P99 - P1) to P99 + (P99 - P1). For normally distributed variables, this range covers approximately 7 standard deviations from the mean in each direction (= 2.325 + (2.325 · (-2.325))), which is more than 99.99% of the observations. The variables used in this study are generally well-behaved, so few observations were deleted.

	N	Mean	StdDev	5%	25%	Median	75%	95%
Implied equity risk premium	13,916	0.069	0.038	0.020	0.048	0.062	0.082	0.131
10-year Treasury yield	13,916	0.058	0.025	0.026	0.041	0.049	0.073	0.113
Implied cost of equity capital	13,916	0.126	0.034	0.086	0.106	0.122	0.141	0.177
Term spread	13,916	0.021	0.011	0.001	0.012	0.023	0.030	0.036
Credit spread	13,916	0.011	0.005	0.006	0.008	0.010	0.012	0.020
VIX / 100	11,006	0.214	0.095	0.116	0.150	0.192	0.248	0.376
Inflation	13,916	0.028	0.014	-0.002	0.020	0.028	0.037	0.049
Production growth	13,916	0.018	0.049	-0.084	0.005	0.026	0.046	0.077
Total assets (million)	13,916	59,167	131,412	369	3,212	12,378	48,957	314,150
Market value of equity (million)	13,916	8,095	18,069	188	1,036	2,852	8,211	27,851
Equity-to-asset ratio	13,863	0.219	0.152	0.051	0.109	0.187	0.285	0.511
Book-to-market ratio	13,811	0.827	0.497	0.270	0.527	0.746	0.995	1.599
Recurring ROE	13,496	0.137	0.117	-0.029	0.088	0.134	0.185	0.305
Market beta	12,647	0.958	0.610	0.245	0.625	0.867	1.131	2.290
Idiosyncratic volatility	12,647	0.080	0.037	0.044	0.058	0.070	0.092	0.142
Subsequent year excess return	13,145	0.086	0.334	-0.411	-0.102	0.086	0.252	0.584

Table 1: Summary statistics

The sample covers insurer/analyst/announcement date observations. All variables are measured based on the most updated publicly available information as of the earnings forecast announcement date. The **implied equity risk premium (IERP)** is derived by inverting the residual income model utilizing an analyst's earnings forecasts as described above and in Appendix A. The **implied cost of equity capital (ICEC)** is calculated by adding the **10-Year Treasury Yield** to the IERP. **Term spread** is calculated as the difference between the 10-year and three-month Treasury rates. **Credit spread** is the difference between Moody's Seasoned Baa and Aaa Corporate Bond Yields. **VIX** is the Chicago Board Options Exchange Volatility Index, which measures the implied volatility of the S&P 500 index. **Inflation** is the percentage change in the "Consumer Price Index for All Urban Consumers: All Items Seasonally Adjusted (CPIAUCSL)" from its level 12 months ago. **Production growth** is the percentage change in the "Industrial Production Index Seasonally Adjusted (INDPRO)" from its level 12 months ago. **Total assets** and **common equity** (book value) are obtained from the most recently filed quarterly report as of the earnings forecasts' announcement date. **Market value of equity** is measured as of the earnings forecasts' announcement date. **Recurring ROE** is measured as the ratio of recurring income to beginning-of-period common equity, where recurring income is measured by subtracting from net income tax-adjusted special items, discontinued operations, extraordinary items, noncontrolling interest in income (after 2008), and preferred dividends. **Market beta** (regression slope) and **idiosyncratic volatility** (regression RMSE) are derived from market model regressions, estimated using monthly stock returns during the 60 months immediately prior to the earnings forecasts' announcement month (minimum of 30 observations is required), with the S&P 500 Total Return index used as a market proxy. The **subsequent year excess stock return** is measured over the year following the earnings forecasts' announcement date, where the benchmark return is the one year Treasury rate on the earnings forecasts announcement date.

is 5.8%. Accordingly, the mean value of the ICEC is 12.6%.⁹ The median values of these variables are somewhat smaller – 6.2% for IERP, 4.9% for the 10-year rate, and 12.2% for the ICEC.

To examine the time-series variation in the IERP, the 10-year Treasury yield and their total (ICEC), Figure 1 plots the median values of these variables for each calendar quarter during the period Q2:1983 through Q3:2012. For most of the sample period (1986-2007), the median IERP was quite stable, fluctuating between 4% and 8% and averaging about 5.5%. However, in the early eighties the median IERP was less than 4%, and, since 2008, it exceeded 8%,

surpassing 15% in the first quarter of 2009. These extreme levels of the IERP were associated with less abnormal values for the ICEC due to a negative correlation between the IERP and the 10-year Treasury yield. During the early eighties – when median IERP was very low – interest rates were very high, and during the financial crises of 2007-2009 – when median IERP reached unprecedented levels – the 10-year Treasury yield was at record low levels.

While the median IERP was relatively stable during most of the sample period, the median ICEC exhibited a negative trend due to a monotonic decline in interest rates. The negative trend of the ICEC was abruptly broken during the financial crisis of 2007-2009, which drastically increased the median IERP and hence median ICEC. In the two quarters following its peak in early 2009, the median IERP declined significantly to approximately 9.5% and it fluctuated around this level through September 2012, the end of the sample

⁹ As discussed earlier, the study uses the term "structure of interest rates" to measure the risk-free component of the cost of equity capital, and it thus derives a term structure of ICEC rather than a point estimate. Still, because most analysts use the 10-year Treasury yield as a proxy for the risk-free component of the cost of equity capital, the total of that rate and the estimated IERP can be used as a rough proxy for the ICEC.

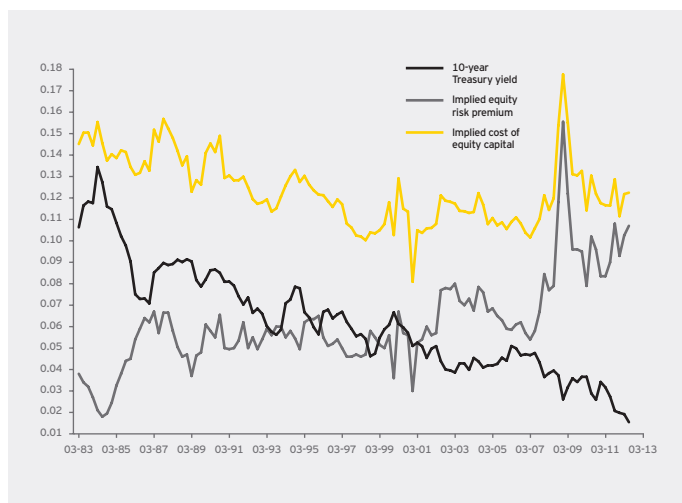


Figure 1: U.S. insurers' median implied equity risk premium over time
 The plots present median values for each calendar quarter of the 10-year Treasury rate, the implied equity risk premium, and their total (an estimate of the implied cost of equity capital).

period. While the median IERP has remained high compared to historical levels, the median ICEC post the financial crisis is comparable to historical levels due to unusually low interest rates.

Table 2 presents correlation coefficients (Pearson below the diagonal, Spearman above) for the analysis variables. As expected (given the patterns in Figure 1), the IERP is strongly negatively related to the 10-year Treasury yield. Consistent with investors demanding a relatively high-risk premium at times of uncertainty or poor economic conditions, the IERP is also positively correlated with the term spread (the difference between the 10-year and three-month Treasury rates), the credit spread (the difference between Moody's Seasoned Baa and Aaa Corporate Bond Yields) and the VIX (implied volatility of the S&P 500 index), and negatively correlated with production growth (the percentage change in the Industrial Production Index).¹⁰ The only macro variable that has an

¹⁰ As is common in the literature, I use industrial production as a proxy for overall economic activity rather than real GDP. Industrial production has the advantage of being reported at a monthly frequency while real GDP is reported on a quarterly basis. Moreover, Hobijn and Steindel (2009) compare real GDP and industrial production in terms of their ability to indicate movements in aggregate economic activity and conclude that "our results suggest that movements in real GDP are not necessarily better at identifying such developments [in aggregate economic activity] than are movements in industrial production measures."

unexpected correlation with the IERP is inflation (the percentage change in the Consumer Price Index). However, the negative correlation between inflation and the IERP is probably due to the high correlation between inflation and the 10-year Treasury yield, which in turn is strongly negatively correlated with the IERP. In the regression analysis below I control for indirect effects by examining all relations simultaneously.

IERP and firm characteristics

In addition to the economy-wide variables, Tables 1 and 2 present summary statistics and correlation coefficient, respectively, for select firm characteristics: size, leverage, value, profitability, stock return, and systematic and idiosyncratic volatility. I next describe these variables and discuss the related statistics. The exact definitions of the variables are provided in the notes to Table 1.

The most common approach for estimating the cost of equity capital is the Capital Asset Pricing Model (CAPM). The fundamental premise of the CAPM is that the risk of a stock can be decomposed into two components – systematic risk, which is related to the overall market, and non-systematic (idiosyncratic) risk, which is specific to the individual stock. According to the CAPM, idiosyncratic risk is not priced (i.e., does not increase the discount rate) because it can be eliminated by holding a diversified portfolio. Systematic risk, in contrast, cannot be diversified away and therefore commands a risk premium. Under some stringent assumptions, systematic risk can be measured using the slope coefficient from a time series regression of the stock's return on a proxy for the market return such as the S&P 500 Total Return. This regression is called the "market model" and the slope coefficient is called "market beta." Thus, if the CAPM holds, a stock's risk premium should increase with its beta and be unrelated to its idiosyncratic volatility. However, contrary to the CAPM premise, beta is at best weakly related to subsequent stock returns [Fama and French (1992)], and idiosyncratic volatility is correlated with future stock returns, although the sign of the correlation is controversial [for example, Ang et al. (2006) versus Fu (2009)].

Academic research and practice suggest that size (market value of equity) is at least as important as systematic volatility when estimating the cost of equity capital [Banz (1981), Fama and French (1992)]. Compared to small firms, large firms are better diversified, more likely to use financial hedging techniques, and more profitable. They also have greater financial flexibility, lower information risk

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15
V1 Equity risk premium		-0.59	0.54	0.17	0.19	0.18	-0.24	-0.21	0.14	-0.13	0.20	-0.05	0.16	0.22	0.07
V2 10-year Treasury yield	-0.48		0.22	-0.15	-0.15	-0.31	0.47	0.28	-0.34	0.09	-0.20	0.21	-0.02	-0.17	-0.02
V3 Implied cost of equity capital	0.76	0.20		0.21	0.29	0.06	0.17	0.02	-0.21	-0.06	0.19	0.06	0.26	0.10	0.15
V4 Term spread	0.17	0.02	0.20		0.37	0.22	-0.21	-0.23	-0.05	-0.02	0.22	-0.17	0.07	0.25	0.20
V5 Credit spread	0.37	-0.04	0.39	0.33		0.47	0.04	-0.34	-0.01	-0.03	0.30	-0.21	0.12	-0.03	0.04
V6 VIX	0.37	-0.27	0.29	0.23	0.72		-0.25	-0.31	-0.03	-0.04	0.21	-0.16	0.13	0.1	0.01
V7 Inflation	-0.23	0.47	0.09	-0.25	-0.06	-0.07		0.07	-0.12	0.01	-0.02	0.14	-0.04	-0.24	0.05
V8 Production growth	-0.34	0.35	-0.12	-0.28	-0.50	-0.45	0.40		-0.13	0.1	-0.06	0.20	0.02	-0.11	0.04
V9 Log of market value of equity	0.05	-0.34	-0.19	-0.06	-0.02	-0.03	-0.11	-0.10		-0.34	-0.15	0.00	0.11	-0.26	-0.02
V10 Equity-to-asset ratio	-0.12	0.05	-0.10	-0.02	-0.06	-0.03	0.00	0.08	-0.35		-0.22	0.30	-0.31	-0.02	-0.05
V11 Log of book-to-market ratio	0.36	-0.13	0.30	0.19	0.30	0.27	-0.07	-0.15	-0.12	-0.24		-0.57	0.17	0.09	0.15
V12 Recurring ROE	-0.13	0.13	-0.05	-0.12	-0.18	-0.12	0.16	0.23	-0.02	0.25	-0.54		-0.10	-0.14	-0.09
V13 Market beta	0.39	-0.14	0.33	0.15	0.19	0.15	-0.21	-0.17	0.12	-0.24	0.33	-0.23		0.10	-0.02
V14 Idiosyncratic volatility	0.28	-0.20	0.16	0.21	-0.01	0.02	-0.22	-0.11	-0.20	0.03	0.19	-0.13	0.44		0.07
V15 Subsequent year excess return	0.20	0.04	0.25	0.19	0.19	0.12	-0.03	-0.08	-0.05	-0.03	0.19	-0.09	0.09	0.07	

Table 2: Correlation matrix

Pearson (Spearman) correlations are reported below (above) the diagonal. Coefficients greater than 0.03 in absolute value are significant at the 1% level. See Table 1 for variable definitions.

and lower variability in profitability and growth rates, and they may be considered “too big to fail” (for example, the government support to a number of the major global financial institutions during the financial crisis). Size is also correlated with stock liquidity, with small firms having high liquidity risk. More fundamentally, these relationships are due to factors such as economies of scale and scope, bargaining power in input and output markets, mature products, access to capital markets, market attention (analysts, institutional investors), and active trading.

Because creditors generally receive a constant return, the variability of the return generated on borrowed funds is absorbed by equity holders. Thus, financial leverage magnifies the variability of equity returns and increases both systematic and idiosyncratic risk. Debt also reduces financial flexibility. Because debt capacity is restricted, high-debt firms have limited ability to borrow additional funds when the need for such borrowing arises. Relatedly, high-debt firms are dependent on debt markets for continued refinancing and so are more sensitive to changes in interest rates, credit spreads, and funds availability, as was evident during the financial crisis of 2007-2009. Financial leverage also affects operating risks. When firms' fortunes deteriorate, customers and other stakeholders often require additional consideration for transacting with the firm, exacerbating the negative shock that caused the initial decline in fortune. This is especially true for insurance companies, where financial stability is a crucial element of the product provided by the insurer. Additionally,

due to extensive regulation – primarily restrictions on the ability to write premiums – insurers' ability to generate business may deteriorate when losses due to financial leverage mount. Thus, while the empirical performance of financial leverage in predicting stock returns has generally been weak [Fama and French (1992)], its impact on risk is likely to be greater in the insurance industry.

Another financial ratio that is commonly used as a proxy for expected returns is the book-to-market ratio. Unlike financial leverage, this ratio has performed well in predicting stock returns, including in the financial sector [Barber and Lyon (1997)]. One explanation for the return predictability of the book-to-market ratio is that book value is a proxy for expected flows (dividends, earnings, cash flow), while market value is a proxy for the present value of those flows. Thus, a high book-to-market ratio implies that investors use a relatively high discount rate in calculating the present value of expected flows, which in turn implies high expected returns and, therefore, high risk. In fact, the IERP is derived using a similar rationale but with a more direct measure of expected flows – earnings forecasts.¹¹

¹¹ In addition to financial leverage and the book-to-market ratio, other fundamentals such as the cash-flow-to-price ratio, earnings momentum, accruals, and asset growth have also been shown to predict stock returns [Subrahmanyam (2009)]. However, whether these factors are proxying for risk or market inefficiency is subject to debate. In addition, at least some of these variables are less relevant for financial services companies (for example, cashflow versus accruals). I, therefore, do not include these variables in the analysis.

	Life and health (Min N = 3,957)			Property and casualty (Min N = 5,198)			Other insurers (Min N = 3,492)		
	Median	Mean	StdDev	Median	Mean	StdDev	Median	Mean	StdDev
Equity risk premium	0.061	0.068	0.041	0.060	0.063	0.031	0.068	0.077	0.041
Total assets (million)	27,528	91,397	146,953	8,188	23,394	37,194	10,427	74,354	179,545
Market value of equity (million)	3,177	7,535	10,130	2,414	6,410	11,703	3,405	11,206	29,119
Equity-to-asset ratio	0.098	0.135	0.120	0.233	0.263	0.128	0.219	0.253	0.174
Book-to-market ratio	0.817	0.908	0.542	0.748	0.804	0.392	0.649	0.767	0.565
Recurring ROE	0.119	0.122	0.094	0.138	0.136	0.105	0.153	0.154	0.149
Market beta	1.009	1.116	0.649	0.777	0.817	0.408	0.888	0.990	0.751
Idiosyncratic volatility	0.075	0.082	0.035	0.070	0.076	0.026	0.067	0.083	0.051
Subsequent year excess return	0.116	0.113	0.361	0.077	0.080	0.302	0.064	0.063	0.346

Table 3: Summary statistics by sub-industry

See Table 1 for variable definitions. "Other" includes multi-line insurers (companies with diversified interests in life, health, and property and casualty insurance), reinsurers, and insurance brokers.

The book-to-market ratio is determined primarily by the relationship between profitability and the cost of equity capital. When profitability is higher than the cost of equity capital, the book-to-market ratio, which reflects investors' pricing of excess profitability, should be less than one. As shown in Table 1, for insurance companies the mean and median values of recurring return on equity (ROE) – a book measure of shareholders' profitability – are close to the mean and median values of the implied cost of equity capital, respectively, and accordingly, the mean and median values of the book-to-market ratio are close to one. These statistics support my argument above, that for insurance companies the book value of equity and expected residual earnings during the explicit forecast period capture much of the intrinsic value of equity, leaving a relatively small portion to be captured by the terminal value calculation.

The correlation coefficients between the IERP and the firm-specific variables, reported in Table 2, are almost all consistent with expectations and are highly significant (greater than 0.03 in absolute value). As predicted by the CAPM, the correlation between the IERP and market beta is positive and highly significant (0.39 Pearson, 0.16 Spearman). Also highly significant are the correlations with idiosyncratic volatility (0.28 Pearson, 0.22 Spearman), log of book-to-market (0.36 Pearson, 0.20 Spearman), and the equity-to-asset ratio (-0.12 Pearson, -0.13 Spearman). Most importantly, the correlation with the

subsequent year excess stock return is positive and highly significant (0.20 Pearson, 0.07 Spearman). These bivariate correlations, however, reflect both direct and indirect effects as well as both time-series and cross-sectional covariation. Above I use fixed effect regressions to estimate the direct effects.

Sub-industry differences

Before turning to the regression analysis, I next examine differences in the risk profiles of insurers across the three sub-industry groups (Life and Health or LH, Property and Casualty or PC, and all others). Table 3 presents summary statistics for each of the sub-industries. As shown, LH insurers have substantially lower equity-to-assets ratios compared to PC and other insurers (median 9.8% versus 23.3% and 21.9% for PC and other insurers, respectively), suggesting that LH insurers are more risky and should therefore have higher risk premium. However, such inference is premature for at least two reasons. First, the difference in leverage is partially due to "separate accounts" which inflate the balance sheet of LH insurers. Separate accounts are similar to assets under management – insurers generally do not bear the risk or receive the return associated with these investments. Second, PC insurers are typically exposed to higher operating risks than LH insurers because both the frequency and magnitude of PC claims are more volatile. PC losses are highly sensitive to catastrophic events such as hurricanes, earthquakes, and terrorism acts, events which typically have limited effect

on LH claims. In addition, payments for PC insurance claims depend on policyholders' incurred losses, while for LH insurance it is generally the face value of the policy. Furthermore, the distribution of PC insurance claims at the firm level can be highly skewed and heavy-tailed, implying that stock returns for PC insurers are likely to be particularly non-normal and may therefore command an incremental risk premium [Cummins et al. (1990)].

On the other hand, LH insurers have significant exposures to market factors that have relatively little impact on PC insurers. Similar to banks, a significant portion of LH insurers' profits is derived from spread income – the difference between the yield on investment assets and the interest cost of insurance reserves.¹² This source of income is sensitive to changes in interest rates, credit spreads and credit losses.¹³ In addition, LH insurers increasingly derive income from management and administrative fees on accounts whose balances are sensitive to market returns.¹⁴ Finally, many LH insurers have significant non-linear exposures to market returns due to various minimum benefit guarantees, primarily related to variable annuity products.

Consistent with the high leverage ratios of LH insurers and their exposures to financial markets, the market-related risk proxies in Table 3 indicate that LH insurers are more risky than PC and Other insurers. In particular, the mean beta of LH insurers is significantly larger than that of PC and Other insurers (p-value for the difference is less than 1% in both cases). In addition, compared to PC and other insurers, LH insurers have significantly

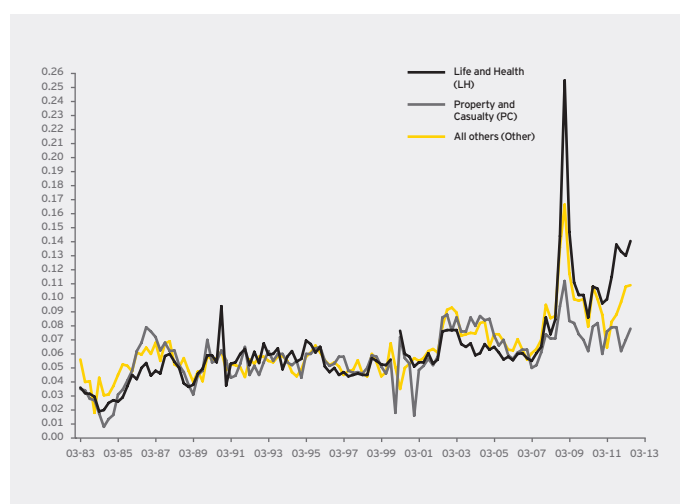


Figure 2: U.S. insurers' median implied equity risk premium by sub-industry
The plots present median values for each calendar quarter of the equity risk premium of three groups of insurance companies: life and health, property and casualty, and all others. "Others" includes multi-line insurers (companies with diversified interests in life, health, and property and casualty insurance), reinsurers, and insurance brokers.

higher book-to-market ratios and idiosyncratic volatility. Finally, the average excess stock returns of LH insurers are significantly larger than those of PC and other insurers.

The significant differences in operations and financial profile across the insurance sub-industries suggest that the IERP is likely to vary significantly across the three groups and be higher for LH insurers. Yet, the estimates in Table 3 indicate that the mean and median values of LH insurers' IERP are significantly smaller than those of other insurers and are only marginally larger than those of PC insurers. Moreover, Figure 2, which reports quarterly median values of the IERP for each of the three sub-industries, indicates that, during most of the sample period, the three median IERP series were quite similar. However, starting in 2008 the median IERP of LH insurers increased dramatically and by early 2009 it reached unprecedented levels. The median IERP of PC and other insurers also increased significantly during that period, but by far less than the increase for LH insurers. In the first quarter of 2009, the median IERP was 25.5% for LH insurers, 11.2% for PC insurers, and 16.7% for other insurers. The large increase in the IERP of LH insurers is consistent with their high sensitivity to fluctuations in financial markets. The differences in the IERP

12 The interest cost of LH insurance reserves includes both explicit and implicit components. LH insurance reserves consist primarily of the liability for future policy benefits and policyholder account balances. The liability for future policy benefits represents the present value of future benefits to be paid to, or on behalf of, policyholders, including related expenses, less the present value of expected future net premiums to be received (essentially gross premiums minus embedded profit). This liability relates to traditional life insurance products such as term and whole life, and general account annuities with life contingencies. Because the liability is reported at present value, the related expense – the policyholder benefits expense, which measures the total of benefit payments during the period and the change in the liability – includes an implicit interest cost component. The liability for policyholder accounts relates to universal life policies and investment products; similar to bank deposits, these accounts earn interest and so generate an explicit interest cost for the insurance company. See Nissim (2010) for a discussion of accounting by insurance companies.

13 Unlike banks, which generate spread income by taking on both interest rate risk and credit risk, insurance companies generate spread income primarily by taking on credit risk. Banks borrow short-term and invest long-term and so benefit from the (usually) positive slope of the term structure, while, for most life insurance companies, asset duration is shorter than liability duration.

14 These include assets under management, separate accounts, and some policyholder accounts, with related portfolios included in general account assets. The balances of these accounts are affected by capital market performance both directly (the returns) and indirectly (net flows).

	Model 1	Model 2	Model 2	Model 2	Model 3	Model 4	Model 5
Sample	All	All	Non FC	FC	All	All	All
Intercept/fixed effect	0.0938 25.1	0.1022 34.1	0.0949 31.8	0.0946 4.8	Firm	Time	Firm& Time
10-year Treasury yield	-0.634 -24.8	-0.7632 -49.5	-0.7413 -49.7	-0.3470 -1.0	-1.1142 -42.6		
Term spread	0.0636 2.4	0.1210 4.9	0.1972 8.9	0.0612 0.3	0.1287 5.8		
Credit spread	2.8794 18.8	2.4054 22.9	1.3945 13.9	3.5872 10.7	1.9844 22.9		
VIX/100	0.0047 0.8						
Inflation	0.1538 5.0	0.2165 7.6	0.3321 11.3	-0.0466 -0.5	0.1929 8.0		
Production growth	0.0183 2.1	-0.0017 -0.2	0.0703 8.6	0.0751 1.5	0.001 0.2		
Market beta	0.0152 23.8	0.0153 23.5	0.0074 13.9	0.0356 14.6	0.0118 18.6	0.0153 15.2	0.0158 15.6
Idiosyncratic volatility	0.0348 3.1	0.0551 4.3	0.1075 7.9	-0.1840 -4.3	-0.0502 -4.2	0.0765 4.8	-0.0745 -4.3
Equity-to-asset ratio	-0.0365 -13.4	-0.0326 -13.5	-0.0218 -9.5	-0.0694 -6.2	-0.0608 -13.4	-0.0258 -10.2	-0.0531 -10.9
Log of market value of equity/100	-0.3617 -13.8	-0.3846 -15.1	-0.2881 -12.2	-0.5040 -6.1	-1.8216 -25.3	-0.3314 -11.7	-1.8101 -18.4
Dummy for LH insurers	-0.0089 -10.6	-0.0090 -12.0	-0.0062 -9.6	-0.0214 -7.0		-0.0084 -10.6	
Dummy for PC insurers	-0.0076 -10.7	-0.0067 -11.0	-0.0045 -8.2	-0.0202 -9.1		-0.0067 -10.1	
R-square	0.4621	0.4695	0.3708	0.5547	0.6529	0.6974	0.8149
Number of observations	9,835	12,596	10,884	1,712	12,596	12,596	12,596

Table 4: Regressions examining the determinants of insurers' implied equity risk premium

The dependent variable in each regression is a firm/analyst/announcement date-specific estimate of the IERP. "FC" refers to observations during the financial crisis, from 1 July 2007 through 31 December 2009. See Table 1 for variable definitions. T-statistics are calculated using White's (1980) heteroskedasticity-consistent standard errors.

across the industry groups remained substantial after the crisis, indicating a structural change in the pricing of LH insurers. Apparently, investors are now better aware of the high sensitivity of LH insurers to financial markets and price this sensitivity.

Regression analysis

The analysis thus far indicates that the IERP is correlated with relevant macro factors and firm characteristics. However, as noted earlier, bivariate correlations reflect both direct and indirect effects. To estimate direct effects, I next turn to a regression analysis. Table 4 reports estimates from seven panel data regressions of the IERP on economy-wide and firm-specific risk factors as well as sub-industry dummies. Model 1 includes all the explanatory variables. The other six regressions omit the VIX variable, which is unavailable prior to 1990 and is insignificant in Model 1. Model 2 is estimated for three samples:

using all observations, excluding the financial crisis (30 June 2007 through 31 December 2009 observations), and for the financial crisis. Model 3 includes firm fixed effect, Model 4 includes time fixed effect, and Model 5 includes firm and time fixed effects. The time effect is measured at a daily frequency and so completely spans the economy-wide variables, which are accordingly omitted from Models 4 and 5. The firm effect does not completely span the sub-industry classification variables due to changes in classification over time, but these are uncommon. The sub-industry dummies are, therefore, not included in Models 3 and 5. With fixed firm effect, each coefficient measures the impact on the dependent variable of a unit deviation of the related explanatory variable from its firm-specific average. Thus, the coefficients from firm fixed effect regressions (Models 3 and 5) are akin to coefficients from a change specification and so are more likely to capture direct effects of the related variables.

In each of the five regressions of Table 4 that includes the macro variables, the credit spread is strongly positively related to the IERP – investors in insurance companies demand large risk premiums when economy-wide credit spreads are high. This was especially true during the financial crisis, as the coefficient on the credit spread is significantly larger in the financial crisis (FC) regression compared to the non-FC regression. (The t-statistics for the FC regression are relatively small due to the small number of observations and short time interval.) The coefficient on VIX is insignificant, but unreported results indicate that this is due to the credit spread subsuming the information in VIX. The 10-year Treasury yield is strongly negatively related to the IERP in each of the three “all” sample regressions as well as for the non-FC observations. Inflation and the term premium are positively related to the risk premium. These results are generally consistent with expectations. Investors demand a relatively high risk premium when the economy is performing poorly or when there is high uncertainty. The only coefficient which is inconsistent with this interpretation is that of production growth, which is positive rather than negative. This result may be due to production growth affecting the demand for equity capital, which in turn increases the equity premium.

Turning next to the firm-specific characteristics, the results are also consistent with expectations. In each of the seven regressions, the IERP is positively and strongly related to market beta and negatively and strongly related to the equity-to-assets ratio and size. Moreover, each of the three relations is substantially stronger during the financial crisis, and the differences in the coefficients between the FC and non-FC samples are statistically significant. Idiosyncratic volatility is positively related to the premium, but this relation reverses sign when firm fixed effects are included as well during the financial crisis.¹⁵ The coefficients of the LH and PC dummy variables are both negative and significant, suggesting that, after controlling for the risk factors, LH and PC insurers are on average less risky than other insurance companies (multi-line insurance companies, reinsurers, and insurance brokers).

Table 5 reports estimation results for the three industry subsamples. Most of the relations hold for each of the three sub-industry groups. In each case, the IERP is negatively and strongly related to the 10-year Treasury yield, the credit spread, the equity-to-assets ratio, and size. In addition, the IERP is positively related to inflation and market beta. The coefficients on the other variables – the term spread, production growth, and idiosyncratic volatility – are less consistent, but they are also less significant for the whole sample (Table 4). The primary differences across the industries are in the magnitudes rather than signs of the coefficients. In particular, the credit spread coefficient is significantly larger for LH insurers than for PC and other insurers. This result is consistent with the large magnitude (relative to equity) of LH insurers’ investment portfolios, which consist primarily of credit risky bonds. In addition, as noted earlier, LH insurers derive much of their income from various fees that are strongly related to capital market returns, and they provide minimum benefit guarantees that are tied to capital market performance. Indeed the coefficient on market beta is also significantly larger for LH insurers than for PC insurers. Compared to PC insurers, the IERP of LH insurers is also more sensitive to cross-sectional and time-series variation in size and the equity-to-assets ratio.

Stock return predictability

The estimates in Tables 4 and 5 show that the IERP is correlated with risk proxies, suggesting that it should predict excess stock returns. Table 6 presents results from regressing excess stock return (over the risk free rate) during the year following the IERP calculation on the IERP and control variables. Three sets of regressions are reported: OLS (Panel A), fixed effects (Panel B), and fixed effects with controls (Panel C). Each set of regressions is run for the full sample as well as for each of the three sub-industry groups. In all cases, the IERP coefficient is positive and highly significant. In contrast, none of the coefficients on the control variables (in Panel C) is consistently significant. The high significance of the IERP coefficient is notable given the low predictability of stock returns and the weak return predictability of IERP estimates in prior studies [Easton (2007)]. As explained earlier, the strong performance of the IERP in this study is likely due to the key role of financial instruments in the insurance industry. Indeed, for PC insurers, whose activities are less financing in nature, the IERP is less strongly correlated with the risk proxies (Table 5) and future excess stock returns (Table 6) compared to LH and other insurers.

¹⁵ I do not include the book-to-market ratio because, as discussed above, the IERP is derived based on the relation between the market and book values, so any measurement error in IERP is likely to be correlated with the book-to-market ratio and therefore bias the estimates.

	Life and health (LH)		Property and casualty (PC)		Other insurers (Other)	
	Model 2	Model 5	Model 2	Model 5	Model 2	Model 5
Intercept/fixed effect	0.1000 13.7	Firm & time	0.0764 19.8	Firm & time	0.1196 24.4	Firm & time
10-year Treasury yield	-0.8032 -23.7		-0.6598 -32.2		-0.8427 -30.4	
Term spread	-0.1167 -2.7		0.2002 5.5		0.1892 4.1	
Credit spread	3.4236 17.5		1.2385 8.5		2.8637 14.2	
Inflation	0.2584 5.1		0.1533 4.0		0.2780 4.9	
Production growth	0.0076 0.6		0.0234 2.2		-0.0277 -2.2	
Market beta	0.0153 15.2	0.0168 4.8	0.0122 9.6	0.0038 2.4	0.0153 12.2	0.0150 7.5
Idiosyncratic volatility	0.1397 4.5	-0.0335 -0.6	0.091 5.0	-0.0804 -2.1	0.0059 0.4	-0.0962 -3.4
Equity-to-asset ratio	-0.0698 -10.8	-0.0842 -5.8	-0.0277 -8.0	-0.0416 -5.4	-0.0304 -7.8	-0.0396 -4.4
Log of market value of equity/100	-0.5640 -10.0	-1.7554 -7.9	-0.0852 -2.6	-1.1027 -8.1	-0.5995 -14.2	-3.1480 -14.1
R-square	0.5669	0.9070	0.3175	0.8437	0.5268	0.8970
Number of observations	3,906	3,906	5,198	5,198	3,492	3,492

Table 5: Regressions examining the determinants of insurers' implied equity risk premium by sub-industry

The dependent variable in each regression is a firm/analyst/announcement date-specific estimate of the IERP. See Table 1 for variable definitions. t-statistics are calculated using White's (1980) heteroskedasticity-consistent standard errors. "Other" includes multi-line insurers (companies with diversified interests in life, health, and property and casualty insurance), reinsurers, and insurance brokers.

If the IERP is measured with no error, and stock prices are efficient with respect to the information contained in the IERP, the IERP coefficient should equal one. If the IERP captures pricing inefficiencies and is measured with no error, the IERP coefficient should be greater than one as prices gravitate to intrinsic values.¹⁶ Any non-systematic error contained in the IERP will bias the IERP coefficient downward. As shown in Table 6, the IERP coefficients are significantly greater than one in all regressions except for PC insurers. Thus, it appears that the IERP captures market

mispricing in addition to risk. In other words, when price is low compared to analysts' earnings forecasts and book value (so the IERP is high), subsequent stock returns are relatively high as price adjusts upward. The converse is true when price is relatively high.

Robustness

As described above and in Appendix A, the derivation of the IERP requires some strong assumptions, particularly regarding the evolution of residual income after the explicit forecast period. To evaluate the robustness of the results, I re-run all analyses using alternative IERP estimates calculated assuming that after year 5 residual income will (1) remain constant, (2) grow at a rate equal to expected inflation, measured using the University of Michigan Inflation Expectation Survey of Consumers, or (3) grow at a rate equal to expected inflation, measured based on the relationship between nominal and inflation-protected 10-year Treasury yields. The rationale for these choices is explained in Appendix A. The quarterly median IERP calculated using each of the three alternative

¹⁶ Note that the IERP measures the average premium in all future years. If the premium reflects mispricing, it is unlikely that that mispricing will be corrected at a constant rate over all future years. Mispricing tends to be corrected within a reasonably short period of time. The stock return during the correction period will be substantially larger than the mispricing component of the IERP. For example, if the risk free rate is 4%, the stock price is \$100, and analysts correctly expect the company to pay \$10 perpetual dividend, then the IERP is 6% (solve $100 = 10 / [0.04 + \text{IERP}]$). If price reflects these expectations, the expected excess stock return next year is 6%. However, if price incorrectly reflects expected perpetual dividends of only \$9 (i.e., investors use a discount rate of 9% (solve $100 = 9/r$)), and price adjusts to reflect the correct dividend expectations in the following year, the new price will be \$111.11 ($= 10/0.09$) and the excess stock return will be 17.11% ($= [10 + (111.11 - 100)] / 100 - 4\%$).

Panel A: OLS regressions				
	All	Life and health	Property and casualty	Other insurers
Intercept	-0.0393 -3.6	-0.0798 -4.2	0.0554 4.6	-0.0993 -4.6
Equity risk premium	1.8496 10.7	2.8877 9.3	0.3964 2.1	2.1378 7.0
R-square	0.0405	0.1002	0.0016	0.0597
Number of observations	13,145	4,136	5,361	3,648
Panel B: Fixed firm and time regressions				
	All	Life and health	Property and casualty	Other insurers
Equity risk premium	2.617 13.6	3.2356 8.3	1.2878 5.4	3.0184 8.1
R-square	0.7191	0.8776	0.8121	0.8017
Number of observations	13,145	4,136	5,361	3,648
Panel C: Fixed firm and time regressions, controlling for firm characteristics				
	All	Life and health	Property and casualty	Other insurers
Equity risk premium	2.1104 11.7	2.0703 6.7	1.2449 5.5	2.3959 6.0
Market beta	-0.0169 -1.7	0.0813 3.4	-0.046 -3.2	-0.0727 -2.9
Idiosyncratic volatility	-0.7472 -3.3	-3.0592 -6.9	2.4525 6.7	-0.4369 -1.2
Equity-to-asset ratio	0.2773 5.0	-0.5136 -3.0	0.4167 4.7	0.3916 3.8
Log of market value of equity/100	-11.9146 -12.7	-10.775 -5.4	3.9799 3.0	-22.3344 -8.8
Log of the book-to-market ratio	0.0890 4.6	0.2629 7.5	0.2869 10.5	-0.0461 -1.0
R-square	0.7502	0.9025	0.8394	0.8218
Number of observations	11,899	3,643	4,956	3,300

Table 6: Regressions examining the relationship between the implied equity risk premium and future excess stock return

The dependent variable in each regression is the excess stock return over the year following the earnings forecasts' announcement date, measured relative to the risk free rate. See Table 1 for variable definitions. t-statistics are calculated using White's (1980) heteroskedasticity-consistent standard errors. "Other" includes multi-line insurers (companies with diversified interests in life, health, and property and casualty insurance), reinsurers, and insurance brokers.

terminal value assumptions as well as under the initial assumption are presented in Figure 3. As shown, for the 80s and 90s the alternative assumptions reduce the IERP by about one-to-two percentage points, but they generally do not change its pattern over time. From the early 2000s, the differences across the estimates decline substantially, and from the beginning of the financial crisis the four estimates converge. I also replicate all tables with each of the three alternative IERP estimates and, in all cases, find similar results to those reported, confirming the robustness of the findings with respect to the most critical assumption made in the IERP calculation.

Conclusion

This paper derives and evaluates estimates of the implied equity risk premium (IERP) of U.S. insurance companies by inverting

the residual income model, utilizing analysts' earnings forecasts as proxies for market expectations of future earnings. During most of the sample period, April 1983 through September 2012, the quarterly median IERP was relatively stable, fluctuating mildly around an average value of about 5.5%. However, during the financial crisis of 2007-2009, the median IERP reached unprecedented levels, exceeding 15% in the first quarter of 2009. Following the financial crisis, the IERP declined substantially but it remained at historically high levels, exceeding 9% on average.

In spite of significant differences in operations and financial profile, the median IERP of Life and Health (LH) insurers was similar to that of Property and Casualty (PC) insurers during most of the sample period. However, during the financial crisis the median IERP

of LH insurers was substantially larger than that of PC insurers, consistent with the higher sensitivity of LH insurers to fluctuations in financial markets. The differences in the IERP across the sub-industry groups remained substantial post the crisis, indicating a structural change in the pricing of LH insurers.

Consistent with investors demanding relatively high expected returns in periods of poor economic performance or high uncertainty, the IERP is positively related to the credit spread, term spread, and inflation, and negatively related to the 10-year Treasury yield. The relations with firm-specific risk factors are similarly consistent with expectations: the IERP is positively related to market beta, and negatively related to size and the equity-to-assets ratio. These sensitivities are generally higher for LH insurers and during the financial crisis. Finally, consistent with the strong correlations between the IERP and the macro- and firm-specific risk factors, the IERP performs well in predicting subsequent excess stock returns. The stock return predictability apparently reflects mispricing in addition to compensation for risk.

These findings improve our understanding of the determinants of, and proxies for, equity risk in the insurance industry. The IERP estimates derived in the study perform better than standard risk measures and also indicate potential mispricing. The results demonstrate a structural change in the risk pricing of insurance companies: following the financial crisis, investors demand a substantially higher risk premium, primarily from LH insurance companies. In addition, the risk sensitivities of LH insurers are significantly different from, and generally larger than, those of other insurers. This evidence suggests that the current trend in accounting regulation to eliminate accounting differences across insurance operations may not be desirable [see, for example, Nissim (2010)].

Appendix A: Derivation of the implied equity risk premium

Given a set of EPS forecasts announced by an analyst (typically EPS for the current and subsequent year and long term EPS growth), I estimate the IERP for that insurer/analyst/announcement date observation by solving the following equation for prem:¹⁷

17 In some cases analysts announce subsets of the EPS forecast series (EPS1-EPS5 and EPS growth) on different dates. To complete forecast series, I look back up to 31 days for annual EPS forecasts and 93 days for EPS long-term growth forecasts, provided that there is no change in the fiscal year to which the forecasts correspond. These adjustments substantially increase the sample size but do not change any of the inferences.

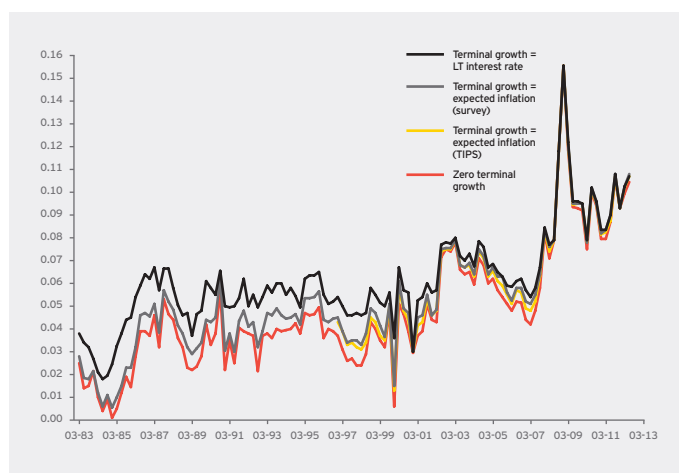


Figure 3: U.S. insurers' median implied equity risk premium under alternative terminal value assumptions

The plots present median values for each calendar quarter of four alternative estimates of the equity risk premium of insurance companies. The estimates differ with respect to the terminal value assumption used in the valuation model from which the implied premium estimate is derived.

$$P^c = [BVPS_0 + \sum_{t=1}^5 \frac{EPS_t - (f_t + prem) \times BVPS_{t-1}}{\prod_{i=1}^t (1 + f_i + prem)} + \frac{\max(\frac{(EPS_5 - (f_5 + prem) \times BVPS_4)}{pre}, \frac{EPS_5 - (f_5 + prem) \times BVPS_4}{f_{t+1} + prem})}{\prod_{i=1}^5 (1 + f_i + prem)}] \times (1 + f_1 + prem)^5$$

Time 0 is the end of the most recent fiscal year (year 0) for which 10-K has been filed as of the earnings forecast announcement date. P^c (cum-dividend price) is the closing share price on the earnings forecast announcement date, adjusted for the reinvestment of dividends between the end of fiscal year 0 and the forecast announcement date. The rationale for the dividend adjustment is that the residual income model values the stock relative to book value at the beginning of the first residual income period (time 0, beginning of fiscal year 1). Consequently, any dividend paid between time 0 and the forecast announcement date reduces price but has no direct effect on the valuation.

The other variables are measured as follows. $BVPS_0$, or book value per share at time 0, is calculated by dividing book value by shares outstanding, and is adjusted for stock splits and stock dividends between time 0 and the forecast announcement date. EPS_t is the analyst's EPS forecast for fiscal year t , $t = 1, \dots, 5$, where $t = 1$ denotes the fiscal year that starts at time 0. Forecasts for $t = 3, 4,$

or 5 are often unavailable. In such cases, I estimate missing forecasts by assuming a constant growth rate equal to the long-term EPS growth forecast, provided that the base forecast is positive.¹⁸ $BVPS_t$, for $t = 1, \dots, 4$, is forecasted using the following relation: $BVPS_t = BVPS_{t-1} + EPS_t - DPS_t$, where DPS_t is forecasted dividend per share for year t , $t = 1, \dots, 4$. DPS_1 is measured as the total of dividends from time 0 through the forecast announcement date and expected dividends for the remainder of the year. Expected dividends are measured based on the most recently declared dividend.¹⁹ DPS_2 is measured by assuming that the annualized most recently declared dividend will grow at the long-term earnings growth rate in year 2. DPS_3 and DPS_4 are estimated by assuming that DPS will continue to grow annually at the same rate as the long-term earnings growth forecast.

f_t is the forward risk-free rate for future year t , derived from the term-structure of U.S. Treasuries as of the earnings forecast announcement date. f_{LT} is a proxy for expected long-term interest rates at time $t=5$, measured using the annualized risk-free forward rate from $t=5$ to $t=10$, as derived from the term-structure of U.S. Treasuries as of the earnings forecast announcement date. This rate tends to be less volatile than the 10-year rate and lies between the 10 and 30 years rates. $prem$ is the insurer/analyst/date-specific IERP, which is being reverse-engineered.

The “max” term measures the present value of expected residual income in all years after year 5. It is the equivalent of the “terminal value” calculation in the DCF model. Although this calculation might appear somewhat arbitrary, it is based on both

economic and statistical considerations as explained below. In addition, I conduct extensive robustness checks using alternative terminal-value calculations and report the results above.

The first term inside the max function assumes that after year 5 residual earnings will grow at a constant rate equal to f_{LT} , a proxy for the expected long-term risk-free rate. The rationale for this assumption is that steady state firms are generally expected to grow at a rate consistent with the nominal long-term growth in overall economic activity, which in turn should be close to the long-term risk-free rate. The nominal long-term growth rate is approximately equal to the total of expected inflation and real growth, while the risk-free rate is approximately equal to the total of expected inflation and the real rate of interest. To the extent that real interest rates predict real returns, which in turn determine real growth, the long-term risk-free rate can serve as a proxy for nominal long-term growth. Given this assumption, the first term in the max function should be familiar – it is essentially the Gordon model applied to residual income.²⁰ An important statistical property of this calculation is that it generates few if any outliers because changes in the risk-free and long-term growth rates offset each other (without this offset, the denominator in a Gordon-like calculation may be close to zero or even negative, generating outliers or meaningless estimates, respectively).

Because residual income measures return relative to the cost of equity capital, negative residual income means that the firm is generating a negative net return to shareholders after considering the cost of equity capital. In such cases, growth destroys rather than creates value, and firms have no incentives to increase invested capital. Accordingly, when residual income is negative, the second term in the max function effectively sets expected residual income after year 5 equal to its level in year 5.²¹

The final term in the equation adjusts the valuation for the expected increase in value from time 0 (the end of the most recent fiscal year for which financial results have been reported) through the forecast announcement date, where F measures the length of that period.

18 When the long-term earnings growth forecast is not available, but EPS forecasts for at least some of the years 2 through 5 are available, I estimate long-term earnings growth using the EPS forecasts. Specifically, I set the long-term EPS growth forecast equal to the first non-missing value in the following sequence: $(EPS5/EPS4 - 1)$, $([EPS5/EPS3]^5 - 1)$, $(EPS4/EPS3 - 1)$, $([EPS5/EPS2]^{.3333} - 1)$, and $([EPS4/EPS2]^5 - 1)$. To mitigate measurement error, I only use positive EPS values for these calculations, and I winsorize the long-term EPS growth forecast at 0 and 0.4 (these values approximately correspond to the 5th and 95th percentiles of the empirical distribution).

19 I use regular dividends, defined by CRSP as “U.S. ordinary cash dividends,” monthly (CRSP 3-digit distribution code 122), quarterly (123), semi-annually (124), or annually (125). I aggregate dividends across tax status (the fourth digit distribution code), and I estimate the annual rate based on the dividend frequency. I use the most recent regular dividend prior to the forecast announcement date, unless it is distant enough to suggest that the company discontinued the dividend. This is evaluated based on the empirical distribution of the time gap between dividend ex-dates for the corresponding frequency. For example, the 99th percentile of the time gap between consecutive quarterly dividends is 125 days. I, therefore, assume that if the ex-date for the last quarterly dividend was more than 150 days prior to the forecast announcement, the company likely suspended its dividend. If no dividend is available, I set the dividend equal to zero.

20 According to the Gordon model, price is equal to $d \times (1+g)/(r-g)$, where d is dividend per share, g is the constant long-term growth rate, and r is the cost of equity capital. If the long term growth rate is equal to the risk free rate, $r-g$ is equal to the risk premium.

21 An alternative assumption, which is used in the robustness section, is to set residual income after year 5 equal to zero when residual income in year 5 is negative. However, companies are often unable to exit investments without incurring the full loss. Consider, for example, life insurers’ investments in long-term fixed income securities. If interest rates rise, residual income will be negative over many years. And if the firm sells the investment, it will still incur the full loss.

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