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The Time-Variation of Risk Premiums on Insurer Stocks

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ABSTRACT

This article examines the economic environment that determines the risk premium on insurer stocks. Our main finding is that variations in the risk premiums of insurance stocks are predictably related to movements in financial and real estate market conditions. We also show that risk premiums paid on insurance stocks vary substantially over time. Preliminary evidence indicates that insurers have been perceived by the market to have increased their real estate risk exposure in the 1980s, despite the fact that their actual holdings, as a percentage of assets, remained relatively unchanged during the period. We also find that the time variation in expected asset returns could be explained by the changing price of risk of one or two systematic factors.

Introduction

This article studies the economic determinants of risk premiums on insurer stocks. Using a life insurance stock index, a property-liability insurance stock index, and some financial and real estate variables, we address the following question: How do changing economic conditions affect the risk premiums on insurance stocks?

It is important for insurers to understand the determinants of equity risk premiums since risk premiums affect not only their investment decisions but also their financing decisions. As is well known in the corporate finance literature, the weighted average cost of capital is a weighted average of the cost of debt and the cost of equity. The higher the equity risk premium, the higher the required rate of return on equity; thus, the higher the weighted average cost of capital. Higher equity risk premiums should lead to reductions in the promised minimum rates of return paid to some universal/variable policyholders

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since certain profit levels must be maintained in order to ensure risk-adjusted returns to shareholders. The variation of risk premiums is also of interest to regulators because it contains information about market perceptions of insurer risk and cost of capital. Thus, in states where policy premiums are regulated, regulators should allow for higher policy premium increases if there is substantial increase in the equity risk premium.

Our study finds substantial variation in risk premiums on insurance stocks that is predictably based on a small set of economic variables. We also find that the risk premiums (expected excess returns) on insurer stocks and equity real estate investment trusts (REITs) have behaved in similar fashion. Preliminary evidence indicates that insurers have been perceived by the market to have increased their real estate risk exposure in the 1980s due to a turbulent real estate market, despite the fact that their actual holdings, as a percentage of assets, remained relatively unchanged during the period. We also find that the time variation in risk premiums could be explained by the changing price of risk of one or two systematic factors.

This study employs a multifactor latent-variable model widely used in the finance literature to study the risk premium of market indices. The risk premium of insurance stocks has not been examined using this method. This methodology, which is designed to capture the movement in *expected* excess returns due to a changing economic environment, is appropriate for our purpose because it allows for time-varying risk premiums. Specifically, it provides a concise framework to study the co-movement of insurance stocks and real estate market returns.

The next two sections outline the asset pricing framework and estimation procedure. They are followed by a description of our data set and an empirical study of the time variation in risk premiums on insurance stocks. A final section summarizes the results.

The Asset Pricing Framework

Using the multifactor latent-variable model of Campbell (1987), Campbell and Hamao (1992), and Ferson (1989), we begin by assuming that asset returns are generated by the following K-factor model:

$$\tilde{r}_{i,t+1} = E_t[\tilde{r}_{i,t+1}] + \sum_{k=1}^{K} \beta_{ik} \tilde{f}_{k,t+1} + \tilde{\varepsilon}_{i,t+1}, \tag{1}$$

where $\tilde{r}_{i,t+1}$ is the return on asset i held from time t to time t+1, in excess of the Treasury bill rate. $E_t[\tilde{r}_{i,t+1}]$ is the expected excess return on asset i, conditional on information known to investors at the end of time period t. The unexpected return on asset i equals the sum of K factor realizations $\tilde{f}_{k,t+1}$ times their betas or factor loadings β_{ik}, plus an idiosyncratic error $\tilde{\varepsilon}_{i,t+1}$. We assume that $E_t[\tilde{f}_{k,t+1}] = 0$, $E_t[\tilde{\varepsilon}_{i,t+1}] = 0$, and $E[\tilde{\varepsilon}_{i,t+1}|\tilde{f}_{k,t+1}] = 0$. Here, the conditional expected excess return, $E_t[\tilde{r}_{i,t+1}]$, is allowed to vary over time according to investors' conditional information set at time t. One could think of equation (1) as an extension to the well-known capital asset pricing model by allowing systematic factors other than the market factor to affect return on assets.

Moreover, we have:

$$E_t[\tilde{r}_{i,t+1}] = \sum_{k=1}^{K} \beta_{ik}\lambda_{kt}, \tag{2}$$

where λ_{kt} is the market price of risk for the kth factor at time t.[1] Equation (2) states that the conditional expected excess return should be a weighted average of factor risk premiums, with the weights equal to the betas of each asset. In this article, we assume the betas to be constant over a given sample period. Thus, the variation in risk premiums is the only source of variation of expected returns on assets.

Now suppose that the information set at time t consists of a vector of L (L > K) forecasting variables X_{pt}, p = 1...L, and that conditional expectations are linear in these variables. Then we can write λ_{kt} as

$$\lambda_{kt} = \sum_{p=1}^{L} \Theta_{kp}X_{pt}, \tag{3}$$

and we have

$$E_t[\tilde{r}_{i,t+1}] = \sum_{k=1}^{K} \beta_{ik} \sum_{p=1}^{L} \Theta_{kp}X_{pt} = \sum_{p=1}^{L} \alpha_{ip}X_{pt}. \tag{4}$$

Equation (4) suggests that expected excess returns are time varying and can be predicted by the forecasting variables, X_{pt}, in the information set. We can see from equation (4) that the model places restrictions on the α_{ip} coefficients, which are

$$\alpha = \begin{bmatrix} \alpha_{11} & \cdots & \alpha_{1L} \\ \vdots & \ddots & \vdots \\ \alpha_{N1} & \cdots & \alpha_{NL} \end{bmatrix} = \begin{bmatrix} \beta_{11} & \cdots & \beta_{1k} \\ \vdots & \ddots & \vdots \\ \beta_{N1} & \cdots & \beta_{Nk} \end{bmatrix} \begin{bmatrix} \theta_{11} & \cdots & \theta_{1L} \\ \vdots & \ddots & \vdots \\ \theta_{k1} & \cdots & \theta_{kL} \end{bmatrix} \tag{5}$$

where β_{ik} and Θ_{kj} are free parameters.

The main objectives of this article are to use the regression system in equation (4) to examine economic variables driving the ex ante conditional risk premium $E_t[\tilde{r}_{i,t+1}]$ on insurance stocks and to test the equilibrium asset pricing restriction of equation (5).

It is worth noting that part of equation (4) can be derived directly from linear projections *without* using the asset pricing framework of equations (1) through (3). In other words, given that the conditional expectations are linear in the forecasting variables, we will have

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[1] This type of linear pricing relationship can be generated by a number of intertemporal asset pricing models, under either a no-arbitrage opportunity condition or through a general equilibrium framework.

$$E_t[\tilde{r}_{i,t+1}] = \sum_{p=1}^{L} \alpha_{ip} X_{pt}. \tag{4a}$$

This is a nontrivial result because it implies that the conditional risk premium estimated using equation (4a) does not depend upon the assumption of beta coefficients being constant through time and the other restrictions imposed by the asset pricing model. Thus, even though the sensitivities of assets toward economic changes vary over time and assumptions about model (1) do not hold, as long as the product of beta and factor premiums in equation (2) are linear in forecasting variables, equation (4a) will still be valid and useful in describing the time variation in expected returns.

The methodology adopted here has several advantages. First, the model allows for time-varying risk premiums. This is a significant improvement over previous studies of insurance and other financial institution stocks that generally assume constant risk premiums (Sweeny and Warga, 1986). It is also consistent with a large body of evidence on time-varying risk premiums, which has been documented extensively by Campbell (1987), Fama (1990), Fama and French (1989), Ferson and Harvey (1991), and Keim and Stambaugh (1986), among others. Further, the estimation procedure is robust to the existence of heteroskedasticity and contemporaneous correlations among idiosyncratic shocks across securities and requires no special assumptions on the error terms except those required by Hansen's (1982) generalized method of moments (GMM).

The Estimation Procedure

A GMM approach similar to that of Campbell (1987), Campbell and Hamao (1992), Ferson (1989), and Ferson and Harvey (1991) is employed to estimate equation (4a) jointly for all assets and to test the linear pricing restriction of equation (5). The forecasting variables in our study include a constant, a January dummy, the yield on one-month Treasury bills, the spread between the yields on long-term AAA corporate bonds and the one-month Treasury bills, the dividend yields on the equally-weighted market portfolio, and the cap rate on real estate. The yield variable shows the level of the current interest rate. The spread variable gives us the slope of the term structure of interest rates. The dividend yield variable conveys information about future cash flows and required returns on stocks in general. These variables have been used extensively in previous studies and have been found to carry important information on the factors determining the risk premiums on various assets (see Campbell, 1987; Campbell and Hamao, 1992; Fama and French, 1988, 1989; Ferson, 1989; Ferson and Harvey, 1991; Keim and Stambaugh, 1986; and Liu and Mei, 1992, among others).

Following Liu and Mei (1992), we also include the cap rate on real estate assets to capture changing real estate market conditions and to study whether movements in the real estate market affect insurance stock returns (see Nourse, 1987). The cap rate is defined as the ratio of net stabilized earnings to the transaction price (or market value) of a property. Net stabilized earnings means that the income figure used in the numerator of the ratio assumes that full lease of the building has occurred such that the building's vacancy is equal to or less than the vacancy of the market (see Liu and Mei, 1992). Although both the cap rate and dividend yield are similar in the sense that they both measure income-to-value, the dividend yield applies to the equity market and the cap rate applies to the real estate market. Moreover, the periodic cash flows of properties are not identical to the cash flows of asset investments in general. Thus, we include the cap rate as an extra forecasting variable since we hypothesize that its movements may contain important information about the real estate market not captured by the dividend yield. The cap rate can also be thought of as equivalent to the earnings-price ratio on direct real estate investment. The cap rate data are taken from the American Council of Life Insurance.

The yield on one-month Treasury bills and the spread between the yields on long-term AAA corporate bonds and one-month Treasury bills are obtained from the Federal Reserve Bulletin and Ibbotson Associates (1989). The dividend yields are defined as the dividend paid during the last twelve months divided by the current prices constructed by using the dividend and price information according to the Center for Research on Security Prices (CRSP).

It is worth pointing out that our results are robust to omitted information. In other words, we do not assume that we have included all relevant variables that can forecast factor premiums. In any case, we can interpret our study as evidence of time variation in factor premiums captured by the information variables, X_{pt}. Moreover, the linear pricing condition (5) is independent of the choice of the information variables. However, the choice of the variables is still important because it affects the *power* of the statistical test. This article employs economic variables that have been found in previous studies to be capable of explaining the time variation of risk premiums on stocks.

Data

We obtained the cusip number for the life and property-liability insurers in our sample from the Compustat tape. These two types of insurers are identified by different industry codes; thus, there is no overlap between the two samples.[2] We use all life and property-liability insurers listed on Compustat and not just those having a continuous trading history in order to avoid selection bias. Overall, the sample included 52 life insurers, and, on average, there are about 25 companies in the sample at any given time. For property-liability stocks, there are a total of 57 companies in the sample, and, on average, about 30 companies are in the sample at any given time. These insurance stocks are listed on the New York Stock Exchange, the American Stock Exchange, or

[2] It is possible that some life insurers also may be in the property-liability business and vice versa. See Appendix B for a list of life insurers and property-liability insurers used in the sample.

Nasdaq. Equally-weighted portfolios are formed for both sets of insurance stocks, and portfolio returns are derived from the CRSP monthly tape.

Returns on a market portfolio and a long-term U.S. government bond portfolio are also taken from the CRSP tape. The value-weighted market portfolio comprises all New York Stock Exchange and American Stock Exchange stocks. The government bond return series is constructed by forming a portfolio of Treasury bonds with an average maturity of 20 years and without call provisions or any other special features.

Returns on a portfolio of equally-weighted equity real estate investment trusts (REITs) serve as proxies for returns on real estate investments. These real estate investment trusts are closed-end mutual funds traded on national stock exchanges, which specialize in investment of real estate properties across the country. Gyourko and Keim (1991) found that returns on REITs not only act as good proxies for real estate asset returns, but that these "market based" series can predict appraisal-based real estate returns, such as the Frank-Russell real estate index. The REIT portfolio comprises 50 REITs on average. For a detailed account of the construction of the REIT portfolio and a definition of REITs, see Liu and Mei (1992).

Empirical Results

Excess Return Correlations

Summary statistics on the behavior of monthly excess returns for insurance stocks, over the one-month Treasury bill rate, relative to other assets over the 1971-1989 period are presented in Table 1. We report the mean, standard deviation, and first-order autocorrelation coefficient of the excess returns. Insurance stocks have higher excess returns relative to market portfolios and government bonds but lower returns than REITs. The excess returns on all asset portfolios display positive first-order autocorrelation; the highest first-order autocorrelation (0.195) is for property-liability insurance stocks, suggesting that 3.8 percent of its excess return variation can be explained by a regression of the excess return on its first lag.

We also calculated the mean and standard deviation of excess returns on various assets for three subperiods, based on three different interest rate regimes (see Table 1). The first subperiod is February 1971 through September 1979, when interest rates were rising. The second subperiod is October 1979 through October 1982, when interest rates were volatile. The third subperiod covers November 1982 through April 1989, when interest rates declined. In general, excess returns on insurance stocks are more volatile than other assets, but they also tend to command higher mean excess returns (risk premiums).

Table 1 also reports the correlations of excess returns among five asset classes. The excess returns on the two insurance portfolios are highly correlated with those of the REITs. Of the four stock portfolios, insurance stocks have a somewhat higher correlation with bonds in excess returns.

Table 1
Monthly Excess Returns for Insurance Stocks and Other Assets, February 1971 Through April 1989 (n = 219)

Dependent Variables	Mean (%)	S.D. (%)	ρ_1
Summary Statistics for February 1971 through April 1989			
Market	0.282	4.822	0.055
Government Bond	0.038	3.287	0.050
REIT	0.679	4.887	0.115
Life	0.570	5.884	0.136
Property-Liability	0.620	6.089	0.195

Summary Statistics for Subperiods

	February 1971-September 1979		October 1979-October 1982		November 1982-March 1989	
	Mean (%)	S.D. (%)	Mean (%)	S.D. (%)	Mean (%)	S.D. (%)
Market	0.018	4.627	0.043	5.373	0.748	4.831
Bond	-0.088	1.953	-0.334	5.440	0.382	3.382
REIT	0.573	5.889	0.863	5.276	0.732	2.860
Life	0.523	6.347	-0.009	6.473	0.908	4.924
Property-Liability	0.392	6.610	0.562	5.428	0.952	5.707

Correlations Among Excess Returns of Different Assets

	Market	Bond	REIT	Life	Property-Liability
Market	1.000	0.317	0.639	0.812	0.803
Bond	1.000	0.186	0.348	0.357	
REIT	1.000	0.654	0.557		
Life	1.000	0.826			
Property-Liability	1.000				

Summary Statistics for Forecasting Variables

Forecasting Variables	Mean (%)	S.D. (%)	ρ_1
Yield on One-Month Treasury Bill	7.373	2.800	0.918
Yield Spread Between AAA Bond and Treasury Bill	2.373	1.818	0.750
Dividend Yield on Equally-Weighted Portfolio	3.055	0.628	0.940
Cap Rate on Equity REITs	10.44	1.141	0.958

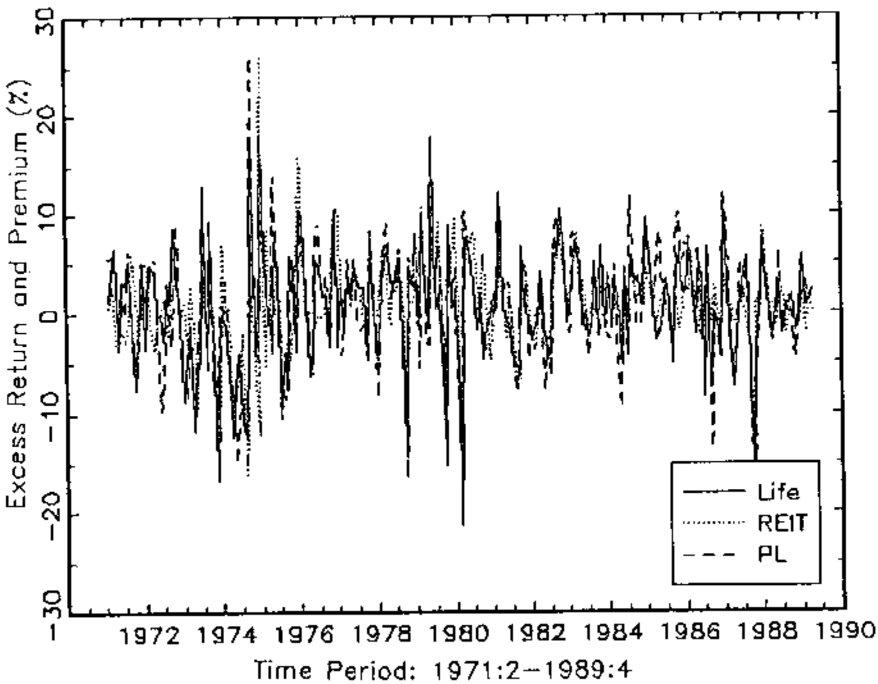
Note: Excess returns are expressed in terms of percentage points per month. One-month Treasury bill rate, term spread, dividend yield, and cap rate are expressed in terms of percentage per annum. S.D. = standard deviation. ρ_1 = the first-order autocorrelation coefficient of the series.

Figure 1 illustrates the movements of the excess returns of the life and property-liability insurance stock portfolios in comparison to the excess returns for REITs. Excess returns on the three assets move quite closely together, confirming the correlation results obtained above and reported in Table 1.

Predictive Power of Five Forecasting Variables

Table 2 reports the results of regressing excess returns on a constant term, a January dummy variable, the yield on one-month Treasury bills, the yield spread, the dividend yield on the equally-weighted market portfolio, and the

Figure 1
Excess Returns on Life Insurance and Property-Liability Insurance and Real Estate Investment Trusts



cap rate on REITs. The first four variables have been used in previous studies for forecasting U.S. stock returns (see, for instance, Campbell, 1987; Fama and French, 1988, 1989; Ferson and Harvey, 1991; and Keim and Stambaugh, 1986). A fairly large component of the excess return on insurance stocks is predictable, and part of this predictability comes from the real estate variable—the cap rate. Specifically, approximately 6.4 percent of the variation in monthly excess returns on life insurers is accounted for by our five forecasting variables after adjustment for degrees of freedom (5.2 percent for property-liability). The returns on REITs and market stocks also post a fairly large predictability component (6.5 percent and 15.2 percent, respectively).[3] The capability of the real estate variable to predict asset returns, especially insurance stock returns and REITs, suggests that changing real estate market conditions have affected the risk premiums paid to insurance stocks.

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[3] The predictability reported in Table 2 is consistent with other studies that use similar variables to predict excess returns on stock and bond portfolios. For example, Campbell (1987) reports an unadjusted R^2 of 11.2 percent on the value-weighted index predicted by a set of term-structure variables. Fama and French (1988), using a slightly different set of variables, report an unadjusted R^2 of 4 percent on the value-weighted index.

Table 2
Regression of Excess Returns on Each Asset Class at Time t+1

$$\tilde{r}_{i,t+1} = \text{Cons.} + \alpha_1\text{Jandum} + \alpha_2\text{TBill}_t + \alpha_3\text{Spread}_t + \alpha_4\text{DivYld}_t + \alpha_5\text{CapRate}_t + \tilde{\varepsilon}_i$$

	Market	REIT	Bond	Life	Property-Liability
Constant	-7.408*	-9.335*	-1.652	-10.260*	-10.886*
	(-2.41)	(-2.80)	(-0.69)	(-2.43)	(-2.48)
January Dummy	1.815	5.316*	-0.747	1.903	1.034
	(1.56)	(4.47)	(-0.92)	(1.34)	(0.70)
Treasury Bill Yield	-0.597*	-0.603*	0.077	-0.706*	-0.630*
	(-3.25)	(-3.40)	(0.61)	(-3.15)	(-2.70)
Spread Between AAA Corporate Bond	0.007	-0.095	0.362*	-0.024	0.062
and Treasury Bill Yield	(0.003)	(-0.45)	(2.41)	(-0.09)	(0.22)
Dividend Yield, Overall Stock Market	1.429*	1.110**	1.239*	1.937*	2.158*
	(2.27)	(1.82)	(2.84)	(2.52)	(2.69)
Cap Rate on Real Estate	0.724**	1.040*	-0.332	0.960**	0.893**
	(1.76)	(2.62)	(-1.16)	(1.91)	(1.71)
Adjusted R2	0.065	0.152	0.033	0.064	0.052
DW	1.87	1.77	1.90	1.73	1.59
Adjusted R^2, Dividend Yield Omitted	0.046	0.143	0.001	0.041	0.024
Adjusted R^2, Cap Rate Omitted	0.056	0.129	0.031	0.052	0.043
Average Adjusted R^2, Ten-Year	0.081	0.165	0.065	0.069	0.047
Rolling Regression	[0.027]	[0.024]	[0.023]	[0.023]	[0.022]

Note: T-statistics are in parentheses. Bracketed numbers in the last row are standard deviations.
* $p \leq 0.05$ ** $p \leq 0.10$

A higher cap rate and a higher dividend yield predict higher future risk premiums on insurance stocks (see Table 2). Since the cap rate tends to rise right before or during the peak and trough of a business cycle—reflecting a price drop due either to excess supply or declining demand for real estate commercial properties (see Liu and Mei, 1992)—our results suggest that investors demand a high expected rate of return (risk premium) on insurance stocks during times of economic difficulty. Prior studies suggest that major movements in the dividend yield series are related to long-term business conditions (see Campbell, 1987; Campbell and Hamao, 1992; Fama and French, 1988, 1989; Ferson, 1989; Ferson and Harvey, 1991; and Keim and Stambaugh, 1986, among others). When business conditions are weak and turbulent, the dividend yield forecasts high future expected returns; low returns are predicted when conditions are strong. The high risk premiums represent compensation for holding risky assets during times of uncertainty and economic recession.

The Treasury bill variable is also significant for insurance stocks. The negative relationship found in the regression between the Treasury bill variable and the risk premiums of insurers suggests that risk premiums on insurance stocks go up when interest rates fall. The yield spread variable, which tracks in part a maturity premium in expected returns, is highly significant for bonds but not significant for other assets, including insurance stocks. The addition of a dummy variable to capture the January seasonality impact has a significant positive effect on REITs, but this January effect is not evident for stocks or bonds. That the January effect is significant for REITs reflects the fact that

REITs are also small capitalization stocks (see Keim, 1983, for a discussion on the January effect for small stocks).

To test the robustness of our predictability results, we alternately omitted the dividend yield variable and the cap rate variable in the regressions. The adjusted R^2 drops to 0.056, 0.129, 0.031, 0.052, and 0.043 for the five portfolios, respectively, if we omit the cap rate variable (see Table 2). Despite this fairly large drop in the adjusted R^2, a simple examination of the regression results indicates that there is still significant predictive power left for the remaining variables.[4] A similar result holds if we drop the dividend yield variable, suggesting that the two variables contribute significantly to the predictability but do not play a dominant role in forecasting future returns. Thus, the result of time variation of risk premiums on various assets appears to hold even if we omit some of our forecasting variables.

To further test the forecasting stability of the regression, we conducted a series of ten-year rolling regressions using the sample model specification. If the regression is capable of forecasting the out-of-sample risk premium, we should expect the average adjusted R^2 to be similar to those from the whole sample and the variation of adjusted R^2 to be small. This is confirmed by our results, which show that the average adjusted R^2s for a series of ten-year rolling regressions are 0.081, 0.165, 0.065, 0.069, and 0.047 for the five portfolios, respectively, with standard deviations of 0.027, 0.024, 0.023, 0.023 and 0.022 (see Table 2).

Figures 2 and 3 illustrate the results in Table 2. Figure 2 plots the actual excess returns on life insurers ($\tilde{r}_{i,t+1}$) and the conditional expected excess return ($E_t(\tilde{r}_{i,t+1})$). The expected excess return does vary over time. In fact, $E_t(\tilde{r}_{i,t+1})$ takes on negative values in some time periods and positive values in other periods. The monthly predictable risk premiums on the life insurance stocks can be as high as 8 percent (January 1975). The huge variation in expected excess returns, or risk premiums, has important implications for shareholders and financial managers of insurers. It suggests that the promised minimum rates of return paid to some universal/variable policyholders probably should be reduced when a future increase in the risk premium is expected, since higher profit levels should be achieved to ensure higher risk-adjusted returns to shareholders. Figure 3 similarly illustrates the returns on property-liability stocks.

Another interesting finding is that the risk premiums for insurance stocks are sometimes negative (see Figures 2 and 3). This negative expected risk premium could reflect either market inefficiency (such as price bubbles) or the fact that the asset provides a good hedge against certain systematic factors under certain economic conditions (for example, a stock with a negative market beta would have a negative risk premium).[5] In the first case, it could be that investors are

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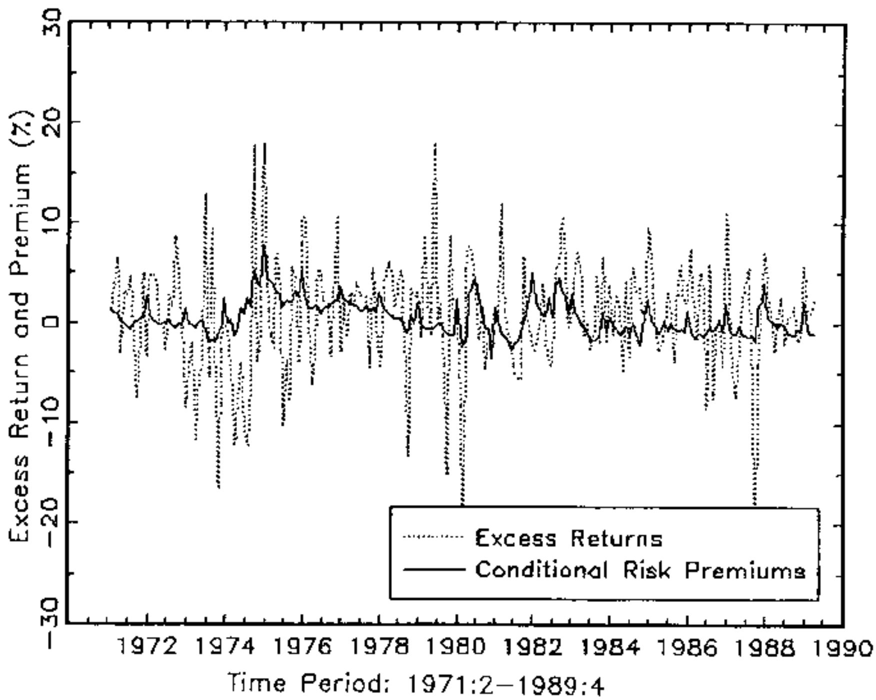
[4] These results are available from the authors upon request.

[5] The negative risk premium also could result from a misspecification of the model. If the actual return-generating process deviates from equation (1), then our risk premium estimates will be biased.

Figure 2
Excess Returns and Risk Premiums on Life Insurance Stocks



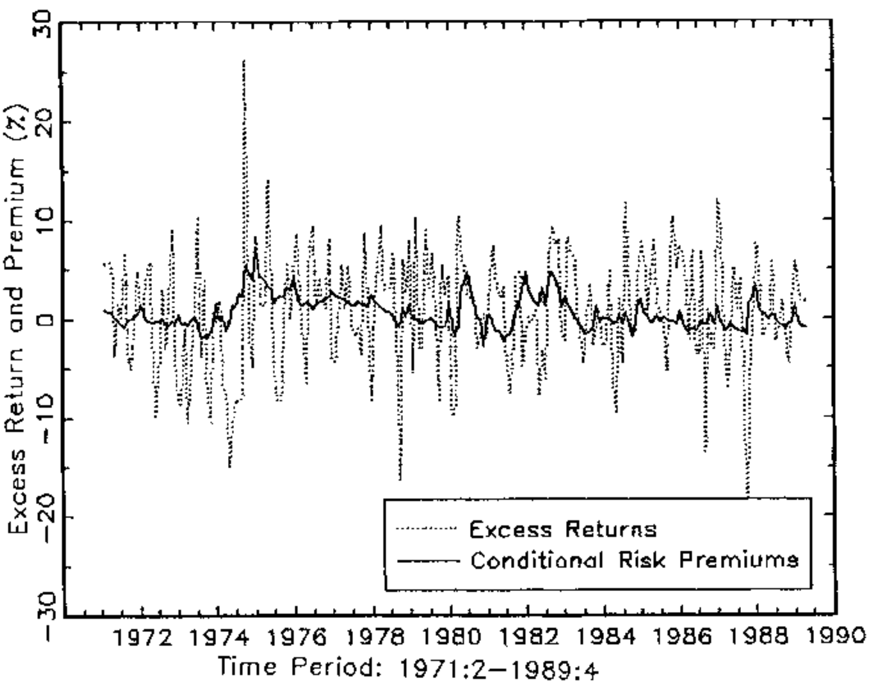
overly optimistic and they bid the price of stock so high that the stock does not offer an adequate return for risk compensation.

Figure 4 plots the expected excess return (risk premiums) for insurance stocks relative to REITs over the February 1971 through April 1989 period (without the January effects). Overall, the expected excess returns of both insurance stocks and REITs move closely in tandem.

Test of Linear Pricing Restriction (5)

The above results do not depend upon the assumptions required for the asset pricing model of equations (1) through (5), such as constant betas and linear factor structure. The only requirements are that the conditional expected return be a linear function of economic state variables, X_{pt}, and that X_{pt} contain information that explains the time variation of risk premiums for various assets. Although the above results are more general, we believe that further insights about insurers' risk premiums can be gained by studying the linear asset pricing relationship (5). Estimating equation (5) might provide interesting sensitivity estimates for various economic factors and show how these sensitivities change over time. We could also check whether risk premiums paid on various assetsare consistent with certain multifactor equilibrium asset pricing models such as the arbitrage pricing theory.

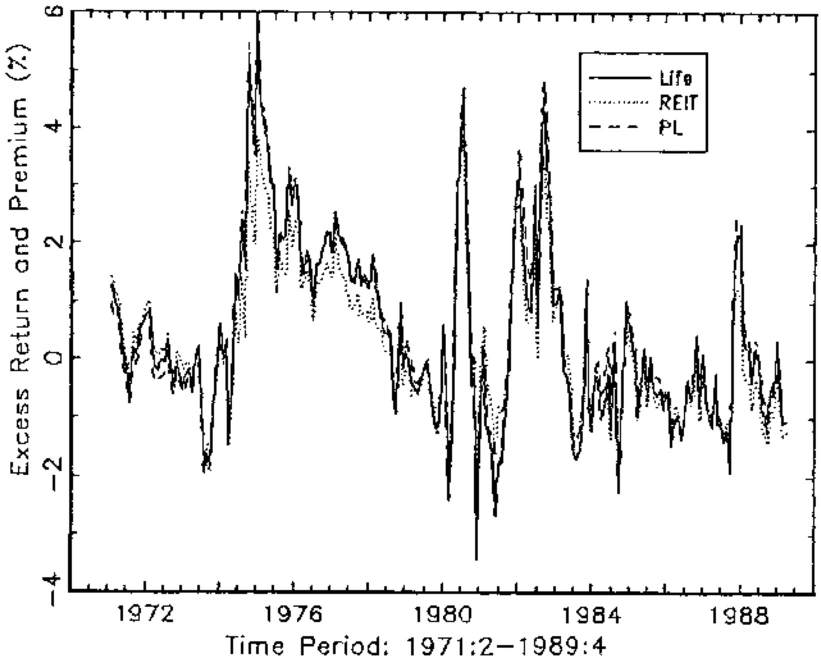
Figure 3
Excess Returns and Risk Premiums on
Property-Liability Insurance Stocks



To test the linear pricing restriction (5), we estimate equation (4a) with the restriction of (5) imposed (see Table 3).[6] We estimate the regression system under the assumption that there is only one systematic factor, $\tilde{f}_{1,t+1}$, in the economy (K = 1). With beta normalized to be one for the value-weighted stock portfolio, we observe that the betas for insurance stocks are higher than those for value-weighted stocks but smaller than those of REITs (Panel A). Bonds have the lowest beta of all asset classes. The beta estimates for the insurance stocks are informative because they indicate that a 1 percent increase in the market excess return would lead to a 1.2 percent increase in excess returns for both types of insurance stocks. This similarity of market risk exposure is interesting, because we normally think that life insurance and property-liability insurance have different risk characteristics. A simple t-test based on the reported parameter estimates and standard errors also indicates that the sensitivity estimates are statistically significant. However, because of the relatively large standard errors, we cannot tell whether beta coefficients for insurers are statistically different from those for the other portfolios. The

[6] As pointed out by Wheatley (1989), this test is joint test of (5) and the assumptions underlying the asset pricing model (1), such as betas being constant during the sample period.

Figure 4
Conditional Risk Premiums on Real Estate Investment Trusts, Property-Liability Insurance, and Life Insurance Without the January Effects



chi-square test indicates that a one-factor model is not rejected by the data (p = 0.316). Thus, the risk premiums for the assets in this study are consistent with a one-factor equilibrium asset pricing model.

The model is also estimated assuming K = 2 (Table 3, Panel B). We normalize the bonds to have a beta of one on the first factor and a beta of zero on the second factor, and we normalize the REITs to have a beta of zero on the first factor and a beta of one on the second factor. Under the normalization, we can call the first factor the bond factor and the second the real estate factor, since changes in these factors will lead to an identical change in their corresponding asset returns. If the overall market is largely driven by an interest rate factor and a real estate factor, insurance stocks are more sensitive than the market portfolio to the bond factor and the real estate factor. The test of restriction (5) suggests that the two-factor model is not rejected by the data.

Sensitivity to the Bond and Real Estate Factors in Two Subperiods

To reduce the possibility of misspecification associated with the assumption of constant beta in the latent-variable model, we split the sample into two subperiods—February 1971 through September 1979 and October 1979 through

Table 3
Estimation of the Latent Variable Model (4)
with Restriction of Equation (5) Imposed

A. Systematic Factors in Economy Equal One (K=1)

Estimated Beta Coefficient	β_{i1}	S.D.
Market	1.000*	---
Bond	0.334	0.130
REIT	1.120	0.190
Life	1.201	0.133
Property-Liability	1.233	0.177

χ^2 Statistic of Restriction (5): 22.40 (df = 20)
Significance Level: p = 0.318

B. Systematic Factors in Economy Equal Two (K=2)

Estimated Beta Coefficient	β_{i1}	S.D.	β_{i2}	S.D.
Market	0.740	0.387	0.571	0.134
Bond	1.000*	---	0.000*	---
REIT	0.000*	---	1.000*	---
Life	1.108	0.410	0.671	0.126
Property-Liability	1.358	0.513	0.618	0.167

χ^2 Statistic of Restriction (5): 8.079 (df = 12)
Significance Level: p = 0.778

Note: S.D. = standard deviation.
* Numbers are normalized to be one or zero.

April 1989—and then estimated the model for the two subperiods (see Table 4).[7] Here, we find some preliminary evidence of time-varying betas. For example, for the life insurance stocks, sensitivity toward the bond factor decreased from 4.509 to 0.227, while sensitivity toward the real estate factor increased from 0.570 to 0.868 in the two-factor model. The same results hold for the property-liability stocks and to a lesser extent also for the market portfolio. Unfortunately, given the large standard errors associated with the sensitivity estimates due to a small sample, we can say only that the changes in the bond sensitivities are statistically significant.[8] We cannot say that the sensitivity changes on real estate are statistically significant or that the changes in bond and real estate sensitivities for insurers are more significant than those for the market. However, this decrease in sensitivity toward the bond factor and increase in sensitivity toward the real estate factor are at least indicative of increasing risk exposure in real estate, as perceived by investors, for all

[7] These two sample periods were chosen based on a major policy shift on interest rates by the Federal Reserve in October 1979.

[8] This is based on a t-test assuming that estimation errors are uncorrelated between the two subperiods.

companies in the economy, including insurers.[9] In other words, the insurance industry's sensitivities to bonds and real estate change in line with market sensitivity changes.

Table 4

Estimation of the Latent Variable Model (4) for Two Subperiods

A. Systematic Factors in Economy Equal One (K=1)

	February 1979-September 1979		October 1979-March 1989	
Estimated Beta	β_{i1}	S.D.	β_{i1}	S.D.
Market	1.000*	---	1.000*	---
Bond	0.218	0.098	0.285	0.212
REIT	0.434	0.320	1.154	0.174
Life	1.387	0.153	1.130	0.160
Property-Liability	1.720	0.284	1.124	0.207
χ^2 Statistic of Restriction (5)	19.03		22.18	
Significance Level	p = 0.519		p = 0.330	

B. Systematic Factors in Economy Equal Two (K=2)

	February 1971-September 1979				October 1979-March 1989			
Estimated Beta	β_{i1}	S.D.	β_{i2}	S.D.	β_{i1}	S.D.	β_{i2}	S.D.
Market	2.658	1.029	0.549	0.135	0.148	0.176	0.770	0.137
Bond	1.000*	---	0.000*	---	1.000*	---	0.000*	---
REIT	0.000*	---	1.000*	---	0.000*	---	1.000*	---
Life	4.509	1.378	0.570	0.190	0.227	0.185	0.868	0.115
Property-Liability	5.045	1.709	0.512	0.278	0.222	0.210	0.859	0.120
$\chi2$ Statistic of Restriction	(5) 7.57				7.92			
Significance Level	p = 0.817				p = 0.791			

Note: S.D. = standard deviation.

* Numbers are normalized to be one or zero.

This indication of increasing real estate risk exposure for insurers is surprising, given the fact that actual real estate holdings for insurers as a percentage of total assets remained almost unchanged during the 1980s. The percentage real estate holdings for life insurers was 3 percent in 1979 compared to 3.1 percent in 1989. (In absolute amount, it was $39.9 billion for 1979 and $43.4 billion for 1989.) The same percentage holdings for property-liability insurers were 2.2 percent in 1984 and dropped to 1.8 percent in 1989 (*1990 Life Insurance Fact Book* and *1990 Property/Casualty Insurance Facts*). Since the sensitivity estimates here are derived from stock market data, this increase in sensitivity could very well reflect investors' worsening *perception* about insurers' real estate exposure, given the fact that so many banks and savings

[9] Campbell and Ammer (1993) offer a possible explanation for this decrease in bond sensitivity from the 1970s to the 1980s. There was relatively little change in economic growth (thus corporate earnings) in the 1970s. As a result, stock prices were more sensitive to bond returns. In the 1980s, as a result of economic recovery, stock prices were more responsive to news about corporate earnings and much less so to interest rates.

and loans failed due to poor real estate investments. Another possible explanation is that, although insurers' percentage real estate holdings remain unchanged, the quality of real estate holdings diminished and the value of these real estate assets dropped significantly due to a depressed real estate market.

Summary and Conclusions

Our main finding in this study of the economic environment that determines the risk premium on insurance stocks is that the variation in risk premiums of insurance stocks is reasonably predictable. We also find that the risk premiums paid on insurance stocks vary substantially over time. This discovery has important implications for insurers' investment and financing decisions. Preliminary evidence suggests that insurers have been perceived by the market to have increased their real estate risk exposure in the 1980s, despite the fact that their actual holdings as a percentage of assets remained relatively unchanged during the decade. Another finding of interest is that these results are consistent with the view that the time variation in expected asset returns can be explained by the changing price of risk of one or two systematic factors.

Appendix A

With minor modifications, this information is taken from Liu and Mei (1992).

To estimate equation (4a) under restriction (5), we first renormalized the model by setting the factor loadings of the first K assets as follows: $\beta_{ij} = 1$ (if $j = i$), and $\beta_{ij} = 0$ (if $j \neq i$) for $1 \leq i \leq K$. Next, we partition the excess return matrix $R = (R_1, R_2)$, where R_1 is a T x K matrix of excess returns of the first K assets, and R_2 is a T x (N-K) matrix of excess returns on the rest of the assets. Using equations (4a) and (5), we can derive the following regression system:

$$\begin{aligned} R_1 &= X\Theta + \mu_1 \\ R_2 &= X\alpha + \mu_2, \end{aligned} \qquad \text{(A1)}$$

where X = a T x L matrix of the forecasting variables,
Θ = a matrix of Θ_{ij}, and
α = a matrix of a_{ij}.

If the linear pricing relationship in equation (2) holds, the linear restriction implies that the data should not reject the null hypothesis H_0: $\alpha = \Theta B$, where B is a matrix of β_{ij} elements.

The regression system of equation (A1) given the restriction in equation (5) can be estimated and tested using Hansen's (1982) generalized method of moments, which allows for conditional heteroskedasticity and serial correlation in the error terms of excess returns. We can see from equation (4) that the error term in system (A1) has conditional mean zero given the instruments X_{pt}. This implies an orthogonality condition $E(U'X) = 0$. Following Hansen, we first construct an N x L sample mean matrix: $G_T = U'X / T$. Next, we stack the column vectors on top of each other to obtain an NL x 1 vector of g_T. A two-step algorithm is then used to find an optimal solution for the quadratic form, $g_T'W^{-1}g_T$, by minimizing over the parameter space of (Θ, α). In the first step, the identity matrix is used as the weighting matrix W. After obtaining the initial solution of Θ_0 and α_0, we next calculate the residuals μ_1 and μ_2 from the system of equations in (A1) and construct the following weighting matrix:

$$W = \frac{1}{T} \sum_t (u_t \mu_t') \otimes (Z_t Z_t'), \qquad \text{(A2)}$$

where $\otimes$ is the Kronecker product. In the second step, we use the weighting matrix as given by equation (A2) to resolve the optimization problem of minimizing $g_T'W^{-1}g_T$ over the choice of (Θ, α). Hansen proved that, under the null hypothesis (i.e., when the model is correctly specified), T times the weighted sum of squares of the residuals, $g_T'W^{-1}g_T$, is asymptotically chi-square distributed, with the degrees of freedom equal to the difference between the number of orthogonality conditions and the number of parameters estimated: (N-K) (L-K), where N is the number of assets studied, K is the number of factor loadings, and L is the number of forecasting variables.

By taking conditional expectations of equation (2), it is straightforward to show that the rank restrictions hold in the same form when a subset of the relevant information is used. Thus, if the coefficients in equation (4a) are subject to the restrictions in equation (5) under the true information vector used by the market, they will be subject to the same restrictions in equation (5) if a subset of this vector is included in the information set. Similarly, if the test using the full set of the market's information does not reject the K-factor model, then the test using a subset of the market's information should not reject the model either. However, the choice of the information variables is still important because it would affect the *power* of the statistical test. A more detailed elaboration of this robustness issue is discussed in Campbell (1987) and Ferson (1989).

Appendix B

New York Stock Exchange and American Stock Exchange

Life Insurers
American General Corp.
American Heritage Life Invt.
Capital Holding Corp. DE
Colonial Penn Group Inc.
Conseco Inc.
First Capital Holdings Corp.
Gulf United Corp.
Jefferson Pilot Corp.
Laurentian Capital Corp.
Liberty Corp. SC
Manhattan National Corp.
NLT Corp.
NWNL Companies Inc.
Richmond Corp.
Transcontinental Tel & Electrs Inc.
United Companies Financial Corp.
USLICO Corp.
USLife Corp.
Williams A. L. Corp.

Property-Liability Insurers
Aetna Life & Casualty Co.
American International Group Inc.
American Plan Corp.
American Reliance Group Inc.
AVEMCO Corp.
Belvedere Corp.
Chubb Corp.
CIGNA Corp.
CII Financial Inc.
CNA Financial Corp.
Continental Corp.
Danielson Holding Corp.
Fairmont Financial Inc.
First Central Financial Corp.
Gainsco Inc.
GEICO Corp.
General Re Corp.
Hartford Steam Boiler Insp. & Ins.
INA Corp.
Kemper Corp.
Lawrence Insurance Group Inc.
Lincoln American Corp NY
Lincoln National Corp. IN
Merchants Group Inc.
Mission Insurance Group Inc.
Orion Capital Corp.
Progressive Corp. OH
Reliance Group Holdings Inc.
RLI Corp.
SCOR US Corp.
Travelers Corp.
Unicare Financial Corp.
USF&G Corp.
Zenith National Insurance Corp.

NASDAQ

Life Insurers
American Heritage Life Invt.
American National Insurance Co.
BMA Corp. New
California Western States Life Insurance
Conseco Inc.
Farmers New World Life Insurance Co.
Fidelity Union Life Insurance Co.
First Capital Holdings Corp.
Government Employees Life Insurance Co.
Great Southern Corp.
Independent Insurance Group Inc.
Kansas City Life Insurance Co.
Laurentian Capital Corp.
Life Insurance Co. GA
Manhattan National Corp.
Monumental Corp.
NWNL Companies Inc.
National Old Line Insurance Co.
Philadelphia Life Insurance Co.
Protective Life Corp.
Provident Life & Accident Insurance Co. Amer.
Republic National Life Insurance Co.
Security Life Denver Insurance Co.
Southwestern Life Corp.
USLICO Corp.
United Companies Financial Corp.

Property-Liability Insurers
American International Group Inc.
American Reliance Group Inc.
Argonaut Group Inc.
Berkley W. R. Corp.
CII Financial Inc.
Chubb Corp.
Fairmont Financial Inc.
First Central Financial Corp.
GEICO Corp.
Gainsco Inc.
General Re Corp.
Hartford Steam Boiler Insp. & Ins.
Kemper Corp.
Merchants Group Inc.
Ohio Casualty Corp.
Orion Capital Corp.
Progressive Corp. OH
RLI Corp.
SCOR US Corp.
Safeco Corp.
St. Paul Companies Inc.
20th Century Industries CA
Unicare Financial Corp.

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