Determining the Fair Rate of Return on Equity for Automobile Insurers

By

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1. Introduction

My name is Richard D. Phillips and I am the Bruce A. Palmer Professor of Risk Management and Insurance at Georgia State University where I am also the Chairman of the Department of Risk Management and Insurance. In addition to my appointments at Georgia State, I am also a Fellow of the Wharton Financial Institutions Center which is an academic research center housed at the University of Pennsylvania. I have written and lectured extensively on issues of fair rate of return in the insurance industry as well as insurance price and solvency regulation. I have been asked to prepare a report for the Alberta Insurance Rate Board that provides a summary discussion of the concept of the fair rate of return for the equity providers of a business enterprise. I was also asked to provide an estimate of the fair rate of return for the equity providers of an insurance company writing property-casualty insurance using data on U.S. publicly traded insurers. This estimate could be used to help guide discussions between the Alberta Insurance Rate Board and the property-casualty insurance industry operating in the Province of Alberta.

In this report I used two methods to estimate the fair rate of return for U.S. property-casualty insurers. The first is based on a widely accepted market value rate of return model, the Fama-French three-factor model. For several reasons discussed in this report, I also estimated the fair rate of return using a second methodology, the full-information beta technique. The Fama-French model has been extensively tested over the past fourteen years in the professional

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finance literature and has also been used by mutual funds and investment advisors. The full-information beta model is theoretically sound and has been used to estimate costs of capital for a wide range of industries.

As a result of my analysis, I estimate that the fair rate of return for U.S. insurers writing property-casualty insurance is 15.53% based upon the Fama-French model and is 15.24% based on the full-information beta approach. If I were advising a U.S. property-casualty that writes a portfolio of insurance policies of average risk (relative to the industry), then the target rate of return I would recommend would be the average of the Fama-French and full-information beta fair rates of return, 15.4%. This is the return required in order to avoid penalizing the equity providers of insurance companies by denying them a rate of return commensurate to the risks they bear by investing in the insurance industry.

The remainder of this report is organized as follows. In the next section I provide an overview of the concept of the fair rate of return. I then explain the Fama-French and full-information beta methodologies in detail and discuss the calculations used to obtain the fair rate of return estimates. In the next section I describe the sources of the data used in my analysis and the sample of companies I chose to analyze. I conclude by presenting the results of the analysis.

The Concept of the Cost of Capital or Fair Rate of Return

The first step in understanding the fair rate of return is to realize that insurers must come to the market with equity capital, supplied by either stockholders for stock insurance companies or by policyholders for mutual insurance companies. Equity capital allows the company to offer the credible promise that claims will be paid when due. It provides a cushion to cover the eventuality that losses and expenses are higher than expected. As part of the solvency surveillance system, state regulators require that insurers maintain a reasonable amount of equity capital relative to premium writings. However, in practice, insurers maintain much more equity

capital than required by regulators in order to respond to market demands by customers for low insolvency risk.

Because equity capital has other potential uses besides backing up insurance liabilities, it is available only at a price, known as the *fair rate of return*. Instead of putting funds into an insurance company, suppliers of equity capital can invest in other sectors of the economy. To attract capital into insurance, investors must receive a rate of return that is comparable to the return they can earn in other sectors of the economy on investments of comparable risk. The comparable risk standard provides the conceptual underpinnings for insurance rate regulation, and the same general concept applies to public utilities and other regulated industries. The comparable risk standard was established in the United States by the U.S. Supreme Court in *Federal Power Commission vs. Hope Natural Gas* in 1944.

The fair rate of return differs depending upon the risk of the corporation or project in which the investment is being made. A more risky company must provide a higher rate of return to appropriately compensate equity providers. This rate of return is called the *fair rate of return* or *cost of capital*. A rate of return less than this amount would unfairly penalize equity providers by not compensating them adequately for the risks they bear and would lead to a decline in the market value of the insurer. A higher return would yield higher than competitive profits to the company. The goal of fair rate of return analysis is to determine the rate of return that fairly compensates equity providers while not under or over-compensating them.

Modern financial theory has determined that the cost of capital has two components: (1) the *risk-free return* and (2) a market reward for risk bearing – the *market risk premium*. The reasoning is that an investor could invest in United States government securities, which are considered "risk-free" in that the promised future cash flows are known with certainty and there is no risk of default. An investment in a risky private venture must earn at least as much as the

government securities rate in order to induce investors to put their money into the private venture. Since private ventures are more risky, they must provide a return in excess of the government securities rate. This excess amount is known as the market risk premium. Modern financial theory has developed methods for estimating the market risk premium. One of the methods traditionally used to estimate the cost of capital is the Capital Asset Pricing Model. However, when I advise insurers about the fair rate of return they should target, I suggest they use both the Fama-French three-factor model and the full-information beta methodology. I explain each cost of capital methodologies in the following section and I also discuss the reasons I suggest companies should use the latter two methods to estimate the fair rate of return for writing property-casualty insurance.

Cost of Capital Estimation Methodologies

The Capital Asset Pricing Model. In order to obtain accurate estimates of the cost of capital that will fairly compensate capital providers for the risks they bear, it is necessary to utilize a methodology that is consistent with modern financial theory. The traditional model from financial theory used to estimate the cost of capital or fair rate of return is the capital asset pricing model (CAPM). The CAPM fair rate of return or cost of capital is equal to the rate of return on U.S. Treasury bills plus a market risk premium. The CAPM method estimates the market risk premium by determining the expected return on investments of average risk and then assigning a proportionately higher or lower return depending upon whether the investment under consideration is of above or below average risk.

The measure of risk used in the CAPM is known as *systematic* or *beta risk*. Beta measures the expected responsiveness of an asset's return to changes in the overall stock market return. Beta risk is also called systematic risk because it measures the degree to which a stock's return varies systematically with the market return as opposed to being determined by

idiosyncratic factors. A beta of 1 is considered average. A diversified portfolio consisting of all assets would have a beta of 1, assets of above-average risk have betas greater than 1, and assets of below-average risk have betas less than 1. If the beta of an asset is 1.5, its return is expected to increase by 15% in response to a market increase of 10%; and if the market goes down by 10%, the market value of this asset is expected to decrease by 15%. Thus, it has more systematic risk than the market average. Conversely, an asset with a beta of 0.5 is expected to increase or decrease by 5% when the market goes up or down by 10%. Such an asset would be considered to have relatively low systematic risk, i.e., to be less volatile than average in response to market movements.

It is important to point out that beta only gives the expected response to market price movements. Individual stocks are also subject to random variations that are uncorrelated with the market. Consequently, a stock can increase or decrease by more or less than predicted by its beta for any given market movement. Thus, having an estimate of beta only allows one to calculate the expected or target return on the stock prospectively. Actual or ex-post returns will differ randomly around this target.

The Fama-French Three-Factor Model. Although the CAPM is a very important model which is consistent with market value principles and modern financial theory, researchers began to discover during the 1980s that there are differences in returns among stocks that are not explained by the CAPM. One of these is the *small stock effect*, i.e., the tendency for stocks of relatively small corporations to have higher rates of return than stocks of larger corporation. Other elements are also present that are not explained by the CAPM. The second major factor, identified by Fama and French in 1992, is the ratio of the book value (BV) of equity to the market value (MV) of equity. The BV to MV ratio reflects financial distress, with financially vulnerable firms having higher values of this ratio than stronger firms. That is, firms that are

financially vulnerable have lower market values relative to their book values because their stock prices have declined to reflect market valuation of their vulnerability to financial distress. This factor controls for the tendency of investors to require higher expected returns on stocks in financially vulnerable firms since these firms will perform particularly poorly exactly when individual investors' portfolios are experiencing overall losses.

Fama and French, in an important series of professional journal articles, beginning in 1992,[4] developed a generalized asset pricing model that bases the market risk premium on three factors: (1) the market systematic risk factor, which is the same as the single systematic risk factor used in the CAPM, (2) a firm size factor to control for the small stock effect, and (3) the BV-to-MV ratio to control for the financial vulnerability effect. In extensive tests conducted by Fama-French and other researchers, the Fama-French three-factor model has been shown to provide a better explanation of differences in expected returns of stocks than the CAPM. Although other multiple factor models have been developed, the Fama-French three-factor model has become the dominant and most widely accepted multiple factor model. Accordingly, it is the model adopted in my estimation of the cost of equity capital or fair rate of return for insurers writing property-casualty insurance.

My use of the Fama-French three-factor model in this report is based on a professional journal article that I co-authored with Professor J. David Cummins where we applied the model to property-casualty insurance companies. The paper, Cummins and Phillips (2005), is cited in the references to this report. In August 2006, the article was given an award by the Casualty Actuarial Society as the best paper published in the *Journal of Risk and Insurance* in 2005 applicable to casualty actuarial science.

The Fama-French three-factor formula for the cost of capital is the following:

[4] Citations to three of the articles are given in the references to this report: Fama and French (1992, 1993, and 1997).

$$E(r_i) = r_f + \beta_{mi}[E(r_m) - r_f] + \beta_{si}\pi_s + \beta_{vi}\pi_v \quad \textbf{(1)}$$

where β_{mi} = firm i's market systematic risk beta coefficient,

$E(r_m) - r_f$ = market risk premium,

β_{si} = firm i's beta coefficient for the size factor,

π_s = the expected market risk premium for firm size,

β_{vi} = firm i's beta coefficient for the financial distress factor, and

π_v = the expected market risk premium for financial distress.

The symbol E is used here to refer to the *expected* value, i.e., the formula is used to estimate expected or prospective rates of return. The risk-premium for systematic market risk, $E(r_m) - r_f$, in the Fama-French three-factor model is the same as the single factor that appears in the CAPM. The final two factors in the model represent *size excess returns* and *financial distress excess returns*, where firm size is defined in terms of total market capitalization (number of shares multiplied by share price) and financial distress is proxied by the ratio of the book value of equity (BV) to the market value of equity (MV).

The excess return series are obtained monthly, and long-term averages of the returns are used to compute the risk premia, $E(r_m) - r_f$, π_s, and π_v. Specifically, long-term averages from 1926 through the year for which the cost of capital is being estimated are used in estimating the risk premia. The use of long-term averages is the standard procedure in cost of capital analysis. The market, size, and financial distress excess returns are used in a regression analysis to estimate the beta coefficients for systematic market risk, firm size, and financial distress. The betas are estimated separately for each firm in the sample. Finally, the estimated beta coefficients for each firm and the time-averaged risk premia, which are the same for all firms, are inserted into equation (1) to estimate the cost of capital for the firms in the sample. It is important to

emphasize that the Fama-French model is based on market values rather than book values, i.e., the parameters of the model are estimated using market value data rather than book value data. Ultimately, the owners of the firm care only about market values because such values determine the profits that they obtain by investing in stocks. Book values are useful only as proxies for the firm's overall performance.

The Full-Information Beta Methodology. In estimating the cost of capital or fair rate of return for insurers writing property-casualty insurance, I also utilize another methodology called the *full-information beta* approach. The reason for using the full-information beta approach along with the Fama-French model is that the Fama-French model provides the fair rate of return or cost of capital for the firm as a whole. However, most firms in the economy, including insurance companies, have more than one line of business. For example, many insurance companies write both property-casualty insurance and life-health insurance, and many are involved in other lines of business as well. The costs of capital are likely to differ by line of business, and these business line differentials are embedded in the overall cost of capital obtained from the Fama-French model. Moreover, because it is the company as a whole rather than the individual lines of business that are traded on stock exchanges, market value data that could be used to estimate the cost of capital by line generally do not exist.

The full-information beta approach provides a way to overcome the lack of market value data by line and obtain cost of capital estimates that vary by line. The full-information industry beta approach was first proposed by Ehrhardt and Bhagwar (1991) and significantly modified by Kaplan and Peterson (1998). I have used the method to estimate costs of capital for property-casualty insurers in Cummins and Phillips (2005).

The full-information beta approach utilizes a sample of conglomerate and specialist firms to identify the impact of various lines of business on the cost of capital. The underlying insight

is that the *observable* beta for the overall firm is a weighted average of the *unobservable* betas of the underlying lines of business. The method proceeds by performing a cross-sectional regression for a sample of firms, where the dependent variable is the observable beta and the independent variables measure the firms' participation in various industries and lines of business.

Three regressions are performed, where the left hand side or dependent variables are the three Fama-French betas for the firms in the sample. That is, there is one regression equation where the dependent variable is the Fama-French market beta, one where the dependent variable is the Fama-French size beta, and one where the dependent variable is the Fama-French BV-to-MV beta coefficient. The independent or right hand side variables in each case are line of business participation variables based on the revenues that each firm obtains from the various industries in which it does business, where one of the industries is property-casualty insurance. Unlike the Fama-French regressions, where the regressions are conducted separately, firm by firm, for each firm in the sample, the full-information beta regressions are conducted across a sample consisting of conglomerate and specializing firms from all industries in the economy.

More precisely, in the full information beta method, the objective is to decompose the overall market beta coefficients from the FF3F model into separate beta coefficients for each industry in which firms participate. There are two steps in the decomposition: (1) Estimate the overall market beta coefficients for a sample of firms using the FF3F method, as discussed above. (2) Obtain full information betas for each industry by performing cross-sectional regressions with the overall market betas as dependent variables and a series of weights proxying for the firm's participation in various lines of business as explanatory variables.

The regression equation for the market systematic risk factor is:

$$\beta_{mi} = \sum_{j=1}^{J} \beta_{fmj}\, \omega_{ij} + \upsilon_{mi} \qquad \textbf{(2)}$$

where β_{mi} = firm i's overall market systematic risk beta coefficient,

β_{fmj} = the full-information market systematic risk beta for industry, line, or division j,

ω_{ij} = firm i's industry participation weight for industry, line, or division j, and

ν_{mi} = random error term for firm i.

The ω_{ij}, j = 1, 2, . . ., J, for firm i, which sum to 1.0, measure the firm's participation in each line of business. Following Kaplan and Peterson (1998), I use revenues by industry to calculate ω_{ij}, so that ω_{ij} = revenues of firm i in industry j divided by total revenues of firm i across all industries. The β_{fmj}, which vary by industry but not by firm, are designed to capture the impact that any particular line of business is expected to have on the overall riskiness and hence the beta coefficient of the firm. The key idea reflected in the FIB technique is that equation (7) can be used "out of sample" to estimate the overall beta coefficients β_{mi} for individual divisions or lines of business. E.g., a firm with 100% of its revenues in industry j would have an estimated overall beta coefficient: $\beta_{mi} = \beta_{fmj}$; and a firm with 50% of its revenues from industries j and k would have an overall beta coefficient: $\beta_{mi} = 0.5(\beta_{fmj} + \beta_{fmk})$.

Using an equation similar to equation (2) would not be appropriate for the FF3F size and book-to-market betas because these betas tend to vary systematically with firm size and book-to-market ratio, respectively. Specifically, the size betas are inversely related to firm size, and the BV/MV betas are directly related to firm BV/MV ratios.[3] To address this problem, I conduct the following regressions for the size and BE/ME betas:

$$\beta_{si} = \sum_{j=1}^{J} \beta_{f1sj}\,\omega_{ij} + \beta_{f2s}\ln(MV_i) + \nu_{si} \qquad \textbf{(3)}$$

$$\beta_{hi} = \sum_{j=1}^{J} \beta_{f1hj}\,\omega_{ij} + \beta_{f2h}\ln(BV_i / MV_i) + \nu_{hi} \qquad \textbf{(4)}$$

[3]See Fama and French (1996), p. 59. There is no apparent pattern of market systematic risk factors in the FF3F model by either size or BV/MV ratio; and, likewise, the size betas have no apparent relationship with the BV/MV ratios, and the BV/MV betas are not systematically related to firm size.

where β_{si} , β_{hi} = overall size and BV/MV beta estimates firm i, s = size, h = BV/MV,

β_{f1sj}, β_{f1hj} = full-information size and BV/MV beta intercept coefficients for industry j,

β_{f2s}, β_{f2h} = full-information size and BV/MV beta slope coefficients,

BV_i, MV_i = book value of equity and market value of equity for firm i,

ω_{ij} = industry-participation weight for firm i in industry j, and

ν_{ji} = random error term for firm i, equation j, j = s, h.

Equations (3) and (4) allow for different intercept coefficients for each industry and also allow the slope coefficients to vary by the log of market equity and the log of the BV/MV ratio, respectively. The slope coefficients capture the systematic relationship between market equity and the size beta in equation (3) and between the BV/MV ratio and the BV/MV beta in equation (4). The full-information beta estimate for the size factors is obtained using the estimated coefficients $\hat{\beta}_{f1sj}$ and $\hat{\beta}_{f2s}$ by inserting the industry participation weights (ω_{ij}) and ln(MV_i) for a given firm into equation (3), and the full information beta for the BV/MV factor is obtained similarly using the estimated version of equation (4).

Equations (2)-(4) are estimated using ordinary least squares. The equations are estimated using the seemingly unrelated regressions (SUR) procedure to improve estimation efficiency by allowing for cross-equation correlations among the regression error terms. Using ordinary least squares rather than weighting the regression using a variable such as market capitalization provides estimates of the betas for the average firm in an industry, which is the objective of this analysis.

The coefficients of the line of business participation variables in the three full-information beta regressions (2) through (4) are then interpreted as the full-information beta coefficients for the business lines. For example, the coefficients on the property-casualty line of business revenue variable are interpreted as beta coefficients that isolate the market risk, size risk, and BV-to-MV risk of conducting property-casualty insurance business. Thus, the

regressions can be used to separately identify the contribution of writing property-casualty insurance to the traded firm's overall beta coefficient. I.e., the coefficients on the property-casualty variables in the three equations isolate the impact of property-casualty insurance on the overall beta of the firms in the sample that write property-casualty insurance, either as part of a conglomerate or as a specialist firm.

The full-information beta regression equations can be used by firms outside of the estimation sample to estimate the cost of capital taking into account their own line of business compositions. Hence, the results can be used to produce cost of capital estimates for non-traded stock firms and mutuals. The procedure would be for the firm to insert its line of business mix variables into the equation and compute the betas for a firm with its specific business mix. E.g., a firm that had 50% of its revenues from life insurance and 50% from property-casualty insurance would insert these percentages and multiply them by the full information beta coefficients for life insurance and property-casualty insurance. Summing the results would produce its overall beta coefficient. The method also can be used to estimate the cost of capital for insurers specializing in particular industry segments or for subsidiaries of insurers and conglomerates specializing in various lines of business. A subsidiary specializing in industry X would simply adopt the full information beta coefficients for industry X from the full-information beta regressions and use those betas in computing its cost of capital.

To summarize, I estimated the fair rate of return for insurers writing property-casualty insurance using two methodologies. The first methodology simply applies the Fama-French three-factor model to a sample of firms writing property-casualty insurance. Because some of these firms also write other lines of business, the robustness of the Fama-French results is tested by also estimating the cost of capital using the full-information beta methodology. Using both methodologies provides a check on the reasonableness of the results and ensures that an

unusually high or low estimate of the cost of capital will not be selected. My final estimate of the cost of capital for firms writing property-casualty insurance is the average of the Fama-French and full-information beta costs of capital.

Data Sources and Sample Selection. The data on stock returns used in this analysis were obtained from the University of Chicago's Center for Research on Securities Prices (CRSP) database, which contains data on all U.S. stocks traded on the New York Stock Exchange, the American Stock Exchange, and Nasdaq. The CRSP data were used to estimate the Fama-French beta coefficients appearing in equation (1). The Fama-French risk premia, also needed in equation (1) were obtained from Kenneth French's website.[5]

To choose the sample of insurance firms to include in the analysis, I first identified all insurance firms in the CRSP database using Standard Industrial Classification Codes and then selected a sample consisting of all firms that derived at least 40% of their revenues from property-casualty insurance. Revenues were identified using the Standard & Poor's Compustat database. After selecting the firms with at least 40% of their revenues in property-casualty insurance, I applied several screens to the data to eliminate firms that were either specialty firms or firms not representative of the types of insurance currently being regulated by the Alberta Rate Hearing Board. Firms were eliminated if they were primarily or exclusively professional reinsurers, title insurers, mortgage insurance companies, specialty medical malpractice companies, or firms primarily engaged in providing financial guarantees rather than writing property-casualty insurance. The list of firms used in the cost of capital analysis is provided in Exhibit 4. There are 98 firms in the sample in at least one year of the sample period, which includes the most recent 10 years of data, 1997-2006. However, not all firms were present in all years of the analysis. It is important to include firms in the analysis even though they are not

[5] The website is: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

present in all years in order to avoid the statistical problem of *survivor bias*, i.e., the chance that new entrants or firms exiting the industry have different costs of capital than firms that were present for the entire sample period.

Cost of Capital Estimates

Extensive research in the financial literature as well as on the insurance industry (Cummins and Phillips 2005) has shown that cost of capital estimates tend to vary over time. Part of the variation is caused by changes in interest rates, but risk premia and beta coefficients also vary somewhat over time. Accordingly, it is usually advisable to estimate the cost of capital over a period of years. In this study, the cost of capital is estimated for the most recent ten year period, 1997-2006. Estimates are conducted annually using sample periods ending on June 30 of each year of the sample period. Using estimates ending in June is a standard procedure in the cost of capital literature and also happened to coincide with the most recent period of data availability at the time this research was conducted.

The Fama-French beta coefficients and risk premia are shown in Exhibit 1. The beta coefficients β_{mi}, β_{si}, and β_{vi} from equation (1) are shown in panel A; and the market risk premia $E(r_m) - r_f$, π_s, and π_v, also from equation (1) are shown in panel B. Inserting these estimates into equation (1), and excluding the risk-free rate r_f, gives the overall market risk premium component of the cost of capital for the Fama-French three-factor model. The numbers shown in Exhibit 1 are averages for the property-casualty insurers in the sample.

The full-information beta estimates are shown in Exhibit 2. The top panel shows the estimated coefficients from the right-hand size of equations (2), (3), and (4) as well as some additional data, and the lower panel shows the computed overall beta coefficients from equations (2), (3), and (4). The beta estimates shown in columns 2, 3, and 4 in the top panel of Exhibit 2 are the beta coefficients on the property-casualty insurance line of business specialization

variables from equations (2), (3), and (4). The market-risk beta from equation (2), β_{fmj}, is shown in column 2 of the table. The small-stock beta from equation (3), β_{f1sj}, is shown in column 3 of the table; and the value-stock beta from equation (4), β_{f1hj}, is shown in column 4 of the table. Columns 5 and 6 of the table show the market value beta coefficient, β_{f2s}, from equation (3) and the book-to-market beta coefficient, β_{f2h}, from equation (4). The beta estimates are based on cross-sectional regressions incorporating all firms in the sample in each year of the sample period. Hence, the betas are not simple averages across firms, but all firms in the sample are used in the regression analysis and hence contribute to the estimated betas. The final two columns in the top panel of Exhibit 2 are the average market-value (total number of shares multiplied by share price) and book-to-market equity ratio for the property-casualty firms in the sample.

The lower panel of Exhibit 2 shows the overall beta coefficients for market systematic risk, the size factor, and the book-to-market factor. The market systematic risk beta is obtained from equation (2) and is the same as the systematic risk beta shown in the top panel of Exhibit 2. The size and book-to-market betas in the lower panel of Exhibit 2 are obtained by calculating β_{si} and β_{hi} for each firm in the sample using equations (3) and (4) under the assumption that each firm derives 100% of its revenues from property-casualty insurance. The size and book-to-market betas in the lower panel of Exhibit 2 are averages computed using all firms in the sample.

The estimated risk premia for the Fama-French three-factor and the full-information industry beta methods are shown in columns 2 and 3 of Exhibit 3. Estimates are shown annually for the period 1997 through 2006. This risk premia are averages for the firms in the sample.

As an illustration of the calculation of the Fama-French risk premium, consider the calculation of the overall market risk premium for 2004, which is 10.51%. The market risk

premium component of equation (1) is given below, followed by the calculation. The data used in performing the calculation are from panels A and B of Exhibit 1, in the row labeled "2004."

$$\textit{Market risk premium} = \beta_{mi}[E(r_m) - r_f] + \beta_{si}\pi_s + \beta_{vi}\pi_v$$

$$= 0.7375*5.7535 + 0.1992*2.9163 + 0.8730*4.8195 = 10.5066$$

The numerical result differs slightly from the number shown in Exhibit 1 because the numbers in this example have been rounded to four decimal places, whereas the numbers in Exhibit 1 have not been rounded.

The calculation of the risk premia using the full-information beta method involves two steps: (1) Calculate β_{mi}, β_{si}, and β_{hi} using equations (2), (3), and (4), respectively, and the beta coefficients shown in the top panel of Exhibit 2. This is done for each firm in the sample under the assumption that 100% of its revenues is derived from property-casualty insurance. The results are shown in the lower panel of Exhibit 2. The coefficients β_{si} and β_{hi} vary across firms because firms are of different sizes and have different book-market equity ratios; but in the full-information beta approach β_{mi} is the same for all firms in the sample, i.e., it represents the beta coefficient for a firm with 100% of its revenues in property-casualty insurance. (2) Insert β_{mi}, β_{si}, and β_{hi} from the lower panel of Exhibit 2 and the Fama-French risk premia into the risk-premium component of equation (1) and calculate the risk premia. The calculations in this step are identical to the Fama-French calculation illustrated above. Therefore, the two methods differ to the extent that they produce different beta coefficients. The Fama-French coefficients are for the entire firm, and the full-information beta coefficients are estimates for firms with 100% of their revenues from property-casualty insurance.

Both the Fama-French and full-information beta methods are used here in estimating the

risk premia because both have advantages. The advantage of the Fama-French method is that it allows all beta coefficients to vary across firms and thus takes into account intra-firm variability in risk premia. The advantage of the full-information beta method is that it permits the estimation of risk premia under the assumption that firms derive 100% of their revenues from property-casualty insurance. However, this method captures less of the variability across firms than the Fama-French method. Thus, using both methods enables us to take advantage of the benefits of both cost of capital estimation methods. Using two methods also provides a reasonableness check and reduces the probability that the estimated cost of capital will be unusually high or low.

It is interesting that the risk premium estimates shown in Exhibit 3 are generally declining over the period included in the study. It is normal for risk premia to change over time, as explained above, and at some stage they can be expected to increase again. Consequently, to smooth out movements over time in the risk premia and give an indication of risk premia that are typical of recent periods, I recommend using a five year average of the risk premia to estimate the cost of capital. I also recommend using the most recent five year average as being most representative of expected future risk premia for purposes of insurance pricing.

The final step in the cost of capital analysis is to add the risk-free rate of interest to the risk premia to produce the overall cost of capital, as shown in equation (1). In most cost of capital estimation, the thirty-day Treasury bill rate is used to represent the risk-free rate and that is the approach adopted here. Because insurance pricing is prospective rather than retrospective, it is important to utilize the most current interest rates in estimating the risk-free rate because these rates are most representative of expected returns in the future. Accordingly, for the risk-free rate, I used the one-month average from September 14, 2006 through October 13, 2006 of the daily U.S. Treasury constant maturity one-month bill yield. This is the most recent one-month period for which data were available at the time I conducted the analysis. A one-month

average is used to smooth out day-to-day fluctuations in the risk-free rate. The data on the risk-free rate were obtained from the Federal Reserve Economic Data (FRED) database of the Federal Reserve Bank of St. Louis.[6] The estimated risk-free rate is 4.74%.

Adding the risk premia and the risk-free rate gives the cost of capital estimates shown in Exhibit 3. As an example of estimating the cost of capital, consider the full-information beta method for the year 2004 shown in Exhibit 3. The market risk premium for the full-information beta method is 10.18% in 2004. Adding the risk-free rate 0f 4.74% to 10.18% gives the full-information beta cost of capital for 2004 of 14.92%.

Using the most recent five-year average of the cost of capital gives an estimated cost of capital of capital or fair rate of return of 15.53% using the Fama-French three-factor model. The estimate based on the full-information beta method is very similar, 15.25%. Thus, the estimate of the fair rate of return I would recommend for insurers writing property-casualty insurance, based upon the data of U.S. insurance industry, is the average of the Fama-French and full-information beta costs of capital, 15.4%.

Summary and Conclusions

This report begins with a discussion of the concept of the fair rate of return for the equity providers of a business enterprise. Modern financial theory suggests the fair rate of return, or the cost of capital, contains two components; the risk-free rate of interest plus a market risk component. The risk-free component is included since capital providers could invest in government bonds which have cash flows known with certainty and there is no risk of default. The market risk component is the premium above the risk-free rate of interest that compensates investors for the risk they face by committing capital in a risk venture. This target fair rate of return is the amount of promised return that is necessary to attract capital to an enterprise without

[6] The FRED website address is: http://www.research.stlouisfed.org/fred2/.

over compensating the equity providers for the risk they bear.

The second part of this report presents estimates of the fair rate of return for firms in the U.S. property-casualty insurance industry using two widely accepted methods – the Fama-French three-factor model and the full-information beta methodology. Both methods rely on estimates of beta coefficients, interest rates, and market risk premia that are obtained from financial market data reporting services. The Fama-French model provides estimates of the cost of capital based on the firm taken as a whole, while the full-information beta methodology provides estimates of the cost of capital based on the assumption that 100% of revenues come from property-casualty insurance.

The cost of capital estimates presented in this report are based on market value data on stock returns of firms writing property-casualty insurance. The database used to obtain the market value data is from the University of Chicago's Center for Research on Securities Prices (CRSP). This database includes all publicly traded firms listed on the New York Stock Exchange, the American Exchange, and Nasdaq. The initial sample of firms used in the study includes all firms that have at least 40% of their revenues from property-casualty insurance. Professional reinsurers and specialty firms that are not representative of the overall property-casualty insurance market were omitted from the sample. The final sample consists of 98 firms that were present for at least one year of the sample period, 1997-2006.

Both the Fama-French three-factor method and the full-information beta method obtain the cost of capital as the sum of the risk-free rate of interest and a risk premium. The risk-free rate of interest used in this study is the thirty day constant maturity Treasury bill rate. Risk premia are estimated using market value data from CRSP. The results of the analysis show that the appropriate cost of capital for firms writing property-casualty insurance is 15.53% using the Fama-French method and 15.25% using the full-information beta approach. The recommended

cost of capital is obtained by averaging these two estimates, producing an average cost of capital of 15.4%. This cost of capital is appropriate for U.S. property-casualty insurers writing insurance that is of average risk for the industry. This estimate should be a good benchmark for Canadian property-casaulty insurers assuming they underwrite insurance policies that are similar in risk to their U.S. counterparts.

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Exhibit 1
Fama-French Beta Estimates and Risk Premia
Averages for Property-Casualty Insurers

A. Parameter Estimates

	Market Beta	Size Beta	BV/MV Beta
1997	1.152	0.239	0.660
1998	1.075	0.572	0.977
1999	0.932	0.660	1.000
2000	1.053	0.507	1.318
2001	1.040	0.396	1.154
2002	0.834	0.414	1.112
2003	0.794	0.364	1.084
2004	0.738	0.199	0.873
2005	0.646	0.333	0.665
2006	0.698	0.415	0.474
Average	0.920	0.418	0.904

B. Fama-French Expected Risk Premia

	Market	Size	BV/MV
1997	8.16%	2.66%	4.77%
1998	8.33%	2.50%	4.83%
1999	8.43%	2.31%	4.53%
2000	8.41%	2.59%	4.14%
2001	8.02%	2.62%	4.72%
2002	7.67%	2.76%	4.94%
2003	7.60%	2.78%	4.77%
2004	7.75%	2.92%	4.82%
2005	7.74%	2.88%	4.94%
2006	7.73%	2.90%	4.97%
Average	0.07985	0.02693	0.04743

Exhibit 2
Full-Information Beta Estimates for Property-Casualty Insurance Segment
1997 - 2006

Table displays full-information beta estimates for each Fama-French risk factor and the Market-Value and Book-to-Market control variables for the Property-Casualty Insurance Industry (NAICS 524126). The estimates shown are full-information beta esimates using seemingly unrelated regressions and ordinary least squares.Sources: Compustat and CRSP data bases.

	Coefficients of w_{ij} from Equations (2), (3), and (4)						
60 Months Ending June	Market-Risk Beta	Small-Stock Beta	Value-Stock Beta	Market-Value Coefficient	Book-to-Market Coefficient	Average Market-Value*	Average Book-to-Market
1997	1.093	1.157	0.786	-0.143	0.217	2,608	0.781
1998	1.079	1.434	1.039	-0.140	0.148	3,896	0.699
1999	0.934	1.366	1.083	-0.115	0.074	4,728	0.885
2000	1.060	1.390	1.266	-0.147	0.287	5,246	1.121
2001	1.061	1.254	1.211	-0.131	0.001	7,661	1.010
2002	0.888	1.250	1.141	-0.136	0.019	4,329	1.133
2003	0.800	1.166	1.028	-0.132	-0.020	4,462	1.049
2004	0.726	1.001	0.840	-0.118	0.054	8,365	0.877
2005	0.582	1.137	0.637	-0.103	0.061	7,204	0.769
2006	0.725	1.286	0.348	-0.127	0.110	7,997	0.717

*Millions of dollars.

	Overall Betas From Equations (2), (3), and (4)		
60 Months Ending June	Market-Risk Beta	Small-Stock Beta	Value-Stock Beta
1997	1.093	0.299	0.715
1998	1.079	0.549	0.974
1999	0.934	0.657	1.066
2000	1.060	0.526	1.273
2001	1.061	0.445	1.211
2002	0.888	0.411	1.140
2003	0.800	0.312	1.029
2004	0.726	0.191	0.829
2005	0.582	0.410	0.618
2006	0.725	0.365	0.306

Exhibit 3
Market Risk Premia and Costs of Capital: Property-Casualty Insurers

	Market Risk Premia		Costs of Capital*			
	Fama-French	Full-Information Beta	Fama-French	Fama-French 5-Year Average	Full-Information Beta	Full-Information Beta 5-Year Average
1997	13.18%	13.12%	17.92%		17.86%	
1998	15.11%	15.07%	19.85%		19.81%	
1999	13.91%	14.23%	18.65%		18.97%	
2000	15.62%	15.54%	20.36%		20.28%	
2001	14.83%	15.39%	19.57%	19.27%	20.13%	19.41%
2002	13.03%	13.57%	17.77%	19.24%	18.31%	19.50%
2003	12.22%	11.86%	16.96%	18.66%	16.60%	18.86%
2004	10.51%	10.18%	15.25%	17.98%	14.92%	18.05%
2005	9.25%	8.74%	13.99%	16.71%	13.48%	16.69%
2006	8.96%	8.19%	13.70%	15.53%	12.93%	15.25%

Note: The risk-free rate is the 1 month constant maturity t-bill rate average from September 14 to October 13, 2006, from Federal Reserve Economic Data, Federal Reserve Bank of St. Louis. Rf = 4.74%.
*Cost of capital = market risk premium + the risk-free rate.

Exhibit 4
Companies in the Property-Casualty Sample

21ST CENTURY HOLDING CO	FARM FAMILY HOLDINGS INC	OHIO CASUALTY CORP
21ST CENTURY INS GROUP	FIDELITY NATIONAL FINL INC	OLD GUARD GROUP INC
ACCEL INTL CORP	FIRST ACCEPTANCE CORP	OLD REPUBLIC INTL CORP
ALFA CORP	FIRST AMERICAN CORP/CA	OMNI INSURANCE GROUP INC
ALLCITY INSURANCE CO	FOREMOST CORP OF AMERICA	ORION CAPITAL CORP
ALLEGHANY CORP	FORTUNE FINANCIAL INC	PAC RIM HOLDING CO
ALLIED GROUP INC	FREMONT GENERAL CORP	PAULA FINANCIAL/DE
ALLMERICA PPTY &CASUALTY COS	FRONTIER INSURANCE GROUP INC	PENN-AMERICA GROUP INC
ALLSTATE CORP	GORAN CAPITAL INC	PHILADELPHIA CONS HLDG CORP
AMER COUNTRY HOLDINGS INC	GUARANTY NATIONAL CORP	PMA CAPITAL CORP
AMERICAN BANKERS INS GROUP	HALLMARK FINANCIAL SERVICES	PRESERVER GROUP INC
AMERICAN EAGLE GROUP INC	HANOVER INSURANCE GROUP INC	PROGRESSIVE CORP-OHIO
AMERICAN FINANCIAL GROUP INC	HARLEYSVILLE GROUP INC	RELIANCE GROUP HOLDINGS
AMERICAN INDTY FINL CORP	HARTFORD FINANCIAL SERVICES	RLI CORP
AMERICAN INTERNATIONAL GROUP	HCC INSURANCE HOLDINGS INC	RTW INC
AMERICAN NATIONAL INSURANCE	HIGHLANDS INSURANCE GRP INC	SAFECO CORP
AMWEST INSURANCE GROUP INC	HORACE MANN EDUCATORS CORP	SAFETY INSURANCE GROUP INC
ARGONAUT GROUP INC	INFINITY PROPERTY & CAS CORP	SELECTIVE INS GROUP INC
ATLANTIC AMERICAN CORP	INTEGON CORP/DE	ST PAUL TRAVELERS COS INC
BALDWIN & LYONS -CL B	INTERCARGO CORP	STATE AUTO FINANCIAL CORP
BANCINSURANCE CORP	KAYE GROUP INC	SUPERIOR NATL INS GROUP INC
BERKLEY (W R) CORP	KINGSWAY FINANCIAL SVCS INC	SYMONS INTERNATIONAL GRP INC
BERKSHIRE HATHAWAY	LEUCADIA NATIONAL CORP	TIG HOLDINGS INC
CAPITOL TRANSAMERICA CORP	LOEWS CORP	TITAN HOLDINGS INC
CHUBB CORP	MARKEL CORP	UNICO AMERICAN CORP
CINCINNATI FINANCIAL CORP	MCM CORP	UNITED FIRE & CAS CO
CITIZENS CORP	MEADOWBROOK INS GROUP INC	UNITRIN INC
CNA FINANCIAL CORP	MERCHANTS GROUP INC	USF&G CORP
COMMERCE GROUP INC/MA	MERCURY GENERAL CORP	VESTA INSURANCE GROUP INC
CUMBERLAND TECHNOLOGIES INC	MERIDIAN INS GROUP INC	WALSHIRE ASSURN CO
DONEGAL GROUP INC	MIDLAND CO	WHITE MTNS INS GROUP LTD
EMC INSURANCE GROUP INC	NATIONAL SEC GROUP INC	ZENITH NATIONAL INSURANCE CP
EXECUTIVE RISK INC	NORTH EAST INSURANCE CO	