Cost of Capital Estimation with Application to Workers Compensation Ratemaking

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Motivation. This paper discusses how NCCI estimates the cost of capital in its ratemaking framework. The implementation of this actuarial concept in ratemaking is challenging because financial economics offers more than one model for estimating the cost of capital. And even where there is agreement on the model, there may be questions about how to measure the variables that enter the model.
Method. The cost of equity capital is calculated using the discounted cash flow model (DCF) and the capital asset pricing model (CAPM). The DCF method employs forecasts for the rate of dividend growth from Value Line Publishing, Inc. The CAPM model utilizes *betas* from Value Line Publishing, Inc., and historical returns on Treasury bills and the stock market from Morningstar, Inc.
Results. Cost of capital estimates are provided based on data available as of November 4, 2010. The two approaches to measuring the cost of capital are conceptually different, yet yield similar results.
Conclusions. NCCI relies on two concepts of estimating the cost of equity capital for ratemaking in workers compensation. Both approaches are recommended methods according to Actuarial Standard and Practice No. 30 (July 1997).
Availability. Historical returns on Treasury bills and the stock market are available from Morningstar, Inc. Dividend growth rates and CAPM *betas* are available from Value Line Publishing, Inc.
Keywords. Dividend Growth Model, Equity Valuation, Workers Compensation

1. INTRODUCTION

Central to developing the underwriting profit provision in actuarial ratemaking is the total financial needs model, which states that "the sum of underwriting profit, miscellaneous (non-investment) income, investment income from insurance operations, and investment income on capital, after income taxes, will equal the cost of capital" (see Actuarial Standards Board [1], p. 8). Among the approaches to estimating the cost of capital that are recognized by the Actuarial Standards Board [1], p. 7) are the discounted cash flow model (DCF) and the capital asset pricing model (CAPM). What follows is a discussion of how NCCI estimates the cost of capital in ratemaking using both the DCF and the CAPM.

Estimating the cost of capital is challenging, and the academic discussion surrounding this concept shows little signs of abating (see, for instance, Dimson, Marsh, and Phillips [6], Goetzmann and Ibbotson [10], and McGrattan and Prescott [17]). In actuarial practice, it is

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critical to follow a parsimonious, transparent, and robust approach for arriving at cost of capital estimates. At the same time, the approach should periodically be re-examined and possibly be updated in the light of new academic research findings.

1.1 Research Context

NCCI employs two concepts for estimating the cost of capital in the context of ratemaking in workers compensation; these two approaches and their implementation are periodically reviewed. What follows is a discussion of the two concepts, along with a detailed description of how NCCI implements these approaches.

1.2 Objective

NCCI estimates of the cost of equity capital rest on both the DCF and the CAPM. The DCF employs estimates of the current dividend yield and forecasts for the rate of dividend growth from Value Line Publishing, Inc, in addition to the long-term average rate of nominal GDP (Gross Domestic Product) growth provided by the BEA (Bureau of Economic Analysis). The CAPM, on the other hand, utilizes *betas* provided by Value Line Publishing, Inc., current Treasury bill yields published by the Board of Governors of the Federal Reserve System, and historical returns on Treasury bills and the stock market complied by Morningstar, Inc.

1.3 Outline

What follows is a description of the two most widely used approaches in the estimation of the cost of capital. It is demonstrated how NCCI implements these methods to compute the cost of capital in workers compensation for ratemaking purposes. Further, cost of capital estimates are provided based on data available as of November 4, 2010.

2. BACKGROUND AND METHODS

The implementation of the actuarial concept of the total financial needs model in ratemaking is challenging because financial economics offers more than one approach to estimating the cost of capital. And even where there is agreement on the choice of the model, there often is no consensus on how to estimate the values of the parameters that feed into this model.

Myers and Borucki [19] describe the DCF model as the "most widely used approach to estimate the cost of equity capital to regulated firms in the United States." The other commonly applied approach is the CAPM, which may be implemented in the original, Sharpe-Lintner version of the model or the Fama-French three-factor extension. Whereas the Sharpe-Lintner model is well-founded in economic theory (and has only one risk factor, which is the market), the Fama-French three-factor approach is *ad hoc* and derives its rationale primarily from its predictive power. NCCI employs both the DCF and the Sharpe-Lintner CAPM.

The cost of equity capital in the insurance industry has been studied by Fama and French [9] and, more recently, by Cummins and Phillips [5]—both studies implement the CAPM as one-factor and three-factor models. NCCI methodology and results are compared to these studies in Section 2.2.3.

2.1 The Discounted Cash Flow Model

Generally, the price of a financial asset is the present value of its future cash flow. When it comes to a share of stock, the cash flow consists of dividend payments. On a more aggregate level, such as the entire stock of a corporation, an industry or a country, cash returned to shareholders also includes cash dispensed in share repurchase programs, so long as these shares are retired (instead of being handed out to executives and employees as compensation, in which case the shares change hands but no cash is paid out on net).

A widely used model for the valuation of corporate stock, which is described in many corporate finance textbooks, is the Gordon dividend growth model; see Gordon [11]. The Gordon model is suitable only for mature industries (such as the P&C industry) because this model assumes that (1) the industry in question returns cash to shareholders and that (2) the amount of cash paid to shareholders grows at a steady rate. As mentioned, cash returned to shareholders includes cash dispensed by means of repurchasing shares for the purpose of retiring them.

The Gordon model is parsimonious and rests on only a few inputs. These inputs are the *effective* dividend yield of the stock (i.e., cash paid out by means of dividends and share repurchases, divided by the stock market valuation of the firm) and the rate at which this dividend yield is projected to grow in the future. Multi-year forecasts for dividend growth rates are available at the company level from disinterested third parties, which is a key factor in a regulatory proceeding.

The following sections provide a summary of the NCCI methodology for estimating the effective dividend yield, the prospective rate of growth of dividends, and how these estimates are combined to generate a measure for the cost of capital within the context of the DCF.

2.1.1 The Present Value of Future Dividend Payments

Conceptually, a share of stock has an infinite lifetime. This assumption is not invalidated by the fact that stock may be repurchased and retired, because the value of the share when repurchased is again the present value of all future dividends, which are paid out lump sum to those that sell shares back to the corporation.

In a generalized, two-stage Gordon dividend growth model, there are n periods during which the dividend payments grow at a forecast rate g^{fct}, followed by an infinite number of periods during which the dividend grows at its long-term sustainable rate g^{avg}.

In general, the present value of a stock, V_0, that pays a dividend for n periods, equals

$$V_0^n = D_0 \cdot \sum_{t=1}^{n} \frac{(1+g)^t}{(1+k)^t}, \tag{2.1}$$

where D_0 is the dividend paid at the present time (the end of period 0), g is the rate of growth of this dividend, and k is the cost of capital. This formula can be simplified to

$$V_0^n = D_0 \cdot \frac{1+g}{k-g} \cdot \left(1 - \frac{(1+g)^n}{(1+k)^n}\right). \tag{2.2}$$

For an infinite number of periods, the present value reads

$$V_0^\infty = D_0 \cdot \frac{1+g}{k-g}, \text{ for all } k > g . \tag{2.3}$$

Hence, the present value of a stock the dividend payment of which grows at the rate g^{fct} for n periods, followed by an infinite number of periods in which the dividend grows at the rate g^{avg}, equals

$$V_0 = D_0 \cdot \left[\frac{1+g^{fct}}{k-g^{fct}} \cdot \left(1 - \frac{(1+g^{fct})^n}{(1+k)^n}\right) + \frac{(1+g^{fct})^n \cdot (1+g^{avg})}{k-g^{avg}} \cdot \frac{1}{(1+k)^n} \right]. \tag{2.4}$$

As a consequence, we obtain the marginal cost of capital (k) by means of solving the following equation subject to the constraint $k > g^{avg}$:

$$\frac{1}{\frac{D_0}{V_0}} = \left[\frac{1+g^{fct}}{k-g^{fct}} \cdot \left(1 - \frac{(1+g^{fct})^n}{(1+k)^n}\right) + \frac{(1+g^{fct})^n \cdot (1+g^{avg})}{k-g^{avg}} \cdot \frac{1}{(1+k)^n} \right], \tag{2.5}$$

where D_0/V_0 is the current (end of period 0) dividend yield.

2.1.2 The Effective Dividend Yield

The NCCI estimate of the dividend yield of the P&C industry rests on dividend yield data of individual insurers, published by Value Line Publishing, Inc. [25][27]. Value Line Publishing, Inc. data are developed in a consistent manner and are generally viewed as reliable. Analyses based on Value Line Publishing, Inc. information are used in many regulatory settings, especially in the insurance industry and the utilities sector (see, for instance, Cummins and Phillips [5], and Morin [18]).

NCCI defines the domain of P&C companies pertinent to determining the cost of capital in workers compensation as consisting of 30 corporations; 21 of these corporations are selected from the Value Line P&C Industry Grouping (PMI was omitted due to its specialization on residential mortgages), eight are selected from Value Line Reinsurance Industry Grouping, and another two (Hartford Financial Services, and Unitrin) are taken from the Diversified Financial Services Grouping. (Hartford Financial Services and Unitrin have significant P&C business as a percent of total; moreover, Hartford is a major writer of workers compensation insurance.) Of these 30 corporations, which are detailed in Table 1, 26 companies currently pay dividends.

The dividend yield is estimated by the average of the dividend yields of all companies that pay dividends. Companies that do not pay dividends are excluded because they are not in a steady state (that is, a state that can repeat itself indefinitely) in the spirit of the Gordon dividend growth model. (Typically, companies that do not pay dividends also do not repurchase shares on a regular basis.) Two types of averages are employed. First, there is the equally weighted average, which affords all companies the same weight. Second, there is the weighted average, where the individual dividend yields are weighted by the companies' market capitalizations. The motivation for using the equally weighted average is that any firm may be regarded as good a representation of the industry as any other firm. Further, the equally weighted average is immune to the idiosyncrasies of large companies, which may manifest themselves (for instance) in temporary discontinuations of dividend payments. As of November 4, 2010, the (equally weighted) average dividend yield came to 2.65 percent; by comparison, the weighted average totaled 2.43 percent.

Table 1: Dividend Yield, Forecast Dividend Growth Rate, and Market Capitalization

Company	Dividend Yield (Percent)	Growth Rate (%) 2007-2009 to 2013-2015	Market Capitalization ($ Billion)
ACE Limited	2.38	3.00	18.4
Alleghany Corp.	0	0	2.6
Allstate Corp.	2.71	-7.00	15.4
Alterra Capital (formerly Max Capital)	not available	not available	1.1
American Financial Group	2.01	6.50	3.2
Assured Guaranty	1.07	5.50	2.9
Axis Capital Holdings	2.64	3.50	4.0
Berkley (W.R.)	1.02	11.00	3.9
Berkshire Hathaway	0	0	200.0
Chubb Corp.	2.70	4.00	17.4
Cincinnati Financial Corp.	5.68	2.50	4.5
CNA Financial Corp.	0.00	14.50	7.2
Erie Indemnity Co.	3.65	2.50	2.7
Everest Re Group, Ltd.	2.44	3.50	4.3
Greenlight Capital	0	0	0.8
Hanover Insurance Group	2.25	17.50	2.0
Hartford Financial Services	0.91	-6.00	10.0
HCC Insurance Holdings	2.16	5.50	2.9
Markel Corp.	0	0	3.2
Mercury General Corp.	5.82	3.50	2.2
Old Republic International	5.29	1.00	3.1
PartnerRe Ltd.	2.63	5.00	5.6
Progressive Corp. (Ohio)	0.78	not meaningful	13.7
RenaissanceRe Holdings	1.75	4.00	3.3
RLI Corp.	2.10	6.50	1.1
Selective Insurance Group	3.32	3.00	0.8
Transatlantic Holdings	1.75	7.00	3.1
Travelers Companies	2.82	7.00	23.6
Unitrin, Inc.	3.55	-8.50	1.6
XL Capital Limited	2.08	-14.00	6.4
Equally Weighted Average*	**2.65**	**3.38**	**12.4**
Weighted Average by Market Cap*	**2.43**	**2.57**	not applicable

* Non-dividend paying companies are excluded from the computation of the averages of the dividend yield and the dividend growth rate.

Note: The dividend yield of any given company is calculated as a 13-week moving average. Data for Progressive Corp. is not meaningful according to Value Line Publishing, Inc. Currently, Value Line Publishing, Inc. does not publish a dividend yield for Alterra Capital. Data as of November 4, 2010. Source: Value Line Publishing, Inc. [25][27].

As mentioned, some of the companies listed in Table 1 are from the Value Line Diversified Financial Services Grouping; these companies do not exclusively operate in the P&C industry. Further, even some of the companies from the Value Line P&C Industry Grouping are not "pure play" firms, but instead are operating lines of business outside the P&C industry as well, most importantly in life insurance. Although diversification may reduce the time variation of the dividend yield, it does not necessarily affect its average level. Thus, the Gordon dividend growth model draws on both "pure play" P&C companies and a small set of diversified firms.

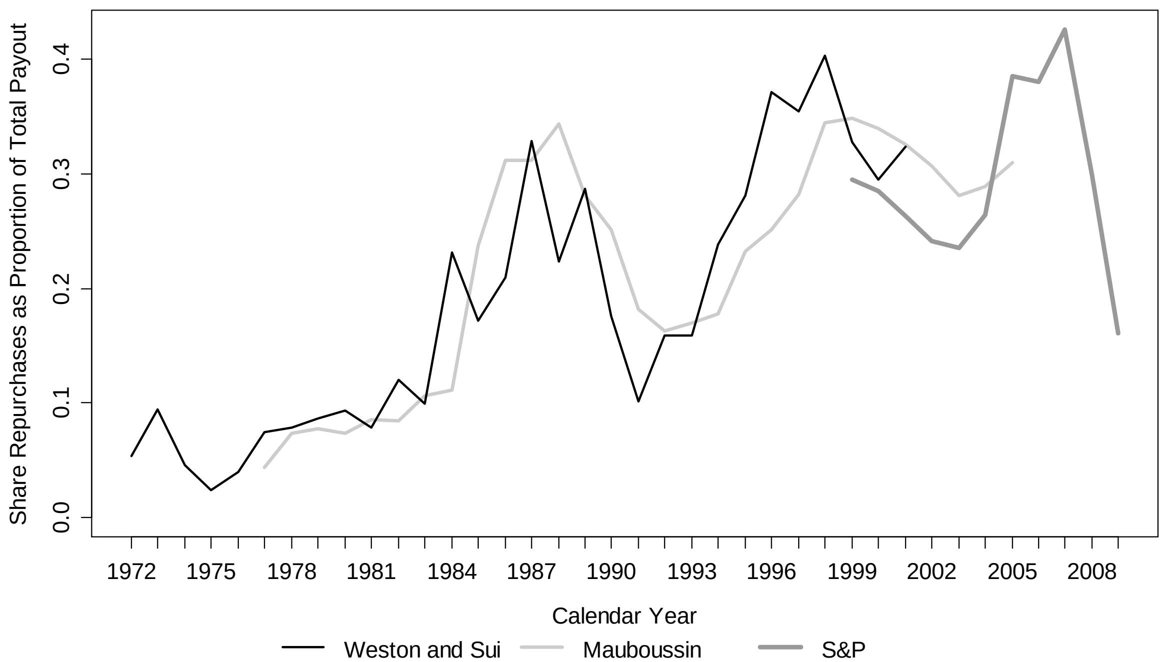
2.1.2.1 Adjustment for Share Repurchases

Dividends are not the only means by which companies return cash to shareholders. As argued, to the extent that share buybacks return cash to shareholders, share repurchases have to be added to the dividend payments when computing the effective dividend yield. Chart 1 shows that, starting in the mid-1980s, share repurchases have gained popularity in the U.S. stock market and now account for about 30 percent of all cash returned to shareholders.

Chart 1 draws on three sources of data. First, there is a series compiled by Weston and Sui [28]; this series runs from 1972 through 2001 and rests on SDC (Securities Data Company) data, thus comprising a broadly defined stock market. Share repurchases are primarily measured by announcements in company press releases and newswires (Weston and Sui [28]). The second series is from Mauboussin [16], who quotes various sources; his estimates line up well with those of Weston and Sui [28]. For both sources, the proportion of share repurchases in the total payout was calculated using dividend information from NIPA (National Income and Products Accounts) Table 1.12. The third data source is S&P (Standard and Poor's). The S&P share repurchases information pertains only to the constituents of the S&P 500 Index. Assuming that the bulk of share repurchases is concentrated among large corporations, the proportion of share repurchases was again calculated using dividend information from NIPA. The resulting proportions are fairly close to those published by Weston and Sui [28] for the three overlapping years, thus confirming that the share repurchases of the large corporations captures the bulk of the repurchase activity.

Quantifying the amount of cash that is returned to shareholders in stock repurchases is not straightforward. Compared to dividends, where management tends to maintain a steady payment pattern over time, share buybacks show pronounced variations over time. Another complicating factor is that such buybacks tend to be concentrated in a relatively small number of companies. Finally, not all shares that are repurchased are also retired; instead, repurchased shares may be handed out to employees or executives as part of their compensation. When repurchased shares are passed on to employees or executives, no cash is returned to shareholders in the aggregate; for a discussion, see Liang and Sharpe [14].

Chart 1: Proportion of Share Repurchases in Total Payout to Shareholders



Source: Weston and Siu [28]; Mauboussin [16], Standard & Poor's [23][24], BEA (NIPA Table 1.12, www.bea.gov). Frequency of observation: annual. Final observation: 2009.

Table 2 provides data on share repurchases and cash dividends for the chosen set of 30 companies. The data were obtained from 10K reports filed with the U.S. Securities and Exchange Commission (SEC; http://www.sec.gov). Table 2 reports that during the period 2004-2009, the sum of average annual share repurchases per firm totaled \$7.15 billion, thus exceeding by 57.5 percent the corresponding number for the cash dividends of \$4.54 billion. Based on these numbers, one could argue that the effective dividend yield is more than 2.5 times the reported dividend yield. However, in light of the variable and skewed nature of share repurchases in the P&C industry, and the possibility that some of the repurchased shares may

Table 2: Dividends and Common Stock Repurchases, 2004-2009

	Dividends						Common Stock Repurchases						Dividends	Repurchases
Companies	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2004-2009 Avg**	**2004-2009 Avg**
ACE Limited	226.0	253.0	312.0	341.0	362.0	388.0	-	-	-	-	-	-	313.7	-
Alleghany Corp.	-	-	-	-	-	-	-	-	39.2	-	25.1	75.9	-	23.4
Allstate Corp.	756.0	830.0	873.0	901.0	889.0	542.0	1,373.0	2,484.0	1,770.0	3,604.0	1,323.0	4.0	798.5	1,759.7
Alterra Capital (formerly Max Capital)	5.5	9.0	14.3	19.2	20.4	21.7	4.9	7.4	18.0	114.4	109.8	34.3	15.0	48.1
American Financial Group	35.1	33.1	38.2	41.9	50.7	59.9	-	-	-	199.1	47.4	81.0	43.2	54.6
Assured Guaranty	4.6	9.0	10.5	11.0	16.0	22.3	6.0	19.0	171.1	9.3	-	3.7	12.2	34.8
Axis Capital Holdings	68.0	82.8	90.6	111.2	106.4	113.0	-	350.0	0.3	308.1	291.0	175.9	95.3	187.6
Berkley (W.R.)	23.5	19.1	29.4	36.3	47.0	28.8	0.3	0.6	45.1	488.8	553.3	147.1	30.7	205.9
Berkshire Hathaway	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chubb Corp.	291.0	330.0	403.0	451.0	471.0	487.0	-	135.0	1,228.0	2,185.0	1,336.0	1,060.0	405.5	990.7
Cincinnati Financial Corp.	177.0	204.0	228.0	240.0	250.0	249.0	59.0	61.0	120.0	307.0	138.0	(1.0)	224.7	114.0
CNA Financial Corp.	-	-	-	95.0	122.0	-	-	-	-	-	70.0	-	36.2	11.7
Erie Indemnity Co.	55.1	81.9	86.1	91.1	92.3	93.0	54.1	99.0	217.4	236.7	102.0	3.1	83.2	118.7
Everest Re Group, Ltd.	22.4	25.4	39.0	121.4	118.6	116.9	-	(38.3)	-	241.6	150.7	190.6	73.9	90.8
Greenlight Capital	-	-	-	-	-	-	-	-	-	-	2.3	-	-	0.4
Hanover Insurance Group	-	13.4	15.4	20.8	23.0	37.5	-	-	200.2	1.6	58.5	148.1	18.4	68.1
Hartford Financial Services	325.0	345.0	460.0	636.0	660.0	149.0	-	-	-	1,193.0	1,000.0	-	429.2	365.5
HCC Insurance Holdings	20.0	27.6	38.9	46.2	52.5	57.4	-	-	-	-	63.3	35.5	40.4	16.5
Markel Corp.	-	-	-	-	-	-	3.4	15.9	45.9	24.2	60.6	-	-	25.0
Mercury General Corp.	80.6	93.9	105.0	113.8	127.0	127.6	-	-	-	-	-	-	108.0	-
Old Republic International	91.6	300.7	135.8	145.4	155.2	160.0	-	-	-	28.3	-	-	164.8	4.7
PartnerRe Ltd.	92.3	118.9	125.4	130.9	134.6	151.9	152.5	(102.4)	(17.2)	275.0	110.0	-	125.7	69.7
Progressive Corp. (Ohio)	23.3	23.7	25.0	1406.5	98.3	-	1,628.5	482.8	1,214.5	1,548.4	179.4	180.6	262.8	872.4
RenaissanceRe Holdings	53.8	57.0	60.4	62.6	57.9	59.7	38.8	0.7	-	200.2	428.4	51.0	58.6	119.8
RLI Corp.	12.6	15.9	19.0	21.7	22.7	25.0	0.0	-	37.6	131.8	47.9	19.3	19.5	39.4
Selective Insurance Group	17.3	19.9	22.8	24.5	25.8	26.3	8.7	22.9	116.4	152.1	46.8	3.0	22.8	58.3
Transatlantic Holdings	24.7	29.0	33.6	39.0	46.4	51.8	1.2	6.3	-	-	-	3.1	37.4	1.8
Travelers Companies	642.0	628.0	702.0	742.0	715.0	693.0	23.0	33.0	1,120.0	2,959.0	2,196.0	3,288.0	687.0	1,603.2
Unitrin, Inc.	113.5	117.4	119.8	300.0	232.1	220.1	-	48.9	89.9	119.9	118.4	66.6	183.8	74.0
XL Capital Limited	270.5	276.7	277.7	274.0	261.4	136.8	4.6	5.5	5.6	1,136.0	5.0	0.6	249.5	192.9
TOTAL	**3,431.4**	**3,944.3**	**4,264.9**	**6,423.5**	**5,157.2**	**4,017.7**	**3,357.9**	**3,631.4**	**6,421.8**	**15,463.5**	**8,463.1**	**5,570.3**	**4,539.8**	**7,151.3**

Note: Numbers are stated in millions of U.S. dollars. Dashes indicate no reported dividend payout and share repurchase activity, respectively; these observations are included in the computation of the average. Numbers in parentheses indicates net issues of common stock and treasury shares. Source: 10K reports, U.S. Securities and Exchange Commission, http://www.sec.gov.

fund share-based compensation and stock option grants, NCCI takes a conservative stance and estimates that the effective dividend yield equals (only) twice the reported dividend yield. (Note that 27 of 30 companies in the NCCI P&C company data set engaged in share repurchases in the period 2004-2009; of those 27 companies that repurchased shares, only three reported a net issuance of shares in their 10K statement; these share issues amounted to about $159 million or roughly 2.2 percent of the average annual share repurchases of all 27 companies taken together.)

Table A-1.1 in Appendix 1 offers an earlier version of Table 2, which was compiled for the years 2004 through 2006 for the then effective set of companies based on data available as of May 25, 2007. In Table A-1.1, too, the amount of share repurchases exceeds the dividend payments, albeit by a smaller percentage.

2.1.3 The Prospective Rate of Growth in Dividends

Forecasting dividend growth is subject to the same principles as economic forecasting in general. Whereas in the short run, the path of future economic activity may be discernable in a fairly accurate way, in the long run, the growth of economic activity must assume a rate that is sustainable indefinitely, which frequently implies reversion to the long-term historical average.

In a similar vein, the NCCI discounted cash flow approach draws on forecasts for the dividend growth rate for the immediate future before this growth rate assumes a value that is sustainable indefinitely. For the immediate future, NCCI uses Value Line Publishing, Inc. five-year ahead forecast for the three-year average dividend growth of the P&C industry. Following this five-year period, we assume that the dividend growth rate reverts to the long-term average growth rate of (nominal) Gross Domestic Product (GDP), thus acknowledging that no primarily domestically operating company can indefinitely grow faster than the economy overall. This approach, which relies on professional forecasts for the near term and on a long-term average for the time thereafter, recognizes the benefit of near-term growth rates in accounting for short-term cyclical factors but, at the same time, restrains any potential optimism bias on the part of the forecasting analyst (see Easterwood and Nutt [7]).

To be specific, for the first five years of the forecasting period, the expected rate of dividend growth is calculated as the average of the forecasts for all dividend-paying companies shown in Table 1. Again, we calculate equally weighted and weighted averages, where the weights are the companies' market capitalizations, as before. The company-level dividend growth rates, which are from Value Line Publishing, Inc. [27], are shown in Table 1. As of November 4, 2010, the (equally weighted) average equaled 3.38 percent; by comparison, the weighted average came to 2.57 percent.

The rate of growth that applies in perpetuity after the initial five-year period is the geometric mean rate of growth of (nominal) GDP. Official GDP data are available from BEA on an annual basis since 1929 (http://www.bea.gov/national/nipaweb/SelectTable.asp; NIPA Table 1.1.5). Assuming that the growth rate of (nominal) GDP reverts to a stationary mean, the long-term average rate of growth can be calculated directly from this series. The resultant long-term rate of dividend growth equals 6.34 percent, based on data as of November 4, 2010.

2.1.4 The DCF Estimate

The DCF approach delivers equally weighted and weighted estimates for the cost of capital of 11.29 percent and 10.72 percent, respectively, based on data available as of November 4, 2010. As discussed, the equally weighted average may be preferable, as this measure is robust to the financial conditions of any of the few large companies in the data set.

2.2 The CAPM

The Sharpe-Lintner CAPM rests on the fundamental insight that the total risk of an equity investment can be broken down into a component that can be eliminated by means of diversification, and a residual component known as systematic risk; see Sharpe [25], and Lintner [15]. Because diversification is brought about by holding (a representative slice of) the entire market, the risk that cannot be eliminated is the one that correlates with the market. The degree of such correlation with the market of an individual stock is known as *beta* (β). Further, only systematic risk generates a risk premium in the marketplace, because this is the risk component that has to be borne by the investor. From this it follows that the return an investor demands for holding a given stock equals

$$k = r_f + \beta \cdot (r_m - r_f), \tag{2.6}$$

where r_f is the return on the risk-free asset (commonly referred to as the risk-free rate of return) and r_m is the expected return on the market portfolio. The difference between the expected return on the equity market and the return on the risk-free asset, $r_m - r_f$, is known as the equity risk premium. The return k defines the marginal cost of equity capital.

According to the cost of capital equation stated above, differences in the cost of capital across companies are due to differences in the degree to which their returns co-vary with the return on the stock market as a whole. A *beta* equal to unity indicates that the company in question offers the same expected return as the market as a whole ($k = r_m$). For companies with *betas* greater than one, the cost of capital exceeds the expected return on the market portfolio.

It is widely accepted that the risk premium, $r_m - r_f$, varies over the business cycle; see, for instance, Lettau and Ludvigson [13]. During recessions, the risk premium increases as investors become more risk-averse. Conversely, during times of economic expansion, the risk premium is comparatively low. The Sharpe-Lintner CAPM, as implemented by NCCI, acknowledges this time variation. During recessions, the risk-free rate (r_f) drops as both short-term and long-term interest rates decline. Although the historic average stock return (r_m) drops as well (due to the typical decline in the stock market that is associated with the onset of a recession), this decline is comparatively small, thus causing the risk premium to increase. For an empirical model that quantifies the time variation in the equity risk premium over the business cycle, see Nyberg [22].

2.2.1 Inputs to the CAPM

Employing the CAPM for the purpose of estimating the cost of capital in the P&C industry necessitates estimating the risk-free rate of return (r_f), the industry *beta* (β), and the expected market return (r_m). Below follows a description of the NCCI estimates of these three variables.

2.2.1.1 Risk-Free Yield

Only short-term rates are free from both default *and* inflation risks. Thus, we gauge the risk-free rate of return by a short-term Treasury yield; see Bodie and Merton [4]. In determining the risk-free rate, NCCI relies neither solely on the current risk-free rate nor entirely on a long-term average. Using exclusively a long-term average renders the CAPM essentially unresponsive to changes in current economic conditions. On the other hand, the current risk-free rate may differ from its intrinsic value—this is because the risk-free rate is not a market outcome but instead follows the monetary tightening and easing cycles of the Federal Reserve. In conclusion, NCCI uses a weighted average of the current risk-free rate (as gauged by the secondary market yield of the 4-week Treasury bill) and the long-term arithmetic mean return on U.S. Treasury bills with about 30 days to maturity, calculated for the period 1926-2009. The weights of the current yield and the long-term average rate of return are 0.33 and 0.67, respectively. As of November 4, 2010, this weighted average equals 2.53 percent (3.7 percent for the long-term average, as documented by Morningstar, Inc. [20]; 0.14 percent for the current 4-week Treasury bill yield, as reported by the Board of Governors of the Federal Reserve System and available for download on the FRED database of the Federal Reserve Bank of St. Louis).

Note that the choice of the risk-free rate has only a modest impact on the NCCI CAPM cost of capital estimate because, as shown below, the *beta* of the P&C industry is fairly close to unity. By rearranging equation (2.6), we can write the marginal cost of capital as a weighted average of the risk-free rate of return (r_f) and the market return (r_m):

$$k = (1 - \beta) \cdot r_f + \beta \cdot r_m \qquad (2.7)$$

Equation (2.7) shows that the closer *beta* is to unity, the smaller is the influence of the risk-free rate of return. For a *beta* of unity, the risk-free rate of return drops out of the cost-of-capital equation.

2.2.1.2 The *Beta*

NCCI obtains company-level estimates for the *betas* of the mentioned set of 30 P&C companies from Value Line Publishing, Inc. [26][27]. These *betas*, which are displayed in Table 3, have been adjusted (by Value Line) for their tendency to mean-revert to unity, as suggested by Blume [3]. Specifically, a (Value Line) Blume-adjusted *beta* is the sum of a constant (0.35) and the weighted originally estimated CAPM *beta* (weight: 0.67).

We aggregate the *betas* of the individual companies to an industry *beta* using the full information approaches suggested by Ehrhardt and Bhagwat [8] and Kaplan and Peterson [12]. The model by Ehrhard and Bhagwat [8] leads to an equally weighted industry beta, whereas the subsequent refinement by Kaplan and Peterson [12] delivers a weighted industry *beta*, where the weights are again the companies' stock market valuations.

Alternatively, "pure play" *betas* could be calculated as equally weighted or weighted means of the *betas* of companies that operate exclusively in the P&C industry; in that approach, diversified companies (e.g., companies that operate in both the P&C and the life insurance industries) are left out. The advantage of the full information concept is that both "pure play" companies (which operate either in the P&C or life insurance industries) and diversified companies (which operate in both the P&C and life insurance industries) contribute to the industry *beta*.

Table 3: CAPM *Betas*, Market Capitalization Weights, and Industry Weights

Company	Beta	Market Capitalization	Proportion of P&C Business
ACE Limited	0.85	0.0353	0.892
Alleghany Corp.	0.80	0.0050	1.000
Allstate Corp.	1.10	0.0296	0.930
Alterra Capital (formerly Max Capital)	1.00	0.0021	0.967
American Financial Group	1.10	0.0061	0.845
Assured Guaranty	1.75	0.0056	1.000
Axis Capital Holdings	0.85	0.0077	1.000
Berkley (W.R.)	0.70	0.0075	1.000
Berkshire Hathaway	0.75	0.3838	not included
Chubb Corp.	0.85	0.0334	1.000
Cincinnati Financial Corp.	0.95	0.0086	0.953
CNA Financial Corp.	1.35	0.0138	0.912
Erie Indemnity Co.	0.70	0.0052	1.000
Everest Re Group, Ltd.	0.75	0.0083	1.000
Greenlight Capital	1.05	0.0015	1.000
Hanover Insurance Group	0.85	0.0038	1.000
Hartford Financial Services	2.10	0.0192	0.449
HCC Insurance Holdings	0.80	0.0056	0.608
Markel Corp.	0.85	0.0061	1.000
Mercury General Corp.	0.70	0.0042	1.000
Old Republic International	1.10	0.0059	1.000
PartnerRe Ltd.	0.70	0.0107	0.857
Progressive Corp. (Ohio)	0.95	0.0263	1.000
RenaissanceRe Holdings	0.70	0.0063	1.000
RLI Corp.	0.80	0.0021	1.000
Selective Insurance Group	0.90	0.0015	1.000
Transatlantic Holdings	0.95	0.0059	1.000
Travelers Companies	0.85	0.0453	1.000
Unitrin, Inc.	1.20	0.0031	0.764
XL Capital Limited	1.60	0.0123	0.903
Aflac, Inc	1.15	0.0476	0.000
AEGON	1.75	0.0203	0.000
Delphi Financial Group	1.40	0.0027	0.000
Genworth Financial	2.45	0.0117	0.000
Lincoln National Corp.	2.00	0.0150	0.000
Manulife Financial	1.50	0.0462	0.000
Metlife Inc.	1.65	0.0627	0.000
Phoenix (The) Companies	2.05	0.0005	0.000
Protective Life	1.45	0.0036	0.000
Prudential Financial	1.90	0.0482	0.000
Renaissance Group	0.90	0.0069	0.000
Torchmark Corp	1.25	0.0084	0.000
Unum Group	1.35	0.0142	0.000

Sources: Value Line Publishing, Inc. [27] and 10K reports, U.S. Securities and Exchange Commission, http://www.sec.gov. The dashed line separates Value Line P&C companies from Value Line life insurance companies.

For the purpose of estimating full-information *betas*, we collect for the Value Line P&C and life Insurance companies the CAPM *betas*, the stock market capitalizations, and the business volumes by line of insurance. When calculating the proportions of the lines of business by company, we distinguish only between P&C and Life/Others; the weights are scaled such that P&C and Life/others add up to 100 percent. Business volume is measured (in this order) either by earned premium, net earned premium, revenue or gross written premium, whichever allowed us to break down the business by line of insurance. (We exclude Berkshire Hathaway from the list of P&C companies for the purpose of estimating the industry *beta*, as this company is a conglomerate with many lines of business outside the insurance industry.) Using the equally weighted and weighed full-information industry *beta* approaches, we arrive at P&C industry *betas* of 0.938 and 0.942, respectively, based on data available as of November 4, 2010. For the CAPM model (and unlike for the DCF approach), the weighted cost of capital is preferred over the equally weighted one—this is because there is little risk of a distortion of the industry *beta* estimate by the idiosyncrasies of a few large companies. This is because, by definition, idiosyncratic risk does not contribute to the *beta* of the firm.

2.2.1.3 The Prospective Return on the Market Portfolio

The expected rate of return on the equity market is a heavily debated matter in financial economics; mostly, this debate is stated in terms of the equity risk premium, which is defined as the *expected* return on the market in excess of the risk-free rate.

Assuming that stock returns mean-revert to a stationary mean, the expected return on the stock market can be estimated using the long-term average realized return. Based on estimates by Morningstar, Inc. [21], for the period 1926-2009, the arithmetic mean annual return on the U.S. Total Return Index (TRI) equals 11.8 percent (compared to the geometric mean return of 9.8 percent). However, it has been argued by Arnott and Bernstein [2] in a 2002 paper that the realized 20th century stock market return came in part at the expense of a secular decline in the dividend yield. Such a decline in the dividend yield may not continue on indefinitely and may even reverse as the dividend yield mean-reverts. From this perspective, the mentioned 11.8 percent may overestimate what can be expected for the future.

In a comprehensive study of market expectations and realized equity returns over more than 200 years, Goetzmann and Ibbotson [10] find that the realized equity risk premium of the 20th century, although much higher than what finance scholars had expected at the time, was not out of line with historical experience. At the same time, these authors confirm that, indeed, there has been a secular decline in the dividend yield in the history of the U.S. stock market.

Specifically, Goetzmann and Ibbotson [10] show that over the period 1792-1925, the difference between the arithmetic mean return on stocks and the arithmetic mean rate of inflation was 7.08 percentage points (7.93 percent minus 0.85 percent); this compares to a 8.63 percentage point difference between the arithmetic mean returns on the U.S. stock market (12.39 percent) and on Treasury bills (3.76 percent) for the period 1926-2004 (see Goetzmann and Ibbotson). Assuming a stable difference between the risk-free rate of return and the rate of inflation, the findings by Goetzmann and Ibbotson suggest that the realized equity risk premium over the period 1792-1925 was 2.19 percentage points ([12.39 minus 3.12] minus [7.93 minus 0.85] percent) lower than over the period 1926-2004 (see Goetzmann and Ibbotson; 3.12 percent is the arithmetic mean annual rate of inflation over the period 1926-2004).

Recent data supplied by Standard and Poor's reports effective dividend yields on the S&P 500 Stock Index that are in the vicinity of the 5.1 percent reported by Arnott and Bernstein [2] for early 1926. Based on semi-annual data between June 30, 2007 and June 30, 2010, the effective dividend yield ("dividend and buyback yield") on the S&P 500 ranged between a low of 3.37 percent and a high of 7.48 percent, with a mean of 5.64 percent and a median of 5.89 percent. The latest, June 2010 number, reads 4.43 percent. From this perspective, there is (currently) no need to adjust for a secular decline in the dividend yield when calculating expected returns based on the average stock return for the period 1926-2009. (Appendix 2 offers an approach to adjusting the mean arithmetic stock market return for a secular decline in the dividend yield.)

2.2.2 Bottom-Line CAPM Estimate

Taken together, we arrive at a CAPM-based cost of capital estimate of 11.23 percent and 11.26 percent for the equally weighted and weighted full information betas, respectively; these values are based on data available as of November 4, 2010. The implied estimate of the equity risk premium equals 9.27 percent.

As discussed, idiosyncratic risk does not enter the CAPM-based cost of capital estimates. Thus, unlike in the case of the DCF, we prefer the weighted full-information *beta* over its equally weighted equivalent.

2.2.3 Discussion

As mentioned, we use *betas* that have been obtained from the Sharpe-Lintner CAPM and are Blume-adjusted. We aggregate these *betas* in two alternative ways to a full information *beta* for the P&C industry. In one approach, the *betas* of all companies are weighted equally, as suggested by Ehrhardt and Bhagwat [8]. In the other approach, the *betas* are weighted by the market capitalizations of the companies; this model was developed by Kaplan and Peterson [12] and implemented for the insurance industry by Cummins and Phillips [5].

Alternative to using *betas* from the Sharpe-Lintner, one-factor CAPM, *betas* from the Fama-French three-factor model may be used. In the Fama-French model, firm size and firm valuation (ratio of book to market) serve as risk factors, in addition to the market. In their 1997 study of one-factor and three-factor *betas* of major U.S. industries, Fama and French [9] find little difference between these two types of *betas*, and little difference between the implied risk premiums—the risk premium obtained with the three-factor model exceeds the 5.14 percent risk premium of the one-factor model by only 0.58 percentage points. On the other hand, Cummins and Phillips [5] in their 2005 paper, find that the three-factor *betas* greatly exceed the CAPM *betas*, thus resulting in large differences in the estimated costs of equity capital between these two approaches. Based on market-value weighted estimates for the P&C industry, these authors report a CAPM *beta* of 0.843 (their Table 4, Panel B) and a three-factor *beta* of 1.099 (their Table 5, Panel B); the corresponding implied costs of equity capital equal 12.0 percent (CAPM; Table 4, Panel D) and 19.1 percent (three-factor model; Table 5, Panel D).

We are skeptical of the three-factor model due to its lack of a theoretical foundation and, with regard to the Cummins and Phillips [5] study, we are unconvinced of (1) the seven percentage point difference in the implied cost of equity capital between the two approaches (remember that Fama and French [9] found only a small difference in risk premiums between the two models) and (2) of the high cost of equity capital of 19.1 percent. Note that the arithmetic mean stock market return of large (small) capitalization stocks from 1926 to 2009 ran at only 11.8 (16.6) percent (Morningstar [20], Table 2-1), which casts doubt on the proposed 19.1 percent cost of equity capital for the P&C industry, the *beta* of which was estimated in the neighborhood of unity by Fama and French [9]. In fact, the Cummins and Phillips estimate of the cost of equity capital of 12.0 percent (as obtained with the CAPM, market-value weighted; their Table 4, Panel D) agrees more with the U.S. long-term average large cap stock return and with our estimate of the cost of capital.

3 THE OVERALL COST OF CAPITAL

The DCF and CAPM are market-based approaches to estimating the cost of capital. That is, they both use financial market data to develop estimates for the expected return demanded by the marginal investor. The DCF method uses current stock prices and dividend yields as important inputs, but is also sensitive to the projected growth in dividends. Similarly, the CAPM is sensitive to the choice of the industry *beta* and, perhaps more critically, to the projected return on the market portfolio (or, alternatively, the assumed equity risk premium).

Given the uncertainty surrounding the projected dividend growth and the ongoing debate among financial economists regarding the equity risk premium, it seems appropriate not to rely on one method alone. For this reason, the NCCI estimate of the cost of capital of the P&C industry is computed as an average of the estimates delivered by the DCF and CAPM approaches. Such averaging is likely to lead to less variation in the cost of capital estimate over time, which is a desirable feature in a regulatory setting.

Table 4 summarizes the DCF and CAPM results based on the NCCI cost of capital methodology; the overall cost of capital comes to 11.28 percent. A comparable table for the methodology put forward in the original, 2008 paper, is shown in Appendix 3.

NCCI updates its cost of capital estimates throughout the year as Value Line Publishing, Inc., releases quarterly updates for the DCF inputs and the CAPM *beta* coefficients and Morningstar, Inc. publishes annual updates of the historical returns on Treasury bills and the stock market, which enter the CAPM.

Table 4: Cost of Equity Estimates Using Data as of November 4, 2010

Model	Percent (Equally Weighted / Weighted)
DCF	**11.29 / 10.72**
Current Dividend Yield	2.65 / 2.43
Effective Dividend Yield	5.30 / 4.86
Forecast Avg. Ann. Growth in Dividends	3.38 / 2.57
Long-term Avg. Ann. Growth in Dividends	6.34
CAPM	**11.23 / 11.26**
Risk-Free Rate	2.53
Full-information *beta*	0.938 / 0.942
Market Return	11.80
Implied Equity Risk Premium	9.27
Cost of Capital	**11.28**

Note: The DCF and CAPM cost of capital estimates are calculated from the displayed rounded numbers. The Cost of Capital is calculated as the arithmetic mean of the equally weighted DCF and the weighted CAPM estimates, again based on the displayed rounded numbers.

4. CONCLUSIONS

The cost of capital is an integral part of ratemaking at NCCI, as its value is a critical element used in the specification of the profit factor. NCCI uses both the DCF and CAPM approaches in estimating of the cost of capital of the P&C industry. The data that feed into these estimates are from publicly available sources that are frequently cited in similar analyses prepared for regulatory proceedings; these sources include governmental institutions (Board of Governors of the Federal Reserve System and U.S. Securities and Exchange Commission) and private organizations (Value Line Publishing, Inc. and Morningstar, Inc.). In addition, NCCI uses long-term averages where appropriate, for instance when estimating the prospective dividend growth in the DCF analysis, and the risk-free rate and market return in the CAPM. The practice of averaging the DCF and CAPM estimates in determining the ultimate cost of capital acknowledges model uncertainty and uncertainty in the employed data inputs. Further, such averaging reduces the time variation of the cost of capital estimates, which is a desirable attribute from a regulatory perspective.

APPENDIX 1

Table A-1.1: Dividends and Common Stock Repurchases, 2004-2006 (Published in the Original, January 2008 Version of the Paper; Data as of May 25, 2007; Corrected)

	Dividends			Common Stock Repurchases			Dividends	Repurchases
Companies	**2004**	**2005**	**2006**	**2004**	**2005**	**2006**	**2004-2006 Avg**	**2004-2006 Avg**
21st Century Insurance Group	8.5	13.7	27.6	-	-	-	16.6	-
ACE Limited	226.0	253.0	312.0	-	-	-	263.7	-
Alleghany Corp	-	-	-	-	-	39.2	-	13.1
Allstate Corp.	756.0	830.0	873.0	1,373.0	2,484.0	1,770.0	819.7	1,875.7
American Financial Group	35.1	33.1	38.2	-	-	-	35.5	-
American International Group	730.0	1,421.0	1,638.0	1,083.0	176.0	20.0	1,263.0	426.3
Assured Guaranty	4.6	9.0	10.5	6.0	19.0	171.1	8.0	65.4
Berkley (W.R.)	23.5	19.1	29.4	0.3	0.6	45.1	24.0	15.3
Berkshire Hathaway	-	-	-	-	-	-	-	-
Chubb Corp.	291.0	330.0	403.0	-	135.0	1,228.0	341.3	454.3
Cincinnati Financial Group	177.0	204.0	228.0	59.0	61.0	120.0	203.0	80.0
CNA Financial Corp.	-	-	-	-	-	-	-	-
Erie Indemnity Co.	55.1	81.9	86.1	54.1	99.0	217.4	74.4	123.5
Everest Re Group, Ltd.	22.4	25.4	39.0	-	(38.3)	-	28.9	(12.8)
Hanover Insurance Group	-	13.4	15.4	-	-	200.2	9.6	66.7
Hartford Financial Services	325.0	345.0	460.0	-	-	-	376.7	-
HCC Insurance Holdings	20.0	27.6	38.9	-	-	-	28.9	-
Markel Corp.	-	-	-	3.4	15.9	45.9	-	21.7
Max Capital Group	5.5	9.0	14.3	4.9	7.4	18.0	9.6	10.1
Mercury General	80.6	93.9	105.0	-	-	-	93.2	-
Ohio Casualty	-	11.5	22.3	-	38.9	98.7	11.3	45.9
Old Republic International	91.6	300.7	135.8	-	-	-	176.0	-
PartnerRe Ltd.	92.3	118.9	125.4	152.5	(102.4)	(17.2)	112.2	10.9
Progressive Corp. (Ohio)	23.3	23.7	25.0	1,628.5	482.8	1,214.5	24.0	1,108.6
Renaissance Hldgs	53.8	57.0	60.4	38.8	0.7	-	57.1	13.2
RLI Corp.	12.6	15.9	19.0	0.0	-	37.6	15.9	12.5
SAFECO Corp.	104.8	118.9	130.2	663.0	255.9	1,165.2	118.0	694.7
Selective Insurance Group	17.3	19.9	22.8	8.7	22.9	116.4	20.0	49.3
Transatlantic Holdings	24.7	29.0	33.6	1.2	6.3	-	29.1	2.5
Travelers Companies	642.0	628.0	702.0	23.0	33.0	1,120.0	657.3	392.0
Unitrin, Inc.	113.5	117.4	119.8	-	48.9	89.9	116.9	46.3
XL Capital Limited	270.5	276.7	277.7	4.6	5.5	5.6	274.9	5.3
TOTAL	**4,206.8**	**5,426.7**	**5,992.4**	**5,103.9**	**3,752.2**	**7,705.4**	**5,208.6**	**5,520.5**

Numbers are stated in millions of U.S. dollars. The Travelers Companies, Inc. were formerly known as The St. Paul Travelers Companies. Dashes indicate no reported share repurchase activity; these observations are included in the computation of the average. Numbers in parentheses indicates net issues of common stock and treasury shares. Source: 10K reports, U.S. Securities and Exchange Commission, http://www.sec.gov.

APPENDIX 2

Adjusting Historical Mean Stock Returns for a Secular Decline in the Dividend

What follows details how to calculate the arithmetic mean return on a stock market index for the period T0 through T1 when adjusting for a secular decline in the dividend yield. First, the T1 total return index value (that is, stock market index with dividend and capital gains reinvested), TRI^{T1}, is adjusted such that the implied dividend yield equals the dividend yield observed in the year T0:

$$\frac{TRI^{\mathrm{T1}} \times dividend\ yield^{\mathrm{T1}}}{adjusted\ TRI^{\mathrm{T1}}} = dividend\ yield^{\mathrm{T0}} \tag{A.1}$$

Second, we calculate the geometric mean annual return as the arithmetic mean annual return in logarithmic space:

$$return^{geometric\ mean} = \frac{\log(adj.TRI^{\mathrm{T1}}) - \log(TRI^{\mathrm{T0}})}{\mathrm{T1} - \mathrm{T0}} \tag{A.2}$$

Third, we obtain the desired arithmetic mean return by exponentiating and (based on the assumption of normality) bias-adjusting:

$$return^{arithmetic\ mean} = \exp(return^{geometric\ mean} + \hat{\sigma}^2 / 2) - 1, \tag{A.3}$$

where $\hat{\sigma}^2$ is an estimate of the variance of the actual annual logarithmic returns (which equal the first differences in the annual logarithmic *TRI* values).

APPENDIX 3

In the original, January 2008 version of the paper, all averages are equally weighted. The growth rate of dividends in the second stage of the Gordon dividend growth model was originally estimated from the post-war growth rate of total financial assets of the P&C insurance industry instead of the long-term average growth rate of GDP. Further, in the original approach, the industry *beta* was not obtained as a full-information market-capitalization weighted *beta* but instead as a simple (equally weighted) average across firms. Finally, the risk-free rate in the CAPM was originally measured by the long-term average return on Treasury bills as opposed to being calculated as a weighted average using the current risk-free rate.

Table A-3.1: Cost of Equity Capital Estimates Based on the Methodology Published in the Original, January 2008 Version of the Paper (Data as of November 4, 2010)

Model	Percent
DCF	**9.71**
Current Dividend Yield	2.62
Effective Dividend Yield	3.12
Forecast Avg. Ann. Growth in Dividends	3.38
Long-term Avg. Ann. Growth in Dividends	6.86
CAPM	**11.07**
Risk-Free Rate	3.70
Full-information *beta*	0.99
Market Return	11.17
Implied Equity Risk Premium	7.47
Cost of Capital	**10.39**

Note: The DCF and CAPM cost of capital estimates are calculated from the displayed rounded numbers. The Cost of Capital is calculated as the arithmetic mean of the DCF and CAPM estimates, again based on the displayed rounded numbers.

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5. REFERENCES

[1] Actuarial Standards Board (ASB), *Treatment of Profit and Contingency Provisions and the Cost of Capital in Property/Casualty Insurance Ratemaking*, Actuarial Standard of Practice No. 30, Doc. No. 057, July **1997**, http://www.actuarialstandardsboard.org/pdf/asops/asop030_057.pdf.

[2] Arnott, Robert D., and Peter L. Bernstein, "What Risk Premium is 'Normal'?" *Financial Analysts Journal,* **2002***,* Vol. 58, No. 2, 64-85.

[3] Blume, Marshall E., "On the Assessment of Risk," *Journal of Finance*, **1971**, Vol. 26, 1-10.

[4] Bodie, Zvi, and Robert C. Merton, *Finance*, **2000**, Upper Saddle River (NJ): Prentice-Hall.

[5] Cummins, J. David, and Richard D. Phillips, "Estimating the Cost of Equity Capital for Property-Liability Insurers," *The Journal of Risk and Insurance*, **2005**, Vol. 72, No. 3, 441-478.

[6] Dimson, Elroy, Paul Marsh, and Mike Staunton, "The Worldwide Equity Premium: A Smaller Puzzle," **2007**, London Business School, Revised April 7, 2006.

[7] Easterwood, John C., and Stacey R. Nutt, "Inefficiency in Analysts' Earnings Forecasts: Systematic Misreaction or Systematic Optimism?" *Journal of Finance,* **1999**, Vol. 54, 1777-1797.

[8] Ehrhardt, Michael C., and Yatin N. Bhagwat, "A Full-Information Approach for Estimating Divisional Betas," *Financial Management* **1991**, Vol. 20, 60-69.

[9] Fama, Eugene F., and Kenneth R. French, "Industry Costs of Equity," *Journal of Financial Economics,* **1997**, Vol. 43, 153-193.

[10] Goetzmann, William N., and Roger G. Ibbotson, "History and the Equity Risk Premium," *Yale ICF Working Paper No. 05-04*, Yale School of Management, **2005**.

[11] Gordon, Myron J., *The Investment, Financing, and Valuation of the Corporation,* **1962,** Homewood, IL: R.D. Irwin.

[12] Kaplan, Paul D., and James D. Peterson, "Full-Information Industry Betas," *Financial Management,* **1998**, Vol. 27, 85-93.

[13] Lettau, Martin, and Sydney Ludvigson, "Time-Varying Risk Premia and the Cost of Capital: An Alternative Implication of the *Q* Theory of Investment," *Journal of Monetary Economics,* **2002**, Vol. 49, 31-6.

[14] Liang, J. Nellie, and Steven A. Sharpe, "Share Repurchases and Employee Stock Options and their Implications for S&P 500 Share Retirements and Expected Returns," **1999**, Division of Research and Statistics, Federal Reserve Board, 1-18.

[15] Lintner, John, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *Review of Economics and Statistics*, **1965***,* Vol. 47*,* 13-37.

[16] Mauboussin, Michael J, "Clear Thinking about Share Repurchase," *Legg Mason Capital Management, Mauboussin on Strategy*, **2006**.

[17] McGrattan, Ellen R., and Edward C. Prescott, "Average Debt and Equity Returns: Puzzling?" *Research Department Staff Report 313*, **2003**, Federal Reserve Bank of Minneapolis.

[18] Morin, Roger, *The New Regulatory Finance*, **2006**, Vienna (VA): Public Utilities Reports.

[19] Myers, Stewart C., and Lynda S. Borucki, "Discounted Cash Flow Estimates of the Cost of Equity Capital: A Case Study," *Financial Markets, Institutions and Instruments*, **1994**, Vol. 3, No. 3*,* 9-45.

[20] Morningstar, Inc., *Stocks, Bonds, Bills and Inflation, Market Results for 1926-2009, 2010 Yearbook, Classic Edition.*

[21] Morningstar, Inc., *Stocks, Bonds, Bills and Inflation, Market Results for 1926-2009, 2010 Yearbook, Valuation Edition*.

[22] Nyberg, Henri, "QR-GARCH-M Model for Risk-Return Tradeoff in U.S. Stock Returns and Business Cycles," Munich Personal RePEc Archive, MPRA Paper No. 23724, **2010**. http://mpra.ub.uni-muenchen.de/23724/

[23] Standard & Poor's, "S&P 500 Second Quarter Buybacks Soar 221% From Q2 2009," Press Release, **2010**, September 22, www.standardandpoors.com.

[24] Standard & Poor's, "S&P 500 Stock Buybacks Retreat 66% in Fourth Quarter; Off 42% in 2008," Press Release, **2009**, March 26, www.standardandpoors.com.

[25] Sharpe, William F., "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *Journal of Finance*, **1964**, Vol. 19*,* 425-442.

[26] Value Line Publishing, Inc., *The Value Line Investment Survey, Summary and Index*, 2010 editions.
[27] Value Line Publishing, Inc., *The Value Line Investment Survey, Ratings and Reports*, July 30, August 20, September 17, 2010 editions.
[28] Weston, J. Fred, and Juan A. Siu, "Changing Motives for Share Repurchases," **2003**, University of California, Los Angeles, Anderson Graduate School of Management, Finance, Paper 3-03.

Abbreviations and notations

BEA, Bureau of Economic Analysis
CAPM, Capital Asset Pricing Model
DCF, Discounted Cash Flow
GDP, Gross Domestic Product
P&C, Property and Casualty
NCCI, National Council on Compensation Insurance
S&P, Standard and Poor's
TRI, Total Return Index

Biographies of the Author

Frank Schmid, Dr. habil., is a Director and Senior Economist at the National Council on Compensation Insurance.