TASK ORDER #20692
RATE OF RETURN UPDATE – 2008: REASONABLE RATE OF RETURN
SECTION 3.1

Prepared for:
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Prepared by:
Milliman, Inc.
David Appel, Ph.D.
Philip S. Borba, Ph.D.

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Executive Summary

The Risk Management Agency (RMA) of the U.S. Department of Agriculture (USDA) engaged Milliman, Inc. (Milliman) to perform an analysis of the reasonable rate of return for crop insurers reinsured by the Federal Crop Insurance Corporation (FCIC) through the Standard Reinsurance Agreement (SRA). Specifically, Milliman was asked to estimate the fair and reasonable return that would have prevailed during the period between 1989 and 2008. The report that follows describes the methodology, analysis and results of the study we undertook in response to this request.

Economic theory indicates that investment opportunities should be undertaken only if the expected economic rate of return is at least equal to the investor's opportunity cost of capital. Standard theory further suggests that, in a workably competitive market, economic returns will be driven to equal to the opportunity cost of capital as firms enter and exit the market in response to alternative investment opportunities.

The economic theory of regulation also suggests that if government is to intervene in an activity, the objective of such intervention should be to emulate the outcomes that would result in a competitive market. Thus, in setting fair returns for government regulated enterprises, regulators should attempt to produce the target return that would be anticipated in a competitive market for an investment of equivalent risk – that is, the opportunity cost of capital. This theory has been validated by the U.S. Supreme Court in its seminal decisions involving the regulation of business. Given this widespread acceptance and legal precedent, Milliman adopted the opportunity cost of capital as the definition of the reasonable rate of return for crop insurance.

To estimate the opportunity cost of capital (or more simply, cost of capital) from 1989 to the present, Milliman relied on the two methodologies that are most widely employed for this purpose in business and regulatory settings, the discounted cash flow model (DCF) and the capital asset pricing model (CAPM). We applied these models to calculate the cost of capital for a sample of property and casualty insurers, which we consider to provide an estimate of the return required for the average risk activity in which insurers are engaged. Given our recommendations regarding the allocation of capital across lines of insurance, we believe that the average cost of capital is a reasonable proxy for the fair rate of return for crop insurers. Based on this approach, Milliman calculated the reasonable rate of return for crop insurers for the years 1989-2008.

Table 1 provides a brief summary of the results. These estimates reflect the fair rate of return that would have applied prospectively during the period in question, but they are not necessarily a good estimator of what actually happened. That is, it is not surprising that the actual return may have differed from the fair return in any particular year, in light of the random nature of insurance losses. Over the long run, one might expect insurers to earn a fair and reasonable return on average, but the return in any one year might deviate significantly from the mean.

Table 1. Reasonable Rate of Return Summary

Year	DCF	CAPM	Reasonable Rate of Return
1989	15.44	16.26	15.85
1990	16.17	16.19	16.18
1991	16.04	14.80	15.42
1992	15.18	13.80	14.49
1993	14.90	12.64	13.77
1994	13.62	13.79	13.70
1995	13.44	13.75	13.59
1996	12.83	13.67	13.25
1997	12.31	13.48	12.90
1998	12.97	13.18	13.07
1999	11.94	13.53	12.73
2000	11.79	14.50	13.14
2001	11.42	12.54	11.98
2002	10.10	11.58	10.84
2003	9.08	10.22	9.65
2004	9.76	10.92	10.34
2005	10.18	11.17	10.67
2006	10.94	12.64	11.79
2007	10.96	12.35	11.66
2008	12.86	10.21	11.53

Notes: a. The final reasonable rate of return estimate equals the average of the average CAPM and the DCF estimates.

b. The reasonable rate of return estimates in columns 2 through 4 are based on information as of July 1 of the indicated calendar year. Since July is the inception of the next reinsurance year, however, the reinsurance year is actually one year ahead of the calendar year. That is, the reasonable rate of return as of, say, July 1989 should be viewed as the fair return for reinsurance year 1990 (the year from July 1989 through June 1990). In this report, we used calendar year instead of reinsurance year in order to compare the reasonable rate of return estimates with other calendar year variables including inflation rates and actual stock returns.

As can be seen in Table 1, the cost of capital declined more or less continuously from 1989 to 2003, in keeping with the general decline in inflation, interest rates, and capital costs on the economy at large. Since the lows in 2003, however, capital costs have increased somewhat; currently, the cost of capital for property casualty insurance is 11.6%.

While we believe the selected models are reasonable, some may question whether a 11.6% return under the SRA can be justified, in light of the recent bear market and low inflation rates. We note that as of February 2009, yields on AAA rated corporate bonds are in the range of 5.3%, implying a risk premium for crop insurance of 630 basis points, an amount that is small relative to the historical risk premium between average risk stocks and corporate bonds. This alone would support our recommended value. However, the results reported here are stronger, in that they indicate that the models utilized are unbiased. For example, we would note that our estimated cost of capital declined throughout the 1995 through 1999 period, and averaged only 13% over those years, despite the fact that the annual average stock market return during that period was 29%. Just as the models did not unreasonably reflect the bull market of the late 1990's, they do not unreasonably reflect the bear market of the recent years.

1. Rate of Return: Definition and Implementation

While there are potentially many different measures of rate of return, standard corporate finance texts suggest that for monitoring performance and evaluating investment opportunities, investors should use the economic rate of return on the equity capital required to support the investment.[1] More specifically, economic theory indicates that investment opportunities should be undertaken only if the expected economic rate of return is at least equal to the investor's opportunity cost of capital.[2] Standard theory further suggests that, in a workably competitive market, economic returns will be driven to equal to the opportunity cost of capital, as firms enter and exit the market in response to alternative investment opportunities.

The economic theory of regulation also suggests that if government is to intervene in an economic activity, the objective of such intervention should be to emulate the outcomes that would result in a competitive market.[3] Thus, in setting fair returns for government regulated enterprises, regulators should attempt to produce the target return that would be anticipated in a competitive market for an investment of equivalent risk – that is, the opportunity cost of capital. This theory has been validated by the US Supreme Court decisions in cases governing the regulation of business.[4] Because of this widespread acceptance and legal precedent, Milliman adopted the opportunity cost of capital as the definition of the reasonable rate of return for crop insurance.

1.1 Definition

The rate of return on equity is the measure most frequently used to evaluate the profitability of current business activities or future investment opportunities. For these purposes, both the accounting rate of return and the economic rate of return have been used. The accounting rate of return is defined as: (revenue - out of pocket costs - depreciation)/book value of investment. In contrast the economic rate of return is defined as: (cash receipts + change in price)/beginning price.

[1] See, for example, one of the most widely used of such texts, Brealey and Myers (1996, pages 14, 301-307).
[2] Opportunity cost is among the most basic concepts in economics. It refers to the fact that any real resource has a variety of uses, and by using a resource in a particular endeavor an investor forgoes the returns that are available in other, alternative activities. Thus, the opportunity cost of capital is the return available from employing that capital in its next best alternative use. This is, of course, the return that investors have forgone by using their capital in support of crop insurance activities.
[3] See, for example, Phillips (1993, page 173): "In short, regulation is a substitute for competition and should attempt to put the utility sector under the same restraints competition places on the industrial sector." For additional discussion of this issue, see the landmark treatise by Supreme Court Justice Stephen Breyer, *Regulation and its Reform.*
[4] The two cases most often cited are Bluefield Waterworks & Improvement Company v. Public Service Commission of West Virginia, 262 U.S. 679, 692-693 (1923), and Federal Power Commission v. Hope Natural Gas Co., 320 U.S. 591, 603 (1944).

According to leading authorities[5], the economic rate of return is the proper profitability measure for evaluating investment opportunities. An investment opportunity should be undertaken only if the expected economic rate of return equals or exceeds the cost of capital (that is, the return investors expect to earn in business of similar risk).[6]

Previous judicial decisions have validated the concept of allowing regulated entities fair compensation for the cost of investors' capital. The most widely cited decisions regarding the fair rate of return for regulated businesses are from two U.S. Supreme Court cases - Bluefield Waterworks and Hope Natural Gas. In Bluefield, the Court stated:

> A public utility is entitled to such rates as will permit it to earn a return on the value of the property which it employs for the convenience of the public equal to that generally being made at the same time and in the same part of the country on investments in other business undertakings which are attended by corresponding risks and uncertainties. Bluefield Waterworks & Improvement Company v. Public Service Commission of West Virginia, 262 U.S. 679, 692-693 (1923).

In Hope, the Court further stated:

> From the investor or company point of view, it is important that there be enough revenue not only for operating expenses, but also for the capital costs of the business. These include service on the debt and dividends on the stock. By that standard the return to the equity owner should be commensurate with the returns on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital. Federal Power Commission v. Hope Natural Gas Co., 320 U.S. 591, 603 (1944).

These decisions clearly articulate two basic principles regarding the allowed return in a regulated environment: (1) the fair return is dependent on risk; and (2) the appropriate standard is a capital attraction standard. It is for these reasons that the fair return is often termed the cost of capital: because it is the return the firm must pay and investors require in order to commit their capital to the regulated enterprise. Milliman thus suggests that the reasonable rate of return for crop insurers should be the opportunity cost of equity capital. A lower rate of return will fail to attract investors to the crop insurance business, while a higher rate of return will overcompensate investors. In either case, if the allowed return is not set equal to the cost of capital, the amount of capital devoted to crop insurance will be sub-optimal.

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[5] See for example Brealey and Meyers, *op. cit.*, page 14.

[6] If the rate of return is lower than the cost of capital, investors will be unwilling to invest in crop insurance, and if it is higher than the opportunity cost, investors will use excessive resource to compete for the crop insurance business, causing the actual rate of return to decline until it reaches the cost of capital.

1.2. Implementation

The reasonable rate of return thus provides a benchmark that can be used in two ways. First, it can be used retrospectively, to measure whether the historical rates of return from the crop insurance program have provided fair compensation to the capital providers in the past.[7] In addition, and perhaps more importantly, it can be used prospectively, to structure the SRA in such a way as to provide fair compensation on an expected value basis in the future.

It is important to note that the reasonable rate of return estimates can embody volatile components including the interest rate and expectations about future economic environments. These estimates can fluctuate rapidly, particularly in periods of economic instability. (For example, in volatile economic environments, interest rates alone can vary by a few hundred basis points within a few months, hence it is possible that the cost of capital also varies by a similar magnitude within the same period of time.) The data upon which we rely for our cost of capital estimates is available quarterly, hence the estimates could be updated at least that frequently. As a practical matter, however, we would recommend that estimates be revised at least annually, and the cost of capital be set using the results of the most recent quarter (or perhaps by averaging the results of the four previous quarters).[8]

2. Equity Capital Determination by Line of Business

While most of this report is devoted to estimating the cost of capital, the purpose of this exercise is to determine the fair rate of return that should be incorporated in the SRA. However, once we have determined the reasonable return to which crop insurers are entitled, we have to then determine the amount of capital required to support the risk of crop insurance in light of the underlying risk of the exposure and the reductions in risk attributable to the SRA. Given an estimate of the equity capital insurers hold, the SRA can be structured to produce the expected underwriting gain which yields a return on the capital base equal to the fair and reasonable return.

Determining the capital required to support insurance exposures is an issue that has received a great deal of attention in the literature. Generally speaking, determining the appropriate amount of capital by line requires (1) the choice of a capital base, and (2) a method of allocating the aggregate amount of capital to individual lines of insurance. Possible choices for a capital base for property/casualty insurance include surplus calculated according to statutory accounting principles (SAP) or generally

[7] Such an analysis should only be done over a long time period. It is expected that in individual years, results will differ, often materially, from expectations. This is particularly true given the catastrophe potential in crop insurance.

[8] One of the principal concerns of actuaries involved in insurance ratemaking is to balance stability and responsiveness. As a practical matter, we do not believe the SRA can be restructured each quarter as capital costs change, however an annual review would seem to be a reasonable interval. When setting the fair return for the coming year, the best estimator is the current cost of capital, which would argue in favor of using the most recent quarterly result. However, in light of the potential volatility in capital costs, it is possible that RMA would prefer to rely on an average of the previous four quarterly results, to enhance stability. Milliman believes that either approach is defensible and consistent with current actuarial practice.

accepted accounting principles (GAAP), or the market value of equity[9]. As to allocation methods, they would include a variety of rules for apportioning surplus according to various measures of risk by line. (Several allocation bases have been suggested in the insurance literature, which we will mention below.)

As regards the capital base, the proper measure from an economic perspective would be the market value of equity, as this is the base upon which investors require a return. It is also the true economic value of the enterprise.[10] However, market values can fluctuate (sometimes dramatically) over time, and to our knowledge are not typically relied upon in practical regulatory applications.[11] As regards the choice between the remaining two options, it is widely agreed that the proper capital base is GAAP net worth.

There are two reasons for this preference. One is that GAAP net worth is a better measure of the economic value of the enterprise than statutory surplus, since GAAP measures the value of a business as a going concern while SAP measures the value on a liquidation basis. The other reason is that the allowed return in ratemaking is designed to permit insurers a return equal to that earned in industries of comparable risk. Therefore, the equity base upon which that return is measured must be comparable as well. This also suggests that GAAP net worth is the proper base for regulatory purposes.[12]

GAAP net worth has historically been between 10% and 25% greater than SAP surplus.[13] Therefore, we would recommend that RMA utilize a conversion factor to transform statutory surplus, as reported on the insurance annual statement, to a GAAP equity equivalent. If such an analysis had been done based on the most recent 5 years of industrywide data, the conversion factor would have been 1.17 (i.e., GAAP net worth was 17% greater than statutory surplus), while in the most recent year the conversion factor was 1.15.[14] Using the most recent value as an example, this implies that for every $100 of statutory surplus allocated to crop insurance, the insurer actually has $115 of

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[9] Surplus measured using GAAP is conventionally called net worth, a nomenclature adopted above.

[10] Neither SAP surplus nor GAAP net worth will equal the economic value of an insurer's equity, i.e., the market value of its assets less the market value of its liabilities. Differences between accounting and economic surplus reflect a variety of considerations, including the reporting of loss reserves at nominal rather than discounted value, the reporting of certain bonds at book rather than market value, and other factors, including the substantial off-balance sheet assets of many insurers that reflect their investments in distribution systems, employee training, claims facilities, name brand recognition and reputation.

[11] The dramatic drop in stock market since October 2007 is an excellent example of this phenomenon. As of March 3, 2009, the Dow Jones Industrial Average – which is a composite index, based on market value of 30 of the largest and most widely held public companies in the United States - stood at 6763, its lowest point in 12 years. The broader market indices such as Standard & Poor's 500 index also experienced similar sharp drop. Most market indices including the Dow Jones Industrial Average have experienced a drop of 50% or more since October 2007.

[12] The NAIC uses GAAP equity when reporting results by state and line in its annual Profitability Report. That document is quite clear in its preference for GAAP over SAP accounting.

[13] See, for example, *ISO Insurer Financial Results: 2005* (Insurance Services Office Properties, Inc., 2005).

[14] For an example of such a calculation, see Testimony of David Appel *In The Matter of The Filing Dated Feb. 1, 2009 By the North Carolina Rate Bureau*, North Carolina Department of Insurance Docket No. 1448.

GAAP equity allocated to the line.

Before leaving the issue of capital base, it is important to emphasize one additional consideration, as follows. Assuming that aggregate industry capital is to be allocated across lines of the insurance, the total amount of capital to be allocated must be the actual, current capital held by the insurance industry[15]. This is critical because the degree of risk to which insurers are exposed, and hence the required return, is dependent on the amount of insurer capital (or operating leverage); if the capital base were, for example, smaller, insurers would be perceived as riskier and hence their cost of capital would be higher.[16] Since the cost of capital is developed based on current capital market conditions, consistency demands that the amount of capital assumed to support insurance transactions be the actual amount as well.

Turning now to allocation of the capital base to line of business, we note at the outset that an insurer's surplus is inherently indivisible, in that the entire amount is available to protect all of its policyholders. Moreover, while models have been developed to allocate surplus, there is no widespread agreement on the appropriate method or allocation base. Indeed, there is no widely accepted and computationally tractable way of measuring risk by line, hence the allocation of capital is inherently problematic. Nevertheless, RMA must determine a reasonable amount of capital to be attributed to crop insurance, in order to measure historical returns and to structure the SRA to yield a fair and reasonable return.

As indicated earlier, in theory capital should be allocated to line of insurance based on each line's relative risk. Ideally, if capital could be allocated in such a way as to equalize risk by line, then a single rate of return for all lines would be appropriate.[17] However, despite literally decades of research, there is still no consensus regarding the proper measurement of risk by line. (Furthermore, most recent research has been directed to the question of capital allocation within a firm, and is not necessarily applicable to industrywide allocations to state and line.) Despite the lack of consensus, practitioners have typically relied on one of several allocation bases: premiums; loss reserves; total (loss and loss adjustment expense plus unearned premium) reserves; or total reserves plus earned premium.[18]

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[15] Some analysts have argued that the capital base on which a return is allowed should be determined based on normative rules; for example one common rule of thumb is that capital should be set equal to 50% of the insurer's written premium in a particular line. Such a rule fails to ensure consistency between the cost of capital (i.e., the insurance industry's perceived risk) and the other assumptions built into the ratemaking process.

[16] See Brealey and Myers (1996, page 456-457) for a discussion of the impact of financial and operating leverage on the cost of capital.

[17] We recognize that all risk differences will not likely be eliminated through the allocation of capital. For example, differential amounts of capital will tend to equalize default risk by line, but there may be other risks (such as earnings volatility) which are partially but not fully addressed by such allocations. The decision to rely on the average cost of capital and to address risk differences through capital allocation is the pragmatic approach that has been widely adopted in insurance regulatory proceedings.

[18] More recent capital allocation methods, such as those based on ruin probability, value at risk, policyholder deficit and options theory, have not been sufficiently well developed to emerge in the regulatory arena. See, for example, recent papers by Myers and Read (2001) and Butsic (1999), which use options models to allocate insurer capital.

Since some method of surplus allocation is required, we propose that RMA rely on the method favored by the National Association of Insurance Commissioners (NAIC) and implicitly utilized in the financial reports required to be filed by insurers with regulators in every state.[19] This method relies on an allocation based on total reserves plus earned premiums. Although there may be arguments in favor of other allocation bases, the fact that the total reserves plus earned premiums method is supported by the NAIC lends strong support to the use, by RMA, of this method as well.

We have calculated leverage ratios for all lines of property casualty insurance using this allocation base, using data as of year-end 2007, the most recent currently available. After appropriate adjustments for certain peculiarities of MPCI, the recommended ratio of net written premium to surplus would be approximately 1.1 to one.

In addition, as noted earlier, this leverage ratio is based on an allocation of statutory surplus, while the appropriate capital base upon which a return should be allowed is GAAP net worth. To adjust the ratios to a GAAP net worth basis, simply divide by the ratio of GAAP equity to statutory surplus[20], which was 1.15 for the property casualty insurance industry in the most recent year. Assuming that value applied to crop insurance, and the premium to allocated surplus ratio was set at 1.1, the ratio of premium to GAAP net worth would be estimated to be 1.0 (i.e., 1.1/1.15=0.96).

[19] One section of the Statutory Annual Statement, the Insurance Expense Exhibit, allocates surplus to line of business using the algorithm relied upon in this report. See Page 350 of 2007 P&C Annual Statement Instructions Supp. Inst. 5-1.
[20] In 2007 Total insurance industry surplus was $517.9 billion, while GAAP net worth was $596.0 billion.

Table 2. Allocation Of Surplus To Lines Of Business Net of Reinsurance Data From 2007 Insurance Expense Exhibit (000 omitted)

(1)	(2)	(3) Premiums Written	(4) Premiums Earned	(5) Unpaid Losses	(6) Defense and Cost Containment Expenses Unpaid	(7) Adjusting and Other Expenses Unpaid	(8) Unearned Premium Reserves	(9) Allocated Surplus	(10) Implied P/S Ratio
1	Fire	9,683,188	9,378,826	4,298,408	190,932	183,630	4,884,419	8,410,885	1.2
2.1	Allied Lines	6,945,637	6,777,088	2,994,304	149,106	197,398	3,517,527	6,056,436	1.1
2.2	Multiple Peril Crop	3,646,992	3,583,527	1,652,445	17898	24,725	226,234	2,445,076	1.5
2.3	Federal Flood	16,266	21,558	7043	266	1,525	11,019	18,393	0.9
3	Farmowners Multiple Peril	2,415,548	2,354,889	689,953	91,225	60,353	1,211,924	1,958,051	1.2
4	Homeowners Multiple Peril	54,867,518	54,761,882	14,332,746	1,593,424	2,094,634	30,558,485	45,900,975	1.2
5.1	Commercial Multi Peril (Non-Liability Portion)	18,152,223	18,201,309	7,082,127	1,481,942	622,875	9,864,092	16,546,348	1.1
5.2	Commercial Multi Peril (Liability Portion)	12,946,462	13,302,815	19,380,738	7,280,951	1,273,954	6,064,088	21,010,338	0.6
6	Mortgage Guaranty	4,508,603	4,326,721	10,037,434	184,893	80,698	858,792	6,879,533	0.7
8	Ocean Marine	3,125,363	3,073,445	2,881,782	221,185	102,331	1,231,931	3,336,011	0.9
9	Inland Marine	9,602,720	9,575,372	2,680,601	167,580	235,707	4,907,998	7,802,837	1.2
10	Financial Guaranty	2,753,772	2,524,327	3,528,132	28,706	1,523	11,249,730	7,698,528	0.4
11	Medical Malpractice	9,167,472	9,205,109	20,962,526	6,491,199	1,039,977	4,628,465	18,800,476	0.5
12	Earthquake	1,575,855	1,578,105	103,310	6,650	16,906	1,041,884	1,220,069	1.3
13	Group A & H (See Interrogatory 1)	4,380,369	4,144,594	2,282,026	84,766	123,452	1,630,168	3,671,062	1.2
14	Credit A & H	303,828	314,237	82,803	516	3,478	102,743	223,762	1.4
15	Other A & H (See Interrogatory 1)	2,337,443	1,898,764	1,796,134	24,586	130,041	5,452,741	4,131,781	0.6
16	Workers' Compensation	44,207,021	43,502,510	117,258,907	9,224,935	6,633,925	12,897,036	84,177,771	0.5
17	Other Liability	40,952,646	40,922,687	94,759,243	18,905,462	5,198,510	23,285,169	81,314,548	0.5
18	Products Liability	3,304,862	3,488,328	11,068,741	4,035,091	942,174	1,434,863	9,313,873	0.4
19.1, 19.2	Private Passenger Auto Liability	94,668,050	94,939,785	69,276,903	9,889,592	6,730,027	29,202,986	93,293,004	1.0
19.3, 19.4	Commercial Auto Liability	18,868,642	19,036,067	22,070,122	2,763,435	1,264,753	9,300,604	24,178,347	0.8
21.1	Private Passenger Auto Physical Damage	64,390,034	64,334,964	2,767,389	238,346	1,565,230	20,834,818	39,860,084	1.6
21.2	Commercial Auto Physical Damage	6,643,072	6,647,852	771,061	108,187	98,590	3,084,910	4,757,320	1.4
22	Aircraft (all perils)	1,771,128	1,744,719	2,216,077	185,478	63,676	811,260	2,230,267	0.8
23	Fidelity	1,249,746	1,244,257	1,148,317	117,949	40,083	711,166	1,448,779	0.9
24	Surety	4,783,965	4,530,017	2,804,051	430,985	185,589	3,131,684	4,922,429	1.0
26	Burglary and Theft	159,682	157,057	55,546	8,125	2,464	72,565	131,366	1.2
27	Boiler and Machinery	1,741,520	1,705,869	810,108	58,668	43,631	844,555	1,538,083	1.1
28	Credit	1,383,924	1,280,177	1,055,617	22,484	9,686	1,018,468	1,504,149	0.9
29	International	136,054	144,608	332,398	8,522	1,198	2,678	217,378	0.6
30, 31, 32	Reinsurance Non-proportional assumed	13,062,273	13,068,449	44,080,287	3,330,278	869,459	3,644,136	28,867,721	0.5
33	Aggregate write-ins for other lines of business	2,226,464	2,382,255	486,248	55,479	24,021	4,532,041	3,322,406	0.7
34	TOTAL (lines 1 through 33)	445,978,365	444,152,181	465,753,501	67,398,899	29,866,240	202,251,180	537,188,116	0.8
	surplus	537,188,116							

Source: Best's Aggregates & Averages - Property/Casualty, 2008

3. The Models

3.1 Choice of the Models

Most of the practical guidance regarding cost of capital methodology has been developed in the regulated public utility sector of the economy. These are the industries (notably the generation, transmission and distribution of electricity and natural gas, and the provision of local water services) which have traditionally been subject to direct rate of return regulation.[21] Since the early days of regulation in the U.S., there have been several methods used to directly estimate the reasonable rate of return, or cost of capital, for an industry. [22]

The earliest cost of capital methodology was known as the "comparable earnings" model, which relied on identifying a set of firms of comparable risk to the regulated entity, and then calculating the historical earned accounting return on equity for the sample. This was then deemed to be the fair return that should be allowed to the regulated entity. However, methods that rely on historical accounting data suffer from well known flaws, and were largely abandoned in the early 1970's in favor of models that rely on market data.[23]

It is widely agreed that methods that rely on market data are preferred, on both theoretical and pragmatic basis, to those that are based on accounting data. Indeed, it is market requirements that suggest use of the term "cost of capital," as the phrase refers to the cost to the firm of attracting investment funds in capital markets. That cost, of course, is the return that the firm must pay and investors expect to earn as a result of placing their capital at risk in the enterprise.

More precisely, reliance on market data is critical for three reasons.

1) Such information reflects the consensus of all investors regarding the risk and required returns on different securities.[24] Thus, the potential for the biases and perceptions of the analyst to over- or understate the fair rate of return is minimized.

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[21] Of course in the past such diverse industries as airlines, telecommunications, and interstate trucking were subject to varying degrees of regulation, however in the past two decades most of this (except telephone) has been rescinded.

[22] For an excellent discussion of the general concepts and considerations in developing fair returns for regulated industries, see Kolbe, Read and Hall (1983).

[23] See the discussion in Morin (1994, page 17): "Before the mid-1960's regulators placed almost exclusive reliance on the Comparable Earnings approach. Because of several problems encountered in implementing that approach, the Discounted Cash Flow (DCF) approach has supplanted Comparable Earnings in popularity."

[24] More exactly, it is the opportunity cost of capital determined by investors at the given time and based on information available at that time. The proper model for estimating the reasonable rate of return is the model most likely to be used by the investors who made the investment decisions. If the SRA did not provide a rate of return equal to the cost of capital, investors would be unwilling to invest in the crop insurance business. If it exceeded the cost of capital perceived by the investors, then excessive resources would be used to compete for the opportunity to invest on the crop insurance business.

2) The alternative to market data is to use historical accounting data to estimate the cost of capital. This procedure is seriously flawed because it is not prospective and does not necessarily reflect the returns which are of ultimate concern to investors--those that can be earned in the market.

3) The use of market-based models is consistent with the dictates of Hope,[25] in the sense that Hope instructs us to consider investor requirements when determining the fair and reasonable rate of return. (For example, "the return to the equity owner should be commensurate with the returns on investments in other enterprises having corresponding risks.")

Hence, we used the two pre-eminent market-based methodologies to compute the reasonable rate of return. The first is the DCF model (sometimes called the Gordon growth model or the dividend valuation model), and the second is the CAPM (also known as the unconditional CAPM, or the Sharpe (1964) and Lintner (1965) version of CAPM). We used two different approaches to obtain independent estimates of the cost of capital, so as not to place undue reliance on any single methodology. It is also our opinion that the two models are good complements of each from certain perspectives to be discussed in the DCF Model subsection.

For practitioners and especially in the regulatory environment, the DCF model (also known as the Gordon growth model, or dividend discount model; see Gordon, 1962) is perhaps the most widely used approach to cost of capital estimation.[26] For example, after reviewing filings and comments from numerous utilities and interested parties, the Federal Energy Regulatory Commission (FERC) ruled in favor of the DCF model as the proper model to determine the required rate of return for public utilities (FERC Order 420, 1985, Federal Register Vol. 50 No. 103, page 21804). Indeed, the widespread use of the DCF model by the utility industry continued even after the uncertainty of the industry greatly escalated in the 1990's due to restructuring and rapid technological innovation in areas such as telecommunication and electricity generation. According to a 1996 report by NARUC, (National Association of Regulatory Utility Commissioners; page 269, 530, 603, 631), nearly every utility regulatory body in the U.S. and Canada lists DCF as a favored methodology for determining the cost of capital. CAPM, on the other hand, was listed by 11 of those regulatory bodies.[27] It has also been our experience that the DCF model is the most commonly relied upon cost of capital methodology in insurance rate hearings.[28]

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[25] *Op. cit.*

[26] See Bonbright, Danielsen and Kammerschen (1988, page 317): "In recent years, the Discounted Cash Flow Model, or what is commonly called the DCF method, has become the most popular technique of estimating the cost of equity, and it is generally accepted by most commissions. Virtually all cost of capital witnesses use this method, and most of them consider it their primary technique."

[27] NARUC stopped conducting the survey in 1996, and we are unaware of any other similar source.

[28] One of the authors of this report (Appel) has testified as an expert witness on more than 200 occasions in well over 100 insurance rate regulatory proceedings. In virtually every one of those cases where cost of capital testimony was presented, witnesses representing all parties – whether insurer, state regulator or consumer – relied upon DCF models to estimate the cost of capital.

3.2 DCF Model

3.2.1 A Brief Explanation

The discounted cash flow (DCF) model assumes that the cost of an investment, typically the price of a stock, must equal the present value of the cash flows from the investment. The logic of this assumption is as follows: investors are willing to pay the current price for a share of stock only if the present value of the expected cash flows emanating from that investment is equal to that price. If the present value of the cash flows were greater (less) than the current price, investors would bid the price up (down).

The cash flows arising from the purchase of a share of stock are the dividend payments and capital gains the investor expects to receive in the future. If the security is held in perpetuity, then the stock price can be expressed as the sum of the discounted dividends (Morin, page 105):

$$P_0 = [D_1/(1+k)] + [D_2/(1+k)^2] + [D_3/(1+k)^3] + ... \qquad (1)$$

where P_0 is the price of the stock, D_i is the dividend in period i, and k is the investor's implicit discount rate, or cost of capital. If dividends are expected to grow at a constant annual rate, g, in the future, then the dividend in time period i is simply the current dividend, D_0, times the growth factor $(1+g)^i$. It can be shown, by suitable mathematical manipulation, that the DCF can be characterized by (Morin, page 109):

$$k = D_1/P_0 + g, \qquad (2)$$

where D_1/P_0 is the dividend yield expected in the first year and g is the expected growth rate in dividends.[29] It can also be shown that even if the investor expects to sell the security at some later date, the price at that time will be equal to present value of future dividend flows. Therefore any expected future capital gain will be impounded in the current estimates of future dividends.

The expected dividend yield is based on the dividend yield reported by Value Line, which is an estimate of the cash dividends payable in the next 12 months divided by the current share price of the stock (i.e., it is a direct estimate of the quantity D_1/P_0). To estimate the dividend growth rate, g, we use the average of two different techniques to compute the average growth rate, one called the "growth forecast" method, and the other termed "fundamental analysis". The first, the growth forecast method, relies on estimates of growth based on historical earnings and dividend data along with analysts' forecasts of growth in these variables. The second or fundamental analysis (also

[29] This derivation, and the equations reported herein, can be found in many sources, including Morin (1994, page 109).

known as the "sustainable growth" or "internal growth" method) relies on estimating a firm's sustainable growth based on the rate at which it retains and reinvests earnings.[30]

As regards the growth forecast method, it is reasonable to believe that investors will consider all available information in forming their estimates of future dividend growth. This suggests that historical growth in dividends and earnings per share will be of some significance in forming investor expectations. At the same time, analysts are an important source of information for investors, and the investment community follows their estimates of future growth closely. Thus, for the growth forecast method, we relied on long term (i.e., ten-year) and short term (five-year) historical information, along with Value Line analysts' forecasts.[31]

When calculating the expected growth rate based on these data, we simply averaged the results of the three data sources. Newbold, et.al., (1987) studied the forecasting property of the forecasts based on historic data (five year unconditional forecast) and concluded that while analysts' forecasts (from *Value Line Investment Survey*) are more accurate, they do not contain all information in the historic data and forecasting error is reduced when analysts' forecasts are combined with historic data. They further used regression analysis in an effort to find the optimal weighted average of historic and analysts' forecasts, and concluded that an equal weight hypothesis cannot be rejected. For these reasons, we have chosen to rely on a simple (i.e., equal weighted) average of the 10 year historical, five year historical and forecasted dividends and earnings growth, in determining the expected growth rate using the growth forecast method.

As regards the fundamental analysis, the underlying premise is that sustainable growth in the future can arise from two sources: retained earnings and issuance of new stock at prices different than book value. In the first case, retained earnings can be reinvested to produce earnings which will be used to pay higher dividends in the future. In the second case, the proceeds from the sale of stock at prices above book value can also generate cash for new investment, the profits of which can ultimately be used to pay higher dividends in the future. Thus, the fundamental analysis computes the expected growth rate as the sum of the earnings retained as a percentage of common equity and a stock issuance adjustment factor, as follows:

$$\text{Fundamental growth} = b \times r + s \times v \quad (3)$$

[32]

[30] See Bonbright, Danielsen and Kammerschen (1988, page 319): "Three methods are commonly used to estimate the growth rate: (1) historical growth rates, (2) analysts' forecasts of growth rates, and (3) sustainable growth or retention growth. The historical growth rate in dividends or earnings per share over some period of time, usually five or ten years, is often used."

[31] We note that some research suggests that analysts forecast are more accurate than historical extrapolations in estimating future growth; however it is important to recognize that the issue is not which method forecasts best, but rather which method is relied upon by investors in setting security prices. For a discussion of this subject, and empirical tests, see VanderWeide and Carlton (1988).

[32] To implement this formula, the following equation applies: Fundamental Growth = [(retained earnings/profit)×(profit/equity)]+ [((projected $\text{shares}_{t+4}/\text{shares}_t)^{0.25}$-1)×(projected market to book ratio_{t+4}-1)].

where: b= retention ratio (retained earnings/profit)
r= return on equity
s= fraction of shares to be issued
v= (market/book) - 1.

The stock issuance adjustment factor, $s \times v$, uses the projected number of shares outstanding at time *t+4*, the projected market-to-book ratio at time *t+4*, and the current number of shares outstanding at time *t* to account for the growth that is expected to occur between time *t* and time *t+4* when a company issues new stock at a price that is different than its book value. The formula is:

$$\text{Stock Issuance Adjustment Factor} = ((\text{projected shares}_{t+4}/\text{shares}_t)^{0.25}-1) \times (\text{projected market to book ratio}_{t+4}-1)$$

In this equation, the first term to the right of the equal sign computes the annual average percentage growth in shares outstanding, and the second term calculates the percent by which future share prices will exceed book value. Thus the product of the two is the annual amount by which value grows due to the sale of shares in excess of book value. As an example, to estimate the growth HCC Insurance Holdings will experience between 2008 and 2012 by issuing new stock, the following equation applies[33]:

$$\text{Stock Issuance Adjustment Factor} = ((125/116)^{0.25}-1) \times (1.5-1) = 0.0094.$$

This result indicates that HCC Insurance Holdings is expected to grow 0.94% annually between 2008 and 2012 as a result of issuing new stock at a price in excess of book value.

Continuing with examining the fundamental analysis, it is appealing as a method of forecasting future dividend growth, because it relies on internally generated growth only. However, the model requires several fairly restrictive assumptions to hold, including that the firm's return on equity and earnings retention rate must be constant over time. While in the case of public utilities there may be some chance that these assumptions would prevail over time, it is less likely to be true in insurance (or in other competitive sectors of the economy). For example, in a year when earnings are depressed (and hence the return on equity is depressed from the norm), a larger share of earnings are used to pay dividends. This implies that in periods of cyclical downturns both the retention ratio as well as the return on equity decline, meaning that both *b* and *r* in the equation above are understated. In addition to this, the model relies on historical earned returns on equity for the *r* value in the equation above, and such returns may not be representative of future investment opportunities.
Based on all of these considerations, we have selected an equal weighting of the growth forecast and fundamental analysis methods to determine the expected dividend growth rate in the DCF. We stress that there is no single "correct" method; in fact, the specific components we used for the estimation

[33] Data for HCC Insurance Holdings obtained from *The Value Line Investment Survey, Part 3, Ratings & Reports, June 20, 2008.*

of growth rate have been endorsed by various FERC rulings, such as the 1987 FERC Order 461 (Docket No. RM86-12-00).[34] While to some extent we rely on FERC for guidance, we also note that FERC indicated that judgment was required. For example, consider the following: "The determination of the growth rate involves substantial judgment on the Commission's part." (Federal Register. Vol. 52, No. 1 page 21).

3.2.2. Issues

The DCF model we used is the version most commonly used by practitioners, however the model is sometimes subject to criticism, particularly for the implicit assumption of a constant long term growth rate in earnings and dividends. Slight variations in the growth rate conditions in the near future could possibly lead to large forecast errors. A less commonly raised criticism is that the model assumes that investors expect the cost of capital to be the same in all future years.

While it is true that growth rate is unlikely to be constant in the future, from the forecasting perspective, we consider the simplicity of the model a virtue considering the limited data available for the analysis. If we had used a more complicated DCF model with variations in future growth rates, we would likely have to use a more complicated nonlinear model to estimate growth rate forecasts. Given the limited data available (no more than 12 observations in most cases), we do not believe that would be a practical approach.[35] As for the assumption of constant cost of capital in the future, the same assumption is also implicit in the unconditional CAPM which we discuss in more detail below.

3.3 CAPM

While it may not be as commonly used in the public utilities industry as the DCF, the CAPM is (as suggested by numerous publications in this field) the modern academic model for the pricing of risk.[36] This model is also commonly used in insurance rate hearings for the cost of capital determination.[37]

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[34] FERC, "Rules and Regulations" *Federal Register* 52 (1987): page 11-37.

[35] It is well-known in the econometrics literature that nonlinear or nonparametric models outperform simple linear models only when there is a much large sample size (Hastie and Tibshirani, 1990, Chapter 3).

[36] Obviously other models, particularly extensions of the CAPM have gained prominence as well, however, see the following citations:
Damodaran (2002, page 69), "The risk and return model that has been in use the longest and is still the standard in most real-world analyses is the capital asset pricing model (CAPM)."
Ferson and Harvey (1999, page 1325), "The Capital Asset Pricing Model (CAPM; see Sharpe (1964) and Black (1972) has long served as the backbone of academic finance and numerous important applications."
Wang (2002, first paragraph of article), "the Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965) and its multifactor extensions are the most widely used tools in empirical studies." Ghysel (1998, page 549), "the unconditional capital asset pricing model (CAPM) and the arbitrage pricing theory (APT) have been the cornerstone of theoretical and empirical finance for decades now."

[37] As with the DCF model, it has been our personal experience that the CAPM is typically utilized by cost of capital experts in insurance proceedings, although with somewhat less reliance than the DCF.

3.3.1 A Brief Description

The CAPM first assumes that there is a risk-free asset, which is typically taken to be a U.S. Treasury security. It then estimates the relative risk of alternative securities to measure the "risk premium" investors require to hold these risky assets. The relative risk of a particular security is measured by a value known as "beta," which is an estimate of the relative volatility of that security's returns (or price) compared with the volatility of the entire market (usually proxied by the S&P 500 index; see Campbell, et al, page 184). The information on beta is used in the following manner to estimate investors' expected rate of return (see, for example, Campbell, et al, 1997; page 182):

$$K = r_f + \beta \times r_d \tag{4}$$

where r_f is the risk-free yield, β is the beta coefficient, and r_d is the market risk premium.

A brief discussion of these parameters appears below.

Risk Free Rate

Although the choice of the T-bill as the risk-free rate is quite common (Campbell, et al, page 184), it is also not uncommon for practitioners to use alternative-term securities, and to measure the risk premium relative to them (Damodaran, 2002, page 161; Copeland et al, 2000 page 215-216; Ibbotson SBBI Valuation Yearbook, 2008 page 45). A longer-term security is frequently recommended when the time horizon of the investment is relatively long, as is often the case with an investment in insurance. In addition, yields on longer term securities tend to be less volatile than T-bills, hence costs of capital developed using long term yields will tend to be more stable than just using T-bills. We therefore use the average of three costs of capital, based on short-, medium-, and long-term treasuries. The risk free rates for the three scenarios are the three-month T-bill (secondary markets), 5-year constant maturity T-bond, and the 20-year constant maturity T-bond.[38]

Estimation of Beta

Different methods have been suggested to estimate beta. A simple and common approach is to estimate an ordinary least square regression of excess market return on the market risk premium using 5 years of data (Campbell et al, page 183-184). Studies, however, have found that these betas tend to revert toward their mean value or the market beta of one (Blume, 1971); if so, then the best

[38] As there was no 20-year constant maturity T-bond issued by the Federal Reserve prior to 1994, we used long term government bond yields from Ibbotson Associates for the years 1989-1993. In addition, The Federal Reserve did not report a one-month T-Bill rate prior to 2002. Therefore, we used three-month T-Bill rate as a proxy for short term rate for 1989-2001.

estimate of a security's future beta would be a value somewhere between the historical beta and the market mean of one.[39] Different approaches have been suggested to adjust the beta to reflect this time series property (see, e.g., Blume, 1971; and Vasicek, 1973). While there is no consensus approach to the estimation of beta, Milliman chose to use the Value Line estimates, which are subject to the adjustment described above.[40] This is based on the fact that Value Line is a commonly used information source for the investment community, and as such represents the likely approach used by investors in forming their expectations.

Market Risk Premium

The expected market risk premium is usually estimated by an unconditional forecast: the average difference between the returns on the market portfolio and the returns on the riskless asset. While some practitioners use a shorter time period, experts in this area usually suggest using all of the data from 1926 to the present (Damodaran, 2002, page 160-161; Copeland et al, 2000, page 217; Ibbotson SBBI Valuation Yearbook, 2008, page 72-73). Using this approach, over the period 1926 – 2007 a diversified portfolio of common stocks earned an annual return which averaged 8.5 percentage points higher than the return on U.S. Treasury bills. Therefore, an individual security of exactly average risk (i.e., with a beta of 1) would be expected to earn 8.5 percentage points more than a T-bill.

Given the chosen time period, the unconditional forecast of the risk premium can be based on either geometric or arithmetic means. After reviewing the literature, it is widely agreed that arithmetic mean is the unbiased forecast of future equity returns, provided that stock returns are not correlated over time. Ibbotson Associates suggests using the arithmetic means (Ibbotson SBBI Valuation Yearbook, 2008, page 77). Damodaran (2002, page 161) and Copeland et al (2000, page 218-219) both cited empirical studies suggesting negative autocorrelation in stock returns (mean reversion), and hence recommend using the average of geometric and arithmetic means.

Campbell et al (1997, Chapter 2) surveys the literature on the predictability of asset returns. For studies using multi-year returns, Campbell et al conclude "there is little evidence for mean reversion in long-horizon returns."[41] Based on a variety of evidence, it is our opinion that the arithmetic mean over the entire historical data set is the proper estimate for future returns.[42]

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[39] This could be thought of, in actuarial terminology, as a credibility adjustment.

[40] The Value Line beta is estimated using a regression of the weekly percentage change in a stock's share price against the weekly percentage change in the market (i.e., NYSE) index. The beta reported in Value Line is then adjusted as follows for its long-term tendency to converge toward one: Adjusted beta = .35 + .67 × estimated beta. This adjustment is based on the analysis in the aforementioned paper by Blume (1971)

[41] There is some evidence of serial correlation in weekly stock returns largely due to cross-autocorrelation among different stocks (small stocks following large stocks). The magnitude of correlation, however, appears to have declined substantially from the 1962-1978 period to the 1978-1994 period.

[42] We acknowledge that this is an area of controversy. Some experts argue that the geometric mean is the best measure of the risk premium, and others claim that the arithmetic mean is appropriate but it should be estimated over a shorter time period**.** Such adjustments tend to result in a risk premium around 2% lower than our recommended estimate. This would imply a CAPM cost of capital around 2% lower than indicated.

3.3.2. Extensions and Variations

As with all academic work, CAPM has been subject to rigorous testing over the years, with the most influential work in this area being the research of Fama and French (1992, 1996). Fama and French found that including beta (i.e., market risk) as the *only* factor has limited ability to predict stock returns, and that the addition of variables to reflect market size and financial distress enhance the predictability of the unconditional CAPM. While several later articles have challenged the results of Fama and French,[43] their research (as well as earlier work by Lucas, 1978, Ross, 1976 and Breeden, 1979) has spawned a large number of new asset pricing models in the past several decades.[44]

These new asset pricing models generally propose alternative factors, in addition to the market beta, to explain cross sectional variation in security returns. Aside from the size and distress factors proposed by Fama and French, other variables that have been tested include interest rate risk, cash flow volatility, default risk, the spread between long and short Treasury yields, labor income growth rate, the cyclical component of GDP, consumption to wealth ratio, the January effect, and the like. Which of these new factors are most promising for asset pricing remains a controversial issue.

Some of these new models also suffer from flaws including that some lack theoretical foundation; some do not fit the data as well as the unconditional CAPM; and most have greater parameter instability and more factors than the traditional CAPM. More factors imply more measurement and parameter errors (Hodrick and Zhang, 2001; Ghysel, 1998). In addition, empirical studies have often found that the multi-factor models do not outperform the unconditional CAPM in terms of forecasting accuracy (Ghysel, 1998; Kan and Wang, 2002; Wang, 2002). It is conceivable that more promising models will emerge in the future, however at this point we believe the unconditional CAPM is still the best choice because of the following advantages:

1) parsimonious,
2) well-known and widely used by investors,
3) relative parameter stability, and
4) the computational procedure is well tested and established.

4. Data

When estimating the cost of capital for crop insurance, it would be ideal to have a database of financial information on publicly traded firms engaged solely in the business of crop insurance. The

[43] See, for example: Using US data, Kim (1997) found stronger support for beta predictability after correcting for the errors-in-variable bias in Fama and French study. Using UK stock market data, Clare et al (1997) found overwhelming support for the predictive power of the CAPM beta using an econometrically superior estimation technique than Fama and French (1992).

[44] Better known examples include Fama and French (1996) three factor and five factor models, the arbitrage pricing model of Ross (1976), the consumption CAPM model of Lucas (1978) and Breeden (1979), the conditioning variables of Lettau and Ludvigson (2001) and Hodrick and Zhang (2001), Cochrane (1996), Campbell (1996), etc.

cost of capital for such “pure play” firms would be an excellent estimator of the fair return that should be allowed under the SRA. However, as is the case with ratemaking for any individual line of insurance, there is no sample of publicly traded firms engaged solely in a single line of the insurance business. In fact, most insurers (and all large, widely held publicly traded insurers) are multi-product firms, engaged in a variety of insurance (and sometimes non-insurance) activities. Thus, as a practical matter, cost of capital estimates that are used for insurance ratemaking rely on the estimated cost of capital for property casualty insurance in general.

Because there is no financial data specifically for crop insurers, we have adopted the same approach used in the development of cost of capital for other lines of insurance (such as automobile, homeowners, workers compensation and the like). Under this approach, analysts select a group of large, publicly traded companies in the insurance business, and estimate the cost of capital for this sample of firms. This is deemed to be the cost of capital for the average risk activity in which insurers are engaged. Then, if the line under consideration is of different than average risk, adjustments may have to be made.

While one could in theory adjust the cost of capital to reflect relative risk, an alternative and practical approach to this problem is to allocate capital to line of business proportional to risk, and thereby equalize relative risk across insurance activities. If risk is equalized across lines, then the average cost of capital would be a suitable target fair return for all lines of average risk. As discussed in the section on the capital base, we believe that the NAIC method for allocating capital to line is a reasonable method of roughly equalizing risk by line. Thus, we recommend the use of the average cost of capital as developed in our analysis.

As regards the information used in this report, Milliman relied on data from reputable, widely relied upon public sources. The interest rate data used for this analysis are from the Federal Reserve website (www.federalreserve.gov) and from *2008 Ibbotson Stocks, Bonds, Bills, and Inflation (SBBI) Classic Yearbook* published by Morningstar, Inc. (formerly Ibbotson Associates, Inc.); the equity market premium estimates are from *2008 Ibbotson Stocks, Bonds, Bills, and Inflation (SBBI) Valuation Yearbook* also published by Morningstar, Inc.; and the insurance company financial data are exclusively from the Value Line Investment Survey.

The Value Line Investment Survey is an independent investment advisory service that provides weekly reports on approximately 1,700 publicly traded stocks. In addition, it provides in depth quarterly reports on each of the firms it covers, which contain a wealth of historical and forecast information on each security. In terms of numbers of subscribers and annual revenues Value Line is one of the largest such services in the world. In addition, in our experience Value Line is the data source most widely relied upon by experts estimating the cost of capital in regulatory proceedings.

The number of articles studying the Value Line rankings and valuations is evidence to the importance of Value Line data to the general investors.[45] According to Warren Buffet:

> I don't know of any other system that's as good… The snapshot it presents is an enormously efficient way for us to garner information about various businesses… I have yet to see a better way, including fooling around on the internet, that gives me the information as quickly. — Warren Buffet, Berkshire Hathaway, 1998 Annual Meeting speaking about Value Line Investment Survey.

The *Ibbotson SBBI Valuation Yearbook* is the common source of stock returns data for most real world estimation of the equity market premium. As suggested by Damodaran (2002), "While users of risk and return models …. We almost all use the same database of historical returns, provided by Ibbotson Associates." Roger G. Ibbotson, Chairman of Ibbotson Associates, a professor of Finance in Yale University, has also published multiple books and articles on related areas (see, for example, Ibbotson, 1991, 2000; Francis and Ibbotson, 2002). Using the Ibbotson data, the risk premium estimate is the arithmetic mean of risk premium from 1926 through the year before the forecast, because annual risk premium data is available only up to the prior year.

As to the time period from which our data are derived, for each calendar, we estimated the cost of capital that would have been relevant as of the middle of the year. That is, we used the April, May, and June Treasury interest rates from the Federal Reserve and the company financial data from the early July/late June issue of the Value Line Investment Survey Ratings/Reports.

5. Results

5.1 Summary and Discussion.

Applying the approach discussed above, Milliman estimated the reasonable rate of return for the years 1989 through 2008. A summary of the results is reported in the Executive Summary, in Table 1 of this report. The estimates are reported using two decimal places only, even though actual computations used as many significant digits as were reported in the original data. (Given the accuracy of the input data and for reasons discussed before, we believe it is not meaningful to report more than one decimal place in the estimates.) Note that the estimates for each year are based on data as of the end of the second quarter of each year**.**

To place these results in a broader context, we provide the information shown on Table 3 below. This table displays interest rates, inflation rates, risk premiums, reasonable rates of return and actual property casualty insurance stock returns (i.e., dividends plus capital gains as a percent of starting price) during 1989 through 2008. The purpose of providing this information is to compare the expected return or cost of capital with the actual return investors have earned on equity investments

[45] See, for example, Hausman (1969), Shelton (1969), or Newbold,, Zumwalt, and Kannan (1987).

in property casualty insurance, and to provide insights into the cause of the declining cost of capital over time.

Table 3. Reasonable Rate of Return of Property Casualty Companies, Beta, Inflation, Risk Premium and Interest Rates

Year	Reasonable Rate of Return	Beta	Inflation	Average Risk Premium	Average Interest Rate
1989	15.9	0.98	4.8	7.8	8.7
1990	16.2	0.97	5.4	8.0	8.4
1991	15.4	0.98	4.2	7.7	7.3
1992	14.5	0.97	3.0	8.0	6.1
1993	13.8	0.97	3.0	7.9	5.0
1994	13.7	0.99	2.6	7.8	6.0
1995	13.6	0.98	2.8	7.6	6.3
1996	13.2	0.93	3.0	8.0	6.2
1997	12.9	0.90	2.3	8.1	6.2
1998	13.1	0.91	1.6	8.4	5.5
1999	12.7	0.95	2.2	8.6	5.3
2000	13.1	0.96	3.4	8.7	6.2
2001	12.0	0.93	2.8	8.4	4.8
2002	10.8	0.95	1.6	8.0	4.0
2003	9.7	0.98	2.3	7.6	2.7
2004	10.3	0.97	2.7	7.8	3.4
2005	10.7	0.96	3.4	7.8	3.7
2006	11.8	0.99	3.2	7.7	5.0
2007	11.7	0.96	2.8	7.8	4.9
2008	11.5	0.93	3.8	7.7	3.1
Change ('89-'08)	-4.3	-0.05	-1.0	-0.1	-5.6

Notes: a. Definitions:

Reasonable rate of return: Cost of capital estimates from Table 1.
Beta: Average beta each year, from Appendix 2.
Inflation: CPI-U average for the year.
Risk Premium: Average of short, intermediate and long-horizon risk premiums, estimated based on arithmetic mean risk premium from 1926 to the prior year.
Interest Rate: Average of short, intermediate and long-term Treasury yields, from Appendix 2

b. The reasonable rate of return estimates in columns 2 through 4 are based on information as of July 1 of the indicated calendar year. Since July is the inception of the next reinsurance year, however, the reinsurance year is actually one year ahead of the calendar year. That is, the reasonable rate of return as of, say, July 1989 should be viewed as the fair return for reinsurance year 1990 (the year from July 1989 through June 1990). In this report, we used calendar year instead of reinsurance year in order to compare the reasonable rate of return estimates with other calendar year variables including inflation rates and actual stock returns.

As shown in Table 3, between 1989 and 2008 the reasonable rate of return has declined from around 16% to less than 12%. Moreover, it is evident from the Table that this decline is directly consistent with declines in risk free rates and therefore capital costs in the economy at large; for example, the property casualty cost of capital has declined by 4.3 percentage points during this period, while risk free rates have declined by 5.6 percentage points. As indicated, the risk premium estimates have only changed slightly during the sample period, and the betas have remained virtually constant, thus the changes in capital costs reflect the fact that CAPM is dependent on risk free rates, and the DCF (even though it follows a very different algorithm) has been similarly responsive to capital market conditions.

Given all the uncertainties in the macro economy, as well as concerns about deflation, some may question if it is still realistic to expect an 11.6% stock return in the near future. As regards the uncertainties in the macro economy in general, it is precisely because of the large uncertainties that one might argue the stock market should command an even higher risk premium over risk free securities than the historic average. As for the concerns about deflation, while the danger of deflation has received substantially more press coverage recently,[46] the concern appears to be due to the potential seriousness of a deflationary environment rather than the likelihood of an actual deflation. While there is increasing concern about the danger of deflation, the consensus inflation forecast by analysts at this point is still positive. As evidence, consider that a recent forecast by the Congressional Budget Office (January 2009) expects 0.1% inflation in 2009, 1.7% in 2010, 2.1% inflation for 2011-2014, a 0.2% T-bill rate for 2009, 0.6% T-bill rate for 2010 and a 3.8% T-bill rate for 2011-2014. (These values are actually larger than the risk-free rates we used for the CAPM analysis.) In addition, the CBO forecasts are actually slightly lower than the consensus forecasts of analysts, which predict 0.6% inflation for 2009, 0.7% 3-month T-bill rate and 3.4% 10-year Treasury note for 2009.[47]

In addition to these considerations, also note that the average seasoned corporate bond yields for AAA and BAA corporate bonds were 5.7% and 7.2% in July 2008 (Federal Reserve Bank of St. Louis, FRED®[48] database), while according to the *2008 Ibbotson SBBI Valuation Yearbook* (page 262), the market risk premium for stocks relative to long-term corporate bond is 7.1%. The market risk premium implies that average risk common stocks should yield a return approximately 710 basis points above the yield on an AAA rated corporate bond; our current cost of capital for property casualty insurers is 11.6%, which is only 590 basis points above the long term average. We believe this strongly supports the reasonableness of our estimates.

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[46] See, for example, *The Washington Post*, October 7, 2008.

[47] See Page 14 of "The Budget and Economic Outlook: Fiscal Years 2009 to 2019" by Congressional Budget Office (January 2009).

[48] FRED® is a trademark of the St. Louis Federal Reserve Bank.

5.2 Computation.

Recall from the formula presented earlier, the DCF model requires an estimate of the current dividend yield and the expected growth rate in dividends. The sum of these is the estimated cost of capital**.** To illustrate the calculation, consider the results for 2008 in Appendix 21. The average dividend yield of all companies in the sample is 2.2%, and the average expected growth rate in dividends is 10.66% (see Appendix 21, Page 3). According to equation (1), the required rate of return (*k*) in this DCF model is equal to:

$$k = D_1/P_0 + g \text{ , or} \quad (5)$$

$$12.86\% = 2.2\% + 10.66\% \quad (6)$$

Similarly for CAPM, combining the information concerning the U.S. Treasury bill, beta coefficients for the property-casualty companies, and the historical differential between risk-free and equity investments, the short-term reasonable rate of return estimate is 9.38%. To illustrate this calculation, consider the full sample model below:

$$K = r_f + B \times r_d \text{ , or} \quad (7)$$

$$9.38\% = 1.52\% + 0.93 \times (8.5\%) \quad (8)$$

Each of the other calculations is performed identically. The results from the short-term, intermediate-term and long-term models are averaged to produce a 10.21% CAPM rate of return.

5.3 Interpretation and Discussions of General Results.

The detailed results of the analyses are displayed in Appendixes 1 through 21. In each appendix, page 1 is the table of contents. Page 2 reports the summary of results. Page 3 reports the summary of the DCF analysis. Page 4 through 8 displays the results of each step of the DCF analysis as well as the input data. Page 9 displays the summary of the CAPM analysis as well as the interest rates and risk premium data. Page 10 displays the input data for the computation of beta.

To illustrate the interpretation of these results, consider Appendix 21 for the year 2008. Page 2 indicates that the final reasonable rate of return estimate is 11.53 % based on the average of the 10.21% CAPM estimate and the 12.86% DCF estimate. The DCF estimate is about 2.6 percentage points higher than the CAPM estimate.

DCF Results

Page 3 of Appendix 21 reports the summary of the DCF analyses. As shown therein, the dividend yield is estimated to be 2.2%, while the dividend growth rate is estimated to be 10.66%. As for the dividend growth rate, unlike most years, the estimate based on the growth forecast method is slightly lower than the fundamental analysis estimate. In addition, there are substantial differences between estimates of the growth rate based on analysts' forecasts and the 5- and 10-year growth rate forecasts.

As regards the difference between fundamental and growth forecast estimates, we discussed earlier several issues about fundamental analysis which suggested a potential downward bias in growth estimates. Nonetheless, we have assigned equal weight to each method in our final estimate of the DCF dividend growth rate. By assigning equal weights to the two methods we believe our estimates are conservative.

Turning to the differences between estimates based on historical data compared to analysts' forecasts, note that for the growth estimates based on earnings, the 5-year (27.92%) is substantially larger than the analysts' forecast (8.02%) and 10-year historical (9.42%) earnings growth rates. This is not necessarily troubling, however: the high 5-year historical growth rate was achieved during a period with a very robust (in retrospect perhaps unrealistically robust) economy, while the low analysts' forecast likely reflect the expectation that the current recessionary business environment will linger for longer than normal, and the acceleration in earnings upon recovery will be slower than normal.[49]

In any event, in this instance the historical growth rates are likely to provide a forecast of future growth that is biased upward, while the analysts' forecast is likely to be biased downward, however when these results are averaged the biases are tempered, and the growth rate estimate (based on this single measure) is 15.12%. For these reasons and based on the previously cited study by Newbold, et.al. (1987), we believe the average of the three should provide the best dividend growth rate forecast.

As for the growth rate forecasts using dividend history, the 10-year (9.19%) and 5-year (8.83%) historical growth and the analysts forecast (10.34%) are relatively close. It appears that analysts' believe that the current recessionary environment will not have a negative effect on the dividend paying capability of P&C insurers.

Pages 4 to 8 display the actual data. Different companies appear to have rather different dividend policies as well as dividend and earnings growth patterns. We used the average of all companies to estimate each element in the forecast model. This approach averages out the idiosyncratic noises of each company's data and provides are more reliable forecast based on the model.

CAPM

Page 9 displays the summary of the CAPM forecasts. As shown therein, the CAPM estimates are substantially lower when using the short-term treasury yield as the risk free rate instead of long-term Treasury yields. While short-term Treasury yields are more responsive, they are at the same time

[49] Based on the general pessimism that pervades market at present, this forecast seems quite reasonable.

more vulnerable to fluctuations in the macroeconomic environment and changes in monetary policy than are long-term Treasury security yields. Since currently the spread between short and long term treasury yields is nearly 300 basis points, as compared with an historical average spread of only 142 basis points, it is not surprising that the cost of capital is much lower using short term yields. The beta estimate as reported on page 10 is 0.93 for the group of insurers, suggesting that property and casualty insurers have an about average risk compare to other companies in the market.

6. Conclusion

Milliman, Inc. employed two prominent cost of capital models to estimate the reasonable rate of return for crop insurers for the years 1989 through 2008. Based on our estimates, the reasonable rate of return for crop insurers ranged from 15.85% in 1989 to 11.53% in 2008, as reported in Table 1 on page 3. In general, the estimates have been declining during the sample period, mostly due to declining interest rates and perhaps partly due to the current adverse business environment. It is our opinion that these estimates represent the consensus expected cost of capital of investors in the middle of each year.

These estimates can be used as a benchmark to measure adequacy of the actual rate of return for providers. They can also be used to determine the cost of capital component for setting premium rates for crop insurance policies in the future. For both applications, proper premium to equity ratio should be determined first for each type of crop insurance policy based on steps suggested in the equity determination Section of this report.

Once again, we would caution that due to the rapid variations in business environment and the high volatility of interest rates, the reasonable rate of return estimates need to be updated as frequently as possible, say at least annually, depending on data availability and the volatility of the business environment. In addition, as research on this area is rapidly evolving, new models are being suggesting continuously, we further caution that the procedure for the estimation of the reasonable rate of return may need to be updated in the future, depending on the developments in academic research in this area.

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8. Definitions for Appendixes.

Annual Dividend Yield: Cash dividends estimated (by Value Line analysts) to be declared in the next 12 months divided by the recent price.

10-Year Historic Growth Rates (Earnings or Dividend Yield): Actual growth rate for each of the past 10 years on a compounded per share basis.

5-Year Historic Growth Rate (Earnings or Dividend Yield): Actual growth rate for each of the past 5 years on a compounded per share basis.

Analysts Forecasts (Earnings or Dividend Yield): Analysts estimated average annual growth rate for the next 5 years on a compounded per share basis.

Retention to Book: Earnings retained as a percentage of common equity.

Stock Issuance Factor: see definition on page 16-17.

Beta: see definition on page 19.

Market Risk Premium: see definition on page 20.

Risk Free Rate: see definition on page 19.

Limitations

Inherent Variability

It is important to realize that all actuarial projections of future contingent events are subject to a high degree of uncertainty. This is particularly true for highly volatile coverages such as multiple-peril crop insurance. Our analysis reflects our best professional judgment; however, substantial variance of actual results from our projections is not unexpected.

Data Sources

In performing this analysis we relied on data from various sources. We have not audited, verified, or reviewed these data and other information for reasonableness and consistency. Such a review is beyond the scope of our assignment. If the underlying data or information is inaccurate or incomplete, the results of our analysis may likewise be inaccurate or incomplete.

David Appel
PhD

TASK ORDER #20692
RATE OF RETURN UPDATE – 2008: REASONABLE RATE OF RETURN
SECTION 3.1.E: APPENDIX

Appendix 1. Reasonable Rate of Return Estimates: 1989-2008

Appendix 2 -21. Reasonable Rate of Return Reports: 1989-2008

- **Appendix 2.** (1989)
- **Appendix 3.** (1990)
- **Appendix 4.** (1991)
- **Appendix 5.** (1992)
- **Appendix 6.** (1993)
- **Appendix 7.** (1994)
- **Appendix 8.** (1995)
- **Appendix 9.** (1996)
- **Appendix 10.** (1997)
- **Appendix 11.** (1998)
- **Appendix 12.** (1999)
- **Appendix 13.** (2000)
- **Appendix 14.** (2001)
- **Appendix 15.** (2002)
- **Appendix 16.** (2003)
- **Appendix 17.** (2004)
- **Appendix 18.** (2005)
- **Appendix 19.** (2006)
- **Appendix 20.** (2007)
- **Appendix 21.** (2008)

Appendix 22. Value Line Investment Surveys: 1989-2008

Appendix 23. Risk Free Interest Rates from Federal Reserve and from Ibbotson

Appendix 24. Ibbotson Risk Premia over Time 1989-2008

Appendix 1. Reasonable Rate of Return Estimates: 1989-2008

Year	DCF	Short-Term CAPM	Interm-Term CAPM	Long-Term CAPM	Average CAPM	Reasonable Rate of Return
1989	15.44	16.74	16.28	15.78	16.26	15.85
1990	16.17	16.22	16.24	16.11	16.19	16.18
1991	16.04	13.77	15.11	15.51	14.80	15.42
1992	15.18	12.14	14.23	15.02	13.80	14.49
1993	14.90	11.30	12.65	13.98	12.64	13.77
1994	13.62	12.52	14.21	14.63	13.79	13.70
1995	13.44	13.79	13.62	13.84	13.75	13.59
1996	12.83	13.23	13.76	14.00	13.67	13.25
1997	12.31	13.04	13.66	13.75	13.48	12.90
1998	12.97	13.38	13.08	13.06	13.18	13.07
1999	11.94	13.42	13.45	13.72	13.53	12.73
2000	11.79	14.77	14.60	14.14	14.50	13.14
2001	11.42	12.10	12.44	13.08	12.54	11.98
2002	10.10	10.09	11.85	12.80	11.58	10.84
2003	9.08	9.34	9.85	11.48	10.22	9.65
2004	9.76	9.31	11.10	12.35	10.92	10.34
2005	10.18	10.93	11.14	11.43	11.17	10.67
2006	10.94	13.12	12.45	12.35	12.64	11.79
2007	10.96	13.06	12.09	11.91	12.35	11.66
2008	12.86	9.38	10.09	11.16	10.21	11.53

Source: These summary results are from Pages 3 and 9 of Appendices 2-21

Notes: a. The final reasonable rate of return estimate equals the average of the average CAPM and the DCF estimates.

b. The reasonable rate of return estimates in columns 2 through 4 are based on information as of July 1 of the indicated calendar year. Since July is the inception of the next reinsurance year, however, the reinsurance year is actually one year ahead of the calendar year. That is, the reasonable rate of return as of, say, July 1989 should be viewed as the fair return for reinsurance year 1990 (the year from July 1989 through June 1990). In this report, we used calendar year instead of reinsurance year in order to compare the reasonable rate of return estimates with other calendar year variables including inflation rates and actual stock returns.

APPENDICES 2 through 24 are redacted.