HISTORICAL RATE OF RETURN ANALYSIS

Prepared for:
Risk Management Agency
United States Department of Agriculture

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Executive Summary

The Risk Management Agency (RMA) of the U.S. Department of Agriculture (USDA) engaged Milliman Inc. (Milliman) to recommend and implement a methodology, based on insurance industry standards, to calculate the historical rate of return attributable to the sale of multiple peril crop insurance reinsured through the Standard Reinsurance Agreement (SRA). This engagement requires Milliman to estimate the actual rate of return for multiple peril crop insurance (MPCI) for the reinsurance years 1989 through 2008, both in the aggregate as well as for individual providers.

The rate of return on equity is the metric that is generally used to evaluate the profitability of investment opportunities. Similarly, in a regulatory context, rate of return on equity is typically used as the target return that a regulated entity should be permitted when setting the price for the regulated good or service. For both purposes, the proper rate of return is understood to be the economic rate of return on equity capital.

As with many economic or actuarial analyses, the estimation of the actual rate of return has to balance the objective of precision in results with practical concerns about both data availability and the costs of implementation. Fortunately, in calculating the historical rate of return attributable to property casualty insurance, there is fairly widespread agreement as regards the proper methodology for measurement. That methodology decomposes the total rate of return into three components: underwriting profit, investment income on insurance operations, and investment income on the insurer's equity capital (or surplus). This is consistent with statutory accounting standards promulgated by the National Association of Insurance Commissioners (NAIC) (as exemplified by the financial reporting contained in the insurance annual statement), as well as insurance industry sources and publications (such as the reports published by A.M. Best Company).

In light of the work order for this engagement, we believe the standard methodology is appropriate for calculating the historical returns attributable to multiple peril crop insurance. However, the somewhat unusual nature of MPCI requires that the methodology be adapted, so as to produce results that are consistent with other lines of insurance. This is particularly important when considering the potential profitability attributable to the expense reimbursement provided under the SRA, as well as when allocating equity across lines of insurance. We discuss these issues at length in the attached report.

Our report also provides estimates of returns attributable to multiple peril crop insurance for individual insurance providers. We emphasize that these estimates are based on standardized assumptions, applied to all insurance providers, regarding the amount of equity supporting the insurance transaction and the investment rate of return. Because actual levels of capitalization and investment portfolios differ across insurers, the returns estimated here will differ from the returns reported by individual insurance providers. However, we believe it is appropriate to rely on industrywide standard assumptions for these variables, since the estimated historical rate of return is

ultimately compared to an industry average cost of capital. In order to be consistent with an industry average cost of capital, it is reasonable to assume an industry average level of capitalization and investment portfolio.

Turning to a very brief summary of the most important results, Table 1 presents the actual returns on equity earned by MPCI insurers for the years 1989 – 2008, along with estimates of the reasonable rate of return or cost of equity capital.

Table 1. Historical and Reasonable Rates of Return by Reinsurance Year: All Insurers

Year	Historical Rate of Return	Reasonable Rate of Return
1989	16.3%	15.9%
1990	20.8%	16.2%
1991	16.3%	15.4%
1992	11.0%	14.5%
1993	-13.4%	13.8%
1994	23.9%	13.7%
1995	19.8%	13.6%
1996	20.9%	13.2%
1997	24.6%	12.9%
1998	17.3%	13.1%
1999	14.4%	12.7%
2000	13.6%	13.1%
2001	15.0%	12.0%
2002	3.5%	10.8%
2003	18.4%	9.7%
2004	20.4%	10.3%
2005	28.4%	10.7%
2006	20.9%	11.8%
2007	26.3%	11.7%
2008	23.3%	11.5%
Average	17.1%	12.8%
Std. Deviation	9.2%	1.8%

As can be seen from the table above, the estimated earned return on equity for MPCI insurers has averaged approximately 17.1%, as compared with an average reasonable rate of return over the same period of 12.8%. Thus, MPCI insurers have earned a return somewhat in excess of the cost of capital. However, the returns have been volatile as well, as evidenced by the fact that in the single

catastrophe year in the sample, the overall rate of return was –13.4%. It is typical for insurers in catastrophe prone lines of business to earn high returns in non-catastrophe years, but to suffer extensive losses in catastrophe years. Therefore, when evaluating the reasonableness of historical returns, it is important to know whether the historical period contains a representative number of catastrophe years. For example in this case, had there been a second catastrophe year in the sample similar in magnitude to 1993, the average return over the period would have been approximately 15.6%.

The remainder of this report describes the methodology, calculations and results of our analysis.

1. Background

Crop production can be a risky business, vulnerable to frequent disruption from adverse weather, pests and diseases. The level of coverage, the range of crops insured, and the type of insurance policies have all been expanded since the enactment of the Federal Crop Insurance Act of 1980. As a result, net expenditures under the Federal crop insurance program exceeded $4.4 billion in 2008.[1] Under the current program, the Federal government provides support to producers (farmers) and insurers through a premium subsidy, an administrative and operation (A&O) subsidy, and the Standard Reinsurance Agreement (SRA).

By using private insurers to deliver and service crop insurance contracts, the program can rely on market forces to ensure the efficient production of insurance services. However, to assure adequate capacity in the program, the pricing of insurance contracts (or in this case the structure of the SRA and the level of the A&O subsidy) must offer investors reasonable compensation for bearing the risks associated with underwriting crop insurance. In addition, to monitor whether the program meets or has met its objectives regarding fair compensation to insurers, it is necessary to measure and evaluate the actual returns insurers have earned.

In a separate study, Milliman established the methodology and estimated the reasonable rate of return for multiple peril crop insurance (Appel, et al, 2009). In this study, we establish the methodology to measure the historical return earned by multiple peril crop insurers, and, based on that methodology, estimate the rate of return to the insurance providers' equity for years 1989 through 2008.

2. Methodology

The rate of return on equity is generally used to evaluate the profitability of investment opportunities. Similarly, when setting the price for the good or service in a regulatory context, rate of return on equity is typically used as the target return that the regulated entity should be permitted. For both purposes, the proper rate of return is understood to be the economic rate of return on equity capital.[2]

As with many economic or actuarial analyses, the estimation of the actual rate of return has to balance the objective of precision in results with practical concerns about both data availability and the costs of implementation. Fortunately, in measuring the historical rate of return attributable to property casualty insurance, there is little difference of opinion regarding the proper methodology.

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[1] This represents the government's cost for the program; the program size exceeded $8.0 billion, part of which is offset by producer paid premiums and fees. See FY 2010 Budget and Annual Performance Plan, USDA at www.obpa.usda.gov/budsum/fy10budsum.pdf.

[2] In theory, the economic rate of return should be measured based on the market value of equity, however in practice, because of the highly volatile nature of market values, returns are normally calculated based on accounting earnings and the accounting value of equity. For insurers, equity may be measured using either statutory or GAAP accounting; when using SAP accounting, equity is termed "surplus" or "statutory surplus".

The current standard in the property casualty insurance industry relies on a methodology that decomposes the total rate of return into three components: (1) underwriting profit, (2) investment income on insurance operations, and (3) investment income on the insurer's equity capital (or surplus). This methodology is consistent with statutory accounting standards promulgated by the National Association of Insurance Commissioners (NAIC) (as exemplified by the financial reporting contained in the insurance annual statement), as well as insurance industry sources and publications (such as the reports published by A.M. Best Company).[3] In light of the work order for this engagement, it is our judgment that such an approach is appropriate for calculating the historical returns attributable to multiple peril crop insurance.

As noted above, the methodology adopted for this report separates insurance returns into underwriting profit, investment income on insurance operations, and investment income on the insurer's equity capital (or surplus). Generally speaking, the first two components, underwriting profit and investment income on insurance operations, are calculated as a percent of insurer premium, while the last piece, investment income on surplus, is denominated as a percent of surplus (or equity). Thus, to calculate the rate of return on equity, the portion of the return denominated as a percent of premium must be multiplied by the ratio of premium to equity, and then added to the investment return on the equity itself.

In algebraic form, the equation for the total return on equity is as follows:[4]

$$ROE = [UW_{\pi} * (1-t_u) + IY_{op} * (1-t_i)] * (P/E) + IY_{eq} * (1-t_i)$$

where: UW_{π} = underwriting profit as a percent of premium
t_u = federal income tax rate on underwriting income
IY_{op} = investment return from insurance operations as a percent of premium
t_i = federal tax rate on investment income
P = premium
E = equity
IY_{eq} = investment return on insurer equity

While the equation above may appear to decompose the total return in a counter intuitive manner,[5] there is actually both logic and historical precedent to support such an approach. The purpose of this method is to distinguish the returns attributable to being in the business of insurance from the returns attributable to investing one's own equity capital. Note that in the first term to the right of the equal

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[3] See, for example, the NAIC (a), Accounting Practices and Procedures Manual Vol. 1; NAIC, Report on Profitability by Line and by State in 2006; or A.M. Best Company, Best's Aggregates & Averages, 2008 edition.

[4] See Appendix A to this report for a technical development of the ROE equation.

[5] It might appear more intuitive to separate the underwriting from the investment portions of the insurance business; such an approach would group all investment income together, so as to distinguish between the underwriting and investment activities pursued by insurers.

sign, the value IY_{op} reflects the return attributable solely to the investment of funds provided from insurance operations. These are the funds insurers receive from policyholders (in the form of premium payments) that are held for the future payment of losses and/or expenses; insurers invest such funds and earn income associated with those investments. Since underwriting profit reflects returns solely from underwriting (i.e., the difference between premiums and associated losses and expenses), and given the definition of IY_{op}, the first term to the right of the equality represents the entire return insurers earn as a result of being in the business of insurance.

In contrast, the second term to the right of the equality represents the return the insurer earns from investing its own equity capital. Such a return could have been realized without bearing the risk of underwriting insurance, by simply using the insurer's equity to purchase its existing asset portfolio. Thus, decomposing the total return as done in the equation above provides a useful distinction between the returns associated with engaging in the insurance activity and the returns associated with investing the insurer's own capital. So long as the insurance activity imposes some risk, the first term on the right should be positive (i.e., the insurance activity should provide a positive return), but in evaluating whether the insurer earns a "fair and reasonable return" it is appropriate to consider all sources of income (including investment income on the insurer's equity).[6]

A discussion of each individual component of the rate of return is provided below.

2.1 Underwriting Profit

Underwriting profit in property casualty insurance is normally defined as the difference between premiums earned and the sum of losses and expenses incurred, as follows:

$$UW_{\pi} = P - IL - ILAE - UE$$

where:
- P = Earned Premium
- IL = Incurred Losses
- ILAE = Incurred Loss Adjustment Expense
- UE = Other Underwriting Expenses[7]

[6] In theory, it is possible that the returns to insurance underwriting are inversely correlated with the market. In a CAPM context, this would imply that investors would be willing to assume insurance liabilities for a total return below the risk free rate, which would further imply that the first term in the equation would be negative. While this theoretical possibility has been discussed, there is, to our knowledge, no empirical evidence supporting it.

[7] For many lines of business, insurers may pay dividends (in effect refunds) to policyholders at the expiration of their policies. If so, underwriting profit would be calculated after such dividend payments. However, for MPCI policyholder dividends are irrelevant, hence they are excluded from further discussion here.

Although this could be computed in absolute dollars, each value in the equation is typically divided by earned premium, so the reported results are expressed as a percent of earned premium, as shown below:

$$UW_\pi/P = P/P - IL/P - ILAE/P - UE/P, \text{ or}$$
$$uw_\pi = 1 - il - ilae - ue$$

where the use of lower case indicates that the values are reported as a percent of earned premium.

This approach to measuring underwriting profit is reasonable for the typical property casualty line of business, because the actuarially developed premium collected by the insurer is intended to cover both the losses and the expenses associated with the insurance contract. In MPCI, however, these two components are separated: "premium" as the term is used in MPCI, refers to the estimated amounts needed to pay only the losses associated with the insurance contract.[8] The expenses associated with the underwriting, delivery and servicing of the contract are separately reimbursed through the A&O (administrative and operating) subsidy. Thus, the standard approach requires modification due to the nature of multiple peril crop insurance.

The alternative approach we rely upon in this report simply decomposes the equation above into two pieces, one related to the pure underwriting profit (which is simply the difference between gross premium and incurred losses) and the other related to the "profit" arising from the A&O subsidy.[9] Thus, we recast the equation above as follows:

$$UW_\pi = \text{Pure } UW_\pi + A\&O_\pi,$$
$$\text{Pure } UW_\pi = P - IL^{10}$$
$$A\&O_\pi = \text{A\&O subsidy} - ILAE - UE$$

To estimate the pure underwriting profit, we relied on data from RMA that provided a summary of the underwriting results for each insurer participating in the MPCI program. These data contain the information of ultimate interest in a profitability analysis, namely, the net retained premium and loss for the insurance provider, aggregated across all states, funds and plans of insurance. As such, the

[8] This "gross premium" is itself split into two parts, the producer paid premium and the premium subsidy (i.e., the amount paid by the government on behalf of the producer).

[9] To the extent that the A&O subsidy exceeds the actual operating expenses of the insurer, there is a potential profit to be earned. Of course, if the subsidy falls short of actual expenses, the insurer could incur a loss as well.

[10] Incurred loss in MPCI is typically referred to as "indemnities" paid to producers.

difference between the two is the value required for the variable Pure UW_{π} : that is, it reflects the final underwriting profit after all provisions of the SRA are taken into account.[11]

2.2 Expenses

Property casualty insurer expenses are normally categorized into classes that include: loss adjustment expense (the costs of investigating, adjusting and settling claims);[12] acquisition costs (commissions to agents and other acquisition expenses); general overhead expenses; and taxes, licenses and fees (where taxes refers to premium and miscellaneous taxes, excluding income tax). When rates are set for property casualty insurance, these expenses are estimated and included, along with the provision for losses, in determining the final premiums paid by insureds.

In contrast, for MPCI reinsured under the SRA, the FCIC compensates insurers for the costs of selling and servicing the coverage through the payment of an administrative and operating (A&O) subsidy. This A&O subsidy is intended to cover all costs associated with the sale and servicing of crop insurance policies, excluding, of course, losses. This raises at least two important issues as regards profitability analysis. First, depending on the level of the A&O subsidy relative to actual incurred expenses, there may be a profit or a loss to insurance providers attributable to the subsidy itself. Second, when evaluating crop insurance expense ratios relative to expenses for other lines of insurance, it is imperative to adjust the ratios to put them on a comparable basis.[13]

This latter point bears additional explanation. Consider a line of insurance such as homeowners, and assume that a policy is issued for a premium of $100, under which there is $70 of expected losses and $30 of expected expenses.[14] In this instance, the reported expense ratio for the insurer would be 30% ($30 of expenses divided by $100 of premium). Now compare that to an MPCI policy with expected losses of $70 and an A&O subsidy of 30%. On such a policy, an insurer would be entitled to $21 to cover expenses (30% of $70 in gross premium, where gross premium is set equal to the expected value of loss). If this information were recorded consistent with the reporting of all other lines of insurance, instead of a 30% expense ratio for MPCI, the value would be approximately 23% (i.e., $21 of expenses divided by $91 of premium) because the premium would include both the loss ($70) and the expense ($21) portions of the rate. Alternatively, if the homeowners data were adjusted to be reported on the same basis as MPCI, the homeowners expense ratio would be almost 43% (i.e., $30 of expense divided by $70 of loss).

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[11] The SRA contains numerous provisions relating to the maximum amount of premium that can be written in the Assigned Risk fund, the minimum retentions required for the provider, and the rules for determining the sharing of underwriting gains and losses between insurers and the FCIC. These rules are all accounted for in the data provided by RMA.

[12] Loss adjustment expenses are typically reported along with losses, not with other underwriting expenses.

[13] This issue has relevance for the determination of the premium to surplus ratio as well. We will discuss this in a later section of the report.

[14] For ease of exposition in this example, we assume there is no profit built into the premium.

As this example demonstrates, it is inappropriate to directly compare the A&O subsidy (in this case 30%) to the reported expense ratios for other lines of insurance, because the premium base in the denominator of these ratios represents different things. In typical property casualty insurance, the premium includes both losses and expenses, while in MPCI the premium includes losses only. To put the A&O subsidy on a comparable basis to expense ratios reported for other lines of insurance, one must add the subsidy to the premium, so as to produce a denominator that is comparable to "normal" premium in other lines. This can be accomplished using the following calculation:

Adjusted expense ratio = [(A&O subsidy)/(1 + A&O subsidy)].

Thus, if the A&O subsidy were set at 25%, that would be equivalent to a reported expense ratio of 20% in any other line of insurance (i.e., 0.25 / (1.0 + 0.25) = 0.20, or 20%).

As indicated in our previous discussion, the A&O subsidy could increase provider profits if the subsidy exceeds actual expenses, and could decrease profits if it falls short of actual expenses. However, the scope of this project does not include an evaluation of the expenses associated with delivering MPCI coverage or a comparison of those costs with the A&O subsidy. Nevertheless, we are aware that the level of the A&O subsidy has been a long standing concern, and that various parties have argued that the subsidy is either excessive (i.e., it exceeds the actual costs of selling/servicing MPCI) or inadequate.

In light of the uncertainties about the A&O subsidy, we have chosen to report historical profitability calculations with the assumption that the A&O subsidy exactly compensates insurers for their expenses; in this case, the A&O subsidy produces zero profit.

2.3 Investment Gains On Insurance Operations

In a typical line of property casualty insurance, the insurer collects premium in advance of the payment of losses and expenses. In fact, in some lines of business, there may be a lag of many years between premium receipt and the final payment of loss.[15] In such lines, investment income plays a major role in insurer pricing and profitability, as the funds advanced by policyholders are invested by the insurer, and can earn significant income. However, the amount of such income depends primarily on the amount of time between the receipt of funds from policyholders and the disbursement of those funds by the insurer.

To evaluate the investment income opportunities for MPCI insurers, we considered the timing of the cash flows attributable to the sale of crop insurance. The dates that are relevant for such an analysis

[15] In a line like workers compensation, payments may extend sixty or seventy years after the sale of a policy, as benefits under the coverage can last for the lifetime of an injured worker.

are the dates at which the insurer; (1) receives premium from the policyholder; (2) remits the premium to RMA; (3) pays losses; (4) receives reimbursement for the loss payment; (5) receives the A&O subsidy; and (6) pays expenses. Based on the timing of these cash flows, it is evident that investment income from insurance operations is a relatively immaterial consideration in the profitability of MPCI insurers.

To illustrate this analysis, Table 2 presents the following important dates for corn producers, prepared by extension economist William Edwards of Iowa State University and available at the Iowa State University website www.extension.iastate.edu/Publications/FM1858.pdf.

Table 2. Important Crop Insurance Dates for Corn Producers in Iowa

Sales Closing Date	March 15
Earliest Planting Date	April 11
Final Planting Date	May 31
End of Late Planting Period	June 25
Acreage Reporting Date	June 30
Billing Date	October 1
End of Insurance Period	December 10
File Notice of Crop Damage Date	15 days after end of crop or Dec. 10
Policy Termination Date	March 15
Cancellation Date	March 15
Production Reporting Date	April 30

Source: http://www.extension.iastate.edu/Publications/FM1858.pdf

The sales closing date is the last date for producers to apply for or cancel crop insurance coverage. Final planting date is the last planting date to receive full coverage, with coverage being reduced daily during the late planting period. Production reporting date is the last day to report the production records for the calculation of APH history.

The following are the transaction dates for the major cash flow components for the insurer.

Premium: At the billing date, the insurer (reinsured by the FCIC) bills the insured for the producer's portion of the premium due. The insured has until the end of the month to pay their premium to the reinsured company. If the insured has not paid by the end of the month, the insurer charges the insured interest until the premium is collected.

The month following the billing date, the premium is due RMA whether the reinsured company has collected it from the producer or not. If it was collected, it is reported as a paid amount on the next

accounting report.[16] If the company does not pay RMA the uncollected premium then interest will attach at the rate of 15% per year. They, however, cannot defer the uncollected premium beyond the annual settlement.

Indemnity: Once the insured notifies the insurer of a loss, the insurer documents the claim and then issues the insured a check drawn on their loss clearing account and submits the loss data to RMA. RMA processes loss data and funds the escrow account for 100% of the loss check amount issued. When the insured's check hits the company's loss account, the funds are then transferred from the escrow account to the loss clearing account to cover the check. If the reinsured company has a net underwriting loss prior to annual settlement, the amount must be paid to RMA, however if there is a net underwriting gain, it is calculated in February, following the end of the reinsurance year.

A&O Subsidy: When the premium data is submitted to RMA, the A&O Subsidy is calculated using the gross premium, which includes the producer's subsidized portion, times the applicable reimbursement percentage. Beginning with the 2006 reinsurance year, 24.2% is the maximum percentage rate and 18.1% is the minimum. The insurer receives the A&O subsidy at around the middle of the insurance period.

It is clear from these dates that the potential to earn investment income is relatively modest for multiple peril crop insurers, because the time period during which they could invest premium revenue is virtually nil. In fact, premium is remitted to the FCIC almost immediately after its receipt by the insurer. In addition, the A&O subsidy is provided to the insurer in the middle of the insurance period, despite the fact that a large portion of expense is incurred at the time the policy is sold. Thus, the insurer has to finance a portion of expenses in advance of reimbursement. While the A&O subsidy provides revenue in excess of these "prepaid expenses", and that excess could be invested, it is unlikely that investment income from that portion of the A&O exceeds the cost to the insurer of financing expense outlays ahead of reimbursements.

Given these facts, there is apparently no meaningful opportunity for insurers to earn investment income from insurance operations. (Indeed, it could be argued that there is an investment cost rather than a gain, due to the early payment of expenses and the timing of underwriting gains versus losses.) As a consequence we have assumed, for purposes of our profitability analysis, that MPCI insurers receive no investment income form insurance operations.[17]

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[16] If the insured has not payed the premium by the policy termination date, they are terminated for indebtedness and made ineligible for program benefits.

[17] It is important to note that the annual statement for property casualty insurers will generally show positive amounts of investment income attributable to MPCI operations. However these positive values result from the fact that there is a mandatory formula used to allocate investment income to line of business. Based on our review of the typical timing of MPCI cash flows, we see no basis for attributing any investment income to insurance operations.

2.4 Investment Income on Equity

As discussed earlier, in addition to investment income from operations, insurers also earn income from the investment of their own equity. In the case of MPCI, this is, in fact, the only source of meaningful investment income for the insurer. To estimate the historical investment income on insurer equity, we relied upon the average yield insurers actually earned on their invested asset portfolios during the period between 1989 and 2008. The average yield was the net income insurers earned from investments divided by the amount of invested assets, which was the average of the current and prior year-end invested assets.[18]

To estimate this value, we compiled data from insurer annual statements reported by *Best's Aggregates & Averages*, the standard reference source in the field. For each year in the sample period, we calculated the ratio of net investment income earned plus realized capital gains divided by average invested assets, and assumed that that was the yield rate that applied to the insurers' surplus during the year. Table 3 presents the results from these calculations.[19]

As would be expected, average returns were substantially higher in the earlier years, as interest rates were generally higher at the time, and insurers also benefited from the higher yields of older bonds in their portfolios.

To use these values in the profitability calculation, we made the standard assumption that the entire allocated equity is invested for the whole year of the transaction, hence investment income on equity is equal to the annual yields shown above.

[18] We used the average yield for the entire property casualty industry rather than the yield earned by MPCI insurers to be consistent with the industrywide cost of capital. That is, since we compare the historical returns from multiple peril crop insurance to an industrywide reasonable rate of return (cost of capital), it is appropriate to impute the industywide investment portfolio to crop insurance. If crop insurers have riskier (or less risky) asset portfolios, their costs of capital would be commensurately higher (lower).

[19] Data for 2008 were not available at the time the calculations were performed for this report. Consequently, the return on investment for 2007 was assumed for 2008.

Table 3. Property-Casualty Average Rate of Return on Investment

Year	Year-End Cash and Invested Asset	Average Invested Asset	Net Investment Income	Return on Investment
1987	360,752,329			
1988	401,776,313	381,264,321	30,448,735	8.0%
1989	445,077,013	423,426,663	35,855,938	8.5%
1990	470,493,393	457,785,203	35,781,530	7.8%
1991	514,564,282	492,528,838	39,053,096	7.9%
1992	539,656,015	527,110,149	43,627,153	8.3%
1993	579,833,900	559,744,958	42,462,989	7.6%
1994	609,505,252	594,669,576	35,350,775	5.9%
1995	664,008,342	636,756,797	42,830,658	6.7%
1996	700,806,046	682,407,194	47,206,297	6.9%
1997	766,061,919	733,433,983	52,306,925	7.1%
1998	796,780,574	781,421,247	57,944,582	7.4%
1999	799,060,669	797,920,622	51,871,077	6.5%
2000	789,330,250	794,195,460	56,908,285	7.2%
2001	781,730,299	785,530,275	44,369,989	5.6%
2002	848,344,235	815,037,267	42,881,934	5.3%
2003	967,703,877	908,024,056	46,617,436	5.1%
2004	1,069,916,761	1,018,810,319	50,260,698	4.9%
2005	1,170,135,319	1,120,026,040	63,928,692	5.7%
2006	1,264,555,809	1,217,345,564	58,233,341	4.8%
2007	1,330,400,451	1,297,478,130	66,564,615	5.1%
2008	NA	NA	NA	NA

Notes: Average invested asset equals current and last year-end average.
Return on investment equals net income divided by average asset.
Data for 2008 not available hence 2007 values used for calculations.

Sources: *Best's Aggregates & Averages, Property-Casualty Edition*, editions for 1988 through 2008.

2.5 Taxes

Since the actual return earned by investors is the after tax return, the rate of return comparable to the reasonable rate of return expected by investors is the after tax return as well. Thus, after the various income items have been calculated, they must be adjusted for tax. To do so, we relied on the appropriate statutory tax rates in effect during each year of the sample period.

Both underwriting and investment gains are subject to Federal income taxes. Based on data from the Internal Revenue Service and the Tax Foundation, the marginal corporate income tax rate on the top

tax bracket has been 34% from 1989 through 1992 and 35% from 1993 through 2008.[20] For the lower income brackets, the corporate income tax rate for the period 1989 through 2008 ranges from 15% for the first $50,000 to the range between 34% and 39% for income above $100,000.[21] We used the tax rate for the top bracket as the corporate income tax rate for our estimation of the tax rate on underwriting income.

The tax rate on investment gains is somewhat more complicated because a significant portion of stock dividends and tax-exempt bond interest are tax-exempt. Consistent with our approach of using the average investment return of all property-casualty insurers, we also used the industrywide average tax rate on investment income as proxy for the investment return tax rate for crop insurers. Since investment income varies by asset categories, we estimated this tax rate by the weighted average tax rate across all investment asset categories.

Due to the enactment of the 1986 Tax Reform Act, 15% of all tax exempt investment income is treated as taxable for property casualty insurance companies. This includes both the interest on tax exempt bonds as well as 70% of stock dividends from unaffiliated companies. (Note that effective tax rate on stock dividends is estimated by taking 15% of the 70% of dividends that are exempt, plus the 30% of dividends that are non-exempt, and multiplying that by the corporate tax rate.) The effective tax rate for each of the investment asset categories are presented in Table 4.

[20] For 1988 through 2002, see the Internal Revenue Service publication "Corporation Income Tax Brackets and Rates, 1909-2002," www.irs.gov/pub/irs-soi/02corate.pdf. For 2003 through 2008, see the Tax Foundation publication "Federal Corporate Income Tax Rates," www.taxfoundation.org/research/show/2140.html.

[21] The tax rates were designed such that companies reaching the top income brackets will pay an average tax rate that equals the tax rate of the top income bracket.

Table 4. Tax Rates on Asset Categories

	1989-1992	1993-2008
Bonds		
Taxable	34.00%	35.00%
Non-Taxable (.15*corp. tax rate)	5.10%	5.25%
Stocks		
Taxable ((.15*.7+.3)*corp. tax rate)	13.77%	14.18%
Non-Taxable (.15*corp. tax rate)	5.10%	5.25%
Mortgage Loans	34.00%	35.00%
Real Estate	34.00%	35.00%
Collateral Loans	34.00%	35.00%
Cash	34.00%	35.00%
Short Term Inv.	34.00%	35.00%
All Other	34.00%	35.00%
Inv. Expenses	34.00%	35.00%
Realized Capital Gains	34.00%	35.00%

Note: Non-taxable stock yields are yields from affiliated companies.

Sources: For 1988 through 2002, see the Internal Revenue Service publication "Corporation Income Tax Brackets and Rates, 1909-2002," www.irs.gov/pub/irs-soi/02corate.pdf (including sources listed at the bottom of the IRS publication). For 2003 through 2008, see the Tax Foundation publication "Federal Corporate Income Tax Rates," www.taxfoundation.org/research/show/2140.html.

Given the effective tax rates shown in Table 4, we also estimated the weighted average effective tax rate for each year in the sample period. Table 5 below presents the distribution of investment income across each of the asset categories, along with investment expense and realized capital gains from investment. These data are from *Best's Aggregates & Averages: Property-Casualty Edition,* editions for 1989 through 2008. Using these data as the weights for each category, the average tax rate is computed and shown in the bottom panel of Table 5. We used these tax rates as proxies for the investment income tax rates for crop insurers.

Table 5. Property-Casualty Investment Portfolio Income Distribution and Average Tax Rate

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Bonds										
Taxable	11,953,865	14,035,065	16,481,406	18,763,192	18,885,479	18,083,944	18,120,773	20,165,755	21,284,291	22,192,677
Non-Taxable	10,317,076	10,726,809	10,656,171	10,489,143	10,741,904	10,455,805	10,981,827	10,626,881	10,726,038	10,833,496
Stocks										
Taxable	2,191,046	2,485,226	2,506,084	2,240,548	2,279,760	2,285,418	2,516,031	2,553,112	2,646,601	2,875,690
Non-Taxable	912,925	951,739	763,103	764,493	676,854	746,344	1,089,813	1,544,022	1,329,733	3,614,550
Mortgage Loans	578,549	595,889	664,301	622,667	559,142	447,315	354,500	268,985	238,435	230,349
Real Estate	765,359	862,449	919,027	1,062,592	1,189,602	1,327,026	1,403,581	1,415,893	1,469,337	1,585,364
Collateral Loans	22,610	26,795	22,222	19,002	11,727	8,277	8,350	7,375	7,861	7,538
Cash	233,664	320,557	309,561	226,325	147,369	107,887	113,323	155,193	146,875	145,552
Short Term Inv.	1,958,448	2,699,557	2,233,902	1,881,931	1,144,607	1,101,885	1,246,789	2,113,673	1,915,691	2,041,421
Cash & Short Term Inv.	-	-	-	-	-	-	-	-	-	-
All Other	619,539	680,191	765,914	713,144	802,575	855,653	823,475	1,024,305	1,277,202	1,531,706
Inv. Expenses	(1,830,516)	(2,176,400)	(2,420,647)	(2,536,299)	(2,705,768)	(2,774,150)	(2,971,192)	(3,040,951)	(3,079,984)	(3,559,449)
Capital Gains	2,725,466	4,648,681	2,880,410	4,806,376	9,893,402	9,817,573	1,663,541	5,997,029	9,243,907	10,807,929
Total	30,448,031	35,856,558	35,781,454	39,053,114	43,626,653	42,462,977	35,350,811	42,831,272	47,205,987	52,306,823
Average Tax Rate	26.4%	23.2%	23.4%	24.5%	25.4%	26.0%	23.4%	25.3%	26.2%	25.6%

Sources: *Best's Aggregates & Averages, Property-Casualty Edition*, editions for 1989 through 2008.

Table 5. Property-Casualty Investment Portfolio Income Distribution and Average Tax Rate (continued)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Bonds											
Taxable	21,776,005	21,108,088	22,029,009	22,302,424	23,094,226	21,190,681	21,696,435	23,254,464	25,429,410	26,829,002	26,829,002
Non-Taxable	11,544,948	11,420,119	10,543,361	9,654,683	9,284,966	9,918,245	11,340,140	13,189,050	14,446,481	15,945,544	15,945,544
Stocks											
Taxable	2,911,625	2,874,275	2,849,541	2,621,526	2,763,531	2,864,754	3,285,602	3,675,690	4,507,468	5,217,764	5,217,764
Non-Taxable	1,690,919	1,156,400	1,326,160	1,405,226	3,977,275	3,838,458	2,131,399	3,597,641	2,839,135	1,787,257	1,787,257
Mortgage Loans	203,942	173,858	261,656	137,721	178,521	158,612	169,603	194,195	195,240	277,884	277,884
Real Estate	1,600,494	1,544,685	1,570,896	1,649,181	1,672,965	1,690,507	1,646,000	1,650,988	1,657,734	1,765,348	1,765,348
Collateral Loans	-	-	-	-	-	-	-	-	-	-	-
Cash	187,099	163,035	224,289	596,201	-	-	-	-	-	-	-
Short Term Inv.	2,104,432	1,855,876	2,145,556	1,203,685	-	-	-	-	-	-	-
Cash & Short Term Inv.	-	-	-	-	1,048,332	1,158,122	1,189,806	3,006,076	4,755,081	5,343,544	5,343,544
All Other	1,615,424	2,339,694	3,568,273	2,418,157	2,428,821	3,691,942	3,751,696	7,530,681	5,389,774	5,818,516	5,818,516
Inv. Expenses	(3,709,511)	(3,782,299)	(3,815,818)	(4,253,706)	(4,336,105)	(4,174,811)	(4,064,665)	(4,363,521)	(4,573,873)	(5,452,582)	(5,452,582)
Capital Gains	18,019,189	13,016,157	16,204,649	6,630,679	2,770,997	6,280,196	9,113,199	12,194,108	3,587,228	9,031,778	9,031,778
Total	57,944,566	51,869,888	56,907,572	44,365,777	42,883,529	46,616,706	50,259,215	63,929,372	58,233,678	66,564,055	66,564,055
Average Tax Rate	27.2%	26.6%	27.8%	26.4%	24.5%	24.9%	25.7%	26.0%	24.6%	25.4%	25.4%

Note: Numbers for 2008 are for year-end 2007 and are placeholders until the year-end results for 2008 become available later in 2009.
Sources: *Best's Aggregates & Averages, Property-Casualty Edition*, editions for 1989 through 2008.

2.6 Determination of Equity Capital[22]

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, as well as (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 accepted accounting principles (GAAP), or the market value of equity.[23] 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.[24] However, market values can fluctuate (sometimes dramatically) over time, and to our knowledge are never relied upon in practical regulatory applications. This leaves either statutory surplus or GAAP net worth as the capital base upon which the return should be calculated. As regards the choice between these two options, it is widely agreed that when comparing insurance returns to other industries, the proper capital base is GAAP net worth. And since the allowed return in ratemaking is designed to permit insurers a return equal to that earned in industries of comparable risk, the equity base upon which that return is measured must be comparable as well. This suggests that GAAP net worth is the proper base for regulatory purposes.[25]

GAAP net worth has historically been between 10% and 25% greater than SAP surplus.[26] Therefore, we would recommend that RMA utilize a conversion factor to transform statutory surplus, as reported on the insurance annual statement, to a GAAP net worth equivalent. If such an analysis had been done based on the most recent five 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

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[22] A similar section is also presented in Appel et al (2009). However in our discussion here, we emphasize several important issues that impact the use of this factor in a historical profitability analysis.

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

[24] 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.

[25] The NAIC uses GAAP net worth when reporting results by state and line in its annual Profitability Report. See, for example, *Report on Profitability By Line By State in 2006* (National Assocation of Insurance Commissioners, 2007). That document is quite clear in its preference for GAAP over SAP accounting.

[26] See, for example, *ISO Insurer Financial Results: 2007* (Insurance Services Office, Inc., 2008).

year the conversion factor was 1.15.[27] Using the average value as an example, this implies that for every $100 of statutory surplus allocated to crop insurance, the insurer actually has $117 of GAAP net worth 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.[28] 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.[29] 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, 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 structure the SRA to yield a fair and reasonable return. Thus, we briefly discuss those allocation bases which have traditionally been proposed in insurance regulatory settings.

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.[30] However, despite literally decades of research, there is still no consensus regarding the proper measurement of risk by line. (Furthermore, much of the 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

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[27] 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.

[28] 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.

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

[30] 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.

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.[31]

As to the methods that have been used in practical applications, allocations based on total reserves or reserves plus earned premium, appear to have the most promise. In fact, both of these methods have some support in the regulatory arena, with the latter one 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.[32] The idea behind these approaches is that insurers face risk from unforeseen events relating to current business as well as from past business for which claims have yet to be paid. Thus, capital should be available (and hence allocated) to protect against adverse current period loss experience as well as adverse loss development from prior years. This leads to an allocation based on either total reserves (which includes loss, loss adjustment expense and unearned premium reserves), or total reserves plus earned premiums.

Since the NAIC relies on an allocation based on total reserves plus earned premiums, we would recommend relying on the same method. 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, based on data as of year-end 2007. (In this context, leverage ratios are defined as the ratio of net written premiums to statutory surplus.) These are shown in Table 6 below. We note two things about these results: (1) the calculations allocate all of the industry's surplus, and are not adjusted to any particular normative level, and (2) they are based on industrywide reserves and premium, rather than the reserves and premium of a sample of insurers.[33]

The results of the allocation process show a premium to surplus ratio for multiple peril crop insurance of 1.5 to 1, which is notably the highest premium to surplus ratio for any line of insurance.[34] Indeed, the results of the surplus allocation process seem anomalously low, and hence the premium to surplus ratio is unusually high, in light of the catastrophe risk potential present in the sale of crop insurance.

There are two principal reasons for this result; one is that multiple peril crop insurance has amongst the smallest unearned premium reserves relative to premium of any line of insurance, and the other is

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[31] 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, papers by Myers and Read (2001) and Butsic (1999), which use options models to allocate insurer capital.

[32] 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.

[33] See Appendix B for a technical description of the calculations used to allocate a portion of the property-casualty insurance industry surplus to the multiple peril crop line.

[34] The computations are displayed rounded to a single decimal place; in our view, no higher degree of precision is warranted in light of the uncertainty associated with any surplus allocation method.

that MPCI reported premium is understated due to the absence of an expense provision. Since both earned premiums as well as the unearned premium reserve are part of the allocation base, and both these values are understated for crop insurance, there is a commensurately smaller allocation of surplus to the line.

As far as the unearned premium reserve is concerned, the low value is likely the result of the fact that premiums in crop insurance are often not paid until the exposure has virtually expired, hence by the time the premium is booked it is already earned. Since the unearned premium reserve (UEPR) is the difference between written and earned premium, the UEPR for crop insurance will be very small. As evidence of this, consider that the UEPR for all lines of property casualty insurance averages approximately 45% of premium, while for crop insurance it is approximately 6% of premium.

In addition to the artificially low UEPR, the other bias in the allocation method results from the fact that MPCI premiums include a provision for losses only, as opposed to the typical property casualty insurance premium that includes both losses and expenses. As we discussed earlier, in order to put MPCI premium on a comparable basis to other lines, the A&O subsidy must be added to the reported premium.[35] Given the size of the subsidy, this has a meaningful impact on the allocation of surplus.

Because the MPCI premium is understated due to the absence of the A&O expenses, we added the expense reimbursement to earned premium and added an amount to the unearned premium equal to the A&O expenses times the ratio of MPCI unearned premium to net written premium before allocating surplus to the MPCI line of business.[36] After both adjustments, the premium to surplus ratio declined significantly, to a value of approximately 1.1.[37]

In addition, as noted earlier, the leverage ratios computed above are 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 these ratios to a GAAP net worth basis, one would divide by the ratio of GAAP net worth to statutory surplus, which was 1.17 for the property casualty insurance industry over the most recent five years. Assuming that value applied to crop insurance, and the premium to allocated

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[35] In effect, other lines of business have surplus allocated for both losses and expenses, whereas MPCI has surplus allocated for losses alone. It is therefore apporpriate to make the adjustment indicated above when allocating surplus and determining the amount of surplus supporting the crop insurance transaction. However, when calculating the premium to surplus ratio for use in the rate of return calculation, the premium in the numerator of that ratio should be the MPCI reported premium (and not the adjusted premium) since the MPCI premium is the base for the other relevant components of the rate of return calculation.

[36] For the years 2001 through 2007, unearned premium as a percentage of net written premium was between 4.6% and 8.3%, and the average was 6.1%. With the exception of one year, the same percentage for the years between 1988 and 2000 was between -0.03% and 1.0%. (The exception was 1996, when unearned premium was 4% of net written premium.) Because it appears that unearned premium was understated for the early years in our analysis, we assumed that unearned premium for MPCI was 6.1% of net written premium for the years 1988 through 2000.

[37] From a risk exposure perspective, the line of business most closely related to MPCI is Allied Lines, the line under which MPCI is actually reported on the annual statement. This line has a premium to allocated surplus ratio of approximately 1.1, which provides additional support for our adjustments.

surplus ratio was set at 1.0, the ratio of premium to GAAP net worth would be estimated to be 0.9 (i.e., 1.0/1.17=0.9).

Table 6. Allocation Of Surplus To Lines Of Business Net of Reinsurance Data From 2007 Insurance Expense Exhibit (000 omitted)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Premiums Written	Premiums Earned	Unpaid Losses	Defense and Cost Containment Expenses Unpaid	Adjusting and Other Expenses Unpaid	Unearned Premium Reserves	Allocated Surplus	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 Multiple 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 Multiple 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	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	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

2.7 Reinsurance

The historical rates of return calculated in this study are estimates of the returns insurers earned net of the reinsurance protection provided under the SRA. However insurers also may purchase additional private sector reinsurance for the exposure retained after the SRA, and we are aware that some MPCI insurers do purchase such coverage. Our rate of return estimates do not consider the impact of private sector reinsurance on the rate of return.[38]

Generally speaking, the price of reinsurance includes a provision for the losses expected to be ceded under the contract, along with provisions for the reinsurer's expenses as well as the cost of the reinsurer's capital. Since the benefit of reinsurance to the primary insurer is the amount of ceded losses, but the cost includes both losses and expenses (including the cost of capital), the purchase of reinsurance will result in a net cost to the primary insurer on average. Even though in any individual year it might be the case that the benefits of reinsurance far outweighed the costs, over a period of 20 years it is quite likely that the long term average result would prevail, and insurers would incur a net cost due to the purchase of private reinsurance. To the extent that reinsurance imposes a net cost on the primary insurer, and we have failed to consider private sector reinsurance in the analysis of profitability, we have likely overstated the rate of return.

2.8 Summary of Components

Table 7 provides a summary of the components of the rate of return computation. We also note that the underwriting data are in reinsurance years, while the expense, investment return and tax rate data are in calendar years. The reinsurance year is defined as the period from July 1 of the previous calendar year to June 30 of the current year – for example, reinsurance year 1990 is calendar period July 1, 1989 through June 30, 1990. Thus, to place the calendar year data on a reinsurance year equivalent basis, we used the average of the two calendar years contributing to the same reinsurance year.

[38] It would not have been possible to estimate this impact with any precision. There was an extremely limited amount of data available for several insurers, for only two years, and it did not contain sufficient information to determine the impact of reinsurance on profitability.

Table 7. Summary of Components of Rate of Return Calculations

Components	Definitions
Rate of Return	[(Underwriting profit + A&O profit) * (1-corporate income tax rate) * premium to equity ratio] + surplus investment return * (1-tax rate on investment return)
Underwriting Profit	Return on premium retained after stop loss.
A&O Profit	A&O subsidy – (Loss adjustment expense + commission brokerage + general expense + other expense+ taxes, licenses and fees)
Investment Return on Operations	Assumed to be zero due to timing of cash flows
Investment Return on Equity	net investment income / the average of current and prior year-end total invested assets (for all property-casualty insurers).

3. Results

Using the approach discussed above, we estimated the rate of return on equity for each individual insurance provider for each reinsurance year from 1989 through 2008. The following section presents a summary of the most important results of that analysis, while the detailed results by provider are contained in the appendix attached to this report. In this section, we discuss only those results from the "base case" expense assumptions, where the A&O subsidy is assumed to produce neither a profit nor a loss for the insurer.

3.1 Aggregate Summary Rate of Returns

Table 8 presents a summary of the estimated actual rate of return for MPCI insurers in the aggregate, compared to the estimated reasonable rate of return, for each year in the sample. Column (2) is the pre-tax underwriting result – that is, the net gain or loss as a percent of retained premium. Column (3) is the corporate income tax described in Table 4, and column (4) is the premium-to-equity ratio derived by Milliman. Column (5) is the post-tax net gain or loss as a percent of equity, which is the pre-tax underwriting result in column (2) multiplied by one minus the tax rate in column (3), and then multiplied by the premium-to-equity ratio in column (4). Column (6) is the post-tax investment income on insurer's equity capital, which is the pre-tax return in Table 3 multiplied by the tax rate on investment income in Table 5. Column (7) is the post-tax total historical return, which is the sum of the post-tax return from underwriting in column (5) and post-tax return from investment income on insurer's equity in column (6). Column (8) is the reasonable rate of return from our earlier report.

As can be seen from the table, the estimated earned return on equity for MPCI insurers has averaged approximately 17.1%, as compared with an average reasonable rate of return over the same period of

12.8%. Thus, while MPCI insurers have earned a return somewhat in excess of the cost of capital, the returns have been somewhat volatile as well, as evidenced by the fact that in the single catastrophe year the overall rate of return was –13.4%. We would caution against drawing any strong conclusions on the adequacy or excessiveness of the historical returns based on a sample of twenty years of data, in light of the fact that only one of those years is a catastrophe year. Had there been a second catastrophe year in the sample similar in magnitude to 1993, the average return over the period would have been approximately 15.6%.

Table 8. Historical and Reasonable Rates of Return by Reinsurance Year: All Insurers

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Reinsurance Year	Net Gain (Loss) as Percent of Retained Premium	Corporate Tax Rate	Premium to Equity Ratio	Post-Tax Net Gain (Loss) as Percent of Equity	Post-Tax Return on Invested Assets	Historical Rate of Return	Reasonable Rate of Return
1989	8.2%	0.34	1.833	9.9%	6.4%	16.3%	15.9%
1990	12.5%	0.34	1.759	14.5%	6.2%	20.8%	16.2%
1991	9.3%	0.34	1.679	10.3%	6.0%	16.3%	15.4%
1992	4.7%	0.34	1.580	4.9%	6.1%	11.0%	14.5%
1993	-19.2%	0.35	1.551	-19.3%	5.9%	-13.4%	13.8%
1994	19.2%	0.35	1.506	18.8%	5.1%	23.9%	13.7%
1995	17.2%	0.35	1.339	15.0%	4.8%	19.8%	13.6%
1996	21.4%	0.35	1.133	15.8%	5.1%	20.9%	13.2%
1997	27.9%	0.35	1.070	19.4%	5.2%	24.6%	12.9%
1998	17.5%	0.35	1.052	12.0%	5.4%	17.3%	13.1%
1999	14.8%	0.35	0.970	9.3%	5.1%	14.4%	12.7%
2000	14.3%	0.35	0.935	8.7%	5.0%	13.6%	13.1%
2001	14.6%	0.35	1.089	10.3%	4.7%	15.0%	12.0%
2002	-0.6%	0.35	1.437	-0.5%	4.1%	3.5%	10.8%
2003	14.5%	0.35	1.542	14.5%	3.9%	18.4%	9.7%
2004	19.2%	0.35	1.337	16.6%	3.8%	20.4%	10.3%
2005	31.6%	0.35	1.187	24.4%	3.9%	28.4%	10.7%
2006	23.4%	0.35	1.119	17.0%	3.9%	20.9%	11.8%
2007	32.1%	0.35	1.081	22.6%	3.7%	26.3%	11.7%
2008	29.4%	0.35	1.024	19.6%	3.8%	23.3%	11.5%
Average						17.1%	12.8%
Std Deviation						9.2%	1.8%

Notes for the derivation of the columns in the table.

(2): RMA provided to Milliman in February 2009.
(3): Table 4.
(4): Milliman analysis.
(5): (2) x (1- (3)) x (4)
(6): Table 3, with the tax rates in Table 5 applied.
(7): (5) + (6)
(8): Appel, et. al, *Reasonable Rate of Return Analysis*, 2009.

Table 9 provides the summary statistics for the annual total rate of return of individual insurers. Note that in this table, the average annual returns differ from those reported earlier. In Table 8 (and Table 1) above, the average annual return was calculated for the aggregate industry; in effect, this is a weighted average return on equity across all firms, where the weights depend on

the individual firm's size.[39] In Table 9, the averages are unweighted, or, alternatively, each observation is accorded equal weight. The purpose of this analysis is to observe the variation in returns across firms during a year, as opposed to the variation in industry returns over time.

Table 9. Summary Statistics for Individual Insurer Rates of Return, by Reinsurance Year

Year	Average	Standard Deviation	Minimum	Maximum
1989	14.2%	6.8%	2.4%	25.1%
1990	20.8%	8.0%	-6.7%	35.1%
1991	14.5%	6.2%	-7.4%	20.3%
1992	11.8%	13.4%	-34.5%	28.8%
1993	-16.7%	18.2%	-57.4%	11.8%
1994	22.7%	7.6%	5.5%	33.7%
1995	20.7%	11.5%	-8.5%	39.0%
1996	22.1%	9.2%	3.6%	34.8%
1997	26.4%	5.3%	16.8%	35.0%
1998	20.9%	11.6%	-12.5%	36.5%
1999	18.2%	8.5%	6.1%	32.6%
2000	14.2%	9.5%	-8.1%	31.2%
2001	15.6%	13.0%	-15.8%	37.0%
2002	3.5%	20.1%	-42.5%	39.9%
2003	25.3%	24.2%	-17.9%	104.1%
2004	21.5%	2.7%	18.2%	28.2%
2005	28.6%	3.3%	22.5%	34.4%
2006	23.2%	6.7%	10.6%	33.7%
2007	26.9%	4.0%	21.4%	34.9%
2008	23.8%	4.9%	16.6%	33.4%

Note: The results in Table 9 are based on unweighted individual-insurer results in Table 10. The results in Tables 1 and 8 are the aggregate, or weighted, results for the MPCI line of business.

Notice that there is significant cross sectional variation within each year: the average coefficient of variation (i.e., the ratio of the standard deviation to the mean rate of return) is more than 60%, with some years in excess of 100%.

[39] Most notably, the net gain (loss) as a percent of retained premium in Table 8 is the total net gain (loss) divided by the total retained premium for all insurers. This percent can also be derived by cacluating the ratio of each insurer's net gain (loss) divided by retained premium, and then weighting these ratios by each insurer's retained premium.

3.2 Rate of Returns by Provider

We also estimated rates of return for individual insurance providers, which are displayed in summary form in Table 10 below (along with the weighted average of all providers and the reasonable rate of return). As discussed earlier in the report, these estimates are based on the actual underwriting results for the individual providers, along with assumptions regarding insurer leverage and investment returns that are based on property casualty insurance industry averages. We note again that these annual returns will differ from those that may be reported by the individual insurance providers.

Table 10. Total Returns, by Insurance Provider

	Reinsurance Year										
Company	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Aggregate Industry Avg Rate of Return	16.3%	20.8%	16.3%	11.0%	-13.4%	23.9%	19.8%	20.9%	24.6%	17.3%	14.4%
Reasonable Rate of Return	15.9%	16.2%	15.4%	14.5%	13.8%	13.7%	13.6%	13.2%	12.9%	13.1%	12.7%

----------REDACTED----------

Table 10. Total Returns, by Insurance Provider (continued)

	Reinsurance Year								
Company	2000	2001	2002	2003	2004	2005	2006	2007	2008
Aggregate Industry Avg Rate of Return	13.6%	15.0%	3.5%	18.4%	20.4%	28.4%	20.9%	26.3%	23.3%
Reasonable Rate of Return	13.1%	12.0%	10.8%	9.7%	10.3%	10.7%	11.8%	11.7%	11.5%
--------REDACTED----------									

4. Comparison with reasonable rate of returns.

In a separate report prepared for the RMA, Milliman estimated the reasonable rate of return for multiple peril crop insurance for the years 1989-2008. The reasonable rate of return is defined as the consensus expected rate of return by investors in general in the given point of time. The estimated reasonable rates of return for multiple peril crop insurance are shown in Table 11.

To compare the actual rate of return with the reasonable rate of return estimates, Table 11 displays both series. We caution that actual returns could deviate significantly from the expected returns because of unexpected events. Therefore a better measurement of whether providers have been reasonably compensated is by comparing mean values over the sample period, and by observing the pattern of difference between actual and reasonable rate of return. The difference between the actual rate of return and the reasonable rate of return is also displayed in Table 11.

Table 11. Differences between Actual and Reasonable Rates of Return

Year	Actual Rate of Return	Reasonable Rate of Return	Difference between Actual and Reasonable
1989	16.3%	15.9%	0.4%
1990	20.8%	16.2%	4.6%
1991	16.3%	15.4%	0.9%
1992	11.0%	14.5%	-3.5%
1993	-13.4%	13.8%	-27.2%
1994	23.9%	13.7%	10.2%
1995	19.8%	13.6%	6.2%
1996	20.9%	13.2%	7.6%
1997	24.6%	12.9%	11.7%
1998	17.3%	13.1%	4.3%
1999	14.4%	12.7%	1.7%
2000	13.6%	13.1%	0.5%
2001	15.0%	12.0%	3.0%
2002	3.5%	10.8%	-7.3%
2003	18.4%	9.7%	8.8%
2004	20.4%	10.3%	10.1%
2005	28.4%	10.7%	17.7%
2006	20.9%	11.8%	9.1%
2007	26.3%	11.7%	14.6%
2008	23.3%	11.5%	11.8%
Mean	17.1%	12.8%	4.3%

As can be seen in the table, the actual rate of return is 4.3% larger than the reasonable rate of return for all years. As noted earlier, this result is quite sensitive to the occurrence of catastrophe years in the sample period. For example, if there had been a second catastrophe year equivalent to 1993 in this sample period, the historical return would have been approximately 15.6%.[40]

As with most lines of insurance that have a significant catastrophe exposure, insurers expect to earn significant profits in non-catastrophe years and significant losses in years with catastrophes. As a result, average returns over relatively short sample periods are not necessarily indicative of the long term pattern or returns. Given the experience in multiple peril crop insurance over the past 20 years, we would suggest that the historical returns reported herein would tend to overstate long term returns if the frequency of catastrophes is greater than one in twenty years, and understate such returns if the frequency is lower than one in twenty.

5. Conclusion, Limitations and Acknowledgement

The Risk Management Agency (RMA) of the U.S. Department of Agriculture (USDA) requested Milliman, Inc. (Milliman) to recommend and implement a methodology, based on insurance industry standards, to calculate the historical rate of return attributable to the sale of multiple peril crop insurance reinsured through the Standard Reinsurance Agreement (SRA). This engagement required Milliman to estimate the actual rate of return for multiple peril crop insurance (MPCI) for the reinsurance years 1989 through 2008 at the aggregate level, as well the returns for individual providers, funds, and years, with and without the impact of catastrophe coverage.

To respond to RMA's request, Milliman developed and implemented a model to estimate historical rates of returns and then applied that model to data for multiple peril crop insurers, for the period between 1989 and 2008. The results of our analysis are contained in this report.

Limtations

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.

[40] We replaced the second lowest return year, 2002, with –9.4% (the return earned during the catastrophe year, 1993) and the all-years mean fell to 13.9%. Replacing any other year would have caused the mean to fall even further.

Data Sources

In performing this analysis we relied on data provided to us by RMA. 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 are inaccurate or incomplete, the results of our analysis may likewise be inaccurate or incomplete.

Acknowledgement

Milliman wishes to acknowledge the invaluable assistance of RMA staff in providing data and information required for the completion of our study.

Appendix A

Derivation of the Total Post-Tax Return on Equity

The purpose of this appendix is to present a technical development of the ROE equation at the beginning of Section 2 (Methodology) in the report. As indicated at the beginning of Section 2, the standard in the property casualty insurance industry is to decompose the rate of return into three components: (1) underwriting profit, (2) investment income on insurance operations, and (3) investment income on the insurer's equity. Therefore, to begin, the pre-tax total profit, in dollars, can be expressed by the following equation:

(A.1) $\$Profit_{pre\text{-}tax} = \$UW + \$IY_{operations} + \$IY_{equity}$

where $\$UW$ = underwriting profit,
$\$IY_{operations}$ = investment income on insurance operations, and
$\$IY_{equity}$ = investment income on insurer's equity.

To compare the total profit from a property casualty insurance operation to other industries, the total profit needs to be expressed as a total return on net worth, or equity. The first two terms in equation (A.1) are commonly expressed as a percent of premium, and then converted to a percent of equity. For these terms, letting P represent premium and $\frac{P}{E}$ represent the premium-to-equity conversion ratio, the pre-tax underwriting return can be expressed by

$$(A.2) \qquad UW_{return} = \frac{\$UW}{P} * \frac{P}{E}$$

and the pre-tax investment income return from operations can be expressed by

$$(A.3) \qquad IY_{return,operations} = \frac{\$IY}{P} * \frac{P}{E}$$

Letting UW_{π} represent the pre-tax underwriting dollars as a percent of premium, IY_{op} represent the investment income from operations as a percent of premium, and IY_{eq} represent the pre-tax investment income return on insurer's equity, the pre-tax total profit in dollars in equation (A.1) can be expressed as the pre-tax total return on equity:

$$(A.4) \qquad ROE_{pre-tax} = UW_{\pi} * \frac{P}{E} + IY_{op} * \frac{P}{E} + IY_{eq}$$

The three terms in equation (A.4) follows the decomposition set forth at the beginning of this discussion—that is, the total return for a property casualty insurance operation can be decomposed into the return from underwriting, the return from the investment income from insurance operations, and the return from the investment of insurer's equity.

Incorporating into equation (A.4) the appropriate tax rate for each term, equation (A.5) presents the post-tax total return on equity.

$$(A.5)\quad \mathrm{ROE}_{\mathrm{post-tax}} = \left[\mathrm{UW}_{\pi} * (1 - \mathrm{t_u}) * \frac{\mathrm{P}}{\mathrm{E}}\right] + \left[\mathrm{IY}_{\mathrm{op}} * (1 - \mathrm{t_i}) * \frac{\mathrm{P}}{\mathrm{E}}\right] + \left[\mathrm{IY}_{\mathrm{eq}} * (1 - \mathrm{t_i})\right]$$

where t_u is the tax rate on underwriting income and t_i is the tax rate on investment income.

Appendix B

Derivation of the Premium to Surplus Ratio

An important consideration in the rate of return calculation is the conversion of the return on premium to a return on equity, which was represented by the premium-to-equity ratio ($\frac{P}{E}$) in equation (A.5) in Appendix A. This ratio can be broken down into two terms:

$$(B.1) \qquad \frac{P}{E} = \frac{\text{Premium}_{MPC}}{\text{Surplus}_{MPC}} * \frac{\text{Surplus}_{PC}}{\text{Equity}_{PC}}$$

A general discussion of the premium-to-surplus ratio, or factor, was presented in Section 2.6. A discussion of the premium-to-equity ratio (or premium-to-GAAP net worth ratio) was presented at the end of Section 2.6. Consistent with the usual practice for these allocation calculations, we assumed that the surplus-to-equity ratio for the property-casualty insurance industry can be applied to each line.

The purpose of this appendix is to present a technical description of the premium-to-surplus ratio for the multiple peril crop line. To begin,

$$(B.2) \qquad \frac{\text{Premium}_{MPC}}{\text{Surplus}_{MPC}} = \frac{\text{Net\_Premium\_Earned}_{MPC}}{\text{Surplus}_{MPC}}$$

where

- $\text{Net\_Premium\_Earned}_{MPC}$ is the reported net premium earned for the multiple peril crop line on insurers' annual statements.

- Surplus_{MPC} is the amount of policyholder surplus allocated to the multiple peril crop line.

As described in Section 2.6, an insurer's surplus is inherently indivisible in that the entire amount is available to protect all policyholders. In theory, capital should be allocated to line of insurance based on each line's relative risk. However, despite decades of research, there is no consensus regarding the proper measurement of risk by line. Nevertheless, allocations based on total reserves or reserves plus earned premium appear to have the most promise. Since the NAIC relies on an allocation based on total reserves plus earned premiums, such an approach was used in the present analysis.

In equation (B.3) below, the amount of surplus allocated to the multiple peril crop line is the amount of premium, loss and loss adjustment expense reserves, and unearned premium reserves for this line as a proportion of the all-lines' totals for the same amounts. There are two noteworthy considerations in this allocation: (1) the calculations allocate all surplus for property-casualty

insurance industry and (2) the calculations are based on the industry's premium and reserves, rather than the reserves and premium of a sample of insurers.

The following expression presents the components of $\text{Surplus}_{\text{MPC}}$ that use the ratio of premium and reserves for the multiple peril crop line relative to the premium and reserves for the industry (the ratio in parentheses) to allocate the surplus for the industry $\text{Surplus}_{\text{PC}}$ to the multiple peril crop line:

$$(\text{B.3}) \quad \text{Surplus}_{\text{MPC}} = \text{Surplus}_{\text{PC}} * \left(\frac{\text{Premium}_{\text{MPC}} + \text{LossLAEUnpaid}_{\text{MPC}} + \text{UEPR}_{\text{MPC}}}{\text{Premium}_{\text{PC}} + \text{LossLAEUnpaid}_{\text{PC}} + \text{UEPR}_{\text{PC}}} \right)$$

where

- $\text{Surplus}_{\text{PC}}$ is the average of the prior-year and current-year policyholder surplus reported on insurers' annual statements.

- $\text{Premium}_{\text{MPC}}$ is the net premium earned for the multiple peril crop line plus the gross premium earned for the line multiplied by the average of the prior-year and current-year A&O subsidy ratios. The net premium earned and gross premium earned are reported on insurers' annual statements. The A&O subsidy ratio is the ratio of the aggregate A&O reimbursement divided by the aggregate total premium. The aggregate A&O reimbursement and the aggregate total premium were provided by RMA.

- $\text{LossLAEUnpaid}_{\text{MPC}}$ is the average of the prior-year and current-year sums of the following items reported on insurers' annual statements for the multiple peril crop line: (a) unpaid losses, (b) defense and cost containment expenses unpaid, and (c) adjusting and other expenses unpaid.

- UEPR_{MPC} is the ratio of the unearned premium reserves to net premium written, multiplied by $\text{Premium}_{\text{MPC}}$. The unearned premium reserves and net premium written are reported on insurers' annual statements. The reporting of unearned premium reserves on insurers' annual statements appears to be incomplete for 1989 through 2000. For these years, the average ratio of the unearned premium reserves to net premium written for 2001 through 2007 was used (0.061).

- $\text{Premium}_{\text{PC}}$ is net premium earned for all lines of insurance plus the gross premium earned for the multiple peril crop line multiplied by the average of the prior-year and current-year A&O subsidy ratios. The net premium and earned and gross premium earned for all lines are reported on insurers' annual statements.

- $\text{LossLAEUnpaid}_{PC}$ is the average of the prior-year and current-year sums of the following items reported on insurers' annual statements for all lines: (a) unpaid losses, (b) defense and cost containment expenses unpaid, and (c) adjusting and other expenses unpaid.

- UEPR_{PC} is the unearned premium reserves reported on insurers' annual statement for all lines less the unearned premium reserves for the multiple peril crop line, plus UEPR_{MPC}.

Substituting the surplus allocation expression in (B.3) into (B.2) produces the premium-to-surplus ratio for the multiple peril crop line:

$$(B.4) \quad \frac{\text{Premium}_{MPC}}{\text{Surplus}_{MPC}} = \frac{\text{Net\_Premium\_Earned}_{MPC}}{\text{Surplus}_{PC} * \left(\frac{\text{Premium}_{MPC} + \text{LossLAEUnpaid}_{MPC} + \text{UEPR}_{MPC}}{\text{Premium}_{PC} + \text{LossLAEUnpaid}_{PC} + \text{UEPR}_{PC}} \right)}$$

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