DISCOUNTED RETURN—MEASURING PROFITABILITY AND SETTING TARGETS

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Abstract

The Hartford Insurance Group employs a total return approach in ratemaking and performance measurement. This article describes the discounted return methodology used by the Hartford in measuring profit and setting prices based on a target return.

Determination of total income involves the consideration of the time value of money in conjunction with the investment period related to key cash flows. The paramount importance of meeting policyholder liabilities precipitates certain investment principles aimed at reducing risk. Liabilities are fully funded with fixed income assets invested at a "risk-free" treasury market rate where maturities match the average duration of liabilities.

Benchmark surplus, dictated by the consideration of funding and solvency, is introduced as a base for measuring return. The benchmark surplus will differ from the actual surplus of a company depending on past results, dividend payout policy, and debt/equity capital management policy.

A methodology is suggested for determining benchmark rates of return for state regulatory purposes, consistent with the management of solvency risk. The benchmark return will differ from actual total return, which is based on reported income and surplus. In this context, the risks and rewards of investment and capital management policies are borne entirely by the owners of the company and reflected in the total company return.

The benchmark return is suggested for use in ratemaking and regulation since 1) it includes income from all sources, 2) it incorporates investment principles which enhance the protection of policyholder funds, and 3) it measures return against a surplus "standard" not influenced by noninsurance driven capital management practices.

1. SUMMARY

This article presents a practical explanation of the discounted return methodology and its use in measuring profit and setting targets. The approach, applied by line of business, essentially looks at the time value of money in conjunction with the investment period related to key cash flows. The key cash flow aspects are premiums receivable, losses and expenses payable, and the new tax law timing impacts due to the unearned premium reserve offset and loss discounting.

The concept of insurance/benchmark surplus is introduced. Reported surplus is viewed as the sum of benchmark and residual surplus. Benchmark surplus is that which is dictated by the consideration of funding and solvency. The remaining residual surplus depends on past results, dividend payout policy, and debt/equity capital management policy.

An important feature incorporated into this approach is the determination of separate investment yields for operating cash flows, benchmark surplus, and residual surplus. The paramount importance of meeting policyholder liabilities precipitates certain investment principles aimed at reducing risk. Liabilities are fully funded with fixed income assets invested at a "risk-free" treasury market rate where maturities match the average duration of liabilities. This rate applies to all operating cash flows. Liability funding requirements are determined on a discounted basis, based on actual business levels and mix.

The following table summarizes the relationship between industry estimated liability funding requirements and invested assets from 1983 to 1988. Pretax investment yields applicable to operating cash flows and benchmark surplus are also shown.

TABLE 1

HISTORICAL INDUSTRY ASSETS, FUNDING REQUIREMENTS, AND YIELDS

Year	$Billion		% of Invested Assets	Investment Yields (Before Tax)		Investment Return (Before Tax) On Average Invested Assets
	Average Cash & Invested Assets	Estimated Liability Funding Required		Operating Cash Flow	Bench-mark Surplus	
1988	381.3	269.5	70.7	8.0	7.2	9.0
1987	337.5	251.1	74.4	7.5	6.8	10.3
1986	286.5	253.3	88.4	7.0	6.3	14.0
1985	239.8	239.4	99.8	9.5	8.6	14.6
1984	216.6	199.4	92.1	11.5	10.4	13.8
1983	205.4	178.1	86.7	10.0	9.0	13.0

It is estimated that $269.5 billion in funding (on a discounted basis) in 1988 was required to meet the expected ultimate liabilities of accident year 1988. This represents 71% of average invested assets in 1988. It is noted that industry invested assets in 1985 were barely sufficient to meet current estimates of ultimate liabilities for that year.

The magnitude of assumed reserve weakening from 1983 to 1985 and reserve strengthening from 1986 to 1988 is substantial and greater than previous cycles due primarily to reinsurance recoverables. Actual investment return on average assets exceeds the investment yields on cash flow due to favorable stock market performance and capital gains realized during this period.

Benchmark surplus is assigned a yield that is tied to the risk-free rate with a reduction to reflect normal overhead (e.g., plant and equipment). The residual surplus yield is that which remains from all other sources of investment and other income and will be affected by items such as

investment in common stocks, lower quality bonds, and tax-free investments. Total investment income from cash flow, benchmark surplus, and residual surplus will equal total portfolio yield.

A methodology is suggested for determining benchmark rates of return for state regulatory purposes, consistent with the management of solvency risk. Risk-free investments and controlled benchmark leverage standards are utilized in order to safeguard policyholder funds. The resultant benchmark return differs from actual total return, which is based on reported income and surplus. In this context, the risks and rewards of investment and capital management policies are borne entirely by the owners of the company and reflected in the total company return.

Section 2 introduces the concepts beginning with a simplified example which considers the timing effect of paid losses only. That is, premium and expense are assumed to be settled at the beginning without delay. Discounted return is defined and this example is used to demonstrate the calculations of return on premium and return on surplus. The concept of an underwriting target is also introduced. The example is then expanded to include a discussion of other time related sources of investment income. The establishment of benchmark surplus and the determination of investment yield on operating cash flow versus benchmark and actual surplus is discussed. Finally, the application of this methodology to the prospective rating process is reviewed.

Section 3 applies these concepts and the detailed methodology to historical industry statutory data from 1983 to 1988. Funding requirements are established and the development of investment yields for cash flow and surplus are presented. Actual line of business rates of return and implied target combined ratios are discussed.

The following brief summary, extracted from Table 5, displays the historical pattern of returns and combined industry all lines statutory results.

TABLE 2

HISTORICAL STATUTORY INDUSTRY EXPERIENCE

Accident Year	Combined Ratio	Benchmark Return	Total Return	Calendar Year Return
1988	104.2%	13.4%	15.3%	13.1%
1987	101.7	13.2	18.4	15.1
1986	104.2	8.6	19.3	15.1
1985	119.2	−0.2	5.0	8.0
1984	122.8	1.5	2.2	6.7
1983	118.5	2.2	5.2	11.1
1983 to 1988	119.9%	7.7%	12.1%	12.1%

This analysis, while based on approximations, demonstrates the large swing in returns over the period from 1983 to 1988. The accident year returns are more extreme than those of the calendar years. The benchmark return methodology, due to the "risk free" investment policies, provides some added stability in the measurement of accident year returns. Over the composite six-year period, it is estimated that the accident year return on benchmark statutory surplus was 7.7%, 4.4 points lower than the estimated 12.1% return on total statutory surplus with actual investment results. Returns by any measure over the past six years have been below other industry standards.

Target combined ratios based on 1988 investment yields and expense levels, extracted from Table 6, are shown below. Personal Automobile and Workers Compensation, for example, are more than 7 and 9 points, respectively, above the levels which would produce a 15% benchmark return.

TABLE 3

	Industry Combined Ratios		
	Target for 15% Benchmark Return	Accident Year 1988	Composite 1983 to 1988
Personal Automobile	99.9%	107.1%	108.4%
Total Personal Lines	99.9	105.7	106.8
Commercial Automobile	100.8	100.3	110.0
Workers Compensation	106.5	115.9	119.9
Total Commercial Lines	105.8	103.1	112.4
Total All Lines	103.2	104.2	109.9

Appendix A presents additional discussion and formulae. The treatment of cash flows, specifically the tax law timing items, and the issue of "surplus" surplus (i.e., surplus greater than might be deemed necessary to support premium writings) is discussed. Two specific technical issues are discussed as well: the discounting of reserves and other balance sheet items, and the relationship of the presented methodology to internal rate of return (IRR).

An overview of the Hartford's discounted return methodology and its key features is presented in outline form below.

Outline of Hartford Insurance Group's Approach to Total Return

Accident Year Basis

Components of Total Return
- Underwriting
- Investment income on underwriting cash flow (float)
- Investment income on insurance/benchmark surplus
- Investment income on shareholder/residual surplus

Discounted Operating Return (excluding surplus)
- Underwriting income
- Present value of investment income from five components
  - Premium collection
  - Loss payment
  - Expense payment
  - Tax prepayment due to unearned premium reserve offset
  - Tax prepayment due to loss reserve discounting
- Fixed assumptions for given accident year

Management of Solvency Risk and Protecting Policyholder Funds
- Asset/Liability duration matching
- Discounting at risk-free treasury rate; independent of asset yields, and at tax rate of 34%
- Investment yields variable by line of business

Insurance/Benchmark Surplus Versus Shareholder/Residual Surplus (Equity)
- Setting benchmark surplus
- Funding basis
- Volatility adjustment
- Benchmark surplus investment yield
- Residual surplus and investment yield

Return on Benchmark Surplus Versus Return on Total Surplus
- Rate of return regulation on benchmark basis
- Shareholder risk, investment and capital management policies, and total return

Alternative Minimum Tax and Changing Tax Rates

2. DISCOUNTED RETURN

What is Discounted Return?

The term statutory underwriting results generally means the current estimate of the ultimate cash values of premiums, losses, and expenses for a given year. Because the magnitude and timing of these cash flows are quantifiable, the investment income to be achieved can be estimated. This investment income, together with underwriting income, produces total operating income.

The concept of discounting involves the recognition of the time value of money. For example, if we had to pay someone $105 next year, we would invest only $100 at a 5% interest rate today to satisfy that obligation. There is $5 worth of value (from investment income) in the one year delay of payment.

This principle of time value applied to insurance says that premiums are worth less to us, due to delay in collection, while expenses and losses cost us less, since payments are paid at some future time. We lose investment income on premiums while we gain investment income on expenses and losses.

Discounted return joins the two concepts by attempting to determine the ultimate financial performance of a year, resulting from both underwriting and investment, valued at the time of the year's exposure. For instance, if the discounted profitability of a book of business is determined to be $1,000, then this means the value of this business is $1,000 at the time it was written.

How It Works: Nominal (Ultimate Cash Amounts) vs. Discounted Return

It is important to understand the relationship between nominal and discounted results. To illustrate this relationship and demonstrate the concepts, the following simplified example will be used:

- Premium of $1,000,
- Expense of $300,
- Loss of $800, to be paid at the end of 2 years,
- Interest rate of 10% before tax, 6.6% after tax for both years.

To simplify the example, it is assumed that no delay in collecting premium or paying expenses exists. The premium offset and loss discounting provisions of the tax law are also ignored.

In this example, underwriting losses are $100 before tax. The after-tax underwriting losses of $66.00 and investment income of $48.44 produce a first-year nominal loss of $17.56. Investment income in the second year is $51.64, resulting in a cumulative nominal income of $34.08 after two years. The present value of the $34.08 is $30.00 on a basis discounted to the beginning of the first year. This is determined by dividing $34.08 by 1.066 squared, that is, discounting for two years.

The discounted profitability of $30.00 is equivalent to the $34.08 that is expected in retained earnings at the end of two years. For example, if $30.00 were in the bank, it would grow to $34.08 in two years, compounded at 6.6%.

Important smoothing of income is achieved by using the discounted calendar year as compared to the nominal calendar year. The nominal calendar income, which begins with a loss of ($66.00) reaches ($17.56) at the end of year 1 and achieves a gain of $34.08 at the end of year 2. The discounted calendar income begins at $30.00 and reaches $31.98 and $34.08 at the end of years 1 and 2, respectively. While the ending retained earnings value is identical, the yearly calendar flows do not provide as clear a picture of profitability.

The $30 discounted calendar year profit from below is the operating income for this business. The underwriting income and investment income is limited to only cash flow sources related to the business; investment income from surplus is treated separately. This discounted operating income then, by convention, consists of nominal underwriting income plus the investment income credit, both after-tax:

$$\text{Discounted Operating Income} = \text{Underwriting Income} + \text{Investment Credit.} \qquad (2.1)$$

ILLUSTRATION 1

NOMINAL AND DISCOUNTED INCOME EXAMPLE

	At Beginning of 1st Year	At End of 1st Year	At End of 2nd Year
Nominal Income Before Tax			
Underwriting	($100.00)	$ —	$ —
Investment from Loss Reserves	—	80.00	80.00
from Retained Earnings	—	(6.60)	(1.76)
Nominal Income After Tax			
Underwriting	(66.00)	—	—
Investment from Loss Reserves	—	52.80	52.80
from Retained Earnings	—	(4.36)	(1.16)
Nominal Balance Sheet			
Loss Reserves	800.00	800.00	0
Retained Earnings	(66.00)	(17.56)	34.08
Net Income			
Nominal	(66.00)	(17.56)	34.08
Discounted	30.00	31.98	34.08

The investment income credit is the present value of the investment income derived from the investment of loss reserves. This is normally determined directly by formula to avoid the need of calculating yearly cash flows as we did above. Since the average payment (in this example, the only payment) is delayed two years, the following formula is used:

$$\begin{aligned} \text{Investment Credit} &= (1 - 1/(1 + r^N)) \times \text{Loss} \\ &= (1 - 1/(1.066^2)) \times \$800 \\ &= \$96 \end{aligned} \qquad (2.2)$$

The present value of the investment income from loss reserves is $96. The discounted operating income is Underwriting Income + Investment Credit = ($66) + $96 = $30. This answer is identical to the figure produced from the more detailed calculations in Illustration 1.

Calculating ROP and ROS

Once the dollars of income have been determined, it is desirable to express them as a measure of return. The first of these is Discounted Operating Return, defined as discounted operating income as a percentage of premium. In our example, ROP is $30 ÷ $1,000, or 3%.

$$\text{Discounted Operating Return } (ROP) = \text{Discounted Operating Income/Premium.} \quad (2.3)$$

Total income includes investment income on surplus-related assets in addition to operating income. Surplus-related assets are the residual invested assets that remain after all operating liabilities are funded. That is, invested assets must first be "put aside" to pay out loss reserves and other liabilities. Only the remaining, uncommitted invested assets produce investment income for surplus purposes.

Surplus is considered in total at this time, with benchmark surplus to be discussed later. Also, the determination of funding requirements plays a key role in the actual process of performance measurement and target setting (also to be discussed later).

Although total income can be related to premium in order to produce a return on premium figure, normally total income is expressed as a percentage of surplus (equity). If investment income on uncommitted assets equates to 6.0% of surplus, when operating at a 2 to 1 premium to surplus ratio, the *ROS* is calculated as follows:

$$\text{Return on Surplus } (ROS) = \text{Operating Return} \times \text{Premium/Surplus Ratio} + \text{Yield on Surplus}$$
$$= 3\% \times 2 + 6.0\% = 12.0\% \quad (2.4)$$

Setting Targets

Selection of an appropriate *ROS* target requires an assessment of the risk/return relationship for a line of business. After this has been evaluated, the process of setting targets involves determining what combined ratio will produce the desired *ROS*. In the simplest terms, the loss figure that will result in the target *ROS*, when fed through the calculations described above, is "backed into."

Suppose the goal is to achieve an *ROS* of 15%. Then it is necessary to determine what level of loss will result in this return. Continuing with the earlier example, it is known that the $800 loss figure (loss ratio of 80% and combined ratio of 110%) is too high since the *ROS* is 12.0%. With a little bit of math, it is determined that a loss of $772.22 (loss ratio of 77.2% and combined ratio of 107.2%) will produce an *ROS* of 15%.

Current Applications at the Hartford

The discounted return methodology is being used today to both measure returns and set targets. Historical returns are measured by line of business throughout the year and over each planning time horizon using the formula approach described. Targets are being determined by this approach as well. In addition, the more detailed approach using specific multi-year cash flows is being applied to specific business programs and large accounts.

The methodology is also being used in the development of prospective rates. Most of the required components are developed as part of the traditional rating process. The prospective underwriting view, which includes a contingency margin, together with the additional assumptions on interest rates and benchmark leverage, lead directly to the determination of an expected rate of return.

Several other factors are considered in this process beyond the simple case illustrated and will be discussed. They do not change the basics discussed so far.

In Practice

The illustration presented above is a simplification. Several other factors are considered when this methodology is applied to actual experience or in prospective rating.

Other Cash Flow Sources of Investment Credit

Five basic cash flow components are considered to impact total investment income. In addition to payment of loss revenues, they are: premium collection, expense payment, and prepayment of tax due to both loss discounting and the 20% unearned premium offset. These latter two are products of the new tax law and result in a loss of investment income. Premium collection delays also result in a loss of investment income while expense payment delays result in a gain of investment income.

Benchmark Leverage

Three sources of insurance company risk are: insurance, investment and solvency. Insurance risk, derived from both the activities of underwriting and the investing of underwriting cash flows, will principally be a function of underwriting if the investment of underwriting cash flows is at a "risk-free" rate where maturities match liabilities (i.e., loss payouts). This investment approach essentially isolates the total operating income from the effects of investment policy and market volatility.

Investment risk is a function of company investment policy concerning types of investments and maturities, which gives rise to yield and default risks and related volatility.

Solvency risk is the exposure of surplus to both insurance (underwriting) and investment risk. The magnitude and volatility of underwriting losses, along with fluctuating investment results with their associated probabilities, are key determinants of this risk.

An important aspect of total return and management of solvency risk lies in determining the proper level of surplus. Surplus should be a function of two factors:

1. The degree and magnitude of financial exposure. This is essentially the amount and length of time over which funds are committed to the insurance operation of a respective line of business, and
2. The degree of volatility in the loss/combined ratio which will establish the prudent amount of surplus required to guard against the probability of ruin.

The approach developed determines funding requirements by line of business to address the first aspect of financial exposure. Surplus is set initially in direct proportion to funding requirements (i.e., money at risk). Judgemental evaluation of the relative volatility of a line of business, to reflect characteristics such as catastrophes, is then incorporated to arrive at a final benchmark leverage.

Statutory policyholder surplus should be the reference basis upon which the benchmark standards are established, since this is the most readily available and is consistent across all companies.

Yields on Operating Cash Flow vs. Surplus

It is important to distinguish among investment yields on operating cash flow, benchmark surplus, and residual surplus. In order to protect policyholder funds and permit market pricing, operating cash flows are assumed to be invested in current fixed income-producing treasury assets, with yields varying by line of business and maturities related to length of payout. Benchmark surplus is assumed to be invested at approximately 90% of the average operating cash flow rate, a reduction for normal noninvested overhead. Other aspects which affect overall yield are reflected in the residual surplus yield so that the total income from both cash flow and all surplus assets when combined will equal the total portfolio yield.

Items which are part of the residual surplus yield determination include realized capital gains, other income, investment in lower-yielding common stock and real estate, adjustments for nonearning assets, and allowance for tax-oriented investment policies aimed at maximizing after-tax income.

GAAP equity versus statutory surplus issues would not affect the benchmark return previously calculated. Total return is calculated after combining both benchmark and residual surplus investment income and is stated as a percentage of total surplus. This total would be the equity as defined by a given company.

Application to Rating

The discounted return methodology is integral to the rating process since it estimates the expected ultimate total return from both underwriting and investment income to be realized from the business under review, measured in today's dollars. The approach presented provides for the calculation of a rate of return coincident with any prospective rate, consistent with the objective of managing solvency risk, and protecting policyholder funds.

Tax Law

The approach utilizes the corporate tax rate effective at the time the business was written (now at 34%). This applies to underwriting and investment income on cash flow and benchmark surplus, since these are assumed to be invested in risk-free Treasurys, which are taxable. Nontaxable investments will affect only the residual surplus yield and the total return, but not benchmark return.

Although we don't know what future revisions may be made in the tax law, existing law should be reflected in the measurement of historical returns. Accident year 1986, for example, would now have a discounted return that is different than originally planned even if all underwriting and investment assumptions held true. The after-tax return would differ due to the tax rate change and its effect on subsequent calendar year investment income derived from the 1986 accident year loss reserves.

The alternative minimum tax (AMT) must also be considered with allowances made for different tax rates and a redefinition of taxable income when this occurs. In the methodology presented, 20%, rather than the 34%, would be used to determine the benchmark return if the AMT were applicable.

3. APPLICATION TO HISTORICAL INDUSTRY DATA

The objective of this section is to demonstrate the application of this methodology by utilizing 1988 industry annual statement data. Only approximate estimates of reserve strengthening and average delay in collection of premium and payment of loss and expense have been made since the focus here is on the presentation of the methodology. The magnitude of reserve weakening from 1983 to 1985, and strengthening from 1986 to 1988, is fairly substantial and greater than previous cycles due primarily to reinsurance recoverables.

Full realization of the investment income credit (i.e., present value of investment income on all cash flows) requires a specific level of funding based on the volume and mix of business written. Funding is the present value equivalent that is invested to produce the investment income credit. This is determined first using the formulas shown in Appendix D.

In order to determine benchmark and total return, investment income in excess of that produced by operating cash flows must also be considered. It is therefore necessary to look at total investment income and reported total surplus to determine this residual after funding is established. This is also shown in Appendix D.

The results of this approach are summarized for personal and commercial lines in the following Table 4. The industry's 1988 statutory data and the Insurance Expense Exhibit as published by A. M. Best are the basis for this analysis.

It should be noted that the application is required by line of business. Funding and discounting, for example, are affected by loss payout. Surplus allocation is based on relativities derived from a simultaneous evaluation of all lines of business using the volatility-adjusted funding approach, with the total benchmark leverage set at 2 to 1. These benchmark leverage standards are not discussed in detail here since their development involves some subjective judgement. They are sufficiently reasonable to serve in the demonstration of the methodology.

TABLE 4

1988 ACCIDENT YEAR ALL LINES FUNDING AND INVESTMENT CREDIT
(ASSUMED AVERAGE 8% PRETAX INTEREST RATE)

($BILLION)

Committed Assets for Liability Funding	Nominal Value	Years Avg Lag	Nominal Balance Sheet	Discounted Balance Sheet	Investment Credit
Personal Lines					
Premium	85.7	.17	−14.3	−13.9	−.7
Expense	22.1	.17	3.7	3.6	.2
Loss	68.6	1.38	94.5	89.0	4.3
Tax Law:					
Unearned Prem. Res. Offset			−2.9	−2.8	−.1
Loss Discounting			−2.8	−2.7	−.1
Commercial Lines					
Premium	113.9	.25	−28.5	−27.6	−1.5
Expense	32.6	.25	8.1	7.9	.4
Loss	84.8	3.11	264.1	232.5	12.6
Tax Law:					
Unearned Prem. Res. Offset			−3.9	−3.7	−.2
Loss Discounting			−14.4	−12.8	−.7
Total All Lines					
Premium	199.6	.21	−42.8	−41.5	−2.1
Expense	54.7	.22	11.8	11.5	.6
Loss	153.4	2.34	358.6	321.5	16.9
Tax Law:					
Unearned Prem. Res. Offset			6.8	−6.5	−.3
Loss Discounting			−17.2	−15.5	−.8
Net Funded Liabilities and Investment Credit			303.6	269.5	14.2
Yield (after tax)					5.3%
Funding Equity				34.1	1.9
Benchmark Surplus			99.8	99.8	4.7
Yield (after tax)					4.8%
Residual Surplus			11.3	11.3	1.8
Net Other Assets/Liabilities			−33.4	−33.4	0
Total Statutory Surplus			111.1	111.1	8.4
Yield (after tax)					7.5%
Cash & Invested Assets			381.3	381.3	22.6
Yield (after tax)					5.9%

It is assumed that all insurance liabilities are fully funded and that only the remaining balance of invested assets is available for surplus-related investment income. In this case, the total (average) statutory cash and invested assets is $381.3 billion, which produced investment income of $22.6 billion. Assets are committed for insurance liability funding for premium (agents' balances viewed as a negative liability), expense payable, loss reserves, and tax law prepayment due to the unearned premium offset and loss reserve discounting. These latter two are also viewed as negative liabilities.

Fixed income treasury market yields have been used to discount the accident year and to determine investment income on funding. These yields average 4.9% and 5.4% after tax, respectively, for personal and commercial lines. Yield curves are used to produce various yields by line assuming an approximate match of investment period with liability payout.

The investment of funds committed to support policyholder liabilities in risk-free Treasurys with maturities matching liability payout essentially eliminates investment and interest rate risk as a factor affecting operating return.

Balance sheet loss reserves (in billions of dollars) are estimated at $358.6 nominal, and $321.5 discounted. Total insurance liabilities to be funded are $303.6 nominal and $269.5 discounted. Invested assets of $269.5 produce an investment income credit of $14.2, for an overall 5.3% average yield. This is based on an average 2-year treasury bill yield of 8% pretax for 1988.

Restated, we need to set aside $269.5 to fund ultimate liabilities of $303.6, which will produce $14.2 of investment income credit on a present value basis. This calculation recognizes the timing of premium, loss, expense, and tax flows and related investment income, on an after-tax basis.

All remaining assets are viewed as uncommitted. Benchmark surplus is established first at an overall 2 to 1 basis, with its yield set at 90% of the cash flow yield, or 4.8%, to adjust for normal noninvested overhead. All investment income on residual assets (after deduction of the benchmark surplus), as well as other income, is related to the residual surplus.

Since surplus is considered to be invested uniformly for all lines, investment income produced on these uncommitted assets is assumed to be at a fixed rate and not variable by line of business.

For convenience, the combined benchmark and residual surplus and related investment income are used in the calculation of total return. The equity due to discounted funding of $34.1 ($303.6 less $269.5) is also considered to be shareholder equity on a discounted basis and income on this is credited to residual surplus. The resultant discount-based total surplus yield is 7.5%.

This yield will fluctuate in comparison to the yield applicable to funding and reserve discounting since it is affected by investment policy. Stock investment is particularly influential in this regard since it brings lower dividend yields, but potentially significant, although erratic, capital gains. The level of invested assets in relation to required funding, especially impacted during periods of substantial business growth, is also a key factor in determining this yield. Increased business writings require the commitment of more funds, leaving relatively fewer residual invested assets to produce investment income for surplus.

It is important to note that all investment income is included in this approach. This methodology has simply determined the allocation of investment income among operating cash flows, benchmark surplus, and residual surplus.

The industry's estimated 1988 statutory discounted operating income is:

$$\begin{aligned} \text{Discounted Operating Income} &= \text{Underwriting Income} + \text{Investment Credit} \\ &= (\$5.6) + \$14.2 = \$8.6 \end{aligned} \tag{3.1}$$

Estimated discounted operating return is:

$$\begin{aligned} \text{Discounted Operating Return} &= \text{Discounted Operating Income} / \text{Premium} \\ ROP &= \$8.6 / \$199.6 = 4.3\% \end{aligned} \tag{3.2}$$

Estimated return on benchmark surplus is:

$$\text{Return on Benchmark Surplus} = ROP \times \text{Premium} / \text{Benchmark Surplus} + \text{Benchmark Surplus Yield}$$
$$BROS = 4.3\% \times 2.0 + 4.8\% = 13.4\% \quad (3.3)$$

Estimated return on total surplus is:

$$\text{Return on Total Surplus} = ROP \times \text{Premium} / \text{Surplus} + \text{Surplus Yield}$$
$$TROS = 4.3\% \times 1.8 + 7.5\% = 15.3\% \quad (3.4)$$

Table 5 summarizes six years of historical industry returns. Approximate assumptions were made as to the degree of reserve strengthening in each year to estimate accident year results. The changing tax law and effective tax rate differences in 1986 and 1987 have been considered.

The accident year returns exhibit more extreme swings over the period as compared to published calendar year returns. The benchmark returns provide some stability, since they are not influenced by capital gains, as are the total returns.

It is worth noting that the returns by any of the measures have been poor over the six-year period. The composite benchmark return has been 7.7% over this period, compared to the total return of 12.1%. The calendar year reported composite is also 12.1%.

Line of Business Targets

Target combined ratios, based on the achievement of a 15% return on benchmark surplus, are shown in Table 6 by line of business. These targets have been developed utilizing the investment yields and expense levels from 1988. Personal lines accident year combined ratios would have to improve (from the 1988 105.7 ratio) by nearly 6 points to 99.9 in order to achieve a return of 15% on benchmark surplus. Commercial lines returns in total, on the other hand, have improved dramatically from the unprofitable experience of earlier years and are at reasonable levels, although cumulatively still below a long run 15% average. Some specific lines still lag substantially behind.

TABLE 5

INDUSTRY STATUTORY RETURNS

Year	Line of Business	Cash Flow Yield (Before Tax)	Acc. Year Comb. Ratio	*ROP*	Benchmark Prem/ Surplus	*BROS*	Total Prem/ Surplus	*TROS*	Cal Year *TROS*
1988	Personal	7.4	105.7	0.4	2.8	5.8	2.5	8.4	
	Commercial	8.2	103.1	7.3	1.7	16.8	1.5	18.4	
	Combined	8.0	104.2	4.3	2.0	13.4	1.8	15.3	13.1
1987	Personal	7.0	103.9	0.6	2.8	5.7	2.7	11.3	
	Commercial	7.7	100.1	7.5	1.7	16.5	1.6	21.5	
	Combined	7.5	101.7	4.6	2.0	13.2	1.9	18.4	15.1
1986	Personal	6.5	107.0	−1.0	2.8	0.5	2.7	11.4	
	Commercial	7.2	102.0	5.3	1.7	12.2	1.6	22.8	
	Combined	7.0	104.2	2.6	2.0	8.6	1.9	19.3	15.1
1985	Personal	8.7	111.8	−2.5	2.7	−2.0	2.5	3.3	
	Commercial	9.7	125.7	2.4	1.6	0.7	1.6	5.8	
	Combined	9.5	119.2	−2.4	2.0	−0.2	1.9	5.0	8.0
1984	Personal	10.5	108.2	0.4	2.6	6.6	2.3	6.7	
	Commercial	11.8	136.8	−4.4	1.6	−1.6	1.4	−0.6	
	Combined	11.5	122.8	−2.0	2.0	1.5	1.8	2.2	6.7
1983	Personal	9.2	105.6	0.9	2.6	7.3	2.2	9.5	
	Commercial	10.2	130.9	3.5	1.6	−0.9	1.4	2.7	
	Combined	10.0	118.5	−1.3	2.0	2.2	1.7	5.2	11.1
1983 to 1988 Composite	Personal		106.8	0.2	2.7	4.0	2.5	8.6	
	Commercial		112.4	3.1	1.7	9.5	1.5	13.9	
	Combined		109.9	1.6	2.0	7.7	1.8	12.1	12.1

TABLE 6

TARGET COMBINED RATIOS FOR 15% BENCHMARK RETURN
(BASED ON 1988 INVESTMENT AND EXPENSE LEVELS)

Line of Business	Cash Flow Yield BT	Payment Lag			Expense Ratio	Target Comb. Ratio	*ROP*	Benchmark	
		Prem	Exp	Loss				Prem/ Surp	*BROS*
Homeowners	7.3	.17	.17	1.25	32.0	99.7	3.2	3.2	15.0
Per Auto Liab.	7.5	.17	.17	1.75	24.1	101.0	4.5	2.3	15.0
Per Auto PhyD.	7.3	.17	.17	.75	24.2	98.4	2.8	3.6	15.0
Total Per Auto		.17	.17	1.34	24.2	99.9	3.8	2.7	15.0
Com Auto Liab.	7.8	.25	.25	2.50	28.3	102.5	5.7	1.8	15.0
Com Auto PhyD.	7.3	.25	.25	.75	30.0	97.0	3.2	3.2	15.0
Total Com Auto		.25	.25	1.97	28.8	100.8	4.9	2.1	15.0
Workers Comp.	8.0	.25	.25	3.00	24.5	106.5	5.7	1.8	15.0
Other Liab.	8.8	.25	.25	5.50	23.6	119.4	9.5	1.1	15.0
Medical Liab.	9.0	.25	.25	6.50	13.9	136.7	9.5	1.1	15.0
Com F & Allied	7.3	.25	.25	1.25	36.5	99.6	2.8	3.6	15.0
Com Multi Peril	7.6	.25	.25	2.00	36.1	98.5	5.7	1.8	15.0
Other	7.6	.25	.25	2.00	31.7	99.1	5.7	1.8	15.0
Personal	7.4	.17	.17	1.32	25.8	99.9	3.7	2.8	15.0
Commercial	8.2	.25	.25	2.94	28.6	105.8	6.2	1.7	15.0
All Combined	8.0	.21	.21	2.24	27.4	103.2	5.1	2.0	15.0

It is important to note that many of the assumptions used in determining these targets are rough approximations for the purpose of demonstrating the methodology. In particular, personal lines and commercial lines premium collections and expense payments are assumed to lag two months and three months, respectively.

Individual company application of this methodology would require determination of the applicable cash flow patterns and modification of the benchmark leverage to reflect unique characteristics of that company's business.

In summary, determination of this target combined ratio requires simply the following input assumptions:

- Expense ratio
- Investment yield (Treasurys)
- Average premium, expense, and loss payment dates
- Benchmark leverage
- Target benchmark return

These should, of course, reflect unique company and state characteristics.

REFERENCES

[1] B. Bunner and D. Wasserman, "The Dynamics of Risk and Return Under California's Proposition 103," *Underwriter's Report,* June 15, 1989.

[2] R. P. Butsic, "Determining the Proper Interest Rate for Loss Reserve Discounting: An Economic Approach," *Evaluating Insurance Company Liabilities,* Casualty Actuarial Society Discussion Paper Program, May, 1988.

[3] S. C. Myers and R. A. Cohn, "A Discounted Cash Flow Approach to Property-Liability Insurance Rate Regulation," *Fair Rate of Return in Property-Liability Insurance,* Kluwer-Nijhoff, 1987.

[4] R. Woll, "Insurance Profits: Keeping Score," *Financial Analysis of Insurance Companies,* Casualty Actuarial Society Discussion Paper Program, May, 1987.

[5] Study of Investment Income, Supplement to the *Proceedings* of the NAIC, 1984, Volume II.

APPENDIX A

SUPPORTING DETAIL AND FORMULAS

Analysis of financial performance is best accomplished on a discounted accident period basis. This presents the truest picture of business being written since the present values of all cash flows are considered, regardless of which calendar period they are reported in. The results may appear quite different than calendar year results viewed on a nominal basis, which are affected by reserve adjustments, underwriting, and investment results attributable to prior accident years.

A detailed model can be used to portray the exact cash flows for a given accident year, and would include items such as the loss payout in subsequent calendar years. Formulas are shown in Appendices B, C, and D which closely approximate such exact model results but provide a much simpler means of application in practice. In these formulas, it is assumed that premium, loss and expense are paid on a single payment date.

In practice, not much accuracy is sacrificed by using average payment date; for that reason, the formulas are presented using average dates. Furthermore, it is assumed that taxes are incurred and paid on underwriting at the beginning of the year without delay. Tax on investment income is paid without delay also. All discounting is as of the beginning of the year.

The same approach used for losses is applied to premium and expense. It should be noted, however, that premiums received late (positive payment lag) or expenses paid early (negative payment lag) will result in a reduction of funding. The tax law timing items—loss discounting and unearned premium offset—are considered to be reductions to funding since credits are to be received at a date in the future.

Industry or company specific cash flow patterns, if credible, can be utilized. This is similar, for example, to the loss discounting approach under the present tax law with regard to loss payout.

Tax Law Timing Items Viewed as a Reserve

The two tax law timing items, the loss discounting and 20% unearned premium offset, are viewed as analogous to losses in terms of their time value effect. When considered as a "loss discount tax reserve" and an "unearned premium tax reserve," parallels to loss reserves are drawn.

Loss reserves are the reserve liabilities which are invested until payments are made. The loss discount tax reserve is the prepaid tax which is paid due to loss discounting and is reduced as recoveries are achieved through successive period discounting. Loss discounting is viewed in this manner as a negative loss reserve with recovery payments resulting in an ending reserve of zero. This negative reserve is invested and produces negative investment income. The unearned premium tax reserve is similar except that the recovery occurs in the following year and the negative investment income is for one year only. All taxes are assumed paid when incurred.

Reconciliation of Nominal and Discounted Income for a Single Year

When following the flows for a single accident year until settlement of all losses, it is possible to provide an exact reconciliation of nominal and discounted results. The nominal ending retained earnings after the settlement of all cash flows for a given year is the total return from underwriting and all investment income. This value, discounted back to the present, will equal the accident year discounted operating return. This is calculated by adding underwriting income and the investment credits from premium, expense, loss, loss discount tax reserve, and unearned premium tax reserve.

Funding

Funding plays a key role in the methodology. Funding is the amount of assets/liabilities that are needed to support a particular level of business. Specifically, it is defined as the present value equivalent in assets that are required to produce the present value of investment income from all future cash flows. Funding is based on the magnitude of the cash flows and the length of time that it takes to settle them, summed across all flows after discounting to present value.

Funding is a beginning point in the establishment of leverage as it provides a measure of the amount of funds committed when writing a line of business—a basis for assigning surplus (before adjusting for volatility). Total funding across all lines of business determines the total invested assets that must be committed by a company to support all writings. The remaining investment assets determine the residual surplus yield.

Surplus Runoff

The need for benchmark surplus remains beyond the initial year that the business is written. It is suggested that surplus committed to support the business be allowed to run off in proportion to the reduction in funding over time. Since loss reserves are the primary long-term user of funds, then consequently surplus should run off as loss reserves decline to zero.

Surplus Surplus and Related Investment Income

In practice, a company operates each year with a beginning reported surplus that results from several factors including past results, dividend payout policy, and debt/equity capital management policies. Also, some of the assets are not income-producing investments. The approach recognizes actual invested assets and accepts the surplus as given.

By introducing benchmark leverage and the associated policyholder risk minimization investment principles, however, the state rate of return calculations can be divorced from reported actual returns. Both the investment income and surplus (or equity) bases differ between the benchmark and reported returns. In this sense, the concept of surplus surplus is irrelevant to the determination of rate of return for state regulatory purposes.

The relationship of invested assets, required funding, and actual surplus is an important one. During periods of rapid growth, funding demands can "use up" invested assets. The result is a reduced yield on residual surplus since relatively fewer invested assets remain to produce residual income.

Technical Issues

Discounting

Discounting (primarily of loss reserves) has gained prominence due to the increasing recognition that much of insurance profitability involves investment income derived from the delay in paying losses subsequent to the collection of premium. Certainly investment income has become increasingly important to insurance industry total returns.

Discounting is viewed as a means of determining the value inherent in balance sheet assets. A discounted loss reserve, for example, is felt to represent the true ultimate liability of losses in present dollars, that is, the amount of money that needs to be set aside to pay ultimate losses. The difference between this discounted reserve and the nominal (i.e., reported) reserve is thus considered company, or shareholder, equity.

Unfortunately, several other items having significant cash flow (and investment income) impact are usually ignored. Agents' balances and reinsurance recoverables, for example, are two important ones. A complete valuation solution requires that a discounted balance sheet be determined in parallel to the present nominal balance sheet in which all items are considered. Focusing on loss reserves only and attempting to introduce this discount into the nominal balance sheet is not sufficient, and perhaps misleading. Also, market valuation of assets is equally important.

The treatment of taxes with respect to loss discounting is a particular problem. The difficulty of handling taxes is often glossed over, if discussed at all. A pretax discount factor is often used and a vague statement made as to the need to "tax effect" the result. Unfortunately, a pretax discount factor will produce an overstated discount equity.

Consider a loss payable in one year of $1,000. If the pretax discount rate is 10%, then the $1,000 reserve discounted for one year will be $909.09, with an apparent discount equity of $90.91. If $909.09 is invested for one year at 10%, however, the $90.91 in investment income must be taxed, leaving an insurance company short of the $1,000 required to pay the claim.

The correct amount is determined by discounting the reserve at the after-tax rate of 6.6%, assuming a 34% tax rate, and also applying the loss discount provision of the tax law. The discounted reserve then will be $938.09, which invested at 10% for one year and taxed at 34% will produce exactly the $1,000 needed to pay the claim, excluding the effect of the discount provision. The reserve discount equity is $1,000 minus $938.09, or $61.91—the investment credit defined earlier. With recognition of the tax law discounting provision, this is reduced to $60, the net investment credit attributable to loss reserves. This is the true equity in the reserve.

RESERVE DISCOUNT EQUITY
$1,000 LOSS PAYABLE IN GIVEN NUMBER OF YEARS
WITH 10% PRETAX DISCOUNT, 34% TAX RATE

	Number of Years		
	1	2	3
After-Tax Based Discounted Reserve	938	880	825
Discount Equity			
—Before Tax Loss Discounting	62	120	175
—Including Tax Loss Discounting	60	114	164
Pre-Tax Based Discounted Reserve	909	826	751
Discount Equity	91	174	249
After Tax at 34%	60	114	164

It should be noted that use of a pretax discount with subsequent taxing of the discount will produce the identical discount equity, as long as the tax law discount rate and payout pattern equals the actual investment rate and payout. This was not true prior to introduction of the loss discount provision of the tax law.

Internal Rate of Return (IRR)

Internal rate of return is sometimes used to determine the "value" of insurance from the shareholder perspective. It essentially provides a single measurement, via the IRR, which indicates the rate of return on shareholder capital over a period of time produced from the net capital flows.

The IRR has inherent limitations, due to its simplicity, that reduce its value in comparison to the discounted return, or net present value, approach. The IRR approach is unable to distinguish between different accident years and/or different types of cash flows and yields. Each accident year should be viewed as a unique entity (much as an individual project in manufacturing), in which each year's characteristics dictate initial benchmark surplus needs and subsequent runoff as this need diminishes. The release of benchmark capital is thus related to the respective accident year operating flows. In addition, operating cash flow and surplus should be viewed as fundamentally different, in terms of cash flow pattern, related invested assets, and yields produced from these invested assets.

By its very definition, the IRR is a single number which represents an overall return from net calendar period capital flows, without recognition of different accident year or cash flow components. The IRR, furthermore, can be altered by arbitrary capital withdrawal (i.e., dividend payment) policies. The discounted return, a specific measurement of profit, is not subject to such alteration.

If the IRR methodology is applied by accident year and capital is withdrawn as liabilities are settled, then the results will be essentially the same as the discounted return methodology. If a single accident year is analyzed and capital is released only after all operating cash flows are settled, the following formula demonstrates the relationship between the IRR and yields applicable to operating cash flow and surplus as used in the discounted return methodology.

$$\text{Ending Capital} = S(1 + \text{IRR})^N = S(1 + R_S)^N + OR(1 + R)^N,$$

where

S = Beginning Surplus,
R_S = Surplus Yield,
OR = Discounted Operating Return,
R = Cash flow yield,
N = Year in which last flows are settled.

Risk Adjustments and Differing Cash Flow Yields

The yield applicable to operating cash flows discussed in this paper has not differentiated between the components of this flow nor have risk adjustments been made. In certain situations the yields applicable to the flows should be different and adjusted for added risk. Yields applicable to retrospective loss rated premiums, for example, should reflect the added credit risk associated with the substantial collection delays. Another example is in the treatment of reinsurance where credit risk adjustments are appropriate both in the premium and loss areas.

Appendices B, C, and D

Appendix B presents further detail on general definitions and formulas, and Appendix C presents the formulas for the loss discount investment income credit when actual payouts and yields differ from the tax law.

It should be noted that the difference between actual yield and that assumed under the tax law has a greater effect than do payout differences. Even though a loss may be modeled on a single payment date, the loss discount is not recovered on a single date but rather as dictated by successive year discounting.

Appendix D summarizes all formulas in tabular form, on both a nominal and a discounted basis. Although this paper has focused on a discounted basis for valuation, a further understanding of the methodology is achieved by considering the parallel nominal balance sheet and income statements.

APPENDIX B

GENERAL DEFINITIONS AND FORMULAS

Underwriting Income = $(P - E - L)(1 - T)$,

where P = Premium, E = Expense, L = Loss, T = Tax Rate

Nominal Basis

Operating Return = Underwriting Income
+ Investment Income on Insurance Liabilities

Total Return = Operating Return
+ Investment Income on Surplus

Discounted Basis

Operating Return = Underwriting Income
+ Investment Income Credit on Insurance Float

Investment Income Credit (ICC) = Present Value of Investment Income on All Cash Flows Related to the Accident Period

Premium $ICC = -(1 - D_p)P$
Expense $ICC = (1 - D_e)E$
Loss $ICC = (1 - D_l)L$
UPR Tax $ICC = (1 - D_u)(.2T)PU$
Disc Tax ICC: See Appendix C for formula

where D = $1/(1 + R)^N$, i.e., Discount Factor
R = rate for calculating discount, *after tax*
R_b = tax law discount rate before tax
N = average payment date for Premium, Expense, or Loss, respectively
for D_u, $N = 1$, UPR tax recovery payment date
U = Annual Premium Year End Unearned factor (i.e., Unearned Premium/Premium)

Nominal/Discounted Reconciliation

$$\text{Discounted Operating Return} = \text{Nominal Ending Total Return} / (1 + R)^N,$$

where N is the ending period when all insurance cash flows have been settled.

All dollar figures and discount factors are after-tax except discount factor for loss discounting using R_b, the tax law discount rate.

APPENDIX C

LOSS DISCOUNTING INVESTMENT INCOME CREDIT FACTOR (FACTOR TIMES LOSS FOR $ IMPACT)

1) Actual and Law Rates and Payouts Same

$$-\{(D_b - D_a) + T(1 - D_b)\},$$

where $D = 1/(1 + R)^N$, i.e., Discount Factor
R = rate for calculating discount
N = payment date
b = before tax
a = after tax
T = tax rate
$D_a = 1/(1 + R_a)^N$
$R_a = (1 - T)R_b$

2) Actual and Law Rates Different, Payouts Same

$$- \{(Dr'_b - D_a) + T(1 - Dr'_b)\}$$
$$+ (Dr'_b - D_a)(R_a - R'_a)/(R_a - R'_b), \qquad \text{(rate adjustment)}.$$

where ′ signifies using law rate

3) Actual and Law Rates and Payouts Different

$$- \{(Dn'r'_b - Dn'_a) + T(1 - Dn'r'_b)\}$$
$$+ (Dn'r'_b - Dn'_a)(R_a - R'_a)/(R_a - R'_b) \qquad \text{(rate adjustment)}$$
$$+ TD_a \{(1 - Dn''r'_b) - (Dn''r'_b - Dn''_a)R'_b/(R_a - R'_b)\} \qquad \text{(date adjustment)},$$

where ′ signifies using law rate or payment date
$n'' = n' - n$, i.e., difference in payment date

Effect of different rates is greater than payout differences and formula 2 is sufficiently accurate for most applications.

An approximate formula to the above is

$$- T\{(1 - Dmr_a) \times (1 - Dn'r'_b)\}, \text{ where } m = (n + 1)/2$$
$$= - T\{(1 - 1/(1 + R_a)^m) \times (1 - 1/(1 + R'_b)^{n'})\}$$

APPENDIX D

BALANCE SHEET AND INVESTMENT INCOME FORMULAS

Committed Assets for Liability Funding (By Line)	Nominal Value	Years Pay Lag	Nominal Balance Sheet	Investment Income	Discounted Balance Sheet	Investment Credit
Premium	P	N_p	$-N_pP$	$-RN_pP$	$-PD(N_p)/R$	$-PD(N_p)$
Expense	E	N_e	N_eE	RN_eE	$ED(N_e)/R$	$ED(N_e)$
Loss	L	N_l	N_lL	RN_lL	$LD(N_l)/R$	$LD(N_l)$
Tax Law:						
UPR Offset			$-.2TPU$	$-.2RTPU$	$-.2TPUD(1)/R$	$-.2TPUD(1)$
Loss Discounting			ZL/R	ZL	KL/R	KL
Total Funding for all Lines of Business			Sum of Above (F_n)	Sum of Above (RF_n)	Sum of Above (F_d)	Sum of Above (RF_d)
Funding Equity			0	0	F_n-F_d	$R(F_n-F_d)$
Benchmark Surplus			MB	RMB	MB	RMB
Residual Surplus			$S-B$	$I-RF_n-RMB$ (I_r)	$S-B$	$I-RF_n-RMB$ (I_r)
Net Other Assets/Liabilities			$A-S-F_n+(1-M)B$	0	$A-S-F_n+(1-M)B$	0
Total Invested Assets and Investment Income			A	I	A	I

APPENDIX D

BALANCE SHEET AND INVESTMENT INCOME FORMULAS

(CONTINUED)

Discount amount factor, $D(N) = \{1-1/(1+R)^N\}$

R = Risk free treasury interest rate, applicable to cash flows, after tax

T = Corporate tax rate, presently 34% (20% if AMT applies)

Loss discount investment income factor approximately equal to $Z = -RT\{(N_l+1)/2\}\{1-1/(1+R_t)^N\}$, where R_t = tax law discount rate

K = Loss discount investment credit factor from Appendix C

M = Benchmark surplus yield overhead adjustment factor

S = Total Surplus

A = Total Invested Assets

I = Total Investment Income

The discounted yield on combined total surplus (benchmark & residual) including reserve discount equity, $R_s = (I-F_d)/S$

Alternatively, $R_s = R_I(A/S) - R(F_d/S)$, where $R_I = I/A$, the total invested asset yield

Return on Benchmark $BROS = U/B + R(F_d/B) + RMB$, where U = Underwriting income after tax

Total Return on Surplus $TROS = U/S + R(F_d/S) + R_s$

The nominal yield on residual surplus, $R_m = I_r/(S-B)$

The discounted yield on residual surplus including reserve discount equity, $R_a = \{I_r+R(F_n-F_d)\}/(S-B)$