AN ILLUSTRATED GUIDE TO THE USE OF THE RISK-COMPENSATED DISCOUNTED CASH FLOW METHOD

(Proposition 103 Testimony)

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I. What We Propose

Fireman's Fund proposes a Risk-Compensated Discounted Cash Flow method for reviewing proposed rates in accordance with Proposition 103.

This Risk-Compensated Discounted Cash Flow method determines a rate for each line of business by discounting the cash flows of the policies under consideration to a present value. The base interest rate used for discounting is a riskless rate; projected policy losses are discounted at a lower, risk-compensated, discount rate. This risk-compensated discount rate allows for profit, to compensate equity holders for the underwriting risk being borne, and is calculated to yield a target rate of return to the equity holders. These calculations produce a benchmark rate used to set premiums.

The risk-compensated discount rate used for these present value calculations can be computed as follows:

The Risk-Compensated Discounted Cash Flow Formula:

$$\text{Risk-Compensated Discount rate} = \text{Risk-free rate} - \left[\text{Ratio of equity to discounted reserves}\right] \times \left[\text{Target return to Stockholders} - \text{Risk-free rate}\right]$$

This paper describes the logic used in selecting this method as well as the factors that go into the computation of the risk-compensated discount rate. Also presented is a basic description of the nature of the actual insurance transactions involved and their relationship to the Risk-Compensated Discounted Cash Flow method. Finally, a description of how such a Risk-Compensated Discounted Cash Flow method should be used to calculate a rate is presented.

To understand why Fireman's Fund believes a discounted cash flow methodology is appropriate to the regulatory process under Proposition 103, it is helpful to understand the following subjects described in subsequent sections of this paper:

- Fireman's Fund's actual experience over the years with alternative methods of analyzing the return on insurance transactions; and

- The pitfalls inherent in using retrospective accounting methods.

The Risk-Compensated Discounted Cash Flow method is in fact the method Fireman's Fund has employed routinely in recent years in developing its

Highlights

- Fireman's Fund proposes a Risk-Compensated Discounted Cash Flow method be employed to review premium rates in accordance with Proposition 103.

- Fireman's Fund uses this method routinely in its business pricing decisions.

- Discounting cash flows to present value is a widely accepted analytical technique.

actual pricing decisions. This technique is designed to produce the insurance premium one would expect from a competitive market.

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A final point: discounting cash flows to present value is an analytical technique accepted by the business and academic community — especially for analyzing the effects of transactions (or cash flows) extending over prolonged periods of time (i.e., several years). This technique has been universally adopted by the life insurance industry and is used by many other property-liability insurers in their premium pricing decisions. This technique is presented in virtually every financial management textbook published today and is taught in every business school in our country.

II. The Pitfalls of Using Retrospective Accounting Results in Reviewing Rates Under Proposition 103

The rate review approach advocated by the Department of Insurance relies on a recent year's Statutory Accounting-based rate of return, under the assumption that this level of profitability will be maintained over the period for which prices for newly-issued policies will be in effect. This method is subject to several flaws which seriously compromise its ability to produce fair prices for different insurers offering the same product. *

Pitfall I: Underwriting income is not matched to the proper period

Loss and loss adjustment expenses must be estimated, by actuaries and others, in advance of paying these costs. Even with the best knowledge and technical expertise, these estimates will eventually prove to be incorrect. Under statutory accounting, the ongoing, hindsight-based correction to these loss estimates must be recorded in the periods when these re-evaluations are made. In liability lines, these adjustments for prior-period loss and loss expense can be extremely large relative to the current year's premiums on policies currently in effect.

Since these subsequent year adjustments to loss projections for old policies have no relevance to the inherent profitability of new policies underwritten in the current year (and thus for the forecast period during which the newly-issued policies will be in effect), they will produce an aberrant indicated price if used to determine prices for new policies.

In other words, the fact that these retrospective accounting adjustments occur in random subsequent periods makes any one particular year's Statutory Accounting results unusable as a foundation for pricing new policies.

A second significant point is that underwriting income reported in any given year using Statutory Accounting methods is in fact a conglomeration of the results of policies written over a number of years. In any given year, income reported under Statutory Accounting methods contains numerous adjustments and corrections of underwriting results for policies written several years earlier.

Pitfall II: Statutory Accounting investment income is not applicable to determining a future premium

The proper amount of investment income to be included in the price for the policies being considered should be the amount expected to be generated by those policies -- and those policies alone. Using reported Statutory accounting investment income has two major flaws. First, the capital gains or

* *The same observations apply to retrospective methods employing GAAP (Generally Accepted Accounting Principles).*

Highlights

The major flaws inherent in using Retrospective Accounting Results

- Underwriting income is not reflected in the appropriate period.
- Investment income is not reflected in the proper period.
- Investment income and underwriting income are mismatched.

Pitfall I: Retrospective accounting underwriting results - not applicable to determining future premiums

- Underwriting income in any given year contains large "catch-up" adjustments to correct prior-period estimates of losses.
- Underwriting income in any given year reports the combined results of policies written in a number of earlier years -- that is, the current year's results represent a commingled pot of policy years.

losses realized in any period have no necessary connection to what the insurer would expect to obtain from investment of funds from the newly-issued policies.

Second, income to be earned on fixed maturity investments (e.g., bonds and mortgages) is based on the "embedded" yield, i.e., the yield promised when the investment was purchased. If interest rates have changed subsequent to the purchase of such securities, the yield rates on the bonds purchased for last year's portfolio will not provide a reasonable expectation for the yield currently available for investing funds provided from newly-issued policies.

Pitfall II: Statutory accounting investment income -- not applicable to determining a fair *premium*

- Recent period investment income reported by retrospective methods may reflect unusual capital gains or losses through investment portfolio liquidations -- which are triggered by discretionary actions of the insurer.
- Historical investment income (or yields on securities purchased in the past) may not be an accurate predictor of yields on investments to be purchased in the future.

Pitfall III: Investment income and underwriting income are mismatched - an example

The following illustrates perhaps the most serious drawback to using retrospective accounting results for determining future prices.

Example

Assume that an insurer collects a premium of $130 *and expects* $30 *of* underwriting expenses and $110 of loss and loss adjustment expenses (on average). The premium is collected and underwriting expenses are paid when the policy is issued on January 1, 1989. The loss and loss adjustment expenses are paid two years later. Even though the loss is paid two years later (at the end of 1990), Statutory Accounting methods would dictate that these loss expenses be "matched" to the premium income recognized in the first year. Therefore, the $110 in loss and loss adjustment expenses is found in the year 1989 in the simple income statement presented below. Assume that cash is invested to return an 8% yield and the insurer needs to maintain $25 of surplus each year to offset the risk that the loss will be larger than expected.

The foregoing example would yield the following Statutory accounting results over the two years of the policy:

Example Income Statement

	1989	1990
Premium Income	$130	N/A
Underwriting Expenses	(30)	N/A
Loss and Loss Adjustment Expense - expected to be paid at end of year 2	(110)	N/A
Net underwriting loss	(10)	N/A
Investment Income earned on policy funds	10	$11
Net Income	**$0**	**$11**

Note that Statutory Accounting precepts dictate that the $110 loss to be paid in year 2 be "matched" to the year 1 premium income.

The above shows that the policy produces a $10 underwriting loss in the first year ($130 in premium minus $140 in losses and expenses -- observe that statutory accounting will seek to "match" the $110 of projected losses to be paid in Year 2 with the premium income received in Year 1.) The net underwriting loss of $10 in Year 1 is then offset by $10 of investment income earned in that first year. In Year 2 there will be investment income of $11 which is earned during the period before the insurance funds are needed to pay the loss.

The reported net income resulting from the foregoing example will produce the following return on equity under a retrospective GAAP or Statutory accounting method.

Insurance Policy Example:	**Retrospective Accounting Methods**	
	1989	1990
Net Income	$0	$11
Equity Invested	$25	$25
Return on Equity	0%	44%

The return on equity reported on the same policy varies dramatically by year.

To summarize the above table; the net income and return on equity (ROE) is smaller in the first year because of the $10 underwriting loss reported in the first year utilizing retrospective accounting methods. Again, in this first year, this $10 underwriting loss will be mitigated by investment income that will be generated in that year. The $11 of net income in the second year represents only investment income. Normally, using retrospective accounting methods, all the underwriting income or loss will be recorded in the first period of the insurance policy. This return on equity pattern for policies written is typical for a liability insurance line of business: a low first-year return followed by high subsequent returns.

What happens if the insurer in the preceding example increases the number of policies written? If, for instance, it wrote two policies this year and one last year, the insurer's rate of return varies dramatically over the years involved. The example below again demonstrates wide variations in rates of return over the time periods presented.

Net Income:	1989	1990	1991
- One policy written in 1989	$0	$11	N/A
-Two policies written in 1990	N/A	0	$22
Total Net Income	$0	$11	$22
Equity required ($25 per policy)	$25 *First Policy Outstanding*	$75 *All Three Policies Outstanding*	$50 *Last Two Policies Outstanding*
Return on Equity	**0%**	**15%**	**44%**

Pitfall III: Investment income and under-writing income are mismatched

- Retrospective accounting methods will seek to match expected losses to the period in which premium income is collected.
- Investment income is recognized (under retrospective accounting methods) over the extended life of the loss period.
- The foregoing results in a mismatch of investment income - in relation to reported premiums and losses - and results in potential wide variations in annual returns on shareholder's equity.

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Note that in the preceding cases, the insurer issued *identical* policies (i.e., with identical profit characteristics). Because GAAP and Statutory Accounting does not properly match investment income and underwriting income, the rate of return in a particular year depends on how many policies an insurer has issued in the *past*. It is clear that only under a *very* stable set of circumstances could the insurer's current Return on Equity (ROE) reported utilizing traditional, retrospective accounting methods accurately represent the average anticipated return for policies about to be issued.

Remedy for Retrospective Accounting Deficiencies

1) The problem of current income distortions resulting from accounting adjustments, for changes in loss estimates for old policies, can be alleviated by referring directly to accident-year loss data. That is, *projections of future loss streams on policies to be issued can be best* determined by analyzing reported loss patterns for recent accident years utilizing accepted actuarial techniques.

2) The problem of prior-period investment income not necessarily matching future investment income expected on new policies can be solved by using the investment return anticipated over the lifetime of the policies being issued, rather than the most recent actual investment results.

3) The cure for the investment/underwriting income mismatch requires major surgery. As indicated in our brief examples, the only way to produce the same statutory income in a recent period for two insurers selling the same type of policy (having identical cash flows) is for the two insurers to have sold the same number of policies in each previous year -- a practical impossibility. The way to correct the investment income/underwriting income timing mismatch is to calculate income *prospectively* -- that is, to determine how much *future* income will be generated by the newly-issued policies alone, relating that income to the equity needed over the same prospective period. Since, as shown in our example, liability insurance contracts will produce income over several years, a reliable rate review method must be capable of collapsing this forward income stream into a *single* profit measure. A method that discounts all cash flows to present value provides exactly this mechanism.

- **Remedy for Retrospective Accounting Deficiencies**
- Loss patterns for recent accident years (utilizing trend analysis techniques) should be used rather than referring to the prior year's underwriting profit.
- Projected future investment returns should be utilized rather than historical returns.
- The only way to correct for the underwriting profit/investment income timing mismatch is to calculate income prospectively.
- Future income streams to be generated by newly-issued policies alone should be considered -- and need to be discounted to the present.

III. Fireman's Fund's Experience with Total Return Methods

Some Background -- Underwriting Profits

Beginning more than ten years ago, when conventional wisdom maintained that an "underwriting profit" was the key financial measure, Fireman's Fund recognized that investment income was becoming increasingly important to management's pricing decisions. We were particularly concerned that because our various lines of insurance had widely different loss payout durations (that is, the length of time from when the loss occurs to when it is paid) -- and thus different amounts of investment income -- that a common underwriting profit or loss standard for all lines did not give us a realistic view of the profitability of each line.

We also determined that, as discussed earlier, directly allocating the latest year's GAAP or Statutory investment income was a poor predictor of the investment income for newly issued policies. Recognizing that investment income was earned over future periods (i.e., over the extended time frames of the policy loss payout duration -- the "tail") we sought a mechanism to relate future investment income to the policy premium to be collected in the present period. Consequently, we determined that a rigorous treatment of investment income meant discounting the projected policy cash flows to present value.

Since our investment risk was self-induced, we determined that the policyholder should not bear the risk of our investment strategy and thus the rate used for discounting purposes should be a riskless rate.

Premium to Surplus Ratios or Reserves to Capital ?

Fireman's Fund also recognized that the amount of capital (or equity) deemed necessary to support any given policy was directly related to the amount of underwriting risk created by the policy. Our initial approach was to use premium-to-surplus ratios (similar to the leverage norms proposed by the Department of Insurance), which varied by line inversely according to the perceived riskiness of the line. These ratios were determined judgmentally. Because the premium-to-surplus ratios offset the underwriting risk of each line, the resulting return on equity (surplus) values had equal risk. This allowed us to use the same return on equity standard for each line of business.

In actually using premium-to-surplus norms, Fireman's Fund discovered problems with them. First, we realized that the risk in the contract was more directly related to the expected policy loss than to the premium. For example, premium increases can result from factors, such as increased selling expense, unrelated to risk. Merely increasing the premium for a policy does not change its risk, but a "premium-to-surplus" ratio would imply more capital was needed. Second, due to the judgmental nature of the premium-to-surplus norms, the specific norms targeted were continually challenged by the product line managers -- whose financial results depended upon these values (note the parallel to current criticisms of the DOI leverage norms).

Highlights

- The concept of underwriting profit as the primary measure of performance is no longer valid.
- Investment income requires consideration in the pricing calculation.
- To reflect investment income, a method has been embraced that discounts cash flows to present value.
- The appropriate discount rate has been determined to be a risk-free rate.
- Rather than using a premium-to-surplus norm, it was deemed to be more appropriate to relate capital requirements to projected losses.
- Fireman's Fund uses the proposed Discounted Cash Flow Method routinely in its pricing decisions and performance measurement.

In 1987 Fireman's Fund solved these two problems by changing the basis for determining the equity required to be maintained for policies written. Since underwriting risk is related to the uncertain nature of losses, and the longer the payment duration (the "tail") the greater the risk that the loss will be larger than expected, especially for liability coverages, we determined that the appropriate base for assessing underwriting risk was the loss reserves -- a balance sheet quantity. Briefly, we take reported statutory industry-wide averages for reserves and surplus, convert those figures to a GAAP basis and discount the converted figures to present value. Dividing the resulting average industry surplus (which is equivalent to the capital invested by shareholders) by average industry reserves produces one capital-to-reserve norm. This single ratio can be applied to all our lines of insurance (except catastrophe lines, such as earthquake); the allocation of capital among lines occurs naturally as a result of setting different levels of reserves for each line of business. Consequently, we modified our method to the Internal Rate of Return model presented in this paper. Soon we discovered that the Risk-Compensated Discounted Cash Flow method (also presented in this paper) was the same model, just viewed differently. However, the calculations using the Risk-Compensated Discounted Cash Flow method were <u>much</u> simpler.

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Through a process of learning and experimentation over the years, Fireman's Fund had developed a risk-compensated discounted cash flow approach to determining premiums. The method was easily implemented for Fireman's Fund's daily pricing decisions. This same approach is recommended to the Department of Insurance for purposes of reviewing rates under the provisions of Proposition 103.

We believe that the use of a present value or discounted cash flow method is the fairest, simplest and most effective means of evaluating the economic basis of a rate. This is a method that Fireman's Fund uses internally to establish its base prices (much as a regulator would). *We then adjust these prices to take into account the prices charged by competitors.* We also use the Discounted Cash Flow method to monitor profitability for our various lines and field offices. This is no theoretical exercise -- we apply this method and its underlying principles to our everyday business.

IV. Introduction to a Simplified Insurance Discounted Cash Flow Model - the Internal Rate of Return Method

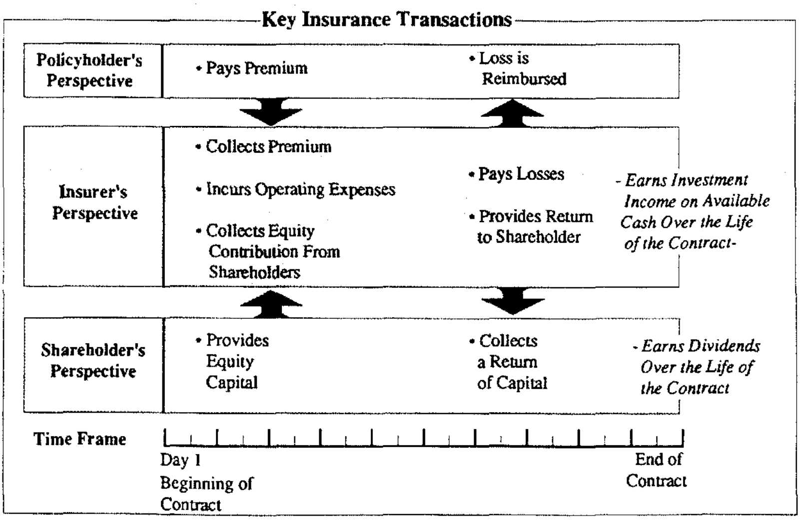
In some ways the insurance process is quite straightforward, especially if one ignores taxes and the concept of uncertainty. The policyholder pays a premium to the insurer, which is used to cover the insurer's operating expenses and taxes -- and which is used to establish a "fund" to pay expected losses (the "loss reserve"). These funds are supplemented by equity contributions from shareholders, which provide a further contingency reserve for the risk of uncertainty -- that is, that the ultimate loss may prove to be substantially in excess of that expected originally. Over time, the excess cash generated from premiums and equity contributions is invested to yield investment income until the time when the cash is required to pay insured losses or to provide dividends to shareholders. Once all losses are paid out any remaining cash is returned to the shareholder (the equity provider).

A summary of the key insurance transactions

Policyholders pay premiums to the insurer in exchange for a transfer of risk. The transactions between these two parties are fundamental and must be incorporated into a mechanism for determining an economically sound price. Both basic economics and the California Supreme Court's interpretation of Proposition 103 dictate that the shareholders of the insurer are entitled to a fair rate of return. Thus, the shareholder's perspective is also important.

Since investment income is earned on available funds during the period of time between premium collection and payment of losses and expenses, the timing of these cash transactions is important as well.

The chart below depicts the interplay of these major transactions:



In some cases after all losses are paid by the insurer, the equity provider will receive less cash back than what was originally invested -- a result of losses being greater than originally anticipated.

In other cases, losses may prove to be less than originally expected, allowing for a greater return of cash to the equity holder. An important observation regarding the fundamental nature of insurance is that the related transactions occur over an extended time frame.

The shareholder supplies capital at the time a policy is issued; this equity is needed to offset the insurer's risk undertaken by entering the contract. As we move through the period of the contract -- the contract terminates when all the losses are paid -- further capital is supplied if needed, or capital not needed to support future liability is returned to the shareholder and dividends are paid. Finally, when all the claims are paid, all remaining capital is returned to the owner since there is no remaining risk accruing to the insurer for this contract. A premium rate is inadequate if this sequence of capital contributions and distributions fails to provide an acceptable rate of return to the shareholder.

The discussions following in this paper, which describe a methodology for evaluating a rate, focus on analyzing the transactions (and cash flows) from the perspective of the insurer as well as the perspective of the shareholder.

The Discounted Cash Flow Technique

Discounted cash flow analysis has a high level of acceptance in both the academic and business communities and is well suited to situations where cash flow occurs over multiple time periods. The technique is particularly well-suited to analyze the transactions involved in an insurance contract -- especially a liability policy -- because these transactions occur over very extended time periods.

"...The Discounted Cash-Flow model ...recognizes that the use of money has a cost (interest) ...A dollar in hand (or paid) today is worth more than a dollar to be received (or spent five years from today)... Because the discounted cash-flow model explicitly and routinely weighs the time value of money, it is usually the best model to use for long range decisions."

Source:
Charles T. Horngren and George Foster, "Cost Accounting, a Managerial Emphasis", Prentice Hall, Englewood Cliffs N.J., 1987 p.649

"....Use of discounted cash flow as primary criteria vis-a-vis others recognizes the time value of money and income beyond the payoff period and emphasizes long-term profitability more than liquidity."

Source:
Patric J. Darvey, "Capital Investments: Appraisal and Limits", New York: The Conference Board, 1974

Factors Significant to a Discounted Cash Flow Methodology

Two key factors are critical to calculating a premium rate utilizing a discounted cash flow methodology:

- Investment Income - How much investment income is generated; and
- Capitalization - How much capital (surplus) is required.

Investment Income

As a matter of principle, the policyholder should not bear any investment risk associated with the company's asset management or investment strategy. The policyholder enters into an insurance contract with the assumption that an incurred loss will be paid by the insurer -- the policyholder does not anticipate incurring any investment risk on this contract.

As a corollary to the above principle, any investment risk that the company assumes in its investment (or asset management) strategy should be allocated entirely to the shareholders -- the shareholders should assume all investment risk of the company.

It follows then, that in calculating a premium to the policyholder, investment income should be computed using a risk-free interest rate.*

This treatment is consistent with the application of the Myers-Cohn model in Massachusetts for workers compensation ratemaking:

> " The discount factor applicable to losses and expenses reflects investment income on the cash flow at a current risk-free rate. Thus the Myers-Cohn Model is consistent with prior models that included investment income at a risk-free rate of return. The Company and its stockholders are assumed to bear the risk and receive the reward for any risky investment strategy."

Source: Richard A. Derrig, *The Use of Investment Income in Massachusetts Private Passenger Automobile and Workers Compensation Ratemaking. Fair Rate of Return in Property-Liability Insurance*, edited by J. David Cummins, Scott A Harrington, Kluwer-Nijhoff Publishing, 1987 p 127

Donald Bashline, the actuarial witness called by the Department of Insurance, also affirmed the appropriateness of using a risk-free rate in estimating investment income.

The use of risk-free yields to determine investment income requires the selection of appropriate risk-free securities as a proxy.

The most appropriate way to select a risk-free security as a proxy is to match the duration, or life, of such a security to the time period in which the insurance policy cash flows, which may span several years, can be invested. U.S. Treasury yields on securities with appropriate durations are generally utilized as a proxy for a risk-free yield.

Because policyholders will be credited with investment income projected to be earned, an appropriate provision for income taxes on such income is also required.

* The alternative of using the return on the insurer's own risky asset portfolio would be feasible as long as sufficient equity was included in the calculation to offset the investment risk.

Fireman's Fund believes that this approach would present a difficult regulatory problem of ascertaining the investment risk of each insurer's portfolio.

Factors Significant to a Discounted Cash Flow Methodology *(continued)*

Capitalization - Allocation of Surplus

Conventional insurance wisdom has historically related capital (surplus) needs to premiums.

Capital is maintained by a property casualty insurer primarily to protect the policyholder from the adverse consequences of two basic types of risks:

Underwriting Risk • *The risk that actual losses will materially differ from the losses anticipated at the time the insurance was purchased*

Investment Risk • *The risk of investment strategies producing lower than expected yields*

As explained earlier, it is most logical to associate capital (equity) needs with reserves for anticipated losses -- rather than to premiums. Investment risk considerations are properly addressed through the use of a risk-free interest rate.

A simple means of explaining why it is more logical to associate capital needs to loss reserves, rather than to premiums, is as follows:

> Assume that after several years of writing policies, that in the current year no policies are written -- therefore no premiums are recorded. The insurer's capital requirements in the current year would not be zero merely because no premiums were recorded. The company's policyholders are still exposed to substantial risk. Underwriting risk continues to exist for claims and losses yet to be paid -- but associated with policies previously written.

This example argues for identifying capital needs with loss reserves -- and not premiums.

This analogy holds true under a variety of situations:

- *Premiums either increasing or decreasing in a given year compared to prior periods;*
- *Long-tail lines of exposure being underwritten versus short-tail lines; (Long-tail or short-tail refers to the time lag during which a policy remains exposed to incurred claims being paid.)*

The underwriting risks in all of these scenarios are linked directly with the projected unpaid losses accrued (i.e., the loss reserves).

This means that for ratemaking purposes, capital levels (i.e., economic surplus) should be related to (discounted) reserves, not premiums, and that the allocation by line should also be on the basis of reserves rather than premiums.

Support for allocating capital in proportion to loss reserves (as opposed to in proportion to premiums) has also been presented in a report by the NAIC Task Force on Investment Income.

Source: *Report of the Investment Income Task Force to the National Association of Insurance Commissioners.* 1984. Reprinted in *Journal of Insurance Regulation* (September): p 44

The approach has also been adopted by regulators in practice.

Source: Richard A. Derrig, *The Use of Investment Income in Massachusetts Private Passenger Automobile and Workers Compensation Ratemaking. Fair Rate of Return in Property-Liability Insurance*, edited by J. David Cummins, Scott A Harrington, Kluwer-Nijhoff Publishing, 1987, pgs. 127 and 136-137.

A Simplified Model

A simple and logical way of considering the cash flows involved in insurance is to look at the Sources and Uses of Cash statement. Cash is provided by the premium, the equity contribution and the investment income. This cash is used to make loss payments, pay operating expenses, pay dividends to the equity provider and pay back the equity after all losses have been paid. Following in this chapter is an illustration of an insurer's cash flow over time as a result of entering into a contract with the following expected characteristics:

Underlying Assumptions to this Illustration

• The amount of the loss expected on this contract to be incurred at the end of year 2	$110.25
• The current interest rate available on risk-free investments	8%
• The amount of equity deemed prudent to be maintained -- as a percentage of expected losses	25%
• The stipulated return on equity to shareholders -- the stipulated target return	20%

Given the foregoing assumptions, the following cash flow pattern would emerge:

A Simple Insurance Cash Flow Model

Sources of Cash	Period "O"	End of Year 1	End of Year 2
Policyholder Premium	$130.00		
Equity Contributions	25.00	$1.25	
Investment Income		10.00	$10.50
Uses of Cash			
Operating Expenses	(30.00)		
Loss Payment			(110.25)
Dividend		(5.00)	(5.25)
Return of Equity Contributions			(26.25)
Net Cash Flow	125.00	6.25	(131.25)
Cash, Beginning of Period	- 0 -	125.00	131.25
Cash, End of Period	$125.00	$131.25	$ - 0 -

A. Policyholder's Premium
Calculated using a Discounted Cash Flow methodology; the premium has been calculated to be sufficient to pay claims when due and yield a (stipulated) 20% return on shareholder's equity. As shown by comparing operating expenses of $30.00 and loss payments of $110.25 to the premium of $130.00, it is evident the policyholder receives the benefit of investment income.

B. Equity Contribution (capitalization)
Equity is assumed required to be maintained at a (stipulated) level of 25% of the discounted reserve for losses.

C. Investment Income
An 8% "riskless" interest rate is used in this example.

D. Operating Expenses
Represents an estimated cost for normal accounting, marketing, actuarial and other operating expenses

E. Loss Payment
Actuarial projection of expected losses

F. Dividends
Dividends in this example have been assumed to be 20% of invested capital -- to provide a 20% return to the stockholder.

G. Return of Capital
Capital (equity) contributed by the stockholder assumed in this simple example to be returned at the end of the insurance contract (assuming losses are no greater than projected).

The following discussion describes these cash flow elements in more detail.

A Discussion of the Sources of Cash in the Simplified Insurance Cash Flow Model

Policyholder's Premium

This is the amount that the policyholders pay the insurance company to assume the liability for any loss that may occur due to loss-causing events during a specified period, referred to as the policy period. Assume for the moment that this premium is given. A detailed description of the calculation of this premium, and the proof of the resulting target return follows in the next chapter.

A. Policyholder's Premium

Calculated utilizing a Discounted Cash Flow methodology; the premium has been calculated to yield a (stipulated) 20% return and is sufficient to pay claims when due and cover operating expenses.

Equity Contribution (Capitalization)

As it is not possible to predict exactly what the future loss may be, a capital fund (surplus) is established, funded by shareholders to cover the possibility of the actual loss exceeding the expected loss. Losses are generally paid out of assets (equal to reserves) funded by the premium. If actual losses exceed this reserve, the losses will also be partially paid out of the funded surplus, thereby depleting the stockholders' equity.

The amount of capital required depends upon the riskiness of the specific line of insurance. A single reserve-to-capital ratio is a practical way of allocating capital among lines. A fixed ratio of reserve to surplus is generally maintained over the life of the liability.

B. Equity Contribution (capitalization)

Equity is assumed required to be maintained at a (stipulated) level of 25% of the discounted reserve for losses.

	Period 0	End of Year 1
Discounted value of reserve for losses *	$100.00	$105.00
Increase in discounted reserve		5.00
Required equity contribution to maintain 25% equity-to-reserve ratio	$25.00	$1.25

Increase in reserve of $5.00 factored by the 25% equity-to-reserve ratio.

* Discounted at a risk-adjusted discount rate. See the following two chapters for an indepth discussion of this subject.

Investment Income

As there is a time lag between receipt of premium and equity and the payout of losses and loss adjustment expenses, the net funds remaining are invested to generate income.

C. Investment Income

Fireman's Fund utilizes a "riskless" interest rate in its model. The company and its stockholders are assumed to bear the risk and receive the reward for any risky investment strategy.

	Year 1	Year 2
Accumulated cash/investment balance	$125.00	$131.25
Risk-free Interest Rate	8%	8%
Interest Income	$10.00	$10.50

For the purpose of computing an insurance rate, it is assumed that funds will be invested at a risk-free rate, so that the funds are absolutely available when needed. In practice, the insurance company may invest the funds in riskier investments, in the hope of a higher return, but this strategy will require an even higher level of equity to offset this higher risk.

Both the risk and rewards of a riskier strategy accrue to the insurance company's shareholders and should not affect the policyholder.

A Discussion of the Uses of Cash in the Simplified Insurance Cash Flow Model

Operating Expenses and Taxes

Insurance companies incur a variety of expenses to properly service their policyholders. These include the normal accounting and marketing functions, customer support, actuarial analysis, claims handling, etc. These expenses together with any federal, state and other taxes represent the normal cost of doing business and are charged to the policyholder as part of the premium.

D. Operating Expenses
Represents an estimated cost for normal accounting, marketing, actuarial and other operating expenses.

Loss Payments

For simplicity, the term "loss" in our discussion is defined to include losses and loss adjustment expenses (LAE). They are an actuarial projection of future losses based on trend analyses of historical loss experience, changes in economic conditions (e.g., inflation) and technological changes. The surplus is provided to cover uncertainties in these future loss projections since the ultimate actual loss depends upon factors which are not under the control of the insurance company.

E. Loss Payment
Actuarial projection of expected losses

Dividends

Dividends are the periodic payments made to the equity provider. As the equity provider invests funds to cover the risk that the actual losses may be greater than anticipated, they must be provided a return on their investment -- and to provide compensation for the possibility of loss of their invested capital. This return must be commensurate with the risk that they are taking. Otherwise, the investor will find other less risky investments with similar returns.

F. Dividends
Dividends in this example have been assumed to be 20% of invested capital -- to provide a 20% return to the stockholder

	Year 1	Year 2
Invested Capital (beginning of year)	$25.00	$26.25
Calculated Dividends	$5.00	$5.25

Return of Capital

Once all losses have been paid out, any remaining surplus is returned to the equity provider. If the losses are as projected, then the equity providers will get all of their equity back.

G. Return of Capital
Capital (equity contributed by the stockholder) assumed in this simple example to be returned at the end of the insurance contract (assuming losses are no greater than projected).

Achieving the Internal Rate of Return to the Stockholder- A Test of the Rate

Summary of Cash Flows to the Stockholder

The cash flow of the stockholders consists initially of the equity that they put in, as surplus. What is returned to the shareholder is the periodic dividend and a final return of equity capital from any leftover surplus after all losses have been paid.

	Period "O"	End of Year 1	End of Year 2
Summary of Cash Flow to the Stockholder	($25.00)	$3.75	$31.50
Internal Rate of Return for the Stockholder	20 %		

A Discussion of Internal Rate of Return for the Stockholder

As mentioned earlier, stockholders must be provided an adequate return if they are to risk their funds. To determine if the cash flow to them provides the target return, we can use the discounted cash flow method described earlier to determine whether the rate of return to the stockholder (implicit in the cash flows experienced by the stockholder) is in fact equivalent to the 20% target rate of return level.

The Internal Rate of Return - A Test of the Rate

One test of a premium or rate is that, when combined with investment income, it covers the expected loss payout, the insurance company's normal operating expenses and taxes and provides the equity investor the target return on their investment, i.e., the cost of equity capital. In other words, the premium revenue is sufficient to pay all costs related to the policy contract.

Calculating the Internal Rate of Return to the Shareholder

The internal rate of return method calculates the actual rate of return implicit in a stream of net cash flows compared to the initial cash outlay (somewhat analogous to the APR disclosed to the borrower on his or her home loan). The internal rate of return method typically requires a trial-and-error approach to solve for the discount rate (yield rate) that equates the original investment to the subsequent positive cash flows. However in this case we know that the discount rate or yield rate should be equal to 20% -- the target rate of return in this example. Therefore, in this example the discount factor of .20 is applied to the total cash flow stream to the investor -- to compare the indicated net present value of this cash flow stream to the $25 original investment made by the shareholder.

Internal Rate of Return to the Shareholder

	Period 0		End of Yr. 1		End of Yr. 2
Equity Contributions	(25.00)		(1.25)		
Dividends			5.00		5.25
Return of Equity					26.25
Cash Flow to Stockholder	(25.00)	÷1.2	3.75	÷1.2	31.50
	3.125		26.25		
	21.875	÷1.2			
Net Present Value at 20%	$0				

In the above chart, the shareholder's cash outflows are shown as negative values and cash inflows are shown as positive values, to reflect the shareholder's point of view. As the net present value of the cash flow to the shareholder is zero based on a discount rate of 20%, it demonstrates that the shareholder receives exactly the target 20% return.

The foregoing analysis demonstrates that the discounted cash flow method can be used to determine whether aggregate premiums will be sufficient to provide the target return to the stockholders.

* * * * * *

The final chart in this chapter presents all of the foregoing in a one-page summarized form.

An Illustration of the Discounted Cash Flow Approach to Insurance Rate Regulation

Exhibit I

Underlying Assumptions:

Risk-Free Interest Rate	8%
Ratio of Required Equity to Discounted Loss Reserve	25%
Operating Expenses	$30
Stipulated Return on Equity	20%

Cash Flows Presented on an Annual Basis.

* To simplify this presentation, the impact of taxes has been ignored (the effect of which would be to increase the premium by the present value of such costs).

A Simple Insurance Cash Flow Model

	Period "O"	End of Year 1	End of Year 2
Sources of Cash			
Policyholder Premium	$130.00		
Equity Contributions	25.00	$1.25	
Investment Income		10.00	$10.50
Uses of Cash			
Operating Expenses	(30.00)		
Loss Payment			(110.25)
Dividend		(5.00)	(5.25)
Return of Equity Contributions			(26.25)
Net Cash Flow	125.00	6.25	(131.25)
Cash, Beginning of Period	- 0 -	125.00	131.25
Cash, End of Period	$125.00	$131.25	$ - 0 -

	Period "O"	End of Year 1	End of Year 2
Summary of Cash Flow to the Stockholder	($25.00)	$3.75	$31.50

Internal Rate of Return for the Stockholder 20 %

Proof that the premium yields the target return

Policyholder's Premium

Calculated utilizing a Risk-Compensated Discounted Cash Flow method; the premium has been calculated to yield a target 20% return and is sufficient to pay claims when due and cover operating expenses. The calculation of this premium is described in the following chapter.

Equity Contribution (capitalization)

Equity is assumed required to be maintained at a (stipulated) level of 25% of the discounted reserve for losses

	Period 0	End of Year 1
Discounted value of reserve for losses *	$100.00	$105.00
Increase in discounted reserve		5.00
Required equity contribution to maintain 25% equity to surplus ratio	$25.00	$1.25

* Discounted at a risk-adjusted discount rate. See the following two chapters for an indepth discussion of this subject.

Loss Payment

Actuarial projection of expected losses

Dividends

Dividends in this example have been assumed to be 20% of invested capital -- to provide a 20% return to the stockholder

	Year 1	Year 2
Invested Capital (beginning of year)	$25.00	$26.25
Calculated Dividends	$5.00	$5.25

Return of Capital

Capital (equity) contributed by the stockholder assumed in this simple example to be returned at the end of the insurance contract (assuming losses are no greater than projected).

Investment Income

A "riskless" interest rate of 8% is used. The company and its stockholders are assumed to bear the risk and receive the reward for any risky investment strategy.

	Year 1	Year 2
Accumulated cash/investment balance	$125.00	$131.25
Risk-free Interest Rate	8%	8%
Interest Income	$10.00	$10.50

Conclusion:

The fact that the return to the stockholder is given to be the target 20% (and neither more or less), and that the remaining cash was sufficient to pay claims as due, proves the calculated premium to meet the target rate of return test.

Fireman's Fund

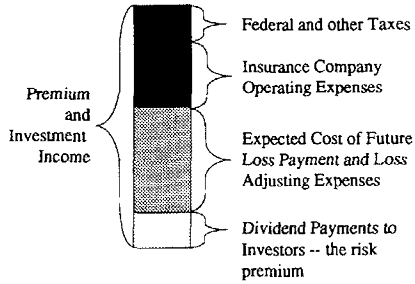
V. The Discounted Cash Flow Methodology -- A Discussion of the Policyholder's Premium Calculation

The Policyholder's Premium

A policyholder premium meeting a target rate of return standard would be one that, combined with investment income, covers the expected cost of future loss payments, permits the insurance company to cover its normal operating expenses, and provides a suitable return to the equity investors for the funds that they are putting at risk.

In the following analysis, only the amount of premium required to cover expected future loss payments and loss adjustment expenses, operating expenses, and the dividend payments is considered. Taxes have been ignored to simplify the discussion.

A Depiction of the Policyholder's Premium



If taxes were to be considered in the following discussion, the effect would be to increase the fair premium by the present value of the projected amount of taxes.

The "Risk Premium"

There is one additional element of the policyholder's premium that remains to be introduced; it is often referred to in financial management literature as the "risk premium."

As stated earlier, shareholders of the company provide equity or surplus which is maintained by the company to provide for the risk that losses may exceed expectations. These surplus funds can be reinvested by the company (together with funds available from premiums) to earn investment income during the period of time before losses are paid. This investment income earned on equity funds will be available to partly cover the necessary return to the shareholder. The remaining cash required to provide this return to the shareholder comes from a portion of the policyholder's premium. This is the "risk premium."

The following discussion describes the calculation of the policyholder's premium of $130 -- which was assumed to be given in the example of the internal rate of return, or discounted cash flow, method presented in the previous chapter. The previous chapter described how the transactions relating to the example insurance policy resulted in cash flows to the insurer and shareholder -- which culminated in a target return of 20% to the shareholder -- all of which was directly tied to the policyholder's $130 premium. The following discussion reveals the logic underlying the development of this $130 premium.

Note, there are two different methods for solving for this $130 policyholder's premium. This chapter describes the calculations utilizing an internal rate of return method (a discounted cash flow method). The next chapter describes a much more direct approach using the Risk-Compensated Discounted Cash Flow approach.

Assumptions:

The discounted cash flow method requires that certain assumptions be explicitly specified before the method can be used to determine the premium. The most significant assumptions are as follows:

- ***Expected future loss payout***
- ***Risk-free investment rate***
- ***Capital-to-reserve ratio***
- ***The stipulated return on equity***

In the simple example that is used to demonstrate the method of computation of the $130 premium, the following assumptions continue to be in effect:

Expected future loss payout at end of year 2	$110.25
Risk-free investment rate	8%
Ratio of Capital (surplus) to Reserve	25%
Stipulated Return on Equity	20%

The Premium of $130 -- Dissected:

The procedure for computing the premium using the internal rate of return (discounted cash flow) method is quite straightforward, except that the computation must be performed through successive approximations (sometimes referred to as "iterations")*. The steps involved in the computation are as follows:

1. Determine the present value of the expected future loss payout.

	Period 0	End of Yr. 1	End of Yr. 2
Present Value of loss	$94.52	$102.08	$110.25
	← ÷1.08	← ÷1.08	

* Period 0 is the start of Year (or Day 1)

The above table shows that a loss of $110.25 is expected to be paid at the end of Year 2. Since we need to collect a premium today to, in effect, "fund" this loss, we need to know the present value of this $110.25 loss expected to be paid two years hence. Our discount rate to calculate the present value of this loss is 8%, the stipulated risk-free interest rate (i.e., the current yield on a U.S. government security of a 2-year duration). Dividing the $110.25 by 1.08 yields the present value of this loss (at 8%) one year earlier, or $102.08. Dividing this amount again by 1.08 results in the present value of this expected loss at "period 0", or at Day 1 of the policy period.

* *This is because the equity investment required depends upon the amount of the discounted loss reserves, which factors in the risk premium. However, the amount of the risk premium depends upon the dividend (or return) on the equity. Hence, an iterative calculation is required.*

2. ***Compute the risk premium. Because this requires successive approximations, or iterations, the computation of the risk premium is discussed later in this chapter. At the moment we will assume a value of $5.48 for the risk premium.***

3. ***Determine the total reserve as the sum of the present value of the loss payout and the risk premium; and then***

4. ***Determine the equity (surplus) required. The equity required equals the reserve multiplied by the equity (surplus) to reserve ratio. This is the amount of equity required to be invested by shareholders to support the risk of this policy.***

	Period 0	End of Year 1
Present Value of Loss	$ 94.52	$ 102.08
Risk Premium	$ 5.48	$ 2.92
Total Reserve	$100.00	$105.00
Equity-to-Reserve Ratio	0.25	0.25
Equity Required	$25.00	$26.25

The above table presents several concepts. First the loss reserve is presented; this represents a snapshot, at two different points of time, of the cumulative amount needed to fund the loss of $110.25 which will be paid at the end of Year 2. The risk premium is also presented as a snapshot at these two periods of time; this is the net amount needed to fund the fair return to the shareholders. The computation of this risk premium is dependent on several other calculations -- and therefore is discussed later.

Second, we must compute the amount of equity required to be on hand as a "cushion" to provide for the risk (i.e., the possibility) of the actual loss turning out to be substantially greater than the original estimate of the loss, $110.25. It has been assumed that equity in the amount of 25% of the loss reserve will be required to be on hand over the life of the policy contract. This results in an indicated amount of equity of $25 at the inception of the contract. The amount of required equity increases to $26.25 one year later as a result of the loss reserve "growing" towards its expected future value of $110.25 at the end of Year 2.

5. ***Based on the stipulated return on equity and the risk-free investment rate, calculate the individual dividend payments required to be paid to the shareholders which will provide the target return over the life of the contract; also calculate the investment income that the insurer will earn on the equity.***

	Period 0	End of Year 1	End of Year 2
Equity (Surplus)	$25.00	$26.25	-
Dividend (20%)		($5.00)	($5.25)
Investment Income (8% Earned on Equity)		2.00	2.10
Additional Cash Required to Pay Dividends		($3.00)	($3.15)

The above table shows that a 20% fair return on the initial capital of $25 results in an indicated dividend of $5.00 at the end of Year 1; and a $5.25 dividend at the end of Year 2 on the cumulative capital of $26.25 contributed through the end of Year 1.

The second aspect of the above table is that investment income is available to the insurer to fund, in part, the dividend requirements. Investment income (at the stipulated risk-free rate of 8%) will be earned by the insurer on the contributed capital. Thus the model "mathematically reflects" investment income on surplus as well as on policyholder-generated funds. In this example, the funds available to the insurer as a result of earning investment income on contributed equity will amount to $2.00 in Year 1, and another $2.10 in Year 2. These funds will be available to go part way toward funding the required return (dividends) to shareholders. By subtraction, then, $3.00 and $3.15 in Years 1 and 2 represent the additional cash still needed to fund the required return to shareholders (the dividend).

6. ***The risk premium is the present value of the additional cash required to make dividend payments (i.e., provide the target return to the shareholder).***

	Period 0	End of Year 1	End of Year 2
Additional Cash Required to Pay Dividends		$3.00	$3.15
	÷1.08		
$3.00 present valued to period 0	2.78		÷1.08
$3.15 present valued to period 0	2.70		
Risk Premium	$5.48	÷1.08 $2.92	

Initially as the risk premium will not be known, it can be assumed as zero, and step 3 through 6 computed. The risk premium computed in step 6 would be substituted back into step 2, and steps 3 through 6 recomputed. In either computer models or manual calculations, this cycle is repeated until the risk premium is properly calculated. This is the successive approximation calculation (the iteration) process previously mentioned.

The steps described above have been summarized on one page in the following exhibit.

* * * * * *

To put the foregoing in perspective it may be helpful to review these last two chapters. This chapter described the detailed logic involved in computing the premium utilizing an internal rate or return, or discounted cash flow, methodology. The previous chapter described the cash flows accruing to the insurer as a result of the insurance contract. The cash flows to the shareholder resulting from the insurance contract also were presented in the preceding chapter. The point of the foregoing was to demonstrate that an internal rate of return, or discounted cash flow, methodology can be used to calculate an economic premium -- and that this methodology can also be used to prove that the resulting return to the shareholders is also equivalent to the target return of 20%.

While the internal rate of return methodology presented requires detailed calculations, the method is practical and in general use today. However, there is a shortcut approach available which accomplishes the same result -- but in a more direct and simple fashion. This is embodied in Fireman's Fund's application of the Risk-Compensated Discounted Cash Flow model for insurance rate regulation presented in the following chapter.

The Discounted Cash Flow Methodology

Exhibit 2

Simplifying Assumptions	
Loss projected at end of Year 2	$110.25
Risk-Free Interest Rate	8%
Ratio of required equity to discounted loss reserve	25%
Stipulated Return on Equity	20%

A Simplified View of the Premium Calculation

Step 1: Expected losses and computing present value of losses:

	Period "0" i.e., Day 1	End of Year 1	End of Year 2 *before loss payout*
Present value of loss *(using the risk-free interest rate)*	$94.52	$102.08	$110.25
Calculated Risk Premium	$5.48	$2.92	-0-
Present value of reserve	$100.00	$105.00	$110.25
Present value of operating expenses	30.00		
Total Premium	$130.00		

	Period "0"	End of Year 1	End of Year 2
Step 2: Calculating the required Equity Investment and "Returns" to the Investor			
Equity Investment Required (25% of reserves)	$25.00	$26.25	NA
	@ 20%	@ 20%	
A. Required Dividends to Stockholders		$5.00	$5.25
B. Investment Income Generated on Equity Invested and Available to Pay Dividends.		$2.00	$2.10
Step 3: Calculating the Additional Funding Required to Generate the Target Return to Stockholders (A - B)		$3.00	$3.15

The Iterative Calculation

Fair Premium required at period "0" -- Calculated to yield the target 20% return on equity

Investment Income will be earned on contributed capital (Equity)

	Year 1	Year 2
Contributed Capital (Equity) beginning of year	$25.00	$26.25
Risk-Free Rate of Return	8%	8%
Investment income on Contributed Capital - available to fund required dividends	$2.00	$2.10

The Iterative Calculation - the Risk Premium

Additional funding required to pay dividends generating a fair rate of return to stockholders:

Additional funding required	$3.00 *(At end of Year 1)*	$3.15 *(At end of Year 2)* ÷1.08
Present value of these amounts at end of Year 1	3.00 ÷1.08	2.92 ÷1.08
Present value of these amounts at period "0" (i.e., Day 1)	2.78	2.70
Total present value of the Risk Premium	$5.48	

Calculation of Present Value of Loss

Projected loss (at end of Year 2) divided by (1 + the risk-free interest rate) $\frac{\$110.25}{1.08} = \$102.08$ {Present value of loss at end of Year 1

Present value of loss (at end of Year 1) divided by (1+ risk-free interest rate), $\frac{\$102.08}{1.08} = \$94.52$ {Present value of loss at period 0 (i.e., Day 1)

Proof of present value calculation:

	Period "0"	End of Year 1	End of Year 2
Amount of money required to fund a loss of $110.25 to be paid at the end of Year 2 *	$94.52	$102.08	$110.25
	@ 1.08	@ 1.08	

**(assuming a risk-free interest rate of 8%)*

Or stated another way:

• Premium required on Day 1 to "fund" the present value of expected losses	$94.52
	8%
• Investment income that will be generated on this premium by the end of Year 1 *(assumed earned at the risk-free rate),*	$7.56
• Funding available for anticipated losses at the end of Year 1,	$102.08
	8%
• Investment income that will be generated on these funds during Year 2 (assumed earned at the risk-free rate),	$8.17
• Funds available to pay expected losses or at the end of Year 2	$110.25

Fireman's Fund

VI. Fireman's Fund's Recommended Method - The Risk-Compensated Discounted Cash Flow Method

Fireman's Fund's recommended method for testing a rate in accordance with Proposition 103 is, in principle, similar to the Myers-Cohn method used in Massachusetts for workers compensation ratemaking. Fireman's Fund's recommended approach is also similar to the well-known Capital Asset Pricing Model (CAPM) in that it adjusts allowable profit according to the risk inherent in insurance.

The internal rate of return (or discounted cash flow) approach to the calculation of the premium discussed earlier can become cumbersome, especially when long payout periods are involved. Myers and Cohn have developed a risk-adjusted discount rate method, based on the Capital Asset Pricing Model (CAPM), which greatly simplifies the computations. Most applications of the Myers-Cohn method to date, however, have the limitation of determining the riskiness of the specific line of insurance relative to other businesses. The data for such calculations are not readily available and the results are erratic.

Fireman's Fund has developed an alternative method for determining the risk-adjusted discount rate. This risk-adjusted discount rate is used for discounting the expected future loss payouts. This method produces a premium which, in combination with the investment income on both premium and equity, covers the expected future loss payouts and the dividend payments. The premium generated using Fireman's Fund's Risk-Compensated Discounted Cash Flow approach is exactly the same premium that would be produced by the iterative internal rate of return calculation previously described.

Having determined the applicable cash flows, they are discounted at the appropriate investment rates. Known cash flows, i.e., cash flows that are certain as to timing and amount, such as commissions or taxes to be paid, are discounted at a "riskless" rate. Losses and loss adjustment expenses, which are the uncertain or risky cash flows, are discounted at a lower rate, the riskless rate less a "risk adjustment".

The risk-compensated discount rate is computed as follows:

$$\text{Risk-compensated discount rate} = \text{Risk-free rate} - \left[\text{Ratio of equity to discounted reserves}\right] \times \left[\text{Target return to Stockholders} - \text{Risk-free rate}\right]$$

The factors that go into the computation of the risk-compensated discount rate are the same that have to be specified for the internal rate of return or discounted cash flow model. These are the basic assumptions that we have seen previously.

Underlying Assumptions:	
Risk-Free Interest Rate	8%
Ratio of Required Equity to Discounted Reserve	25%
Stipulated Return on Equity	20%

If these assumptions are used to compute the risk-compensated discount rate, we would get:

$$\text{Risk-compensated discount rate} = 0.08 - 0.25 \times (0.20 - 0.08) = 0.05$$

In other words, the risk-compensated discount rate would be 5% as compared to the 8% for the risk-free rate. It can easily be shown that this gives us the same premium as computed using the discounted cash flow model, as shown in the following example. An accounting "proof" of the Risk-Compensated Discounted Cash Flow method is presented as Appendix A.

Calculating the Premium
The Risk-Compensated Discounted Cash Flow Method "Shortcut"

The fair premium to be calculated in this simple example can be computed directly, using a *risk-compensated discount rate.*

The Risk-Compensated Discounted Cash Flow Formula:

$$\text{Risk-compensated discount rate} = \text{Risk-free rate} - \left[\text{Ratio of equity to discounted reserves}\right] \times \left[\text{Target return to Stockholders} - \text{Risk-free rate}\right]$$

Application of the Risk-Compensated Discounted Cash Flow Formula

$$\text{Risk-compensated discount rate} = \text{Risk-free rate} - \left[\text{Ratio of equity to discounted reserves}\right] \times \left[\text{Target return to Stockholders} - \text{Risk-free rate}\right]$$

Assumptions:
(embodied in simple illustration of the Discounted Cash Flow Methodology - Exhibit 1)

Risk-free interest rate	8%
Ratio of required equity to discounted reserve	25%
Stipulated return on equity to stockholder	20%
Projected loss payable in Year 2	$110.25
Premium calculated via the discounted cash flow method (Exhibit 1)	$130

Risk-compensated discount rate = 0.08 - 0.25 x (0.20 - 0.08)

Risk compensated discount rate = 0.05

Application of the Risk-Compensated Discounted Cash Flow Methodology

Period 2	Discounted to Period 1	Discounted to Period 0
Projected loss $110.25 expected in Period 2	$\frac{\$110.25}{1.05}$ = $105.00	$\frac{\$105.00}{1.05}$

Yields: the portion of the premium representing risky cash flows--claims and losses — $100

Add: the present value of operating expenses — 30

$130

To calculate the premium utilizing the Risk-Compensated Discounted Cash Flow method, the projected losses are discounted to present value utilizing the risk-compensated discount rate.

The calculated premium utilizing the Risk-Compensated Discounted Cash Flow Methodology
- sufficient to provide funding for anticipated losses and provide a target return -- and nothing more or less

Note:
To consider taxes in this calculation, the target rate of return to the stockholder would be the appropriate after-tax rate of return.

VII. How the Risk-Compensated Discounted Cash Flow Method Can be Used in Rate Regulation

- The riskless yield would be based on the rate for an appropriate U.S. Treasury security. The rate would be reviewed quarterly by the Department of Insurance and adjusted if major changes in interest rates occurred.

- The risk-compensation adjustment (which could be the same for all but catastrophe lines) would be initially set by the Department of Insurance. These values (which are independent of the level of market interest rates) would be reviewed annually by the Department of Insurance, with input being provided by insurers and other interested parties.

- Anticipated losses and expenses would be determined using actuarially sound methods chosen by the insurer. These would be subject to review and challenge by the Department of Insurance.

- Companies would use their own data for premium collection and incurred loss and expense payout patterns to be used in the Risk-Compensated Discounted Cash Flow method. Companies with insufficient data on these patterns could use industry data supplied by the Department of Insurance.

- The federal income tax rate and accounting provisions (particularly the discounting of incurred losses) applicable to the cash flows for the policies being priced, would be applied in the price calculation. Since the riskless Treasury interest is fully taxable, the applicable income tax rate would be the current rate of 34%.

- The chief benefit to the Department of Insurance of using a Risk-Compensated Discounted Cash Flow method is the ease of implementation. The Department needs to monitor only a few factors using such a method:

    - the appropriate risk-free rate to be used;
    - the appropriate level of surplus to be maintained;
    - the appropriate target rate of return to be achieved; and
    - the projected cash outflows for losses and loss adjustment expense (LAE) of the insurer--together with the projected operating expenses of the insurer.

VIII. Observations

In performing the analysis presented in the previous chapters, certain issues and conclusions present themselves which merit further discussion. We have identified the more pertinent issues and have discussed them further in the following pages. Most of these issues deal with the rate of return to the stockholder, its sensitivity to changes in some of the assumptions and its impact on the policyholder's premium. These issues are discussed in the following sections.

Compensation to Stockholders for Risk and its Impact on the Policyholder's Premium

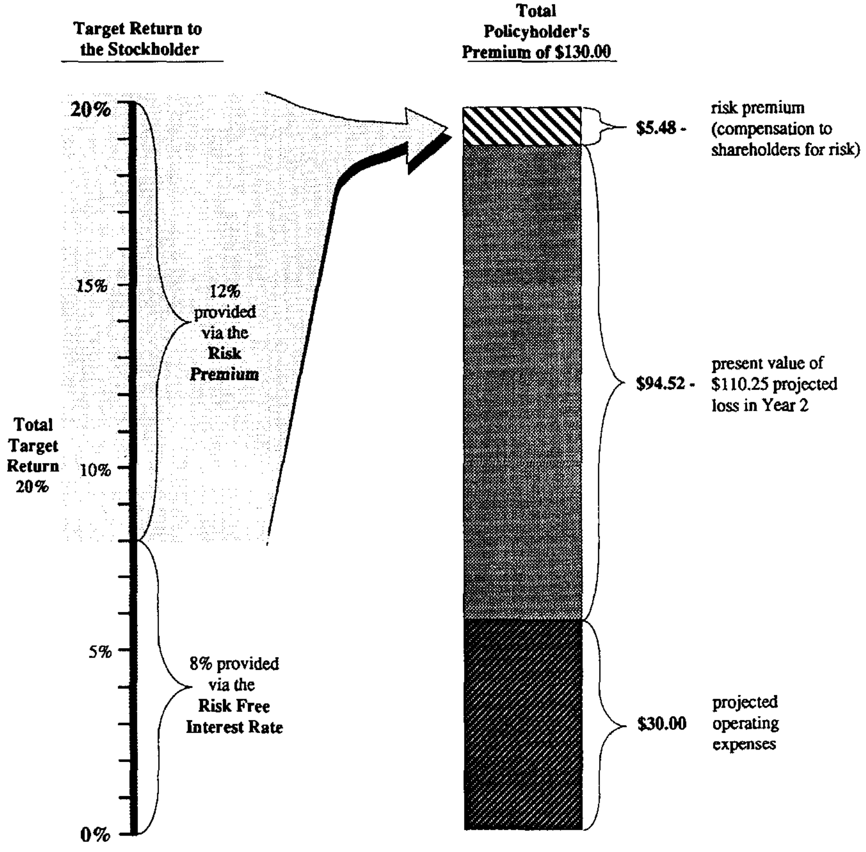
The portion of the premium used to provide the stockholders an adequate return is relatively small.

The following exhibit depicts the relative size of the risk premium compared to the total premium, based on the example that has been used in the proceeding sections. The risk premium accounts for only 4-5% of the total premium; the major part of the premium goes toward payment of losses and loss adjustment expenses.

As the risk premium represents such a small portion of the total premium, the impact of varying the return to the stockholder has a very limited impact on the total premium. Page 2 of the exhibit demonstrates, based on the same previous assumptions, how the total premium would change as the return to the stockholder varies by 20% in either direction, i.e., goes down to 16% from 20% and goes up to a 24% rate of return. As the exhibit shows, the net result is that the total policyholder premium changes by less than $2 in either direction.

To summarize, the portion of the premium providing a fair return to stockholders represents a very small part of the total premium and even moderate changes in the stipulated target return do not have significant impact on the total premium.

A Depiction of the Amount of Premium Representing Compensation to the Stockholder for Risk



Assumptions in simplified model	
• Originally Estimated Loss	$110.25
• Target Return to Stockholders	20%
• Ratio of Equity to Discounted Reserves	25%
• Operating Expenses	$30.00
• Fair Premium	$130.00

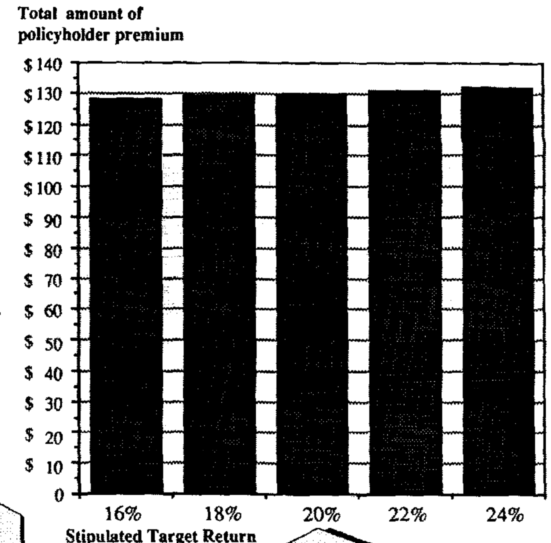
Conclusion:

The risk premium of $ 5.48 represents only 4% of the total policyholder premium of $130.00

Implications of a Target Rate of Return to Stockholders

Assumptions

• Estimated Loss (two years hence)	$110.25
• Ratio of Equity to Discounted Reserves	25%
• Operating Costs	$ 30.00
• Risk-Free Interest Rate	8%



Policyholder Premium Required	**$128.12**	**$129.05**	**$130.00**	**$130.96**	**$131.93**
Stipulated Target Return	**16%**	**18%**	**20%**	**22%**	**24%**

Conclusion:

The policyholder premium required to fund a $110.25 loss (expected two years hence) -- and provide for a fair return to stockholders -- is not significantly affected by even large changes in the stipulated target return. The major component of the premium remains the cost of the projected claims and expenses of the insurance transaction.

Capitalization of the Insurer and Its Relationship to the Policyholder's Premium

The level of capitalization (equity) required is one of the issues that is broadly discussed in determining a premium. The analysis on the following page shows that even large variations in the equity-to-reserve ratio do not have a significant impact on the premium. Erring on the conservative side in the equity-to-reserve ratio may be preferable, as undercapitalization exposes the policyholder to additional risk through the possibility of the insolvency of the insurer.

Capitalization of the Insurer and Its Relationship to Policyholder Premiums

Calculated Premiums -- The Relationship to Capitalization of the Insurer

One of the basic assumptions considered in calculating a premium (using a Risk-Compensated Discounted Cash Flow Methodology) is the amount of assumed capitalization of the insurer -- the ratio of equity maintained as compared to discounted reserves.

As the tables show, even assuming a uniform target rate of return, the amount of the calculated premium varies only slightly (approximately 3%) given major changes in capitalization (e.g., given a change in capitalization from a level of 25% to 40%).

For example:

Given a target fair rate of return to the stockholder of 20%, the following premiums would be calculated utilizing a discounted cash flow methodology:

Equity maintained-- as a Percentage of Discounted Reserves	Calculated Premium Yielding a Stipulated 20% Target Rate of Return
10%	$126.66
15%	$127.75
20%	$128.87
25%	**$130.00**
30%	$131.15
35%	$132.33
40%	$133.52

Assumptions in simplified model:

Estimated loss in Year 2	$110.25
Target return to stockholders	20%
Risk-free interest rate	8%

To simplify this presentation, the impact of taxes has been ignored (the effect of which would be to increase the premium by the present value of such costs).

Target Returns to the Stockholder and the Relationship to the Level of Equity Maintained

In a regulated environment, the rate of return on equity to the stockholder is dependent upon the level of equity actually maintained, which may be different from the level used in determining the regulated premiums.

As the graph on the following page shows, reducing the amount of equity has a significant impact on the stockholder return, but it also increases the possibility of insolvency.

It is important to recognize that under the proposed methodology, the level of capitalization of an insurer will not affect the regulated rates. All firms will charge essentially the same premium for comparable insurance policies--as one would expect of a competitive marketplace. However, the resulting rate of return to the insurer would vary according the the insurer's respective degree of capitalization.

Target Returns to the Stockholders and the Relationship to the Level of Equity Maintained by the Insurer

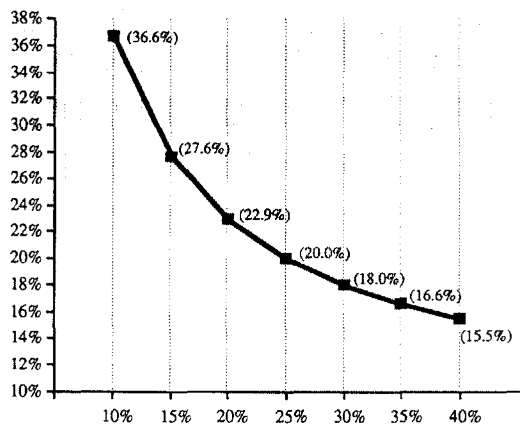
The target rate of return to the stockholder must be viewed in conjunction with the level of equity maintained by the insurer:

- with higher levels of equity, the insurer is reducing the overall risk and thus its cost of capital;
- with reduced levels of equity, the risks of insolvency increase.

An Illustration of the Yield Implicit in a Fixed $130 Premium

Percentage of Equity Maintained Compared to Discounted Reserves	Rate of Return Implicit in the $130.00 Premium
10%	36.6%
15%	27.6%
20%	22.9%
25%	**20.0%**
30%	18.0%
35%	16.6%
40%	15.5%

Rate of Return Implicit in the $130 Premium



Ratio of equity maintained in comparison to reserves

Assumptions in simplified model	
Risk-free interest rate	8%
Projected loss at end of Year 2	$110.25
Stipulated premium	$130.00
Operating Expense	$30.00

* *Taxes have been ignored to simplify this presentation.*

Test of an Appropriate Premium:

Although by reducing equity (given a fixed premium) higher returns may be obtained, the following principles must be observed:

1) Enough equity must be maintained to keep the insolvency risk to the policyholder at an acceptable level.

2) A higher return must be provided to the stockholder to compensate the stockholder for the risk of higher degrees of leverage.

3) The allowed rate of return to the stockholder should vary depending on the level of capitalization of the insurer; a single target rate of return coupled with a capital-to-reserve norm achieves this result.

Forecast Errors and Their Impact on the Return to Stockholders

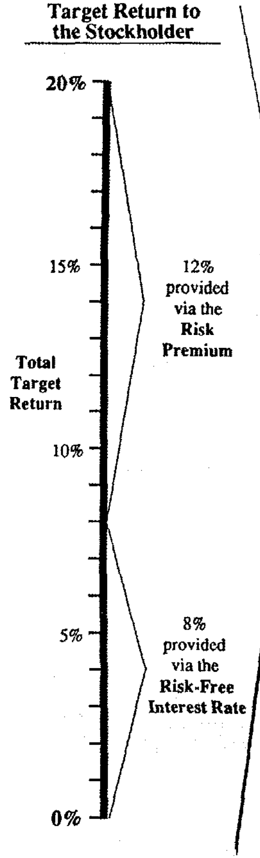
The risk involved to the equity provider comes from two sources:

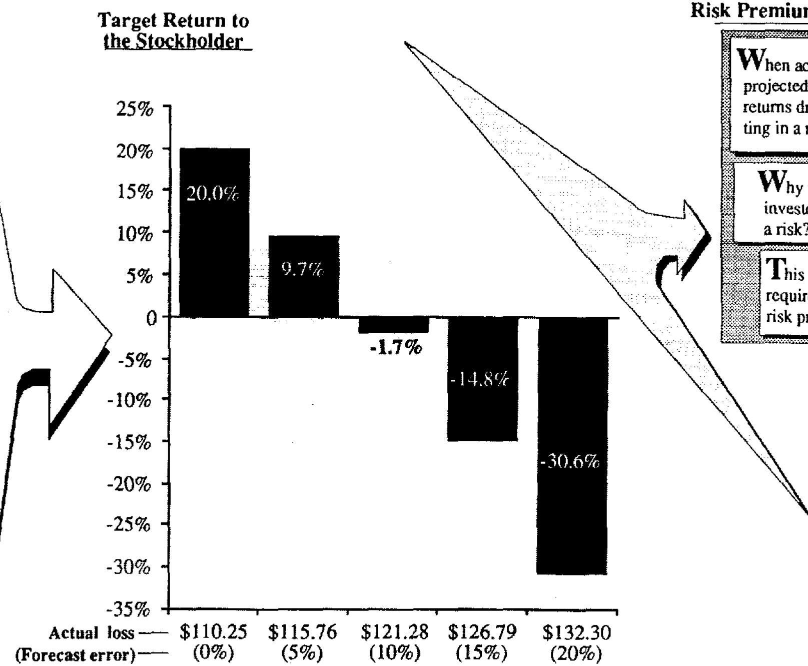
1. Normal fluctuations in the estimated loss payout based on chance variations in the number, type and severity of loss causing events.

2. Errors in estimating the impact on future loss payouts due to changes in prices, labor costs, the tort system, etc.; and

The first source represents the normal risk that the equity provider takes, as he can control it to some extent by pooling a large enough group of similar policies. However, the second source of risk presented above represents errors resulting from factors outside the forecaster's control, and these errors can have a very negative effect on the return to stockholders. The insurer must maintain sufficient equity to protect itself from insolvency in case the actual losses turn out to be significantly greater than anticipated.

The chart on the following page shows that the impact of even a modest forecast error can result in a large reduction in the return to the shareholders.





Risk Premium Requirement

When actual losses exceed projected losses by 20%, returns drop 253% -- resulting in a negative yield.

Why would a prudent investor accept such a risk?

This explains the requirement for a risk premium.

Assumptions in Simplified Model

• Originally Estimated Loss	$110.25
• Target Return to Stockholders	20%
• Ratio of Equity to Discounted Reserves	25%
• Premium	$130.00

**Taxes have been ignored to simplify this presentation.*

Conclusion:

The ultimate return to the investor is substantially affected by the risk of actual losses exceeding projected average losses.

Observations Regarding the Structure of Premiums

In situations where the amount of risk can be widely diversified, (such as in automobile insurance), the following observations regarding the structure of premiums are relevant:

- The Risk Premium is in fact a small fraction of the Total Policyholder Premium;
- Even broad changes in the return to stockholders, or in the required surplus, do not have a significant impact on the calculated Total Premium; conversely, small changes in premiums have a significant impact on the stockholders's return;
- Expected losses and loss adjustment expenses are the largest single component of the Total Premium;
- Operating expenses and taxes are the next largest component of the Total Premium;
- To make any significant impact on the premium, the factors that need to be controlled are the loss and LAE expenses, with operating expense as the next possible option.

Plain Talk About Massachusetts

Several witnesses in these proceedings have criticized elements of insurance regulation in Massachusetts. The Myers-Cohn method developed for Massachusetts shares certain elements of the Risk-Compensated Discounted Cash Flow (RCDCF) method we recommend. Fireman's Fund is certainly well aware of the rate regulation problems in Massachusetts. Indeed, the Company withdrew from that state at substantial cost because of the nature of regulation there. However, the lesson to be learned is not that discounted cash flow methods are inherently flawed. Rather, the principal error in Massachusetts was the state's failure to recognize loss and expense trends in developing premiums.

Massachusetts Automobile and Workers Compensation Rate Environment

Lessons Learned

- ... " Actual results fell short of the target underwriting profit provisions;"

Lines	Time Frame	Shortfall
• Automobile	years 1978 - 1983	6% of Premium
• Workers Compensation	years 1976 - 1981	11% of Premium

- ..." At the same time, they (the Regulators) resisted efforts to accurately estimate loss and expense costs"

  ..." Hindsight suggests that the Insurance Department's refusal to accept the prospective trend methodology for workers compensation during the period 1977-1982 may have been responsible for the mismatch of target and realized results."

  ..." underestimates in predicted loss costs of more than 8% per year led directly to the poor results for 1978-1983.."

- ..." Elegant theory and accurate parameter estimation will mean nothing if the basic ratemaking problem of estimating losses and expenses is handled unfairly or with poorly performing methods."

Source: Richard A. Derrig, *The Use of Investment Income in Massachusetts Private Passenger Automobile and Workers Compensation Ratemaking. Fair Rate of Return in Property-Liability Insurance*, edited by J. David Cummins, Scott A Harrington, Kluwer-Nijhoff Publishing, 1987

The Accounting "Proof" of the Risk-Compensated Discounted Cash Flow Method

The Risk-Compensated Discounted Cash Flow method "Shortcut" can be proven algebraically utilizing a traditional accounting approach:

See Exhibit 1

Assumptions:

	Period 0	End of Year 1	End of Year 2 (Immediately prior to loss payout)
Investment Income (utilizing an 8% risk-free rate)		$10.00	$10.50
Discounted Reserve Balance	$100.00	$105.00	$110.25
Equity Maintained	$25.00	$26.25	$27.56

Other Assumptions:

Risk free interest rate	**8%**
Loss payable at end of Year 2	**$110.25**
Ratio of required equity to discounted reserve	**25%**
Stipulated return on equity to stockholder	**20%**

The Accounting Sources and Uses Model:

	End of Year 1	End of Year 2
Sources of Funds:		
Equity Contribution	$1.25	$1.31
Investment income on premium funds allocated to the reserve	8.00	8.40
Investment income on equity contributions	2.00	2.10
Total sources of funds	$11.25	$11.81
Uses of Funds		
Increase in assets allocated to insurance operations		
- allocated to reserve	$5.00	$5.25
- allocated to equity	1.25	1.31
Dividends	5.00	5.25
Total uses of funds	$11.25	$11.81

Exactly offsetting; therefore ignore as they cancel out of the "Equation" (Equity Contribution $1.31 and allocated to equity 1.31)

The Risk-Compensated Discounted Cash Flow Method Shortcut -- "Reducing" the Algebraic Equation

1. Increase in reserve + dividend = Investment income on reserve + Investment income on equity

Restating the above equation:

2. Increase in reserve = Investment income on reserve — [Dividends — Investment income on equity]

Restating the increase in reserve to be the result of growth via the risk-compensated discount rate

Restated as:

Dividends and investment income on equity restated as a function of equity

3. [Reserve X Risk compensated interest rate] = [Reserve X Risk-free interest rate] — Equity X [Dividend rate — Risk-free rate]

Restating the above equation to remove "Reserve" from the left argument

4. Risk compensated interest rate = Risk-free interest rate — [Equity / Reserve] X [Dividend rate — Risk-free rate]

Risk-Compensated Discounted Cash Flow formula structure

Accounting "Proof" of the Fireman's Fund Risk-Compensated Discount Rate Method

The equivalence between the discounted cash flow method and the risk-compensated discount rate method is not intuitively obvious. That the two methods are equivalent can be demonstrated by starting out with the basic equation for a "Fair" Premium. We have demonstrated this using a "one period" model, but it is equally valid for multiple periods.

Loss Payout		Premium
+		+
Dividend Payments	=	Investment Income on Reserves
+		+
Operating Expenses		Investment Income on Equity

This is actually just the basic accounting statement that the total cash flow out must be equal to the cash flow in. The equity investment has been ignored, for the equity that is invested initially is returned at the end.

The risk-compensated discount rate method determines a rate so that:

		Opening Reserve (Premium)
Loss Payout	=	+
		Reserve x Risk-Compensated Rate

And as the opening reserve is the same as premium, the above can be restated as:

Loss Payout - Premium	=	Reserve x Risk-Compensated Rate

This permits us to restate the original "fair" premium equation as:

Reserve x Risk-Comp. Rate		Investment Income on Reserve
+	=	+
Dividend Payments		Investment Income on Equity

The dividend payments and the investment income on the equity are both dependent upon the amount of equity invested, hence:

Dividend Payment	=	Equity x Dividend Rate
Investment Income on Equity	=	Equity x Risk-Free Rate

Similarly, the investment income on the reserve can be stated in terms of the amount of reserve and the risk-free investment rate.

Investment income on Reserve	=	Reserve x Risk-Free Rate

If we replace the dividend amount and the investment income by their definitions in terms of amounts and rates, the "fair" premium equation can be further simplified to:

$$\text{Reserve} \times \text{Risk-Adj. Rate} + \text{Equity} \times \text{Dividend Rate} = \text{Reserve} \times \text{Risk-Free Rate} + \text{Equity} \times \text{Risk-Free Rate}$$

If the terms are re-arranged this can be written as

$$\text{Reserve} \times \text{Risk-Adj. Rate} = \text{Reserve} \times \text{Risk-Free Rate} - \text{Equity} \times \text{Dividend Rate} + \text{Equity} \times \text{Risk-Free Rate}$$

The above can be further re-written to remove Reserves explicitly from the left side of this equation, the equation then reduces to:

$$\text{Risk Adj. Rate} = \text{Risk-Free Rate} \cdot \frac{\text{Equity}}{\text{Reserve}} \left[\text{Dividend Rate} - \text{Risk-Free Rate} \right]$$

As the dividend rate is the rate that will provide a fair return to the investor, this brings us to the relationship that was originally stated:

$$\text{Risk Adjusted Discount Rate} = \text{Risk Free Rate} - \left[\text{Ratio of Equity to Discounted Reserves} \right] \times \left[\text{Target Return to Stockholders} - \text{Risk Free Rate} \right]$$

Through this derivation has been presented in a rather simplified manner, it can be shown that it is equivalent to the discounted cash flow method in all cases. The preceding exhibit summarizes the above and supports it with a numerical example.