CHAPTER FOUR

CASH FLOW MODELS IN RATEMAKING: A REFORMULATION OF MYERS-COHN NPV AND IRR MODELS FOR EQUIVALENCY[1]

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SUMMARY

The Myers-Cohn Net Present Value model and NCCI's IRR model are the two leading cash flow models used in ratemaking. This paper presents simple parameter and structural changes which demonstrate their equivalency. The "fair" premium produced by both models is shown to be identical given rational and consistent rules for setting parameter values, control of the flow of surplus, and discounting.

A byproduct of the structural changes proposed in the models is a rate of return that measures operating profitability. This "Operating Rate of Return" measures the insurance risk charge implicit in the ratemaking process in the form of a rate of return, yet it avoids the need to allocate surplus to lines of business. It is suggested as a replacement for the Return on Premium statistic.

Finally, ratemaking implications are discussed involving comparison of the liability beta and the equity beta, key parameters used in the Myers-Cohn and IRR models, respectively, which lead to determination of premium levels.

[1] Greg Taylor has also explored the relationships between the Myers-Cohn and the internal rate of return methods. "Fair Premium Rating Methods and the Relations Between Them," The Journal of Risk and Insurance, 1994 Vol. 61, No. 4, 592-615.

OVERVIEW

In recent years discounted cash flow models have gained in prominence as a ratemaking methodology and are often recommended by theoreticians and practitioners in the insurance field. The two predominant variations of cash flow models are the Myers-Cohn (MC) net present value (NPV) model, as used in Massachusetts, and the NCCI internal rate of return (IRR) model, used in many state workers compensation rate filings. Recent articles have discussed these two variations in detail and have further demonstrated the conditions under which they produce equivalent results. (See references (1), (3) and (11).)

The purpose of this paper is to suggest simple and straightforward modifications to these models in order to enhance their usage and to eliminate the unnecessary confusion that has existed as to the "differences" in these models when, in reality, there are none when the same parameters and assumptions are used. References (3) and (4) provide a more detailed background on the concepts and formulas which form the foundation for the material to be presented here.

The Myers-Cohn model is structured at an operating income level, that is, it deals with the present value of income from underwriting and from the investment only of policyholder provided funds. Formally, it does not provide a rate of return, and, by excluding surplus (except to reflect the tax on surplus related investment income when the "fair" premium is derived), it does not produce total net income and total rate of return. The NCCI model, in contrast, focuses primarily on the net cash flows to the shareholder, and the IRR that results, and it does not provide an operating return to measure the performance of insurance operations alone. The present form of each of these models, in terms of construction and underlying assumptions, makes it difficult to compare the results produced by them.

The modifications to be suggested here can be divided into a first group that is simply structural in nature to bring the models into alignment with each other and a second group that has to do with the parameter assumptions in order to establish consistency in application. The two most important technical points have to do with the use of after-tax discount rates, rather than before-tax rates, and the use of a liability-to-surplus leverage ratio to control shareholder surplus flows over time. As a result of these changes, each revised model will provide a clear statement of the separate rates of return to the policyholder, to the company from insurance operations, and to the shareholder. There will be a clear and identifiable linkage between the assumptions and results of both models, and income and rates of returns will be equivalent.

This article will begin by explaining the modifications required of the MC model to provide a NPV total rate of return. This will be followed by the modifications required of the IRR model to provide a rate of return that parallels the traditional MC operating level view, although the model is fine as is if the only objective is to produce a total rate of return to the shareholder. Essentially, MC will be expanded whereas IRR will be broken down to a finer level of detail.

The balance sheet corresponding to the underlying cash flows assumed by the models will be brought into the discussion since policyholder liabilities and surplus play an important role in the rate of return measurement process. The important linkage of surplus to liabilities will be discussed, as well, describing how both the initial surplus and its subsequent release to the shareholder should be governed by the nature of the insurance cash flows over a multi-year time frame.

Three rates of return are presented in the paper: (1) ***Underwriting Return*** (cost of policyholder supplied funds), (2) ***Operating Return*** (the charge to the policyholder for the transfer of underwriting risk to the company) and (3) ***Total Return*** to the shareholder. The Operating Return is presented as an alternative to the Return on Premium statistic preferred by those in the industry who have an aversion to the allocation of surplus and total return.

As a last point, the implications for ratemaking will be discussed. It will be shown that the premium determined by both the "reformulated" Myers-Cohn and IRR agree and the economic rationale for this. Of particular interest is the underlying connection between two critical parameters of the models: the liability beta, used by Myers-Cohn to establish the risk-adjusted discount rate for calculation of the "fair" premium, and the equity beta, used by the IRR approach to determine the cost of capital target return. Formulae are presented for the fair premium and the betas which, in the absence of measured market data, are used to demonstrate the (theoretical) relationships among the equity and liability betas, leverage and other variables.

Since the term "fair premium" is used often in the context of Myers-Cohn, definitions are offered below relative to both Myers-Cohn and IRR.

A premium is considered to be "fair" in the Myers-Cohn sense if the risk-adjusted total rate of return that results from use of this premium equals the risk-free rate.

A premium is considered to be "fair" in the IRR sense if the total rate of return that results from use of this premium equals the cost of capital.

This paper will demonstrate how the Myers-Cohn and IRR models, given equivalently defined parameters and model assumptions, produce an identical fair premium.

Myers-Cohn Net Present Value Model: Reformulation

The traditional MC model format as shown in reference (9) is as follows:

$$P = PV(L) + PV(UWPT) + PV(IBT)$$

This states that the fair premium, P, is equal to the sum of the present value of the losses, L, the tax on underwriting profit, $UWPT$, and the tax on investment income derived from the investable balance, IBT. The investable balance includes all policyholder liabilities (net of premium, loss and expense) and surplus. Note that underwriting expense is combined with loss as total liabilities in the example in the cited reference.

It is suggested that the discount rates be adjusted for risk (i.e. uncertainty), particularly the rate applicable to losses. No mention is made as to whether discount rates are on a before-tax or after-tax basis.

This traditional format will be followed to some degree, but extended to two periods and with slightly modified assumptions. A group of policies produce a premium, P, which is collected without delay (at time 0). Expenses, E, are \$0. Losses, L, total \$1,000 dollars and are paid at the end of two years. Taxes on underwriting and investment will be assumed to be paid without delay. In the original reference presentation underwriting taxes were assumed to have a one year delay in their payment. The tax loss discount (TRA 86) will be excluded for simplification.

Surplus will be set at each point in time to an amount equal to L/F, where F is the liability/surplus leverage factor. In the reference (9) previously cited, S was set equal to P for the single period example presented.

The following specific modifications to the traditional MC model are suggested to produce a total rate of return and permit an alignment with a similarly modified NCCI model.

STRUCTURAL CHANGES

1. Introduce surplus flows into the model, including related investment income.

2. Separate and clearly delineate income from (1) underwriting, (2) investment of policyholder funds, and (3) investment of shareholder surplus.

3. Construct balance sheets and income statements, valued on both a nominal and a present value basis, given the respective cash flows. The present value of liabilities and surplus are of particular importance.

4. Discount all flows using after-tax rates, whether risk-free or risk-adjusted rates.

5. Develop rate of return measures from the net present value income components (underwriting, operating income, and total income) by forming a ratio to the relevant balance sheet liability item. Although "fair" premiums are determined using risk-adjusted discount rates, display net present value calculations both ***with*** and ***without*** risk-adjustment to allow comparison to results produced via Internal Rate of Return.

6. Discount surplus and underwriting taxes also on a risk-adjusted basis to the degree they are influenced by losses. Surplus, since it is determined by use of a leverage ratio relative to liabilities inclusive of loss, and underwriting taxes, are both affected by loss and must also be risk-adjusted for the portion so affected. As in the case of losses, display net present value calculations both with and without risk-adjustment.

PARAMETER/OPERATIONAL CHANGES

1. Control surplus flows through a linkage with liabilities, both with respect to amount and timing.

2. Distribute operating earnings in proportion to the liability exposure over the period for which exposures exist. Essentially this rule distributes operating earnings in proportion to the loss reserve over time.

The use of an after-tax rate for discounting is critical, since a true economic present value cannot be determined unless the need to pay taxes is recognized. Furthermore, the fact that taxes are paid shortly after (investment) income is earned must also be reflected. This means that "inside-buildup" discount calculations, wherein before-tax rates are used with taxes determined in a single final step, is incorrect. In addition, use of an after-tax rate is necessary to bring the NPV measurements of income and return into sync with the IRR, in which use of an after-tax discount is implicit. The issue of after-tax discounting is discussed in more detail in the Appendix.

While the risk-adjusted discount rates may be used to calculate a "fair" premium, an alternative view is to focus on the total return instead. Using the same premium, when net present values are calculated without risk adjustment, the treatment of risk is framed in the context of establishment of a fair total return target, rather than as a discussion of how to risk-adjust losses. It is for this reason that present values are to be calculated both with and without risk adjustment. As will be shown in the examples, ***the risk-adjusted NPV rate of return will always equal the risk-free rate, and the NPV rate of return, not risk-adjusted, will equal the targeted cost of capital as calculated by the IRR.***

Exhibit I presents the derivation of the "fair" premium that results from this reformulated Myers-Cohn approach - from the use of after-tax discounting and the control of surplus via its linkage to liabilities. In this example interest rates are 10%, the tax rate is 35%, and a risk adjustment of 2.0%, before-tax (i.e. 1.3% after-tax) is made when discounting. A liability/surplus ratio of 4 to 1 is used to determine the level of surplus. The premium in this example is $876.63. As stated previously, premiums and taxes are assumed to have no delay in their receipt or payment.

EXHIBIT I

DERIVATION OF "FAIR" PREMIUM WITH AFTER-TAX DISCOUNTING

P =	PV(L)	903.60	$L/(1+R-R_L)^N$ $1000/(1+0.065-0.013)^2$
	+ PV(UWPT)	-43.18	$T[P/(1+R)^{N_T} - L/(1+R-R_L)^{N_T}]$ $0.35[876.6/(1+0.065)^0 - 1000/(1+0.065-0.013)^0]$
	+ PV(IBT)	16.22	$T\,Rb\,S[(1-1/(1+R-R_L)^N/(R-R_L)]$ $(0.35)(0.10)(250)[1-1/(1+0.065-0.013)^2/(0.065-0.013)]$
"Fair" Premium Equals		**876.63**	

P:	Premium	Rb:	Interest Rate, Before-Tax
L:	Loss	R:	Interest Rate, After-Tax
N:	Loss Payment Date	R_L:	Risk Discount Adjustment, After-Tax
T:	Tax Rate	F:	Liability / Surplus Leverage factor
N:	Under. Tax Payment Delay	S:	Initial Surplus Contribution (L/F)

UWPT: Underwriting Profit Tax

IBT: Investable Balance Investment Income Tax

Notes: Due to After-Tax Discounting $PV(IBT)$ reduces to simply tax on investment income derived from the investable surplus balance.

Liability/Surplus Relationship implies Surplus level affected by risk adjustment.

Exhibit II presents a summarized balance sheet and income statement for this example, following conventional accounting rules. A two-period total and net present values, both with and without risk adjustment, are also shown for some items.

EXHIBIT II

BALANCE SHEET AND INCOME STATEMENT
(TWO PERIOD EXAMPLE)

	PERIOD				NPV	NPV
	0	1	2	Total	Not Risk Adjusted	Risk Adjusted
BALANCE SHEET (Ending)						
Total Assets	1,170	1,209	0	2,378	2,164	2,206
Loss Reserve	1,000	1,000	0	2,000	1,821	1,854
Retained Earnings	-80	-41	0	-122	-112	-112
Shareholder Surplus	250	250	0	500	455	464
Liabilities/Surplus	4.0	4.0	0			
INCOME AFTER-TAX						
Underwriting Income	-80	0	0	-80		
Investment Income						
Loss Reserves		65	65	130		
Retained Earnings		-5	-3	-8		
Total Operating	-80	60	62	42		
Investment Income						
Shareholder Surplus		16	16	32		

NET PRESENT VALUE INCOME AND RATE OF RETURN

The steps necessary to structure the model to produce total income and rate of return are recapped in Exhibits IIIa and IIIb (following page 35). Exhibit IIIa presents the calculations using a risk adjustment, and Exhibit IIIb presents them without the risk adjustment. First NPV Operating Income is calculated as:

$$\text{NPV Operating Income}(OI) = PV(P) - PV(L) - PV(UWPT)$$

The following is an alternative, yet equivalent, form of presentation for this operating income:

$$\text{Underwriting Income(UI)} + \text{Policyholder Funds Investment Income Credit}(IIC)$$

The use of the term "credit" is to reinforce the fact that this is the present value of investment income to be earned in the future. The net present value of income is calculated with risk-adjustment and without risk-adjustment (i.e. R_L is set to "0").

To include investment income on surplus it is necessary to simply add this to the formula as follows:

$$\text{NPV Total Income}(TI) = \text{Operating Income} + \text{Surplus Investment Income Credit}$$

The investment income on surplus is the present value of investment income to be earned on surplus in the future. Here surplus is set initially and then maintained over time using a given the liability/surplus leverage factor. Note that when losses are risk-adjusted $(R_L > 0)$ that surplus is implicitly risk-adjusted as well.

In order to permit the calculation of rates of return from operations and to the shareholder, the balance sheet "investment" upon which these returns are earned is needed. These items, NPV Operating Liabilities and NPV Surplus, are as shown.

It should be noted that all formulas presented are simplified due to the example selected, especially the assumption that all losses are to be paid in a single payment at the end of two years. In application, actual cash flows occurring over multi-periods each need to be discounted and summed to determine present value.

Three rates of return are of interest:

1. the underwriting rate of return on the assets corresponding to the liabilities assumed by the company when writing this business (i.e. the cost to the company of policyholder supplied funds),

2. the operating return to the company on the assets corresponding to the same policyholder liabilities assumed, including investment income on policyholder funds, (i.e. the insurance risk charge to the policyholder for the transfer of insurance risk to the company), and

3. the rate of return to the shareholder.

Each of these three rates of return is calculated by dividing a particular income item by its respective balance sheet liability (or its matching asset commitment). These are summarized below:

The underwriting return on liabilities, the cost of policyholder supplied funds to the company, is the ratio:

Underwriting Return = NPV Underwriting Income/NPV Policyholder Liabilities

The operating return on liabilities, the risk charge to the policyholder, is the ratio:

Operating Return = NPV Operating Income/NPV Policyholder Liabilities

Operating income is the sum of underwriting income and investment income on policyholder funds. Total return to the shareholder also includes investment income on surplus and is the ratio:

Total Return on Surplus(ROS) = NPV Total Income/NPV of Surplus

It is important to note that net present value of surplus is the sum of the amounts of surplus committed over the period of years, in present value terms. As mentioned previously, the control of this surplus flow is critical. Use of the liability/surplus leverage ratio over time is necessary to produce a result wherein the ROS equals the IRR. Also, as will be shown later, the annual income distribution to the shareholder will also equal this rate in each period.

The cost of policyholder supplied funds represents the rate of return the company pays to the policyholder on the pure underwriting related flows with the transfer of insurance risk to the company. The investment income on these flows will then accrue to the company's benefit. The net insurance charge to the policyholder reflects the sum of the underwriting cost, offset by the gain on investments realized by the company. Viewed mathematically (and using the data in Exhibit IIIB), the cost of policyholder funds of -4.4% plus the market rate of return on investments of 6.5% equals the insurance risk charge of 2.1%. In essence, the company earns the excess of the risk-free interest rate over the cost of funds paid to the policyholder in exchange for assuming the underwriting risk embodied in the transaction.

EXHIBIT IIIA

NET PRESENT VALUE INCOME, BALANCE SHEET AND RATE OF RETURN DEFINITIONS, FORMULAS AND CALCULATIONS **WITH** RISK ADJUSTMENT

INCOME ITEMS	FORMULAS
Underwriting Income	$(P-L)(1-T)$ $(876.63-1{,}000)(1-0.35)=-80$
Operating Income	$PV(P)-PV(L)-PV(UWPT)=P-L/(1+R-R_L)^N-T(P-L)$ $876.63-1{,}000/(1+0.065-0.013)^2-(0.35)(876.63-1{,}000)$ $(P-L)-T(P-L)/(1+R)^N+L\left(1-1/(1+R-R_L)^N\right)$ $(876.63-1{,}000)-(0.35)(876.6-1{,}000)/(1+0.065)^0$ $+1{,}000\left(1-1/(1+0.065-0.013)^2\right)$ = Underwriting Income + Investment Income Credit on Policyholder Liabilities $-80+96=16$
Surplus Investment Income	R(Surplus) $(0.065)(464)=30.16$
Total Income	Operating Income + Investment Income on Surplus $16+30=46$
BALANCE SHEET ITEMS	
Policyholder Liabilities	$L\left(1-1/(1+R-R_L)^N\right)/(R-R_L)$ $1{,}000\left(1-1/(1+0.065-0.013)^2\right)/(0.065-0.013)=1854$
Surplus	$S\left(1-1/(1+R-R_L)^N\right)/(R-R_L)$ $250\left(1-1/(1+0.065-0.013)^2\right)/(0.065-0.013)$
RATES OF RETURN	
Underwriting Return on Liabilities (UROL) (Cost of Policyholder-Supplied Funds)	Underwriting Income / Policyholder Liabilities $-80/1{,}854=-4.3\%$
Operating Return on Liabilities (ROL) (Risk Charge to Policyholder)	Operating Income / Policyholder Liabilities $16/1{,}854=0.9\%$
Total Return on Surplus (ROS) (Shareholder Return)	Total Income / Surplus $46/464=10.0\%$ $=(ROL)$(Liability/Surplus) + R $0.9\%(4)+6.5\%=10.0\%$

EXHIBIT IIIB

NET PRESENT VALUE INCOME, BALANCE SHEET AND RATE OF RETURN DEFINITIONS, FORMULAS AND CALCULATIONS **WITHOUT** RISK ADJUSTMENT

INCOME ITEMS	FORMULAS
Underwriting Income	$(P-L)(1-T)$ $(876.63-1{,}000)(1-0.35)=-80$
Operating Income	$PV(P)-PV(L)-PV(UWPT)=P-L/(1+R)^N-T(P-L)$ $876.63-1{,}000/(1+0.065)^2-(0.35)(876.63-1{,}000)$ $(P-L)-T(P-L)/(1+R)^N+L\left(1-1/(1+R)^N\right)$ $(876.63-1{,}000)-(0.35)(876.6-1{,}000)/(1+0.065)^0+1{,}000\left(1-1/(1+0.065)^2\right)$ = Underwriting Income + Investment Income Credit on Policyholder Liabilities $-80+118=38$
Surplus Investment Income	R(Surplus) $(0.065)(455)=29.58$
Total Income	Operating Income + Investment Income on Surplus $38+30=68$
BALANCE SHEET ITEMS	
Policyholder Liabilities	$L\left(1-1/(1+R)^N\right)/R$ $1{,}000\left(1-1/(1+0.065)^2\right)/0.065=1821$
Surplus	$S\left(1-1/(1+R)^N\right)/R$ $250\left(1-1/(1+0.065)^2\right)/0.065=455$
RATES OF RETURN	
Underwriting Return on Liabilities (UROL) (Cost of Policyholder-Supplied Funds)	Underwriting Income / Policyholder Liabilities $-80/1821=-4.4\%$
Operating Return on Liabilities (ROL) (Risk Charge to Policyholder)	Operating Income / Policyholder Liabilities $38/1821=2.1\%$
Total Return on Surplus (ROS) (Shareholder Return)	Total Income / Surplus $68/455=14.9\%$ $=(ROL)$(Liability/Surplus) + R $2.1\%(4)+6.5\%=14.9\%$

"FAIR" PREMIUM EXAMPLES: THE EFFECT OF TAXES AND RISK ADJUSTMENT

It is interesting to observe how the modified fair premium determined in the manner shown produces a logical result in terms of rate of return from operations and to the shareholder as tax rates and the risk adjustment vary. Four examples are presented in Exhibit IV. Example 4 is the example used above.

Example 1 is without tax and without risk adjustment. The fair premium is $826.45, corresponding to an operating return of 0%, and the total return is 10%. ***When there is no risk, the return to the shareholder is simply the risk-free rate of 10%.***

Example 2 is with taxes at 35% and without risk adjustment. The fair premium increases to $842.45, the operating return is 0.9%, and the total return is 10%. The increased premium exactly covers the amount of taxes on the investment income from surplus necessary to provide a before-tax return to the shareholder. ***The shareholder is not responsible for payment of any taxes incurred within the insurance entity, and this is covered by the increased policyholder premium.*** Again, since there is no risk to the shareholder, the return to the shareholder is the risk-free rate of 10%.

Example 3 is presented to demonstrate what happens if the tax on the surplus related investment income is not included in premiums. This example, with taxes at 35% and without risk adjustment, is similar to Example 2, but the present value of the tax on the investment income from the surplus balance has been excluded from the determination of the fair premium. The premium declines to $817.94. The operating return is 0% and the total return is 6.5% to the shareholder. In this case the shareholder will receive only an after-tax rate or return. This demonstrates that ***the common definition of "break-even" as "0" operating return is not break-even from an investor's standpoint.***

The break-even return to the investor must be equivalent to a before-tax rate of return for it to be comparable to other investment opportunities. An insurance company must run above "0" operating return to be at break-even.

Example 4 is with taxes at 35% and with a risk adjustment of 2.0% before-tax, 1.3% after-tax. The premium increases to $876.63 to cover the added risk related to the uncertainty of the loss. This is the example presented earlier. Example 4A, utilizes this same fair premium but simply displays the results without use of the risk adjustment in the calculation of the net present values.

EXHIBIT IV

MODIFIED "FAIR" PREMIUM AND NET PRESENT VALUE INCOME, BALANCE SHEET AND RATES OF RETURN WITH VARYING TAX RATES AND RISK ADJUSTMENT

	Examples				
Assumptions & "Fair" Premium	1	2	3	4	4A
Tax Rate	0	35%	35%	35%	35%
Risk Adjustment(Before Tax)	0.00%	0.00%	0.00%	2.00%	set to 0
"Fair" Premium	826.45	842.45	817.94	876.63	same
Net Present Value Income Items					
Underwriting Income	-174	-102	-118	-80	-80
Operating Income	0	16	0	16	38
Surplus Investment Income	43	30	30	30	30
Total Income	43	46	30	46	68
Net Present Value Balance Sheet Items					
Net Operating Liabilities	1,736	1,821	1,821	1,854	1,821
Surplus	434	455	455	464	455
Net Present Value Rates of Return					
Underwriting Return (Cost of Policyholder Supplied Funds)	-10.0%	-5.6%	-6.5%	-4.3%	-4.4%
Operating Return (Risk Charge to Policyholder)	0.0%	0.9%	0.9%	0.9%	2.1%
Total Return (Shareholder Return)	10.0%	10.0%	6.5%	10.0%	14.9%

Notes: Example 3 calculates fair premium without including tax on investment income from surplus.
Example 4A is same as Example 4, except that present values are calculated without risk adjustment

Example 4 and 4A represent two alternative views. ***The financials are equivalent in both cases, but the way that risk is reflected differs***. Example 4, by introducing the risk adjustment into the discount rate, produces a ***risk-adjusted*** operating return of 0.9%, the same as in Example 2, and a ***risk-adjusted*** return to the shareholder of 10%, also the same as in Example 2. However, this is a bit circumspect since investors do not normally view the world in a risk-adjusted manner.

Example 4A determines the net present values ***without risk adjustment***. The operating return that results is 2.1% and the return to the shareholder is 14.9%. This is the return that the shareholder will actually see and it is the rate of return that will be used for comparison to alternative investments in the equity marketplace. Presenting the results in this manner provides an explicit statement of how an investor is to be compensated for the added risk involved when investing in insurance. In this example, a risk premium of 4.9% over and above the risk-free rate will be returned to the shareholder to compensate for the riskiness of making this insurance investment.

Note that the operating returns shown in Examples 4 and 4A differ by the amount of the risk adjustment. That is, the difference between 0.9% and 2.1% is the 1.3% after-tax risk adjustment (difference due to rounding).

What this shows is that the MC formulation, and NPV models generally, can be modified to produce rates of return on operations and to the shareholder, with and without risk adjustment. While the choice of whether risk adjustment is to be used is one of preference here, if reconciliation to the NCCI's IRR model is to be shown then the risk adjustment must be omitted, so that rates of return are reflected as they would appear in normal, undiscounted financials.

A more detailed discussion of the net present valued income, balance sheet, and rates of return is presented in references (3) and (4).

At this time, the NCCI and the cash flow perspective will be explored and modifications suggested for it presented.

THE IRR CASH FLOW PERSPECTIVE: REFORMULATION

The NCCI cash flow model's primary objective is to develop a series of shareholder flows, based on the underlying insurance cash flow characteristics, so that an internal rate of return (IRR) can be calculated. The IRR value thus determined represents the rate of return realized by an investor in this insurance business.

If the only concern is to develop this total shareholder return, then this result is sufficient. However, much underwriting and cash flow detail underlies this determination which can be utilized to develop other useful rate of return measures, such at the operating rate of return discussed previously. This will be explored in more detail after the specific suggested IRR model modifications are made.

The following specific modifications to the IRR model are suggested to produce additional rates of return and align its structure with the MC (revised) model.

STRUCTURAL CHANGES

Separate and clearly delineate cash flows from (1) underwriting, (2) investment of policyholder funds, and (3) investment of shareholder surplus.

1. Construct the balance sheet that corresponds to the cash flows in the model.
2. Develop IRR rate of return measures corresponding to the aggregate cash flows pertaining to underwriting and net operating income (underwriting and investment income from policyholder funds) in addition to that at the shareholder level.

PARAMETER/OPERATIONAL CHANGES

1. Solve for a fair premium based on a specified target total rate of return. Eliminate reference to such things as "profit loads" since this whole concept has little meaning in the context of total return.
2. Use a risk-free earnings rate to project investment income. If higher risk investments must be used, provide this in addition to, but not as a replacement for risk-free rates.

The NCCI usually develops a rate indication predicated on a total return, yet it still refers to a "profit load" in filings, as do many companies. This is a throwback to prior times when "profit loads" served to act as a frame of reference in the ratemaking process. With the greater role of investment income and the increased complexity of insurance contracts and cash flows, this concept should be retired. Whether intended or not, this leaves the impression that some sort of profit guarantee has been loaded into the rates. Nothing could be further from the truth. In reality, ***the profit load is simply 100% less the combined ratio, an "underwriting margin"***. This says little about profit, since it is a measure of underwriting performance only, excluding investment income, and it is on a before-tax basis. In addition, it lacks a frame of reference as to what a "fair" level ought to be in a given line of business.

Most importantly, today it generally is not a starting point in the ratemaking process. Both the Myers-Cohn and NCCI approaches deal prospectively with underwriting and investment together with their attendant risks. (Actually, Myers-Cohn as it is presently structured does not deal with investment risk, as will be discussed later.) This rate of return-oriented ratemaking basis renders the concept of profit load largely irrelevant. A so-called profit load is simply a by-product result of the process.

As an example of the type of changes suggested to the NCCI's IRR model, Exhibit V utilizes a cash flow perspective to demonstrate all flows involved in the insurance transaction for the same example used previously. The focus of Exhibit V is on the cash flow transactions that occur internally between the policyholder and company, and between the company and shareholder. Positive cash flows are ***to*** the company, negative flows are ***from*** the company. See reference (3) for more detail.

The first section of Exhibit V summarizes the transactions between the policyholder and the company and shows the total operating flows from underwriting net of premium, loss, underwriting taxes and retained earnings, before investment. In the example, in the initial time period the company receives a premium of $877 and a tax credit of $43. In addition, the policyholder "account" is made whole by funding the change in retained earnings in the amount of $80 from the surplus account. The change in retained earnings captured in the policyholder level account reflects the implicit flow necessary to fully fund operational liabilities.

The net initial policyholder level cash flow is thus $1000 at policy inception followed by payments of $44 (change in retained earnings net of its related investment income) in years 1 and 2 and a loss payment of $1000 at the end of year 2. The total of these flows is a net payment outflow of $88, $80 of which is the after-tax underwriting loss and $8 of which is the loss of investment income on the negative retained earnings. The *IRR **to the policyholder*** for this stream of cash flows is 4.4%, or -4.4% ***to the company***. This is the "cost of policyholder funds" supplied to the company.

The company invests the policyholder supplied funds prior to payment of losses, and the resultant cash flows are $65 in years 1 and 2, and total $130.

The total operating flows including investment is $1000 at policy inception and $21 and -$979, at the end of years 1 and 2, respectively. The total of $42 is the operating income. The IRR is -2.1% ***to the policyholder***, or +2.1% ***to the company***. This is the "insurance risk charge", the rate of return implicit in the transfer of underwriting risk from the policyholder to the company. In essence, the company keeps the investment income in excess of that needed to cover underwriting costs in exchange for the transfer of risk. Viewed mathematically, the market rate of return on investments of 6.5% less the 4.4% cost of policyholder funds equals the 2.1% insurance risk charge.

EXHIBIT V

UNDERWRITING, OPERATING AND SHAREHOLDER CASH FLOWS AND IRR'S FROM COMPANY PERSPECTIVE

	PERIOD 0	1	2	Total	NPV Not Risk Adjusted	NPV Risk Adjusted
OPERATIONS						
Premium Receipts	877	0	0	877	877	877
Loss Payments	0	0	-1,000	-1,000	-882	-904
Underwriting Tax	43	0	0	43	43	43
Ret. Earns "Funding"	80	-44	-44	-8	0	0
Total UW / PH	1,000	-44	-1,044	-88	38	16
					4.4%	**IRR**
IRR is the return on underwriting to the policyholder.						
This is the "Cost of Policyholder Funds" to the Company.						
Investment Income (AT)		65	65	130		
Total Operating	1,000	21	-979	42		
					-2.1%	**IRR**
IRR is the operating return to the policyholder.						
This is the "Risk Charge" to the Policyholder.						
SURPLUS						
Contributed	250	0	-250	0	Note (1)	
Investment Income (AT)		-16	-16	-32	Note (2)	
Oper Earnings Distribution		-21	-21	-42	Note (3)	
Net Shareholder	250	-37	-287	-74		
					14.9%	**IRR**
IRR is the total return to the shareholder.						
PERIOD RETURN						
Rate of Return on Surplus Beginning of Year		**14.9%**	**14.9%**			

Notes:
(1) Governed by Constant Liability/Surplus Ratio.
(2) Distributed as Earned.
(3) Distributed in Proportion to per Period Liability Exposure.

Switching to the transactions between the company and the shareholder, three important rules govern the flow of surplus:

1. the level of surplus is controlled so that the ratio of liabilities to surplus is fixed (4 to 1 in this example),

2. investment income on surplus is returned to the shareholder as it is earned, and

3. operating earnings are distributed to the shareholder in proportion to the settlement of liability exposures over time.

These criteria will be discussed in more detail later. The net shareholder surplus flow consists of three components: the initial contribution of surplus and its subsequent withdrawal, investment income on this surplus, and operating earnings. In this example, the company received a shareholder contribution of $250 initially, followed by payments to the shareholder of $37 and $287, in years 1 and 2, respectively. This totals a net payment of $74 to the shareholder, which is the total net income. The IRR ***to the shareholder*** is 14.9% and this is the shareholder total return in this example.

An important result that is achieved when the rules governing the flow of surplus are followed in this manner is that the actual rate of return received each year by the shareholder is equal to 14.9% of each year's beginning surplus. That is to say, if dividends are paid to the shareholder using the net flows shown, the shareholder will realize a return on investment of 14.9% ***every*** year until the initial investment is fully returned.

This demonstrates how an IRR model can be utilized to provide the following three useful rates of return:

1. underwriting rate of return to the policyholder (i.e. cost of policyholder provided funds),

2. operating rate of return (i.e. insurance risk charge), and

3. total rate of return.

The NCCI model currently is structured to provide the total rate of return only. Yet the flows necessary to support the calculation of these additional rates of return can be easily extracted.

The section that follows will expand on the meaning and potential use of the operating rate of return.

OPERATING RETURN: RATE OF RETURN WITHOUT ALLOCATION OF SURPLUS

The use of total rate of return for ratemaking and profitability measurement is difficult for some to accept since this perspective involves an implicit allocation of surplus to lines of business. The *Return on Premium* (*ROP*) is often used as an alternative measure in those instances when surplus allocation is to be avoided. Unfortunately, *ROP* is lacking a contextual framework in that it has meaning only within the insurance industry. Comparable measures do not exist across other industries, and it is difficult to assess what a "fair" *ROP* is. No body of comparative reference data exists to aide in its determination in the way that cost of capital data exists to guide the selection of a target total return. Even more troublesome is the fact that *ROP's* differ widely among insurance lines of business due to differing conditions, most notably the length of the loss payout "tail" and the investment income that results. This investment income bears little direct relationship to the level of premium itself. In essence, *ROP* is a poor measure of return, since it relates income to sales, rather than to investment.

The reformulation of the Myers-Cohn NPV and IRR models produces, as a byproduct, three useful rate of return measures: (1) Underwriting Return, (2) Operating Return and (3) Total Return. Respectively, these measure the cost of policyholder supplied funds to the company, the charge to the policyholder for the transfer of underwriting risk to the company, and total return to the shareholder. The operating return is of particular interest, and it is suggested here as an alternative to the *ROP*. The operating return has the following attributes:

1. It does not require the allocation of surplus.

2. It uses the same components of income as included in the *ROP* but is a true expression of a rate of return in that operating income is measured against an "investment" rather than a sales figure.

3. Differences among lines of business are reflected automatically and, if a constant liability-to-surplus leverage factor is assumed (much like a constant premium to surplus is assumed at times when using *ROP*), the operating return is but one component of a total return approach.

4. Its definition and measurement is entirely consistent with total return.

The operating rate of return, or insurance risk charge, offers a rate of return which can be used in the establishment of a "fair" insurance return consistent (since it is mathematically part of total return) with total return as commonly accepted in the financial community. (See (3).)

The following section will briefly discuss controlling of surplus flow and recap the equivalency in rates of return for the reformulated Myers-Cohn (MCR) and NCCI models.

CONTROLLING THE FLOW OF SURPLUS AND NPV/IRR EQUIVALENCY

Surplus exists as a financial buffer in support of business writings. The amount of the initial surplus contribution and the timing of its subsequent withdrawal is an important component of total return. An IRR is calculated directly from this series of flows. From a present value perspective, the total rate of return is the total income as a percentage of the surplus committed, wherein both income and surplus are sums across the many years of financial activity as the liabilities run off.

This perspective focuses on a single policy (or accident) period and its development over future calendar periods. This differs from a calendar period view which is, in effect, constructed by summing contributions from the current and previous policy periods. It is common to view the development of calendar loss reserves in the form of a loss triangle, and if one is interested in calendar income, surplus and rate of return, it is suggested that they be viewed in an analogous manner (i.e. in the form of triangles). (See (4)).

Selecting a financial leverage factor (i.e. the ratio of liabilities to surplus) is a critical starting point since this factor determines the initial surplus contribution and the amounts of surplus subsequently released over time as liabilities are settled. The following principles guide the flow of surplus once this leverage factor has been selected (i.e. both initial shareholder surplus contribution and subsequent withdrawal):

1. The surplus level is controlled over time by a direct linkage of that level to the level of net policyholder liabilities.

2. Insurance operating earnings (underwriting and investment income on policyholder supplied funds) of each accident year are released to the shareholder (e.g. as dividends) as insurance liabilities are settled.

The release of operating earnings suggested here reflects the means by which the company (and the shareholder in turn) gains ownership to the operating profits. Operating profits result from, and are for the transfer of risk, and the release of profits in this manner corresponds to the per period exposure to this risk.

In this scenario, all three of the following will be identical:

1. the net present value ROS,

2. the internal rate of return (IRR)

3. the annual increments of shareholder earnings distribution, as a rate of each year's beginning surplus.

The balance sheet and cash flow perspectives have been used to develop the NPV and IRR rates of return, respectively. In addition, rates of return have been determined at the policyholder, company and shareholder levels. Exhibit VI provides a summary of the results and demonstrates the equivalency in returns. Properly calculated net present value (not risk adjusted) balance sheet liabilities, surplus and income produce the same underwriting, policyholder and shareholder returns as their nominal (undiscounted) counterparts do. And they are equivalent to the IRR's produced from the cash flows.

As shown in this table, the policyholder, company, and shareholder rates of return produced by the NPV and IRR approaches are identical. This important result confirms their equivalency and demonstrates that, when surplus is controlled in the same manner, the results produced by the two approaches will be equal.

This demonstration that the NPV and IRR models are equivalent given consistency in model structure and parameters has implications for ratemaking. The underlying principles, such as use of a liability / surplus leverage ratio to control surplus flow, are based on a sound rationale and are not simply academic attempts to force two models to produce the same answer. Approaches to dealing with risk, return and leverage are valid irrespective of a model's mechanics.

EXHIBIT VI

NOMINAL AND NET PRESENT VALUE RATE OF RETURN SUMMARY

NOMINAL BASIS	Year 1		Year 2	
Assets/Liabilities	Balance Sheet	Income	Balance Sheet	Income
Policyholder	1,000	-85	1,000	-3
Net Operating	1,000	-20	1,000	62
Surplus	250	16	250	16
Net	250	-4	250	79

Assets / Liabilities	Total Balance Sheet	Total Income	Total Return	IRR
Policyholder	2,000	-88	-4.4%	4.4%
Net Operating	2,000	42	2.1%	-2.1%
Surplus	500	32	6.5%	
Net	500	74	14.9%	14.9%

The reversed sign of the IRR reflects return from the policyholder perspective.

NET PRESENT VALUE BASIS

NOT RISK ADJUSTED

Assets/Liabilities	Balance Sheet	Income	Return	
Policyholder	1,821	-80	-4.4%	(1)
Net Operating	1,821	38	2.1%	(2)
Surplus	455	30	6.5%	
Net	455	68	14.9%	

(2)-(1)= 6.5% The Risk-Free Earnings Rate, After-Tax

RISK ADJUSTED

Assets/Liabilities	Balance Sheet	Income	Return	
Policyholder	1,854	-80	-4.3%	(3)
Net Operating	1,854	16	0.9%	(4)
Surplus	464	30	6.5%	
Net	464	46	10.0%	

(4)-(3) = 5.2% The Risk-Free Earnings Rate, After-Tax
Less 1.3% Risk Adjustment, After-Tax

RATEMAKING IMPLICATIONS: PARAMETER SELECTION AND KEY RELATIONSHIPS

Given a consistent set of parameters and the equivalent results produced by NPV and IRR models, it is worth exploring the question of how each model selects its key assumptions in practice. Both models require use of an investment yield, assumed here to be the risk-free rate. The risk adjustment applicable to losses is the key assumption in the Myers-Cohn model which drives the fair premium calculation. The cost of capital (i.e. the target total return) is the key assumption of the IRR model which drives the premium result of this model. As discussed earlier, if the NPV calculation of a fair premium were to be without risk adjustment then the cost of capital would be the key assumption in this model as well. This begs the question as to how the risk adjustment and cost of capital are determined and their relationship to each other.

The traditional approach is to use the Capital Asset Pricing Model (CAPM) (see (2)) as follows:

$$\text{Liability Return} = \text{Risk - Free Rate} + \text{Liability Beta} \times \text{Risk Premium}$$

(i.e. the risk adjustment equals Liability Beta x Risk Premium)

$$\text{Capital Return} = \text{Risk - Free Rate} + \text{Equity Beta} \times \text{Risk Premium}$$

Using the model structures presented and the assumptions noted previously, formulas are presented (without proof) in Exhibit VII which will be used to demonstrate the relationship among key variables. Presented are formulas for the required premium to satisfy both the NPV and IRR models simultaneously, and the formulas linking equity beta to the liability beta and vice versa.

These formulas have been used to develop Charts I through III, to demonstrate key points to be discussed momentarily. In order to produce a more realistic view, premium and expense with their respective cash flow timing assumptions will be introduced into the calculations. The previous loss liability of $1,000 has been broken into loss of $750 and expense of $250. Both premium and expense are assumed to be paid with a 3 month delay, and loss remains payable at the end of 2 years. (A quarterly model calculation has been used to develop the results to be shown). Use of loss as the sole liability and cash flow distorts the results when the risk adjustment is applied to this full amount. However, the premium and expense and associated cash flow delays have not been risk adjusted. In reality, these are subject to risk as well, but the magnitude of adjustment is likely to be much less than that pertaining to loss.

EXHIBIT VII

PREMIUM, LIABILITY BETA AND EQUITY BETA FORMULA RELATIONSHIPS

(SIMPLIFIED SINGLE PAYMENT CASE)

Premium (P) : Premium that is "fair" and produces IRR = Cost of Capital

$$L + L(1 - D_1)\left(\frac{T R_b / F - (R - R_1)}{(1 - T)(R - R_1)}\right) + E(1 - D_e)\left(\frac{T R_b / F - (R)}{(1 - T)(R)}\right), \text{ Assumes } N_p = 0$$

Equity Beta (B)

$$M(R_b / R_p)(K - 1)(T - F + F\,T) - M\,F\,K(1 - T)B_1$$

Liability Beta (B_1)

$$(R_b / R_p)\left[\frac{(K - 1)(T - F + F\,T)}{F\,K(1 - T)}\right] - \left[\frac{B}{M\,F\,K(1 - T)}\right]$$

D_1 : Loss Discount Factor with Risk Adjustment $= 1/(1 + R - R_1)^N$

D : Loss Discount Factor without Risk Adjustment $= 1/(1 + R)^N$

D_e : Expense Discount Factor without Risk Adjustment $= 1/(1 + R)^{N_e}$

K: Risk-Adjusted PV of Loss Liabilities, Not Risk Adjusted

$$K = [(1 - D_1)/(R - R_1)] / [(1 - D)/(R)]$$

Note: "L's" in numerator and denominator cancel

M: PV of Loss Liabilities / PV of Net Liabilities, neither risk-adjusted

$$M = [L(1 - D)/(R)] / [E(1 - D_e)/(R)], \text{ Assumes } N_p = 0$$

CAPM Required Return on Capital $= R_b + (B)(R_p)$

CAPM Required Return on Liabilities $= R_b + (B_1)(R_p)$

P:	Premium	R_b:	Interest Rate, before-tax
L:	Loss	R:	Interest Rate, after-tax
E:	Expense	R_l:	Risk Discount Adjustment, after-tax
N_p:	Premium Collection Date	F:	Liability / Surplus Leverage Factor
N:	Loss Payment Date	T:	Tax Rate
N_e:	Expense Payment Date		

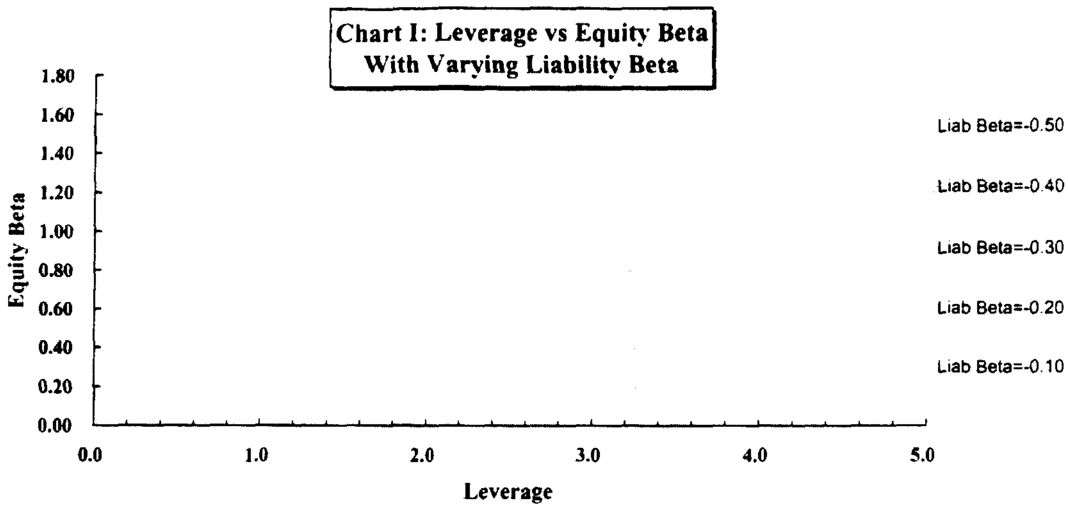

Chart I demonstrates the relationship of liability betas and equity betas, given varying levels of leverage. Chart I assumes a tax rate of 35%. As the risk adjustment of loss becomes greater, reflected in an increasingly more negative liability beta, the equity beta increases. It is interesting to note that the traditional liability beta of approximately -.20 does not produce equity betas near the 1.0 to 1.2 range observed in actual markets. The apparent discrepancy between the liability and equity betas may be explained by the following:

1. Risk adjustments are needed for ***premium and expense*** as well as losses. That is, the liability beta as presently defined understates underwriting risk.

2. The equity beta reflects the greater risk arising from investment and underwriting. Given the discrepancy between the betas, it appears that a significant portion of the equity beta is due to investment risk.

The conclusion to draw from this is that the use of a liability beta alone of -.20 will understate the fair premium required to produce a rate of return equal to the cost of capital.

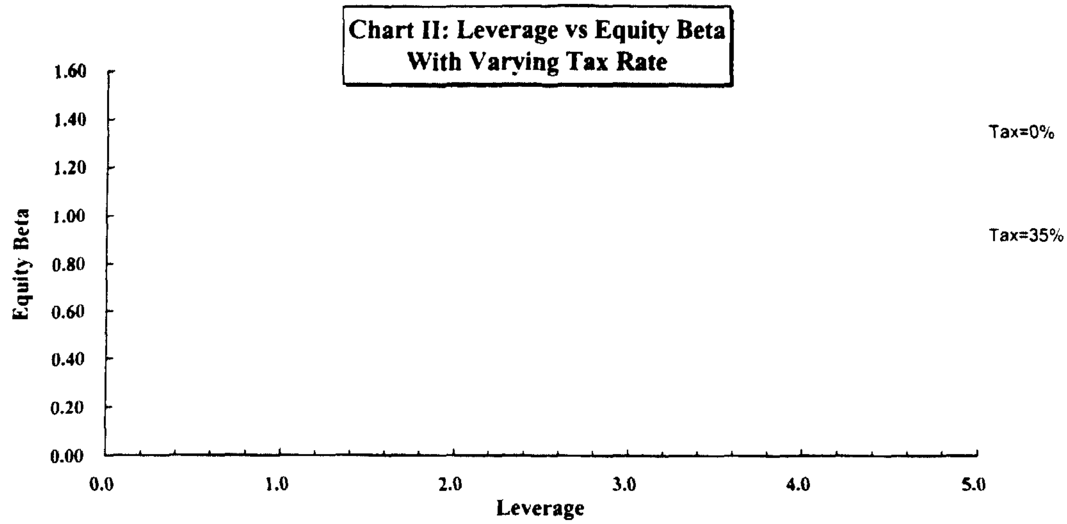

Chart II is similar to Chart I, but demonstrates how taxes affect the relationship between the betas. Chart II assumes the liability beta is -0.30. All else being equal, taxes reduce the level of equity betas. In effect, the tax acts as a suppressant to risk (i.e. volatility of return), since part of this is borne by the government.

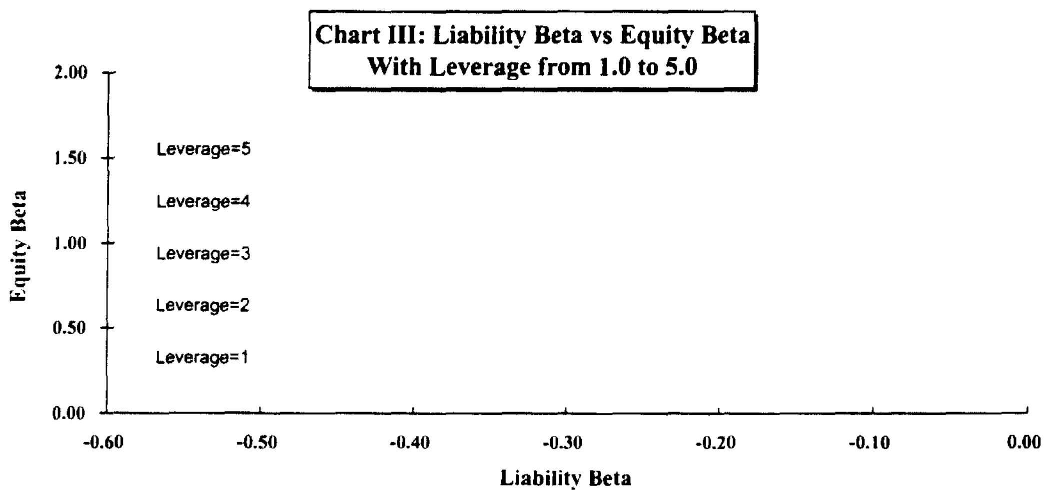

Chart III demonstrates the relationship of leverage and equity beta, given varying levels of liability betas. Chart III assumes a tax rate of 35%. From this it is easy to see how the equity beta should increase (at least in theory) as a company employs additional leverage in its operations.

It would seem intuitive that the risk inherent in liabilities, as measured here by the liability beta, is a fundamental element which should drive the resultant equity beta rather than the other way around. Unfortunately, liability betas are difficult to measure whereas equity betas can be observed much more easily in financial markets.

If a direct means can be developed to measure the risk (and in turn beta) inherent in a particular class of liabilities, then a company's mix of business and operating leverage would provide an indication of its expected equity beta. While some like to believe markets to be efficient, it is difficult to see how investors can adequately evaluate the riskiness of a particular insurance company given the complexity of insurance liabilities and the joint and interrelated risk entailed by both underwriting and investment activities. The question remains as to whether the market properly reflects risk, given the observed levels of equity betas. Perhaps the conservative, low levels of leverage at which most companies in the industry operate is the cause of lower equity beta valuations.

CONCLUSION

This article has demonstrated how conceptual and operational equivalency in net present value and IRR models can be achieved. Suggestions have been made as to how the Myers-Cohn and NCCI IRR models can be modified to permit their reconciliation. Results of the two models, the determination of "fair" premium in particular, can also be made identical given the same set of assumptions.

While many supposed ratemaking "methods" are discussed in the actuarial literature (see (10)), most of these can be shown to fall within the general umbrella of discounted cash flow models; their equivalency can be shown in much the same way as the MC and IRR models were shown in this paper.

Reconciliation of MC and IRR, and the other various "methods" as well, is more than an academic exercise. The principles brought out in this article, such as the use of liability to determine surplus levels over time, the release of operating earnings to the shareholder, and after-tax discounting, are important to the measurement of financial performance and, in turn, management decision making. Insofar as financial models are able, they contribute to the overall management of the risk / return relationship. To enhance their usefulness, it is suggested here that ratemaking approaches should have the following attributes:

1. Be supported by models which contain cash flow, balance sheet, income statement, and rate of return, and
2. Specify the principles underlying the control of all variables embodied in a total return structure, such as the flow of surplus, in addition to the "traditional" actuarial assumptions such as loss cost and trend factors.

Any approach which does not provide the full complement of financial statements of cash flow, balance sheet and income, runs the risks of error and inconsistent assumptions. Furthermore, whether stated or not, any method employed makes implicit assumptions relative to the fundamental principles which are integral to total return. Unless they are made evident, and the results measured within a total return framework, it is difficult to assess whether the results are appropriate.

Much dialogue has taken place within the insurance industry regarding the total return perspective, and its role in ratemaking and measurement of profitability. Two somewhat competing points of view remain and are represented by: (1) the actuarial ratemaking traditionalists who prefer return on premium (ROP) and (2) those with a capital market shareholder financial perspective who prefer return on equity or surplus (ROE). These two views have more to do with presentation than with substantive model development and results. The fact is that these two views are both embodied in the discounted cash flow models presented in this article. Use of either ROP or ROE as ***statistics*** is a voluntary ***choice*** and both can be used simultaneously. The results should be unaffected.

The operating rate of return presented in this article and referred to as the "risk charge" is proposed here as a measure which should be used in ratemaking rather than ROP. It is part of the total return calculation, yet it avoids the allocation of surplus to lines of business, the main concern of those who prefer ROP. (See (3) for further details.)

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APPENDIX: DETERMINING ECONOMIC NET PRESENT VALUE WITH AFTER-TAX DISCOUNTING

No technical issue seems to evoke such passion as the issue of whether discounting should be on a before-tax or an after-tax basis. Both approaches have a place in the valuation process. For example, the market value of a zero coupon bond is based on a before-tax discount. The conclusion that NPV models need to use after-tax discounting is based on an understanding of two key concepts:

1. The difference between market value and economic value, and
2. the difference in corporate (or personal) taxes as they appear on an income statement and taxes as part of the time value process.

Market value, as used here, means the price the market places on a freely tradable asset (or a liability). Taxes are not accounted for at the time this exchange takes place. For example, a zero coupon bond is traded at a market value based on a discounted value determined by use of a before-tax rate. A $1,000 zero coupon bond that matures in one year will trade for $909 if interest rates are 10%. That is 1000/1.10.

If one is concerned with Economic value, however as used here, then the effect of taxes must be considered as well. Economic value is a broader concept than market value in that it encompasses both market value and the effect of taxes. For example, the $91 of income received on the same zero coupon bond will be subject to tax. If the corporate tax rate is 35%, the after-tax value will be $59. This is the economic value associated with the zero coupon bond.

The key question to ask relative to the ***economic net present value*** is "how much must be invested today to pay a $1,000 liability that is payable in one year, given that the investment income will be subject to tax?" If such a loss were funded by the purchase of a zero coupon bond for the $909 in this example, the funds available after taxes are paid would be less than $1000, since the $91 of income would be subject to tax. If this loss were funded by purchasing a zero coupon bond for $939 then exactly $1000 would remain after payment of taxes. The $939 is $1000/1.065, that is, discounted with an after-tax rate. Four examples are presented in Exhibit VIII to demonstrate this in more detail. The following observations are important to note.

1. The economic net present value of a series of cash flows must recognize that taxes will be paid on investment income essentially as it is earned.
2. The present value amount required to fund future insurance liabilities must be based on an after-tax discount rate.
3. Internal rate of return calculations are equivalent to after-tax discounting, when taxes on investment income are reflected.

As noted, the internal rate of returns produced are implicitly equivalent to after-tax discounting when taxes are reflected in the cash flows.

This economic value, with the affect of taxes included, is an integral component of net present value models. The use of after-tax discounting is necessary in order to determine the true economic net present value and to allow comparison to internal rate of return calculations. See reference (7).

The second point noted is that income taxes are not the same as the tax effect relative to the time value of money. Less confusion would exist if all taxes shown on a company's books were simply referred to as "expense", since that is what they are. These taxes have little to do with the tax treatment required in the determination of present value. Taxes, as part of the present value process to determine the time value of money, are simply reflecting the fact that the real (risk-free) earnings rate is after-tax. One sits shoulder-to-shoulder with the government, paying taxes over time as investment income is earned. It may sound a bit extreme, but the before-tax rate is essentially meaningless in terms of economic value since it is never achieved.

One last point that arises at times has to do with use of the cost of capital as a discount rate. The relevant discount rate applicable to any investment is determined by the available rate at which such an investment can be made, given similar investment options available (and properly adjusted for risk). Investors (i.e. shareholders) faced with rates of return of 15% might want to use this rate to evaluate present values to themselves. However, all funds that exist within the insurance operation, both policyholder and surplus related, face simply risk-free investment options, when risk is considered, and this should be the basis of the discount rate selection. ***Within discounted cash flow models it is NOT appropriate to discount internal cash flows at the cost of capital. This is appropriate only from a shareholder, total return perspective.*** A company can view individual lines of business as investments, each charged with producing a total return relative to a cost of capital if it chooses. However, the evaluation of present values of cash flows related to a companies assets and liabilities should be at a risk-free rate.

The challenge to the insurance company is to produce a total rate of return to the shareholder which achieves some desired cost of capital. This is separate from the determination of economic net present values within the insurance company. This article has shown that the use of risk-free, after-tax rates are appropriate to discount internal company cash flows, and further has provided the linkage to the total rate of return available to the shareholder. A shareholder is free to apply any discount rate to the net cash flows received from the company. ***Cost of capital is the appropriate discount rate only from an investor perspective.***

EXHIBIT VIII

DISCOUNTING, MARKET VALUE, ECONOMIC VALUE AND TAXES

Example 1- $1,000 Fixed Income Investment, Annual Coupon Payments

10% Yield B.T. 35.0% Tax Rate 6.5% Yield A.T.

Period	0	1	2	3	4	
Interest Earned Before Tax		100	100	100	100	
Tax		-35	-35	-35	-35	
Income After Tax		65	65	65	65	
Investment Balance	1,000	1,000	1,000	1,000	0	
						IRR
Net Cash Flow After Tax	-1,000	65	65	65	1,065	6.5%

Present Value Discounted at 10.0% = 889, at 6.5% = 1,000
IRR properly reflects rate of return on investment of 6.5% A.T
Correct Present value of 1,000 is calculated using After-Tax discount rate.

Example 2: Funding of Expected $1,000 Loss Payment at Before Tax Discount Rate

Period	0	1	2	3	4	
Interest Earned Before Tax		68	73	77	83	
Tax		-24	-25	-27	-29	
Income After Tax		44	47	50	54	
Investment Balance	683	727	775	825	0	
						IRR
Net Cash Flow After Tax	-683	0	0	0	879	6.5%

Present Value Discounted at 10.0% = 600, at 6.5% = 683
Balance of $879 falls short of Required 1,000.

Example 3: Funding of Expected $1,000 Loss Payment at After-tax Discount Rate

Period	0	1	2	3	4	
Interest Earned Before Tax		78	83	88	94	
Tax		-27	-29	-31	-33	
Income After Tax		51	54	57	61	
Investment Balance	777	828	882	939	0	
						IRR
Net Cash Flow After Tax	-777	0	0	0	1,000	6.5%

Present Value Discounted at 10.0% = 683, at 6.5% = 777
Balance of $1,000 covers loss payment due.
ECONOMIC Present Value of loss reserve must be based on After-tax Discount rate.

EXHIBIT VIII (CONTINUED)

DISCOUNTING, MARKET VALUE, ECONOMIC VALUE AND TAXES

Example 4: Zero Coupon Bond (Market value based on 10% spot rate)

Period	0	1	2	3	4	
Interest Earned Before Tax		68	75	83	91	
Tax		0	0	0	0	
Income After Tax		68	75	83	91	
Investment Balance	683	751	826	909	0	
Tax: Interest Earned Before Tax		0	0	0	0	
Tax: Income After Tax		-24	-26	-29	-32	
Tax: Income After Tax xxxx		-24	-26	-29	-32	
Tax: Investment Balance		0	0	0	0	
						IRR
Net Cash Flow After Tax	-683	-24	-26	-29	968	6.5%

Present Value Discounted at 10.0% = 596, at 6.5% = 683
MARKET Present Value of zero coupon bond is based on Before-tax Discount rate.
Value of bond will grow to $1,000 at maturity.
Value of Investment is less than $1,000 at maturity after taxes are deducted.

Conclusion: While the MARKET Value of Assets (or Liabilities) is the present value determined by BEFORE-tax discounting, their ECONOMIC value is the present value determined by AFTER-tax discounting to properly reflect the effect of taxes when assessing time value.