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# Using Internal Rate of Return Methods in Aggregate Ratemaking

**Presented by  
Harry Shuford**

CAS Ratemaking and Product Management Seminar  
Risk and Return Considerations in Ratemaking  
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Chicago, IL

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Why Rate of Return Analysis in Aggregate Ratemaking?
  - Judicial Opinions
  - Actuarial Standards
- Cost of Capital in Aggregate Ratemaking
  - As a Concept
  - In Implementation
    - DCF and CAPM
- The Cost of Capital, Cash Flows, and the IRR
- Unusual Times
  - Negative Carry in Today's Financial Markets

# Using Internal Rate of Return Methods in Aggregate Ratemaking

Why Rate of Return Analysis in Aggregate Ratemaking?

Judicial Opinions

The US Supreme Court on a “Fair Rate of Return”  
For Regulated Firms and Industries

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Why Rate of Return Analysis in Aggregate Ratemaking?
  - Judicial Opinions – US Supreme Court set two standards:
    - Investors in a regulated industry should have the opportunity to earn a return comparable to that which can be expected by investing in other businesses of similar risk
    - The return should be adequate for the regulated firm or industry to attract and retain capital

# Using Internal Rate of Return Methods in Aggregate Ratemaking

## Cost of Capital in Aggregate Ratemaking

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Cost of Capital in Aggregate Ratemaking
  - As a Concept
    - Not a forecast of returns, rather:
    - What investors currently expect/require
    - Reflected in relationship among competing/available investment options

Therefore

- The “CoC” must be reflected in the current financial markets

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Cost of Capital in Aggregate Ratemaking
  - In Implementation
    - Drawing on financial market data
      - a) Discounted cash flow (DCF)
      - b) Capital Asset Pricing Model (CAPM)

# Using Internal Rate of Return Methods in Aggregate Ratemaking

Cost of Capital in Aggregate Ratemaking

Discounted Cash Flow Method (DCF)

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Cost of Capital in Aggregate Ratemaking
  - In Implementation
    - Discounted Cash Flow Method (DCF) - bonds:
      - a) Market price of a bond  
Equals:
        - a) Net present value of cash flows:
          - 1) Coupon stream
          - 2) Payment at maturity
        - b) Discounted at the current market yield to maturity

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Cost of Capital in Aggregate Ratemaking
    - In Implementation
      - Discounted Cash Flow Method (DCF) - bonds:
        - a) Yield to maturity, therefore, is defined as the discount rate that:  
Makes:
          - a) The net present value of cash flows:
            - 1) Coupon stream
            - 2) Payment at maturity
- Equal:
- a) The market price of a bond

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Cost of Capital in Aggregate Ratemaking
  - In Implementation
    - Discounted Cash Flow Method (DCF) - stocks:
      - a) Cost of capital is defined as the discount rate that:  
Makes:
        - a) The net present value of cash flows:
          - 1) dividend stream to perpetuity
    - Equal:
      - b) The market price of a stock

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Cost of Capital in Aggregate Ratemaking
  - In Implementation
    - NCCI uses a two-stage projection of cash flows:
      1. Projections of independent stock analysts (specifically Value Line) for estimates of:
        - near term dividends (influenced by the stage of the business cycle)
      2. An internal estimate of the long term growth rate
        - Historical growth in real rate of total financial assets of the P&C industry
        - .plus financial market based estimate of expected inflation – reflected in the yield spread between conventional and inflation-indexed (TIPS) 10-year Treasury notes

# Using Internal Rate of Return Methods in Aggregate Ratemaking

Cost of Capital in Aggregate Ratemaking

Capital Asset Pricing Model (CAPM)

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Cost of Capital in Aggregate Ratemaking
  - In Implementation
    - In estimating the cost of capital based on CAPM NCCI uses the following:
      - a) the return on the market -
      - b) the return on the equity of the firm (or an industry portfolio of equities), and
      - c) a measure of the return on a “risk free” asset – typically a Treasury bill.

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Cost of Capital in Aggregate Ratemaking
  - In Implementation
    - A significant part of the return on equities is the change in stock prices;
    - Dividends are also a material component.

# Using Internal Rate of Return Methods in Aggregate Ratemaking

Why Rate of Return Analysis in Aggregate Ratemaking?

Actuarial Standards – ASOP 30

“Total Financial Needs Model”

“Net Present Value Model”

# Using Internal Rate of Return Methods in Aggregate Ratemaking

Why Rate of Return Analysis in Aggregate Ratemaking?

Actuarial Standards – ASOP 30

“Total Financial Needs Model”

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Why Rate of Return Analysis in Aggregate Ratemaking?
  - Actuarial Standards – ASOP 30;
    - “Total Financial Needs Model—Total financial needs models are used to develop the underwriting profit provision such that the sum of underwriting profit, miscellaneous (non-investment) income, investment income from insurance operations, and investment income on capital, after income taxes, will equal the cost of capital. Each of these components is explicitly quantified.”

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Why Rate of Return Analysis in Aggregate Ratemaking?
  - Actuarial Standards – ASOP 30;
    - “develop the underwriting profit provision such that the sum of:
      - a) underwriting profit,
      - b) miscellaneous (non-investment) income,
      - c) investment income from insurance operations, and
      - d) investment income on capital,
      - e) after income taxes,will equal
      - a) the cost of capital.

# Using Internal Rate of Return Methods in Aggregate Ratemaking

Why Rate of Return Analysis in Aggregate Ratemaking?

Actuarial Standards – ASOP 30

“Net Present Value Model”

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Why Rate of Return Analysis in Aggregate Ratemaking?
  - Actuarial Standards – ASOP 30;
    - “Net Present Value Model—The net present value (NPV) model is used to discount the estimated net cash flow to the capital provider at a rate equal to the cost of capital. For the purpose of these calculations, net cash flow is defined as the residual amounts of cash that flow to and from the equity account, after all policy obligations are met. The net cash flow reflects the timing of each of the individual cash flows, including the commitment and release of capital in support of the insurance transaction. The internal rate of return (IRR) model, a specific application of the general NPV model, uses an iteration technique to calculate the rate(s) of return that will set the net present value of a risk transfer's cash inflows and outflows equal to zero.”

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Why Rate of Return Analysis in Aggregate Ratemaking?
  - Actuarial Standards – ASOP 30;

“Net Present Value:

- discount the estimated net cash flow to the capital provider

at a rate equal to

- the cost of capital.

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Why Rate of Return Analysis in Aggregate Ratemaking?
  - Actuarial Standards – ASOP 30;

Net cash flow is defined as:

- the residual amounts of cash that flow
- to and from the equity account
- after all policy obligations are met.

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Why Rate of Return Analysis in Aggregate Ratemaking?
  - Actuarial Standards – ASOP 30;

Net cash flow reflects:

- the timing of each of the individual cash flows,
- including the commitment and release of capital in support of the insurance transaction.

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Why Rate of Return Analysis in Aggregate Ratemaking?
  - Actuarial Standards – ASOP 30;

The internal rate of return (IRR) model,

- a specific application of the general NPV model,
- to calculate the rate(s) of return
- that will set the net present value
- of a risk transfer's cash inflows and outflows
- equal to zero.”

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Why Rate of Return Analysis in Aggregate Ratemaking?
  - Actuarial Standards – ASOP 30;

The “individual cash flows”

- correspond to the specific components in the total financial needs model.

In effect, the model determines:

- the underwriting profit required so that,
- when discounted at the cost of capital,
- the NPV of the net cash flows from these individual inflows and outflows balance out to zero;
- this essentially means that total after tax profit equals the cost of capital.

# Using Internal Rate of Return Methods in Aggregate Ratemaking

The Cost of Capital, Cash Flows, and the IRR

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- The Cost of Capital, Cash Flows, and the IRR
  - Cost of capital – based on DCF & CAPM
  - Cash flows and IRR – reflect ASOP 30:
    - the underwriting profit required so that,
    - when discounted at the cost of capital,
    - the NPV of the net cash flows from these individual inflows and outflows balance out to zero;
    - this essentially means that total after tax profit equals the cost of capital.

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- The Cost of Capital, Cash Flows, and the IRR
  - NCCI's IRR model -
    - framework based on statutory accounting
  - Premium equals the sum of:
    - Losses and loss adjustment expenses
    - Underwriting expenses
    - Premium taxes
    - Underwriting profit and contingency provision
  - Loss ratio + underwriting P&C factor =
  - $1.00 - (\text{Expense ratios} + \text{premium tax rates})$

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- The Cost of Capital, Cash Flows, and the IRR
  - NCCI's IRR model -
  - Cash flows based on estimated patterns, e.g.:
    - Premium collection
    - Expense payments
    - Tax payments
    - Loss payments
    - Policyholder dividend distributions
    - Investment income
    - Surplus commitments – linked to reserves  
(loss reserves based on incurred less payments;  
premium reserves based on written less earned)



# **NCCI 2009 Florida Rate Hearing**

## **Financial Analysis**

**October 6, 2009**

**Harry Shuford**

**Chief Economist**



# Financial Analysis

- Cost of Capital
- Internal Rate of Return (IRR)
- Profit & Contingency Factor (P&C)

# Summary of Results

- Cost of Capital 10.45%
- Profit & Contingency Factor from NCCI's IRR Model
  - Including* Policyholder Dividends: 10.99%
  - Excluding* Policyholder Dividends: 6.21%
- **Both P&C estimates support NCCI's filed**
- **P&C factor of 2.5%**

# Cost of Capital

The expected rate of return  
that a business must offer to investors  
because

It's what investors require based on  
what's available in the financial markets  
on comparable investments

## Cost of Capital - Sample Used

- 29 Insurance Companies reported by Value Line (VL) Investment Services
  - All but one company in the VL Property and Casualty Insurance Group (27 of 28 – excludes PMI)
  - Two companies from the VL Diversified Financial Services Group (Hartford and Unitrin)

## Estimating the Cost of Capital

Two Methodologies Were Used

- Discounted Cash Flow (DCF)
- Capital Asset Pricing Model (CAPM)

# Discounted Cash Flow

- Based on concept that the current market value of an investment (e.g., a share of stock) reflects the future cash flows expected from that investment
- The DCF Cost of Capital is equal to the discount rate that equates the expected (future) cash flows to the investment's current value.
- Focus is on dividends. Key challenge- estimating the dividend growth rate

## Discounted Cash Flow Estimating the Dividend Growth Rate

How could investors estimate future dividend growth?

1. Dividend growth
  - Recent dividend history
  - Analysts' forecasts
  
2. Earnings growth (source of future dividends)
  - Recent earnings history
  - Analysts' forecasts
  
3. Growth in Capital Base (source of earnings growth)
  - Retained earnings
  - Stock issuance/buy back

## Discounted Cash Flow Estimating the Cost of Capital- Results

Estimated near term dividend growth rate = 4.58%

1. Estimated long-term dividend growth rate = 6.28%

2. Current dividend yield = 3.81%

3. Estimated cost of capital\* – DCF = 10.04%

- \*Includes impact of “half-year” convention

# Capital Asset Pricing Model (CAPM)

Investors will require a higher expected return on investments with higher risk.

How much risk premium do investors require?

CAPM uses market data to estimate the required risk premium and the cost of capital required for risky investments.

## Capital Asset Pricing Model (CAPM)

Investors can invest in US Treasuries – “risk free”.

Investors can invest in a diversified stock portfolio – it carries the “market risk”

Investors can invest in individual stocks.

What expected return are investors requiring on risky investments?

## Capital Asset Pricing Model (CAPM) What Are Investors Requiring?

Risk free rate	3.80%
Risk premium	7.13%
Return on the market	10.93%
=	
Cost of Capital (S&P 500)	10.93%
Beta coefficient (Prop & Cas)*	0.99
<b>Cost of Capital - CAPM (P&amp;C)</b>	<b>10.86%</b>

\* Risk coefficient (beta) estimated at .99 for the Property and Casualty Insurance Industry based on VL data

# Cost of Capital – Overall Result

Cost of Capital (DCF) 10.04%

Cost of Capital (CAPM) 10.86%

Because each method has strong theoretical underpinnings and reflects different types of market information they were given equal weight in estimating the ultimate cost of capital currently required by investors for the property & casualty insurance industry.

**Estimated Cost of Capital (DCF & CAPM) 10.45%**

# Estimating the Profit & Contingency Factor

The profit & contingency factor was estimated using the 10.45% cost of capital and NCCI's internal rate of return (IRR) model.

The IRR model uses statutory accounting relationships in calculating the cash flows.

The IRR model simulates the cash flows associated with the proposed workers compensation program.

## Estimating the Profit & Contingency Factor

In addition to being able to calculate an internal rate of return discount rate based on statutory accounting relationships the IRR model is able to “back solve”.

In “back solving”, the cost of capital is fixed and the model calculates the profit and contingency factor necessary to produce a rate of return equal to the target return.

## Estimating the Profit and Contingency Factor - Results

- A P&C factor of 10.99% is required to generate the cost of capital of 10.45%, using loss costs and expense factors provided by NCCI's actuaries, including a provision for policyholder dividends (at 5.6% of premium)
- P&C factor would be 6.21% if policyholder dividends were excluded from the analysis
- **Both results support the 2.5% filed P&C factor**



# **NCCI 2009 Florida Rate Hearing**

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# NCCI 2009 Florida WC Rate Hearing Financial Analysis

- Methodology Unchanged
- Financial Markets Have Changed

# NCCI 2009 Florida WC Rate Hearing Financial Analysis – What’s Changed

Florida 2009 Analysis						
		2008		2009	Change	
Post Tax Yield		3.58%		3.03%	-0.55%	down
Cost of Capital		10.93%		10.45%	-0.48%	down
Reserve/Surplus		2.40		2.24	-0.16	down
Policyholder Dividend		3.80%		5.60%	1.80%	up
Profit & Contingency		7.52%		10.99%	3.47%	up



**Thank You for the Opportunity to Share This Information**

**Questions or Comments?**



# Using Internal Rate of Return Methods in Aggregate Ratemaking

Unusual Times in the Financial Markets  
Implications for IRR Analysis

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Unusual Times
  - How can a change that generates more investment income result in a larger required underwriting profit?
  - Negative Carry in Today's Financial Markets

# Using Internal Rate of Return Methods in Aggregate Ratemaking

- Unusual Times – Based on 2009 Florida IRR
  - Negative Carry in Today's Financial Markets

Reserve to Surplus Ratio	=	2.25
Invested Assets to Surplus Ratio	=	3.25
After Tax Return on Investments	=	3.00%
Estimated After Tax Return to Surplus from Investments	=	9.75%
Cost of Capital => Total Target Return to Surplus	=	10.45%
"Negative Carry"	=	-0.70%



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