

# Capital Requirements for Insurance Companies

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*Aon Re Worldwide*

# *Agenda*

- NAIC Risk-Based Capital Requirements
- A.M. Best and S&P Capital Models
- Using DFA for Setting Capital Level

# *How Much Capital Should We Have?*

- Premium to Surplus
- Reserves to Surplus
- NAIC Risk Based Capital Requirement
- Rating Agency Capital Adequacy Models
- Dynamic Financial Analysis
  - Only Provides Distribution of Outcomes
  - Answer Dependant on Criteria Used

# *NAIC Risk Based Capital*

- Goals of NAIC RBC Requirement
  - Relate capital and surplus requirements of an insurer to the risks inherent in its particular operations
  - Establish a universally recognized capital standard
  - Provide regulators with the authority to enforce compliance with more appropriate capital requirements

# *NAIC Risk Based Capital*

- $R_0$  Off Balance Sheet
- $R_1$  Fixed-Income Securities
- $R_2$  Equity Securities
- $R_3$  Credit
- $R_4$  Loss and LAE Reserves
- $R_5$  Net Written Premium

# *NAIC Risk Categories*

- $R_0$ 
  - Investments in insurance affiliates
  - Non-controlled assets
  - Guarantees for affiliates
  - Contingent liabilities
- $R_1$ 
  - Fixed income securities (cash, bonds, bond size adjustment factor, mortgage loans)
  - Short term investments
  - Collateral loans
  - Asset concentration adjustment for fixed income securities

# *NAIC Risk Categories (cont.)*

- $R_2$ 
  - Equity investments (common stocks, preferred stocks, real estate)
  - Other invested assets
  - Aggregate write-ins for invested assets
  - Asset concentration adjustment
- $R_3$ 
  - Credit risk (reinsurance recoverables, other receivables)

# *NAIC Risk Categories (cont.)*

- $R_4$ 
  - Reserving risk (basic reserving risk charge, offset for loss-sensitive business, adjustment for claims-made business, loss concentration factor, growth charge for reserving risk)
- $R_5$ 
  - Written premium risk (basic premium risk charge, offset for loss-sensitive business, adjustment for claims-made business, premium concentration factor, growth charge for premium risk)

# *NAIC Risk-Based Capital*

Total Capital Requirement =

$$R_0 + \sqrt{R_1^2 + R_2^2 + \left(\frac{R_3}{2}\right)^2 + \left(\frac{R_3}{2} + R_4\right)^2 + R_5^2}$$

# A.M. Best's BCAR

# *A.M. Best BCAR*

$$BCAR = \frac{\text{Adjusted Surplus}}{\text{Net Required Capital}}$$

# *Net Required Capital Components*

- $B_1$  Fixed-Income Securities
- $B_2$  Equity Securities
- $B_3$  Interest Rate
- $B_4$  Credit
- $B_5$  Loss and LAE Reserves
- $B_6$  Net Written Premium
- $B_7$  Off Balance Sheet

# *Adjustments to Surplus*

- Unearned Premium
- Assets
- Loss Reserves
- Reinsurance
- Surplus Notes
- Debt Service Requirements
- Potential Catastrophe Losses
- Future Operating Losses

# *A.M. Best BCAR*

$$BCAR = \frac{\text{Adjusted Surplus}}{\text{Net Required Capital}}$$

$$NRC = \sqrt{B_1^2 + B_2^2 + B_3^2 + \left(\frac{B_4}{2}\right)^2 + \left[\frac{B_4}{2} + B_5\right]^2 + B_6^2 + B_7}$$

# S&P Capital Adequacy Ratio

# *S & P Capital Adequacy Ratio*

$$\frac{TAC - C_1 - C_2}{C_3 + C_4 + C_5}$$

TAC = Total Adjusted Capital

- Reserves Adjusted for Deficiency and then Discounted

# *S & P Capital Adequacy Ratio*

$C_1$  – Asset Risk Charge

$C_2$  – Credit Risk Charge

$C_3$  – Underwriting Risk (WP Risk)

$C_4$  – Reserve Risk

$C_5$  – Other Business Risk

# Comparison of Models

		A.M. Best	Standard & Poor's	NAIC
Asset Risk	Debt	B <sub>1</sub>	C <sub>1</sub>	R <sub>1</sub>
	Equity	B <sub>2</sub>		R <sub>2</sub>
Interest Rate Risk		B <sub>3</sub>	Explicitly Included	Not Included
Credit Risk		B <sub>4</sub>	C <sub>2</sub>	R <sub>3</sub>
Underwriting Risk	Reserve Risk	B <sub>5</sub>	C <sub>4</sub>	R <sub>4</sub>
	NWP Risk	B <sub>6</sub>	C <sub>3</sub>	R <sub>5</sub>
Other Risk		B <sub>7</sub>	C <sub>5</sub>	R <sub>0</sub>

# Financial Strength Ratings

## A.M. Best's

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<b>Secure</b>	<b>A++</b>	Superior
	<b>A+</b>	Superior
	<b>A</b>	Excellent
	<b>A-</b>	Excellent
	<b>B++</b>	Very Good
	<b>B+</b>	Very Good

<b>Vulnerable</b>	<b>B and B-</b>	Fair
	<b>C++ and C+</b>	Marginal
	<b>C and C-</b>	Weak
	<b>D</b>	Poor
	<b>E</b>	Regulatory Supervision

## Standard & Poor's

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<b>Secure</b>	<b>AAA</b>	Extremely Strong
	<b>AA</b>	Very Strong
	<b>A</b>	Strong
	<b>BBB</b>	Good

<b>Vulnerable</b>	<b>BB</b>	Marginal
	<b>B</b>	Weak
	<b>CCC</b>	Very Weak
	<b>CC</b>	Extremely Weak
	<b>R</b>	Regulatory Action

# Capital Adequacy Scale

## A.M. Best's BCAR

<b>Secure</b>	<b>A++</b>	> 175%
	<b>A+</b>	160 - 175%
	<b>A</b>	145 - 160%
	<b>A-</b>	130 - 145%
	<b>B++</b>	115 - 130%
	<b>B+</b>	100 - 115%

<b>Vulnerable</b>	<b>B and B-</b>	80 - 100%
	<b>C++ and C+</b>	60 - 80%
	<b>C and C-</b>	40 - 60%
	<b>D</b>	<40%
	<b>E</b>	

## Standard & Poor's CAR

<b>Secure</b>	<b>AAA</b>	> 175%
	<b>AA</b>	150 - 175%
	<b>A</b>	125 - 150%
	<b>BBB</b>	100 - 125%

<b>Vulnerable</b>	<b>BB</b>	< 100%
	<b>B</b>	
	<b>CCC</b>	
	<b>CC</b>	
	<b>R</b>	

# Comparison of Asset Charges

	<u>A.M. Best</u>	<u>S &amp; P</u>	<u>RBC</u>
Bonds	0-30%	0-30%	0-30%
Common Stock	15%	15%	15%
Real Estate	20%	10%	18%

# *Credit Risk*

- Primarily Related to Reinsurance Recoverables
- Rating Agencies Vary Charge Based on Reinsurer's Rating
- NAIC Model Uses Flat Charge

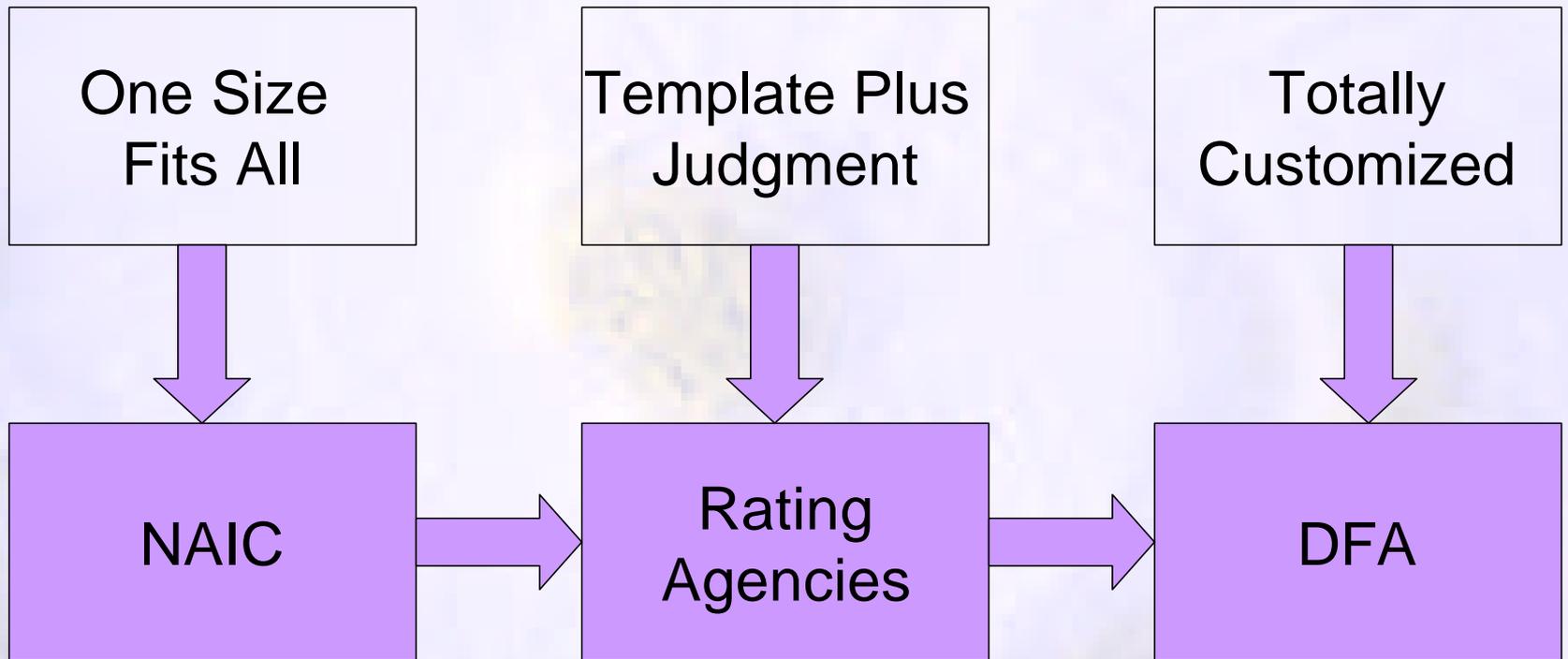
# *Written Premium Risk Charges*

	<b>A.M. Best</b>	<b>Standard &amp; Poor's</b>
Homeowners	.37 - .54	.27
Other Liability Occ.	.32 - .40	.33
CMP	.29 - .37	.14
Personal Auto	.25 - .40	.07
Property	.33 - .51	.18

# *Reserve Risk Charges*

	<b>A.M. Best</b>	<b>Standard &amp; Poor's</b>
Homeowners	.19 - .39	.21
Other Liability Occ.	.26 - .48	.13
CMP	.25 - .45	.14
Personal Auto	.20 - .48	.11
Property	.26 - .47	.28

# *Continuum of Risk Measurement*



# *Dynamic Financial Analysis (DFA)*

- Sophisticated modeling of the range of insurance company financial outcomes
- Analysis may be performed on a segment of the company
- Direct results
  - Separate variability modeled for premiums, claims and loss adjustment expenses
- Ceded results - Application of specific treaty terms to the authentic ground-up results
- Net results - Analysis of net results versus direct results specifically analyzing:
  - The equity capital released through reinsurance
  - The cost of the reinsurance capital
  - Economic Value Added (EVA) through reinsurance
- Integrated investment risk analysis
- Multiple year analysis possible

# *How Much Capital Should We Have?*

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- NAIC Risk Based Capital Requirement
- Rating Agency Capital Adequacy Models
- **Dynamic Financial Analysis**
  - Only Provides Distribution of Outcomes
  - Answer Dependant on Criteria Used
- When is Enough Enough?

# *Decision Criteria*

- Probability of Ruin
- Value at Risk (VaR)
- Expected Policyholder Deficit
- Tail VaR
- $n$  Standard Deviations

# *Value at Risk Defined*

(1) An estimate of the level of loss on a portfolio which is expected to be equaled or exceeded with a given, small probability.

(2) A number invented by purveyors of panaceas for pecuniary peril intended to mislead senior management and regulators into false confidence that market risk is adequately understood and controlled.

- Barry Schachter

# Tail Value at Risk

$$TCE_{\alpha}(X) \equiv TailVaR_{\alpha} \equiv E[X \mid X \geq VaR_{\alpha}(X)]$$

$$TailVaR_{\alpha}(X) = VaR_{\alpha}(X) + \frac{EPD(VaR_{\alpha}(X))}{1 - \alpha}$$

TailVaR is a Coherent Risk Measure

# *Coherent Risk Measure Properties*

- Subadditivity
- Monotonicity
- Positive Homogeneity
- Translation Invariance

# *Coherent Risk Measure Properties*

- **Subadditivity**
- VaR Violates this Axiom

$$\rho(X + Y) \leq \rho(X) + \rho(Y)$$

# Subadditivity

$$\rho(X + Y) \leq \rho(X) + \rho(Y)$$

<u>Scenario</u>	<u>X</u>	<u>Y</u>	<u>X + Y</u>
1	2	2	4
2	3	2	5
3	4	2	6
4	5	2	7
5	5	2	7
6	5	2	7
7	6	2	8
8	7	2	9
9	8	10	18
10	10	2	12
VaR <sub>15%</sub>	8	2	12

# *Coherent Risk Measure Properties*

- **Monotonicity**
- Standard Deviation Violates this Axiom

If  $X \leq Y$  for each scenario, then

$$\rho(X) \leq \rho(Y)$$

# *Monotonicity Violated*

Scenario	X	Y
1	2	10
2	3	11
3	4	11
4	5	11
5	5	11
6	5	11
7	6	10
8	7	10
9	8	10
10	10	11
Mean	5.50	10.60
Std Dev	2.25	0.49
Mean + 3 Std Dev	12.24	12.07

# *Coherent Risk Measure Properties*

- **Positive Homogeneity**

For all  $\lambda \geq 0$ ,

$$\rho(\lambda X) = \lambda \rho(X)$$

# *Coherent Risk Measure Properties*

- **Translation Invariance**

For constants  $\alpha$ ,

$$\rho(X + \alpha) = \rho(X) + \alpha$$

# TailVar Example

<b>Prob(X)</b>	<b>X</b>
5.00%	2.0
10.00%	3.0
50.00%	5.0
25.00%	7.0
5.00%	10.0
5.00%	13.0
Average	6.67
$VaR_{0.899}(X)$	10.00
$EPD(10.0)$	0.15
$TailVaR_{0.899}(X)$	11.50

# *Selecting The Most Efficient Capital*

- Sources Of Capital
- Reinsurance vs. Equity Capital
- The Cost Of Equity Capital
- The Cost Of Reinsurance Capital
- The Optimal Retention Decision

# The Cost Of Equity Capital

## Revenues

Latest Qtr. (Sep 00)	200 Mil	dn 4%	5 Yr Hist
Latest 12 Months	813 Mil	0%	7%

## Dividends

Indicated Rate & Yield	.56	2.1%	5 Yr Hist
Increases Last 5 Yrs	5		8%

## Key Ratios & Measures

	5 Yr. Range	Current
P/E	7 - 25	18.2
Price to Book	.6 - 1.8	1.4
Price to Cash Flow	7.2 - 19.8	16.8
Price to Sales	.4 - 1.1	0.96
Return on Equity	7.9% - 13.2%	7.9%

## Beta

0.29



Source: Baseline

CAPM Model:  $[\text{Risk-Free Rate}] + [\text{Beta}] * [\text{Equity Risk Premium}]$

DCF Model:  $[\text{Free Cash Flow Growth Rate}] + 1/ [\text{Price To Free Cash Flow}]$

Typically in the range 10 - 16% for property/ casualty insurers.

Wide variability between methods and considerable uncertainty.

# Overview of DFA In Reinsurance

