



# ACTEX

Group & Health Extension  
for the SOA ERM Exam Study Manual

**RISK**

Investments  
Contingencies  
**Insurance**  
Life Health  
Retirement  
**Disability**  
Probability  
Pension  
**Finance**  
Economics

$$\begin{aligned} &= .5567(32) - 32e^{-.04(.25)}N(.0175) \\ &= 17.81 - 31.68N(.0175) \\ &= 17.81 - 31.68 \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{.0175} e^{-x^2/2} dx \end{aligned}$$

Fall 2015 Edition

**Crispina O. Caballero, FCIA, FSA, MAAA**

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P.O. Box 974  
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**RISK-BASED CAPITAL FORMULAS**

Bell et. al., Chapter 22

**I. BACKGROUND****A. Definition**

1. Risk-based capital formula, in general
  - a. Calculates target capital
  - b. Reflecting level of financial risk of corporation
2. Risk-based capital, commonly, formulas used by US regulators
  - a. Set minimum capital requirements

**B. Types**

1. Health RBC formula
2. Life RBC formula
  - a. For life insurers with limited volume of health insurance
  - b. Different parameters
  - c. Long-term risks
  - d. Asset-based risks

**C. History**

1. 1990 —NAIC introduced RBC for life insurance companies, separate for P&C companies
2. 1998 —RBC for health organizations
3. RBC based on NAIC annual statements
  - a. Orange —health RBC
  - b. Blue —life RBC
  - c. Yellow —P&C RBC
4. 2006
  - a. Orange —companies specializing in group medical
  - b. Blue —companies primarily writing DI, LTC and group life

**II. NAIC RBC MODEL ACTS****A. Model laws —for states to enforce RBC requirements**

1. Life and P&C model act – 1993
2. RBC health organization model act – 1998

- B. RBC model act
  - 1. Specifies regulatory action that can be and must be used by insurance commissioner
  - 2. Action —function of ratio of actual capital to required capital (RBC formula)
  - 3. RBC formula not defined —function of company’s assets, credit risk, underwriting risk and other business risks
  - 4. NAIC specifies RBC formula —updates does not require legislative or regulatory action
- C. Ratios and associated regulatory action in states which has adopted model act
  - 1. TAC (total adjusted capital) – compared to ACL (authorized control level)
  - 2. TAC includes
    - a. Statutory capital and surplus
    - b. Some adjustments for life and P&C subsidiaries
  - 3. TAC/ACL >200% – no action
  - 4. TAC/ACL ratio and action levels
    - a. >200% —no action
    - b. 150% to 200% —company action
    - c. 100% to 150% —regulatory action
    - d. 70% to 100% —authorized control
    - e. <70% —mandatory control
  - 5. Action level requirements
    - a. Company action – submit corrective action plan to Commissioner
    - b. Regulatory action —+ Commissioner may examine company and issue specific corrective actions
    - c. Authorized control —+Commissioner may place company under regulatory control
    - d. Mandatory control —Commissioner must take regulatory control of the company
- D. Influence of health RBC
  - 1. Orange blank filing —required to calculate health RBC and disclose 5-year calculated results
  - 2. Regulators are very familiar with health RBC —likely to state formal concern when ratios <200%
  - 3. RBC formally espoused by quasi-regulatory bodies —such as rating agencies and BCBS

## III. HEALTH RBC FORMULAS

## A. Key factors

1. Amount and type of insurance product
2. Health plan performance and loss ratios
3. Methods for reimbursing health plan providers
4. Amounts and types of assets

## B. Considerations

1. Standardized approach
  - a. Aggregate perspective —applied across companies and across time periods
  - b. Fixed factor —to information from annual NAIC filing or internal records
  - c. Advanced approach – company specific internal models, tailored to company
2. Intended to identify financially weak companies – not to assess relative financial strength

## C. RBCAC —RBC after covariance

$$1. \text{ RBCAC} = H_0 + [H_1^2 + H_2^2 + H_3^2 + H_4^2]^{(1/2)}$$

- a.  $H_0$  =asset risk for affiliates
- b.  $H_1$  =asset risk for other assets
- c.  $H_2$  =underwriting risk
- d.  $H_3$  =credit risk
- e.  $H_4$  =business risk

$$2. \text{ ACL} = 50\% \text{ of RBCAC}$$

## D. Aggregate risk profile of BCBS in 2001

1. Note dominance of  $H_2$
2.  $325 = [1484] * (34.9) / (159.40)$

<u>Risk Category</u>	<u>Relative Risk</u> (Index $H_2=100$ )	<u>Marginal Impact on</u> <u>RBCAC of \$1000 Increase</u> <u>in Risk</u>
H <sub>1</sub>	34.9	\$325
H <sub>2</sub>	100.0	\$931
H <sub>3</sub>	8.6	\$80
H <sub>4</sub>	15.9	\$148
$\Sigma$	<b>159.40</b>	<b>\$1484</b>
$(\Sigma (x)^2)^{(1/2)}$		<b>\$1000</b>

- 
- IV. UNDERWRITING RISK — H<sub>2</sub>
- A. H<sub>2</sub>—underwriting risk, in general
    - 1. Underestimate cost of insurance—inadequate premium rate in the future
    - 2. For each health insurance product
    - 3. Risk factor applied to insurer’s exposure measure
    - 4. Exposure
      - a. Earned premium or incurred claim
      - b. Annual basis
      - c. Net of ceded reinsurance
    - 5. Risk factor—across companies with 2 exceptions
      - a. Tiered by size
      - b. Adjusted for provider reimbursement contracts
  - B. Components of H<sub>2</sub>
    - 1. Claim experience fluctuation risk
    - 2. Other underwriting risks
  - C. Claim experience fluctuation risk
    - 1. Cover medical insurance and similar products
    - 2. 5 product groupings
      - a. Comprehensive medical & hospital
      - b. Medicare supplement
      - c. Dental and vision
      - d. Medicare Part D
      - e. Others
    - 3. Risk charge per product group
      - a. Premium multiplied by
      - b. (Incurred claim/premium) multiplied by
      - c. Risk factor multiplied by
      - d. Managed care risk adjustment factor
      - e. Subject to a floor, alternative risk charge
    - 4. Alternative risk charge = risk from catastrophic claims on individual risks irrespective of number of members

## D. Underwriting risk factors

1. Factor —reflect relative volatility of experience
2. Weighted average risk factor —function of underwriting revenue per tier

<b>Underwriting risk factors by revenue tier</b>			
<b>Coverage</b>	<b>\$0 -3 million</b>	<b>\$3-25 million</b>	<b>\$25 + million</b>
Comprehensive	15.0%	15.0%	9.0%
Medicare Supp.	10.5%	6.7%	6.7%
Dental & Vision	12.0%	7.6%	7.6%
Medicare Part D	25.1%	25.1%	15.1%
Other	13.0%	13.0%	13.0%

## E. Managed care risk adjustment factor

1. Certain contractual reimbursement arrangements —allows greater predictability of future claim level
2. Claims paid over the previous 12 months —assigned to 5 categories
3. Paid claims —eliminate misstatement of claim reserves and avoid difficulty of estimating
4. 5 categories
  - a. Category 0 —default; fee-for-service; UCR
  - b. Category 1 —contractual protection re level of allowed charges; fee schedule; hospital per diem or case rates; non-adjustable case and global rates
  - c. Category 2 —category 0 or 1 but with withhold or bonus arrangement; 2a and 2b
  - d. Category 3 —capitation fixed for at least 12 months; special limitation for capitation payments to intermediaries
  - e. Category 4 —salary arrangements; staff model HMO; non-contingent salaries to direct care providers & facility-related medical expenses
5. Weighted average of factors for each category —with claim payments as weights
6. Overall factor —applied to all product groups except Medicare Part D & Other
7. Medicare Part D & Other —relates to catastrophic reinsurance provision between insurer and federal government
8. Table of adjustment discount actors

<b>Managed care risk adjustment discount factor</b>		
<b>Category</b>	<b>Description</b>	<b>Discount factor</b>
0	Arrangements not included below	0%
1	Contractual fee payments	15%
2	Bonus/withhold arrangements	Variable 0.08% to 15%
3	Capitation	60%
4	Non-contingent expenses	75%

F. Other underwriting risk

1. DI —factor applied to earned premium
  - a. Group —long-term or short-term
  - b. Individual —renewability provision
  - c. Combine group and combine individual, separately
  - d. Within group or individual —RBC-maximizing ordering of products

<b>RBC factors for DI by earned premium tier</b>		
<b>Coverage</b>	<b>\$0-50 million</b>	<b>\$50 + million</b>
Non-cancellable	35%	15%
Other individual	25%	7%
Group long-term	15%	3%
Group short-term	5%	3%

2. LTC
  - a. 3 components
  - b. Earned premium —10% on first 50 million, 3% on excess; 105 additional for non-cancellable
  - c. Incurred claims (adjusted for 2-year rolling average loss ratio) —25% on first 35 million, 8% on excess; 37%/12% when absence of premium component
  - d. LTC claim reserves —5%
3. Other coverage
  - a. FEHBP, TRICARE —cost-plus administration arrangement, similar to ASO
  - b. Stop-loss —higher claim volatility
  - c. Table of RBC requirements

<b>RBC requirements for miscellaneous coverage types</b>	
<b>Coverage</b>	<b>RBC requirement</b>
FEHBP and TRICARE	2% of incurred claims
Stop loss and minimum premium	25% of premium
Supplemental benefits with stand-alone Medicare Part D coverage	25% of claims
Hospital indemnity and specified disease	3.5% of premium plus \$50,000
AD&D	5.5% of premium less than 10 million, plus 1.5% of premium in excess of 10 million plus 3 times the maximum retained risk (3x retained risk capped at 300,000)
Other accident	5% of premium

4. Rate guarantees
  - a. 2.4% of earned premium for guarantees of 15-36 months; 6.4% for longer
5. Premium stabilization reserves
  - a. No credit if FEHBP, else a reduction of 50% of reserve

## V. OTHER RISKS

### A. Asset risk – affiliates (c)

1. Risk of low value of affiliate stock
  - a. If affiliate is subject to RBC —see thru basis; RBCAC of subsidiary prorated by % ownership
  - b. Limits and adjustments —RBC of affiliate as it relates to surplus and book value
  - c. RBCAC for parent —same as if parent and affiliate were merged
2. Other investments in affiliates
  - a. Factor multiplied by book value
  - b. Factor —30%; 1005 for non-US insurance subsidiaries
3. Off-balance sheet items
  - a. 1% of reported value
  - b. Contingent liabilities; non-controlled amounts; amounts pledged as collateral & guarantees

- B. Asset risk – other ( $H_1$ )
  - 1. Risk investment default or decrease in value
  - 2. Book values multiplied by factor
  - 3. Factor —0% to 30%; doubled (capped at 30%) for assets held in 10 largest securities issuer because of concentration
  - 4. Some assets
    - a. Handled in credit risk —reinsurance receivables
    - b. Not included in RBC formula —due and unpaid premium
  - 5. Asset risk reduced by covariance
  - 6. Cash & bonds
    - a. US government bonds —0%
    - b. Cash, money market mutual bonds, corporate bonds — class 1 at 0.3%
    - c. Other bonds —class 2 (1%) to class 6 (30%)
  - 7. Common stocks
    - a. 15%, except 2.3% for Federal Home Loan Bank stock
  - 8. Property & equipment —10% factor against admitted asset balance
- C. Credit risk ( $H_3$ ) —risk that amount owed not recovered
  - 1. Some receivables unique to health insurers
    - a. Pharmacy rebates
    - b. Non-fulfillment of capitated providers
  - 2. Capitation
    - a. 2% of annual capitation paid to provider (one week paid capitation); 45 of paid to intermediaries
    - b. LOC or funds withheld —exemption
  - 3. Other types of credit risk
    - a. 0.5% of reinsurance receivables for non-affiliates
    - b. 1.0% of investment income receivables
    - c. 5.0% of health care receivables, amounts due from affiliates, receivables re ASC/ASO plans



- D. Business risk (H<sub>4</sub>)
    - 1. Administrative expense risk —misestimating
      - a. Weighted average risk factor
      - b. 4% to 7% of annual administrative expenses, excluding ASC/ASO revenues, expenses and commission
    - 2. Risks from ASC/ASO business
      - a. 2%, 1% additional for ASC
      - b. ASC —benefits paid from health insurer's bank account then reimbursed by third party
      - c. ASO —bank account owned and funded by third party
    - 3. Guaranty fund assessment risk
      - a. 0.5 % risk factor —against premium subjected to guarantee fund assessments
    - 4. Excessive growth risk
      - a. Underwriting RBC increases by more than safe harbor
      - b. Safe harbor — $10\% + (\text{CY underwriting revenue} / \text{PY underwriting revenue})$
      - c. > 50% in excess of safe harbor
  - E. Reserving risk
    - 1. Notable absence
      - a. Disconnect from level of conservatism in reserves
      - b. TAR (total asset requirement) = statutory reserves + capital
      - c. TAR adequate with high probability, 95% —adequate 95% of the time
      - d. Theoretically medical liabilities set at 50% confidence interval
- VI. RBC FORMULA
- A. Underwriting risk
    - 1. Component that dominates health RBC
    - 2. But treated overly simplistic for health insurance in existing life and P&C companies

## B. Ruin theory model

1. Capital —95% probability that companies will not be insolvent over a 5-year horizon
2. Key factors
  - a. Risk of catastrophic claims and other statistical fluctuations
  - b. Risk of misestimating trends or other pricing error
  - c. Length of time to recognize pricing error, implement adjustment and for adjustment to be effective
3. Claim probability distribution for an individual by coverage
4. Monte Carlo distribution of total claims for portfolio
5. Fluctuations of loss ratios over time by coverage

## C. Life RBC formula

## 1. RBCAC

$$= C_0 + C_{4a} + \left[ (C_{1o} + C_{3a})^2 + (C_{1cs} + C_{3c})^2 + C_2^2 + C_{3b}^2 + C_{4b}^2 \right]^{(1/2)}$$

$C_0$  = asset risk, affiliates

$C_{1cs}$  = asset risk, unaffiliated common stock and affiliated non-insurance stock

$C_{1o}$  = asset risk, all other

$C_2$  = insurance risk

$C_{3a}$  = interest rate risk

$C_{3b}$  = health credit risk

$C_{3c}$  = market risk

$C_{4a}$  = business risk

$C_{4b}$  = health administrative expense component of business risk

2. Health insurance written by life insurers
  - a. Lower effective capital requirement
  - b. Compared to mono-line health insurers
  - c. Effect of covariance adjustment, from diversification

- D. Insurance risk factors
  - 1. C2 component —based on treatment of H<sub>2</sub> component in health RBC
  - 2. Several key differences
  - 3. Individual medical —life formula
    - a. 20% load
    - b. For risk arising from additional time for premium rate increase to be filed and approved
  - 4. Claim reserves —life formula
    - a. 5% against all health claim reserves not just LTC claim reserves
    - b. Still does not resolve charge for claim liabilities rather than for claim reserves —medical insurance
  - 5. DI/LTC
    - a. Superficially materially higher than health RBC formula
    - b. Reflection of complex series of tax adjustments
  - 6. Group life
    - a. Provision for group life
    - b. Factor multiplied by net amount at risk
    - c. Tiered by premium volume
    - d. 0.18% for first 500 million grading to 0.08% for over 25 billion
  - 7. Workers' compensation carve out
    - a. P&C companies cede out to life insurer health & disability risk of workers compensation
    - b. Desire to minimize capital requirement
    - c. Life formula modified with special factors for more consistent treatment in P& C formula
- E. Conclusion
  - 1. All RBC formulas
    - a. Missing an explicit safety level for aggregate RBC
    - b. No study of overall risk profile
  - 2. Missing risk considerations in health RBC
    - a. Pandemics, biological terrorism
    - b. Increased compliance & regulatory costs —ACA
    - c. Financial and reputational risks —privacy breach
    - d. Longer duration products
    - e. Financial risks (ACA) MLR, rate review, guaranteed issue, risk adjustment