The (United States) National Association of Insurance Commissioners (NAIC) instituted its RBC system for life insurance companies in 1993, followed by a property-casualty system in 1994 and a health system in 1998. The NAIC’s RBC system consists of two parts:

- A formula that is used to set a regulatory minimum capital level for each insurer, based on that insurer’s mix of assets, liabilities, and risk, and
- Definition of “financial impairment” and remedies to state insurance regulators in the event that an insurer meets that definition of impairment.

Formulas continuously evolve. NAIC publishes newsletters and guidelines for the calculation of Risk-Based Capital. The RBC system is meant to be a supplement, not a replacement, for the existing fixed minimum capital requirements that exist in each state. That is, the RBC formula requirements can be higher or lower than the fixed minimum capital requirements (which are typically $1 to $2 million), but each insurance company must meet both sets of standards. Many small insurance companies generate RBC requirements that are lower than the fixed dollar minimums, but for virtually all medium-sized and large insurers, the capital requirements generated by the RBC formula are higher than the state fixed minimums.

The RBC requirement (level of capital required in view of risk undertaken) is calculated by multiplying risk factors times statement values, adding the results together, and then adjusting for covariance between major risk categories. The formula results are compared to the risk-adjusted capital of the insurer to develop the RBC ratio, which is the ratio of risk-adjusted capital to RBC. The ratio results are used to determine the degree to which an insurance company’s surplus is impaired. The model act specifies a series of increasingly stringent regulatory responses, as the RBC ratio decreases below 200%. A trend test is included to test whether insurers that were between the 200% breakpoint and 250% level were trending downward, which will trigger regulatory action, but an RBC ratio over 250% for a life company is sufficient to receive a passing grade on this pass/fail test.
There are four “action levels” under the NAIC RBC system.

- **Company Action Level (CAL).** If this level is reached, insurer is required to automatically submit a written, detailed business plan within 45 days that details the causes and actions that have led up to the capital impairment as well as a plan for the restructuring of the insurer’s business to rebuild capital to acceptable levels. Alternatively, the company can detail plans to reduce its risk to a level commensurate with its actual capital level.

- **Regulatory Action Level (RAL).** In this case, insurer must conform to the requirements stated in the Company Action Level, and in addition is subject to an immediate regulatory audit. The regulator can then issue protective orders to force the insurer to either lower its risk profile or increase its capital to a level commensurate with its risk. A company that has reached the Company Action Level and that does not conform to the statutory requirements spelled out in the statute is also automatically deemed to have triggered the Regulatory Action Level.

- **Authorized Control Level (ACL).** Its triggered by having statutory capital that is less than the Authorized Control Level RBC, as computed by the RBC formula or by failing to meet regulatory requirements imposed by the Regulatory Action Level. The Authorized Control Level is the capital level at which the state insurance commissioner is authorized, although not required, to place the insurance company under regulatory supervision.

- **Mandatory Control Level.** When that happens, the state regulator is required by statute to take steps to place the insurer under regulatory supervision.
Risk categories in the Life RBC formula

Originally, the major risk categories in the Life RBC formula were C1 – Asset Risk, C2 – Insurance Risk, C3 – Interest Rate Risk and C4 – Business Risk. These generic categories have been later refined and currently they are:

- C0 Affiliates Risk
- C1cs Asset Risk – Unaffiliated Common Stock
- C1o Asset Risk – Other Assets Risk
- C2 Insurance Risk
- C3a Interest Rate Risk
- C3b Health Credit Risk
- C4a General Business Risk
- C4b Administrative Expense Risk

The values calculated for each category are then combined in what is commonly called the covariance formula.

The results of the covariance formula produce the Company Action Level RBC capital requirement. The Company Action Level requirement is twice the Authorized Control Level requirement.

If the insurer’s Total Adjusted Capital is less than the Authorized Control Level RBC requirement, the regulator is authorized to seize control of the company. The ACL RBC and the Total Adjusted Capital are both reported in the Five-Year History page of the annual statement. The RBC formula inputs and calculations are not made public.

Total Adjusted Capital =
Statutory Capital & Surplus + Asset Valuation Reserve (AVR) including AVR in separate accounts + Half of company’s liability for dividends + company’s ownership share of AVR of subsidiaries + Half of company’s ownership share of subsidiaries’ dividend liability

Separate risk-based capital models apply to life companies, property/casualty companies and health organizations. The common risks identified in the NAIC models for all types of companies include Asset Risk-Affiliates, Asset Risk-Other, Credit Risk, Underwriting Risk, and Business Risk.
Steps in RBC calculation:
- Apply risk factors against annual statement values,
- Sum risk amounts and adjust for statistical independence (using the covariance formula),
- Calculate Authorized Control Level Risk-Based Capital amount,
- Compare ACL RBC to Adjusted Capital.

Total Adjusted Capital (Actual Capital) is divided by Authorized Control Level RBC (Hypothetical Minimum Capital) to get the RBC Ratio
- No Action (98% of companies) -- TAC/RBC over 200%
- Company Action Level -- TAC/RBC is 150% to 200%
- Authorized Control Level -- TAC/RBC is 70% to 100%
- Mandatory Control Level -- TAC/RBC is less than 70%

After the calculation of RBC, the company is also expected to perform sensitivity tests to indicate how sensitive the results are to certain risk factors’ changes.
Major categories in life RBC formula:
C0 – Subsidiary Insurers Risk
C1 – Asset Risk
C2 – Insurance Risk
C3 – Interest Rate Risk
C4 – Business Risk

Major categories in property/casualty RBC formula:
R0 – Subsidiary Insurers Risk
R1 – Fixed Income Asset Risk
R2 – Equity Asset Risk
R3 – Credit Risk
R4 – Insurance Risk – Reserve Development
R5 – Insurance Risk – Written Premiums

Major categories in health RBC formula:
H0 - Insurance Subsidiaries Risk
H1 –Asset Risk
H2 – Insurance Risk
H3 – Credit Risk
H4 – Business and Admin Expense Risk
Life asset risk accounted for:

- Defaults on Fixed Income Investments
- Changes in Market Value of Equity Investments
- Unrecoverability of Reinsurance Balances
- Company-Specific Experience (e.g., Mortgage Experience Adjustment)
- Over-Concentration in Specific Asset Investments
- Additional Risk from Affiliated Investments

Asset risks not accounted for:

- Market Value Adjustments
- Quality of Investments, although the following do adjustments do occur:
  - Bond Factors Differ By NAIC Rating Class
  - Mortgages In Default Have Higher Factors
  - Certain Types of Reinsurance Have Higher Factors
- Common Stock Diversification
- Interest Rate Risk
- Quality of Reinsurance
- Duration/Convexity Risk (not in the asset formula, and even in the C-3 part, not directly)

RBC treatment of an affiliate:

- RBC calculated by affiliate
- Parent RBC charge equal to its prorated share of affiliate’s RBC
  - 100% ownership = 100% rollup of RBC
  - 50% ownership = 50% rollup of RBC
- Treats affiliate as an extension of parent
Asset risk (C1) calculation example:
Note: Risk factors are developed by an NAIC Advisory Group. Based on simulation testing for portfolios of bonds. They are intended to account for default risk only. In what follows we use factors that may not be exactly the ones currently used.

<table>
<thead>
<tr>
<th>Asset portfolio given:</th>
<th>Factor</th>
<th>RBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAIC Class 1, U.S. Government</td>
<td>$1000</td>
<td>0.000</td>
</tr>
<tr>
<td>NAIC Class 1, non-U.S. Government</td>
<td>$1000</td>
<td>0.003</td>
</tr>
<tr>
<td>NAIC Class 2</td>
<td>$1000</td>
<td>0.010</td>
</tr>
<tr>
<td>NAIC Class 3</td>
<td>$1000</td>
<td>0.020</td>
</tr>
<tr>
<td>NAIC Class 4</td>
<td>$1000</td>
<td>0.045</td>
</tr>
<tr>
<td>NAIC Class 5</td>
<td>$1000</td>
<td>0.100</td>
</tr>
<tr>
<td>NAIC Class 6</td>
<td>$1000</td>
<td>0.300</td>
</tr>
<tr>
<td>Total</td>
<td>$7000</td>
<td>$478.00</td>
</tr>
</tbody>
</table>

There is then a bond size adjustment factor, i.e., the resulting RBC is multiplied by a number $f_{\text{SIZE}}$, which is determined by the number of bonds in the portfolio. Note: there are no adjustments for portfolio size for stocks and mortgages.

For stocks, the C1 RBC is derived by multiplying the total value of all stocks by a factor provided by NAIC (30% for life companies, 15% for property/casualty companies, but note that factors do change over time).

Life mortgages formula is based on Asset Valuation Reserve (AVR)
- Mortgage Experience Adjustment (MEA)
- Separate Risk Factors By Mortgage Type
  o Farm
  o Residential
  o Commercial
  o Restructured
- Separate Risk Factors By Quality
  o In Good Standing
  o Overdue
  o In Foreclosure
Life real estate formula:
- Separate calculations for each property, then add up to get the total.
- Large number of separate RBC factors depending on type and quality of property, very complex.
- Questionable accuracy.

Accounting for insurance risk C2:
- Life formula uses tiered factors to adjust for size differences.
- Life insurance - Apply factors against net amount at risk.
- Health insurance - Apply factors against earned premiums.
- Flat factor is applied against health insurance reserves (e.g., not size-based).
- Credit allowed for premium stabilization reserves.

Example of tiered premium insurance risk RBC calculation:
A company has $10,000,000 in net amount at risk. A factor of 3.5% is applied to the first $5 million, and 2.0% for the next $5 million. Then the insurance risk RBC for this company is: 3.5% of $5,000,000 plus 2.0% of $5,000,000, for a total of $175,000 + $100,000 = $275,000.
The C3 risk RBC calculation uses the asset-liability model used for year-end Asset Adequacy Analysis cash flow testing, or a consistent model. You start by running the scenarios (12 or 50) produced from the interest-rate scenario generator. The statutory capital and surplus, \( S(t) \), should be captured for every scenario for each calendar year-end of the testing horizon. For each scenario, the C-3 measure is the most negative of the series of present values \( S(t) \), using 105 percent of the after-tax one-year Treasury rates for that scenario. Then one should rank the scenario-specific C-3 measures in descending order, with scenario number 1’s measure being the positive capital amount needed to equal the very worst present value measure. Taking the weighted average of a subset (currently, scenarios ranked 17th through 5th are used with weights 0.02, 0.04, …, 0.16, …, 0.04, 0.02) of the scenario specific C-3 scores derives the final C-3 factor for the 50 scenario set. For the 12 scenario set, the charge is calculated as the average of the C-3 scores ranked 2 and 3, but cannot be less than half the worst scenario score. There are also cases when single scenario testing is allowed.

Finally, the C4 RBC is calculated generally as a small percentage of premiums, in the range of 2%.

The original life RBC covariance formula was:

\[ \sqrt{(C1 + C3)^2 + C2^2 + C4}. \]

It has been since then changed to:

\[ C0 + \sqrt{(C1 + C3)^2 + C2^2 + C4}. \]

The property/casualty covariance formula is:

\[ R0 + \sqrt{(R1 + R2 + R3 + R4 + R5)^2}. \]

The result of this formula is used in the RBC ratio to compare to the Company Action Level RBC (200% of Authorized Control Level). If you would rather compare to the Authorized Control Level, the life covariance formula is:

\[ \frac{1}{2}\left(C0 + \sqrt{(C1 + C3)^2 + C2^2 + C4}\right). \]
Historical results, life companies

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No Action</td>
<td>1,532</td>
<td>1,515</td>
<td>1,494</td>
<td>1,440</td>
<td>1,210</td>
</tr>
<tr>
<td>Company Action Level</td>
<td>9</td>
<td>16</td>
<td>12</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>Regulatory Action Level</td>
<td>8</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Authorized Control Level</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Mandatory Control Level</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>1,559</td>
<td>1,543</td>
<td>1,513</td>
<td>1,472</td>
<td>1,231</td>
</tr>
</tbody>
</table>

Historical results, property/casualty companies

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No Action</td>
<td>2,348</td>
<td>2,346</td>
<td>2,359</td>
<td>2,353</td>
</tr>
<tr>
<td>Company Action Level</td>
<td>20</td>
<td>33</td>
<td>39</td>
<td>33</td>
</tr>
<tr>
<td>Regulatory Action Level</td>
<td>13</td>
<td>15</td>
<td>19</td>
<td>12</td>
</tr>
<tr>
<td>Authorized Control Level</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Mandatory Control Level</td>
<td>27</td>
<td>22</td>
<td>25</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>2,413</td>
<td>2,422</td>
<td>2,453</td>
<td>2,419</td>
</tr>
</tbody>
</table>

Source: Dr. Michael Barth, Georgia Southern University
The following notes are based on two articles in the *Record of the Society of Actuaries*. These are panel discussions on Risk-Based Capital at the Society of Actuaries meetings.


Panel:
Kriss Cloninger III, Moderator
Bryan J. Featherstone
John O. Nigh
Frederick S. Townsend

The summaries of the debaters’ statements are identified by their names.

John Nigh
Companies can do the following to improve their RBC ratios:
• Enhance capital
  - Receive investment from a parent company (i.e., get cash infusion into surplus),
  - Use reinsurance,
  - Structure financing.
• Restructure asset portfolio (change investments)
  - Choose higher quality assets
  - Diversify portfolio
These remedies do work, but implementing them can create problems: recognition of capital losses, lower yields may result, and there will be expenses.
• Reorganize affiliates
• Restructure liabilities
  - Reduce excess liabilities,
  - Reduce growth in surplus-intensive products,
  - Use reinsurance or pooling,
  - Write liabilities that use the properties of the covariance formula.
Bryan J. Featherstone
Proposes that quota-share reinsurance affects investment risk and liability risk and can be used as an RBC management tool. Reinsurance on an in-force block of business gives a reduction in required RBC, because the ceding company is paid for profits embedded in business. Here are the advantages of reinsurance for RBC management:
- Policyholders will understand it and not perceive it as a cause for a run-on-the-bank.
- Reinsurer pays the ceding company a ceding allowance, and an ongoing allowance for expenses, so the ceding company still enjoys economies of scale.

Consider the examples in the presentation:

Example 1: Small Accident and Health Insurance Co. It has capital of 10, C1 reinsurance credit is 0.50%, and its original RBC position is as follows:

<table>
<thead>
<tr>
<th>Risk</th>
<th>Amount</th>
<th>Factor</th>
<th>Products &amp; RBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>50</td>
<td>0.60%</td>
<td>0.30</td>
</tr>
<tr>
<td>C2 (premium)</td>
<td>30</td>
<td>25.00%</td>
<td>7.50</td>
</tr>
<tr>
<td>C2 (amount at risk)</td>
<td>35</td>
<td>5.00%</td>
<td>1.75</td>
</tr>
<tr>
<td>C3</td>
<td>0</td>
<td>0.00%</td>
<td>0.00</td>
</tr>
<tr>
<td>C4</td>
<td>30</td>
<td>0.50%</td>
<td>0.20</td>
</tr>
</tbody>
</table>

ACL RBC = \[\frac{1}{2} \left( \sqrt{(0.30 + 0.00)^2 + (7.50 + 1.75)^2 + 0.20} \right) = 4.70\].

RBC Ratio = \[\frac{10}{4.70} = 213\%\]. Now suppose that this company obtains a 10% coinsurance. The new RBC position is:

<table>
<thead>
<tr>
<th>Risk</th>
<th>Amount</th>
<th>Factor</th>
<th>Products &amp; RBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>50% (30) = 27.00</td>
<td>0.59994%</td>
<td>0.30 (0.29997)</td>
</tr>
<tr>
<td>C2 (premium)</td>
<td>90% (30) = 27.00</td>
<td>25.00%</td>
<td>6.80</td>
</tr>
<tr>
<td>C2 (amount at risk)</td>
<td>90% (35) = 31.50</td>
<td>5.00%</td>
<td>1.60</td>
</tr>
<tr>
<td>C3</td>
<td>90% (0) = 0</td>
<td>0.00%</td>
<td>0.00</td>
</tr>
<tr>
<td>C4</td>
<td>30 (unchanged)</td>
<td>0.50%</td>
<td>0.20</td>
</tr>
</tbody>
</table>

ACL RBC = 4.24

RBC Ratio = 236%

The C4 amount is unchanged, because this is indemnity contract, not assumption. The C1 amount is 0.30 – 10%(0.60% - 0.50%)0.30 = 0.29997.
With 20% coinsurance, the position is:

<table>
<thead>
<tr>
<th>Risk</th>
<th>Amount</th>
<th>Factor</th>
<th>Products &amp; RBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>50</td>
<td>0.59988%</td>
<td>0.30 (0.29994)</td>
</tr>
<tr>
<td>C2 (premium)</td>
<td>80%(30) = 24.00</td>
<td>25.00%</td>
<td>6.00</td>
</tr>
<tr>
<td>C2 (amount at risk)</td>
<td>80%(35) = 28.00</td>
<td>5.00%</td>
<td>1.40</td>
</tr>
<tr>
<td>C3</td>
<td>80%(0) = 0</td>
<td>0.00%</td>
<td>0.00</td>
</tr>
<tr>
<td>C4</td>
<td>30 (unchanged)</td>
<td>0.50%</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACL RBC = 3.78</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RBC Ratio = 265%</td>
</tr>
</tbody>
</table>

Example 2.
Large Life Insurance Co.
This company has capital of 100. The product line under consideration has profits with the present value of 50. It receives C1 reinsurance credit factor of 0.50%. Before reinsurance it looks like this:

<table>
<thead>
<tr>
<th>Risk</th>
<th>Amount</th>
<th>Average factor</th>
<th>Products &amp; RBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>2000</td>
<td>2.000%</td>
<td>40</td>
</tr>
<tr>
<td>C2 (premium)</td>
<td>50000</td>
<td>0.078%</td>
<td>39</td>
</tr>
<tr>
<td>C3</td>
<td>1800</td>
<td>0.600%</td>
<td>11</td>
</tr>
<tr>
<td>C4</td>
<td>250</td>
<td>2.000%</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACL RBC = 34.52</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RBC Ratio = 290%</td>
</tr>
</tbody>
</table>

The company chooses to obtain a 30% coinsurance on a business segment with the following characteristics:

<table>
<thead>
<tr>
<th>Risk</th>
<th>Coinsured amount</th>
<th>Coinsured factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>400</td>
<td>0.80%</td>
</tr>
<tr>
<td>C2 (premium)</td>
<td>10000</td>
<td>0.06%</td>
</tr>
<tr>
<td>C3</td>
<td>400</td>
<td>0.50%</td>
</tr>
<tr>
<td>C4</td>
<td>50</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

After this reinsurance, the company has the following RBC position (the company receives allowance for 30% of profits ceded):

<table>
<thead>
<tr>
<th>Risk</th>
<th>RBC components and results</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>40 – 30%(0.80%-0.50%)400 = 39.64</td>
</tr>
<tr>
<td>C2 (premium)</td>
<td>39 – 30%(0.06%)10000 = 37.20</td>
</tr>
<tr>
<td>C3</td>
<td>11 – 30%(0.50%)400 = 10.40</td>
</tr>
<tr>
<td>C4</td>
<td>5 (no change, as this is an indemnity contract)</td>
</tr>
<tr>
<td></td>
<td>ACL RBC = 33.60</td>
</tr>
<tr>
<td></td>
<td>RBC Ratio = (100 + 30%(50))/33.60 = 342%</td>
</tr>
</tbody>
</table>
Now suppose that the company purchases a 60% coinsurance instead, on the same business segment. Then after this reinsurance, the company has the following RBC position:

<table>
<thead>
<tr>
<th>Risk</th>
<th>RBC components and results</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>$40 - 60%(0.80% - 0.50%)400 = 39.28$</td>
</tr>
<tr>
<td>C2 (premium)</td>
<td>$39 - 60%(0.06%)10000 = 35.40$</td>
</tr>
<tr>
<td>C3</td>
<td>$11 - 60%(0.50%)400 = 9.60$</td>
</tr>
<tr>
<td>C4</td>
<td>5 (no change, as this is an indemnity contract)</td>
</tr>
<tr>
<td></td>
<td>ACL RBC = 32.68</td>
</tr>
<tr>
<td></td>
<td>RBC Ratio = $(100 + 60%(50))/32.68 = 398%$</td>
</tr>
</tbody>
</table>

Example 3.
This example considers a Very Large Life Insurance Company, with a capital of 350, and the PV of future profits in the segment ceded of 50, with C1 reinsurance credit factor of 0.50%. The company is assumed to have the following RBC position before reinsurance:

<table>
<thead>
<tr>
<th>Risk</th>
<th>Amount</th>
<th>Average factor</th>
<th>Products &amp; RBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>5000</td>
<td>4.000%</td>
<td>200</td>
</tr>
<tr>
<td>C2 (premium)</td>
<td>90000</td>
<td>0.066%</td>
<td>59</td>
</tr>
<tr>
<td>C3</td>
<td>3500</td>
<td>0.750%</td>
<td>26</td>
</tr>
<tr>
<td>C4</td>
<td>250</td>
<td>2.000%</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>ACL RBC = 119.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RBC Ratio = 350/119.46 = 290%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Now suppose that the company purchases a 30% coinsurance on a business segment with the following properties (note that the company cedes risky assets in this reinsurance contract):

<table>
<thead>
<tr>
<th>Risk</th>
<th>Coinsured amount</th>
<th>Coinsured factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>500</td>
<td>30.0%</td>
</tr>
<tr>
<td>C2 (premium)</td>
<td>10000</td>
<td>0.06%</td>
</tr>
<tr>
<td>C3</td>
<td>400</td>
<td>0.50%</td>
</tr>
<tr>
<td>C4</td>
<td>50</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
After this reinsurance, the company’s RBC profile is:

<table>
<thead>
<tr>
<th>Risk</th>
<th>RBC components and results</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>$40 - 30% (30.00% - 0.50%)\times 500 = 155.75$</td>
</tr>
<tr>
<td>C2 (premium)</td>
<td>$59 - 30% (0.06%)\times 10000 = 57.60$</td>
</tr>
<tr>
<td>C3</td>
<td>$26 - 30% (0.50%)\times 400 = 25.65$</td>
</tr>
<tr>
<td>C4</td>
<td>5 (no change, as this is an indemnity contract)</td>
</tr>
<tr>
<td>ACL RBC</td>
<td>97.66</td>
</tr>
<tr>
<td>RBC Ratio</td>
<td>$(100 + 30% (50))/97.66 = 358%$</td>
</tr>
</tbody>
</table>

If, instead, reinsurance is for 60%, then the new RBC profile is:

<table>
<thead>
<tr>
<th>Risk</th>
<th>RBC components and results</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>$40 - 60% (30.00% - 0.50%)\times 500 = 111.50$</td>
</tr>
<tr>
<td>C2 (premium)</td>
<td>$59 - 60% (0.06%)\times 10000 = 55.80$</td>
</tr>
<tr>
<td>C3</td>
<td>$26 - 60% (0.50%)\times 400 = 25.05$</td>
</tr>
<tr>
<td>C4</td>
<td>5 (no change, as this is an indemnity contract)</td>
</tr>
<tr>
<td>ACL RBC</td>
<td>76.26</td>
</tr>
<tr>
<td>RBC Ratio</td>
<td>$(100 + 60% (50))/76.26 = 459%$</td>
</tr>
</tbody>
</table>

The above illustrate that improvement in RBC position is not only possible, but quite likely with the use of reinsurance. Things to keep in mind when using reinsurance:

- Improvement is not always achieved for the C1 risk with the transfer of assets, as there is generally a credit factor (usually 0.50\% = 50 bps) that the ceding company must pay. Thus C1 contribution to RBC will only decline if the assets transferred have an average RBC factor in excess of 0.50\%.
- Improvement in the C2 and C3 risk is usually easy to achieve.
- On indemnity reinsurance, there is no C4 relief.
Frederick Townsend

Discusses the actions taken by the five companies with lowest RBC ratios. Such actions also help solvency and liquidity concerns, and ratings. Here are the companies:

- **Equitable Life of New York**
  - Issued surplus notes,
  - Securitized junk bonds,
  - Sold investment management firm to the parent company,
  - Restructured mortgage loans,
  - Left group life, group health, and GIC business.

- **New England Mutual**
  - Reduced dividends paid to participating policies,
  - Securitized and restructured mortgage loans,
  - Sold investment management firm to the public,
  - Left GIC business.

- **Mutual of New York**
  - Issued surplus notes,
  - Left group life, group health, and GIC business,
  - Reinsured existing GIC business with Metropolitan,
  - Sold group annuity business to Aegon,
  - Sold joint ventures and realized profits on them.

- **State Mutual**
  - At the time of the publication of the article, still in trouble due to holdings in Hanover Insurance.

- **Xerox Financial Services Life**
  - Took capital gains on bond portfolio (due to low interest rates),
  - Exchanged surrendable SPDAs to nonsurrendable SPDAs.

Panel:
Perry L. Wiseblatt, Moderator
Josephine Elizabeth Marks
Bradley M. Smith

This panel discussion took place after the changes to RBC formula with respect to the treatment of subsidiaries, but before the new health RBC was fully implemented. The issue is again: what are the methods that insurance companies can utilize to improve their RBC situation? Methods identified:
- Asset allocation strategies,
- Reinsurance/risk sharing,
- Product design strategies.

Perry Wiseblatt
What are the parties interested in a company’s RBC?
- Company management,
- Regulators (not mentioned by Wiseblatt, but obvious),
- Rating agencies,
- Policyholders,
- Shareholders.

Bradley Smith
Limited resources lack of which may cause companies to fail:
- Capital,
- Profitable marketing opportunities.

Define the $R$-factor in RBC covariance formula as: $R = \frac{C_2}{C_1 + C_3}$. We use it to compare the insurance-related risk to the asset-related risk. Let:

$$w_A = \frac{1}{\sqrt{1 + R^2}} = \frac{C_1 + C_3}{\sqrt{(C_1 + C_3)^2 + C_2^2}}$$

and

$$w_I = \frac{R}{\sqrt{1 + R^2}} = \frac{C_2}{\sqrt{(C_1 + C_3)^2 + C_2^2}}.$$
These factors, when multiplied by the incremental RBC factors, give the incremental RBC that is given by a marginal unit of asset risk or insurance risk.

Companies generally want to maximize their return on investment in light of their constraints (capital constraints and regulatory constraints are key, and RBC is the essential combination of the two). Thus companies:
- Must identify lines of business for which the company can write business without affecting its total RBC (and the \( w \) factors can be helpful in identifying them),
- The total return on capital must incorporate the change in RBC. For example, you can still do better with lower margin if you can improve your RBC position in the process.

Josephine Marks
The Canadian equivalent of the U.S. RBC is called the Minimum Continuing Capital and Surplus Requirement (MCCSR). It is set by the Office of Supervision of Financial Institutions (OSFI). 120% of MCCSR is the acceptable level of capital for an insurance firm. But to have higher ratings, must have higher MCCSR. The key components of MCCSR calculation are:
- Asset risk,
- Mortality-morbidity risk,
- Repricing risk,
- Interest rate risk.

In the case of the speaker’s company, asset risk contributes 60% of MCCSR. The calculation is done by applying factors to the book value of different asset classes according to their riskiness. As in the U.S., all federal government bonds have a 0% factor. But unlike the U.S., also provincial bonds have 0% factor.

Some issues in the calculation:
- There is no credit for diversification of assets,
- There is no differentiation among bonds once placed in a specific quality group (regardless of their maturity, or small differences in quality),

Effectively, assets should be evaluated based on their returns after consideration for the MCCSR factor. Return (or spread) alone is not enough. MCCSR position may be improved by securitizing assets.
Also, MCCSR formula does not consider derivatives, and one may use derivatives to improve MCCSR position.

Josephine Marks then examined the impact of MCCSR on the efficient frontier of company’s asset portfolio. Results:
- Efficient frontier shifts down, as all returns are reduced by their MCCSR impact,
- Bond holdings increase, stocks and real estate decrease,
- Companies generally set a target multiple of MCCSR they hold, and higher multiples generally cause greater effects of the two phenomena identified above.

Perry Wiseblatt
Note that it is the RBC Ratio that should be managed, and this can be achieved by managing the numerator or the denominator of the fraction. The following are ways to manage the numerator (Total Adjusted Capital):
- Reinsure,
- Raise equity,
- Purchase contingent equity,
- Issue surplus notes,
- Reduce capital intensive new business.

Reinsurance has some advantages:
- It helps both the numerator and the denominator of the RBC Ratio,
- It helps to allocate capital more efficiently,
- It can be targeted to problem lines of business,
- It allows company a lot of flexibility.

The value of reinsurance comes from the following:
- It frees up capital to grow new business or improve ratings (assuming reinsurer can provide that capital, but reinsurer generally faces different constraints than the ceding company),
- Shift low-return business to reinsurer,
- Reinsurance may be a source of valuation of the company’s business.

Note that for reinsurance to be feasible, the cost of capital to the reinsurer (after consideration for expenses) must be less than the rate earned on the freed-up capital by the ceding company. NAIC RBC formula does not provide guidance about that, it was created for a different purpose: to identify distressed companies. Irony of the RBC formula: a company that decides to strengthen its reserves will deteriorate in its RBC profile.
Insight about capital and reinsurance from Zurich Centre Group:
- Project future cash flows with and without reinsurance, with many simulations and a distribution of results,
- “At Risk Capital” = amount of capital the company thinks it needs,
- “Market Perception Capital” = amount of capital the market thinks the company needs,
- “Face capital” is the difference of the two.

Considerations in reinsurance:
- Guide yourself by statutory or GAAP accounting?
- Be careful of the audience to which the deal is presented,
- Choices: Coinsurance, Yearly-Renewable-Term, Stop-Loss.
- Can reinsure new business or in-force business.
- Must decide whether to use authorized or unauthorized reinsurer.