Concept Tested (Year, No.)

# SOLVENCY MEASUREMENT FOR P&C RISK BASED CAPITAL APPLICATIONS

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## Economic Basis for Risk-based Capital

The main purpose of solvency regulation is to ensure that the promised insurance protection is available and at an acceptable degree of certainty.

Technical insolvency occurs when obligations exceed assets.

**RBC:**

(a) Is the theoretical amount needed to absorb the risk of conducting a business.

(b) Is the amount of capital necessary to assure the major parties to an insolvency that the danger of failure is acceptably low.

In a perfectly efficient market, solvency regulation would not be necessary.

- Consumers would know the likelihood of their insurer's becoming insolvent, with the price of the policy being adjusted to reflect the solidity of the insurer.
- Insurers would adjust their capital levels to meet the customers needs for protection/price tradeoff.

Regulation exists particularly for the *less informed personal lines customers*.

Using a risk based capital program:

(a) regulation can provide a minimum level of protection against insurer insolvency, with

(b) additional security provided by a competitive insurance market.

**3 Desirable Features of a Risk based Capital Method:**

1. The **solvency standard** should be **the same for all classes** (personal vs commercial, primary vs reinsurers, 2nd party vs 3rd party claimants).
2. **RBC** should be **objectively** (expressed as a mathematical formula) **determined.**
   Two insurers with the same risks should have identical RBC amounts.
3. The method **must be able to discriminate between quantifiable items of meaningful value that differ materially in their riskiness**.
   Each distinct item is a risk element, and when viewed in conjunction with time, must be a balance sheet quantity.

## Expected Deficit as a Measure of Insolvency Risk:

For a balance sheet item, risk is present when the future realization of the item can be one of several values, but the particular outcome is currently unknown.

The Model:

The value of Assets (assets are cash, the realizable value is certain) is A.

The loss reserve (is the unpaid loss, with a realizable value that is a random variable) is L.

The capital ( with a realizable value that is a random variable ) is C = A - L.

The usual measure of risk with respect to insolvency is the probability of ruin, although it is inadequate for public policy.

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96,50 Expected policyholder deficit (EPD):

EPD = Expected value of (the amount the insurer is obligated to pay) - the amount actually paid.

EPD ratio = EPD / Expected Loss (shown as $d_L$ and $d_A$). .

EPD with Liability Risk:

For a discrete size of loss distribution, EPD = $D_L = \sum_{x>A} p(x)(x - A)$, and EPD ratio, $d_L = D_L / L$.

EPD with Asset Risk: For a discrete distribution of asset values, EPD = $D_A = \sum_{L>y} q(y)(L - y)$, $d_A = D_A / L$.

**Tables 1 and 2**

| | Asset Amount (1) | Loss Amount (2) | Capital Amount (3)=(1)-(2) | Probability (4) | Claim Payment (5) | Deficit Max of [0, (1)- (5)] |
|---|---|---|---|---|---|---|
| **Insurer A** | | | | | | |
| Scenario 1 | 13,000 | **6,900** | | 0.20 | 6,900 | 0 |
| Scenario 2 | 13,000 | **10,000** | | 0.60 | 10,000 | 0 |
| Scenario 3 | 13,000 | **13,100** | | 0.20 | 13,000 | 100 |
| Expectation | 13,000 | 10,000 | 3,000 | | | |
| | | | | | EPD = $D_L$ = | 20 |
| Expected Loss | | 10,000 | | | EPD ratio= $d_L$ = | 0.002 |
| **Insurer B - Risky Liabilities** | | | | | | |
| Scenario 1 | 13,000 | **2,000** | | 0.20 | 2,000 | 0 |
| Scenario 2 | 13,000 | **10,000** | | 0.60 | 10,000 | 0 |
| Scenario 3 | 13,000 | **18,000** | | 0.20 | 13,000 | 5,000 |
| Expectation | 13,000 | 10,000 | 3,000 | | | |
| | | | | | EPD = $D_L$ = | 1,000 |
| Expected Loss | | 10,000 | | | EPD ratio= $d_L$ = | 0.100 |
| **Insurer C - Risky Assets** | | | | | | |
| Scenario 1 | **12,000** | 5,000 | | 0.10 | 5,000 | 0 |
| Scenario 2 | **6,000** | 5,000 | | 0.80 | 5,000 | 0 |
| Scenario 3 | **3,000** | 5,000 | | 0.10 | 3,000 | 2,000 |
| Expectation | 6,300 | 5,000 | 1,300 | | | |
| | | | | | EPD = $D_A$ = | 200 |
| Expected Loss | | 5,000 | | | EPD ratio= $d_A$ = | 0.040 |

Expectations for both assets and liabilities are sumproducts of the amounts and probabilities.

Both insurer A and B have a 20% chance of being insolvent under scenario 3, but Insurer B's policyholders are clearly worse off. They will forfeit $1,000, on average, of their claim payments.

Thus, it is **not sufficient to consider the probability of ruin only** to express the policyholder's exposure to loss; its severity must also be incorporated.

**Setting Capital to a Common EPD ratio:**

Suppose a regulator wishes to set a capital standard so that the EPD is the same for all insurers:

Example: Let EPD = 5% of expected losses. Assume: The expected loss is given for each insurer.

Thus, the EPD for insurers A, B, and C would be .05 * 10,000 = 500, .05 * 10,000 = 500, .05 * 5,000 = 250.

**To satisfy this requirement, adjust the level of beginning assets**, by adding or subtracting assets of the same type as the original assets (so that the probability distribution of the ending assets to the beginning assets stays constant), to reach the desired capital.

| **Given:** | Insurer A | Insurer B | Insurer C |
|---|---|---|---|
| 1. Begining Assets | 13,000 | 13,000 | 6,300 |
| 2. Expected Loss | 10,000 | 10,000 | 5,000 |
| 3. Capital = 1. - 2. | 3,000 | 3,000 | 1,300 |
| 4. Scenario 3 Loss Amount | 13,100 | 18,000 | 5,000 |
| 5. Scenario 3 Probability | 0.200 | 0.200 | 0.100 |
| 6. Desired EPD = .05*E[L] | 500 | 500 | 250 |
| **Compute:** Adjusted assets to Produce a desired 5 % EPD ratio | | | |
| ***A. Adj Assets = Loss - EPD/Prob*** | ***10,600*** | ***15,500*** | ***2,500*** |
| B. Adjustment to Original Assets | -2,400 | 2,500 | -3,800 |
| C. EPD = $\sum_{X>A} p(x)*(X-A)$ | .2*(13.1-10.6) = 500 | .2*(18-15.5) = 500 | .1*(5-2.5) 250 |

A = (4.) - (6.)/(5); B = (A.) - (1.)

C. The computed EPD equals the desired EPD. Thus, to set a to set a capital standard so that the EPD is the same for all insurers, the capital for insurer B must be increased, while the capital for insurers A & C must be decreased.