2013 Investment Seminar
Colloque sur les investissements 2013

Session / Séance 5:
The use of Economic Capital in ORSA

Speaker / Conférencier:

Bogie Ozdemir
Disclaimer and References

• *Adapting to Basel III and the financial crises, Re-engineering capital, business mix, and performance management practices*, Bogie Ozdemir, Peter Miu, January 2013, Risk Books
• *Managing Performance using a Dual Measure*, Bogie Ozdemir, Evren Cubukgil, Huaxing Xia, working paper
• *Managing differences in Economic and Regulatory capital, Dynamics of ROE maximizing behaviour*, Bogie Ozdemir, Evren Cubukgil, working paper

• Opinions expressed are those of the speaker and are not necessarily endorsed by the speaker’s employer.
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Agenda

• The use of Economic Capital in ORSA
  – Background
  – Going and Gone concern
  – Development stages for different risk types
  – Shortcuts and approximations for 2014 ORSA

• Supplementing EC via Stress Testing, EaR, CTE

• Co-managing ORSA and Regulatory Capital
Background

• OSFI’s minimum requirements for ORSA
  – Comprehensive Identification and Assessment of Risks
  – **Relating Risk to Capital**
  – Board Oversight and Senior Management Responsibility
  – Monitoring and Reporting
  – Internal Controls and Independent Review
  – ORSA Report and Key Metrics Report
  – Use Test
ORSA is a Risk based, integrated, comprehensive capital and business planning tool

Managing the Capital buffer between “Available Capital” (the supply) and “Risk Capital” (the demand) with respect to the organization's Risk Appetite and Strategic Objectives considering both expected and stress business conditions
Example ORSA report (needed for 3 to 5 years)

### Key Metrics Report

<table>
<thead>
<tr>
<th></th>
<th>Regulatory Capital</th>
<th>ORSA Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$</td>
<td>% (of A)</td>
</tr>
<tr>
<td><strong>TOTAL CAPITAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insurance Risk</td>
<td>55</td>
<td>55%</td>
</tr>
<tr>
<td>Market Risk</td>
<td>30</td>
<td>30%</td>
</tr>
<tr>
<td>Credit Risk</td>
<td>15</td>
<td>15%</td>
</tr>
<tr>
<td>Subtotal (A)</td>
<td>100</td>
<td>100%</td>
</tr>
<tr>
<td>Operational Risk</td>
<td>20</td>
<td>20%</td>
</tr>
<tr>
<td>Regulatory Minimum</td>
<td>120</td>
<td>120%</td>
</tr>
<tr>
<td>Other Risks (e.g.: Credit Concentration)</td>
<td>15</td>
<td>15%</td>
</tr>
<tr>
<td>Other Risks (e.g.: Strategic/Reputation)</td>
<td>20</td>
<td>20%</td>
</tr>
<tr>
<td>Other Risks (e.g.: Other)</td>
<td>15</td>
<td>10%</td>
</tr>
<tr>
<td>Aggregation Benefit</td>
<td>5</td>
<td>5%</td>
</tr>
<tr>
<td>Scenario &amp; Stress Testing</td>
<td>150</td>
<td>150%</td>
</tr>
<tr>
<td>Other Capital Adjustments (Specify)</td>
<td>5</td>
<td>5%</td>
</tr>
<tr>
<td>Regulatory Target / Own Capital Needs</td>
<td>150</td>
<td>150%</td>
</tr>
<tr>
<td>Scenario &amp; Stress Testing</td>
<td>15</td>
<td>15%</td>
</tr>
<tr>
<td>Other Capital Adjustments (Specify)</td>
<td>5</td>
<td>5%</td>
</tr>
<tr>
<td>Internal Target</td>
<td>185</td>
<td>185%</td>
</tr>
<tr>
<td>Available Capital</td>
<td>220</td>
<td>220%</td>
</tr>
</tbody>
</table>

### Core Capital

<table>
<thead>
<tr>
<th></th>
<th>Regulatory Capital</th>
<th>ORSA Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Core Capital Required</td>
<td>105</td>
<td>105%</td>
</tr>
<tr>
<td>Available Core Capital</td>
<td>175</td>
<td>175%</td>
</tr>
</tbody>
</table>
ORSA connects Risk to Capital – Internal Capital becomes the currency for Risk – becoming **Risk Capital**
..and it integrates Risk, Finance and Actuarial Processes

**ORSA Process Flow**

Optimal Capital allocation and Business Mix to maximize ROE
Managing both Insurer Financial Strength & Issuer Credit Ratings

- Target debt Rating determines Confidence Level under Going Concern; Protect Debt & Policy Owners
- Target Financial Strength Rating determines Confidence level under Gone Concern; Protect Senior Debt & Policy Owners

A Standard & Poor's insurer financial strength rating is a forward-looking opinion about the financial security characteristics of an insurance organization with respect to its ability to pay under its insurance policies and contracts in accordance with their terms. Insurer financial strength ratings do not refer to an organization's ability to meet non policy (i.e. debt) obligations. A Standard & Poor's issuer credit rating is a forward-looking opinion about an obligor's overall financial capacity (its creditworthiness) to pay its financial obligations. This opinion focuses on the obligor's capacity and willingness to meet its financial commitments as they come due. It does not apply to any specific financial obligation, as it does not take into account the nature of and provisions of the obligation, its standing in bankruptcy or liquidation, statutory preferences, or the legality and enforceability of the obligation. [http://www.standardandpoors.com/ratings](http://www.standardandpoors.com/ratings).
Risk/Economic Capital

• 1-year (risk horizon) VaR
  – Full Monte Carlo simulation with Risk Neutral (RN) Valuation as the exit value. Therefore, 1-year Real World Scenarios followed by RN valuations (RN scenarios or closed form when available) at 1-year point for exit value
  – Consistent with Solvency II, Basel II, OSFI’s direction on new generation MCCSR (as per QIS)
  – RN valuation at 1 year risk horizon produce more market consistent results than
    • Run-off valuation (RW ‘till maturity), and
    • RW (over 1 year) followed by RW valuation (at 1 year point ‘till maturity)
  – Will follow IFRS 4 Phase II

• Selection of Confidence Level
  – Tied into Target Debt Rating (Debt Holders’ perspective), Target Financial Strength Rating (Policy holders perspective), Solvency II: VaR 99.5%
Risk/Economic Capital

• Diversification
  – Market Risk correlations are captured within (correlated) ESG runs (Interest Rates, Equity returns, FX, Vol, Credit Spread)
  – Credit Risk via asset correlations (proxied via equity correlations).
  – Market, Operational, Credit & Insurance Risks are aggregated using Solvency II correlations with a conservative bias.
    • use copulas when full distribution is available
    • use Modified Variance, Covariance approach when full distribution is not available
Credit Risk EC

- Standard Merton based Structural Model capturing downgrade and defaults
- Matured and became the standard model on the bank side
- Inputs: PDs and LGDs are estimated very similar to Basel II A-IRB
- Unlike MCCSR, it captures term and concentration risk

<table>
<thead>
<tr>
<th>Similar PD, LGD, Exposure</th>
<th>Marginal RC</th>
<th>Marginal EC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank of Nova Scotia</td>
<td>12.4 MM</td>
<td>19.33 MM</td>
</tr>
<tr>
<td>Canada Post</td>
<td>12.4 MM</td>
<td>6.99 MM</td>
</tr>
</tbody>
</table>

- Forecasting and Stress testing: Under the base case (business plan) and stress scenarios, we need to incorporate:
  1. Portfolio growth
  2. Conditional TM to estimate
     1. Portfolio migrations over time (Starting portfolio will change at each of the future years due to migrations during the previous years)
     2. Conditional VaR/EC (Conditional TM is the input)
Market Risk EC (non-Seg-funds)

• Integrated market scenarios are simulated using our internal ESG.
• Interest rate and equity risks are modelled separately in 2014 ORSA,
  – Interest rate risk: contractually fixed asset and liability cash flows are discounted under the simulated interest rates.
  – Equity risk: initial equity positions are valued under the simulated equity levels.
• Forecasting: Proportional to a relevant risk factor already estimated under the business plan (e.g. reserves)
• With the introduction of LSMC in 2015 ORSA, the interdependence between interest rate and equity risks within the cash flow models can be more accurately quantified, and forecasting can be done directly.
Market Risk EC (Seg-funds)

- LSMC utilized. LSMC proxy function is a polynomial regression of Net CFs against the underlying risk factors. Unlike traditional Curve Fitting, fitting is done on a multivariate uniform risk space. Eliminating the bias ensure stability.
- Correlated ESG scenarios are uploaded into the LSMC proxy function to produce a loss distribution from which EC is calculated.
- Operationally efficient as number of RN valuations are reduced drastically.
- The close form approximation of EC enables transparency and trackability, which is essential for ORSA.
- Lends itself to forecasting, stress testing and hedge benefit estimations.
- Forecasting/Stress Testing: ESG scenarios (conditional on Business Plan and Stress scenarios) is uploaded into LSMC proxy function.
Insurance & Operational Risk EC

• Insurance risk; 2014 ORSA:
  – Estimate Risk Capital by utilizing QIS 5 results and modifying as necessary. Longer term plan is being developed.
  – Forecasting: Proportional to a relevant risk factor already estimated under the business plan (e.g. reserves)

• Operational Risk; 2014 ORSA:
  – Use QIS 5 or EaR and modify as necessary. Longer term plan is being developed.
  – Forecasting: Proportional to a relevant risk factor already estimated under the business plan (e.g. business volume)
Other EC

• Surplus Capital:
  – Assets backing Surplus Capital will be evaluated using ESG scenarios (interest and equity risk). May need to develop an ESG model for real estate.
  – Forecasting: Proportional to a relevant risk factor already estimated under the business plan (e.g. investment plan)

• FX Risk; 2014 ORSA:
  – Under discussion. Use ESG FX model. Potential applications may include:
    • Surplus capital
    • Future foreign income
    • Net asset positions in various currencies
    • Counterparty risk on currency swaps (under credit risk)
Supplementing EC

Pros:

- Direct usage of risk drivers,
- Single currency for risk,
- Provides a full, correlated loss distribution with explicit probabilities
- Directly represents Equity (or Equity + Junior debt) - thus lending itself to Risk Adjusted Probability Calculations as an ROE measure
## Supplementing EC

<table>
<thead>
<tr>
<th>Cons</th>
<th>Remediation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlations may falter under extreme stress</td>
<td>Estimate Stress EC</td>
</tr>
<tr>
<td>Uninformative of causes of the losses</td>
<td>Supplement it with Scenario Analysis</td>
</tr>
<tr>
<td>Cannot be fully back tested</td>
<td>Validate it with Stress Testing</td>
</tr>
<tr>
<td>Uninformative of losses beyond the critical Value (e.g CL=99.85)</td>
<td>Use CTE/Expected Shortfall measure</td>
</tr>
<tr>
<td>Uninformative of near term losses</td>
<td>Supplement it with EaR measure</td>
</tr>
</tbody>
</table>
Managing EaR

\[ EC_p = VaR_\delta - EL \]
\[ EC_p = E[L_p | L_p \geq VaR_\delta] - EL \]

\[ EaR = VaR_\eta - EL \]
\[ EaR = E[L_p | L_p \geq VaR_\eta] - EL \]

Critical Loss can be exceeded once in 10 years VaR is calculated at 90% etc.

- Under the singular EC framework, tail between \( VaR_\eta \) and \( VaR_\delta \) is not managed
- Extreme tail measures do not explicitly measure thus guard against more moderate, one in 10, 20 year loss events, which would erode the expected income
- Use \( EaR \leq E[NI] \) as an additional constraint
Implementation Challenges

• Senior Management buy-in
• Falling in love with technical aspects resulting in false accuracy
• Transparency and trackability – need to explain changes over time
• Run-time
• Real-time assessment
• Efficient production model
• Co-managing ORSA and Reg Capital
How to co-manage ORSA Capital and Regulatory Capital when they diverge?

Is ORSA capital still relevant if Regulatory Capital is higher on aggregate?
Dynamics of ROE Maximizing Behaviour

\[ AC_{Min} = \max \left( k_A^{EC} \times \sum_{i=1}^{n} EC_i , k_A^{RC} \times \sum_{i=1}^{n} RC_i \right) \]

EC or RC will be binding constraint on aggregate

\[ ROE = \frac{\Delta NI}{\Delta AC_{Min}} \quad \text{and} \quad ROEC = \frac{\Delta NI}{k_A^{EC} \times \Delta EC} \]

\[ ROE = ROEC \times \left( 1 + \frac{G}{k_A^{RC} \times \Delta RC} \right) \quad \text{and} \quad G = k_A^{EC} \times \Delta EC - k_A^{RC} \times \Delta RC \]

Gap closure (G) will provide a lift for ROE. Under expansion, (\(\Delta RC>0\)), Marginal ROE will exceed Marginal ROEC. Under contraction, (\(\Delta RC<0\)), Marginal ROEC will exceed Marginal ROE. When RC>EC on aggregate, this will create incentive to ‘DIAL UP Economic Risk’. EC and RC should converge as this is arbitraged away. Arbitraging, while boosting ROE, creates Economic Cost; \((ROE - ROEC) \times k_A^{EC} \times \Delta EC\)
**Dynamics of ROE Maximizing Behaviour**

**RC is the Binding Constraint**

\[ k_A^{RC} \sum RC > k_A^{EC} \sum EC \]

| \( \sum NI \) | $9 |
| \( k_A^{RC} \sum RC \) | $100 |
| \( k_A^{EC} \sum EC \) | $80 |
| ROE | 9% |

**Expansion**
- EC increases faster.
- Marginal ROE=20%, ROEC=6.7%
- \[ \frac{2}{10} = \frac{2}{30} \times \left(1 + \frac{20}{10}\right) \]

**Contraction**
- RC decreases faster.
- Marginal ROE=3.3%, ROEC=10%
- \[ -\frac{1}{-30} = -\frac{1}{-10} \times \left(1 + \frac{20}{-30}\right) \]

Unused Economic Risk Taking Capacity is utilized to foster ROE, but at the expense of ROEC. Low ROEC businesses acquired; high ROEC businesses divested.
Dynamics of ROE Maximizing Behaviour

EC is the Binding Constraint,

\[ k_A^{RC} \sum RC < k_A^{EC} \sum EC \]

<table>
<thead>
<tr>
<th>(\Sigma NI)</th>
<th>$15</th>
</tr>
</thead>
<tbody>
<tr>
<td>(k_A^{RC} \Sigma RC)</td>
<td>\leq 150</td>
</tr>
<tr>
<td>(k_A^{EC} \Sigma EC)</td>
<td>150</td>
</tr>
<tr>
<td>ROE</td>
<td>10%</td>
</tr>
</tbody>
</table>

Expansion
RC may increase faster

<table>
<thead>
<tr>
<th>(\Sigma NI)</th>
<th>$10</th>
</tr>
</thead>
<tbody>
<tr>
<td>(k_A^{RC} \Sigma RC)</td>
<td>\leq 100</td>
</tr>
<tr>
<td>(k_A^{EC} \Sigma EC)</td>
<td>100</td>
</tr>
<tr>
<td>ROE</td>
<td>10%</td>
</tr>
</tbody>
</table>

Contraction
EC decreases faster
Dynamics of ROE Maximizing Behaviour

**EC is the Binding Constraint**, $k^R_C \sum RC < k^E_C \sum EC$

- An FI whose EC is larger than RC on the aggregate would have capacity to accept regulatory capital heavy deals as long as ROEC > h
- As a result of accepting such deals, aggregate EC and RC requirements may move closer together
- Only this condition guarantees that there is no Economic Cost; $G = 0$, thus no incentive to dial up Economic Risk

\[ ROE = ROEC \times \left( 1 + \frac{G}{k^R_C \times \Delta RC} \right) \quad G \to 0; \quad ROE = ROEC \]

- Undoubtedly this is a more natural operating model where the business is managed based on EC while RC is used as a regulatory constraint to identify outliers whose EC is unreasonably low relative to the economic Risk taken
With the advent of Basel III and the overall increase in regulatory requirements stemming from the economic crisis, financial institutions face regulatory capital mandates that have strained strategic plans more than ever. As a by product of the increased focus on regulatory capital, some financial institutions have reduced their attention to economic capital, arguing that with a binding regulatory capital constraint, economic capital is less relevant.

AMERICAN BANKER 2013-09-11
JP Morgan report confirms RWA reduction led to CIO loss
A misguided plan to reduce Basel 2.5 RWAs and a series of management failures combined to leave JP Morgan’s chief investment office with a $6 billion loss, the bank finds

JP Morgan has finally lifted the lid on the events that led to its chief investment office (CIO) losing $6 billion in a credit derivatives trading misadventure last year. An internal report released yesterday attributed the error to a misguided attempt to reduce the CIO's risk-weighted asset (RWA) consumption under Basel 2.5 while maintaining profitability.

“People are being pushed into the direction of managing RWAs rather than managing actual risk. So what you get in some cases is RWA decreasing but economic risk massively increasing. There is increasing recognition that this is a problem, but there have been no specific proposals from the Basel Committee on how to deal with it. A pattern is developing of regulation being ill-thought out but pushed through anyway because of political pressure. The consequences of this are making themselves apparent, and we'll need to wait a while before these problems are resolved”