# CAPITAL RESERVING FOR CREDIT RISK

FOR

## INSURERS (LIFE & GI) AND OTHER INSTITUTIONS

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# Agenda

- Introduction
- Brief overview of methods & our model
- Summary of some indicative results
- Observations and Comments
- Discussion (your part)

# Introduction

- Large multifaceted subject
- Is increasingly impacting on actuaries
- Focus of paper on reserving for credit risk

# Introduction (cont)

- Why interest in credit reserving?
- Life Insurers:
  - Required to reserve for asset liability mismatch risk. Rules (RR) reflect crude risks.
  - Recently, many LIs reducing crude risk
  - Moving from high grade to lower grade debt
  - New Solv and CapAd Standards require the actuary to consider reserving for credit risk

# Introduction (cont)

- Equal application to:
  - General Insurance
  - Health
- Super
  - Issues UFP & IAS19
  - Increasing focus on A/L mismatch likely
  - Credit risk likely to rise in importance
- Other Financial Institutions
  - Credit risk often important to new complex products but analysis methods lagging

# Introduction (cont)

- **Credit Risk Elements**
  - **Credit risk is a subset of broader subject of asset/liability mismatch risk.**
  - **For a matched A/L portfolio, initial impression: actual default only risk**
  - **<u>BUT</u> must consider technical solvency:**
    - **LIASB Solvency and GPS110 liabilities discounted at sovereign debt rates**
    - **LIASB CapAd disconnect between asset and liability discount rates**

# Introduction (cont)

- Technical credit reserving elements:
  - The impact of potential actual defaults
  - The impact of credit rating migration
  - The impact of adverse market credit spread movements (⇔ liability discount rates).

- However, legitimate to reduced reserve to the extent the liability discount rates < expected earnings on the assets.

# Banking Industry Approaches

- Basel
- Basel II
- Internal bank models

# Banking Industry Approaches

- **Basel I**
  - **Risk weighting approach**
  - **Must hold 8% of risk-weighted assets**
  - **Weighting dependent on counterparty type**
    - **0% - OECD Government Bonds**
    - **100% - Corporate Bonds irrespective of rating**

- **Very blunt method (over/under reserve):**
  - **Ignore corporate debt rating, duration effects**
  - **Unclear how addresses reserve elements**

# Banking Industry Approaches

- **Basel II**

- **Three approaches available:**
  - **–"Standardised Approach"**
  - **–"Foundation Internal Rating Approach"**
  - **–"Advanced Internal Ratings Approach"**

# Banking Industry Approaches

- **Standardised Approach:**
  - **Similar to Basel I, except:**
  - **Risk weightings based on credit rating of issuer**
  - **Risk weighting for corporate bonds are:**

| *Credit Assessment (S&P Scale)* | AAA to AA- | A+ to A- | BBB+ to BB- | Below BB- | Unrated |
|---|---|---|---|---|---|
| *Risk Weighting* | 20% | 50% | 100% | 150% | 100% |

- **Still a blunt method. Ignores duration. Unclear how all risk elements addressed.**

# Banking Industry Approaches

- **Foundation Internal Approach:**
  - **Greater granularity of the risk weights**
- **Advanced Internal Approach:**
  - **As above, plus the time to maturity**
- **Better, but still relatively blunt. Market spread vol? Diversification level? etc**

# Banking Industry Approaches

- Internal bank models
  - Use credit risk models
- Two general types of models:
  - Based on the default mode (DM) paradigm - a credit loss only occurs when a borrower defaults.
  - Based on the mark-to-market (MTM) paradigm - a credit loss also from a reduction in market value from credit rating downgrade.
- Still limitations. E.g. market spread vol.

# Two Models Outlined

- Two actuarial models outlined
- An "Adjusted Default Based" Model (the ADB model):
  - Based on DM paradigm
  - "Deterministic"
- An "Adjusted MTM Transition" Model (the AMTMT model):
  - Based on MTM paradigm
  - "Stochastic"

# ADB Model

- Four calculation components
  - A default risk reserving model (that deals with the risk of actual default experience);
  - An approximate migration reserving model;
  - An approximate credit spread reserving model; and
  - An out-performance reserving reduction estimate.

# ADB model (Cont.)

- Default risk is calculated using the mean/standard deviation approach
  - Similar to calculating the value at risk of an equity portfolio
  - Based on probabilities of default
  - Allows for correlation
  - Allows for loss (severity) variation
  - Analytical (deterministic) approach

# ADM model (Cont.)

- Credit Migration Reserve
  - Migration probabilities
  - Correlation ignored
  - "Continuous" assumption (offset above)
- Credit Spread Reserve
  - Simply spread volatility (100% correl)
- Outperformance Offset
  - Spread earned during period, plus
  - Value gain from spreads narrowing

# AMTMT model

- Stochastic model
- Based on JP CreditMetrics Model
- But we added in credit spread vol
- Two calculation components
  - Credit risk model that reserves for default, migration, and credit spread
  - An outperformance offset

# AMTMT model – Single Bond

**Distribution of Bond Value at year end**

| | |
|---|---|
| Value at beginning of year | 100.00 |
| Nominal value at end of year | 100.14 |

| Rating Year End | Probability (%) | Value ($) |
|---|---|---|
| AAA | 0.04 | 102.67 |
| AA | 0.25 | 102.06 |
| A+ | 0.37 | 101.41 |
| A | 0.98 | 101.34 |
| A- | 3.17 | 101.15 |
| BBB | 89.12 | 100.14 |
| BB | 4.70 | 84.48 |
| B | 0.81 | 78.99 |
| CCC | 0.27 | 69.27 |
| Default | 0.30 | 50.00 |
| Expected Value at Year End | | 99.05 |

| | |
|---|---|
| Nominal Spread Margin | 1.10 |
| Spread Narrowing Gain | 0.14 |
| Expect Default Loss | -0.15 |
| Expect Migration Loss | -0.94 |
| **Expect Profit** | **0.15** |

# AMTMT model – Portfolio

- Allow for correlation between defaults and migrations.
- Correlation based on an underlying "asset model", i.e. movements in credit rating are related to returns on assets underlying the security
- Also, high level correlation between overall migration outcome and market spreads

# The AMTMT Model

# is not

# as complex as the Matrix

# Indicative Results

- Example portfolio
- Liabilities: simple fixed rate, fixed term annuity portfolio
  - 5 year term
  - Return of capital
  - Value $1.4 Billion

Assume flat CTB yield curve of 5%

# Indicative Results

**Bond Portfolio**

| Rating | No. of Holding | Face Value of Holding | Coupon Rate | Term to Maturity |
|---|---|---|---|---|
| AAA | 7 | 20,000,000 | 5.4% | 5 yrs |
| AA | 21 | 20,000,000 | 5.6% | 5 yrs |
| A+ | 7 | 20,000,000 | 5.7% | 5 yrs |
| A | 7 | 20,000,000 | 5.8% | 5 yrs |
| A- | 7 | 20,000,000 | 5.8% | 5 yrs |
| BBB | 7 | 20,000,000 | 6.1% | 5 yrs |
| BB | 7 | 20,000,000 | 11.1% | 5 yrs |
| B | 7 | 20,000,000 | 13.1% | 5 yrs |
| CCC | 0 | 20,000,000 | 17.1% | 5 yrs |
| Total | 70 | 1,400,000,000 | | |

| | |
|---|---|
| Rating of Portfolio (based on nominal credit rating) | A |
| Rating of Portfolio (based on weighted average default rate) | BB |

# Indicative Results

**Calculated Reserves for example portfolio**

| | 95% CI | | 99% CI | | 99.5% CI | | 99.9% CI | |
|---|---|---|---|---|---|---|---|---|
| | ADB | AMTMT | ADB | AMTMT | ADB | AMTMT | ADB | AMTMT |
| Default Risk | 2.4% | 2.3% | 3.4% | 3.9% | 3.7% | 4.5% | 4.5% | 5.6% |
| Migration | 1.5% | 0.6% | 2.1% | 1.3% | 2.4% | 1.4% | 2.9% | 1.9% |
| Spread | 1.4% | 1.6% | 2.0% | 2.1% | 2.2% | 2.3% | 2.7% | 2.7% |
| **Credit Risk Reserve** | **5.3%** | **4.6%** | **7.5%** | **7.2%** | **8.4%** | **8.2%** | **10.0%** | **10.1%** |
| Outperformance | -1.6% | -1.6% | -1.6% | -1.6% | -1.6% | -1.6% | -1.6% | -1.6% |
| **Total Reserve** | **3.8%** | **3.0%** | **6.0%** | **5.7%** | **6.8%** | **6.6%** | **8.5%** | **8.5%** |

**Calculated Reserves for example portfolio**

| | **Credit Risk Reserve** |
|---|---|
| BASEL I | 8.0% |
| BASEL II (Standardised Approach) | 3.8% |
| ADBM* | 6.8% |
| AMTMT* | 6.6% |

*99.5% confidence interval

# Observations & Comments

- Credit reserves can be significant
- Relative small below “A” exposure can generate significant risk & reserves
- Duration can be important (impact of spreads)
- A deterministic model can produce reasonable results in appropriate circumstances

# Observations & Comments

- A number of practical issues to consider:
- Need to allow for actual aggregate exposure:
  - Need to aggregate exposures
  - Should properly net (but make sure valid)
  - Difficulties with aggregate exposures that span different credit rankings
  - Need to consider derivative exposures
- In reality, should model A/L mismatch as a total
  - "Market risk" + "Credit risk" in one big DFA model
  - Correlation, diversification and optionality

# Observations & Comments

- Individual large credit spread needs individual consideration.
- Low diversification also needs careful consideration (res < any one exp).
- Junk Bonds – quasi equity
- Parameter variability
- Parameter accuracy / consistency
- Time Horizon and ruin probabilities