Wider Fields: Stress Testing in the Banking Industry

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Presenter Backgrounds

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• **Actuary** working in financial risk management: credit risk, market risk, liquidity risk, stress testing, regulatory capital
• **Examiner** for F206 Banking Specialist Applications – South African Fellowship Core Course
• Previously **PwC** South Africa, now PwC Singapore

Michael Zhou

• **Actuary** working in financial risk management: credit risk, market risk, stress testing, economic capital, regulatory capital
• Previously **PwC** Australia, now PwC Singapore
Agenda

Industry Trends & Context

Technical Theory & Case Study

Wider benefits from stress testing

Challenges
Overview of Stress Testing in Banks

**What?**
Stress testing for banks involves testing the **financial solvency** of banks under adverse scenarios.

**Why?**
Mandated by a number of regulators, due to regulators’ lack of confidence in internal models. Instituted by organisations according to organisation’s own governance framework.

**Relevance**
Increased area of work for actuaries
Increased focus in the media
Bank Stress Testing in the Media

- Latest ECB Results from Oct 2014
- 9 in Italy, 3 in Greece
- Greek Bank Eurobank resulted in biggest shortfall in capital for adverse scenario: -€4.6bn (-6.4% CET1 Ratio)

- Banks are beginning to stress-test other solvency-sensitive metrics
- WTI fell from $96 to $45 in 5 months
- Oil price is sensitive to credit quality of more than just the energy loan portfolio
US Bank Stress Testing in the Media

• In 2014, five banks failed the US Fed CCAR stress tests.
  Failures were driven by a range of reasons, including: poor risk management controls, weak modelling practices, data inadequacy amongst others.

• Two banks failed in 2015, as a result of increased investment in the stress testing process.
  Santander was the only bank to fail in both 2014 and 2015.
Trends: More stringent regulatory testing, and emergence of data and management issues

**More stringent regulatory testing**
- US Federal Reserve CCAR (2/31 banks failed)
- European Central Bank (25/130 banks failed)
- APRA (Big 4 passes housing stress scenarios)

**Failures are driven by more than solvency breach**
Banks have failed due to:
- Breach of solvency threshold
- Significant model risk
- Lack of mitigating processes
- Data adequacy

**Emerging issues with stress testing**
- Data Quality Issues
  - Accurate downturn data rarely available
- Management Issues
  - Under-estimating effort required
  - Collaboration with front-office
Bank Credit Risk Stress Testing Process and Methodology

• Stress testing *scenarios* may include:
  – Macroeconomic factors
  – Enterprise-specific factors
• Stress testing can be performed
  – at *enterprise/portfolio* level; or
  – for particular *segments*.
• *Range of models* and formulae are used in bank stress testing depending on the portfolio:
  – Logistic Regression Model
  – Vasicek Model (Merton DD)
  – Roll-Rate model
• *Outputs* include both financial and non-financial metrics
Credit Risk Stress Testing Case Study

Credit Risk Basics and Methodology Overview

The most common approach is to estimate frequency and severity.

\[
\text{Losses} = \text{PD} \times \text{LGD} \times \text{EAD}
\]

**PD**
- **Probability of Default**
  - Probability that a loan defaults within a certain time period (e.g. 12-months)

**LGD**
- **Loss Given Default**
  - Percentage of loss following default of loan (or facility/obligor)

**EAD**
- **Exposure at Default**
  - Outstanding balance and any potential further exposure increases at time of default.
Credit Risk Stress Testing Case Study

1 Correlation Analysis
Identify macro-economic variables correlated with default rates for each asset class.

<table>
<thead>
<tr>
<th>Approach</th>
<th>MEV 1</th>
<th>MEV 2</th>
<th>MEV 3</th>
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<tbody>
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2 Stressing PD
Use the Vasicek formula to stress PD value given a prescribed macro-economic shock.

\[
Stressed \ PD = \Phi \left( \frac{\Phi^{-1}(PD_{LR}) + \sqrt{\rho}Z}{\sqrt{1 - \rho}} \right)
\]

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortgage</td>
<td>House Price Index</td>
</tr>
<tr>
<td>Corporate, SME</td>
<td>GDP</td>
</tr>
<tr>
<td>Personal, Occupation Loans</td>
<td>Unemployment Rate</td>
</tr>
</tbody>
</table>
Credit Risk Stress Testing Case Study

3 Benefits of this approach

- Allows for non-linear correlation, a characteristic suitable for stress testing.

![Linear Correlation](image1)

![Vasicek Non-Linear Correlation](image2)

PD deteriorates at an increasingly faster rate – reflective of outcome of severe downturn economic scenarios

- Requires less data as calibrations necessary for stressing PD (as well as LGD and EAD) can be leveraged from regulatory standards and industry benchmarks.
Credit Risk Stress Testing Case Study

4 Stressing LGD and stressing EAD

Given the purpose of stress testing, the approach had been to assume worst case scenarios when estimating LGD and EAD.

- **LGD Treatment**
  - 100% – % of Recovery Amount after Collateral Haircut

- **EAD Treatment**
  - The higher of outstanding balance and facility limit

5 Projection Engine

Stressed credit risk inputs are input into a 5-year projection engine to generate a range of outputs, complying with local regulations.

- Projected Balances
- Projected Provisions
- Projected RWA (Basel II Std)
There are challenges associated with the stress testing process

Data
- Lack of downturn historical data: presents difficulties for factor selection as well as model calibration
- Lack of current data: causes issues in a fast changing business environment

Modelling
- Selecting fit-for-purpose model: can be difficult given downturn purpose and lack of data
- Integrating models into existing processes: is a significantly value-adding exercise but difficult to achieve and use for business improvement

Management
- Managing stakeholders across firm: can be challenging given non-technical audience and possibly unfavourable results
- Significant investments: in this area may need to be justified as this is often perceived as a non-front office regulatory exercise
Banks are beginning to focus on using stress testing to derive wider benefits, instead of treating it as a risk management exercise.

### Functional Value Delivery

**Strategic Risk-Taking**
- Stress testing models could drive decisions about capital allocation, expansion into new products.

**Risk-Adjusted Pricing**
- Pricing of products could be better informed by stressed default rates and portfolio performance.

### Organisational Value Delivery

**Improved Financial Performance**
- Banks with risk-adjusted decision-making will result in improved competitive advantage and long term financial performance.

### Macro Value Delivery

**Wider Benefits**
- Over the longer run, stress testing will result in a more resilient banking system. A more resilient banking system would lead to less severe banking-sector driven economic downturns, delivering stability across the global economy.
Further Reading and Q&A

Passing the Stress Test – Survey on Regulatory Stress Testing in Banks

Turning regulatory stress testing into competitive advantage
http://www.pwc.se/sv_SE/se/bank-kapital/assets/turning-regulatory-stress-testing-into-competitive-advantage.pdf