

Wider Fields: Stress Testing in the Banking Industry

Actuarial Insights Series

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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
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- **Actuary** working in financial risk management: credit risk, market risk, stress testing, economic capital, regulatory capital
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Agenda

**Industry Trends
& Context**

**Wider benefits
from stress testing**

**Technical Theory
& Case Study**

Challenges

Overview of Stress Testing in Banks



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

What?



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.

Why?



Increased area of work for actuaries
Increased focus in the media

Relevance

Bank Stress Testing in the Media



Actuaries Institute logo and navigation bar (HOME U.S., NEWS, MARKETS, INVESTING, TECH, SMALL BIZ, VIDEO, SHOWS, PRIM) are visible at the top. The main headline reads: "EUROPE NEWS" followed by "ECB tests fail 25 banks with \$32B shortfall". The author is Phillip Tutt (@phillt) and the date is Sunday, 26 Oct 2014 | 11:17 AM ET.

- 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)



Actuaries Institute logo and navigation bar (TRENDING Bank of Canada | Oil | Target | Russia | BlackBerry | Keystone XL | Red Tape Week) are visible at the top. The main headline reads: "FINANCIAL POST" followed by "Canadian banks are now stress-testing how their oil portfolios will withstand prices as low as US\$35 a barrel".

- 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

COMPLIANCE WEEK

Five Big Banks Failed Federal Reserve's Annual Stress Tests

Joe Mont | March 27, 2014

- 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

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Banks

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Last updated: March 11, 2015 11:02 pm

Deutsche and Santander fail US stress test

Tom Braithwaite and Ben McLannahan in New York and Barney Jopson in Washington

- 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

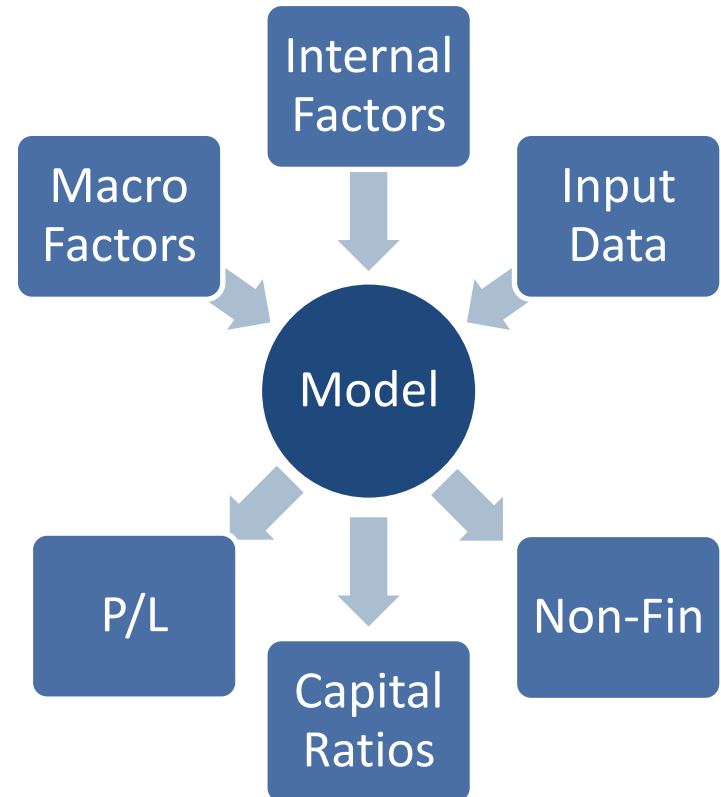
- Banks have failed due to:
- Breach of solvency threshold
 - Significant model risk
 - Lack of mitigating processes
 - Data adequacy

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.

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.



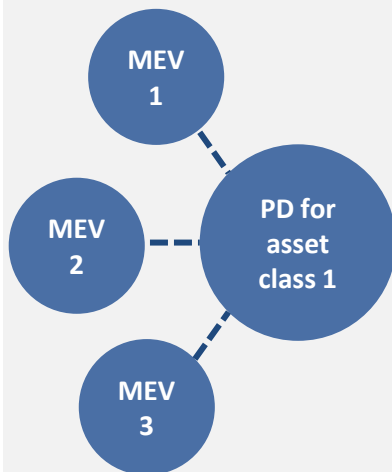
Losses =
 $PD \times LGD \times EAD$

Credit Risk Stress Testing Case Study

1 Correlation Analysis

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

Approach



Our Results

Asset Class	Variable
Mortgage	House Price Index
Corporate, SME	GDP
Personal, Occupation Loans	Unemployment Rate

2 Stressing PD

Use the Vasicek formula to stress PD value given a prescribed macro-economic shock.

PD_{LR} = Long Run PD

Z = Macro-economic Shock

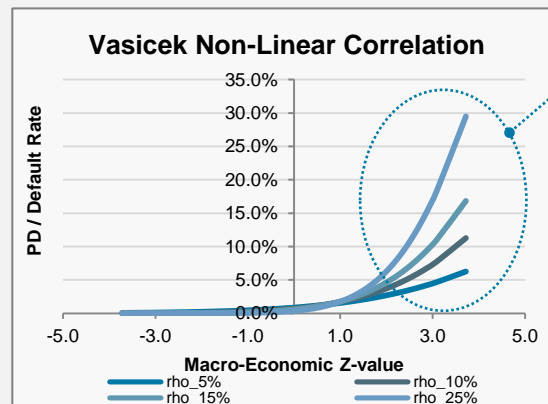
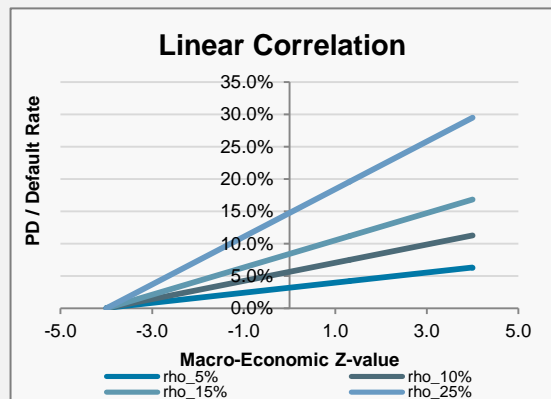
ρ = Asset Correlation

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

Credit Risk Stress Testing Case Study

3 Benefits of this approach

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



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

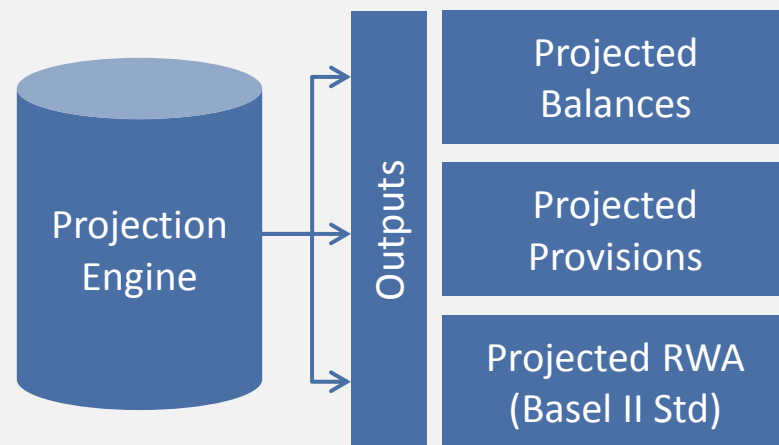
EAD Treatment

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.



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

http://www.pwc.com/en_GX/gx/financial-services/publications/assets/pwc-passing-the-stress-test-pwc-survey-on-regulatory-stress-testing-in-banks.pdf



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

