Operational Risk Stress Testing

Stress Testing Model Symposium
Federal Reserve Bank of Boston
September 14, 2012

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* Comments should not be taken as official policy of Citi
Stress Testing Focuses On Impact of Adverse Conditions

- Stress testing is a process used to determine operational effectiveness under adverse conditions.

- As a conditional estimate, it is focused on unexpected or the rate of change relative to expected conditions.

- Depending on needs, assessments may take place at the process, business, or consolidated level.

- A shift in the number or magnitude of loss events, e.g. due to environmental conditions, may impact financial results and impact exercises like CCAR.
Consolidated Stress Testing Framework Needs To Consider Business Needs

Minimum Conditions
• **Conceptual Soundness**, i.e. no unwarranted assumptions or logical flaws

Framework Criteria
• **Flexibility**: framework can incorporate a range of techniques
• **Comparability**: resulting loss estimates are comparable across business lines and event types
• **Transparency**: framework is easily explained to internal and external audiences
• **Implementable**: easy to run calculations and do what if analysis

Business Implementation Criteria
• **Empirical Support**: parameter choices are empirically supported
• **Business Relevance**: estimates can be meaningfully related to key drivers of risk
• **Model Minimalism**: fewer assumptions are better, all else being equal
• **Data Richness**: makes maximum use of all available data

Internal Focus Is Largely On Understanding Loss Frequency

• Internal efforts have largely focused on loss frequency analysis in an effort to provide tools to support proactive risk management.
  – Anticipation allows for the possibility of influencing outcomes.

• Primary focus on frequency also recognizes challenges in operational risk quantification resultant from fat-tailed loss data.
  – Risk is dominated by infrequent large events and the largest losses often take years to be realized.
  – Consequent severity modeling is limited in precision.
Internal and Industry Data Can Be Used For Frequency Modeling

- Frequency model construction ideally would link internal operational risk loss experience with business identified performance metrics.

- However, data is comprehensively available for at-most one economic cycle making statistical relationships difficult to identify.

- Further, internal performance metrics are influenced by the business environment.

- Issue can be partially resolved by leveraging longer-dated industry loss data sourced from vendors to augment internal sources.

- Analysis of industry experience indicates frequency has cyclical behavior and is related to credit conditions in several categories that significantly contribute to industry loss experience.
Industry Data Usage Requires Special Considerations

• Utilization of public industry data for assessing cyclicality of loss frequency requires consideration of several items.
  – Event relevance
  – Reporting bias
    • Event size
    • Event types
    • Geographic
  – Delays in capture

• Corrections are also needed for threshold or scale effects.
In Addition To Establishment of Model Selection Criteria

- Model selection and implementation requires consideration of
  - Economic rationale
    - Origination
    - Growth
    - Detection
  - Statistical significance
  - Out of sample / time performance
Once completed, the process can combine history with forecasts to produce loss estimates.

- Historical Loss Data
- Historical Macro Data
- Frequency Model (F)
- Severity Model (S)
- Forecasts (Macro / Business)
- Model Application (F x S)
- Review
- Submission

Illustrative