Operational Risk Stress Testing

Stress Testing Model Symposium
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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 that 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.

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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

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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.

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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.

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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.

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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

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Once Completed The Process Can Combine History With Forecasts To Produce Loss Estimates

Illustrative

```
Historical Loss Data ──┐
                       ├──→ Frequency Model (F) ──┐
Historical Macro Data ─┘                           ├──→ Model Application (F x S) ──→ Review ──→ Submission
                       ┌──→ Severity Model (S) ────┘              ↑
                                                    Forecasts (Macro / Business)
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