Stress Testing Methodology

Operational Risk

Loss Estimation

Session Objectives

1. Overview of operational risk in the context of enterprise-wide stress scenario analysis
2. Scenario design
3. Operational risk loss estimation approaches
4. Range of practice discussion and observed strengths and weaknesses

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Operational Risk Overview

- Definition of operational risk
  - Inadequate or failed internal processes, people, systems, or external events
- Objective of operational risk stress testing
  - Determine if a firm can withstand a severe operational risk event or series of events that could occur during a stressed economic environment
  - Capture the material types of loss events to which the firm has exposure regardless of whether they are directly linked to the macroeconomic scenario
- Area of evolving industry practice and supervisory expectations
  - Begin with historical internal loss data to provide historical perspective and then incorporate forward-looking elements, idiosyncratic risks, and tail events
  - Supplement with external loss data as necessary
  - Use an approach that is reasonable for the size and complexity of the firm

Operational Risk Overview: Challenges

Since firms have found it challenging to identify meaningful relationships between operational losses and macroeconomic factors, supervisors are moving away from requiring that firms demonstrate a direct linkage to scenario conditions. Instead:

- Use a pragmatic, conservative approach, recognizes that operational loss events can occur at any point, including during a downturn, and firms should be capitalized to withstand these events.
- Have to balance credible severity against plausibility and common sense – not trying to create a scenario where absolutely everything is pushed towards all time worst levels.
- Have told firms not to force the use of unstable and/or unobservable correlations and use alternative approaches assuming operational events will occur during the 9Q period of CCAR.
- Have encouraged firms to use existing risk management tools such as top risk reports or risk and control self assessments to determine what material risks should be captured in a stress test

Operational Risk Overview: Data

- Robust and comprehensive internal loss data collection method
  - Loss data collection should include critical dates, event types, and business lines
- External loss data
  - Historical operational losses experienced at other companies is often used to supplement internal loss data
  - Requires scaling commensurate with firm's individual risk profile
- Data collection thresholds
  - Minimum dollar of loss required before data will be collected for use in modeling
- Expect firms to account for potential mergers and acquisitions
  - If data are not available for an acquired firm, firms should scale existing data using size of operations and apply an add-on

Operational Risk Overview: Data

- Many firms have formal operational risk programs to collect data
  - those subject to the advanced approaches (i.e., Basel II) have in place operational risk data and assessment systems, operational risk quantification systems, and related processes to ensure data quality.
  - Basel II firms are required to have at least 5 years of loss data, which gave them a head start for stress testing in CCAR.
  - Firms that are not subject to the advanced approaches often have significantly less infrastructure
    - implies limited or inconsistent capture of internal loss data, short historical periods and few (or no) high severity events
- Firms typically use the Basel II AMA event-type categories for collecting and describing op loss data:
  - internal fraud; external fraud; employment practices and workplace safety; clients, products, and business practices; damage to physical assets; business disruption and system failures; and execution, delivery, and process management

Operational Risk Overview: Data Challenges

- Data capture is a significant concern across BHCs – issues typically included:
  - Immature data collection methods
  - Use of net losses (including recoveries and/or insurance)
  - Subjective exclusion of large historical losses
  - Truncated date ranges
  - Scaled down internal losses

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Scenario Design and Operational Risk

- Linkage to macroeconomic factors
  - Difficult to determine clear link to macro factors
  - Challenge to perform correlation analysis given data limitations
  - Spurious and negative correlations may lead to lower loss estimates, which is inconsistent with the overarching goal of stress testing
- Definition and capture of idiosyncratic risk
  - How much is captured by internal loss data?
  - How do you capture either a sufficient number of loss events, or a sufficiently severe but plausible loss event, within the 9 quarter planning horizon?

Operational Risk
Scenario Design: Challenges

- Difficulties with identifying a link of operational losses to macro economic factors is due to:
  - Lack of loss data
    - Due to limited history or immature data collection methods
  - Link does not exist
    - especially in certain event types like Damage to Physical Assets
  - Choice of reporting date and date range
    - can be a time lag between occurrence, discovery, and accounting dates – especially for legal losses
    - choosing a date range is up to judgment and selections must be justified

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Loss Estimation Approaches

- Best practice: use a combination of approaches to account for data and model limitations
- Segmentation of operational losses (units of measure)
  - Must be granular enough to capture similar types of losses with potentially common risk drivers, but also provide enough data within each segment to support robust analysis
  - Typically done by event types and/or business lines
- Different models are sometimes used for legal and/or fraud losses
- Modeling practices are still evolving– not as mature as market or credit risk modeling

Loss Estimation Approaches

- Common approaches used
  - Regression model
  - Loss distribution approach
  - Historical average
  - Scenario analysis

Loss Estimation Approaches

- Examples of how firms use a combination of approaches include:
  - LDA or regression model with scenario overlays for idiosyncratic risks
  - Regression model for event types with identified link to macro factors and historical average for other event types
  - Regression model for frequency (with link to macro factors) and historical average for severity (since no link found)
  - LDA model for some event types and scenario analysis for others with limited data

- Approached used depends on:
  - How much data the firm has collected
  - Size and complexity of firm, and experience of staff
  - Whether or not the firm identified a link to macro factors

Loss Estimation Approaches: Regression Models

- Regression models are generally used to estimate loss frequency (number of losses) and loss severity (loss amount) separately
  - Examples: linear, Poisson, negative binomial and exponential regression
  - May include a single factor or multiple factors (typically ranges from 1-8)
  - Variables often transformed to reflect time lag assumptions
  - Selection of time periods and model specifications are mostly judgmental and typically lack sufficient statistical support

- Use of regression models requires a clear understanding of data and model limitations, with compensating adjustments that are well supported and documented

Loss Estimation Approaches: Regression Models

- Some firms that identified a link between operational losses to macro economic factors used the results to adjust loss frequency in a regression model
  - Severity calculations were then simplified to a static or four quarter moving average based on the most recent crisis period

- Issues with regression models tend to include:
  - Lack of support for assumptions, especially date ranges chosen
  - Not including time lag assumptions, especially for legal losses
  - Not stressing all event types and/or not stressing severity because a link to macro factors was not found

Loss Estimation Approaches: Loss Distribution Approach

- Loss distribution approach (LDA) is an empirical modeling technique to estimate value-at-risk (VaR) measures for operational risk losses based on loss data and fitted parametric distributions
  - Estimate probability distributions for the frequency and severity of loss events for each defined unit of measure
  - Distributions are then combined, typically using Monte Carlo simulation to estimate probability distribution for annual operational risk losses
  - LDA model output is annual – in CCAR firms need to adjust this for the 9 quarter timeframe required
    - Typically done by simply multiplying by 9/4

*Advanced approaches firms are required to use an LDA model to comply with Basel II AMA

Loss Estimation Approaches: Loss Distribution Approach

- Modifications to LDA:
  - Some firms modify the confidence interval
    - Median is typically used for the baseline scenarios
    - Ranges from 70th to 98th percentile for stressed loss estimates
    - We require firms to justify the percentile used, and provide a sensitivity analysis on various percentiles considered
  - Some firms that identified a link between operational losses and macro economic factors adjusted the frequency distribution based on the output of the correlation analysis

Loss Estimation Approaches: Historical Averages

- Historical averages are typically used in combination with other approaches
  - Some firms used regression or LDA for event types with identified correlation and historical average for others
- When used alone, this approach is backward looking and excludes potential risks the firm has not experienced
- Must have support for time periods, thresholds, and excluded or adjusted data
  - Justify the date range chosen through extensive sensitivity analysis, including exploring moving averages, averages during stressed periods, rolling averages, and worst quarter results
  - Stress averages for both frequency and severity

Loss Estimation Approaches: Scenario Analysis

- Scenario analysis is the systematic process of obtaining opinions from subject matter experts to assess the likelihood and loss impact of plausible severe operational risk events
  - Should be combined with or anchored to internal or external loss data
  - Can capture events not previously experienced by a firm
  - Process must be credible and clearly defined with appropriate rationale for events chosen
  - Helps compensate for data and model limitations
  - Must have controls to address scenario bias

Loss Estimation Approaches: Scenario Analysis

- Various techniques and methodologies can be used based on the particular losses to be stressed
  - Must be logical, well-supported, and effectively stress material risks
- Sometimes used as an overlay to a model based approach, in other cases it may be the primary/only approach
- Number of scenarios varies widely
- Firms use historical loss data, external loss data, and risk assessments to inform scenario development
- Challenge to determine how many and which scenarios to include:
  - We expect firms to balance reasonableness of scenarios (both frequency and severity) with conservativeness of a stress test

Loss Estimation Approaches: Legal Losses

- Legal losses (including expenses, judgments, fines, and settlements) should be estimated under both baseline and stress conditions
  - Baseline scenarios should use expected litigation-related losses
  - Stress scenarios should include estimates of potential losses by assuming unfavorable, stressed outcomes on current, pending, threatened, or otherwise possible claims of all types
- Firms should capture both settled legal losses and legal reserves
  - Should be well supported by detailed underlying analysis
  - Should be estimated separately from other operational risk losses
- Various estimation methods are used
  - Judgmental add-on, legal reserve add-on, historical average, or a separate regression model

Loss Estimation Approaches: Range of Practice

- Baseline scenario
  - Majority of firms leverage budget/forecasting processes
- Stress scenarios
  - Many firms use a combination of approaches
  - Most use regression or LDA as the main model
  - Some use historical averages and/or scenario analysis for certain event types or layered on top of model results
  - Some project fraud and/or legal losses in separate models
- Model risk management practices are evolving
  - Few firms have developed benchmarks, performed back-testing or conducted sensitivity analysis