Risk Practitioner Conference 2014

Credit Loss Estimation:
Industry Challenges & Solutions for Stress Testing

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October 2014
Objectives

1. Review basic background around DFAST requirements and stress testing
2. Introduce a methodology and platform to derive PDs and LGDs for firms that need to develop internal PD and LGD estimates.
3. Introduce a separate methodology for deriving conditional loss estimates at a granular, bottom-up level for firm’s that have a PD and LGD for their underlying obligors
4. Questions and Answers
1 Background
Stress-Testing and Capital Planning

Industry Observations:

» The stress-testing process requires an unprecedented amount of coordination and collaboration across numerous front, middle, and back office functions.

» Communication, documentation, and well-defined business processes are required, and assumptions made to conditional forecasts require justification.

» Governance of the process can be as important as the result(s). The FRB is more highly focused on process than ever before in determining compliance.

» Risk identification and quantification is critical at all levels, with challenger approaches considered sound practice.

» Best practice requires firms leveraging industry know-how, and development of solutions that are tailored to the specific needs, business model(s), financial risks, and end-user needs, not merely back-office functions.

» Creating increased efficiency in the process is necessary, motivating the need for cost savings and automating the analytics and reporting processes.

Financial and Risk Forecast

» Pro-forma balance sheet (under scenarios)

» PPNR

» Losses, charge-offs, and recoveries

» Valuations

» Operational risk(s)

» Accounting measures (e.g., DTA, Goodwill)

» Documentation and Validation
## Problem Definition

### CCAR Banks

- To date, many firms have been “fighting the CCAR fire” (CCAR Fatigue). Little time to automate and enhance the process.

- After 3 CCAR submissions, large banks are thinking about:
  - Better use and management of models
  - Improving process automation
  - Developing better data procurement

### Themes

- Automation of calculation and reporting, to “wrap around” highly complex stress testing & capital planning processes and workflows
- Robust, built-for-purpose infrastructure that is flexible enough to adapt to internally AND externally developed analytics and data
- Control over assumption inputs and results output
- Effective challenge processes from LOBs
- Modeling of PPNR components
- Challenger model approaches

### DFAST Banks

- Much lower compliance threshold than CCAR banks

- Difficulties exist in meeting stress testing guidance due to historical reliance on expert judgment in credit processes (e.g. judgment driven risk ratings, lack of bifurcation)

- Limited investment in data collection and storage for credit elements needed for loss and PPNR estimation

- We observe differences in approach due to:
  - Size and complexity of the bank
  - Growth aspiration

### Themes

- Loss estimation improvements
- Report assembly
- Rating system redesign
- Spreading systems and tools
- Data management
DFAST Requirements

March 13, 2014 Final Rule:

1. Timelines
2. Data Sources and Segmentation
3. Model Risk Management
4. Loss Estimation
5. Pre-Provision Net Revenue (PPNR)
6. Balance Sheet and Risk-Weighted Asset Projections
7. Allowance for Loan and Lease Losses (ALLL)
8. Controls, Oversight and Documentation
9. Reporting and Disclosure
The Most Common Concern is Credit Losses Under Stress

**Economic Conditions**
- Real GDP Growth
- Employment
- Interest Rates
- Home Prices
- (Others)

**Credit Quality Metrics**
- Quarterly expected loss rates by portfolio segment

**Capital and Liquidity Metrics**
- Portfolio loss levels
- Impact to earnings
- Impact to cash
- Implied risk-based capital ratios

**Economic Forecast Assumptions**

**Econometric Models**

**Balance Sheet & Income Statement Models**
Loss Modeling

Top-down modeling approaches (portfolio level)
» Global transition matrices
» Portfolio level
» Asset-class/Call Report category

Depending on size and complexity, bottom-up models
» Capture obligor/borrower level details
» More consistent with business-line approaches

Challenges:
» Reliable PD and LGD
» Data availability
Multiple Approaches to Credit and PPNR Stress Testing are a Must

Principle 2: An effective stress testing framework employs multiple conceptually sound stress testing activities and approaches

“All measures of risk, including stress tests, have an element of uncertainty due to assumptions, limitations, and other factors associated with using past performance measures and forward-looking estimates. Banking organizations should, therefore, use multiple stress testing activities and approaches ..., and ensure that each is conceptually sound. Stress tests usually vary in design and complexity, including the number of factors employed and the degree of stress applied. A banking organization should ensure that the complexity of any given test does not undermine its integrity, usefulness, or clarity. In some cases, relatively simple tests can be very useful and informative.

Furthermore, almost all stress tests, including well-developed quantitative tests supported by high-quality data, employ a certain amount of expert or business judgment, and the role and impact of such judgment should be clearly documented”.

Interagency Guidance on Stress Testing for Banking Organizations with Total Consolidated Assets of More Than $10Bn
SR Letter 12-7, May 14, 2012
Modeling Challenges: Credit Risk

Major themes regarding quantitative modeling for CCAR purposes:

» Asset-class coverage
» Variable selection
» Primary and challenger model approaches
» Segmentation and granularity / White-box v. Black-box
» Data and Data Availability
  – Gathering all of the required modeling data in one place
» Loss-emergence
» Back-testing and benchmarking
Methodology and Platform for Deriving PDs and LGDs
Spread, Store, Score, Origination & Stress Testing Needs

**Stress Testing Solutions**
- Dashboard
- Portfolio Reports
- Stress Testing Models by Asset Class

**Data Collection**
- Consistent
- Single Source spreading software – RiskAnalyst™ & RiskOrigins™ software

**Financial Analysis**
- Data Templates in RiskAnalyst & RiskOrigins software

**C&I & CRE Scoring**
- RiskCalc™ & CMM™ (Commercial Mortgage Metrics)

**Scorecards**
- Dual Risk Rating including PD, LGD & EL
- Credit risk scores combined with qualitative factors producing ratings
RiskAnalyst™ software has wide industry coverage for financial statement data collection needs

» Minimize data entry errors by using one of our industry templates
  – Middle Market Accounting Standard (MMAS) data template
  – Income Producing Commercial Real Estate (IPRE) data template

» Meet your specific business objectives with the flexibility to change templates or add new templates

» Integrate with credit risk assessment models for C&I & CRE exposures; RiskCalc™ & Commercial Mortgage Metrics™ models
RiskCalc™: Credit Research Database (CRD™)

The largest financial statement and default database in the world

The RiskCalc Plus network is comprised of unique models covering:

**Americas:** USA, Canada and Mexico country models, plus U.S. Insurance, U.S. Banks and North America Large Firm

**Europe, Middle East and Africa:** Austria, France, Netherlands, Nordic (Denmark, Norway, Sweden, Finland), Portugal, Spain, UK, Germany, Belgium, Italy, South Africa, Switzerland, Russia, Banks

**Asia Pacific:** Japan, Korea, Australia, Singapore, China, Banks

**Other:** Emerging Markets

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RiskCalc™ Modeling Process

1. Collect Financials and Default Data
2. Select Relevant Ratios
3. Compute the Model Output
4. Calibrate the Model Output to Actual Defaults: Financial Statement Only (FSO) EDF™ (Expected Default Frequency)
5. Incorporate a market signal to determine the Credit Cycle Adjusted (CCA) EDF
RiskCalc Stress testing – Two different approaches

**RiskCalc Ratio Based Approach**  
(Obligor-Level Modeling)

- **Data:**
  - Credit Research Database (CRD)

- **Inputs:**
  - RiskCalc US 4.0 Corporate Income Statement & Balance Sheet Inputs
  - Macro scenarios

- **Modeling:**
  - Financial ratios are linked to macroeconomic variables
  - CCA “credit cycle adjusted” view for forecasted EDFs under stressed scenarios

- **Output:**
  - Two years of pro-forma financials
  - Baseline EDF and Stressed EDF

**RiskCalc PD&LGD Based Approach**  
(Granular Modeling)

- **Data:**
  - Credit Research Database (CRD)
  - Default & Recovery Database (DRD)

- **Inputs:**
  - Initial PD & LGD
  - Sector
  - Debt type (secured loans, unsecured loans or revolvers)
  - Macro scenarios
  - Outstanding Loan Balance
  - Total Commitment

- **Modeling:**
  - Calibrated on RiskCalc US 4.0
  - PD: Forecasting future change based on PD level, sector and forecasted macro scenarios
  - LGD: Predict recovery rates based on debt type, sector, stressed PD levels and macro scenarios

- **Output:**
  - Stressed PD & LGD, expected loss, charge offs, EAD, portfolio balance, usage
Moody’s Commercial Mortgage Metrics ("CMM")

CMM is the leading analytical model for assessing risk in commercial real estate (CRE) loans

- **Flexible framework** that allows clients to customize real estate, econometric forecasts and model settings
- **Robust scenario analysis/stress testing capabilities** that are integrated with Moody’s Economy.com macro-economic scenarios to support regulatory compliance
- **Built on extensive, proprietary data-set** and calibrated to recent financial crisis
- **Monte Carlo methodology**
- **Flexible delivery** – Manual and batch processing, Web delivery, Natively integrated with Moody’s Analytics suite of Enterprise Risk Solutions (RiskOrigins & Scenario Analyzer)
### CMM Inputs, Outputs & Uses

#### CMM Inputs
- **Loan Details**
  - Loan Amount, Term/Amort *
  - Rate: Fixed, Floating, Other *
  - Structure *
- **Property details**
  - Property type, Location, Property Value, NOI *
  - Rent, Vacancy, Cap Rate, Lease rolls, Expenses
- **Asset Volatility**
  - Systematic and Idiosyncratic volatility

#### CMM Outputs
- Estimated Property Value
- Estimated NOI
- Expected Default Frequency (EDF)
- Loss Given Default (LGD)
- Expected Loss (EL)
- Yield Degradation (YD)
- Stressed Risk Measures
  - Stressed PD, LGD
  - Unexpected Loss
- Implied Moody’s Rating
- Customer Rating (Based on customer rating scale)

#### CMM Uses
- Stress Testing
- Identify sources and causes of risk
- Price new loans
- Monitor loan expected performance as markets change
- Early Warning System
- Identify loans for potential sale
- Identify periods of maximum risk
- Respond to management and regulators
- Efficiently size capital allocations vis-à-vis competing asset classes

* Required input
CMM’s Stress Testing Modeling Framework

Macroeconomic Scenario

National and Local Real-Estate Market Factors

CRE loans

Stressed Losses

Moody’s Analytics
Ongoing Monitoring – Identify Issues Before they Arise

» Understand risks in your portfolio within specific segments
  – View a single borrower’s or property performance, or performance for specific groups across your portfolio
  – Identify outliers in a portfolio and identify key trends and insights within important segments
  – Monitor EDF & LGD over time for an early warning indicator and an effective approach towards dual risk rating
Managing the Multiple Dimensions to Stress Testing

- Regulatory Requirements
- Firm Goals
- Primary, Challenger & Benchmark Model
- Customization & Variable Selection
- Methodology “Bottom-up vs. Top-down” Segmentation & Granularity
- Asset Class Coverage
- Data Availability & Quality
## Stress Testing Modeling Approaches

### RiskCalc
- **Private Firm C&I**
  - **Ratio Based Approach**
    - Financial ratios are linked to macroeconomic variables
    - Two years of pro-forma financials calculating Baseline and Stressed EDF
  - **PD & LGD Granular Approach**
    - Starting PD & LGD, Sector, Debt Type, Loan Amount and Commitment
    - Stressed PD & LGD, EL, EAD, balance, net charge offs, portfolio balance, ALLL, provisions
  - **Macro Economic Scenarios**
    - Economic Consumer & Credit Analytics (ECCA) – economy.com
    - Regulatory Scenarios
    - Custom Scenarios
  - **Model Customization**

### CMM
- **Income Producing CRE**
  - Translating macro-scenario into CRE market factors
  - Set of models that quantify how national macro-economic forecasts affects national CRE market factors (i.e. Vacancy Rent, Cap Rates)
  - Translate national market factors into local market (MSA level) conditions
  - Macro Economic Scenarios
    - Economic Consumer & Credit Analytics (ECCA) – economy.com
    - Regulatory Scenarios
    - Custom Scenarios
  - **Model Customization**

### GCorr™ Macro EL Calculator
- **(All Asset Classes)**
  - Bottom-up methodology for instrument-level expected losses (EL)
  - Single model calculates EL across multiple asset classes – C&I, CRE, Retail, SME, Sovereign
  - Lightweight data requirements for entire portfolio
  - Integrate RiskCalc & CMM for the baseline probability of default measure for C&I and CRE asset classes

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Methodology for Deriving Granular Conditional Loss Estimates
Innovative & Flexible Approach to Stress Testing

» Single model calculates ELs across multiple asset classes – C&I, CRE, Retail, SME, Muni, Sovereign
   – Consistent modeling framework across entire portfolio
   – Model distinguishes unique sensitivities of each borrower to changes in the macroeconomy

» Bottom-up methodology for instrument-level expected losses (EL)

» Consistent, lightweight data requirements for entire portfolio
   – Solution requires instrument-level data – commitment amount plus baseline PDs and LGDs

» Calculations delivered via a low-footprint technology platform
   – No need for extensive IT infrastructure or complex data management
Stressed EL Calculator Workflow

Stressed EL Calculator
- Stressed PDs & LGDs
- Stressed Expected Losses

Data Collection
- Consistent
  - Single Source spreading software – Risk Analyst & Risk Origins software

Financial Analysis
- Data Templates in Risk Analyst & Risk Origins

C&I & CRE Baseline PD & LGD
- RiskCalc & CMM

Retail, Sovereign, Muni Internal Ratings
- Map internal ratings back to PDs
Our Global Correlation Model (GCorr™) is the industry-leading correlation model for explaining portfolio credit dynamics

- Used by over 70 global institutions in 19 different countries
- It is the correlation model used by our Economic Capital solution, RiskFrontier™
- Clients include more than 50% of the CCAR banks

GCorr is a granular, multi-factor model that uses a common structure across all asset classes (C&I, SME, CRE, Sovereign, and Retail)

- Each borrower’s credit risk is determined by sensitivity to relevant factors
- Factors are based on financial market data and balance sheet information, not changes in macrovariables (MVs)

GCorr has distinct credit quality drivers for each asset class - C&I, SME, CRE, Sovereign, and Retail

- C&I, SME: Country & industry
- CRE: MSA & property type
- Retail: MSA & product type
## GCorr Example – U.S. Automobile Firm

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<thead>
<tr>
<th>Strong economy</th>
<th>Weak economy</th>
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<tbody>
<tr>
<td><strong>U.S. Country</strong></td>
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<td>GCorr Factor</td>
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### Credit Quality

<table>
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<tr>
<th>Strong economy</th>
<th>Weak economy</th>
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</thead>
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<tr>
<td>Low Instrument PD</td>
<td>High Instrument PD</td>
</tr>
<tr>
<td>Low Instrument LGD</td>
<td>High Instrument LGD</td>
</tr>
<tr>
<td>Low Instrument EL</td>
<td>High Instrument EL</td>
</tr>
</tbody>
</table>
GCorr Macro is Extension of the GCorr Factor Model

» GCorr does not explicitly account for changes in macro-economic conditions
  – They are composite metrics that include GDP, unemployment, etc.

» GCorr Macro measures the correlation between each MV and our underlying GCorr credit factors

» Gcorr Macro is able to compute borrower-level sensitivities to changes in macrovariables
  – The model quantifies impact of changes to MVs to changes in borrower credit quality (PDs, LGDs)
GCorr Macro Example Continued
Same U.S. Auto Firm

Unstressed Firm

GCorr Country & Industry Factors

Macroeconomic Scenario

↑ US Unemployment
↑ Interest Rates
↓ US GDP

Stressed Firm

Stressed PDs and LGDs
Implementation Details

- Users need to load portfolio data into our solution
  - Instrument details
    - Commitment amount, usage expectations
  - Borrower details
    - Need to map your borrower info to our GCorr risk factors
    - MA will help secure that information during implementation
  - Unstressed instrument PDs, such as from your internal risk rating
    - Used to calibrate stressed PDs calculated by GCorr Macro
  - Unstressed instrument LGDs
- Stressed EL can be calculated using any combination of MVs
  - Solution has DFAST scenarios preloaded and users can modify existing scenarios or upload their own
Models to Calculate CCAR/DFAST Expected Credit Losses

As of or for the year ended December 31

Selected income statement data

+ Interest income
- Interest Expense

Net interest income

+ Non-interest income
- Non-interest expense

Pre-provision net revenue

- Change in ALLL
- Net charge-offs
- Securities Losses
- Trading/counterparty losses

Pre-tax net income

- Taxes

After-tax net income

- Dividends

Earnings Retained to Capital

Expected Credit Losses = PD * LGD * EAD

Consistent with Principle 2, SR 12-7

“An effective stress testing framework employs multiple conceptually sound stress testing activities and approaches.”
Questions?
To learn more about this topic:

» Make an appointment to meet 1-1 with our experts in the Solutions Café:
  – Chris Shayne, Director, Product Management, RiskFrontier
  – Mehna Raissi, Director, Product Management, RiskCalc & CMM
  – Sumit Grover, Associate Director, Product Management, RiskCalc & CMM

» Attend related sessions taking place after this session:
  – Incorporating Dual Risk Ratings in Credit Loss Forecasting (for DFAST)
  – Moving between Rating Space and PD Space

» Read related materials available in the RPC Mobile App:
  – Whitepaper: Using GCorr™ Macro for Multi-Period Stress Testing of Credit Portfolios
  – Whitepaper: A Theory of Monitoring Credit Risk
  – Product Brochures: CMM (Commercial Mortgage Metrics), RiskCalc Plus, RiskFrontier