CREDIT RISK ISSUES IN CAPITAL EVALUATION

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Credit Risk Issues in Capital Evaluation

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Goals

- Credit Risk concepts in the financial industry
- Current techniques used in estimating Credit Risk
- Credit Risk issues related to agricultural finance
- Proposed estimation application
Credit Risk

- Industry converging on two statistics:
  - Expected losses
  - Critical value on a loss distribution (Credit VaR or Credit Risk Capital, Unexpected loss)

**Credit VaR**

Joint probability that **credit events** will occur?

Loss in value should the **credit events** occur?

Quality (PD)

Exposure (LGD)
Modeling Credit Event Distributions

- Modeling Credit Quality
  probability of default

- Modeling Default Correlations
  across borrowers or
  borrower classes

- Modeling Cyclical Behavior
  of defaults over time

Measuring Exposure

- Loan Equivalent Exposure
  Two Distinct Elements

  - Current Exposure
    - Exposure to a particular borrower

  - Potential Exposure
    - Basel Committee add-on
    - Expected potential exposure
    - Maximum potential exposure
Basel Accord

Additional Credit Risk Concepts

Recommendations/Statements

Criteria on Risk Assessment

Basel: At minimum, methods and data should account for:
- Historical and projected cash flow repayment ability
- Capital structure
- Quality of earnings
- Quality of information
- Operating leverage: financial efficiency
- Financial flexibility: liquidity
- Management quality
- Position in industry: peer group
- Risk characteristics of the country
Estimation Requirements

- Population closely represents borrowers
- Underwriting standards are comparable to those used by institution
- Economic conditions relevant to current and foreseeable conditions
- Number of loans in sample and data provide strong grounding in historical experience
- Calibrated to new information
- Minimum length of underlying data period: 5 years

Validation System

- Validate input data
- Periodic monitoring
- Identify relationships that are no longer appropriate
Stress Tests

- Identification of events
  - Economic or Industry Events
  - Market Risk Events
  - Liquidity Conditions

- Assess the migration of exposures to lower grades

- Suggest tests be conducted by an independent unit

Main Methods

- Credit Metrics™
- KMV Corporation
- CreditRisk +™
- Credit Portfolio View™
IRB Approach: Key Elements

1. Classification of Exposures
   - Corporates
   - Retail
   - Banks
   - Project Finance
   - Equity
   - Sovereigns

Traditional Ag

2. IRB Approach: Key Elements
   - Probability of Default
     - Loss Given Default
     - Exposure at Default
     - Maturity

Foundation v. Advanced
IRB Approach: Key Elements

3. Risk weight function

4. Minimum requirements

5. Supervisor review and compliance

Corporate Exposures
Two Steps:

- Baseline levels
  Estimates of PD, LGD & EAD

- Granularity adjustments
  - Specific borrower
  - Specific borrower class
Suggested Granularity Estimation

Express portfolio as a function of four risk drivers
- PD
- LGD
- Systemic risk sensitivity index
- Effective number of loans

Issues:
Retail Exposures

Two general families of risk components
- Separate estimates of PD and LGD
- Estimate of Expected Loss
  \( EL = LD \times LGD \)
Issues in Agricultural Finance

- How to measure frequency and severity?
- High borrower concentrations (large loans)
- Heavy industry (commodity) concentrations
  - positive correlations among borrowers: granularity
- Stress test w/economic events of the 1980s and other economic events
  - cyclical nature of agricultural losses

Issues in Agricultural Finance

- Value of collateral highly related to income producing capability of industry
- Limited data: quality and quantity
  - loan level (one point in time)
  - aggregate data (S&P ratings)
Issues in Agricultural Finance
Desired Data Components

- underwriting variables at origination and subsequent periods
- data encompass desired underwriting standards
- information on collateral quality and value at origination and subsequent periods
- loan repayment history
- measure of default and amount of loss PD (frequency) and LGD (severity)
- measures of commitments (EAD)
- farm level observations from the 1980s

Challenges in Estimation in Agriculture

- Data systems being revised/developed
  - FCS migration
  - FCA adapting their LARS system
  - FMAC developing data series
  - Larger commercial banks developing histories

- Length and economic events spanned w/data
Estimation Techniques

- Lender Loan Data
- Benchmark Risk Measures

Estimation Methods
- Internal Default Experience
- Mapping to Existing Data
- Statistical Default Models
- Simulation Techniques

Judgmental Factors

Expected Default Frequencies

Simulation Approach

Estimate PD

Advantages
- Control economic environment
  - Replicate history
  - Model economic and stress scenarios
- Control firm-characteristics and collect desired underwriting variables
- Evaluate performance over time: migration tables
- Probabilistic estimates
General Model Characteristics

- Earlier version of the model used to assist in the development of a proprietary credit scoring model
- 10-year model
- Stochastic components
  - Commodity prices
  - Production levels
  - Interest rates
  - Financial asset returns
  - Input cost growth rates
  - Capital asset growth rates

Farm Financial Simulation Engine

Deterministic Assumptions
- Baseline Assumptions
- Enterprise Selection and Budgets
- Capital Investment Activities
- Financial Investments
- Nonfarm Income

Stochastic Assumptions
- Commodity Prices
- Production Levels
- Interest Rates
- Stock, Bonds, Mutual Funds
- Inflation & Growth

Risk Engine

Linked Financial Statements

Covariance Relationships
Firm-level Stress Test

- Combine VaR with Stress Testing

Picture of Risk Report

October 1, 2001

Stress Scenarios - P&L Changes
1. 1980's Farm Crisis - 1,478,041
2. 1990's Livestock Disease - 887,200
3. Asian Crisis (1997) - 191,300
4. Remove 2% Government payments - 239,932
5. September 11, 2001 1 day - 146,649

Manage Multiple Farms-Types?

- Seven Dimensions
  - Farm size
  - Leverage
  - Tenure
  - Asset structure
  - Liability structure
  - Non-farm income level
  - Management

- Economies of size functions
- Production efficiency assumptions
Example Sampling
3 dimensions

Establish cutoffs

Model Overview

FAPRI

Other Baseline

Economic Conditions

Farm Type Selection

Evaluate Financial Performance

Store Results

Equal sampling within each dimension
1,458 samples/farm type
Default function

Initial Farm Characteristics

- economic conditions \( N - t \)
- underwriting variables \( N - t \)

Financial Performance

\[ \text{Financial performance}_{N} = f(\text{economic conditions}_{N-t}, \text{underwriting variables}_{N-t}, \text{initial conditions}_{0}) \]

Example Output

Credit Scoring Model

PD for three credit classes

- Clearly acceptable = 0.95%
- Evaluation region = 4.65%
- Clearly unacceptable = 21.06%
Simulation Model to Risk Map

Challenges w/Approach

- Creating representative farm types/budgets
- Validation
- Need for reliable data (estimate probability distributions)
- Perception of synthetic data
Summary

- Issues related to credit risk measurement
- Elegant techniques, but data in agriculture fall short
- Introduced an alternative/flexible tool
  - develop “S&P” type Ag Finance Benchmarks
  - use w/management

Prototype Credit Risk Data Systems

Borrower Level Analysis

Market Data

Risk Engine

Portfolio System