The Use of Financial Statements to Predict Default and Improve Middle-Market Loan Liquidity

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Bankers need information to managed credit risk

- Both agency ratings and public firm EDF™ credit measures provide valuable signals for firms that have publicly traded debt or equity or both.

- Behavioral information is useful for consumers and very small firms

- For the ‘middle-market,’ bankers traditionally have relied on financial statements and fundamental analysis to assess risk

- Over the past 20 years, the concept of the probability of default has become an increasingly important tool in credit risk management
  - Key role in the securitization of middle-market debt
  - Key role in determining capital requirements
Traditional middle market banking

Reference Portfolio

Loans to Small and Medium Size Enterprises

Liabilities

90% Senior Tranche (depositors)

10% Equity Tranche (bank shareholders)

• Was relationship based
• Small spread earned on a levered portfolio
• If losses were low, then return on equity could be substantial
Growth of CLO market may transform middle market banking

- Very active rapidly growing markets in Collateralized Loan Obligations in Japan, US, Germany and Spain
- CLOs can be viewed as ‘synthetic banks’
- This market requires a ‘lingua franca’ of risk

Sources: Update on the US Market for SME CLOs, 2006 and Information on EMEA SME Securitisations, 2007 Moody’s Investors Service
Like banks, the equity tranche of a CLO makes a small spread on a levered portfolio

In this specific deal, equity holders borrow at a spread of 46bps (weighted average spread on senior and mezzanine tranches)

Spreads on underlying assets for this type of deal typically exceed 4%

Equity tranche is levered by a factor of 10

If losses are low, returns to equity holders can be substantial
A middle-market CLO requires a measure of credit risk for the underlying exposures

## CDO Rating Factors

**Moody's Rating Approach to U.S. SME CLOs:**
Using Credit Tools to Expand Manager Flexibility

<table>
<thead>
<tr>
<th>Lowest .EDF</th>
<th>Maximum Senior Implied Mapped Rating (applicable to loans)</th>
<th>Maximum Senior Unsecured Mapped Rating (applicable to bonds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;=.baa</td>
<td>Ba3</td>
<td>Ba3/B1</td>
</tr>
<tr>
<td>.ba1</td>
<td>B1</td>
<td>B1/B2</td>
</tr>
<tr>
<td>.ba2, .ba3, .b1</td>
<td>B2</td>
<td>B2/B3</td>
</tr>
<tr>
<td>.b2, .b3</td>
<td>B3</td>
<td>B3/Caa1</td>
</tr>
<tr>
<td>.caa</td>
<td>Caa1</td>
<td>Caa1/Caa2</td>
</tr>
</tbody>
</table>

(1) For LBOs or other combination type transactions, mapping will be reduced by an additional ½ rating subcategory. In addition, all ratings will be calculated without regard to any projected synergies.

(2) Managers will have the flexibility to reduce the ratings if in their judgment lower ratings are warranted.
Performance on SME CLOs has been strong

- Of 61 US deals, 7 experience upgrades and only one downgrade
  - For the downgrade, interest and principal was paid in full

- In Japan, there have been 50 deals with 4 upgrades and no downgrades

- In Europe, SME CLOs are reported to be performing in line with expectations

- SME CLOs have not yet been tested through an adverse credit environment on a large scale

Source: Moody’s Investors Service (Update on the US SME Market for CLOS, 2006; Performance Review of Japanese CLOs/CDOs, 2006; European SME Securitisation Review 2005)
Introduction to the RiskCalc Network
RiskCalc network since 2000

- Has expanded to cover 22 different countries representing 80% of the world’s GDP
- Includes a model for Private US Banks
- Is actively used by over 200 clients
  - Monitoring of both loans and leases
  - Implementation of risk based pricing
  - Regulatory compliance
  - Transfer pricing
  - Portfolio management
  - Securitization of Small and Medium Size Enterprise (SME) debt into Collateralized Debt Obligations (CDOs)
- Based on data of actual unlisted firms from each country
RiskCalc’s international coverage continues to grow

Greenland is part of the Kingdom of Denmark
Credit Research Database (CRD)

- Began effort in 1997
- Database of borrower financial statements matched to select credit performance data
- Data includes
  - Balance sheets and income statements
  - Default status
  - Internal loan grades
  - LGD information
  - Other obtainable loan information
    - loan rate pricing, origination/maturity dates, etc.
A few of our 49 CRD participants…
## Credit Research Database today

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of Customers</th>
<th>Defaulted Customers</th>
<th>Number of Fin Stmts</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>106,052</td>
<td>10,496</td>
<td>536,515</td>
</tr>
<tr>
<td>Europe</td>
<td>1,711,990</td>
<td>141,178</td>
<td>9,043,417</td>
</tr>
<tr>
<td>Asia</td>
<td>263,083</td>
<td>15,609</td>
<td>1,219,300</td>
</tr>
<tr>
<td>Australia</td>
<td>31,576</td>
<td>2,715</td>
<td>102,778</td>
</tr>
<tr>
<td>Africa</td>
<td>19,633</td>
<td>415</td>
<td>52,613</td>
</tr>
<tr>
<td><strong>GRAND TOTAL</strong></td>
<td><strong>2,132,334</strong></td>
<td><strong>170,413</strong></td>
<td><strong>10,954,623</strong></td>
</tr>
</tbody>
</table>
RiskCalc models

- Seek to maximize the predictive power provided the model is
  - Transparent
  - Intuitive
  - Reasonable
- Extract a risk assessment from the financial statements
  - Localized to the specific accounting practices of the country
- Makes an adjustment for industry differences
- Adjusts for the current state of the credit cycle
RiskCalc uses similar financial statement ratios to those used by credit analysts

TABLE 1  Groupings of Financial Statement Ratios

Examples of ratios in the **profitability** group include: net income, net income less extraordinary items, EBITDA, EBIT and operating profit in the numerator; and total assets, tangible assets, fixed assets and sales in the denominator. → *High profitability reduces the probability of default.*

Examples of ratios in the **leverage** group include liabilities to assets and long-term debt to assets. → *High leverage increases the probability of default.*

**Debt coverage** is the ratio of cash flow to interest payments or some other measure of liabilities. → *High debt coverage reduces the probability of default.*

**Growth** variables are typically the change in ROA and sales growth. These variables measure the stability of a firm’s performance. → *Growth variables behave like a double-edged sword: both rapid growth and rapid decline (negative growth) will tend to increase a firm’s default probability.*

**Liquidity** variables include cash and marketable securities to assets, the current ratio, and the quick ratio. These variables measure the extent to which the firm has liquid assets relative to the size of its liabilities. → *High liquidity reduces the probability of default.*

**Activity** ratios include inventories to sales and accounts receivable to sales. These ratios may measure the extent to which a firm has a substantial portion of assets in accounts that may be of subjective value. For example, a firm with a lot of inventories may not be selling its products and may have to write off these inventories. → *A large stock of inventories relative to sales increases the probability of default; other activity ratios have different relationships to default.*

**Size variables** include sales and total assets. These variables are converted into a common currency as necessary and then are deflated to a specific base year to ensure comparability (e.g., total assets are measured in 2001 U.S. dollars). → *Large firms default less often.*
RiskCalc first models the relationship between default and individual financial ratios. By relying on an extensive database, the model captures the fact that the relationship between default frequency and ratios is not linear.
Transforms are computed with a non-parametric methodology

• Non-parametric refers to fitting a continuous function (curve) of the ratio that does not conform to a specific functional form.

• We generally use local regressions (loess) to derive the non-parametric function.

• We estimate a linear regression through a radius of points (locality) and connect the local regressions into one curve.
RiskCalc then statistically combines the risk assessment of different ratios into a single EDF

RiskCalc combines several relationships between ratios and default frequencies in a consistent and objective credit risk measure.

Probability of Default: EDF
The core of RiskCalc is a Generalized Additive Model

- The functional form that RiskCalc employs

\[ \text{probability of default} = g\{f_1(x_1)+f_2(x_2)+...+f_n(x_n)\} \]

Where \( x_i \) is a financial statement ratio, \( f \) is a continuous function and \( g \) is the so-called link function.

- This form balances

  - the need for incorporating nonlinearities to achieve **discriminatory power**
  - the need to create a **transparent** and **intuitive** model

- The role of each variable in the model can be ascertained by examining its transform.
## RiskCalc 3.1: Examples of Model Ratios

<table>
<thead>
<tr>
<th>Ratio</th>
<th>U.K.</th>
<th>Japan</th>
<th>U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Profitability</strong></td>
<td>• Net P&amp;L/Turnover</td>
<td>• Gross Profit to Total Assets</td>
<td>• Net Income/Assets (ROA)</td>
</tr>
<tr>
<td></td>
<td>• Chg in ROA</td>
<td>• Previous year’s net income to sales</td>
<td>• Change in ROA</td>
</tr>
<tr>
<td><strong>Leverage</strong></td>
<td>Liabilities/Assets</td>
<td>• Liabilities less Cash to Assets</td>
<td>• Retained Earnings to Current Liabilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Retained Earnings to Total Liabilities</td>
<td>• Long Term Debt (LTD) to LTD plus Net Worth</td>
</tr>
<tr>
<td><strong>Activity</strong></td>
<td>• Trade Creditors/Turnover</td>
<td>• Inventory to Net Sales</td>
<td>• Inventories/Sales</td>
</tr>
<tr>
<td></td>
<td>• Chg in AR/Sales</td>
<td>• Trade Receivables to Net Sales</td>
<td>• Current Liabilities to Sales</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Change in Turnover</td>
</tr>
<tr>
<td><strong>Liquidity</strong></td>
<td>Current Assets/Current Liabilities</td>
<td>Cash to Total Assets</td>
<td>Cash and Marketable Securities to Assets</td>
</tr>
<tr>
<td><strong>Growth</strong></td>
<td>Sales Growth</td>
<td>Sales Growth</td>
<td>Sales Growth</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>Total Assets</td>
<td>Net Sales</td>
<td>Total Assets</td>
</tr>
<tr>
<td><strong>Debt Coverage</strong></td>
<td>Operating Cash Flow/Interest Expense</td>
<td>EBITDA to Interest Expense</td>
<td>Operating Cash Flow to Interest Expense</td>
</tr>
</tbody>
</table>
Default Risk Varies with the Credit Cycle

- Episodes of elevated default risk are typically associated with the respective contemporaneous locations in the business cycle.

- EDF RiskCalc v3.1 incorporates a forward looking assessment of the credit cycle by drawing from Moody’s KMV Public Firm Model (e.g., CreditMonitor).
1-Year CCA vs FSO EDF: US CRD 1993-2006
Level Validation
Level validation of private firm default prediction models has been challenging

- PD models have been evaluated on both their ability to ‘rank order credits’ as well as the correctness of the actual ‘PD’

- Level validation of a PD model is more challenging than demonstrating an effective rank ordering

- The distribution of defaults is skewed so most of the time a correct model will over predict defaults

- Due to data issues, level validation in private firm models has been particularly difficult

- Nevertheless, the actual level of the PD is a key determinant of the expected return of a portfolio.
In the US, we have been collecting loan accounting system data since 2000

- Five CRD participants have reliably provided such information

- Loan accounting system provides comprehensive default information on 90DPD, Substandard Loans, Charge-Offs and Non-Accrual

- Loan accounting system also allows for the construction of an *Active Borrower Date* for each loan

- Consequently, an ‘actual default rate’ can be constructed and used for level validation
By restricting to a sample with complete default information, we see that the actual default rate ranges from 2.7% to 1.1%.
Conclusion
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- In the middle-market, financial statements play a key role in determining default risk.

- The models are playing an important role in improving ‘middle market’ liquidity through securitization.

- Using loan accounting systems data, the actual default rate on middle market loans ranges from 2.7% to 1.1% over the past six years.

- The performance on SME CDOs has been strong suggesting lower risks than anticipated.

- Increased liquidity in the middle market could lead to lower future spreads on SME loans.