A Market-Based Measure of Credit Quality and Banks’ Performance During the Subprime Crisis

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Introduction
Traditional measures of asset quality of banks have drawbacks...

- Existing literature mainly focuses on balance sheet (BS) data (e.g. non-performing loans (NPL) or loan loss provisions (LLP))

- Shortcomings:
  - backward-looking, low frequency, under discretion of banks, miss non-traditional sources of credit risk

This paper: a *market-based* approach of asset quality
Credit risk (CR) should be reflected in a bank's share price, as it aggregates all information from a variety of sources in a very timely and forward-looking manner.

Lehar et al. (2007) ”Most studies encourage the use of market information arguing that regulatory assessments will become more precise”
The Credit Risk Indicator

Introduction

The Credit Risk Indicator

Idea

Derivation

Derivation (2)

Identification

Regression

Regression (2)

CRI Discussion

CRI Discussion (2)

Empirical Evidence

Conclusions

Faculty of Economics and Business Administration
The Idea

Suppose: two types of loans, high-risk (H) and low-risk (L) and suppose a bank’s portfolio contains mostly high-risk loans

- Share price should react relatively strongly to news about default risk of H loans, but less so to news about L loans

⇒ Bank’s relative share price sensitivity to either type of news gives information about the perceived quality of its loan portfolio
The Derivation

- Value of bank equity

\[ V(\text{Equity}) = V(\text{Loans}) + V(\text{Oth. Assets}) - V(\text{Debt}) \]  

(1)

- Two prototypical loans in economy: high risk and low risk loans with outstanding volumes \( H \) and \( L \)

- Value of the bank’s loan portfolio

\[ V(\text{Loans}) = \frac{H(1 - EL^H) + L(1 - EL^L)}{1 + i^{\text{Loan}}} \]

(2)

where \( EL(EL^H > EL^L) \) are expected losses from default
To obtain CRI, consider a change in \( V(E) \) from \( t - 1 \) to \( t \):

\[
\Delta V(E) = \Delta V(Loans) + \Delta V(Oth. Assets) - \Delta V(D) \tag{3}
\]

Assuming constant book values, we get

\[
\Delta V(E) = \Delta V(Loans) + \Delta V(Oth. Assets) - \Delta V(D) \\
= -H \Delta EL^H - L \Delta EL^L + \Delta V(Oth. Assets) - \Delta V(D) \tag{4}
\]
The Identification

- Identification happens through variations in $EL^H$ and $EL^L$, which are proxied by CDS indices.
- The price of a CDS should reflect expected loss from default (EL) of underlying exposure.
- We thus write

$$CDS^H \approx EL^H \quad \text{and} \quad CDS^L \approx EL^L$$

Hence,

$$\Delta V (E) \approx -H \Delta CDS^H - L \Delta CDS^L + \Delta V (Oth. Assets) - \Delta V (D)$$

(5)
The Regression Approach

We can then estimate the following regression at the bank level:

\[
\Delta p_{i,t} = \alpha_i + \gamma_i \Delta CDS_t^H + \delta_i \Delta CDS_t^L + \phi_i \Delta Z_t + \epsilon_{i,t}
\]  

(6)

- where \( i \) denotes the bank
- \( Z \) is a vector of control variables ⇒ to correct for changes in \( V(\text{Oth. Assets}) \) and \( V(D) \)
We define our Credit Risk Indicator (CRI) as the relative share of high risk loans in the loan portfolio:

\[ CRI = \frac{H}{H + L} \]

We estimate \( \hat{\gamma}_i \) and \( \hat{\delta}_i \) and calculate the CRI of bank \( i \) as:

\[ CRI_i = \frac{\gamma_i}{\gamma_i + \delta_i} = \frac{H_i}{H_i + L_i} \]
The CRI: A Discussion

- The CRI is a comprehensive measure of asset quality: captures credit risk exposure from non-traditional sources (e.g., writing protection in CDS market or buying CDO tranches).
- It is the market’s assessment of bank asset quality: will change as new information about bank assets becomes available.
- It is a relative risk measure (composition of assets) and thus different from bank’s absolute level of risk ⇒ relates to the composition of a bank’s credit exposure.
The CRI: A Discussion

- As a relative measure derived from sensitivities it is robust to mispricing issues such as bubbles in credit markets or to risk premia in CDS prices.

- Difference to individual CDS spread:
  - CDS measures overall default risk - identify banks currently in trouble.
  - CRI measures credit risk exposure - identify banks prone to downturn.
Empirical Evidence
Data

- 150 largest BHCs during February 2006 to February 2008
- Daily data: share prices, CDS indices, control variables (e.g., interest rates, stock market index)
- Balance sheet variables: FR Y-9C Reports
- CDS indices:
  - high risk: Markit CDX *Cross-over* index (contains ratings from BBB to B)
  - low risk: Markit CDX *IG* index (contains ratings from AAA to BBB)
Implementation

\[ \Delta p_{i,t} = \alpha_i + \gamma_i \Delta CDS_t^H + \delta_i \Delta CDS_t^L + \phi_i \Delta Z_t + \epsilon_{i,t} \]

- The market return (S&P500) is orthogonalized with CDS prices to take out the credit risk information
- Moreover, changes in IG and XO will be highly correlated \( \Rightarrow \) coefficients are not estimated precisely due to multicollinearity
- This issue is addressed by orthogonalizing the CDS prices with each other \( \Rightarrow \) two possibilities (turns out: choice does not matter)
1. **Aggregate and Individual CRIs**

1. CRI on aggregate level: Coefficients of interest are highly significant and have correct (negative) sign

2. Individual CRIs: Reasonable cross-sectional variation, only few outliers, no clear pattern emerges
2. How does CRI relate to traditional measures of asset quality?

<table>
<thead>
<tr>
<th>Relationship between CRI and Selected Measures of Credit Risk</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period 15.06-31.08.07 excluded</td>
<td></td>
</tr>
<tr>
<td>Non-Perform. Loans/TL</td>
<td>4.60598**</td>
</tr>
<tr>
<td>Loan Loss Provisions/TL</td>
<td>16.54446***</td>
</tr>
<tr>
<td>Loan Loss Allowance/TL</td>
<td>1.99673</td>
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<tr>
<td>Net Charge Offs/TL</td>
<td>7.19843*</td>
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<tr>
<td>Tot. Risk Weight. Assets/TA</td>
<td>0.00844</td>
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<tr>
<td>Loan Growth</td>
<td>0.68211**</td>
</tr>
<tr>
<td>Interest from Loans/TL</td>
<td>3.87150**</td>
</tr>
<tr>
<td>Real Estate Loans/TL</td>
<td>0.17752***</td>
</tr>
</tbody>
</table>

TL= Total Loans; TA= Total Assets
2. How does CRI relate to traditional measures of asset quality?

⇒ CRI contains variety of asset quality information
3. **Can CRI predict the share price performance of banks during the crisis?**

- First step: estimate CRI s using information up to June 2007
- Second step: relate CRI to share price performance between June 2007 and end of sample

\[
\text{share price perf bank } i = \alpha + \beta \hat{RI}_i + \gamma Y_i + \epsilon_i \quad (7)
\]

- Control factors \((Y_i)\): traditional asset quality variables, size, capital structure, securitization activities, beta and share price volatility
## Relationship between CRI and Banks’ Share Price Performance

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
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<tbody>
<tr>
<td>Non-Performing Loans/TL</td>
<td>-2.457</td>
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<td>36.40</td>
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<td>Loan Loss Allowance/TL</td>
<td>-651.9**</td>
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<td>-451.6*</td>
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<tr>
<td>Net Charge Offs/TL</td>
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<td>-1591</td>
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<td>Risk Weight. Assets/TA</td>
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<td>-21.66***</td>
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<td>Loan Growth</td>
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<td>Interest from Loans/TL</td>
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<td>ROA</td>
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<td>263.4</td>
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<td>Debt/TA</td>
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<td>27.19</td>
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<td>4.202</td>
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<td>Loans/TA</td>
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<td>-25.91***</td>
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<td>-13.39*</td>
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<td>log(TA)</td>
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<td>-2.390***</td>
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<td>-2.111***</td>
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<tr>
<td>Real Estate Loans/TL</td>
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<td></td>
<td>-7.306*</td>
<td>-8.825**</td>
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<td>Dum Sec. Real Estate L.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>-5.593***</td>
<td>-2.542</td>
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<td>Beta</td>
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<td></td>
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<td></td>
<td>5.634**</td>
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<td>Vola</td>
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<td>1.170</td>
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<td>Constant</td>
<td>-3.972***</td>
<td>4.282</td>
<td>19.78***</td>
<td>26.02</td>
<td>2.383</td>
<td>-11.22***</td>
<td>57.56**</td>
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<td>Observations</td>
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<tr>
<td>$R^2$</td>
<td>0.072</td>
<td>0.138</td>
<td>0.211</td>
<td>0.267</td>
<td>0.155</td>
<td>0.113</td>
<td>0.381</td>
</tr>
</tbody>
</table>
3. Can CRI predict performance of banks during crisis?

- CRI is negatively and significantly related to subprime performance, after controlling for variety of other factors
- CRI thus contains useful information beyond these factors
4. The CRI and failed banks

- Compute CRI of failed banks (in total five banks with complete data and liquid share prices)

- Two methods for computing CRI: use information
  - up to one month before failure
  - up to drop in share price (visual inspection)

- Results: for either method
  - all failed banks have a higher CRI than the average CRI
  - their mean CRI is 2-3 the average CRI
Conclusions
Conclusions

- We propose a new market-based measure of bank asset quality
- CRI can be easily estimated (only need market data)
- Independent assessment of a bank’s risk
- CRI comprehensive measure of asset quality
  1. incorporates many sources of information
  2. measures also credit risk arising from non-traditional sources
Thank You!