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

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

- typically based on balance sheet information (e.g., non-performing loans or loan loss provisions)
- disadvantages:
  - backward-looking, low frequency, under discretion of banks, miss non-traditional sources of credit risk

This paper: a *market-based* approach of asset quality
The basic idea

- suppose there are two types of loans in economy: high-risk and low-risk loans
- consider bank with many high-risk loans: share price should react relatively strongly to news about the default risk of high-risk loans in the economy, but less to news about low-risk loans
- *Credit Risk Indicator* (CRI): sensitivity of share price to news about high-risk loans, relative to low-risk loans

⇒ the CRI measures proportion of high-risk loans, as perceived by the market
Main results

- estimate CRIs for U.S. BHCs
- CRI contains information from a variety of traditional credit risk-measures
- but also seems to capture information beyond: CRI can predict share price performance of banks during subprime crisis (after controlling for traditional factors)
- we can use CRI to track perceived asset quality in financial system: market was aware of (average) credit quality of BHCs well before the crisis
Growing interest in market-based measures...

- evidence that market does well in evaluating the risks at financial institutions (Smirlock and Kaufold 1987, Flannery and Sorescu 1996, Morgan and Stiroh 2000, Hancock and Kwast 2001,...)

- market information has predictive power (Berger, Davies, Flannery 2000, Evanoff and Wall 2001, Lopez and Krainer 2004, ...)

- existing market-based measures of bank risk have focused on the likelihood of failure (e.g., subordinated debt spread) or systemic risk (e.g., CoVAR)

- asset quality of banks
The Credit Risk Indicator

- value of bank equity

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

(1)

- loan portfolio consists of two prototypical loans: high risk and low risk loans

- outstanding volumes are \( H \) and \( L \)

- value of the loan portfolio

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

(2)

where \( EL \) (\( EL^H > EL^L \)) are expected losses from default
The Credit Risk Indicator (CRI): the proportion of high risk loans in the loan portfolio

\[ CRI = \frac{H}{H + L}. \] (3)
write change in equity (ignoring interest rate, other assets and debt for the moment)

\[ \triangle V(\text{Equity}) = \triangle V(\text{Loans}) = -H \triangle EL^H - L \triangle EL^L \] (4)

proxy for expected losses: spread on CDS index for high and low risk names (\(CDS^H\) and \(CDS^L\))

\[ EL^H \approx CDS^H \text{ and } EL^L \approx CDS^L \] (5)

we then get

\[ \triangle V(\text{Equity}) \approx -H \triangle CDS^H - L \triangle CDS^L \] (6)
estimates of $H$ and $L$ can be obtained by regressing (daily) bank share price changes on changes in the spread on high and low risk CDS index

$$\triangle p_t = \alpha - \beta \triangle CDS^H_t - \gamma \triangle CDS^L_t + \delta Z_t + \epsilon_t.$$  \hspace{1cm} (7)

control variables $Z_t$ proxy for changes in $V(\text{others assets})$, $V(\text{debt})$ and interest rates

CRI is then simply the ratio of the estimated sensitivities: $CRI = \frac{\hat{\beta}}{\hat{\beta} + \hat{\gamma}}$
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)
- 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
- as a relative measure it is robust to mispricing issues such as credit bubbles in market prices
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)
- CDS indices:
  - high risk: Markit CDX Cross-over index (contains ratings from B to BBB)
  - low risk: Markit CDX IG index (contains ratings from BBB to AAA)

⇒ estimated CRIs for the 150 BHCs are available on 
http://people.pwf.cam.ac.uk/ww243/CRI.xls
How does CRI relate to traditional measures?
Relationship between CRI and Selected Measures of Credit Risk

<table>
<thead>
<tr>
<th>15.06-31.08.07 excluded</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Perform. Loans/TL</td>
<td>4.60598**</td>
</tr>
<tr>
<td>Loan Loss Provisions/TL</td>
<td>16.54446***</td>
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<tr>
<td>Loan Loss Allowance/TL</td>
<td>1.99673</td>
</tr>
<tr>
<td>Net Charge Offs/TL</td>
<td>7.19843*</td>
</tr>
<tr>
<td>Tot. Risk Weight. Assets/TA</td>
<td>0.00844</td>
</tr>
<tr>
<td>Loan Growth</td>
<td>0.68211**</td>
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<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
CRI positively correlated with traditional loan-risk measures

⇒ CRI contains variety of asset quality information
Can CRI predict performance of banks during crisis?

- first step: estimate CRIs using information up to June 2007
- second step: relate CRI to share price performance between June 2007 and end of sample

\[ \text{share price perf. bank } i = \alpha + \beta \text{CRI}_i + \gamma Y_i + \epsilon_i \]  
(8)

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

<table>
<thead>
<tr>
<th>Dep.Var.: share price perf.</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Perform. Loans/TL</td>
<td>-2.457</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>36.40</td>
</tr>
<tr>
<td>Loan Loss Provisions/TL</td>
<td>1001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1999</td>
</tr>
<tr>
<td>Loan Loss Allowance/TL</td>
<td>-651.9**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-451.6*</td>
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<tr>
<td>Net Charge Offs/TL</td>
<td>-1352</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-1591</td>
</tr>
<tr>
<td>TRWA/TA</td>
<td></td>
<td>-21.66***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-12.16</td>
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<tr>
<td>Loan Growth</td>
<td>-27.12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-14.98</td>
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<tr>
<td>Interest from Loans/TL</td>
<td>-485.8**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-401.6</td>
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<tr>
<td>ROA</td>
<td>263.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>416.6</td>
</tr>
<tr>
<td>Debt/TA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>27.19</td>
<td>4.202</td>
</tr>
<tr>
<td>Loans/TA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-25.91***</td>
<td></td>
<td>-13.39*</td>
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<tr>
<td>log(TA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-2.390***</td>
<td></td>
<td>-2.111***</td>
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<tr>
<td>Real Estate Loans/TL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-7.306*</td>
<td>-8.825**</td>
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<tr>
<td>Sec. Real Est. Loans</td>
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<td></td>
<td></td>
<td></td>
<td>-5.593***</td>
<td></td>
<td>-2.542</td>
</tr>
<tr>
<td>Beta</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.634**</td>
<td>1.170</td>
</tr>
<tr>
<td>Vola</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-2823</td>
<td>-2494</td>
</tr>
<tr>
<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>
</tr>
</tbody>
</table>

| Observations | 150 | 150 | 150 | 150 | 150 | 150 | 150 |

*Wolf Wagner (Tilburg University) A Market-Based Credit Quality Measure*
Can CRI predict performance of banks during crisis?

- CRI enters negatively and significantly in all specifications, after controlling for variety of other factors.
- CRI thus does contain useful information beyond this factors.
- Ability to forecast shareprice performance seems noteworthy since not only crisis of asset quality but also liquidity and funding issues which are not captured by the CRI.
The CRI and failed banks

- some of the banks from our sample failed after the sample period (in total 5 banks)
- mean CRI among those banks is 0.28 (0.21), compared to 0.11 for entire sample
The development of the CRI of the BHCs

⇒ instead of individual CRIs, we can also estimate average CRI of BHCs
Average BHC CRI (Rolling window analysis)
The development of the CRI of the BHCs

- main message: CRI at end of sample not significantly different from beginning of sample
- thus, no significant update about average asset quality at banks since start of crisis
- suggests that market was aware of asset quality of banks before crisis
A puzzle?

- seems to contradict the fact that share prices declined substantially during crisis
- explanation: market was aware of composition of portfolios in financial system (investment grade versus cross-over exposures) but not of the absolute level of risk of each loan type
Conclusions

- we propose a new market-based measure of bank asset quality
- CRI can be easily estimated (only need share prices)
- 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
- CRI seems to contain information not contained in traditional asset quality measures
Extension: Perceived tail-risk

- method can be extended to measure perceived tail-risk of financial institutions
- analogous to CRI, perceived tail-risk can be quantified by estimating sensitivities to tail-risk news (prices of index put options or senior tranches of securitizations)
- advantages:
  - forward-looking measure
  - in order to quantify tail-risk exposure, we do not actually need to observe tail-risk observations
CDS indices over time

01Feb2006 01Jul2006 01Jan2007 01Jul2007 01Jan2008

50 100 150 200 250 300 350 400

XO in bps IG in bps
Table 2 Descriptive Statistics for Individual CRIs

<table>
<thead>
<tr>
<th>Variable</th>
<th>Observations</th>
<th>Mean</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
<th>St.Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRI</td>
<td>150</td>
<td>0.1143</td>
<td>0.1082</td>
<td>-0.0329</td>
<td>0.4433</td>
<td>0.0626</td>
</tr>
</tbody>
</table>
Wolf Wagner (Tilburg University)  A Market-Based Credit Quality Measure

BHCs ranked by Asset Size