Discretionary Credit Rating and Bank Stability During a Financial Crisis

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Motivation

• Existing accounting standards and banking regulation induce procyclicality in the loan-loss provisions.

• In economic downturns the incidence of loan default increases and the value of banks’ assets decreases.

• Resulting higher loan-loss provisions negatively reflect in the P&L account and bank capital, which creates incentives to relax standards of credit risk assessment and valuation of assets in times of economic downturn.

• Persistent underestimation of credit risk results in significantly weaker banks.
Motivation
Slovenian case in the current crisis

- Slovenia experienced a major banking crisis.
- By 2012 the NPL ratio exceeded 20%.
- In 2013 10 banks, accounting for about 70% of assets, went through a comprehensive review.
- Huge capital shortfalls:
  - 214% of existing capital overall
  - Big differences across banks:
    - 78% foreign-owned banks - 244% domestic banks.
    - Within domestic group: large (2 banks) 228% - small 278%.
    - 2 largest banks majority state owned and held 36% market share ⇒ "too-big-to-fail" + explicit state guarantee.
Motivation

Topic of the paper

• This paper focuses on discretion in credit risk assessment.
• Incentives for discretion differ across banks: size, ownership, access to funding/capital.
• Hypotheses:
  • Banks that are bigger and have easier access to funding have less incentives to underestimate risk.
  • Foreign owned bank should have the least incentives, followed by large domestic banks.
  • The most pronounced incentives to underestimate risk in a crisis are in small domestic banks.
Motivation

Topic of the paper

- We analyze how incentives to underestimate credit risk reflect in credit ratings assigned by banks to their clients by ...
- ... testing for the capacity of credit ratings to predict financial default across different groups of banks: foreign, large domestic, small domestic.
- Link the results on changes in predictive capacity of credit ratings to incentives to underestimate credit risk.
Relation to the literature

- They report significant discrepancies between market value and banks’ valuation of real-estate related securities for the case of the US mortgage crisis.
- These differences attributed to the use of discretion over classification of mortgage-backed securities with the aim of inflating banks’ books.
- Our paper focuses on assessment of credit risk.
- First paper analysing the information content of credit ratings.
Plan of the talk

- Incentives for discretionary risk assessment
- Econometric methodology
- Main findings
- Robustness checks
- Conclusions
Incentives for discretionary risk assessment
Loan-loss Provisions Across Credit Ratings

<table>
<thead>
<tr>
<th>Credit rating</th>
<th>Loan-loss provisions in % of outstanding loans</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.6</td>
</tr>
<tr>
<td>B</td>
<td>3.2</td>
</tr>
<tr>
<td>C</td>
<td>13.6</td>
</tr>
<tr>
<td>D</td>
<td>41.4</td>
</tr>
<tr>
<td>E</td>
<td>80.6</td>
</tr>
</tbody>
</table>
## Incentives for discretionary risk assessment

Non-performing loans and coverage ratios across groups of banks

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Share of NPLs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Domestic Banks</td>
<td>2.8</td>
<td>3.3</td>
<td>6.6</td>
<td>16.5</td>
<td>26.7</td>
<td>33.2</td>
</tr>
<tr>
<td>Small Domestic Banks</td>
<td>2.3</td>
<td>3.5</td>
<td>7.1</td>
<td>11.7</td>
<td>19.2</td>
<td>26.4</td>
</tr>
<tr>
<td>Foreign Banks</td>
<td>2.1</td>
<td>3.9</td>
<td>6.6</td>
<td>8.7</td>
<td>9.0</td>
<td>11.9</td>
</tr>
</tbody>
</table>
Incentives for discretionary risk assessment

Summary

- Foreign banks had the weakest incentives to underestimate risk (access to funding through internal capital market, smaller burden of NPLs, better collateral).
- Small domestic banks at the opposite end of the specter (cut of from wholesale funding, weak owners, NPL burden).
- Large domestic banks in between (high NPL burden, but explicit state guarantee).
Test for discretion in credit risk assessment

Basic idea

• When assigning credit ratings banks dispose with publicly available (balance sheet and income statement data) and private information (relations with clients).
• An econometrician disposes only with publicly available data.
• Banks thus have an information advantage over an econometrician: credit ratings should be informative about the probability of default.
• We estimate two bankruptcy prediction models: one using credit ratings, the other using information from balance sheets and income statements.
• Compare classification accuracy of defaulted non-financial corporations in (1) time and (2) across groups of banks.
Test for discretion in credit risk assessment

Basic idea

- Prior expectations:
  - Time domain: As the crisis unfolds incentives to underestimate credit risk increase in general. We should observe a deterioration of classification accuracy of credit ratings relative to a pure financial info.
  - Cross-section domain: The deterioration of classification accuracy of credit ratings should be larger for those banks that have bigger incentives to underestimate risk.
Test for discretion in credit risk assessment

Data

- Over 18000 bank-firm observations per year in 2006 - 2012
- Non-financial corporations (over 80% of NPLs)
- Credit registry of the Bank of Slovenia: credit ratings, info on blocked transaction accounts
- Financial statements published by the Agency for public and legal records
Test for discretion in credit risk assessment

The Balance-Sheet Model

\[ Y_{it} = \begin{cases} 
1 & \text{if firm } i \text{ is } > 90 \text{ days overdue to at least one bank in } t \\
0 & \text{otherwise} 
\end{cases} \] (1)

\[ P(Y_{it} = 1|X_{it-1}) = \Lambda(\alpha + \beta X_{it-1}) = \frac{e^{\alpha + \beta X_{it-1}}}{1 + e^{\alpha + \beta X_{it-1}}} \] (2)

\( X_{it-1} \) contains financial ratios and sectoral dummies.
Test for discretion in credit risk assessment

The Credit-Ratings Model

\[ Y_{ijt} = \begin{cases} 
1 & \text{if firm } i \text{ is }> 90 \text{ days overdue to bank } j \text{ in time } t \\
0 & \text{otherwise} 
\end{cases} \] (3)

\[ P(Y_{ijt} = 1|R_{ijt-1}) = \Lambda(\delta + \gamma R_{ijt-1}) = \frac{e^{\delta+\gamma R_{ijt-1}}}{1 + e^{\delta+\gamma R_{ijt-1}}} \] (4)

\( R_{ijt-1} \) is a set of five dummy variables for each of the credit ratings from A to D.
## Comparison of classification accuracy

<table>
<thead>
<tr>
<th>Year</th>
<th>The Balance Sheet Model</th>
<th>The Credit Ratings Model</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall</td>
<td>Defaulters</td>
<td>Overall</td>
</tr>
<tr>
<td>2007</td>
<td>96.2</td>
<td>21.3</td>
<td>96.9</td>
</tr>
<tr>
<td>2008</td>
<td>95.2</td>
<td>17.3</td>
<td>96.0</td>
</tr>
<tr>
<td>2009</td>
<td>93.8</td>
<td>17.1</td>
<td>94.5</td>
</tr>
<tr>
<td>2010</td>
<td>93.8</td>
<td>28.2</td>
<td>93.8</td>
</tr>
<tr>
<td>2011</td>
<td>93.8</td>
<td>33.0</td>
<td>93.4</td>
</tr>
<tr>
<td>2012</td>
<td>93.3</td>
<td>34.7</td>
<td>92.9</td>
</tr>
</tbody>
</table>
Comparison of classification accuracy of firms in default

- The Balance Sheet Model
- The Credit Ratings Model

![Graph showing classification accuracy from 2007 to 2012](image)

2007: 21.3
2008: 19.3
2009: 17.2
2010: 17.0
2011: 28.0
2012: 33.2

2007: 13.9
2008: 10.2
2009: 9.2
2011: 16.0
2012: 19.9

35.1
Comparison of classification accuracy across groups of banks

- Banking System
- Large Domestic Banks
- Small Domestic Banks
- Foreign Banks
- The Balance Sheet Model
Main findings

• Precision of ratings in predicting default deteriorated in crisis and only gradually picked up:
  • In absolute terms
  • Relative to a benchmark logit model using standard publicly available financial ratios

• Credit ratings of foreign banks the most reliable in predicting default.

• Followed by large domestic banks.

• Small domestic banks the least reliable.

• Differences widened with the amplification of the crisis.

• In line with our hypotheses, smaller banks and banks without access to market funding, have the strongest incentives to underestimate risk in times of financial distress.

• Can explain findings of the comprehensive review about shortages of capital.
Robustness checks

- Controlling for updating of banks’ information set:
  - Rating changes
  - Public release of balance sheet and income statement data
- Forecast horizon
- Our basic conclusions remain valid.
Conclusions

• The paper tests for discretionary risk assessment in the Great recession in Slovenia.

• The comprehensive review subjected banks to external examination using common methodology.

• Results revealed significant shortages of bank capital that differed significantly across banks.

• Our empirical analysis show that differences can be linked to differences in the incentives banks had to underestimate credit risk.

• EA-wide comprehensive review in 2014: capital shortfalls significantly larger for smaller banks.
Policy implications

1. Regulation should pay attention to incentives to underestimate risk in times of financial turmoil.
   - Incentives to underestimate risk present also in case of advanced IRB systems.
   - Risks eventually materialize ⇒ prolonged financial crises, higher social cost (direct fiscal cost of bank bailout in Slovenia exceed 10% of GDP, 2 banks being closed down).
   - External control/provision of credit risk assessment.
2. Increasing capital requirements in times of financial distress may be counterproductive.

- Example: European Banking Authority required banks to hold at least 9% Core Tier 1 capital adequacy ratio by mid 2011.
- Our analysis shows that such a measure could have amplified the incentives to underestimate risk.
## The Balance Sheet Model - Estimates for Each Year Separately

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>log(Total sales)(_{it-1})</td>
<td>-0.275***</td>
<td>-0.157***</td>
<td>-0.136***</td>
<td>-0.096***</td>
<td>-0.111***</td>
<td>-0.095***</td>
</tr>
<tr>
<td>Age(_{it-1})</td>
<td>-0.022***</td>
<td>-0.038***</td>
<td>-0.050***</td>
<td>-0.046***</td>
<td>-0.040***</td>
<td>-0.043***</td>
</tr>
<tr>
<td>Quick ratio(_{it-1})</td>
<td>-0.142***</td>
<td>-0.093***</td>
<td>-0.159***</td>
<td>-0.218***</td>
<td>-0.226***</td>
<td>-0.159***</td>
</tr>
<tr>
<td>Debt-to-assets(_{it-1})</td>
<td>0.016**</td>
<td>0.006</td>
<td>0.072*</td>
<td>0.382***</td>
<td>-0.017</td>
<td>0.040</td>
</tr>
<tr>
<td>Cash flow ratio(_{it-1})</td>
<td>-0.319***</td>
<td>-0.232***</td>
<td>-0.136***</td>
<td>-0.276***</td>
<td>-0.441***</td>
<td>-0.326***</td>
</tr>
<tr>
<td>Asset turnover ratio(_{it-1})</td>
<td>-0.471***</td>
<td>-0.650***</td>
<td>-0.458***</td>
<td>-0.733***</td>
<td>-0.608***</td>
<td>-0.478***</td>
</tr>
<tr>
<td>No. of days with bl. ac.(_{it-1})</td>
<td>0.011***</td>
<td>0.011***</td>
<td>0.012***</td>
<td>0.012***</td>
<td>0.014***</td>
<td>0.014***</td>
</tr>
<tr>
<td>No. of bank-bor. rel.(_{it-1})</td>
<td>0.401***</td>
<td>0.376***</td>
<td>0.386***</td>
<td>0.381***</td>
<td>0.430***</td>
<td>0.497***</td>
</tr>
<tr>
<td>No. of observations</td>
<td>15751</td>
<td>16018</td>
<td>17572</td>
<td>18010</td>
<td>18193</td>
<td>18249</td>
</tr>
</tbody>
</table>

Source: Bank of Slovenia, AJPES, own calculations.

* \(p < 0.10\), ** \(p < 0.05\), *** \(p < 0.01\)
## The Credit Ratings Model - Estimates for Each Year Separately

<table>
<thead>
<tr>
<th></th>
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<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit rating $A_{ijt-1}$</td>
<td>-6.189***</td>
<td>-5.554***</td>
<td>-5.171***</td>
<td>-5.790***</td>
<td>-6.096***</td>
<td>-5.832***</td>
</tr>
<tr>
<td>Credit rating $B_{ijt-1}$</td>
<td>-4.779***</td>
<td>-4.220***</td>
<td>-4.206***</td>
<td>-4.666***</td>
<td>-4.940***</td>
<td>-4.677***</td>
</tr>
<tr>
<td>Credit rating $C_{ijt-1}$</td>
<td>-3.425***</td>
<td>-2.954***</td>
<td>-3.044***</td>
<td>-3.333***</td>
<td>-3.214***</td>
<td>-3.065***</td>
</tr>
<tr>
<td>Credit rating $D_{ijt-1}$</td>
<td>-1.900***</td>
<td>-1.901***</td>
<td>-1.920***</td>
<td>-2.242***</td>
<td>-2.413***</td>
<td>-2.112***</td>
</tr>
<tr>
<td>Constant</td>
<td>1.290***</td>
<td>1.177***</td>
<td>1.480***</td>
<td>1.946***</td>
<td>2.168***</td>
<td>1.948***</td>
</tr>
<tr>
<td>No. of observations</td>
<td>21275</td>
<td>21551</td>
<td>23974</td>
<td>24981</td>
<td>25258</td>
<td>25656</td>
</tr>
</tbody>
</table>

Source: Bank of Slovenia, own calculations.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Controlling for updating of banks’ information set

Effect of rating changes

- Data on credit ratings is on quarterly and even monthly frequency (after 2009).
- We can trace the timing of rating changes, which occur after banks update their information set.
- Imperfect cannot identify cases where information set updated but no corresponding rating change.
- Nevertheless, controlling for rating changes could improve the performance of the credit rating model.
Robustness checks

Controlling for updating in the banks’ information set - Correctly Classified Defaulters
Four Quarters Ahead Across Groups of Banks (in %)

(a) Banking System  (b) Large Domestic Banks
(c) Small Domestic Banks  (d) Foreign Banks
Controlling for updating of banks’ information set

Effect of public release of balance sheet data

• Balance sheet and income statement data released in March for past year
• Potential information advantage for the balance sheet model
• Compare models with forecast horizon displaced by 2 quarters
Controlling for updating of banks’ information set

Effect of public release of balance sheet data

(e) BS model $t+3$, CR model $t+1$

(f) BS model $t+4$, CR model $t+2$

(g) BS model $t+5$, CR model $t+3$

(h) BS model $t+6$, CR model $t+4$
Robustness checks

Controlling for forecast horizon

• Thus far we considered predicting default 1 year ahead
• Managing risk in a financial crisis requires prompt reaction
• We can check robustness also at shorter horizons
Robustness checks
Controlling for forecast horizon - correctly classified defaulters at horizons 1 to 4

(i) Banking System  (j) Large Domestic Banks

(k) Small Domestic Banks  (l) Foreign Banks