

Estimating Probability of Default and Comparing It to Credit Rating Classification by Banks

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Outline

Firms' Credit
Risk

M. Volk

Outline

Data

Econometric
approach

Results

Application

Conclusions

- Estimate default probability models
- Use models that fit the best in the application to credit rating classification
- The goal is to test if banks adequately assess firms' riskiness with credit ratings

Data

Three sources

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1 Balance sheet and income statement data

- liquidity
- profitability
- leverage, etc.

2 Data from credit register

- credit exposures
- credit ratings
- credit overdues, etc.

3 Macroeconomic and financial series

- GDP growth
- credit growth
- interest rate, etc.

Data for modeling PD

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- Firm i is in default if it's principal or interest payments are more than 90 days overdue in at least one bank in year t
- Yearly data at firm level
- Panel of non-financial firms from 2007 to 2010
- New borrowers are excluded
- Firm specific variables are restricted between 1st and 99th percentile

Econometric approach

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- The probability of default $\lambda_{it} = P(T_i = t | T_i > t - 1)$ is estimated using different specifications of the model:

$$P(Y_{it} = 1 | X_{it}, Z_t) = F(\alpha + \beta X_{it} + \gamma Z_t)$$

- Random effects probit model
- Measures for goodness of fit:
 - 1 Receiver operating characteristics (ROC) curve
 - 2 Brier score
 - 3 Pseudo R^2
 - 4 Likelihood ratio (LR) test

Results

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	(1)	(2)	(3)	(4)	(5)	(6)
Total sales	-0.019***	-0.018***	-0.018***	-0.018***	-0.018***	-0.019***
Firm age	-0.013***	-0.014***	-0.013***	-0.014***	-0.013***	-0.013***
Quick ratio	-0.036***	-0.041***	-0.036***	-0.035***	-0.034***	-0.036***
Debt-to-assets	0.560***	0.540***	0.554***	0.542***	0.547***	0.559***
Cash flow	-0.137***	-0.137***	-0.135***	-0.138***	-0.140***	-0.136***
Asset turnover r.	-0.278***	-0.270***	-0.274***	-0.271***	-0.274***	-0.277***
Account blockade	0.008***	0.007***	0.008***	0.007***	0.008***	0.008***
No. of exposures	0.379***	0.369***	0.375***	0.368***	0.371***	0.378***
2008	0.212***					
2009	0.173***					
2010	0.209***					
GDP growth		-0.011***				
GDP growth (t-1)					-0.038***	
NFC loan growth			-0.005***			-0.007***
NFC loan g. (t-1)					0.018***	
Interest rate				0.024***		0.046***
Quick r.*GDP gr.		0.006***			-0.001	
Constant	-2.635***	-2.403***	-2.414***	-2.401***	-2.654***	-2.381***
Observations	68444	68444	68444	68444	68444	68444
Pseudo R^2	0.096	0.095	0.095	0.095	0.095	0.096
Log. lik.	-8313.6	-8331.3	-8326.7	-8332.6	-8329.0	-8321.1
LR test	138.38	103.06	112.13	100.42	107.60	123.34
AUC	0.890	0.889	0.889	0.890	0.890	0.889
Brier score	0.029	0.030	0.029	0.030	0.030	0.029

Source: AJPES, Bank of Slovenia and own calculations.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Robust standard errors are used.

Application to credit rating classification

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- **Are credit ratings a reliable measure of firms' creditworthiness?**
- Link firms' PDs with all their relations to banks
- A particular firm represent the same level of risk to all banks
- Use estimated PDs from Model 1 and Model 6

Application to credit rating classification

PD vs. credit ratings

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Table: Number of firms according to the estimated PDs

PD	Credit Rating					Total
	A	B	C	D	E	
Model 1						
$PD \leq 1$	18641	7596	868	399	16	27590
$1 < PD \leq 5$	24621	15815	2296	808	57	43597
$5 < PD \leq 10$	5669	4727	1062	406	58	11922
$10 < PD \leq 25$	2992	2944	933	383	63	7315
$25 < PD \leq 50$	748	838	395	285	68	2334
$PD > 50$	202	368	334	504	178	1586
Model 6						
$PD \leq 1$	18519	7488	855	396	13	27271
$1 < PD \leq 5$	24776	15899	2317	815	62	43869
$5 < PD \leq 10$	5711	4784	1070	386	53	12004
$10 < PD \leq 25$	2949	2938	924	398	66	7275
$25 < PD \leq 50$	710	795	398	280	70	2253
$PD > 50$	208	384	324	510	176	1602
Total	52873	32288	5888	2785	440	94274

Source: Bank of Slovenia, own calculations.

Application to credit rating classification

Consistent rating standards?

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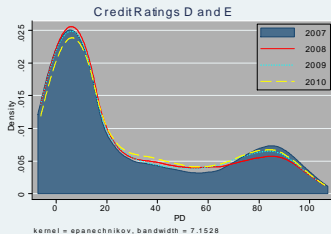
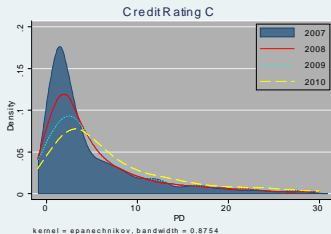
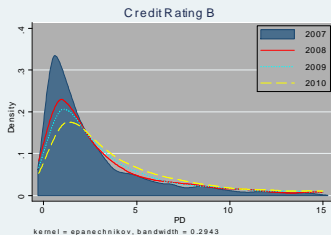
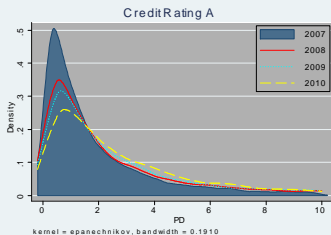
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Application to credit rating classification

Actual vs. predicted rating structure

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Table: Actual vs. predicted rating structure

	Actual		Model 1				Model 6			
			Cut-off 2007		Cut-off 2008		Cut-off 2007		Cut-off 2008	
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
A	55.39	54.28	39.54	36.87	56.41	54.67	43.88	37.37	53.79	47.64
B	34.25	35.88	45.33	48.39	33.28	35.40	42.81	48.00	35.23	40.53
C	7.07	6.39	8.83	8.75	6.58	6.53	7.64	8.70	7.06	7.92
D	3.03	3.17	5.55	5.33	2.96	2.73	4.99	5.26	3.10	3.07
E	0.27	0.28	0.76	0.66	0.76	0.67	0.68	0.67	0.82	0.85

Source: Bank of Slovenia, own calculations.

Notes: Only firms included in the models are taken into account.

Thank You for Your attention

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Link to the paper in EBR journal

<http://www.ebrjournal.net/ojs/index.php/ebr/article/view/178>