Measuring and Forecasting Financial Stability

Workshop by Deutsche Bundesbank and Technische Universität Dresden
Dresden, 15-16 January 2009

Natalja von Westernhagen
Deutsche Bundesbank

„Bank Ownership and Stability: Evidence from Germany“

Bank Ownership and Stability: Evidence from Germany

(joint work with Thorsten Beck (Tilburg University) and Heiko Hesse (IMF) and Thomas Kick (Deutsche Bundesbank))

Presentation by Natalja v. Westernhagen
Deutsche Bundesbank

A Workshop "Measuring and Forecasting Financial Stability", 15-16 January, Technische Universität Dresden, Dresden

In This Paper

- **We measure bank financial stability in three different ways:**
  - Z-Score – measure of distance from insolvency
  - Non-performing loans (NPL-Score) – measure of lending risk
  - Distress probabilities (PD-Score) – measure of probability of distress

- **Macroeconomic and bank-specific determinants of bank financial stability**

- **Comparison of financial stability across different banking groups**
  - Private banks (without big banks)
  - Savings banks (without Landesbanks)
  - Cooperative banks (without central institutions of cooperative banks)

- **Comparison of the impact of bank-specific variables across different banking groups**

Motivation

- **Germany – a unique „laboratory“ to explore bank stability across different ownership types.**
  - Public sector banks (savings banks and Landesbanks)
  - Cooperatives (cooperative banks and their central institutions)
  - Commercial banks (five big banks and private banks)

- **Profit maximization is not a primer goal for savings banks and cooperative banks (more than 75 percent of all German banks).**
  - The mandate of the savings banks is to foster the economic development of their regions.
  - Cooperative banks preserve capital endowment for future generations while maximizing consumer surplus for current members (better credit conditions, lower fees, higher deposit interest rates).

- **The banks face the same institutional, macroeconomic and similar financial safety net arrangements.**

Main Results

DEUTSCHE BUNDESBANK

- **Cooperative banks are more stable (Z-Score).**
- **Private banks are less stable (Z-Score, lending risk, probability of distress).**
- **Larger private banks are less stable.**
- **Larger cooperative and savings banks are actually more stable.**
- **Higher loan concentration results in higher fragility for cooperative banks but less fragility for savings and commercial banks.**

Theory (I) - Conflicting Predictions

- **Theory predicts that banks with large dominating shareholders – with easy control over management – tend to take more aggressive risks than manager-dominated banks with small disperse shareholdings (Jensen and Meckling,1976; Galai and Masulis, 1976; Esty, 1998).**
  - German savings banks have typically one dominating shareholder – the local or regional government – easy influence on management.
  - Cooperative banks have a disperse membership – influence on management is more difficult – lower risk taking.
  - Since shareholders of private banks focus on profit-maximization they are clearly more focused on risk taking than cooperative or state-owned banks.

Related Empirical Literature (I)

- **On Ownership and Stability:**
  - Government-owned banks are more risky (La Porta et al., 2002; Barth, Caprio and Levine, 2004, Ianotta, Nocera and Sironi, 2007)
  - Spanish commercial banks are more risky than savings banks (Garcia Marco and Robles Fernandez, 2008)
  - Commercial banks are more risky than cooperative banks (Cihak and Hesse, 2007)
  - Banks with larger shareholders are more risky (Saunders et al, 1990; Laeven and Levine , 2008)
- **Relationship between Bank Size and Stability Ambiguous**
  - Boyd and Runkle, 1993; Calomiris and Mason, 2000; Chong, 1991; Hughes and Mester, 1998, among others; De Nicolo, 2000; Mishkin, 1999
- **Relationship between Sectoral Concentration and Stability not Robust**
  - Winton, 1999; Archaya et al., 2006; Hayden et al., 2008

Data Set (I)

- **Data sources**
  - (1) Bundesbank database *BAKIS* – bank-specific variables
  - (2) Bundesbank distress database – bank probabilities of distress (PDs)
  - (3) Bundesbank borrowers' statistics – sectoral loan concentration of banks
  - (4) Bundesbank credit register – regional market concentration
  - (5) Federal Statistical Office and the Bank of International Settlements (BIS) – macroeconomic variables

- **Time period: 1995 – (currently) 2007**
  - We do not cover the current crisis period.

Data Set (II)

DEUTSCHE BUNDESBANK

- **Sample of 3,405 banks and 18,801 bank-year observations**
  - 2,598 cooperative banks (69% cooperative bank-year observations)
  - we exclude central institutions of credit cooperatives.
  - 588 savings banks (24% savings bank-year observations)
  - we exclude central institution of savings banks (Landesbanken).
  - 218 private banks (7% private bank-year observations)
  - we exclude big five private banks.

- **Bank mergers**
  - After a bank merger we create a new separate institution.
  - The two banks before the merger and the new institution after the merger are treated independently.

Z-Score

DEUTSCHE BUNDESBANK

Core capital („Tier 1”) plus Supplementary capital („Tier 2”)

$$Z = \frac{\dfrac{\text{Equity Capital}}{\text{Assets}} + ROA}{\delta_{ROA}}$$

Profitability

Volatility of the profitability

- The z-score has become a popular measure of bank soundness (Boyd and Runkle (1993); Beck and Laeven (2006); Laeven and Levine (2006); Hesse and Cihak (2007)).
- The z-score measures the number of standard deviations a return realization has to fall in order to deplete equity.
- A higher z-score implies a lower probability of insolvency risk.

Z-Score-modified

DEUTSCHE BUNDESBANK

Core capital („Tier 1”) plus Supplementary capital („Tier 2”)
plus Still (Hidden) Reserves

Profitability over RWA

$$Z = \frac{\dfrac{\text{Equity Capital}}{\text{RWA}} + RORWA}{\delta_{RORWA}}$$

RWA

RORWA-Volatility

- We set lower and upper bounds for the RORWA-Volatility within each banking group.
- To set the lower and upper bounds we focus only on banks with more than 8 bank-year observations.
- As lower and upper bounds we take the 1st and the 99th percentile within each banking group.
- We generate Z-Score at mid point.

Probability of Distress (PD)

- **Distress events consist of:**
  - compulsory notifications by banks about events that may jeopardize the existence of the bank as a going concern according to §29(3) of the German act (“KWG”)
  - notifications by banks of losses amounting to 25 percent of liable capital according to §24(1)5 KWG or a severe decline in bank’s return on equity
  - capital injections from the deposit insurance scheme
  - takeovers classified by the Bundesbank as restructuring mergers
  - enforced closures of banks initiated by the BaFin, which happened in Germany only for a few private banks but not for savings and cooperative banks

Decomposition of Z-Score, NPL-Score and PD-Score

	Z-score	Equity to RWA (percent)	RORWA	Standard Deviation of RORWA	NPL-Score	PD-Score
All banks	28.974	14.155	1.221	0.631	-2.837	-4.763
Private banks (P)	17.692	25.499	1.673	2.521	-2.672	-2.777
Savings banks (S)	25.198	13.391	1.330	0.623	-2.808	-5.741
Cooperative banks (C)	31.431	13.235	1.136	0.479	-2.863	-4.632
			Mean-comparison tests			
S vs. P	**-7.507*****	**12.109*****	**0.342*****	**1.898*****	**0.136*****	**2.964*****
Equality of means	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
C vs. P	**-13.739*****	**12.265*****	**0.536*****	**2.042*****	**0.191*****	**1.854*****
Equality of means	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
C vs. S	**-6.232*****	**0.156*****	**0.194*****	**0.144*****	**0.055*****	**-1.109*****
Equality of means	**(0.000)**	**(0.001)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**

The null hypothesis of equality of means in tested with the mean-comparison test (in Stata ttest). P-values in parentheses.

*, ** and *** indicate rejection of the null hypothesis at the 10, 5 and 1% significance levels respectively.

Methodology

- **Panel regressions**

$$Score_{i,t} = \alpha + \beta B_{i,t-1} + \gamma M_{i,t} + \delta_1 S_i + \delta_2 C_i + \varepsilon_{i,t}$$

- Score – Z-Score, NPL-Score or PD-Score
- B – vector of lagged bank characteristics
- M – vector of contemporaneous macroeconomic variables
- S – dummy variable for savings banks
- C – dummy variable for cooperative banks
- We run random effects with robust standard errors.
- We control for outliers.

Definition of Variables (I)

Proxy for Variables	Variable Name	Description	Source
		Bank-specific Variables	
Business Growth	**RWA Growth**	Growth of Risk-weighted Assets	BAKIS
Heterogeneity Across Banks in Size, Asset Structure, and Efficiency	**Bank Size**	Ln of Total Assets in Mio. EUR	BAKIS
	Risky Assets	Risk-weighted Assets to Total Assets	BAKIS
	Cost Efficiency	Cost-Income Ratio: General Administrative Expenses to Raw Result	BAKIS
Diversification	**Income Diversification**	One Minus the Square of Net Interest Income Divided by Total Net Revenue Plus the Square of Net Non-interest Income Divided by Total Net Revenue	BAKIS
	Sectoral Loan Concentration	HHI of Sectoral Loan Concentration	Borrowers Statistics
Regional Competition	**Regional Market Concentration**	Average Across Bank Concentration in Each State (Weighted by the Loan Exposure of the Bank in Each State)	Credit Register
Distress	**Distress Indicator**	Dummy that Takes on 1 when a Bank is Distressed in a Certain Year	Bundesbank Distress Database

Definition of Variables (II)

Proxy for Variables	Variable Name	Description	Source
		Macroeconomic Variables	
Business Climate	**Insolvency Rate, Bundesland Level**	Insolvent Firms as a Fraction of Total Firms on the State-level (Weighted by the Loan Exposure of the Bank in Each State)	Federal Statistical Office / Credit Register
	Real Asset Price Growth	Growth Rate of the BIS Aggregate Asset Price Index for Germany	Bank of International Settlements
Cost of Capital	**Real One-year Interest Rate**	One-year Government Bond Rate Minus CPI Growth Rate	Federal Statistical Office

* BAKIS is the Deutsche Bundesbank’s Prudential Database

Descriptive Statistics

Variable		Mean	Standard Deviation	25th Quantile	Median	75th Quantile	Min	Max
Z-Score	Share	28.97	11.91	20.48	26.27	35.11	2.78	68.09
Capital to RWA Ratio	Share	14.16	9.67	11.08	12.69	15.04	8.85	186.18
RORWA	Share	1.22	1.27	0.70	1.16	1.65	-11.88	14.83
Standard Deviation of RORWA	Standard Deviation	0.63	0.85	0.35	0.49	0.67	0.17	11.12
NPL-Score	Score	-2.85	0.62	-3.25	-2.81	-2.41	-5.03	-0.62
PD-Score	Score	-4.80	2.03	-5.95	-4.62	-3.50	-16.21	3.26
Bank Size	ln (Mio Euros)	5.49	1.25	4.50	5.40	6.39	2.53	9.34
Risky Assets	Share	61.17	11.18	54.74	61.99	68.51	15.23	98.69
RWA Growth	Growth Rate	3.00	8.00	-1.24	2.51	6.59	-40.65	70.04
Cost Efficiency	Share	64.72	10.83	58.90	64.38	69.81	29.23	176.46
Income Diversification	Share	32.45	6.89	28.15	32.48	36.94	3.53	49.86
Sectoral Loan Concentration	Share	25.12	11.43	19.74	21.82	25.68	16.80	100.00
Regional Market Concentration	Share	5.28	1.65	4.13	5.22	6.40	2.01	13.46
Insolvency Rate, Bundesland Level	Share	1.00	0.39	0.75	0.87	1.12	0.50	3.07
Real Asset Price Growth	Growth Rate	1.47	6.83	1.35	5.15	6.63	-10.65	6.99
Real 1 Year Interest Rate	Interest Rate	1.88	0.76	1.58	1.86	2.55	0.57	3.27
Private Banks Dummy	Dummy	0.07	0.26	0	0	0	0	1
Savings Banks Dummy	Dummy	0.24	0.42	0	0	0	0	1
Cooperative Banks Dummy	Dummy	0.69	0.46	0	1	1	0	1

Results

- **Regressions without interaction terms**
  - The differencies between banking groups according to Z-Score & dec., NPL-Score and PD-Score
  - The impact of bank-specific variables
  - The impact of macroeconomic variables

- **Regressions with interaction terms**
  - The differencies between banking groups in the impact of bank-specific variables
    - The impact of Bank Size
    - The impact of Sectoral Loan Concentration

Differencies Between Banking Groups (I)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	**Z-Score**	**Capital to RWA Ratio**	**RORWA**	**Standard Deviation of RORWA**	**NPL-Score**	**PD-Score**
Estimation Technique	**RE**	**RE**	**RE**	**OLS**	**RE**	**RE**
Bank-Specific Variables						
Savings Banks Dummy (S) (t-1)	**6.431*** **	**-10.078*** **	**-0.628** **	**-1.076*** **	**-0.303*** **	**-2.936*** **
	(1.534)	**(2.224)**	**(0.252)**	**(0.140)**	**(0.087)**	**(0.139)**
Cooperative Banks Dummy (C) (t-1)	**15.424*** **	**-13.212*** **	**-0.576** **	**-1.359*** **	**-0.293*** **	**-2.169*** **
	(1.586)	**(2.636)**	**(0.240)**	**(0.138)**	**(0.085)**	**(0.118)**
Constant	**23.673*** **	**36.668*** **	**6.790*** **	**1.694*** **	**-2.707*** **	**-1.904*** **
	(2.744)	**(5.675)**	**(0.684)**	**(0.377)**	**(0.204)**	**(0.369)**
R-squared-within	0.272	0.146	0.099		0.092	0.118
R-squared				0.490		
Number of banks	3405	3405	3405	3670	3214	3594
Observations	18801	18801	18801	3670	15582	19328
Test on Equality						
C vs. S	**8.994*** **	**-3.134*** **	0.053	**-0.282*** **	0.010	**0.766*** **
	(0.892)	**(1.025)**	(0.088)	**(0.046)**	(0.042)	**(0.112)**

* Significant at the 10% level, ** Significant at the 5% level, *** Significant at the 1% level.

Differencies Between Banking Groups (II)

- **Z-Score**
  - cooperative banks > savings banks > private banks
- **Capital**
  - cooperative banks < savings banks < private banks
- **Profitability**
  - (cooperative banks = savings banks) < private banks
- **Volatility of Profitability**
  - cooperative banks < savings banks < private banks
- **NPL-Score**
  - (cooperative banks = savings banks) < private banks
- **PD-Score**
  - savings banks < cooperative banks < private banks

Interpretation on Differencies Between Banking Groups (III)

- **Private banks are less stable than both cooperative and savings banks.**
  - Higher volatility of profits of private banks dominates the effect of higher capital and higher profits.
  - private banks face higher lending risk.
  - private banks face higher probability of distress (higher tail risk).

- **The result is consistent with the hypothesis:**
  - privately-owned financial institutions focus on higher return activities, even if it implies higher risks.

Interpretation on Differencies Between Banking Groups (IV)

- **Cooperative banks are - on average - father away from insolvency (Z-Score).**
  - This result on Z-Score is driven by the lower volatility of returns for cooperative banks.
- **The result is consistent with the stability-enhancing impact of:**
  - focus on capital endowment protection
  - consumer surplus maximization
  - disperse shareholdings
- **The result is consistent with the stability-reducing effect of:**
  - political interference into savings banks
  - stability-reducing effect of a large dominant shareholder
- **But cooperative banks seem to face a higher tail risk of actual distress (PD-Score).**

The Impact of Bank-Specific Variables (I)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	**Z-Score**	**Capital to RWA Ratio**	**RORWA**	**Standard Deviation of RORWA**	**NPL-Score**	**PD-Score**
Estimation Technique	**RE**	**RE**	**RE**	**OLS**	**RE**	**RE**
Bank-Specific Variables						
Bank Size (t-1)	0.591	**-1.437*** **	**-0.080** **	**-0.052*** **	0.012	**-0.169*** **
	(0.372)	**(0.506)**	**(0.036)**	**(0.018)**	(0.017)	**(0.032)**
Risky Assets (t-1)	**-0.177*** **	**-0.203*** **	**-0.028*** **	**-0.016*** **	**0.004*** **	**0.007** **
	(0.014)	**(0.033)**	**(0.003)**	**(0.002)**	**(0.001)**	**(0.003)**
RWA Growth (t-1)	**-0.082*** **	**-0.135*** **	-0.001	-0.002	**-0.008*** **	
	(0.008)	**(0.023)**	(0.004)	(0.009)	**(0.001)**	
Cost Efficiency (t-1)	-0.009	**0.093** **	**-0.044*** **	**0.020*** **	-0.001	**0.018*** **
	(0.007)	**(0.038)**	**(0.007)**	**(0.004)**	(0.001)	**(0.001)**
Income Diversification (t-1)	**0.164*** **	**0.057*** **	-0.000	**-0.008* **	**-0.009*** **	**-0.030*** **
	(0.013)	**(0.022)**	(0.004)	**(0.004)**	**(0.001)**	**(0.003)**
Sectoral Loan Concentration (t-1)	0.013	**0.169*** **	0.004	**0.017*** **	**-0.005*** **	**-0.008*** **
	(0.017)	**(0.059)**	(0.005)	**(0.004)**	**(0.002)**	**(0.003)**
Regional Market Concentration (t-1)	**0.121** **	-0.050	**0.029*** **	-0.002	**0.026*** **	**-0.032* **
	(0.056)	(0.053)	**(0.009)**	(0.007)	**(0.005)**	**(0.017)**

* Significant at the 10% level, ** Significant at the 5% level, *** Significant at the 1% level.

The Impact of Bank-Specific Variables (II)

- **Bank Size**
  - Z-Score (no); NPL-Score (no), PD-Score (reduces)
- **Risky Assets**
  - Z-Score (reduce); NPL-Score (increase), PD-Score (increase)
- **RWA Growth**
  - Z-Score (reduces); NPL-Score (reduces), PD-Score (no)
- **Cost Efficiency**
  - Z-Score (no); NPL-Score (no), PD-Score (increases)
- **Income Diversification**
  - Z-Score (increases); NPL-Score (reduces), PD-Score (reduces)
- **Sectoral Loan Concentration**
  - Z-Score (no); NPL-Score (reduces), PD-Score (reduces)
- **Regional Market Concentration**
  - Z-Score (increases); NPL-Score (increases), PD-Score (reduces)

The Impact of Macroeconomic Variables (I)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	**Z-Score**	**Capital to RWA Ratio**	**RORWA**	**Standard Deviation of RORWA**	**NPL-Score**	**PD-Score**
Estimation Technique	**RE**	**RE**	**RE**	**OLS**	**RE**	**RE**
Macroeconomic Variables						
Insolvency Rate, Bundesland Level	**-0.716*** **	**-0.808** **	-0.019		**0.212*** **	**0.239*** **
	(0.194)	**(0.381)**	(0.053)		**(0.022)**	**(0.063)**
Real Asset Price Growth	**0.125*** **	**0.043*** **	**0.010*** **		**-0.002*** **	**-0.033*** **
	(0.005)	**(0.010)**	**(0.001)**		**(0.001)**	**(0.001)**
Real 1 Year Interest Rate	**-1.543*** **	**-0.688*** **	**-0.139*** **		**-0.028*** **	
	(0.049)	**(0.084)**	**(0.015)**		**(0.007)**	

* Significant at the 10% level, ** Significant at the 5% level, *** Significant at the 1% level.

The Impact of Macroeconomic Variables (II)

- **Insolvency Rate, Bundesland Level**
  - Z-Score (reduces); NPL-Score (increases), PD-Score (increases)
- **Real Asset Price Growth**
  - Z-Score (increases); NPL-Score (reduces), PD-Score (reduces)
- **Real 1 Year Interest Rate**
  - Z-Score (reduces); NPL-Score (reduces)

The Impact of Bank Size (I)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	**Z-Score**	**Capital to RWA Ratio**	**RORWA**	**Standard Deviation of RORWA**	**NPL-Score**	**PD-Score**
Estimation Technique	**RE**	**RE**	**RE**	**OLS**	**RE**	**RE**
P*Bank Size (t-1)	**-2.406*** **	**-6.447*** **	-0.012	**-0.376*** **	**-0.235*** **	**-0.202*** **
	(0.600)	**(1.360)**	(0.153)	**(0.098)**	**(0.055)**	**(0.036)**
Savings Banks Dummy (S) (t-1)	**-13.862** **	**-63.281*** **	-1.012	**-3.938*** **	**-1.527** **	0.148
	(6.795)	**(14.154)**	(1.808)	**(1.345)**	**(0.684)**	(0.917)
S*Bank Size (t-1)	**1.296** **	0.107	**-0.126*** **	**-0.031*** **	-0.006	**-0.284** **
	(0.652)	(0.133)	**(0.025)**	**(0.011)**	(0.027)	**(0.118)**
Cooperative Banks Dummy (C) (t-1)	**-12.348** **	**-62.183*** **	**-3.310* **	**-4.605*** **	**-2.421*** **	**-3.802*** **
	(5.672)	**(14.143)**	**(1.796)**	**(1.337)**	**(0.662)**	**(0.561)**
C*Bank Size (t-1)	**3.394*** **	0.091	**-0.104*** **	**-0.035*** **	**0.091*** **	-0.048
	(0.407)	(0.064)	**(0.010)**	**(0.005)**	**(0.014)**	(0.044)
Constant	**41.403*** **	**79.935*** **	**7.548*** **	**5.643*** **	**-0.989**	**-2.336*** **
	(5.544)	**(14.121)**	**(1.792)**	**(1.336)**	**(0.644)**	**(0.322)**
R-squared-within	0.339	0.233	0.132		0.117	0.151
R-squared				0.613		
Number of banks	3405	3405	3405	3670	3214	3594
Observations	18801	18801	18801	3670	15582	19328

* Significant at the 10% level, ** Significant at the 5% level, *** Significant at the 1% level.

The Impact of Bank Size (II)

- **Z-Score**
  - private banks (negative); savings banks (positive); cooperative banks (positive)
- **Capital**
  - private banks (negative); savings banks (no); cooperative banks (no)
- **Profitability**
  - private banks (no); savings banks (negative); cooperative banks (negative)
- **Volatility of Profitability**
  - private banks (negative); savings banks (negative); cooperative banks (negative)
- **NPL-Score**
  - private banks (negative); savings banks (no); cooperative banks (positive)
- **PD-Score**
  - private banks (negative); savings banks (negative); cooperative banks (no)

Interpretation of Results on Bank Size (III)

- **Bank Size is negatively associated with distance from insolvency, with lending risk and with distress probability in the case of private banks.**
  - The result for Z-Score is driven by lower capitalization of private banks as they grow larger.
- **Larger private banks might benefit from the Too-Big-To-Fail phenomenon.**
  - Larger banks take on more risk relative to their capital than smaller banks.

The Impact of Sectoral Loan Concentration (I)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	**Z-Score**	**Capital to RWA Ratio**	**RORWA**	**Standard Deviation of RORWA**	**NPL-Score**	**PD-Score**
Estimation Technique	**RE**	**RE**	**RE**	**OLS**	**RE**	**RE**
P*Sectoral Loan Concentration (t-1)	**0.056*** (0.021)**	**0.320*** (0.096)**	0.005 (0.010)	**0.026*** (0.006)**	-0.001 (0.003)	-0.002 (0.002)
Savings Banks Dummy (S) (t-1)	**-13.862** (6.795)**	**-63.281*** (14.154)**	-1.012 (1.808)	**-3.938*** (1.345)**	**-1.527** (0.684)**	0.148 (0.917)
S*Sectoral Loan Concentration (t-1)	**0.155*** (0.034)**	**0.116*** (0.016)**	**-0.008** (0.004)**	0.002 (0.003)	-0.001 (0.003)	**-0.093*** (0.018)**
Cooperative Banks Dummy (C) (t-1)	**-12.348** (5.672)**	**-62.183*** (14.143)**	**-3.310* (1.796)**	**-4.605*** (1.337)**	**-2.421*** (0.662)**	**-3.802*** (0.561)**
C*Sectoral Loan Concentration (t-1)	**-0.051** (0.021)**	**-0.019** (0.008)**	**0.008*** (0.001)**	**0.002*** (0.001)**	**-0.008*** (0.002)**	0.006 (0.006)

* Significant at the 10% level, ** Significant at the 5% level, *** Significant at the 1% level.

The Impact of Sectoral Loan Concentration (II)

- **Z-Score**
  - private banks (positive); savings banks (positive); cooperative banks (negative)
- **Capital**
  - private banks (positive); savings banks (positive); cooperative banks (negative)
- **Profitability**
  - private banks (no); savings banks (negative); cooperative banks (positive)
- **Volatility of Profitability**
  - private banks (positive); savings banks (no); cooperative banks (positive)
- **NPL-Score**
  - private banks (no); savings banks (no); cooperative banks (negative)
- **PD-Score**
  - private banks (no); savings banks (negative); cooperative banks (no)

Interpretation of Results for Concentration (III)

- **Sectoral loan concentration is stability-enhancing for private and savings banks.**
  - Herfindahl-index is on average of 21.6 for savings banks.
  - Herfindahl-index is on average of 48.1 for private banks.
  - Positive impact is driven by higher capitalization (as compensation for higher risk).

- **In the case of relatively riskier banks (private banks) higher loan diversification might lead to more risk taking and higher fragility (expanding into new segments).**

- **Sectoral loan concentration is stability-reducing for cooperative banks.**
  - Herfindahl-index is on average of 23.9 for cooperative banks.
  - Negative impact is driven by higher volatility.

- **Higher diversification results in better risk diversification possibilities and thus lower profit volatility.**

Conclusions (I)

- Cooperative banks are farthest away from insolvency.
- Savings banks are the least likely to fail.
- Private banks are closest to insolvency, have highest lending risk, and are most likely to fail.
- Larger private banks are less stable (they have less capital relative to their risk) – suggesting Too-Big-To-Fail problem.
- Larger cooperative and savings banks are actually more stable.
- Higher loan concentration results in higher fragility for cooperative banks but less fragility for savings and commercial banks.

Conclusions (II)

- **Our findings are consistent with findings by Cihak and Hesse (2007).**
  - For a sample of European countries - cooperative banks are more stable than banks of other ownership types.

- **Cooperative banks are subject to a certain degree of tail risk in form of a higher distress probability than savings banks.**

- **Our findings provide empirical support in favour of the Too-Big-To-Fail notion for private banks.**
  - This explains the closer proximity to insolvency and
  - lower distress probability.