Capital Structure and Bank Risk Taking--- The Case of German Banks in 1895-1933

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Introduction

- The heavy use of debt financing by commercial and investment banks had been hypothesized to cause the credit crisis in 2007-2008[1]. To lower future risk in the banking system, Basel III was developed to restrict bank leverage and strengthen bank liquidity requirements. Meanwhile, some argue that the mere imposition of minimum thresholds on capital and liquidity is insufficient for reducing bank risk[2].
- This research collects balance sheet data of German banks during 1895-1933 from a manual of German share companies[3] to study the relationship between capital structure and bank risk.
- The fixed effects models show that banks do exercise more prudence under a higher capital ratio. This, however, does not reduce the risk that is eventually faced by banks. There appears to be a gap between the level of risk that banks pursue and the level of risk that remains in the system.

Methodology

- Fixed effects regressions are chiefly used to investigate the association between capital-to-asset ratio and bank risk taking.
- Capital includes ordinary shares, preference shares, share premium, and other reserves but excludes profit/loss for the current fiscal year.
- How risky a bank behaves is measured by its liquidity condition and asset growth rate, assuming that banks that are risk-seeking tend to back their current liabilities with less amount of current assets and are more eager to grow their businesses.
- Variability of profit over years is this study's ultimate measurement of bank risk since profit is the operating result of a bank and variability is a common measurement of risk in finance.

Sample

- *Handbuch der Deutschen Aktien-Gesellschaften*[3] was an annual publication that attempted to record detailed balance sheet data of all public and private share companies registered in Germany at that time. For the purpose of this research, only banks located in contemporary Germany are studied.
- Balance sheet data of 1552 German banks during 1895-1933 were extracted from the *Handbuch*, giving a total of 13168 observations. Data include not just aggregate asset, liability, and capital, but also individual items such as cash holdings and deposits from customers.
- As data cleaning process is still on-going and 1923 data are heavily skewed by hyperinflation, only 1054 banks (5973 observations, spreading across all years of 1895-1933 except year 1923) whose asset and liability balances are 95% accurate are actually used as sample
- To obtain a more balanced panel for the fixed effect models, 70 banks that appear continuously during 1904-1913 (700 observations) are sub-sampled. This is the largest number banks over the longest continuous panel that can be obtained. All models are run on both the sample and the sub-sample.

Models

1. $CR_{it} = \beta_0 + \beta_1 CAR_{it} + \beta_2 EV_t + \beta_{3\ldots17} State_i + a_i + u_{it}$
2. $AG_{it} = \beta_0 + \beta_1 CAR_{it} + \beta_2 GDP_t + \beta_{3\ldots17} State_i + a_i + u_{it}$
3. $\ln(PV_{it}) = \beta_0 + \beta_1 CAR_{it} + \beta_2 \ln(TA_{it}) + \beta_3 EV_t + \beta_{4\ldots18} State_i + a_i + u_{it}$

- CR = Current Ratio=Current Assets/Current Liabilities
  - liquidity measurement
- AG = Annual Percentage of Asset Growth
- PV = Profit Variability $=|(Profit_t - Profit_{t-1})/Profit_{t-1}|$ X 100
- CAR = Capital Ratio= (Capital/Total Assets) X 100
  - chief independent variable of interest
- TA = Total Assets
  - due to ability to diversify, larger firms face less variability in profit[4]
- GDP = Real GDP Growth Rate[5]
- EV = Variability in Economy = $|$Real GDP Growth Rate$_t$ - RGDP Growth Rate$_{t-1}|$
- State = Dummy Variables for 15 States of Germany
  - representing different industry conditions in different locations
  - 16 states in contemporary Germany: Berlin as the reference group
  - only appear in OLS of the large sample because it is time-invariant and the counts for each state is too few in the sub-sample
- Log is taken for PV and TA to get normal distributions

Results

1. Regressions of Current Ratio (Liquidity Measurement)

Model	OLS	FE	OLS_Sub-sample	FE_Sub-sample
Capital Ratio	.03924542***	.04759162***	.04156522***	.02886331***
EconomyVar	-.01083225**	-.005806	.01679674	.00619731
State#	(skipped)			
_cons	.94351359***	.33432035***	.61823189***	.87365234***
R-Squared	.15767296	.10798781	.08782394	.02696685
Adjusted R2	.1549929		.08508878	
Within R2		.10798781		.02696685
Between R2		.15051734		.07198405
Overall R2		.14406925		.08781541
no.Banks	954	954	68	68
no.Obs	5361	5361	670	670
avg.Obs/Bank		5.6194969		9.8529412

2. Regressions of Asset Growth

Model	OLS	FE	OLS_Sub-sample	FE_Sub-sample
Capital Ratio	-.24537432***	-.94091167***	.05769167*	-.07927535
RGDP Growth	1.2009515***	1.337627***	-.9997986***	-1.0543959***
State#	(skipped)			
_cons	37.747559***	38.704922***	6.7762478***	9.5874262***
R-Squared	.00948509	.01618376	.01711518	.01574892
Adjusted R2	.00438089	-.21728905	.01412769	-.10289595
Within R2		.01618376		.01574892
Between R2		.00775585		.06045994
Overall R2		.00353321		.00001344
no.Banks	635	635	70	70
no.Obs	3317	3317	661	661
avg.Obs/Bank		5.223622		9.4428571

3. Regressions of Log of Profit Variability

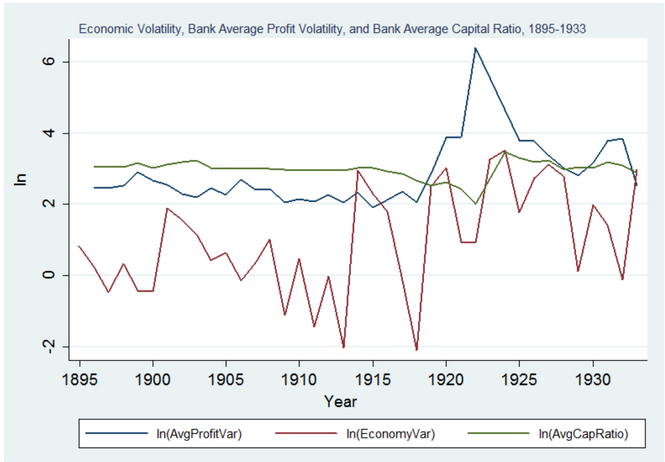
Model	OLS	FE	OLS_Sub-sample	FE_Sub-sample
Capital Ratio	.0034756**	.00181567	-.00616386	.00168262
ln(TA)	-.12803006***	-.23387014***	-.08569052***	-.49041221
EconomyVar	.04490409***	.01409008*	-.0361565	-.06267962
State#	(skipped)			
_cons	4.6381819***	5.925437***	3.6378147***	9.5353869*
R-Squared	.06634924	.01495048	.01463281	.00411652
Adjusted R2	.06062132		.00954486	
Within R2		.01495048		.00411652
Between R2		.08695846		.03922553
Overall R2		.03370633		.01066816
no.Banks	597	597	65	65
no.Obs	2953	2953	585	585
avg.Obs/Bank		4.9463987		9

legend: * p<.1; ** p<.05; *** p<.01

#States are confounding variables in OLS models and their coefficients are not displayed here. All significant coefficients are negative: Saxony, Rhineland-Palatinate, Lower Saxony, and Schleswig-Holstein are significant in all three OLS models; other states like Brandenburg, Thuringia, and Bavaria are significant in one or two of the models; only the state Hesse has no significant coefficients in any of the three models.

Discussion

- As capital ratio increases, banks hold more current assets against current liabilities (meaning a better liquidity position) and are more cautious to grow. Both measures show that banks pursue less risk when they are financed more by equity.
- Capital ratio is not significantly associated with profit variability after unobserved heterogeneity is taken out.
- Although capital structure has an effect on bank risk-seeking behaviors, the final resulting bank risk seems to be affected rather more by macro-economic fluctuations.



- Models run on the sub-sample tend to show no significant results, and in the case of asset growth, show significant results that are contradictory to models run on the entire sample. Hausman tests indicate that random effects should be used over fixed effects in all the three regressions on the sub-sample; the tests show that fixed effects are rightly chosen for all the three regressions on the entire sample.

Implications & Further Research

- Ever since the financial crisis, much blame has been placed on the misdemeanors of banks in leading to the credit crunch; as such, institutional reconstruction focuses on tightening bank regulations on capital structure and liquidity. But this research shows that bank risk is perhaps more a result of the instability in the larger economic system.
- Benchmark interest rates in the U.S., the federal fund rate for instance, went through 4-5 cycles of ups and downs in the twenty years before the financial crisis---ending low right before[6] whereas interest rates' trends were much more persistent before 1982.[7] Such medium-run interest rate instability may have effects on bank risk much like the volatility of economic growth rate.
- To test this hypothesis in the German banks sample, benchmark interest rate needs to be added to the model on profit variability. Question arises on how to determine such benchmark as there maybe wider interest rate spreads in different regions of Germany back then.
- Regional differences are significantly associated with bank risk-taking measurements and profit variability. It remains to find out what exactly the regional differences are (e.g. different bank regulations perhaps) and then include those factors, instead of just the geographical locations, in the models.

References & Acknowledgements

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