Competition and the riskiness of banks' loan portfolios

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♣ The views expressed in this presentation do not necessary represent the official positions of the Norwegian Competition Authority.

Motivation

- Banks serve an important role in the economy
  - Intermediaries of transactions
  - Offer credit to borrowers
  - Accept and manage deposits from the public

- Ensuring a stable banking system is crucial for financial stability

- Does competition between banks lead to more or less stability?

- We address the questions raised theoretically by focusing on banks risk taking on the borrower side, and empirically using a panel from the Norwegian banks industry covering 23 years.

Existing Literature (a rather incomplete and selective overview)

Competition-fragility (started by Keeyley, 1990); Increased competition has a negative effect on banks' profit margins and therefore reduces the "franchise value" - the market value beyond the banks' book values - and this reduction in franchise value causes an increase in banks' risk taking.

Hellmann *et al.* (2000) competition in the deposit market increases the moral hazard incentives of banks. As a result, competition gives banks incentives to increase their risk exposure and gamble with the depositors' money (see also Matutes and Vives; 2000)

If the banks' credit screenings are independent of each other and the judgment errors being made differ across banks, the amount of loan applicants being approved by at least one bank will increase with the number of banks (Broecker, 1990). (see also; Shaffer, 1990).

The competition-stability view (Boyd and De Nicolo (BDN, 2005)); the *risk shifting*-effect; with higher interest rates the values of the borrowers' projects decrease. Low levels of banking competition therefore increase the riskiness of the borrowers (see also Martinez-Miera and Repullo, 2010). These latter ones find a non-monotonic relationship between risk and competition.

The "too big to fail"-hypothesis (Mishkin, 1999); banks will be more risk seeking, knowing that negative consequences will be covered by the government. In a more fragmented banking market, the problem of excessive risk taking due to banks being "too big to fail" will be reduced.

Empirical studies;

Berger *et al*. (2008); (23 developed countries); banks with higher market power have less overall risk exposure and higher loan portfolio risk

Tabak *et al*. (2012) (10 Latin American countries); a significant non-linear relationship, but unlike other studies the estimated coefficients indicate that both high and low competition increase financial stability.

Jiménez *et al*. (2013) (Spanish banking market); find support of a non-linear relationship when using market concentration indexes in the loans market as competition measures. (However, when using Lerner indexes the results for the loans market are more in support of the original franchise value hypothesis.)

The empirical literature on banks' risk-taking and competition is inconclusive. Results vary with different measures of competition and risk.

Our contribution to the question about the relationship between competition and risk

Theoretical model:

Focusing on the borrower side.

The banks' overall risk taking on the borrower sided is endogenous (note: BDN2005 focus on behavior of the borrowers, not the banks).

The banks serve first the low-risk borrowers. Then it is shown that a higher margin on lending will give incentives to serve one more borrower. Thus dampening price competition (higher margins) will lead to more risk-taking by the banks. => Dampened competition leads to less stable banking industry.

Empirical testing;

Using a panel of more than 150 Norwegian banks over 20 years show a non-monotonic relationship between competition and the riskiness of banks' loan portfolios.

We find a U-shaped relationship between concentration and non-performing loan rates (decreasing and then increasing). The findings suggest that a continued increasing trend in concentration contributes to higher non-performing loan rates. Similar results are found when using interest margin as the measure of the toughness of competition.

Outline of the talk

Intro

Theoretical Model

Data

Econometric specification and estimation techniques

Econometric Approach

Empirical results

Summary

Theoretical Model

$$\underset{Q}{Max}\,\pi = p\big(Q\big)\cdot Q\cdot r - Q\cdot C \tag{1}$$

where

- $p(.)$ - the probability of **success** for the project the borrower asks the bank to finance ($0 < p < 1$)
- Q - the number of borrowers
- r - the price on a loan (all borrowers pay the same price r (uniform price))
- C - the bank's unit cost

It is assumed that $p(Q)$, and that $p' < 0$ (prob. for success for the next borrower the bank finances is decreasing in the nbr. of borrowers that are accepted by the bank, i.e. the bank accepts first borrowers with a high probability of success – a simple way of including adverse selection)

First order condition

Optimal risk exposure by the bank:

$$p^* = \frac{C - Q^* \cdot r \cdot p'}{r} \left(= \frac{C}{r} - Q^* \cdot p' \right) \tag{2}$$

Higher cost C will lead to fewer accepted borrowers and therefore less risk on the last borrower being accepted.

The argument in the parenthesis shows that a higher margin will give incentives to serve one more borrower (which is riskier). => dampening price-competition (seen as higher r/C ratio) may lead to more risk-taking (seen as lower prob. of success) and less stable banking industry.

From (2), the following relationship occurs:

$$\frac{\partial p^*}{\partial r} = -\frac{C}{r^2} < 0 \qquad (3)$$

A higher price r paid by the borrowers will lead to a lower p, *i.e.*, a higher risk on the last borrower being accepted. The bank accepts a larger number of borrowers, because it earns a higher margin on each borrower.

This illustrates that dampened price competition can lead to more risk taking by banks.

Dampening the competition on prices, for example due to the establishment of collusion in the industry, will lead to more intense effort on attracting borrowers (so-called semi-collusion; firms collude in one (or several) choice variable(s) and compete in other)

Data

- Norwegian banks
- Unbalanced panel with a total of 171 banks over the period 1992Q1 to 2014Q4 (final dataset 1995Q1-2014Q4)
- Initial sample starts in the last phase of the Norwegian banking crisis, exclude years 1992-1994 from the sample
- Balance sheet information of all banks operating in Norway, reported to Statistics Norway
- Include banks with eight or more consecutive observations
- The number of banks varies from 136 to 156
- A total of 11502 observations

Dependent variable

Non-performing loan rate:

$$NPLrate_{i,t} = \frac{Non\text{–}perfoming\ loans_{i,t}}{Total\ loans_{i,t}} * 100$$

A loan is considered non-performing when interest and principal payments have not been paid on time.

Competition measures

C5-index, the sum of the combined market shares of the five largest banks in loans market.

$$C5_t = \frac{\sum_{i=N-4}^{N} Total\ loans_{i,t}}{\sum_{i=1}^{N} Total\ loans_{i,t}} * 100$$

Herfindahl-Hirschman index (*HHI*);

$$HHI_t = \sum_{i=1}^{N} Marketshare_{i,t}^2$$

HHI has a range of $\frac{1}{N}$ – all have equal market shares, to 1 – one bank has the entire market.

IRmargin; The difference between the average interest rate charged on loans and banks' funding cost (proxied by the 3-month NIBOR (Norwegian Inter Bank Offer Rate))

$$IRmargin_{i,t} = (4 \cdot \frac{Interest\ income_{i,t}}{Total\ loans_{i,t}} - NIBOR_t) * 100$$

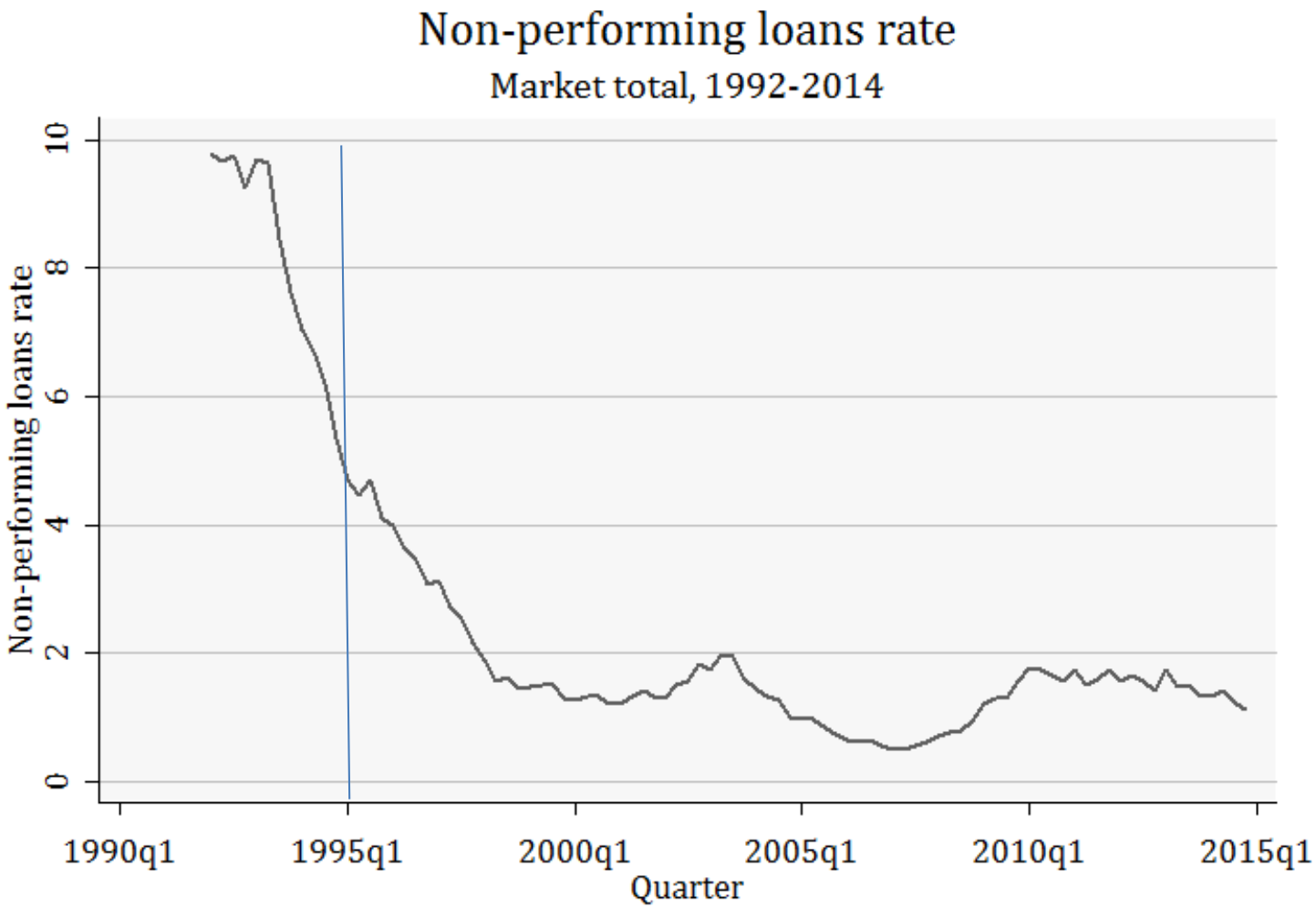
where the ratio is multiplied by 4, to be able to interpret *IRmargin* in yearly percentages.

Control variables
GDPgrowth: change in GDP from one quarter to the next for mainland Norway (seasonally adjusted by Statistics Norway)
ROA; return on assets – a proxy for the profitability of the bank.
Marketshare: a bank's market share in the loans market.
Equityratio; equity over total assets.
Quarterly- and yearly dummies

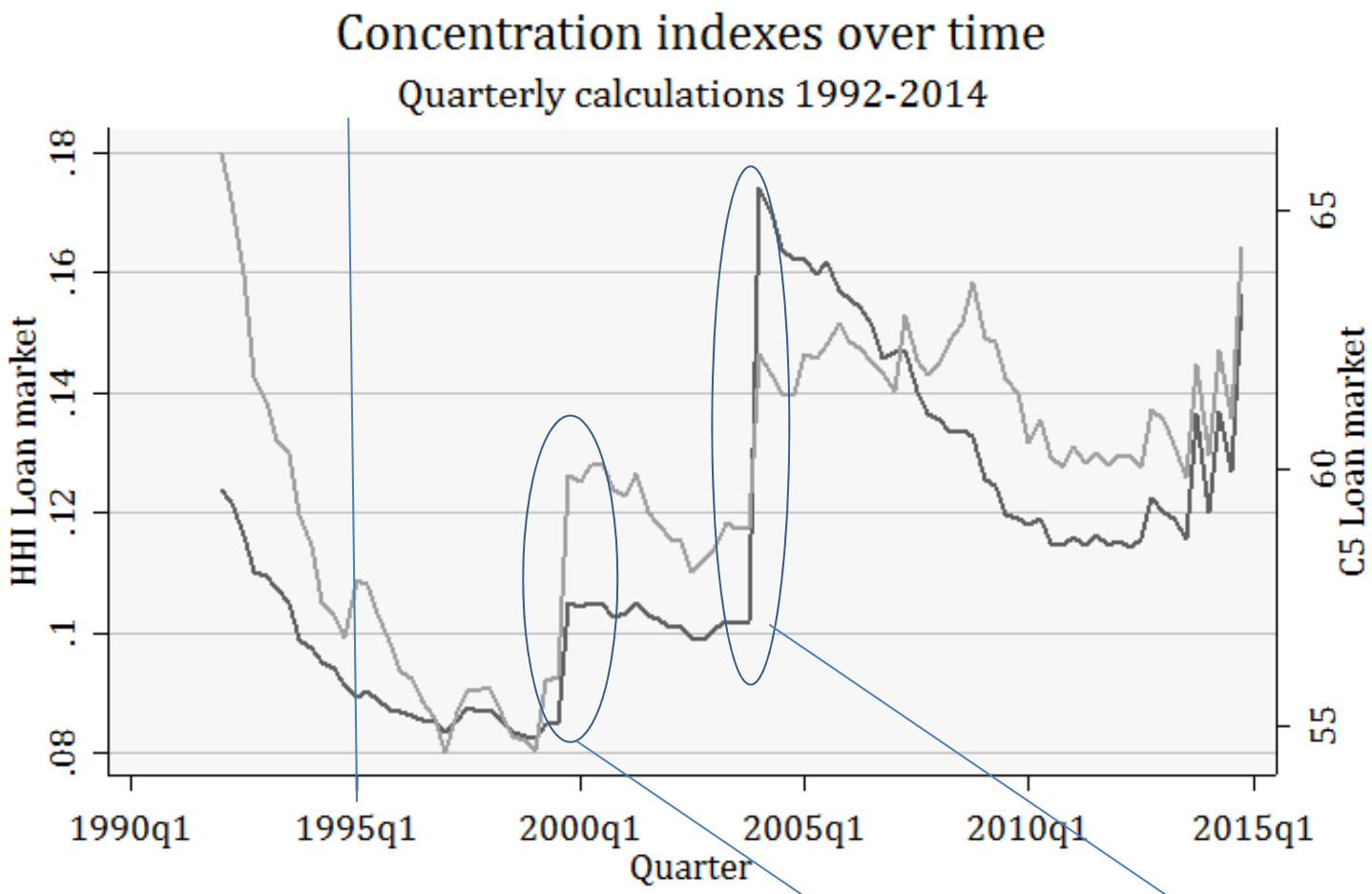
Table 1: Summary statistics for regression variables

	Mean	Observations	Median	Min	Max	St. dev
Dependent variable						
NPLrate	2.057	11502	1.44	0.0003	25.5	2.089
Competition variables						
C5	59.5	11502	60.1	54.5	64.3	2.554
HHI	0.12	11502	0.11	0.08	0.17	0.025
IRmargin	2.6	11502	2.5	-3.5	17.3	1.635
Control variables						
GDPgrowth	0.726	11502	0.61	-2.28	4.23	0.989
ROA	0.297	11502	0.29	-4.66	6.09	0.294
Marketshare	0.695	11502	0.09	0.0022	36.9	2.721
Equityratio	10.38	11502	9.81	-11.8	64.1	3.997

Notes: The statistics are based on observations in the sample from regressions in Tables 2-4.

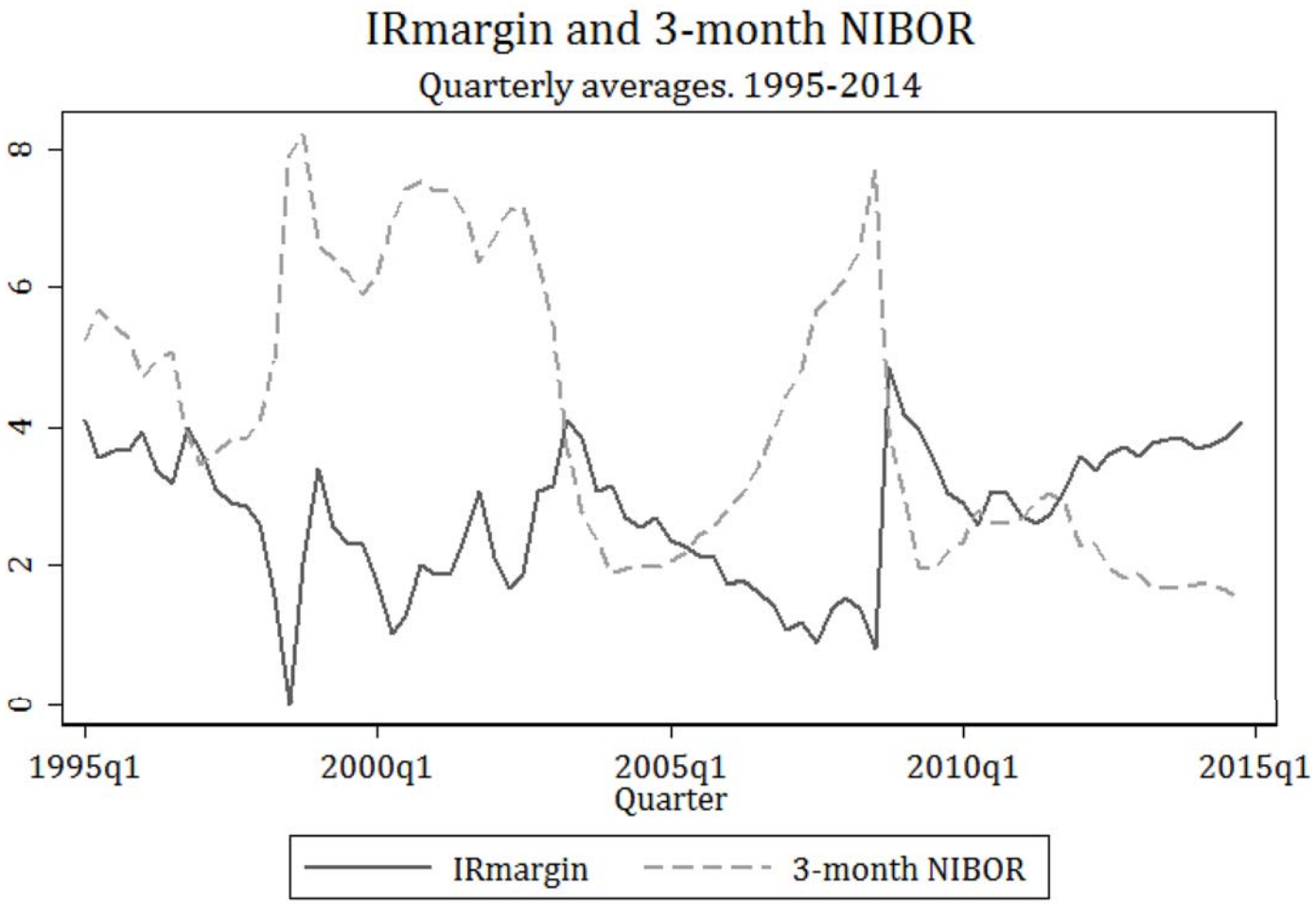


Note: EU average 5.7% while Norway 1% (March 2016)



DnB Gjensidige (2 largest banks)

DnB Postbanken



Note: NIBOR is the main component of marginal funding.

Econometric specification, and estimation techniques

$NPLrate_{i,t}$ - the ratio of non-performing loans to total loans (a risk proxy)

$$NPLrate_{i,t} = \beta_0 + \beta_1 Competition_{i,t} + \beta_2 Competition_{i,t}^2 + \sum_{n=1}^{M} \kappa_n \left(Controls_{i,t,n}\right) + \sum_{j=1}^{2} \gamma_j \left(NPLrate_{i,t-j}\right) + \varepsilon_{i,t} \quad (4)$$

Note: (i) allow for a nonlinear relationship between risk and competition, (ii) four lags of dependent variable to account for persistency in non-performing loans.

Estimated with

- WG (within group)
- IV(instrumental variable)
- GMM (one-step)

Empirical results

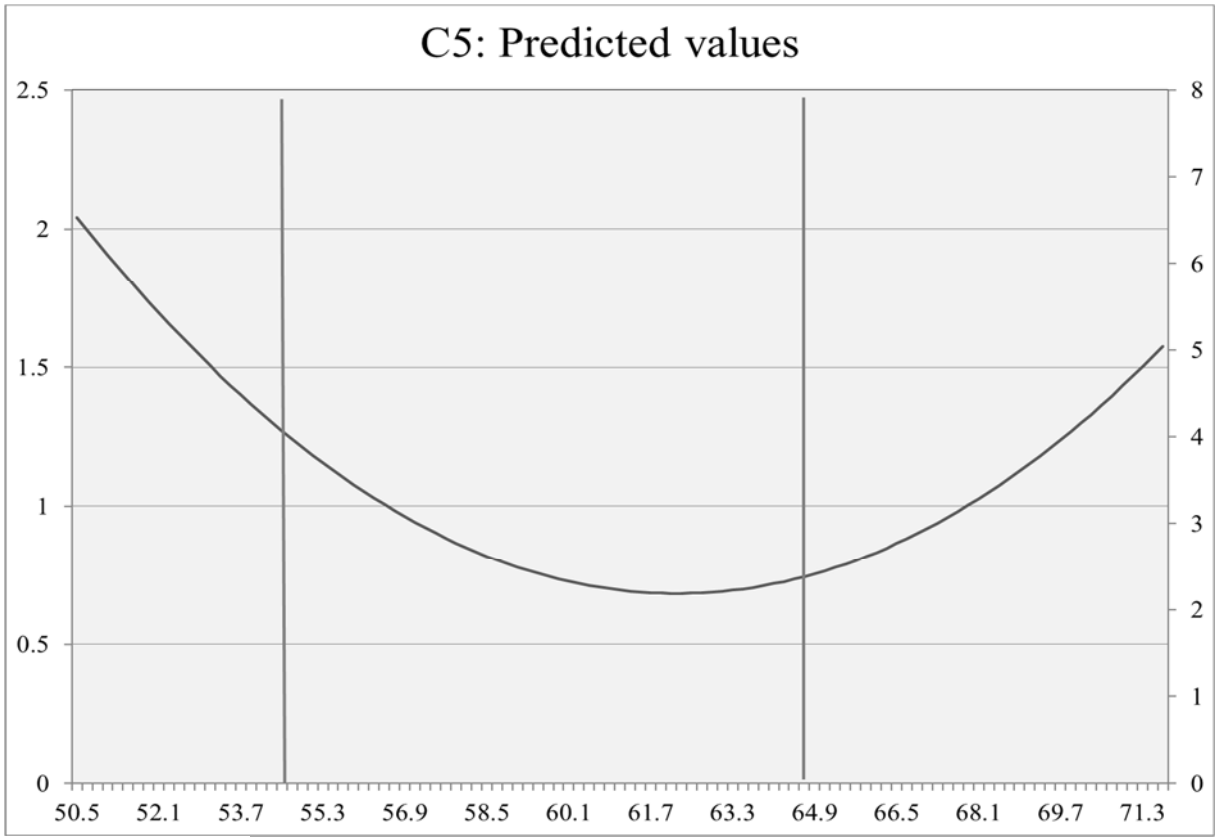
Table 2 - Regression with *C5* as competition proxy

Variables	(1)WG	(2) IV-REG	(3) GMM
C5	-1.4504***	-0.8925***	-1.2318***
	(0.2840)	(0.3164)	(0.3303)
C5-squared	0.0116***	0.0070***	0.0099***
	(0.0023)	(0.0026)	(0.0027)
L1.NPLrate	0.5267***	0.5259***	0.4446***
	(0.0274)	(0.0426)	(0.0344)
L2.NPLrate	0.2231***	0.1613***	0.1195***
	(0.0216)	(0.0298)	(0.0263)
L1.GDPgrowth	-0.0309***	-0.0249**	-0.0204*
	(0.0116)	(0.0121)	(0.0112)
Some coeff. estimates excluded from table			
Observations	11502	11502	11502
1st order AC - m1			-7.648
2nd order AC - m2			-1.918
Hansen test			0.000

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

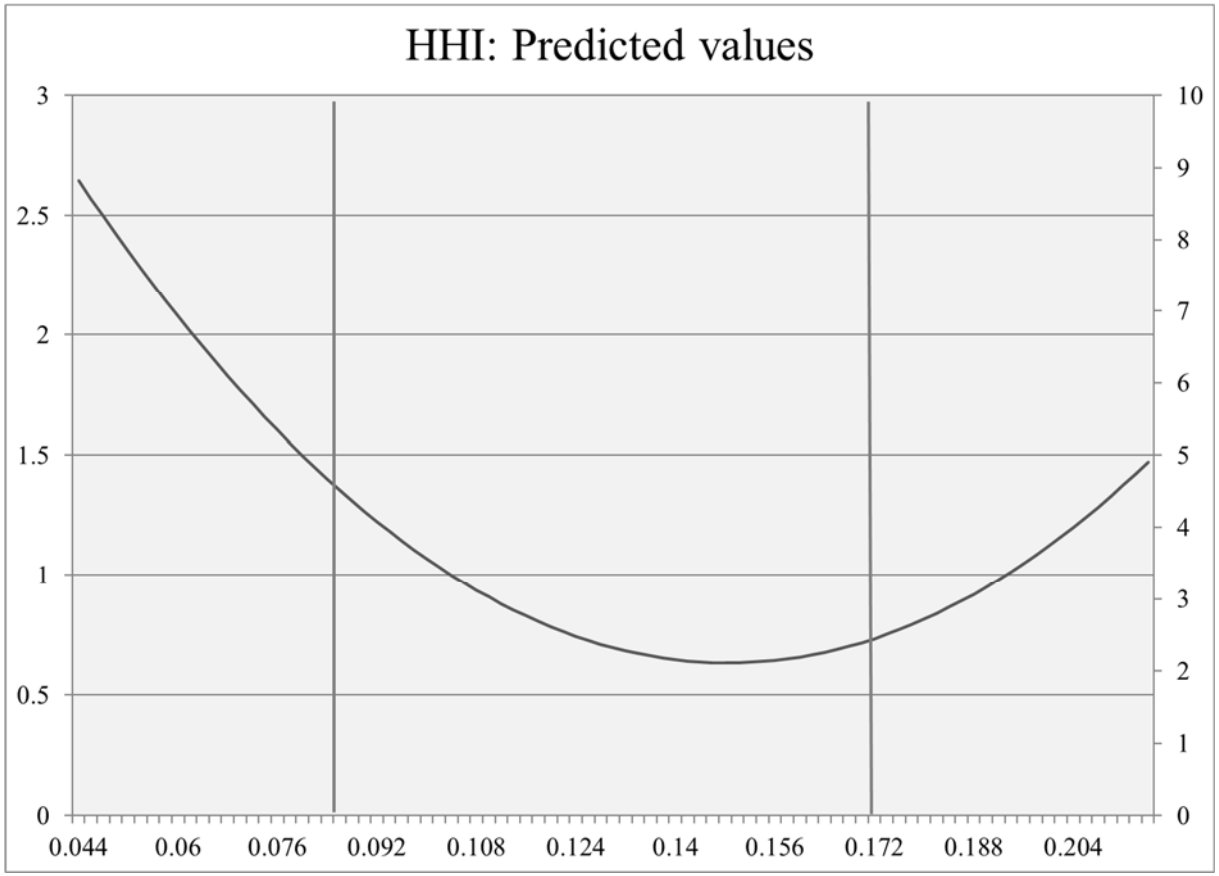
Based on column (3) estimation results



Higher comp. ← → Lower competition

A *U*-shaped relationship between concentration and the riskiness of the banks' loan portfolios.

The HHI predictions confirm the C5 predictions

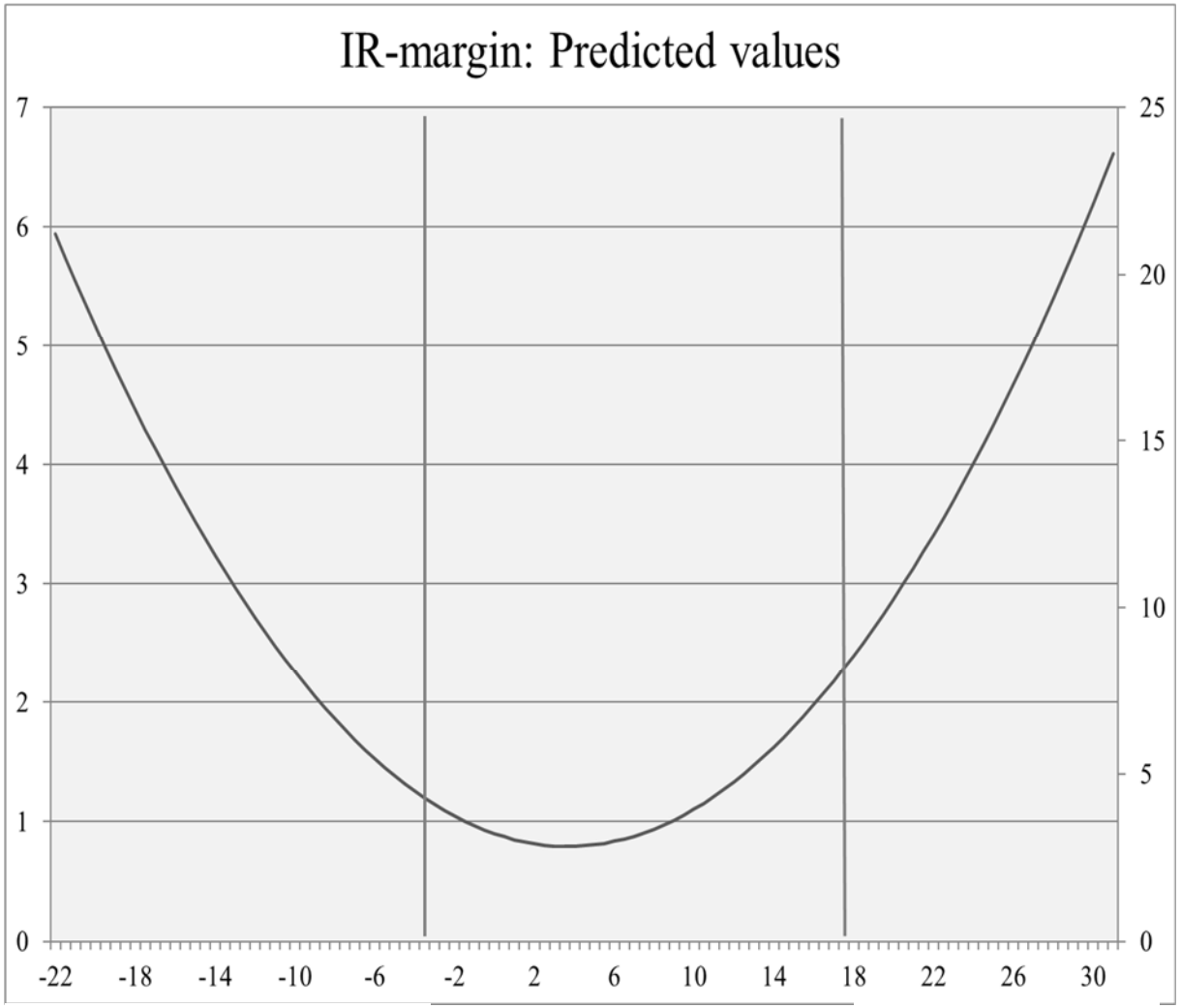


Higher comp. ← → Lower competition

Table 4 - Regression with *IRmargin* as competition proxy

Variables	(1) WG	(2) IV-REG	(3) GMM
IRmargin	-0.0359*	-0.0597**	-0.0575*
	(0.0183)	(0.0299)	(0.0308)
IRmargin squared	0.0059***	0.0071**	0.0078**
	(0.0017)	(0.0033)	(0.0034)
L1.NPLrate	0.5248***	0.5162***	0.4384***
	(0.0271)	(0.0404)	(0.0323)
L2.NPLrate	0.2213***	0.1586***	0.1164***
	(0.0216)	(0.0306)	(0.0271)
L.GDPgrowth	-0.0430***	-0.0308***	-0.0313***
	(0.0110)	(0.0119)	(0.0104)
Some coeff. estimates excluded from table			
Observations	11502	11502	11502
1st order AC - m1			-7.7743
2nd order AC - m2			-0.221
Hansen test			0.000

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$



Lower competition ← → Higher comp.

Confirms the patterns seen in the two previous figures

Summary

- Theoretical model shows that higher margins can lead to more risk-taking by the banks on the borrower side.

  In our model, we considered the effect of a dampened competition on prices, which may occur due to an establishment of collusion in the industry. This will lead to more intense effort on attracting borrowers.

- Existing (theoretical) literature has advocated both a negative and a positive relationship between competition and banks' risk.

- Also the existing empirical literature on banks' risk-taking and the competition is inconclusive.

- Using 23 years of quarterly data for a total of 171 Norwegian banks we find a U-shaped relationship between market concentration and loan-risk. The same relationship is found between banks' IRmargin and loan-risk.

- It is not clear that dampening the competition in the banking sector will lead to more stability. It depends on the existing level of competition.

- Our findings help us to better understand the mixed results in the literature concerning the relationship between competition and risk-taking in the banking industry.

- It is crucial to consider whether competition is dampened or not initially.

  - If it is dampened initially, then there is more likely that a further dampening of competition can be harmful to stability in the banking industry. In such a situation there is no trade-off between competition and stability, since tougher competition leads to more stability.

  - Only in those cases where there is tough competition initially, there will be a trade-off between dampening of competition and more stability.

Thanks for your time.

Alternative model with non-uniform prices

$$\underset{Q}{Max}\,\pi = p\left(Q\right)\cdot Q\cdot r(\,p(Q))-Q\cdot C \qquad (1')$$

where

$p(.)$	- the probability of **success** for a project the borrower asks the bank to finance ($0 < p < 1$). $p_Q' < 0$ (more borrowers, less success)
Q	- the number of borrowers
$r\,(p(Q))$	- the price on a loan, $r_p' < 0$ (larger prob. for success, lower loan rate)
C	- the bank's unit cost

Optimal risk exposure by the bank:

$$p^* = \frac{C - Q^* \cdot r \cdot p_Q'}{r + Q^* \cdot r_p' \cdot p_Q'} \qquad (2')$$

The last new term in the denominator is positive. Thus the optimal risk exposure is somewhat lower compared to the uniform price case - the one analyzed in the paper.

It is no clear though how a higher price cost margin, (earlier represented with an increase in r, but holding C constant, such that the r/C ratio would increase) would change our results without choosing some more functional forms.