

XXV Meeting of the Central Bank Researchers Network

Bank Competition and Risk-Taking

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The views expressed in this paper do not necessarily represent those of the Central Reserve Bank of Peru

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Introduction

- We study empirically the relationship between competition in the credit market and risk-taking in the Peruvian financial system.
- This work is motivated by Martinez-Miera y Repullo (2010).
 - ▶ They find a U-shaped relationship between competition and risk-taking.
 - ▶ Jimenez et al. (2013) support that relationship for Spain.
- We replicate Jimenez et al. (2013) for the Peruvian economy.
- We then go further and use credit registry data with location information and add another dimension “region” to be able to control for bank lending opportunities & bank strategies.
- We find evidence of an inverted U-shaped relationship.

Motivation

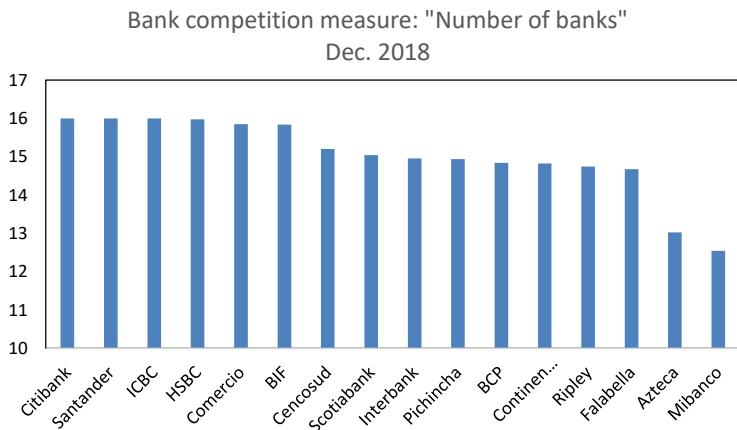
- Motivation 1: Bank Competition and Concentration in Latin America

	3-bank asset concentration (%)	5-bank asset concentration (%)	H-statistic	Lerner index
	2016	2016	2014	2014
Brazil	69.8	85.0	0.72	0.21
Chile	43.2	69.3	0.77	0.25
Colombia	78.7	89.4	0.51	0.48
Mexico	52.6	68.0	0.83	0.38
Peru	71.9	87.5	0.60	0.50
Uruguay	69.2	88.2	0.80	0.19
EME	63.2	75.9	0.57	0.35
AE	67.3	81.9	0.64	0.27

Source: Global Financial Development. 3-bank asset concentration: Assets of three largest banks as a share of total banking assets. 5-bank asset concentration: Assets of three largest banks as a share of total banking assets. H-statistic: A measure of the degree of competition in the banking market. It measures the elasticity of banks revenues relative to input prices. The closer to 1, the higher the competition. Lerner index: A measure of market power. It compares output pricing and marginal costs (that is, markup). A high value suggests less competition. EME and AE correspond to simple averages across emerging market economies and advanced economies, respectively.

Motivation

- Motivation 2: Peruvian banking system - Heterogeneity:



Source: SBS. Own calculations. Number banks: the number of banks that has the representative region for bank i at time t , calculated as the weighted average over the number of banks that exists in all regions where banks grant loans, where weights are given by the regional loan size.

Literature review

- Bolt et al. (2004): Higher competition, higher bank risk-taking: Less strictness to issue loans decreases loan quality.
- Boyd and De Nicolo (2005): competition reduces the risk of bank failure. (key modeling assumption: loan risk, which increases with the loan rate, and bank default are perfectly correlated).
- Martinez-Miera and Repullo (MMR, 2010): No linear relationship.
 - ▶ Higher competition: A small interest rate produces two opposite effects on risk-taking:
 - ★ (a) Risk-shifting effect: A small number of firms default, which reduces bank risk-taking.
 - ★ (b) Margin effect: Banks' revenues decreases, which increases bank risk-taking.
 - ▶ In a less competitive market (a) dominates.
 - ▶ In a very competitive environment (b) dominates.
 - ▶ There is a U-shaped relationship between # banks (bank competition) and the risk of bank failure.
- Jimenez et al. (2013): Using Spanish data they support the nonlinear relationship found in MMR.

The model: Banks (2004-2018)

- Similar to Jimenez et al. (2013):

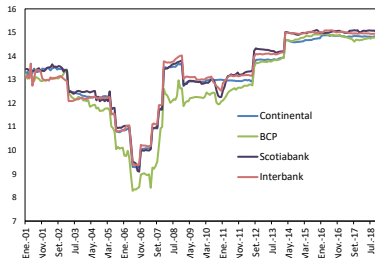
$$endo_var_{it} = \alpha + \beta_0 * endo_var_{it-1} + \beta_1 * exo_var_{it-1} + \beta_2 * exo_var_{it-1}^2 + \beta_3 * cont_{it-1} + error$$

i : bank, t : año.

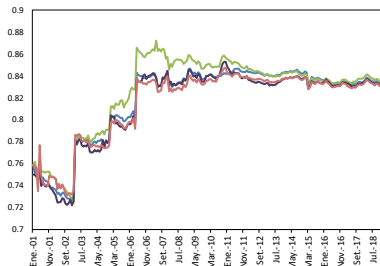
- $endo_var_{it} = \ln(mor_{it}/(100 - mor_{it}))$, mor_{it} : “creditos atrasados (criterio SBS)/ creditos directos”,
- exo_var_{it} :
 - ▶ # **banks**: the number of banks that has the representative region for bank i at time t , calculated as the weighted average (by total loans) over all the regions where banks grant loans,
 - ▶ **C4**: share of 4 largest banks in the representative region for bank i at time t ,
 - ▶ **Herfindahl index**: sum of banks' squared market shares in loans granted in the representative region.
- $cont$: control variables: bank size, ROA, foreign debt, RWA-to-capital ratio, economic cycle, non-financial bonds.
- Other controls: bank FE & time FE.
- Banking features:
 - ▶ Four largest banks account for around 85% of the whole credit. The presence of these is almost all regions.
 - ▶ In addition to banks there are other credit institutions (CMACs, CRACs, EPDYMEs, *empresas financieras*)

Competition and concentration measures

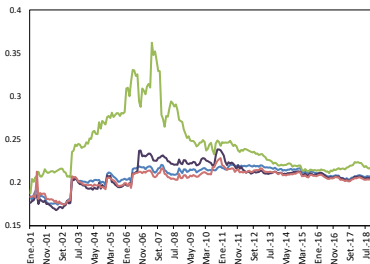
Bank competition measure: "Number of banks"



Bank concentration measure: C4



Bank concentration measure: Herfindahl index



Source: SBS. Own calculations.

Results: Banks (2004-2018)

Banks

exo_var	ln (# banks)			C4			Herfindahl index		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
L.endo_var	0.759***	0.488***	0.770***	0.822***	0.477***	0.809***	0.792***	0.469***	0.807***
L.exo_var	10.27**	1.726	12.30*	-2.364	134.6**	-44.61	65.07***	12.53	66.03***
L.exo_var2	-2.271**	-0.238	-2.699*	4.430	-85.71**	32.91	-131.6***	-39.65	-133.0***
L.roa	-1.808	-3.331*	-2.022	-2.223	-3.440**	-2.386	-2.108	-3.347**	-2.349
L.size	-0.823***	3.911	-0.812***	-0.686***	6.361	-0.868***	-0.971***	4.297	-0.962***
L.for_cred	0.735**	0.494	0.719**	0.850**	0.624**	0.827**	0.861**	0.398	0.901***
L.bond_cred	-3.265***	-0.767		-0.276	-2.261***		-0.579	-1.361*	
L.RWA	0.0331	0.0577**	0.0202	0.0223	0.0577**	0.0123	0.0176	0.0688***	0.00551
rg_gdp	-3.879***	-3.024*		-3.270**	-2.557**		-3.535**	-3.219**	
L.rg_gdp	0.0419	-0.914		0.427	-0.334		0.594	-1.003	
Observations	196	194	196	196	194	196	196	194	196
R-squared	0.824	0.904	0.838	0.820	0.909	0.834	0.825	0.909	0.837
F test (ρ -value)	0	1.50e-10	0	0	1.73e-10	0	0	0	0
Bank FE	No	Yes	No	No	Yes	No	No	Yes	No
Time FE	No	No	Yes	No	No	Yes	No	No	Yes

*** statistically significant at 1%, ** statistically significant at 5%, * statistically significant at 10%

Banks, CMAC, CRAC, EDPYMES and Financieras

- Five groups: banks, CMAC, CRAC, EDPYMEs and **Financieras**.
- Annual data. Period 2004-2018. There are 75 financial institutions.
- We control for group and for several events (reallocations across groups, mergers and acquisitions, etc.).
- There **is not** competition between two institutions from different groups.

exo_var	ln (# institutions)			C4			Herfindahl index		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
L.endo_var	0.771***	0.571***	0.771***	0.776***	0.573***	0.778***	0.774***	0.568***	0.775***
L.exo_var	0.163*	-0.140	0.178*	0.0717	-6.202	2.111	0.392	-0.975	0.430
L.exo_var2	-0.0763*	0.0792	-0.0773*	0.389	3.630	-0.782	-0.395	0.676	-0.435
L.roa	-1.015*	-0.415	-1.139	-1.057*	-0.478	-1.182	-0.966	-0.375	-1.110
L.size	0.0115	0.726**	0.0202	0.0200	0.414	0.0252	0.0811	0.719**	0.0861
L.for_cred	0.116	0.132	0.108	0.130	0.154	0.119	0.119	0.146	0.109
L.bond_cred	-1.278***	-1.079**		-1.240***	-1.566***		-0.987***	-1.293***	
L.RWA	0.0193*	0.0329**	0.0204*	0.0208*	0.0295**	0.0219*	0.0208*	0.0318**	0.0218*
Observations	783	781	783	783	781	783	783	781	783
R-squared	0.786	0.847	0.792	0.786	0.846	0.792	0.785	0.847	0.791
F test (ρ -value)	0	0	0	0	0	0	0	0	0
Bank FE	No	Yes	No	No	Yes	No	No	Yes	No
Time FE	No	No	Yes	No	No	Yes	No	No	Yes

*** statistically significant at 1%, ** statistically significant at 5%, * statistically significant at 10%

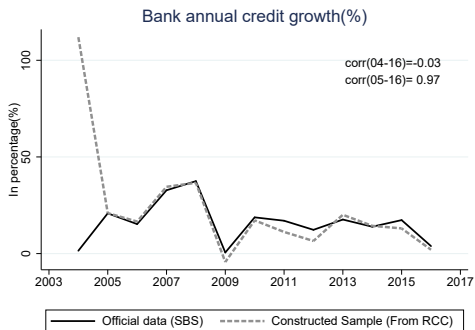
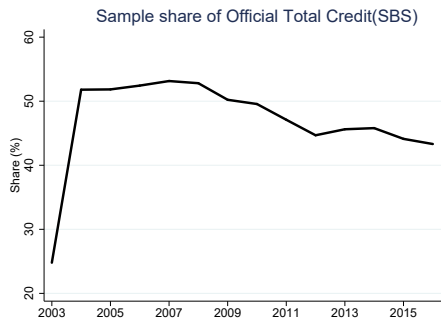
Granular data

- To add another dimension “region”: To control local lending opportunities & bank level strategies.
- Input Sources:
 - ① Credit Registry Data (RCC):
 - ★ Loan-level data.
 - ★ Quarterly frequency: 2003Q1-2010Q3 and Monthly frequency : 2010m10-2018m08.
 - ★ Clients identified by: tax ID (RUC) or National ID (DNI).
 - ② Tax ID - Location Data:
 - ★ SUNAT: Tax administration data on individual and firm Tax ID (RUC) and Location codes (UBIGEO).
 - ★ INEI: Location ID to Region’s names correspondence.
- Output:
 - ▶ Our sample: credit to firms (corporate credit and small firm credit), mortgage and personal credit. This is because there are tax IDs that has mortgage or personal credit.
 - ▶ Sample:
 - ★ Clients with RUC with matched location: approx. 11%
 - ★ Represents around 80% of loans to firms.
 - ▶ Final sample: credit to firms.
 - ▶ We build competition/concentration and risk-taking measures at the bank-region-time level.

Matching Results: Representativeness of credit

Our sample vs official data

- In aggregate, our sample mimics the dynamic of aggregate bank credit.

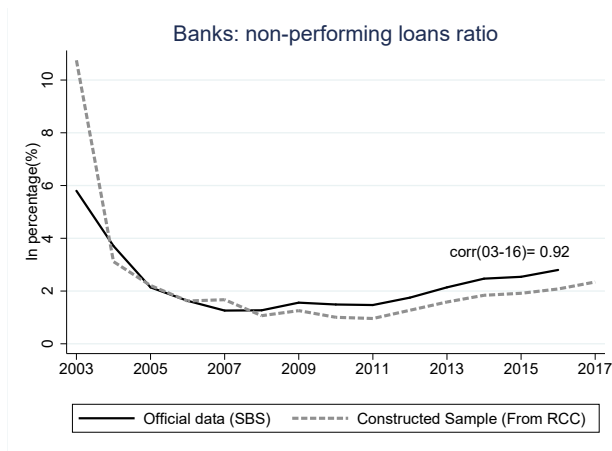


Note: Annual Sample 2004-2016.

Matching Results: Representativeness of Non-Performing loans(NPL) ratio

Our sample vs official data

- In aggregate our sample mimics also the dynamics of NPL ratio.



Note: Annual Sample 2004-2016. SBS Official Data from

http://www.sbs.gob.pe/app/pp/seriesHistoricas2/Paso3_Mensual.aspx?cod=6&per=7&paso=2&secu=01

RCC sample: Banks - credit to firms

exo_var	ln (# banks)			C4			Herfindahl index		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
lag_endo_var	0.451***	0.448***	0.430***	0.449***	0.447***	0.430***	0.448***	0.444***	0.429***
lag_exo_var	1.131**	1.157	1.157*	-23.03	-35.65	-20.12	2.668**	4.072	2.023
lag_exo_var2	-0.349**	-0.377	-0.329*	13.25	20.22	11.43	-2.539**	-3.905	-2.064
lag_size_bt_t	9.833***	10.01**		10.33***	10.33***		10.20***	10.17***	
lag_size_brt_bt	-1.361	-1.496	-0.610	-1.292	-1.550	-0.613	-1.353	-1.546	-0.617
Observations	2,612	2,594	2,597	2,612	2,594	2,597	2,612	2,594	2,597
R-squared	0.349	0.445	0.404	0.349	0.445	0.403	0.349	0.446	0.403
F test (p -value)	0	1.62e-07	0	0	7.95e-09	1.69e-09	0	7.68e-08	1.24e-09
Region Time FE	No	Yes	No	No	Yes	No	No	Yes	No
Bank Time FE	No	No	Yes	No	No	Yes	No	No	Yes
Bank FE	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Region FE	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
Time FE	Yes	No	No	Yes	No	No	Yes	No	No

*** statistically significant at 1%, ** statistically significant at 5%, * statistically significant at 10%
 Period 2004-2017.

RCC sample: Five groups - credit to firms

- Assumption: There **is** competition among groups.

exo_var	ln (# institutions)			C4			Herfindahl index		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
lag_endo_var	0.222***	0.202***	0.127***	0.223***	0.203***	0.128***	0.222***	0.202***	0.126***
lag_exo_var	0.605	1.341***	0.950**	10.80***	16.77***	15.43***	0.537	1.568	1.200
lag_exo_var2	-0.158**	-0.298***	-0.213***	-6.876***	-10.73***	-9.804***	-1.435	-2.895**	-2.329**
Observations	5,889	5,881	5,753	5,889	5,881	5,753	5,889	5,881	5,753
R-squared	0.233	0.283	0.339	0.232	0.282	0.340	0.232	0.282	0.339
Region Time FE	No	Yes	No	No	Yes	No	No	Yes	No
Bank Time FE	No	No	Yes	No	No	Yes	No	No	Yes
Bank FE	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Region FE	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
Time FE	Yes	No	No	Yes	No	No	Yes	No	No

*** statistically significant at 1%, ** statistically significant at 5%, * statistically significant at 10%
 Period 2004-2017.

Conclusions

- There is evidence of a non-linear relationship between competition and risk-taking.
- We find evidence of an inverted-U relationship in an emerging economy as Peru, if we look at the number of banks as our competition measure.
- The competition across groups within provinces is relatively more related with the risk-taking than the competition within regions.