Imperfect Banking Competition and Financial Stability

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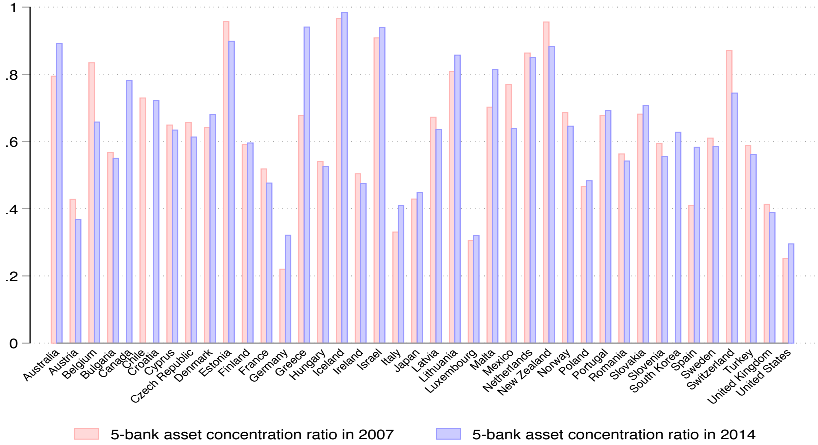
  - **Short run**: less competition can jeopardize stability

    due to larger size of loan assets $\rightarrow$ lower equity ratios
- Empirically, this paper finds:
  - bank concentration (inverse proxy for competition) has a positive effect on change in bank equity
  - banks' equity ratios are negatively related to their default probabilities (proxied by credit default swap spreads)

Imperfect Banking Competition

Highly Concentrated Banking Sectors in EU and OECD Countries in 2007 and 2014



Data sources: ECB, Bankscope

5-bank asset concentration = sum of market shares of the largest 5 banks by total assets

Literature Review

How does bank competition affect financial stability?

Mixed theoretical results:

- risk-taking effect: competition $\rightarrow$ lower profits $\rightarrow$ more risk taking by banks $\rightarrow$ instability (e.g. Corbae and Levine, 2018; Allen and Gale, 2000)
- risk-shifting effect: competition $\rightarrow$ lower loan rate $\rightarrow$ less risk taking by borrowers $\rightarrow$ stability (e.g. Boyd and De Nicolo, 2005)
- margin effect: competition $\rightarrow$ lower revenue from performing loans $\rightarrow$ less buffer against loan losses (e.g. Martinez-Miera and Repullo, 2010)

▶ This paper builds on margin effect with dynamics in bank equity

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Mixed empirical evidence (partly depending on measures used):

- competition → instability (e.g. Corbae and Levine, 2018; Ariss, 2010; Beck et al., 2006; Salas and Saurina, 2003; Keeley, 1990)
- competition → stability (e.g. Anginer et al., 2014; Dick and Lehnert, 2010; Uhde and Heimeshoff, 2009; Schaeck and Cihak, 2007)
- ambiguous relationship (e.g. Jimenez et al., 2013; Tabak et al, 2012)

▶ This paper provides evidence on the role of bank equity accumulation in the relationship between competition and stability

Main Contributions to Literature

- New equity ratio effect: competition affects banks' equity ratios and thus financial stability
  - − Short run: less competition can jeopardize stability
    larger loan assets → lower banks' equity ratios
  - + Long run: less competition enhances stability
    higher profits → faster equity accumulation → higher equity ratios

    ⇒ important role for macroprudential policies
- New measure of financial stability gain vs macroeconomic efficiency loss
  - − without equity accumulation ⇒ efficiency loss outweighs stability gain
  - + with equity accumulation ⇒ stability gain can outweigh efficiency loss
- Empirical evidence on implications of the model:
  - ✓ less competition ⇒ greater profits ⇒ larger change in bank equity
  - ✓ banks with higher equity ratios have lower default probabilities

Outline

- Theoretical model set-up and basic model results
- Calibration and simulation results
- Data
- Empirical specifications
- Empirical results
- Conclusions

Model Set-up

- 2 types of risk-neutral agents:
  - perfectly competitive entrepreneurs, short-lived, no initial wealth

    $\Rightarrow$ borrow to finance physical capital k_t (only production input)
  - banks compete for loans *à la* Cournot

- 2 types of independent multiplicative productivity shocks (unobserved ex ante)
  - aggregate shock $\epsilon \geqslant 0$, i.i.d. across time, continuous c.d.f. $\Gamma(\epsilon)$, $E(\epsilon) = 1$, observed by all agents ex post
  - idiosyncractic shock $\omega \geqslant 0$, i.i.d. across entrepreneurs and time, continuous c.d.f. $F(\omega)$, $E(\omega) = 1$, observed by entrepreneurs ex post (info asymmetry)

- Each bank lends to a large number of randomly distributed entrepreneurs

  $\Rightarrow$ banks can perfectly diversify idiosyncratic risk but NOT aggregate risk

Entrepreneur's Default Threshold

A continuum of unit mass of ex ante identical entrepreneurs borrow at a gross loan rate $R_{b,t}$ to finance k_t

Ex post, each entrepreneur i receives a different realized idiosyncratic shock $\omega_{i,t+1}$ and produces output:

$$y_{i,t+1} = \omega_{i,t+1}\epsilon_{t+1}Ak_t^{\alpha}$$

where A is common deterministic productivity level, $\alpha \in (0,1)$ is capital share

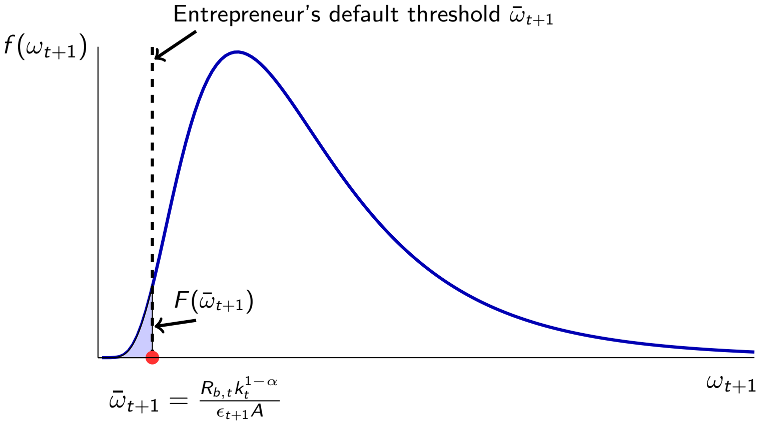
Entrepreneur i defaults if $\omega_{i,t+1}$ is below a threshold $\bar{\omega}_{t+1}$ determined by:

$$\bar{\omega}_{t+1}\epsilon_{t+1}Ak_t^{\alpha} - R_{b,t}k_t = 0 \quad \rightarrow \quad \bar{\omega}_{t+1} = \frac{R_{b,t}k_t^{1-\alpha}}{\epsilon_{t+1}A}$$

This implies:

$$\frac{\partial\bar{\omega}_{t+1}}{\partial k_t} = \frac{(1-\alpha)R_{b,t}k_t^{-\alpha}}{\epsilon_{t+1}A} > 0$$

Entrepreneur's Default Probability



Higher $\bar{\omega}_{t+1} \rightarrow$ higher entrepreneur's default probability $F(\bar{\omega}_{t+1})$

Expected Profit Maximization

Assume entrepreneurs have limited liability,

- when $\omega_{i,t+1} \geqslant \bar{\omega}_{t+1} \Rightarrow$ repay full debt obligation $R_{b,t}k_t$
- when $\omega_{i,t+1} < \bar{\omega}_{t+1} \Rightarrow$ declare bankrupt

  bank confiscates output (subject to a collection cost)

The entrepreneur takes $R_{b,t}$ as given and chooses k_t to maximize:

$$\mathrm{E}_t\left[\int_{\bar{\omega}_{t+1}(R_{b,t},k_t,\epsilon_{t+1})}^{\infty} \omega\epsilon_{t+1}Ak_t^{\alpha}dF(\omega) - \int_{\bar{\omega}_{t+1}(R_{b,t},k_t,\epsilon_{t+1})}^{\infty} R_{b,t}k_t dF(\omega)\right]$$

where $\mathrm{E}_t[.]$ is taken over the distribution of ϵ_{t+1}.

FOC wrt $k_t \Rightarrow$ loan demand curve is downward-sloping: $\frac{dk_t}{dR_{b,t}} < 0$

Using optimal k_t, $\frac{d\bar{\omega}_{t+1}}{dR_{b,t}} = 0$

Derivation

Cournot Banking Sector

N Heterogeneous Banks

Assumptions:

- N banks (indexed by j) with different marginal intermediation costs τ_j
- Loans are financed by deposits and equity $n_{j,t}$ (retained earnings)

Bank j's Balance Sheet

Loans	$k_{j,t}$	Deposits	$k_{j,t} - n_{j,t}$
		Equity	$n_{j,t}$

- Bankers are appointed for one period

  $\Rightarrow$ choose loan quantity $k_{j,t}$ to maximize expected profit $\mathrm{E}_t \pi^B_{j,t+1}(\epsilon_{t+1})$
- Full deposit insurance (presuming zero insurance premium)

  $\Rightarrow$ exogenous gross deposit rate R_t

Sum of all banks' loan quantities determines equilibrium gross loan rate $R^*_{b,t}$

Bank j's Problem

Bank j maximizes the expected profit $\mathrm{E}_t \pi^B_{j,t+1}(\epsilon_{t+1})$ with respect to $k_{j,t}$:

$$\pi^B_{j,t+1} = \underbrace{\int_{\bar{\omega}_{t+1}(\epsilon_{t+1})}^{\infty} R_{b,t} k_{j,t} dF(\omega)}_{\text{performing loan revenue}} + \underbrace{\frac{k_{j,t}}{k_t}(1-\mu)\int_0^{\bar{\omega}_{t+1}(\epsilon_{t+1})} \epsilon_{t+1}\omega A k_t^{\alpha} dF(\omega)}_{\text{nonperforming loan revenue}}$$

$$- R_t \underbrace{(k_{j,t} - n_{j,t})}_{\text{deposits}} - \tau_j k_{j,t} - n_{j,t}$$

$$= G(\epsilon_{t+1}) R_{b,t} k_{j,t} - R_t(k_{j,t} - n_{j,t}) - \tau_j k_{j,t} - n_{j,t}$$

$\mu \in (0,1)$: collection cost incurred to verify the entrepreneur's output

$G(\epsilon_{t+1}) = [1 - F(\bar{\omega}_{t+1}(\epsilon_{t+1}))] + \frac{1-\mu}{\bar{\omega}_{t+1}(\epsilon_{t+1})} \int_0^{\bar{\omega}_{t+1}(\epsilon_{t+1})} \omega f(\omega) d\omega < 1$

where revenue fraction $G(\epsilon_{t+1})$ satisfies $G'(\epsilon_{t+1}) > 0$

Bank Equity Accumulation

Let $D_{j,t+1}$ denote bank j's dividend payment in period $t+1$.

Bank j's net worth (equity) $n_{j,t+1}$ evolves as follows:

$$n_{j,t+1} = n_{j,t} + \pi^B_{j,t+1} - D_{j,t+1} = G(\epsilon_{t+1}) R_{b,t} k_{j,t} - R_t (k_{j,t} - n_{j,t}) - \tau_j k_{j,t} - D_{j,t+1}$$

Implications:

- less competition $\rightarrow$ greater profit $\pi^B_{j,t+1}$ $\rightarrow$ higher $n_{j,t+1}$
  (long-run equity ratio effect)
- relevance of macroprudential policies that control dividend distribution

Equity Accumulation under Three Different Cases of Dividend Distribution or Macroprudential Policies

1. No dividend distribution:

$$n_{j,t+1} = n_{j,t} + \pi^B_{j,t+1}$$

2. Distribute all positive net profits to shareholders:

$$n_{j,t+1} = \min(n_{j,t} + \pi^B_{j,t+1}, \;\; n_{j,t})$$

3. Distribute when equity ratio exceeds the desired/required level κ^*:

$$n_{j,t+1} = \min(n_{j,t} + \pi^B_{j,t+1}, \;\; \kappa^* k_{j,t})$$

Bank j's Default Threshold

Bank j defaults if the pre-dividend equity $\pi^B_{j,t+1}(\epsilon_{t+1}) + n_{j,t}$ is negative.

This occurs if the realized aggregate shock to productivity ϵ_{t+1} is below a certain threshold $\bar{\epsilon}_{j,t+1}$ determined by:

$$G(\bar{\epsilon}_{j,t+1})R_{b,t} - (R_t + \tau_j) + R_t \frac{n_{j,t}}{k_{j,t}} = 0$$

where revenue fraction $G(\bar{\epsilon}_{j,t+1})$ satisfies $G'(\bar{\epsilon}_{j,t+1}) > 0$

$\Rightarrow$ Banks with higher equity ratios $\kappa_{j,t} \equiv \frac{n_{j,t}}{k_{j,t}}$ have lower default thresholds:
$\frac{d\bar{\epsilon}_{j,t+1}}{d\kappa_{j,t}} = -\frac{R_t}{R_{b,t}G'(\bar{\epsilon}_{j,t+1})} < 0 \;\; \forall\, j$

Basic Results

Assuming mean efficiency $\bar{\tau}$ is unaffected by changes in number of banks N

- N decreases $\Rightarrow$ gross loan rate $R_{b,t}$ increases
  $\Rightarrow$ equilibrium aggregate loan quantity k_t decreases
  $\Rightarrow$ lower macroeconomic efficiency $A(k_t)^{\alpha}$

- ambiguous change in bank j's loan quantity $k_{j,t}$ after N changes:

$$\frac{dk_{j,t}}{dN} = ms_{j,t}\underbrace{\frac{dk_t}{dN}}_{>0} + k_t\underbrace{\frac{dms_{j,t}}{dN}}_{<0}$$

where $ms_{j,t} \equiv \frac{k_{j,t}}{k_t}$ and $\frac{dms_{j,t}}{dN} = -\frac{1}{N^2}\frac{(R_t+\tau_j)}{R_t+\bar{\tau}} < 0$

but $\boldsymbol{\frac{dk_{j,t}}{dN} < 0}$ when all banks have identical or very similar efficiency

such that $\frac{R_t+\bar{\tau}}{(2-\alpha)(1-\frac{1-\alpha}{N})} < R_t + \tau_j < \frac{R_t+\bar{\tau}}{1-\frac{1-\alpha}{N}}$

Short-run Equity Ratio Effect vs Margin Effect

From bank j's default condition, it can be proven that:

$$\frac{d\bar{\epsilon}_{j,t+1}}{dN} = \frac{\overbrace{R_t \frac{n_{j,t}}{k_{j,t}^2} \frac{dk_{j,t}}{dN}}^{(-)} \overbrace{- G(\bar{\epsilon}_{j,t+1}) \frac{dR_{b,t}}{dN}}^{(+)}}{\underbrace{G'(\bar{\epsilon}_{j,t+1}) R_{b,t}}_{(+)}}$$

2 potentially opposite effects of a lower N:

- $k_{j,t}$ tends to increase $\rightarrow \frac{n_{j,t}}{k_{j,t}}$ falls $\rightarrow$ more likely to default ($\bar{\epsilon}_{j,t+1}$ rises) (short-run equity ratio effect)
- $R_{b,t}$ increases $\rightarrow$ higher revenue on performing loans $\rightarrow$ more buffer against losses $\rightarrow$ less likely to default ($\bar{\epsilon}_{j,t+1}$ falls) (margin effect)

Summary

- Competition has different short-run and long-run effects on equity ratios
  - SR: less competition $\rightarrow$ larger loan assets $\rightarrow$ lower equity ratios
  - LR: less competition $\rightarrow$ faster equity accumulation $\rightarrow$ higher equity ratios

    $\Rightarrow$ macroprudential policy can regulate banks' dividend distribution

  ▷ to be illustrated using calibrated model
- Lower macroeconomic efficiency under less competition

  ▷ efficiency loss to be compared with stability gain using calibrated model
- Less competition improves financial stability via equity accumulation
  - less competition $\rightarrow$ higher profit $\rightarrow$ larger change in equity
  - banks' equity ratios are negatively related to their default probabilities

  ▷ to be shown empirically

Calibration

Parameters calibrated to match the data for Germany during 1999-2014

Parameter	Value
Number of banks N	60
Capital share α	0.3
Desired equity ratio κ^*	0.072
Collection cost μ	0.04
Support for bounded Pareto distribution of τ	[0.001, 0.04]
Shape for bounded Pareto distribution of τ	0.1
Mean of log-normal distribution of ω	-0.15
Variance of log-normal distribution of ω	0.3
Mean of log-normal distribution of ϵ	-0.14
Variance of log-normal distribution of ϵ	0.28

Matching Model Moments with Data

Variable	Model $N = 60$	Data Germany
5-bank asset concentration	0.229	0.249
HHI (total assets)	0.025	0.021
Net corporate lending rate	5.07%	4.06%
Loan impairment charge/gross loans	0.006	0.006
Non-interest expense/total assets	0.032	0.026
Bank's default probability	2.13%	2.01%
Interest income/total assets	0.012	0.024

Data sources: ECB, Bankscope, Thomson Reuters EIKON

HHI (Hirschman-Herfindahl Index) = sum of squared market shares of all banks

High HHI implies high concentration

Bank's default probability calculated from average CDS spread, following Hull (2012)

Stability Gain from Imperfect Banking Competition

$$\text{Financial Stability Gain of Bank } j = \Gamma(\bar{\epsilon}^{PC}_{t+1}) - \Gamma(\bar{\epsilon}_{j,t+1})$$

$\Gamma(\bar{\epsilon}^{PC}_{t+1})$: representative bank's default probability under perfect competition

$\Gamma(\bar{\epsilon}_{j,t+1})$: bank j's default probability under imperfect competition

The default threshold of the representative bank $\bar{\epsilon}^{PC}_{t+1}$ is determined by:

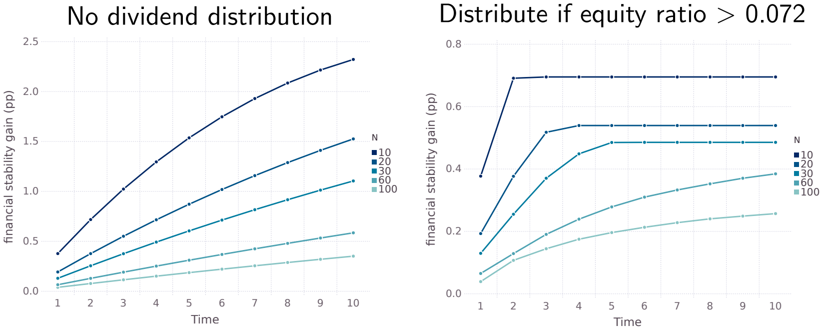
$$G(\bar{\epsilon}^{PC}_{t+1})R^{PC}_{b,t} - (R_t + \bar{\tau}) + R_t\frac{n_t}{k_t} = 0$$

$\Gamma(\bar{\epsilon}^{PC}_{t+1}) > \Gamma(\bar{\epsilon}_{j,t+1})$ due to

- $R^{PC}_{b,t} < R_{b,t}$ and hence lower profit margin (margin effect)
- lower equity ratio $\frac{n_t}{k_t}$ over time (long-run equity ratio effect)

Impact of Dividend Distribution on Stability Gain

Mean Stability Gain across Banks with Different N

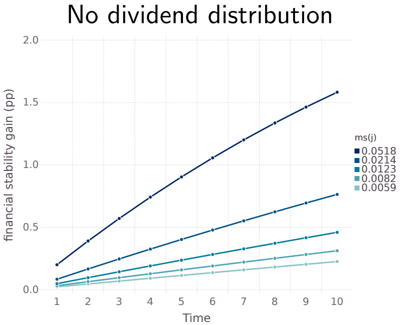


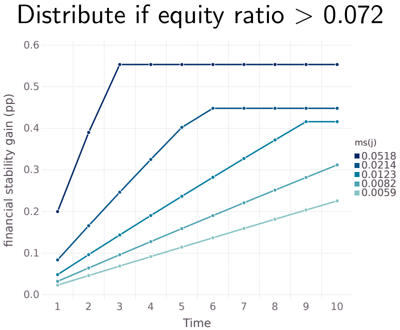
Note: Financial stability gain (percent points) $= \frac{1}{N}\sum_j \left(\Gamma(\bar{\epsilon}^{PC}_{t+1}) - \Gamma(\bar{\epsilon}_{j,t+1})\right) * 100$

Assume all banks start with zero initial equity with different number of banks N.

Impact of Dividend Distribution on Stability Gain

Banks with Different Market Shares with $N = 60$





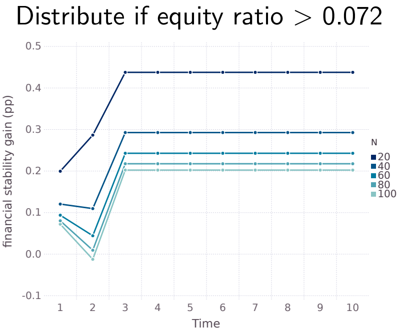
Financial stability gain (percent points) $= \left(\Gamma(\bar{\epsilon}^{PC}_{t+1}) - \Gamma(\bar{\epsilon}_{j,t+1})\right) * 100$

Assume all banks start with zero initial equity with different number of banks N.

Banks at 1st, 25th, 50th, 75th, 99th percentiles of market share ms_j are plotted.

Bank Merger Scenario

Mean Stability Gain across Banks with Different Initial N



Financial stability gain (percent points) $= \frac{1}{N} \sum_j \left(\Gamma(\bar{\epsilon}^{PC}_{t+1}) - \Gamma(\bar{\epsilon}_{j,t+1}) \right) * 100$

Before the merger: $\frac{N}{2}$ efficient banks have initial equity ratios of 0.072 (solvent banks)

$\frac{N}{2}$ inefficient banks have no initial equity (distressed banks)

Merger ($t = 1$): each solvent bank merges with one distressed bank $\Rightarrow$ N reduces to $\frac{N}{2}$

Efficiency Loss from Imperfect Banking Competition

Macroeconomic efficiency loss caused by imperfect banking competition:

$$\text{Macroeconomic Efficiency Loss} = \frac{\mathsf{E}_t(y_{t+1}^{PC}) - \mathsf{E}_t(y_{t+1})}{\mathsf{E}_t(y_{t+1}^{PC})}$$

$\mathsf{E}_t(y_{t+1}^{PC})$: expected output under perfect banking competition

$\mathsf{E}_t(y_{t+1})$: expected output under imperfect banking competition

$\mathsf{E}_t(y_{t+1}^{PC}) > \mathsf{E}_t(y_{t+1})$ because

lower loan rate $R_{b,t}^{PC}$ $\rightarrow$ higher demand for k_t $\rightarrow$ higher expected output

Compare Efficiency Loss with Stability Gain

Construct Net Gain

Output measure for stability gain based on banks' expected default losses:

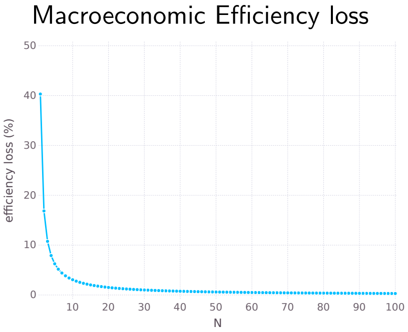
$$\text{Stability Gain} = \frac{\sum_j \overbrace{\int_0^{\bar{\epsilon}_{j,t+1}} \pi^B_{j,t+1}(\epsilon) + n_{j,t} d\Gamma(\epsilon)}^{\text{default loss of bank } j} - \overbrace{\int_0^{\bar{\epsilon}^{PC}_{t+1}} \pi^B_{t+1}(\epsilon) + n_t d\Gamma(\epsilon)}^{\text{default loss under perfect competition}}}{\mathrm{E}_t(y^{PC}_{t+1})}$$

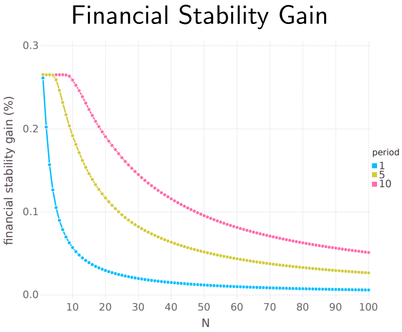
default loss = expected value of liabilities that the bank fails to repay

Net Gain = Financial Stability Gain − Macroeconomic Efficiency Loss

Positive net gain ⇒ stability gain outweighs efficiency loss

Efficiency Loss and Stability Gain



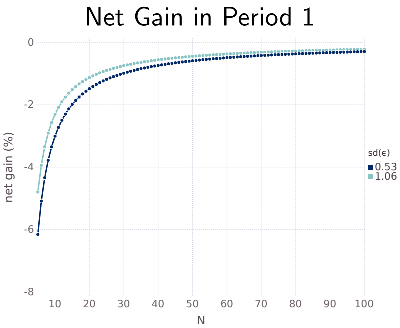


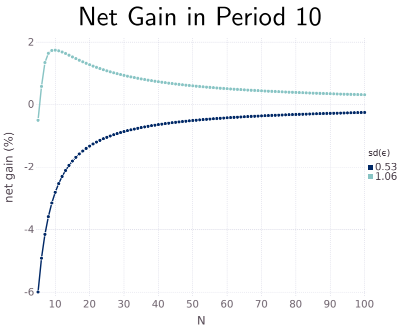
The number of banks N ranges from 1 to 100.

Assume all banks have zero initial equity.

Second graph plots financial stability gain (%) in period 1, 5 and 10 across different N.

Compare Efficiency Loss with Stability Gain





The number of banks N ranges from 5 to 100.

Assume all banks have zero initial equity.

First graph: net gain (%) in period 1 across different N and different sd(ϵ)

Second graph: net gain (%) in period 10 across different N and different sd(ϵ)

More Graphs

Data

- Financial stability: banks' default probabilities,
  proxied by 5-year quarterly credit default swap (CDS) spreads
  (Thomson Reuters EIKON)

- Bank competition: Hirschman-Herfindahl Index (HHI) and 5-bank asset concentration ratio as inverse proxies
  (ECB, own calculation using Bankscope annual balance sheets)

- Bank-level financial variables: equity to assets ratio,
  loan impairment charge to gross loans ratio, etc
  (Bankscope quarterly and annual financial statements)

- Country-level macro variables: real GDP growth rate, inflation rate
  (World Bank, OECD)

- Country-level corporate lending rates
  (ECB Monetary and Financial Institutions MFI interest rates)

Empirical Specification

Specification 1: less competition → larger change in equity

$$\frac{n_{j,c,t} - n_{j,c,t-1}}{k_{j,c,t-1}} = \beta_0 + \beta_1 N_{c,t-1} + \beta_j + \beta_c + \beta_t + \boldsymbol{\beta}'\boldsymbol{x} + \varepsilon_{j,c,t}$$

where j, c, t denote bank, country and year respectively.

Dependent variable: proxied by change in equity over lagged assets

$N_{c,t-1}$: lagged concentration index HHI as inverse proxy

Specification 2: higher equity ratios → lower default probabilities

$$\text{CDS Spread}_{j,c,t} = \beta_0 + \beta_1 \frac{n_{j,c,t-1}}{k_{j,c,t-1}} + \beta_j + \beta_c + \beta_t + \boldsymbol{\beta}'\boldsymbol{x} + \varepsilon_{j,c,t}$$

where j, c, t denote bank, country and quarter respectively.

$\frac{n_{j,c,t}}{k_{j,c,t}}$: proxied by lagged bank's equity to assets ratio

$\boldsymbol{x}$: lagged loan impairment charge to gross loans ratio, lagged real GDP growth rate, etc

Effect of Concentration on Change in Equity

for EU and OECD Countries during 1999-2014

Dependent variable: change in equity/lagged assets

	(1) EU	(2) EU	(3) EU	(4) EU	(5) OECD	(6) OECD
L.HHI (ECB)	0.14***	0.11***				
	(0.02)	(0.02)				
L.HHI (Bankscope)			0.05***	0.04***	0.04***	0.03***
			(0.01)	(0.01)	(0.00)	(0.00)
L.loan impairment ratio		-0.06***		-0.07***		-0.15***
		(0.02)		(0.02)		(0.01)
L.GDP growth rate		0.11***		0.12***		0.06***
		(0.01)		(0.01)		(0.01)
inflation rate		0.11***		0.11***		0.12***
		(0.02)		(0.02)		(0.01)
Observations	44,419	44,419	45,033	45,033	199,317	199,317
No.banks	4,875	4,875	4,936	4,936	19,230	19,230
Adjusted R^2	0.270	0.279	0.265	0.275	0.105	0.110
Within R^2	0.004	0.015	0.001	0.015	0.001	0.008

Bank, country, and year fixed effects are included in all regressions.
Bank-level clustered standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Data sources: ECB, Bankscope annual data, World Bank

loan impairment ratio = loan impairment charge/gross loans

Effect of Equity Ratio on Default Probability

for EU and OECD Countries during 2003-2016

Dependent variable: CDS spreads (in percent points)

	(1) EU	(2) EU	(3) Eurozone	(4) Eurozone	(5) OECD	(6) OECD
L.Equity Ratio	-0.34***	-0.25**	-0.32**	-0.23*	-0.33***	-0.33***
	(0.11)	(0.11)	(0.12)	(0.12)	(0.10)	(0.10)
L.Loan Impairment Ratio		0.59***		0.65***		0.56***
		(0.15)		(0.17)		(0.12)
L.GDP growth rate		-0.74***		-1.00***		-0.43***
		(0.18)		(0.18)		(0.14)
Observations	1,344	1,340	998	994	3,008	2,871
Number of Banks	50	50	38	38	108	104
Adjusted R^2	0.723	0.752	0.727	0.763	0.690	0.719
Within R^2	0.060	0.159	0.056	0.180	0.093	0.175

Bank, country, quarter fixed effects are included in all regressions.
Bank-level clustered standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Data sources: Thomson Reuters EIKON, Bankscope quarterly data, OECD

Robustness Checks

Results from specification 1 using ECB measures are robust to:

- further splitting the samples of countries into:
  Eurozone, non-Eurozone EU countries, non-EU OECD countries
- using 5-bank concentration ratio instead of HHI
- using pre-dividend change in equity $\frac{n_{j,t}+D_{j,t}-n_{j,t-1}}{k_{j,t-1}}$ as dependent variable
- further splitting the sample period 1999-2014 into:
  1999-2006 (not significant), 2006-2014, and 2010-2014 for EU countries

Results from specification 2 are robust to using:

- different data frequency (i.e., annual data)
- country*year fixed effects instead of country and quarter fixed effects

The effect of bank concentration on bank default probabilities Empirical results

Conclusions

Competition affects banks' equity ratios and thereby financial stability

− **SR**: less competition → larger size of loan assets → lower equity ratio

+ **LR**: less competition → faster equity accumulation → higher equity ratio

⇒ role for macroprudential regulation on bank dividend distribution

Financial stability gain vs macroeconomic efficiency loss

- without equity accumulation, efficiency loss overrides stability gain
- with equity accumulation, stability gain can outweigh efficiency loss

Empirically, this paper finds:

- bank concentration (inverse proxy for competition) has a positive effect on change in bank equity
- banks' equity ratios are negatively related to their default probabilities

Entrepreneur's Default Threshold Unaffected by Loan Rate

Entrepreneur's default threshold $\bar{\omega}_{t+1}$ can be written as an implicit function of $R_{b,t}$ and exogenous aggregate productivity shock ϵ_{t+1}:

$$\bar{\omega}_{t+1}(R_{b,t}, k_t(R_{b,t}), \epsilon_{t+1})$$

It can be shown that $\bar{\omega}_{t+1}$ is independent of $R_{b,t}$:

$$\frac{d\bar{\omega}_{t+1}}{dR_{b,t}} = \underset{(+)}{\frac{\partial\bar{\omega}_{t+1}}{\partial R_{b,t}}} + \underset{(+)}{\frac{\partial\bar{\omega}_{t+1}}{\partial k_t}} \underset{(-)}{\frac{dk_t}{dR_{b,t}}} = 0$$

Implications:

- entrepreneur perfectly internalizes the effect of changes in $R_{b,t}$ on $\bar{\omega}_{t+1}$
- banks do not affect the entrepreneur's default probability directly

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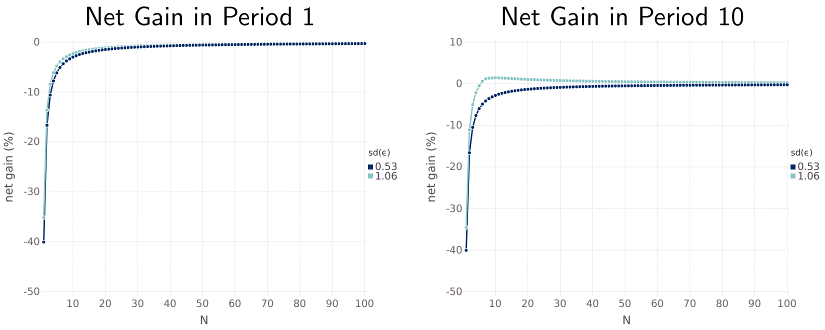
Compare Efficiency Loss with Stability Gain



The number of banks N ranges from 1 to 100.

Assume all banks have zero initial equity.

First graph: net gain (%) in period 5 across different N and different sd(ϵ)

Second graph: net gain (%) in period 10 across different N and different sd(ϵ)

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Effect of Bank Concentration on Default Probability

Dependent variable: CDS spreads (in percent points)

	(1) EU 2003-2016	(2) EU 2003-2016	(3) EU 2003-2011	(4) EU 2003-2011	(5) EU 2011-2016	(6) EU 2011-2016
L.HHI (ECB)	-0.01	-0.08	0.08	-0.03	-0.50***	-0.52***
	(0.06)	(0.06)	(0.12)	(0.09)	(0.08)	(0.11)
L.Equity Ratio		-0.04		-0.33*		0.05
		(0.05)		(0.19)		(0.08)
L.Loan Impairment Ratio		0.50**		1.12***		0.24
		(0.21)		(0.36)		(0.15)
L.GDP growth rate		-0.08		-0.31**		-0.06***
		(0.08)		(0.14)		(0.02)
Observations	704	702	345	342	423	422
Number of Banks	76	76	66	65	76	76
Adjusted R^2	0.653	0.683	0.483	0.605	0.859	0.866
Within R^2	0.000	0.093	0.001	0.245	0.181	0.226

Bank, country, and year fixed effects are included in all regressions.
Bank-level clustered standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Data sources: ECB, Bankscope annual data, World Bank

loan impairment ratio = loan impairment charge/gross loans

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