Bank Capital Regulation with Unregulated Competitors

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SUERF/BAFFI Conference 17
"While higher capital and liquidity requirements on banks will no doubt help to insulate banks from the consequences of large shocks, the danger is that they will also drive a larger share of intermediation into the shadow banking realm."

S. Hanson, A. Kashyap, and J. Stein (2011)
Introduction

- Optimal capital regulation
  - In the presence of unregulated competitors

- Welfare effects of unregulated competitors
  - Taking into account optimal capital regulation

- Focus on financial system structure
  - Competition regulated banking system
  - Efficiency of unregulated competitors
Lending and Regulation - Recent trends

- Tightening of bank regulation since 07/08 crisis
  - Higher (and new) capital requirements
  - Liquidity requirements

- Options for banks:
  - Raise new equity
    - Might be costly - Admati et al. critique
  - Reduce Lending
    - Significant reduction especially in long term lending

- Unregulated institutions stepping in, filling the void
  - Unregulated = Non regulated banks
Unregulated Lending

- Business of direct lending (private debt) is booming
  - Insurance companies, MMF, P2P
  - Fintech companies

- Institutions not considered as banks → not regulated as such
  - No capital regulation
    - No regulatory compliance cost

- Funding directly from (institutional) investors
  - No deposit insurance
  - Investors must bear any losses
Related Literature

- Literature on structure of financial system

- Literature on bank capital requirements
  - Repullo (2004), Blum (1999)

- Literature on bank competition
  - Keeley (1990), Boyd and DeNicolo (2005)

- Literature on “shadow banks”
  - Plantin (2014), Harris, Opp and Opp (2014), Ordoñez (2015), Martinez-Miera and Repullo (2017),
Our contribution

- Unregulated lenders compete with banks
  - They are not set up by banks

- Focus on competitive effects of unregulated institutions
  - No risk shifting effects
    - Introduce (them) in extension
  - No exogenous cost of equity

- **Key role of competitive intensity in banking sector**
  - Long standing literature on bank competition
Main results

- Unregulated competition can increase or decrease welfare
  - Depends on intensity of bank competition

- **Low bank competition** → Uncovered banking market
  - Unregulated lending provides loans to uncovered market and *increases* welfare
  - Capital requirements are higher

- **Intermediate bank competition** → Covered banking market
  - Rent seeking of banks pushes borrowers to unregulated lending
  - Lower welfare → Capital requirements are lower

- Optimal regulatory response increase or decrease in regulation
The Model
Entrepreneur’s financing decision

- No Loan
- Bank 1

Entrepreneur's decision process:
- If no loan is taken, the entrepreneur retains control and profits.
- If a loan is accepted from Bank 1, the entrepreneur gains access to capital but may need to share control or face loan repayment conditions.
Entrepreneur’s financing decision

- No Loan
- Bank 1
- Bank 2
Entrepreneur’s financing decisions

- No Loan
- Bank 1
- Bank 2
- FinTech
Entrepreneur’s financing decisions
Increase bank competition
Entrepreneur’s financing decisions
Increase in Unregulated Institution efficiency
Main building blocks

- Banks have **market power**
  - Can lead to low production
    - Spatial competition model (information)
  - Exogenous (or endogenous) competition intensity $n$
    - Competition regulation or fixed entry costs (regulatory compliance costs)

- **Deposit insurance** for banks
  - Levied with distortionary taxation
  - Bank default is socially costly

- **Different transport costs**
  - Transport costs to banks $\neq$ to unregulated institutions
Why Salop Competition?

- Allows for market power and "standard" solutions
  - Simplifies the analysis

- Has some "disadvantages"
  - Covered vs uncovered situations
  - Clear interpretation of "distance" in reality (information)

- We see covered vs uncovered as a strength
  - Covered markets
    - Situations in which further stimulus does not increase production
  - Uncovered markets
    - Situations in which further stimulus does increase production
Model - Agents

- Static risk neutral setup

- Investors with deep pockets but no access to projects
  - Provide deposits and equity (no extra cost of equity)
  - Outside option cash: risk less interest normalized to zero

- Entrepreneurs
  - Need funding for risky project

- Financial institutions
  - Banks and unregulated institutions
  - Grant loans to entrepreneurs
  - Fund themselves from investors
Deposit Insurance

- If bank defaults DI has to cover losses
  - Not if an unregulated institution defaults
- Cost of raising tax to cover shortfall is captured by $\Psi \geq 1$

Bank obtains $1 - \lambda$ in default and has $1 - k$ deposits

- Shortfall is $\lambda - k$
- Cost of bank default is $\Psi (\lambda - k)$
Road Map

1. Only Bank competition (Inefficient UI)
   1. Uncovered Market $\rightarrow$ Low bank competition
   2. Covered Market $\rightarrow$ High bank competition
   3. (Un)Covered Market $\rightarrow$ Medium bank competition

2. Unregulated Competition (efficient UI)
   1. Uncovered Market $\rightarrow$ Low bank competition
   2. (Un)Covered Market $\rightarrow$ Medium + High bank competition
Bank Lending
Entrepreneurs

- Continuum of penniless entrepreneurs endowed with risky project

\[ R = \begin{cases} 
1 + \alpha & \text{with probability } 1 - p \\
1 - \lambda & \text{with probability } p
\end{cases} \]

- Funded by a bank loan \( 1 + r \)

- Perfect correlation in loan default
  - One loan defaults all loans default
Entrepreneurs heterogeneity/distance

- Heterogeneous in access/distance to a given bank
  - Uniformly distributed on a unit length Salop Circle
  - Entrepreneurs have distance \( \vartheta_i \) to closest bank and traveling cost \( \mu \) per unit of distance

- Entrepreneurs’s utility depends on the rate \( r \) and distance \( \vartheta_i \):

\[
U(r, \vartheta_i) = (1 - p)((1 + \alpha) - (1 + r)) - \mu \vartheta_i
\]
Banks

- Fixed amount $n$
  - Banks settle symmetrically on the Circle

- Collect insured deposits from investors at deposit rate $r_D = 0$

- Subject to capital regulation, $k \geq \hat{k}$
  - Binding $r_D < r_E = \frac{p}{1-p}$

- Banks offer standard debt contract
  - Require repayment $1 + r$

- In case of failure
  - Borrowers and Banks receive nothing
  - DI receives $1 - \lambda$ from failed project and repays $1 - k$ to depositors
Bank Competition level

- Three relevant levels of $n$
  - Always uncovered market
    - Low level of competition $n < \bar{n} = \frac{\mu}{(1-p)\alpha}$
  - Always covered market
    - High level of competition $n > \bar{n} = \frac{\mu}{(1-p)\alpha-p\lambda}$
  - Market being covered depends on regulation
    - Medium level of competition $\underline{n} \leq n \leq \bar{n}$
Bank Lending - Uncovered Market
The indifferent borrower $U(r(k, n), \theta) = 0$ determines demand

$$\hat{\theta}(r) = \frac{(1 - p)(\alpha - r)}{\mu}$$

Profits of the bank

$$\Pi(r, k) = 2\frac{(1 - p)(\alpha - r)}{\mu} \left[(1 - p)((1 + r) - (1 - k)) - k\right]$$

Equilibrium loan rate

$$r^*(k) = \frac{1}{2} \left(\alpha + k \frac{p}{1 - p}\right)$$

Higher capital requirements increase $r^*(k)$, decreasing loan demand $\hat{\theta}(k)$.
Bank Lending - increase in k
Bank Lending - increase in k
Welfare - Only banks

- Bank profits $\Pi(k) = \frac{(1-p)\alpha - kp}{2\mu}^2$
- Borrowers utility $U_\theta(k) = \frac{1}{2}((1-p)\alpha - kp) - \mu \theta$

\[
2 \int_0^{\theta(k)} U(r^*, \theta) d\theta = 2\theta(r^*) \frac{1}{2} (((1-p)\alpha - kp) - 2 \int_0^{\theta(k)} \mu \theta d\theta
\]

- Expected DI costs (per bank) $DI = p2\hat{\theta}(r^*) \Psi(\lambda - k)$

- Welfare

\[
W(k) = n \left( \Pi(k) - \Psi DI(k) \right) + 2n \int_0^{\hat{\theta}(k)} U(r, \theta) d\theta
\]
Welfare - Uncovered Market

- Recall $\hat{\theta}(r) < 1$:

\[2n\hat{\theta}(k) \left[ \left( (1 - p)\alpha - pk \right) - p\Psi(\lambda - k) \right] - 2n \int_{0}^{\theta(k)} \mu \theta \, d\theta\]

- Marginal increase in capital requirement
  - Reduces DI costs $\rightarrow \uparrow$ welfare $\rightarrow \frac{d\Psi p(\lambda - k)}{dk} < 0$
  - Reduces production $\rightarrow \downarrow$ welfare $\rightarrow \frac{d\hat{\theta}(k)}{dk} < 0$

- "Default cost" vs "Production" trade-off
  - $\Psi$ is key
Optimal capital requirements

\[ k^*(\Psi) = \begin{cases} 
0 & \text{if } \Psi < \Psi_{\min}^B = \frac{3}{2} \frac{(1-p)\alpha}{(1-p)\alpha + \lambda p} \\
\lambda & \text{if } \Psi > \Psi_{\max}^B = \frac{3}{2} \\
& \quad \text{if } \Psi_{\min}^B \leq \Psi \leq \Psi_{\max}^B
\end{cases} \]

Being

\[ k^* = \frac{\lambda p\psi - (1 - p)\alpha \left( \frac{3}{2} - \psi \right)}{p(2\psi - \frac{3}{2})} \]
Capital Requirements - Uncovered Market

\[ \lambda \]

\[ \psi_B^{\text{min}} \]

\[ \psi_B^{\text{max}} \]
Bank Lending - Covered Market

Bank

Bank

Bank
All borrowers receive loans for $k = \lambda$

- $n$ high enough

$$n > \bar{n} = \frac{\mu}{(1 - p)\alpha - \lambda p}$$

- Marginal borrower is indifferent between bank $i$ and bank $j$

$$(1 - p)(\alpha - r_i) - \theta \mu = (1 - p)(\alpha - r_j) - \mu \left(1 - \frac{1}{n} - \theta\right)$$

The critical distance that defines the indifferent borrower is:

$$\hat{\theta} = \frac{\mu + n(1 - p)(r_j - r_i)}{2\mu n}$$
Banks - Covered Market

- Profits of the bank

$$\Pi(r, k) = 2\frac{\mu + n(1 - p)(r_j - r_i)}{2\mu n} [(1 - p)((1 + r) - (1 - k)) - k]$$

- Equilibrium loan rate

$$r^*(k) = \left( \frac{kp + \frac{\mu}{n}}{1 - p} \right)$$

- Higher capital requirements $\rightarrow$ $r^*(k) \rightarrow$ loan demand
Recall $\hat{\theta}(r) = 1$:

$$
1 \left[ \underbrace{((1 - p)\alpha - kp)}_{\text{successful production}} - \underbrace{\Psi p(\lambda - k)}_{\text{net bank default cost}} \right] - 2n \int_{0}^{\frac{1}{2n}} \mu \theta \, d\theta
$$

Marginal increase in capital requirement

- Reduces DI costs $\rightarrow \uparrow$ welfare
- Does not change production

No trade-off
- $\Psi > 1$
Optimal capital requirements

\[ k^*(\Psi) = \begin{cases} 
\lambda & \text{if } \Psi > 1 
\end{cases} \]
Market being covered or not depends on $k$

- $n$ intermediate
- For $k = 0$ market is covered
- For $k = \lambda$ market is uncovered

Parameter space

$$\frac{\mu}{(1 - p)\alpha} = n < n < \bar{n} = \frac{\mu}{(1 - p)\alpha - \lambda p}$$
Bank Lending - (Un)covered Market - high k
Bank Lending- (Un)covered Market- low k
Optimal capital regulation

- For $k < k^{\text{crit}}$
  - Market is covered
  - No trade-off

- For $k > k^{\text{crit}}$
  - Market is uncovered
  - Trade-off

$$k^{\text{crit}} = \frac{(1-p)\alpha - \frac{\mu}{n}}{p}$$
Optimal capital requirements

\[ k^*(\Psi) = \begin{cases} 
  k^{\text{crit}} & \text{if } \Psi < \hat{\Psi}_B = \frac{3}{2} \frac{\mu}{n((1-p)\alpha + \lambda p) + 2\mu} \\
  k^* & \text{if } \hat{\Psi} \leq \Psi \leq \Psi_B^{\text{max}} \\
  \lambda & \text{if } \Psi > \Psi_B^{\text{max}} = \frac{3}{2} 
\end{cases} \]

Being

\[ k^* = \frac{\lambda p \psi - (1-p)\alpha(\frac{3}{2} - \psi)}{p(2\psi - \frac{3}{2})} \]
Capital requirements (un)covered Market

\[ \lambda \]

\[ k_{B}^{\text{cont}} \]

\[ \Psi_{B}^{\text{cont}} \]

\[ \Psi_{B}^{\max} \]
Unregulated Financial Institutions - Shadow banks

- Located at the center of the circle
  - All entrepreneurs have travel cost of $\mu_{SB}$
  - Measure of efficiency is $\mu_{SB}$ vs $\mu$

- Not subject to regulation
  - No regulatory compliance costs

- No deposit insurance

- Free entry $\to$ perfect competition

- Loan rate offered by SB

\[
(1 - p)(1 + r_{SB}) + p(1 - \lambda) \geq 1
\]

\[
r_{SB} = \frac{p\lambda}{1 - p}
\]
Unregulated Financial Institutions - Shadow banks

Bank 1

Bank 2

Unregulated FI
Unregulated Financial Institutions - Shadow banks

Diagram:
- Bank 1
- Unregulated FI
- Bank 2
Utility for an entrepreneur if SB loan

\[ U_{SB} = (1 - p)(1 + \alpha - (1 - r_{SB})) - \mu_{SB} = (1 - p)\alpha - p\lambda - \mu_{SB} \]

SB are "competitive" as long as \( U_{SB} > 0 \)

\[ \mu_{SB} < (1 - p)\alpha - p\lambda = \bar{\mu}_{SB} \]

Indifferent entrepreneur

\[ (1 - p)(\alpha - r_S) - \mu\theta = U_{SB} \]

\[ \hat{\theta}_{SB} = \frac{(p\lambda + \mu_{SB}) - (1 - p)r_S}{\mu} \]
Unregulated and Bank lending
Unregulated + "not high" $n$

- Unregulated competitors can be a competitive threat
  - If $n < \bar{n}$ and $\mu_{SB} < \bar{\mu}_{SB}$

- The profit of the bank
  \[ \Pi(r_S) = 2 \frac{(1-p)(\alpha - r_S) - U_{SB}}{\mu} [(1-p)r_S - kp] \]

- Equilibrium loan rate
  \[ r^*_S(k) = \frac{1}{2} \left( \alpha + \frac{kp}{1-p} \right) - \frac{1}{2} \frac{U_{SB}}{(1-p)} \]

- SB increase competition
  - Lower loan rates $\rightarrow$ Lower supply of loans by banks $\rightarrow$ but higher from SB
Welfare with SB

- Welfare

\[
2n \hat{\theta}_{SB}(k) \left[ \frac{((1 - p) \alpha - kp) - \Psi p(\lambda - k)}{\text{production}} - \frac{\Psi p(\lambda - k)}{\text{DI cost}} \right] - 2n \int_{0}^{\theta_{SB}(k)} \mu \theta \, d\theta
\]

\[+ (1 - 2n \hat{\theta}_{SB}(k)) U_{SB} \]

shadow borrowing
Welfare with SB

\[(1 - p)\alpha - p\lambda - 2n\hat{\theta}_{SB}(k) (\Psi - 1) p(\lambda - k)\]

- **Full Production**
- **DI cost**

\[-2n \int_{0}^{\hat{\theta}_{SB}(k)} \mu\theta \, d\theta - (1 - 2n\hat{\theta}_{SB}(k))\mu_{SB}\]

- **traveling cost bank**
- **travelling cost unreg**

- **Effect of an increase in capital**
  - Reduction in DI costs (Welfare increasing)
    - Smaller banking sector $\rightarrow \downarrow \hat{\theta}_{SB}(k)$
    - Smaller shortfall $\rightarrow \downarrow (\lambda - k)$
  - Change in transport costs (Welfare reducing)
    - Lower transport costs to banks
    - Higher transport costs to unregulated

- **Changed from overall production losses to efficiency losses**
Optimal Capital regulation with SB

- Optimal $k$ is a function of bank default externalities $\Psi$

$$k_{SB}^*(\Psi) = \begin{cases} 
0 & \text{if } \Psi < \Psi_{SB}^{min} = \frac{3}{2} \frac{p\lambda + \mu_{sb}}{2p\lambda + \mu_{sb}} \\
 k_S^* & \text{if } \Psi_{SB}^{min} \leq \Psi \leq \Psi_{max}^{max} \\
 \lambda & \text{if } \Psi > \Psi_{max}^{max} = \frac{3}{2} 
\end{cases}$$

- Where

$$k_S^* = \lambda - \frac{\mu_{SB} \left( \frac{3}{2} - \psi \right)}{p \left(2\psi - \frac{3}{2}\right)}$$
Capital with SB

\[ \Psi_{SB}^{\text{crit}} \rightarrow \Psi_{\text{max}} \]
Optimal capital with/without SB -low n-
Capital and welfare with SB

- Capital with SB + low $n$ is higher than without SB
- Welfare with SB + low $n$ is higher than without SB

Main intuition
- Lower cost of higher capital requirements
  - Because entrepreneurs obtain financing from SB
SB + intermediate n low k
Optimal Capital regulation with SB

- Optimal $k$ is a function of bank default externalities $\Psi$

$$k_{SB}^*(\Psi) = \begin{cases} 
  k_{SB}^{crit} & \text{if } \Psi < \Psi_{SB}^{min} = \frac{3}{2} \frac{p\lambda + \mu_{sb}}{2p\lambda + \mu_{sb}} \\
  k_{SB}^* & \text{if } \Psi_{SB}^{min} \leq \Psi \leq \Psi_{SB}^{max} \\
  \lambda & \text{if } \Psi > \Psi_{SB}^{max} = \frac{3}{2} 
\end{cases}$$

- Where

$$k_{SB}^* = \lambda - \frac{\mu_{SB}(\frac{3}{2} - \psi)}{p(2\psi - \frac{3}{2})}$$
Optimal Capital with/without SB - intermediate n -

\[ \dot{\lambda} \]

- Capital with Unregulated
- Capital with Only banks

\[ \psi^{\text{max}} \]
Covered banking market for $k = 0$
- Also covered banking market for $k = k_B^-$

For $k = k_B^-$ some entrepreneurs shift to SB
- $\hat{\theta}_s < \hat{\theta}_B$
- Pay travel costs $\mu_{sb}$ instead of $\mu \theta_i$ but pay $r_{SB} < r_B$

Welfare trade-off of such shift
- Pay travel costs $\mu_{sb}$ instead of $\mu \theta_i$
- Save on DI costs $\hat{\theta}_s < \hat{\theta}_B$

\[
\left(1 - 2n\hat{\theta}_s\right)\left[\mu_{SB} - 2n\int_{\hat{\theta}_s}^{\frac{1}{2n}} \mu \theta \, d\theta\right] \leq \left(1 - 2n\hat{\theta}_s\right)\left[(\Psi - 1)\, p\left(\lambda - k_B^{\text{crit}}\right)\right]
\]

$\Delta\text{Transport Costs}$

$\Delta\text{DI Costs}$
Main trade-off

- If you set \( k = k_B^* \) some entrepreneurs shift to SB
- This can have higher travel costs (more inefficient lending)
- Regulator has to set lower \( k \) to prevent that shift

This is bad for society (compared to no SB)

- Does not increase production (market was covered)
- But increases cost of bank failure
More efficient Unregulated Institutions- low n

\[ W \]

\[ \kappa \]

![Graphs showing relationship between \( W \) and \( \kappa \) with \( \mu_{SB} \) as parameter.](image)
More efficient Unregulated Institutions - medium n
Welfare results

\[ n \]

SB
Decrease
Welfare

SB
Increase
Welfare

\[ \mu_{SB} \]
Welfare results
Capital Regulation with unregulated entities is complex
- Depends on the degree of bank competition
- Depends on the efficiency of unregulated entities

Unregulated entities can increase or decrease welfare
- Response is to increase or decrease capital regulation