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 $\longrightarrow$ 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
  - Hölmstrom and Tirole (1997), Repullo and Suarez (1998)
- 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

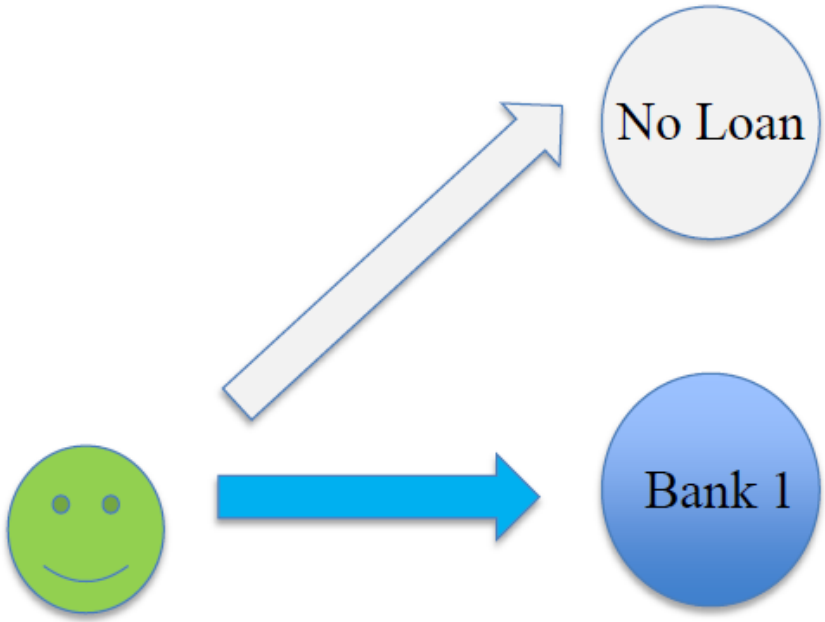
- Unregulated lenders compete with banks
  - They are not set up by banks
- Focus on competitive effects of unregulated institutions
  - No risk shifting effects
    - Introduce (them) in extension
  - No exogenous cost of equity
- **Key role of competitive intensity in banking sector**
  - Long standing literature on bank competition

Main results

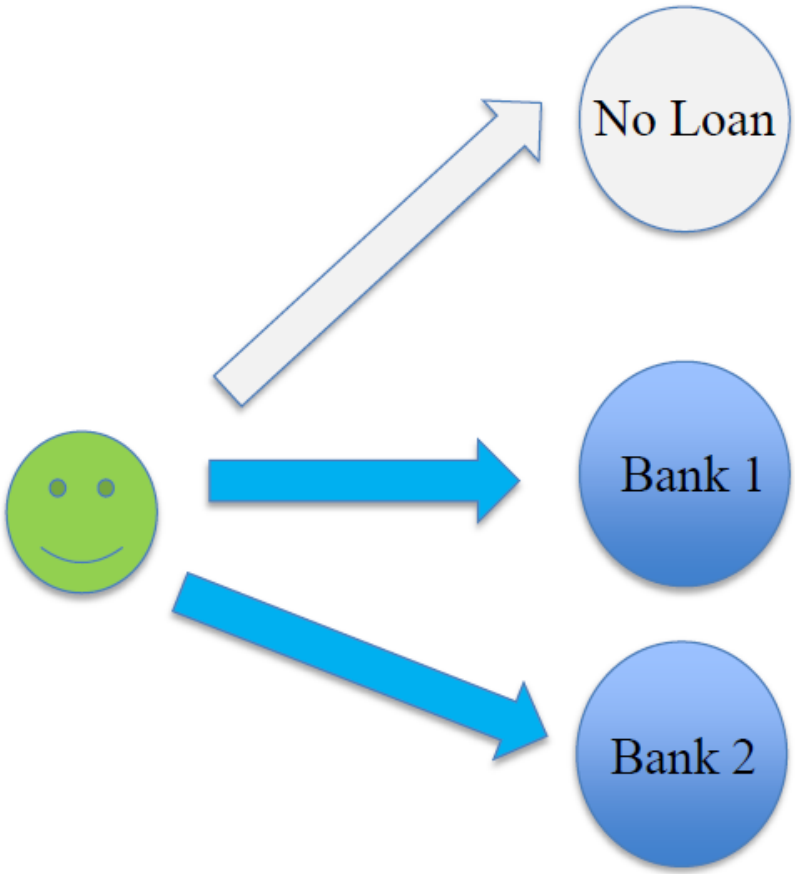
- Unregulated competition can increase or decrease welfare
  - Depends on intensity of bank competition
- **Low bank competition** $\longrightarrow$ Uncovered banking market
  - Unregulated lending provides loans to uncovered market and **increases welfare**
  - **Capital requirements are higher**
- **Intermediate bank competition** $\longrightarrow$ Covered banking market
  - Rent seeking of banks pushes borrowers to unregulated lending
  - **Lower welfare** $\longrightarrow$ **Capital requirements are lower**
- Optimal regulatory response increase or decrease in regulation

The Model

Entrepreneur's financing decision



Entrepreneur's financing decision



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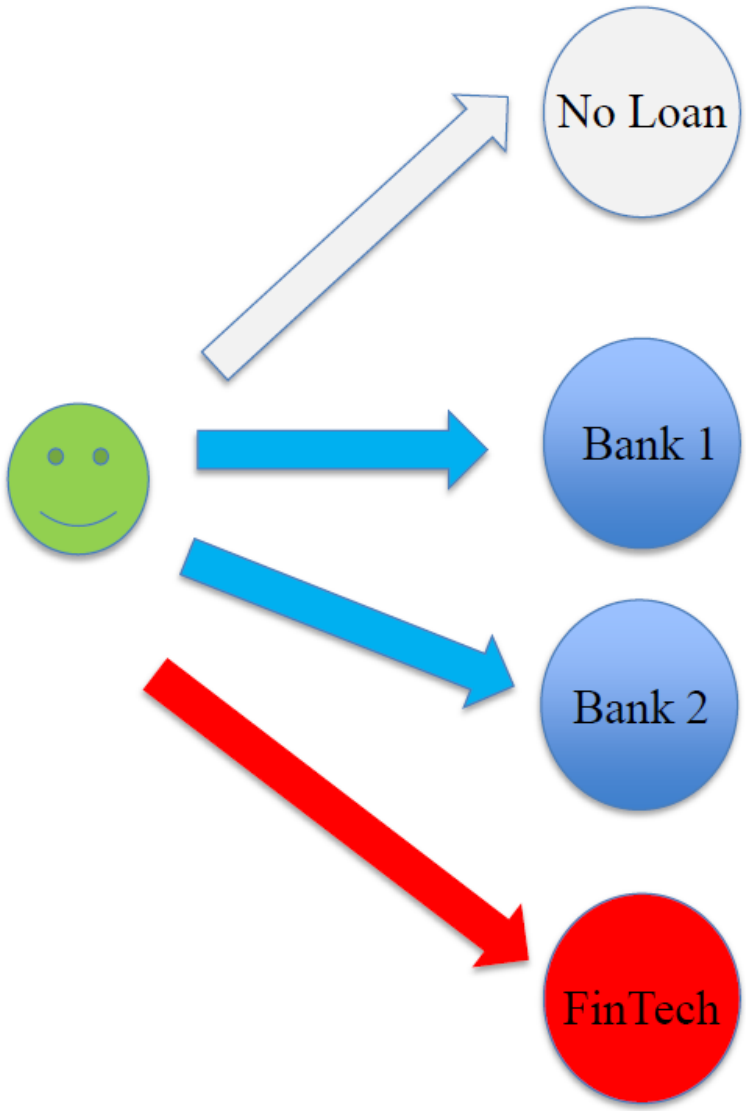

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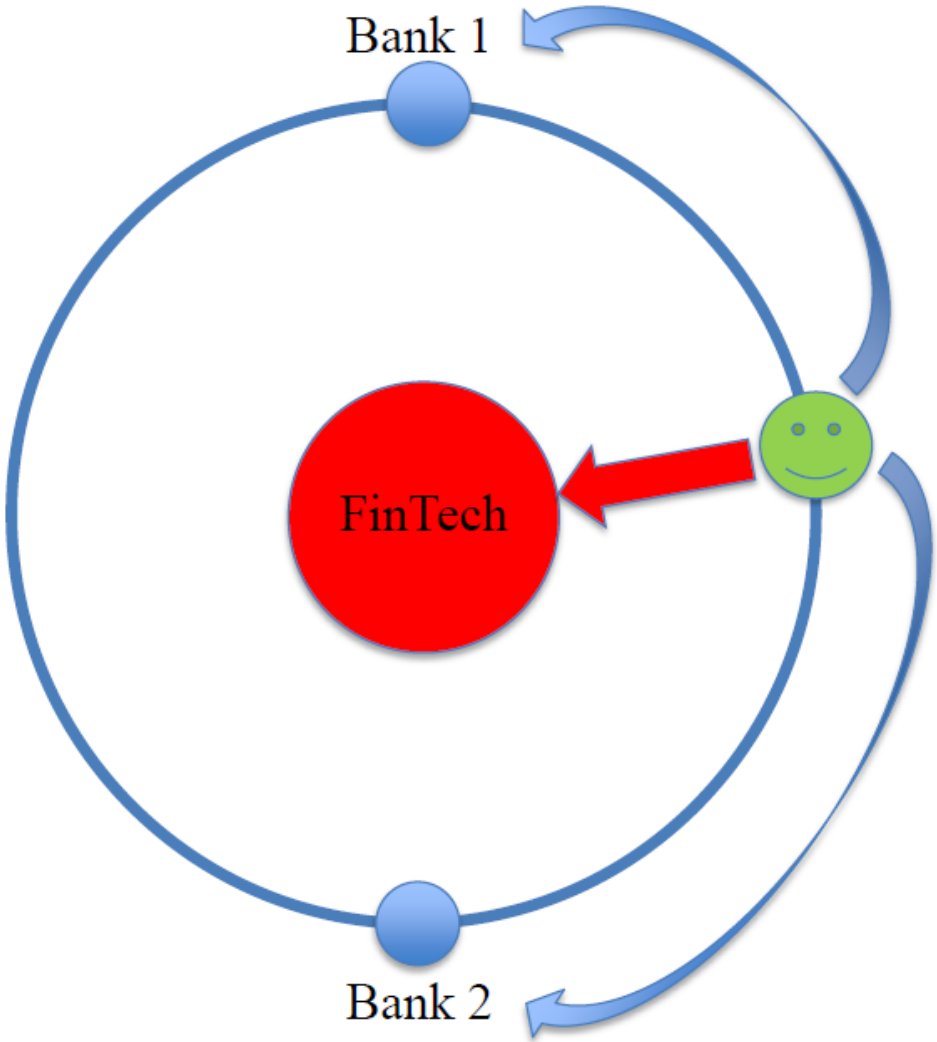
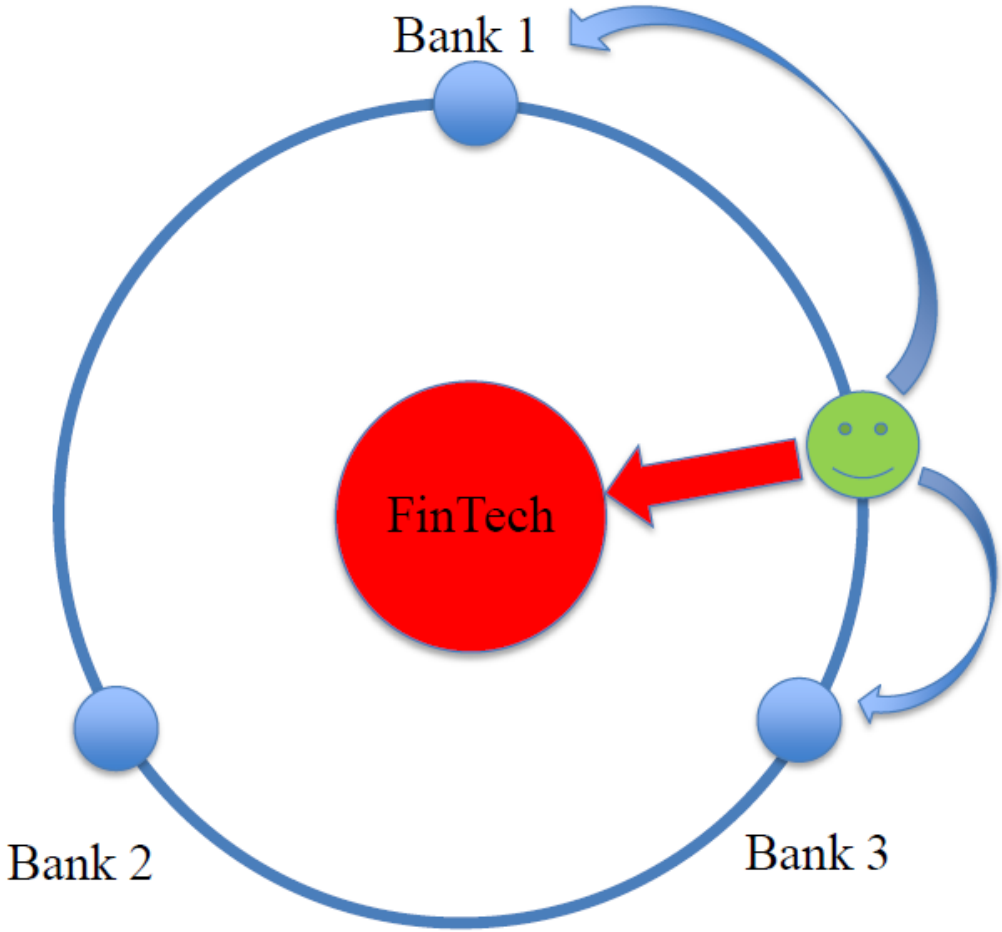
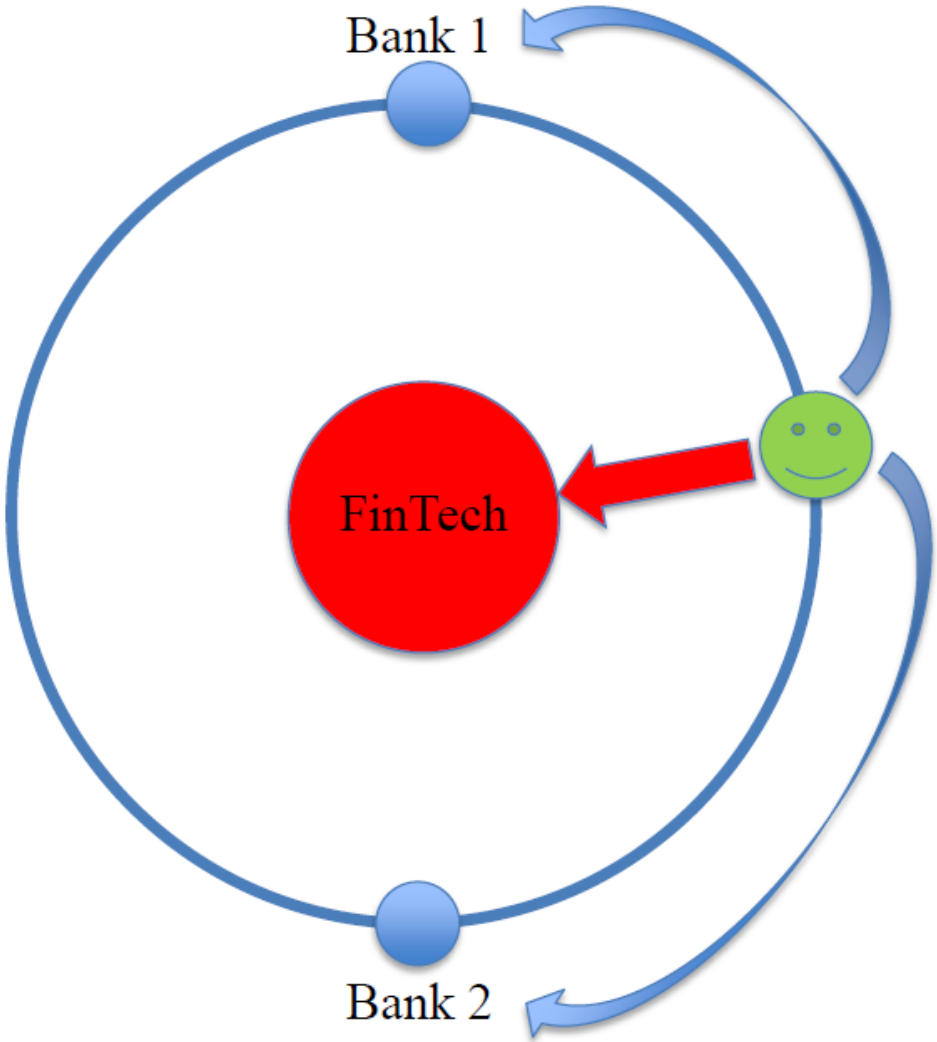


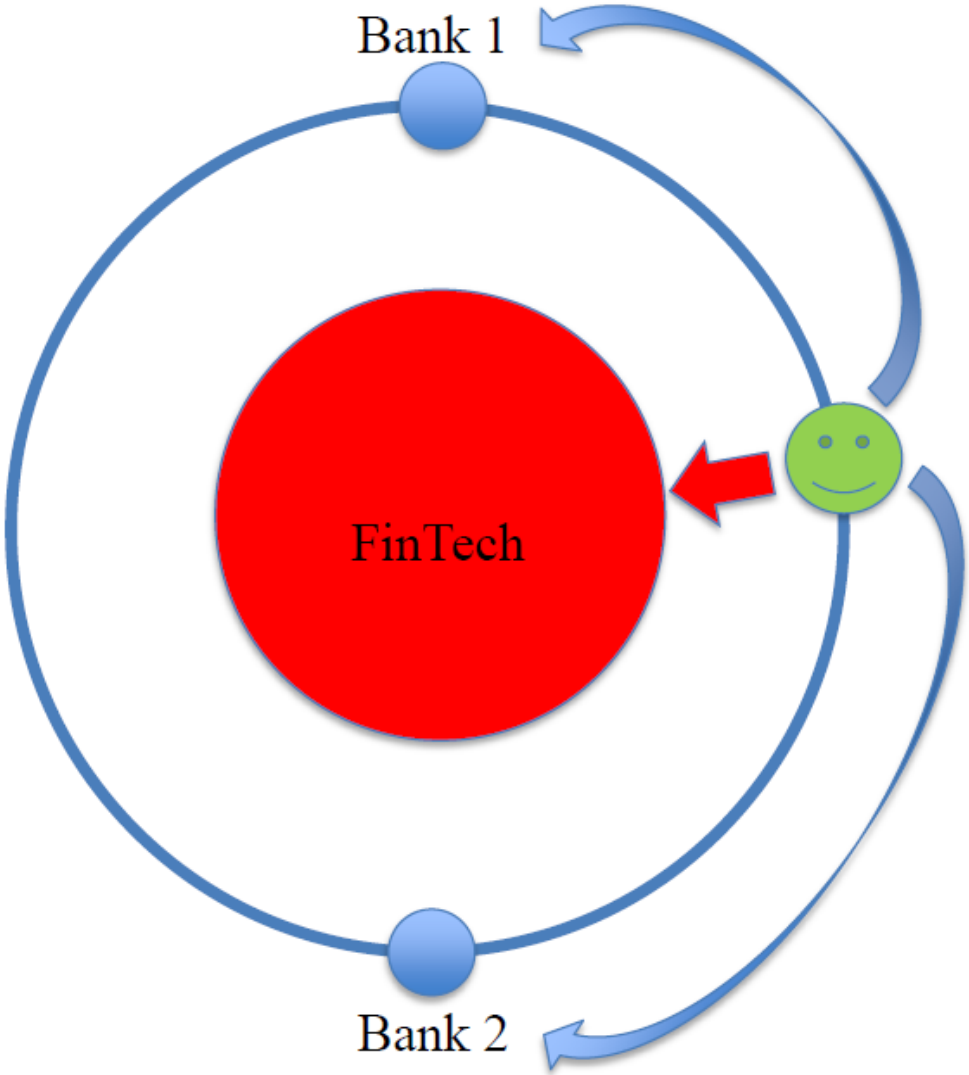
Increase bank competition



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

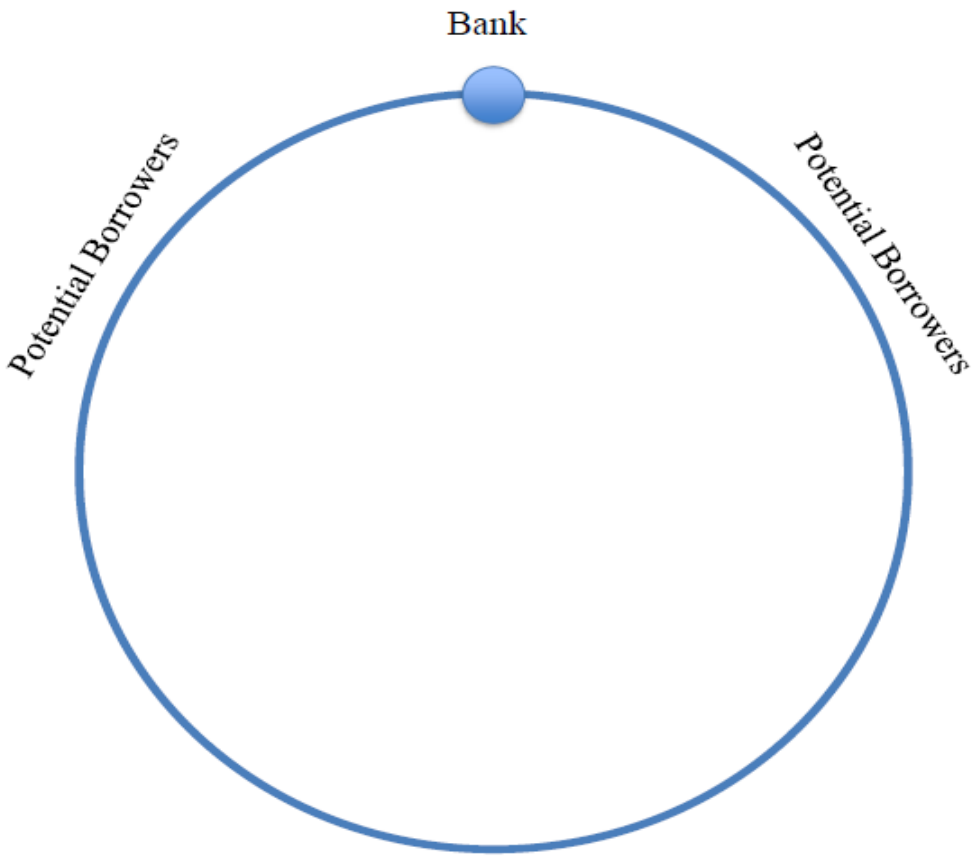
Model - Deposit insurance fund

- 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 $\longrightarrow$ Low bank competition
    2. Covered Market $\longrightarrow$ High bank competition
    3. (Un)Covered Market $\longrightarrow$ Medium bank competition
2. Unregulated Competition (efficient UI)
    1. Uncovered Market $\longrightarrow$ Low bank competition
    2. (Un)Covered Market $\longrightarrow$ Medium + High bank competition

Bank Lending



Entrepreneurs

- Continuum of penniless entrepreneurs endowed with risky project

$$R \quad \begin{cases} 1+\alpha & \text{with probability } 1-p \\ 1-\lambda & \text{with probability } p \end{cases}$$

- 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 ϑ_i to closest bank and traveling cost μ per unit of distance
- Entrepreneurs's utility depends on the rate r and distance ϑ_i

$$U(r, \vartheta_i) = (1 - p)((1 + \alpha) - (1 + r)) - \mu\vartheta_i$$

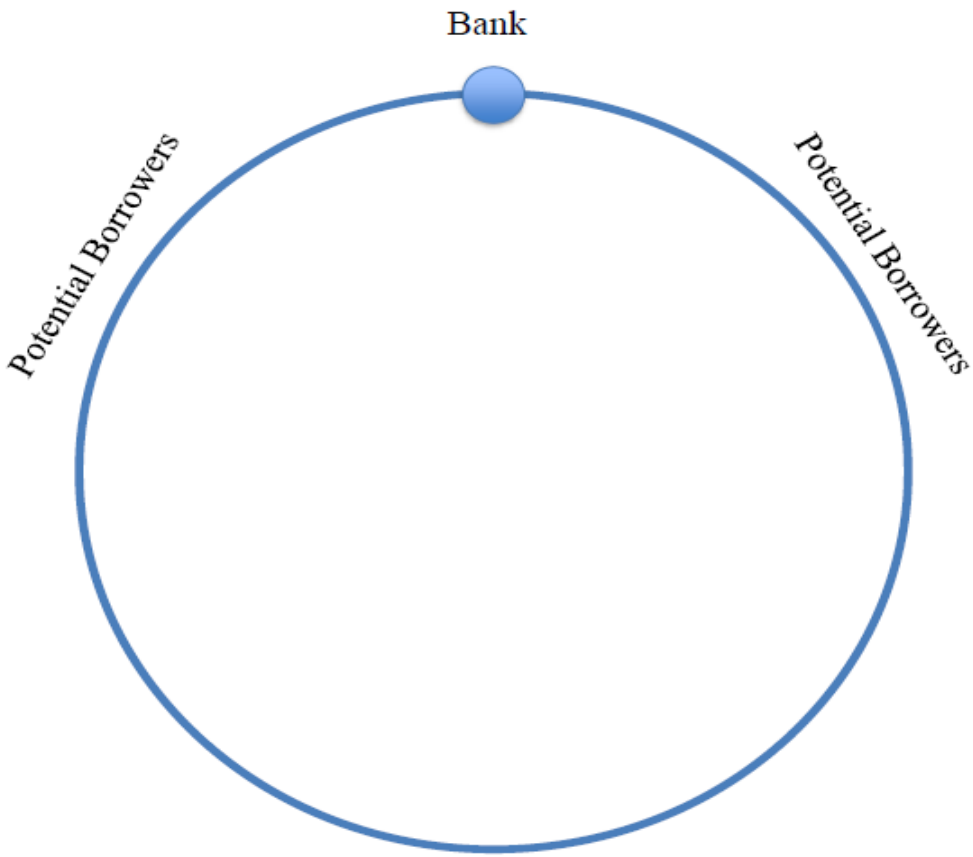
Banks

- 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

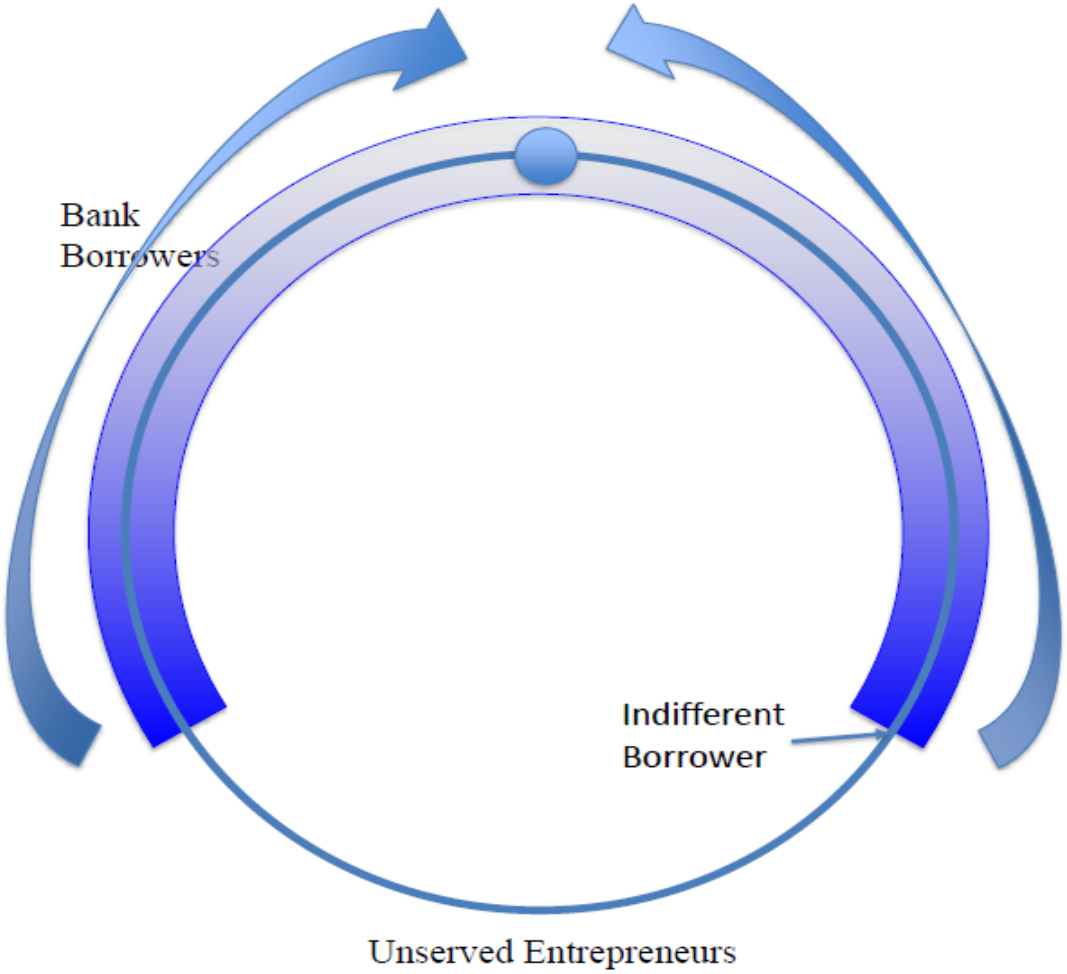
Bank Competition level

- Three relevant levels of n
- Always uncovered market
  - Low level of competition $n < \underline{n} = \frac{\mu}{(1-p)\alpha}$
- 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



Bank Lending- Uncovered Market



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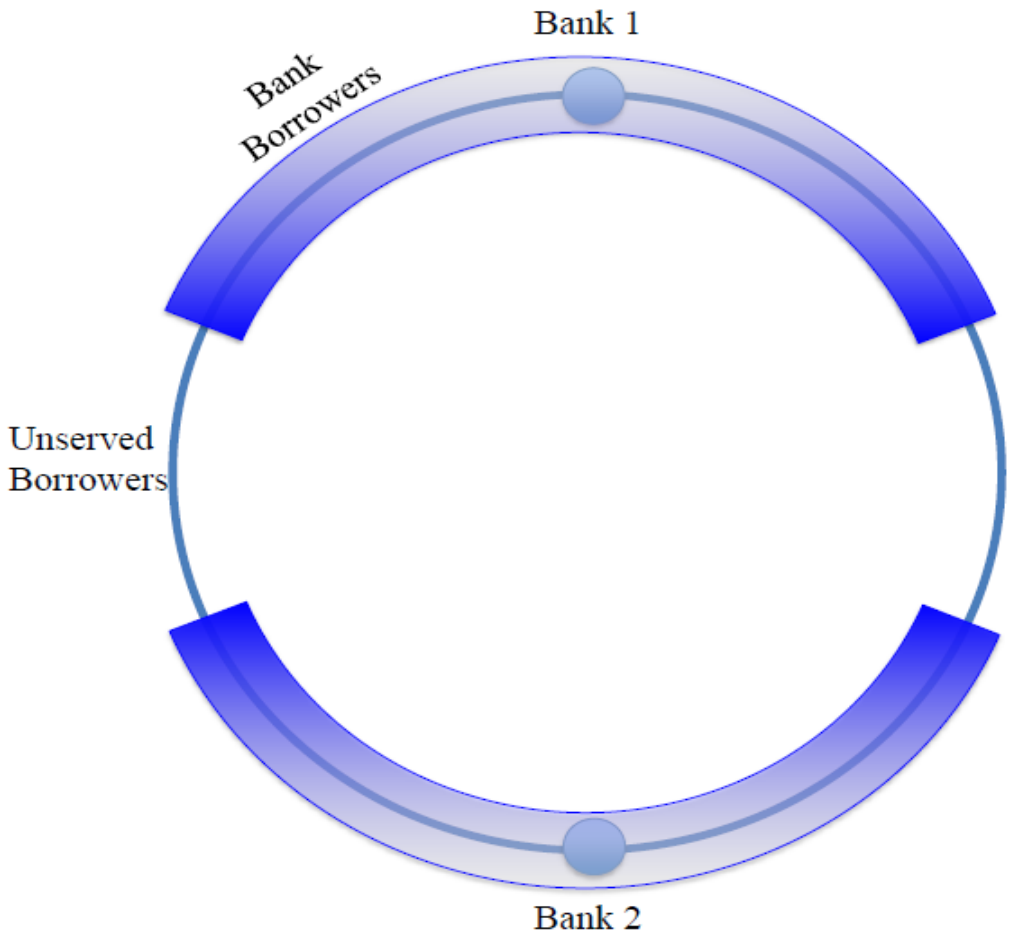


Banks - Uncovered Market

- The indifferent borrower $U(r(k,n),\theta) = 0$ determines demand

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

- Profits of the bank

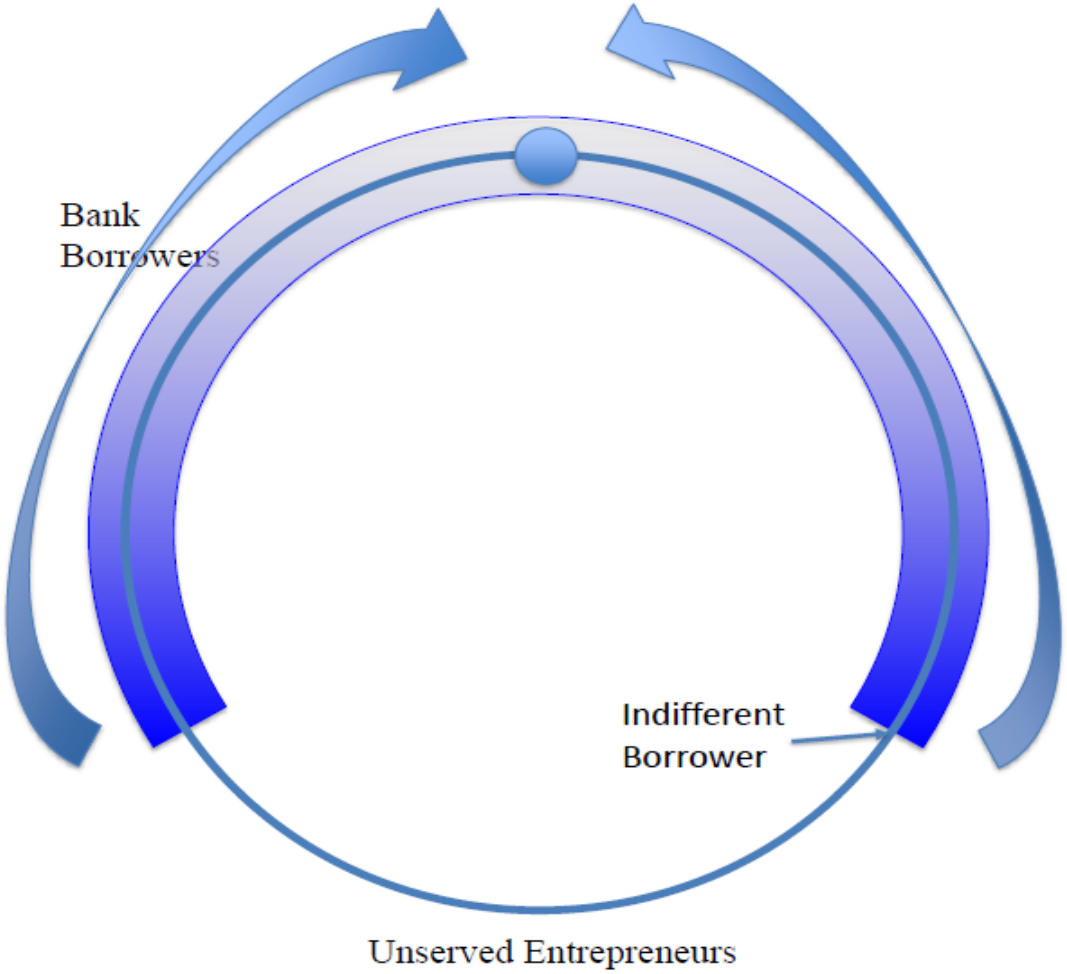
$$\Pi(r,k) = 2\frac{(1-p)(\alpha - r)}{\mu}\left[(1-p)\left((1+r)-(1-k)\right)-k\right]$$

- Equilibrium loan rate

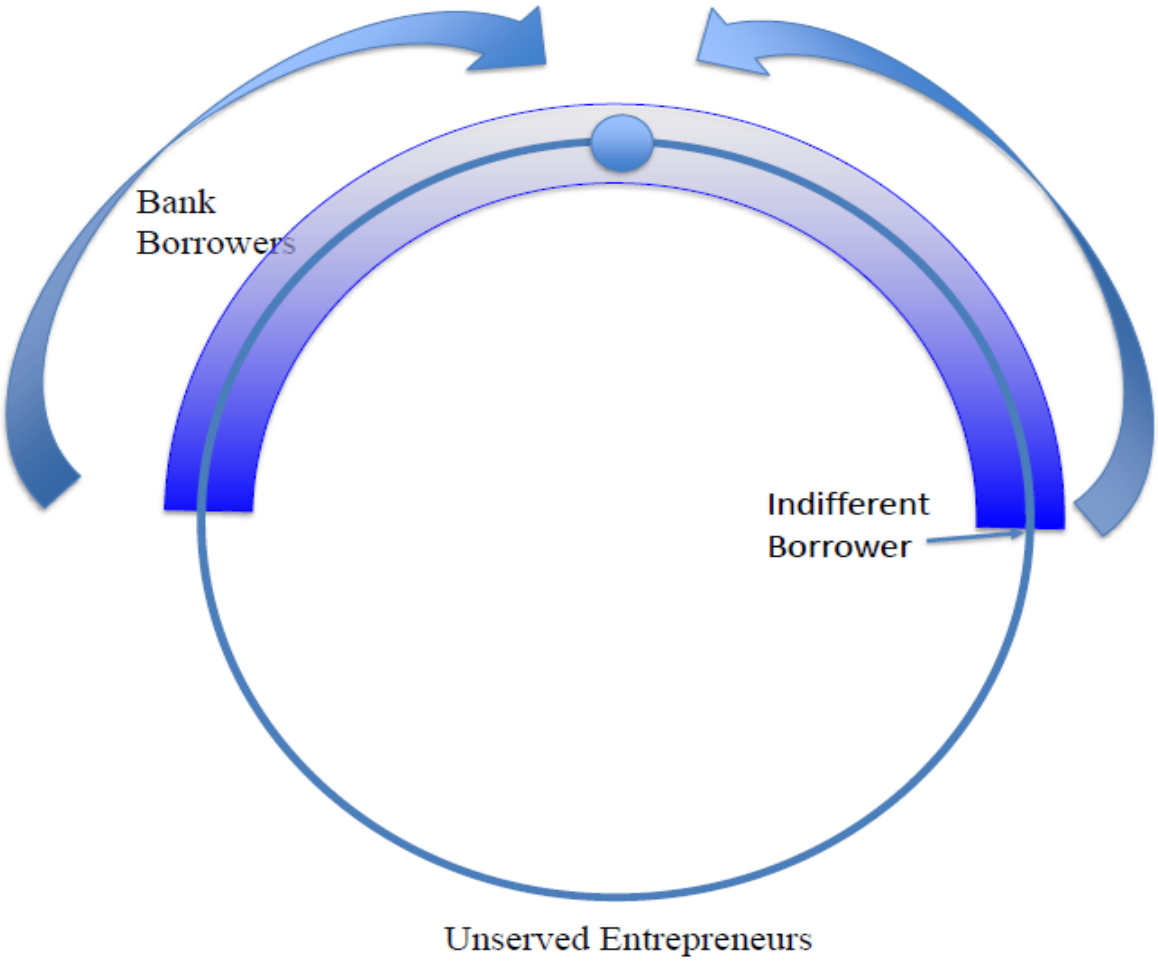
$$r^*(k) = \frac{1}{2}\left(\alpha + k\frac{p}{(1-p)}\right)$$

- Higher capital requirements$\longrightarrow\uparrow$ $r^*(k) \longrightarrow\downarrow$ loan demand $\hat{\theta}(k)$

Bank Lending - increase in k



Bank Lending - increase in k



Welfare - Only banks

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

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

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

$$W(k) = n\,(\Pi(k) - \Psi DI(k)) + 2\,n\int_0^{\hat{\theta}(k)} U(r,\theta)d\theta$$

Welfare - Uncovered Market

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

$$2n\hat{\theta}(k)\left[\underbrace{((1-p)\alpha - pk)}_{\text{production}} - \underbrace{p\Psi(\lambda - k)}_{\text{deposit insurance cost}}\right] - 2n\underbrace{\int_0^{\theta(k)} \mu\theta \, d\theta}_{\text{traveling cost}}$$

- Marginal increase in capital requirement
  - Reduces DI costs $\longrightarrow\uparrow$ welfare$\longrightarrow \frac{d\Psi p(\lambda - k)}{dk} < 0$
  - Reduces production $\longrightarrow\downarrow$ welfare$\longrightarrow \frac{d\hat{\theta}(k)}{dk} < 0$
- "Default cost" vs "Production" trade-off
  - Ψ is key

Capital Requirements - Uncovered Market

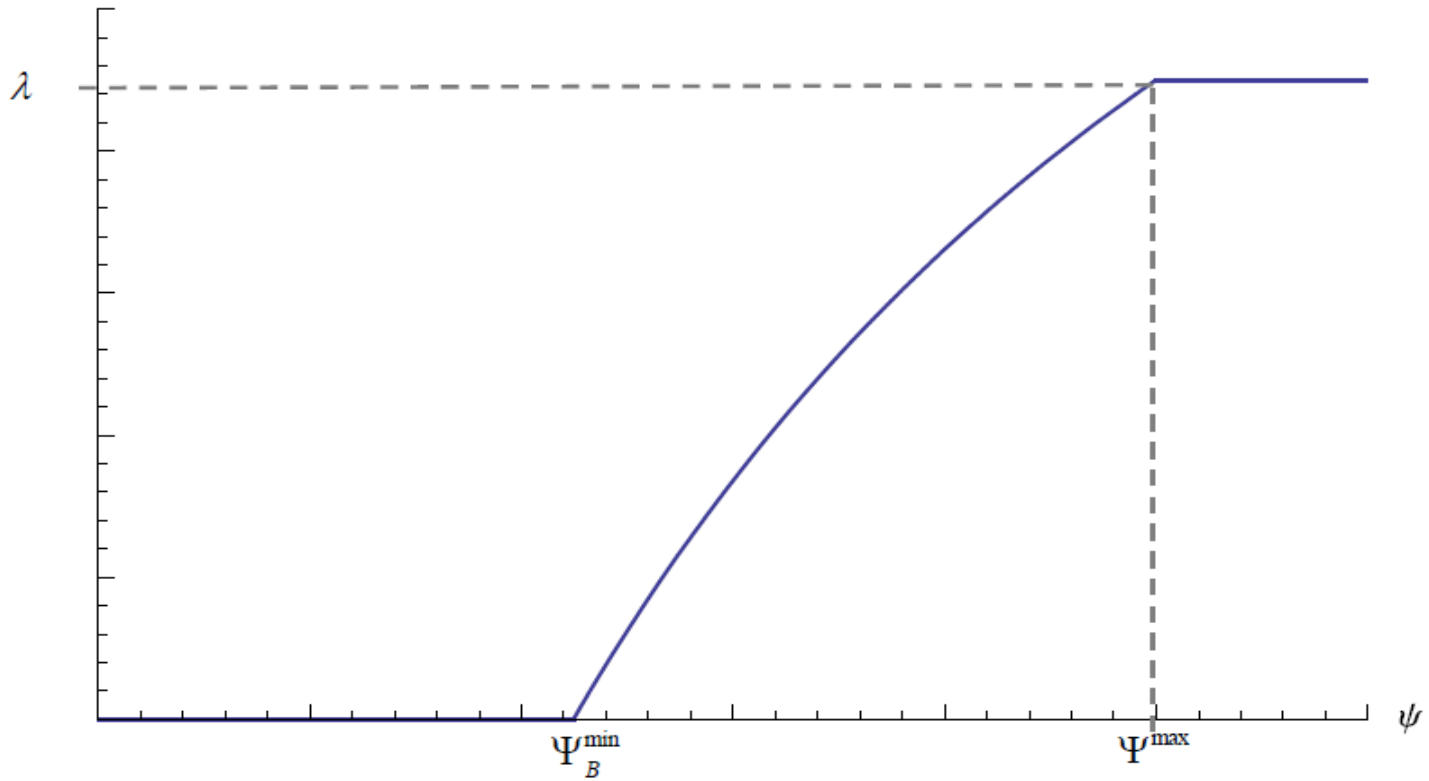
- Optimal capital requirements

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

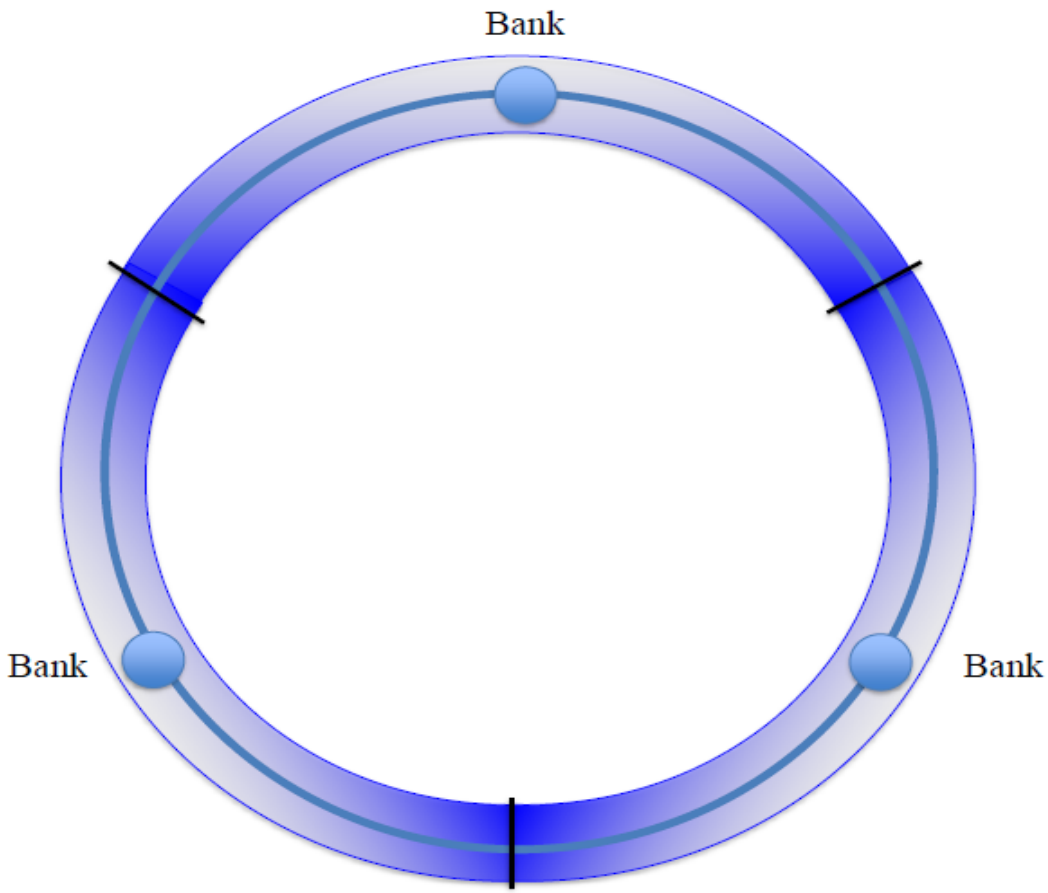
- Being

$$k^* = \frac{\lambda p\psi - (1-p)\alpha(\frac{3}{2} - \psi)}{p(2\psi - \frac{3}{2})}$$

Capital Requirements - Uncovered Market



Bank Lending- Covered Market



Banks - Covered Market

- 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

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

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

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

- Equilibrium loan rate

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

- Higher capital requirements$\longrightarrow\uparrow$ $r^*(k)$ $\longrightarrow=$loan demand

Welfare - Covered Market

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

$$1\left[\underbrace{((1-p)\alpha - kp)}_{\text{successful production}} - \underbrace{\Psi p(\lambda - k)}_{\text{net bank default cost}}\right] - \underbrace{2n\int_0^{\frac{1}{2n}} \mu\theta \, d\theta}_{\text{traveling cost}}$$

- Marginal increase in capital requirement
  - Reduces DI costs $\longrightarrow\uparrow$ welfare
  - Does not change production
- No trade-off
  - $\Psi > 1$

Capital Requirements - Covered Market

- Optimal capital requirements

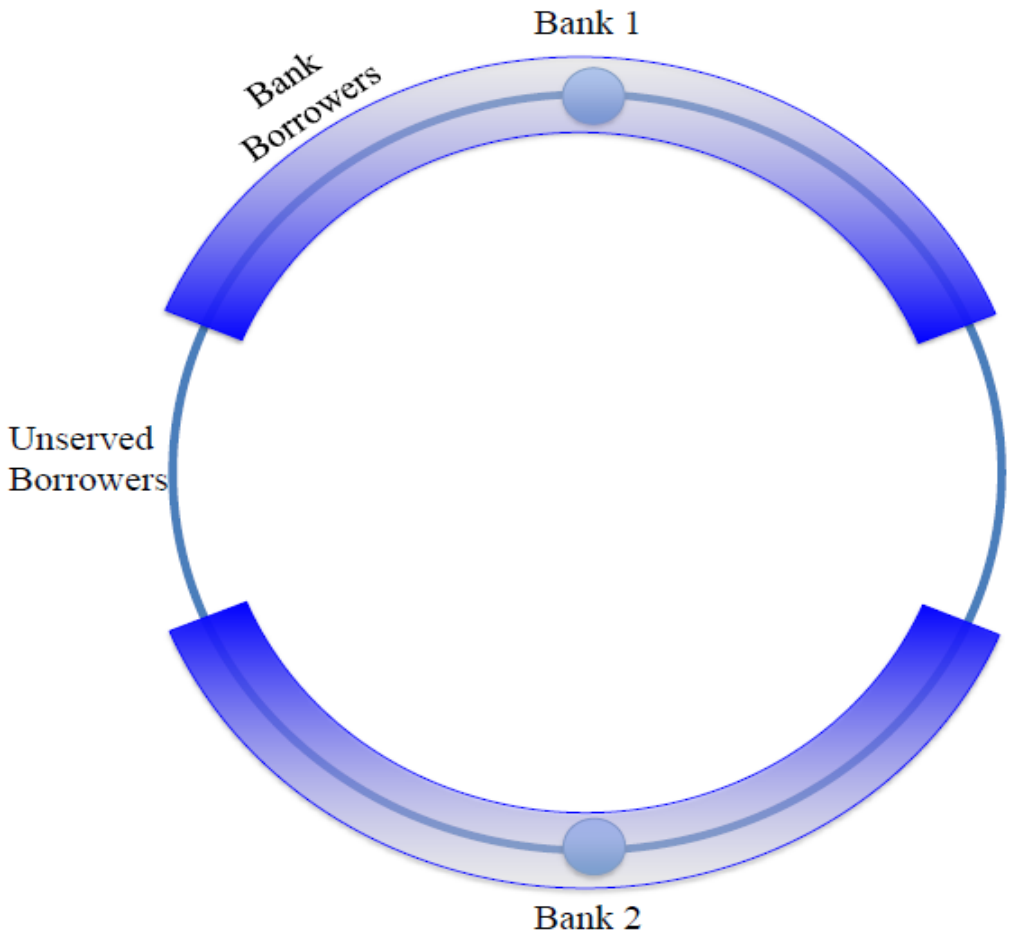
$$k^*(\Psi) = \begin{cases} \lambda & \text{if } \Psi > 1 \end{cases}$$

Banks - (Un)Covered Market

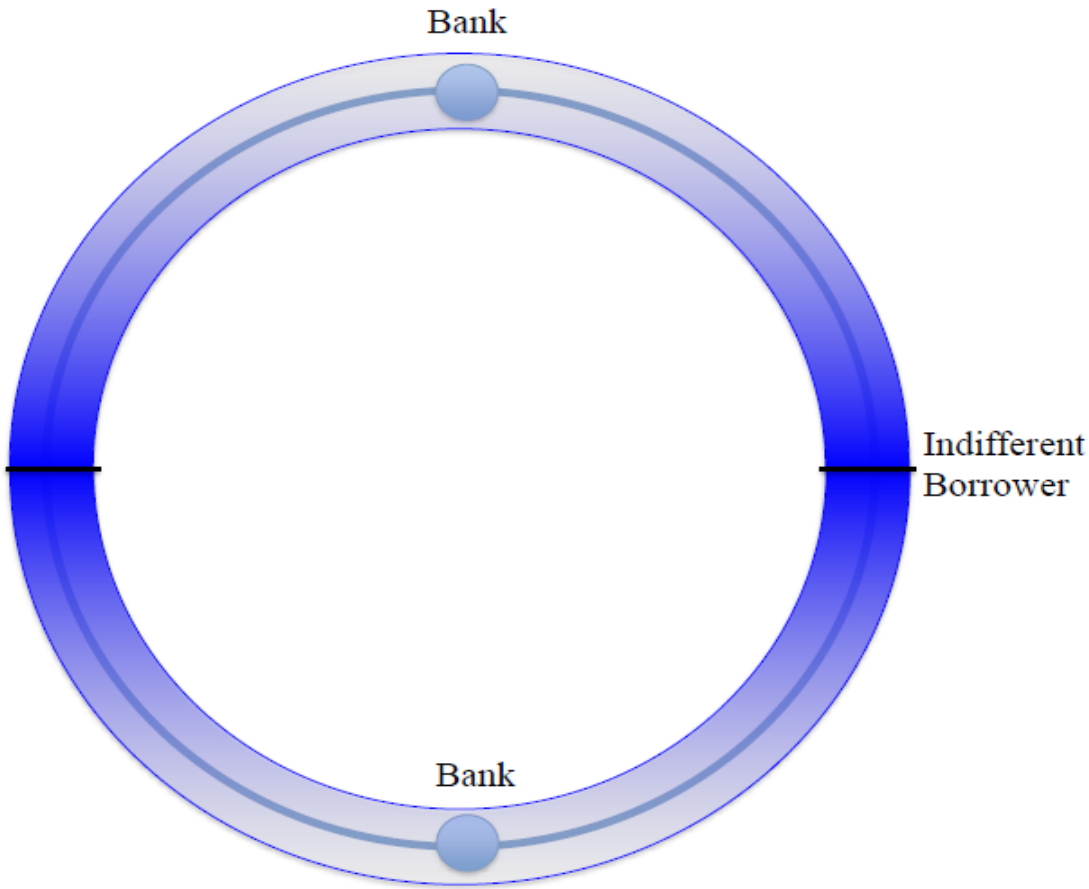
- Market being covered or not depends on k
  - n intermediate
  - For $k = 0$ market is covered
  - For $k = \lambda$ market is uncovered
- Parameter space

$$\frac{\mu}{(1-p)\alpha} = \underline{n} < n < \overline{n} = \frac{\mu}{(1-p)\alpha - \lambda\, p}$$

Bank Lending- (Un)covered Market-high k



Bank Lending- (Un)covered Market- low k



Optimal capital regulation

- For $k < k^{crit}$
  - Market is covered
  - No trade-off
- For $k > k^{crit}$
  - Market is uncovered
  - Trade-off
- $k^{crit} = \frac{(1-p)\alpha - \frac{\mu}{n}}{p}$

Capital Requirements - (Un)covered Market

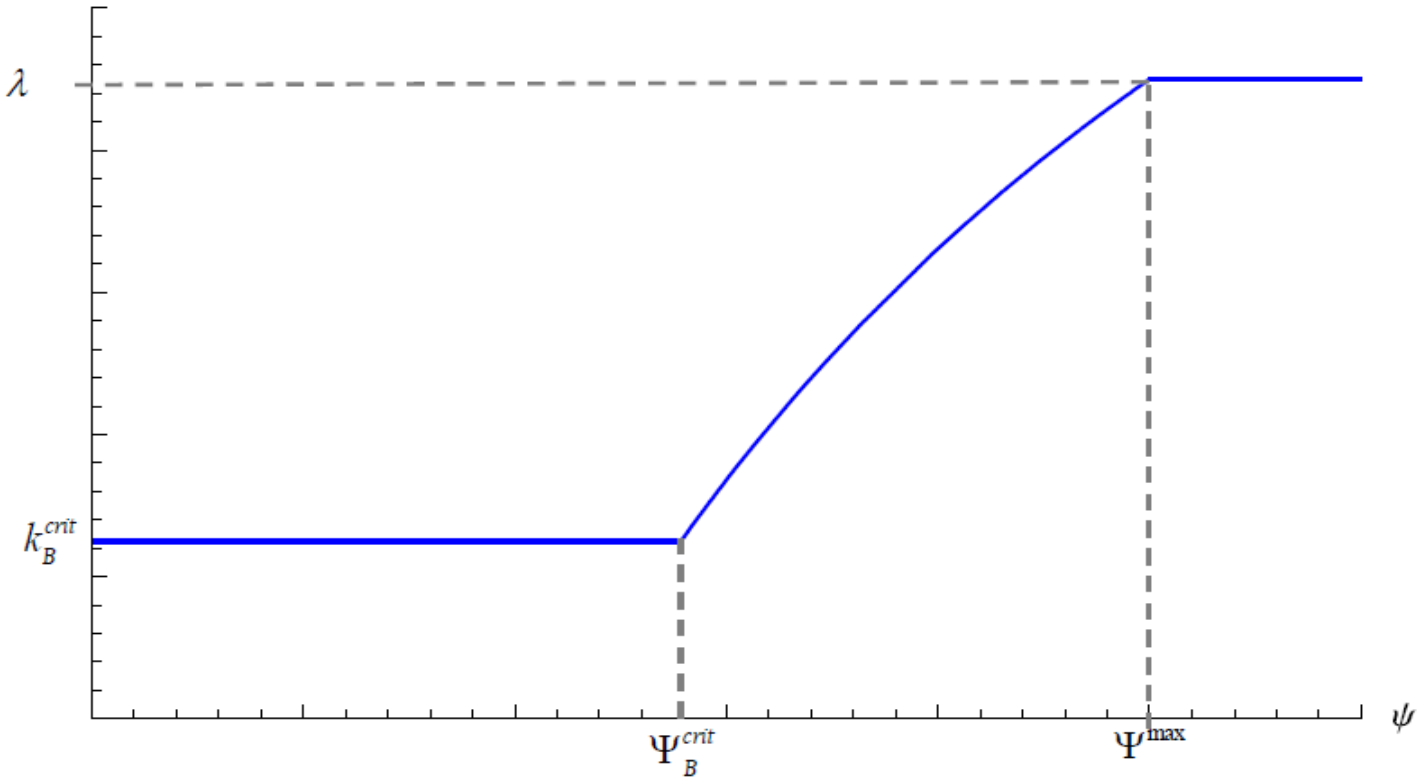
- Optimal capital requirements

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

- Being

$$k^* = \frac{\lambda p\psi - (1-p)\alpha(\frac{3}{2} - \psi)}{p(2\psi - \frac{3}{2})}$$

Capital requirements (un)covered Market

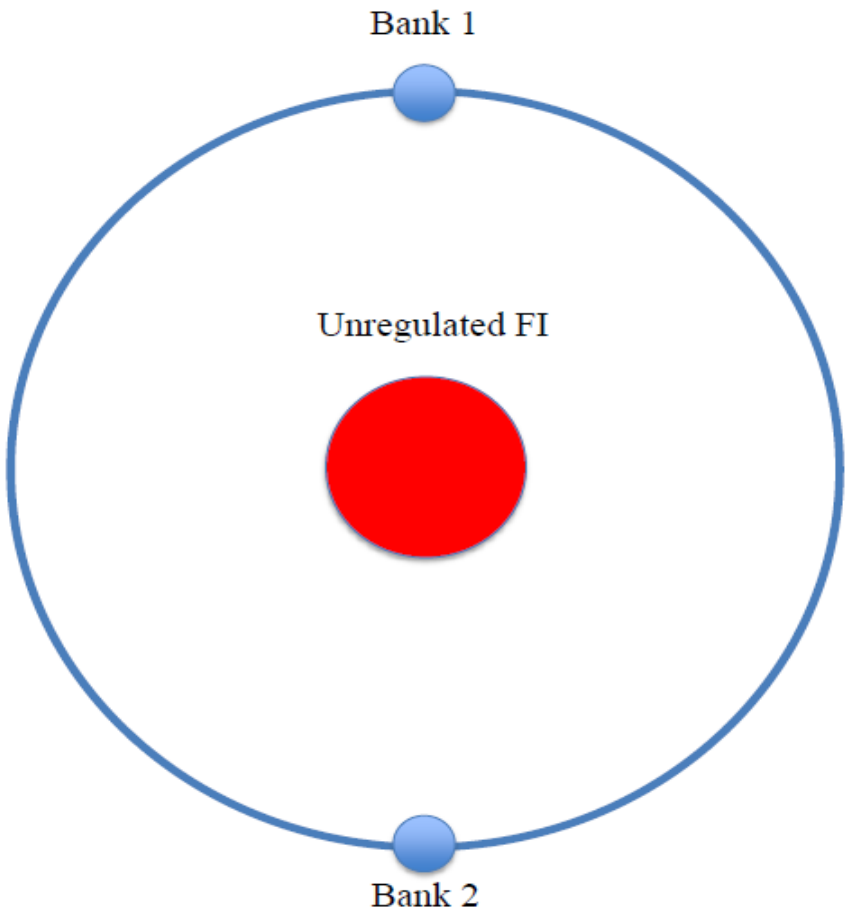


Unregulated Financial Institutions- Shadow banks

- Located at the center of the circle
  - All entrepreneurs have travel cost of μ_{SB}
  - Measure of efficiency is μ_{SB} vs μ
- **Not subject to regulation**
  - No regulatory compliance costs
- **No deposit insurance**
- Free entry$\longrightarrow$ perfect competition
- Loan rate offered by SB

$$\begin{aligned}(1-p)(1+r_{SB})+p(1-\lambda) &\geq 1\\ r_{SB} &= \frac{p\lambda}{1-p}\end{aligned}$$

Unregulated Financial Institutions- Shadow banks



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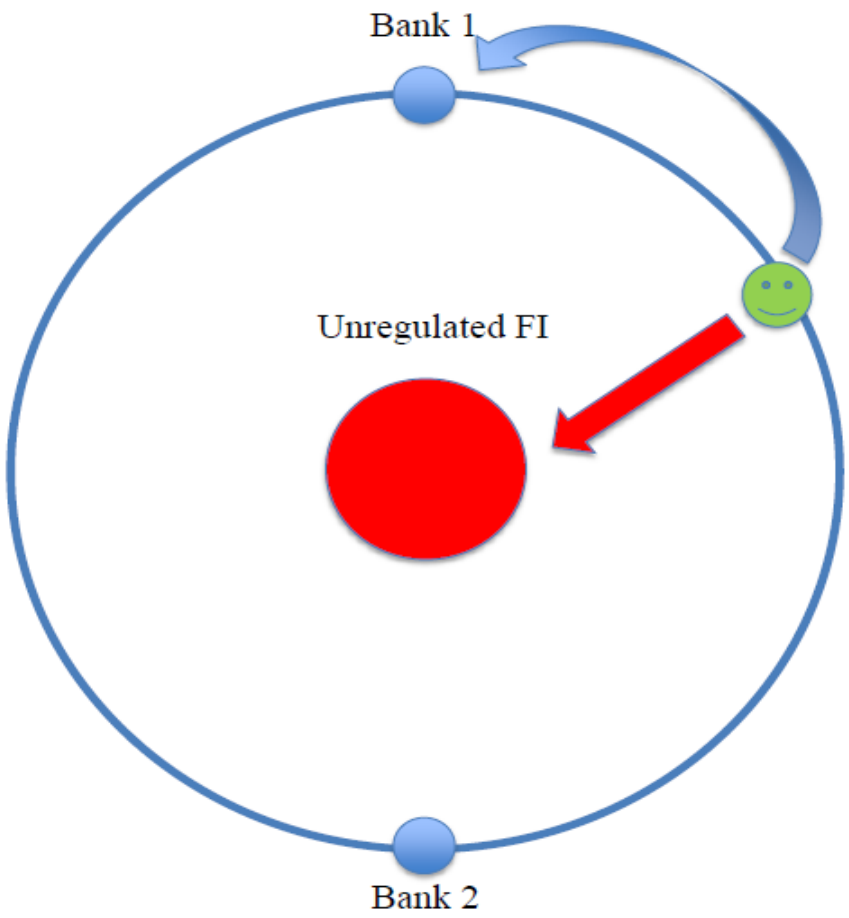


Shadow banks and Bank lending

- Utility for an entrepreneur if SB loan

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

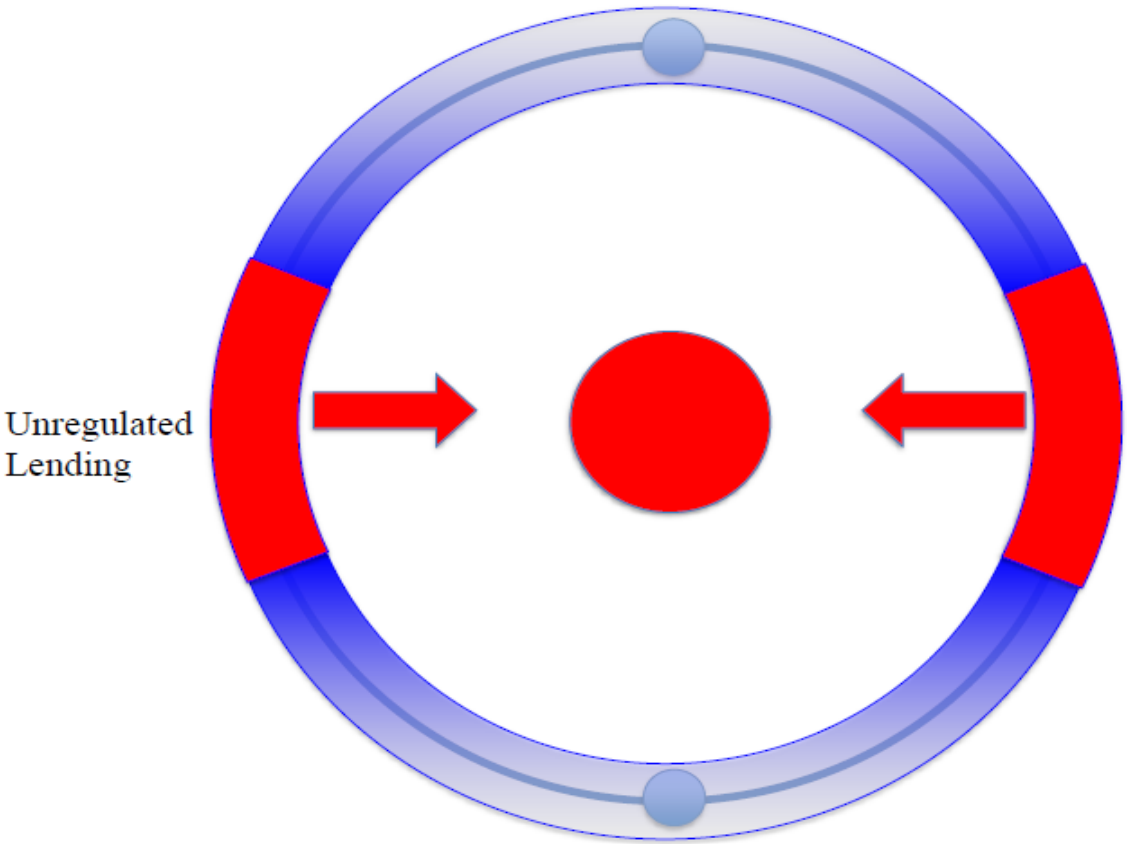
- SB are "competitive" as long as $U_{SB} > 0$

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

- Indifferent entrepreneur

$$\begin{aligned}(1-p)(\alpha - r_S) - \mu\theta &= U_{SB} \\ \hat{\theta}_{SB} &= \frac{(p\lambda + \mu_{SB}) - (1-p)r_S}{\mu}\end{aligned}$$

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

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

- Equilibrium loan rate

$$r_S^*(k) = \underbrace{\frac{1}{2}\left(\alpha + \frac{k\,p}{(1-p)}\right)}_{r^*(k)} - \frac{1}{2}\frac{U_{SB}}{(1-p)}$$

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

Welfare with SB

- Welfare

$$2n\hat{\theta}_{SB}(k)\left[\underbrace{((1-p)\alpha - kp)}_{\text{production}} - \underbrace{\Psi p(\lambda - k)}_{\text{DI cost}}\right] - \underbrace{2n\int_0^{\theta_{SB}(k)} \mu\theta\, d\theta}_{\text{traveling cost}}$$

$$+\underbrace{(1-2n\hat{\theta}_{SB}(k))U_{SB}}_{\text{shadow borrowing}}$$

Welfare with SB

$$\underbrace{(1-p)\alpha - p\lambda}_{\text{Full Production}} - \underbrace{2n\,\hat{\theta}_{SB}(k)\,(\Psi-1)\,p(\lambda-k)}_{\text{DI cost}}$$

$$\underbrace{-2n\int_0^{\theta_{SB}(k)} \mu\theta\, d\theta}_{\text{traveling cost bank}} - \underbrace{(1-2n\hat{\theta}_{SB}(k))\mu_{SB}}_{\text{travelling cost unreg}}$$

- Effect of an increase in capital
  - Reduction in DI costs (Welfare increasing)
    - Smaller banking sector $\longrightarrow\downarrow \hat{\theta}_{SB}(k)$
    - Smaller shortfall$\longrightarrow\downarrow (\lambda - k)$
  - 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

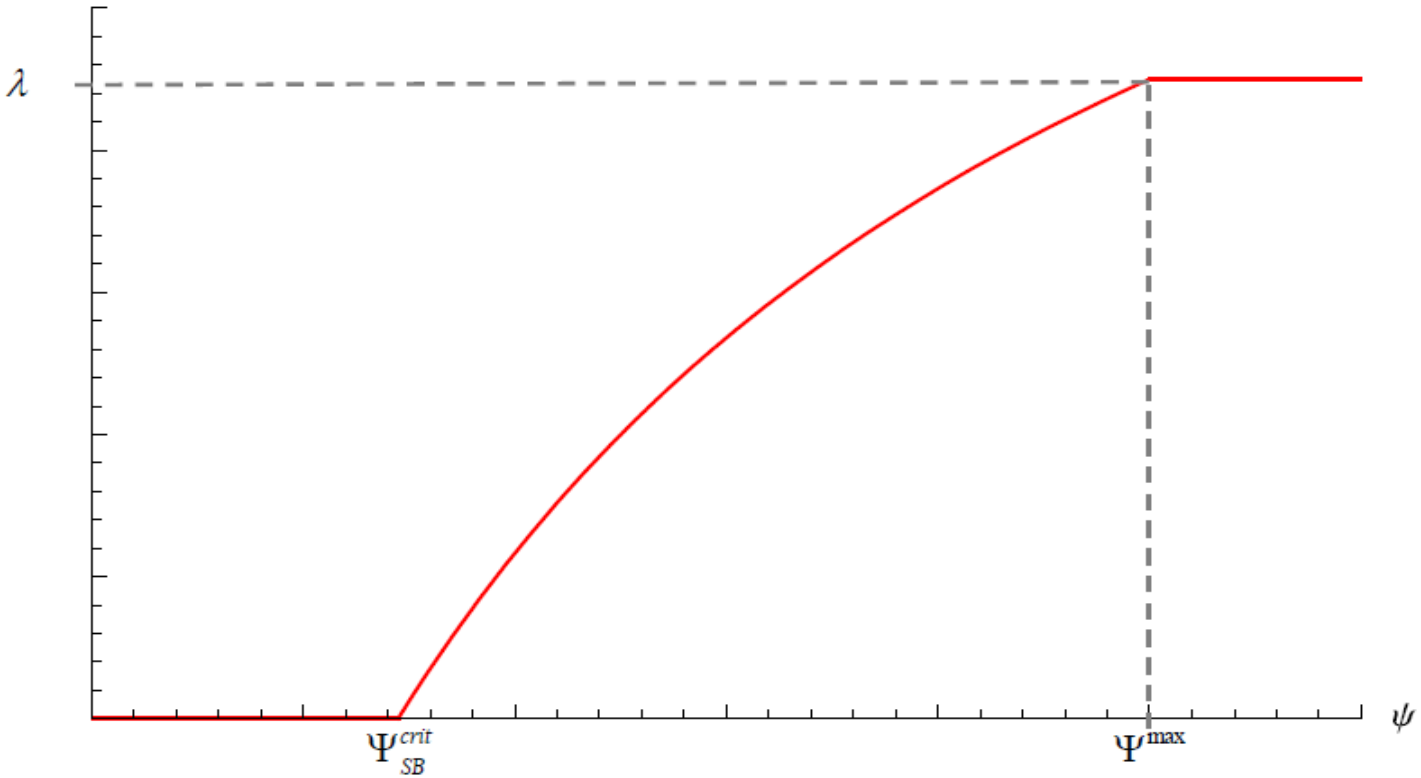
- Optimal k is a function of bank default externalities Ψ

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

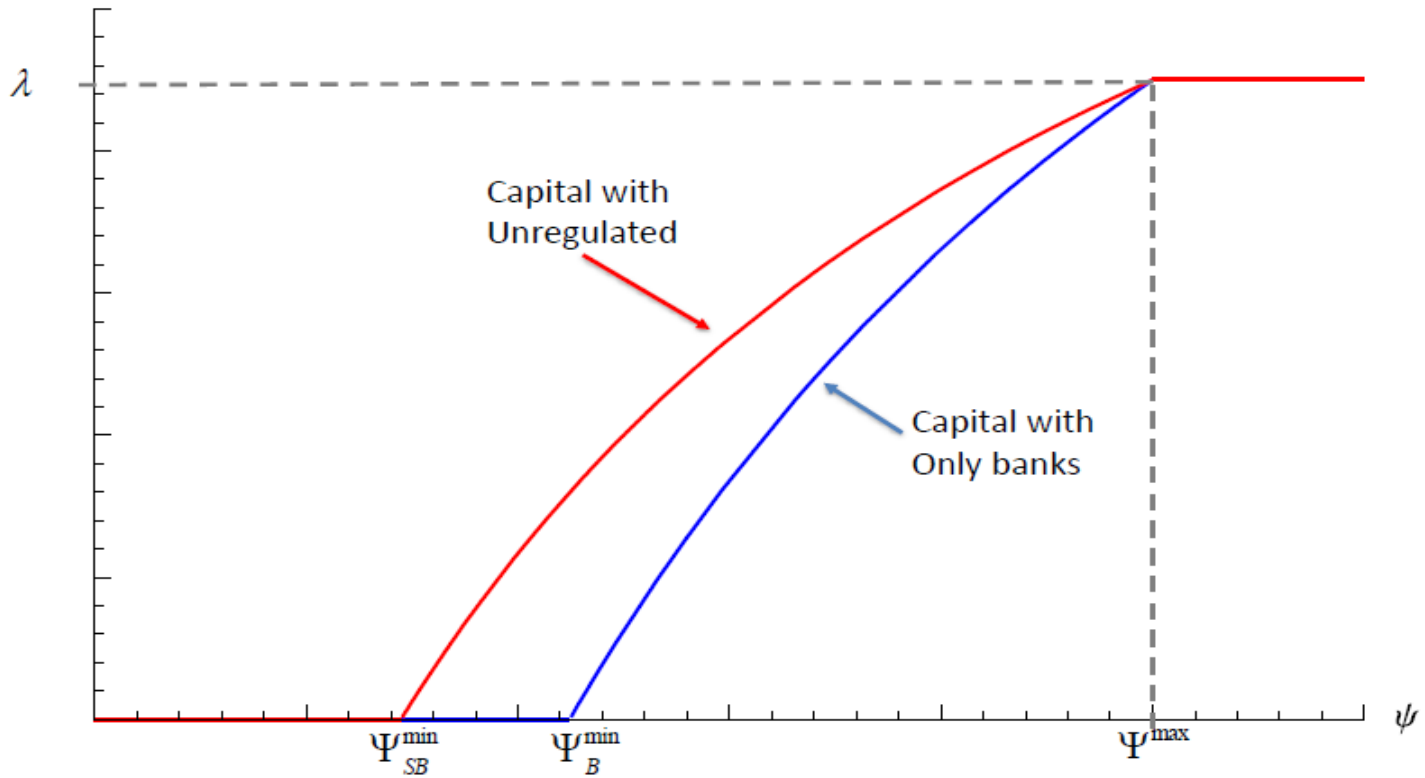
- Where

$$k^*_S = \lambda - \frac{\mu_{SB}(\frac{3}{2} - \psi)}{p(2\psi - \frac{3}{2})}$$

Capital with SB



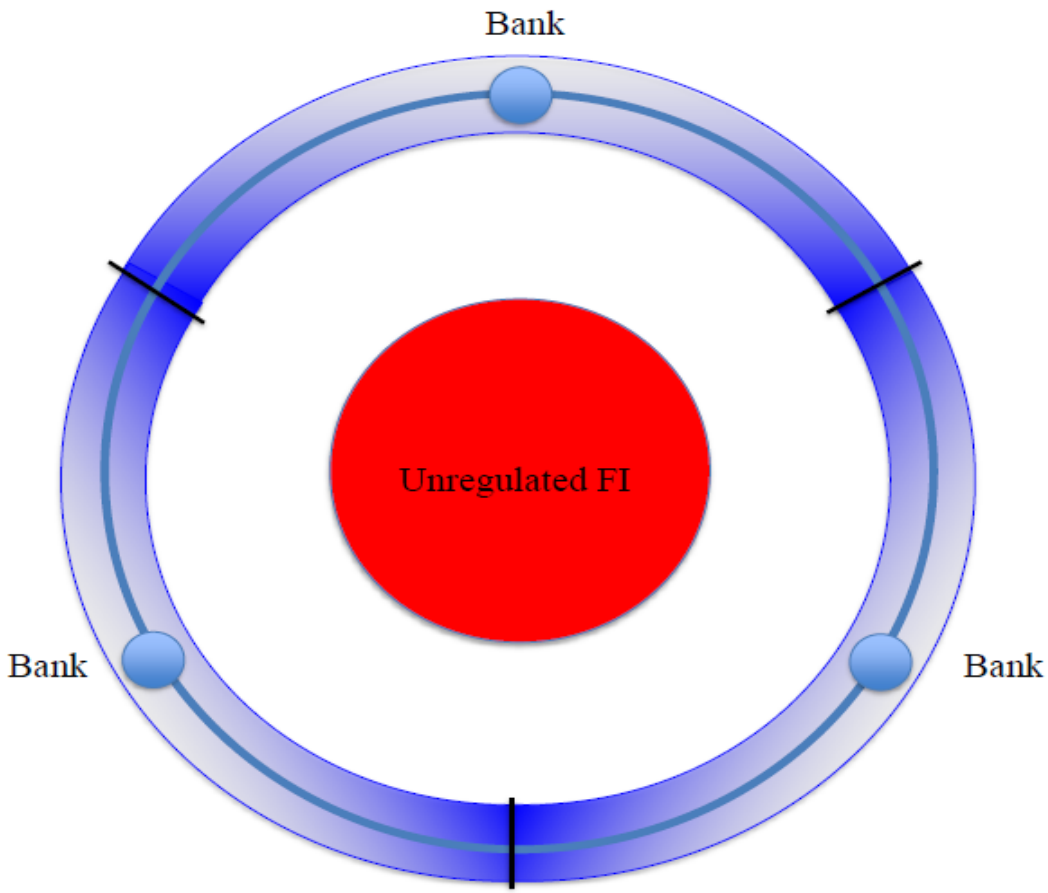
Optimal capital with/without SB -low n-



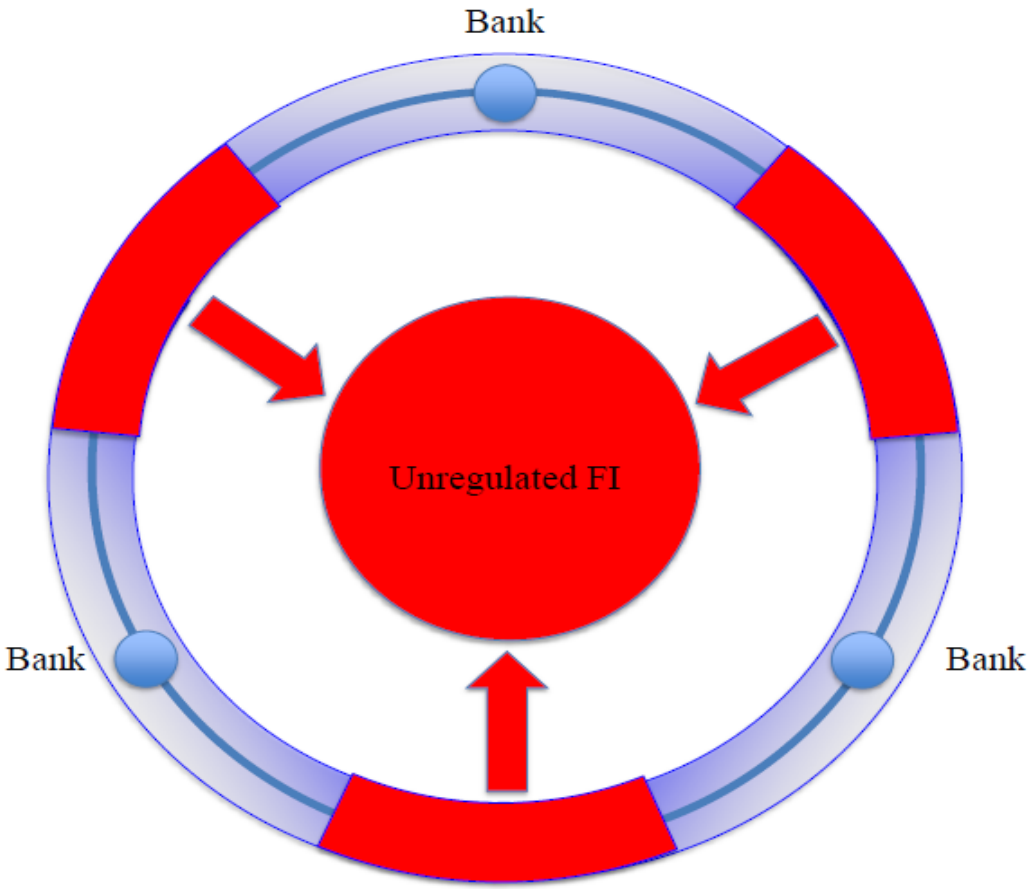
Capital and welfare with SB

- 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



SB + intermediate n high k



Optimal Capital regulation with SB

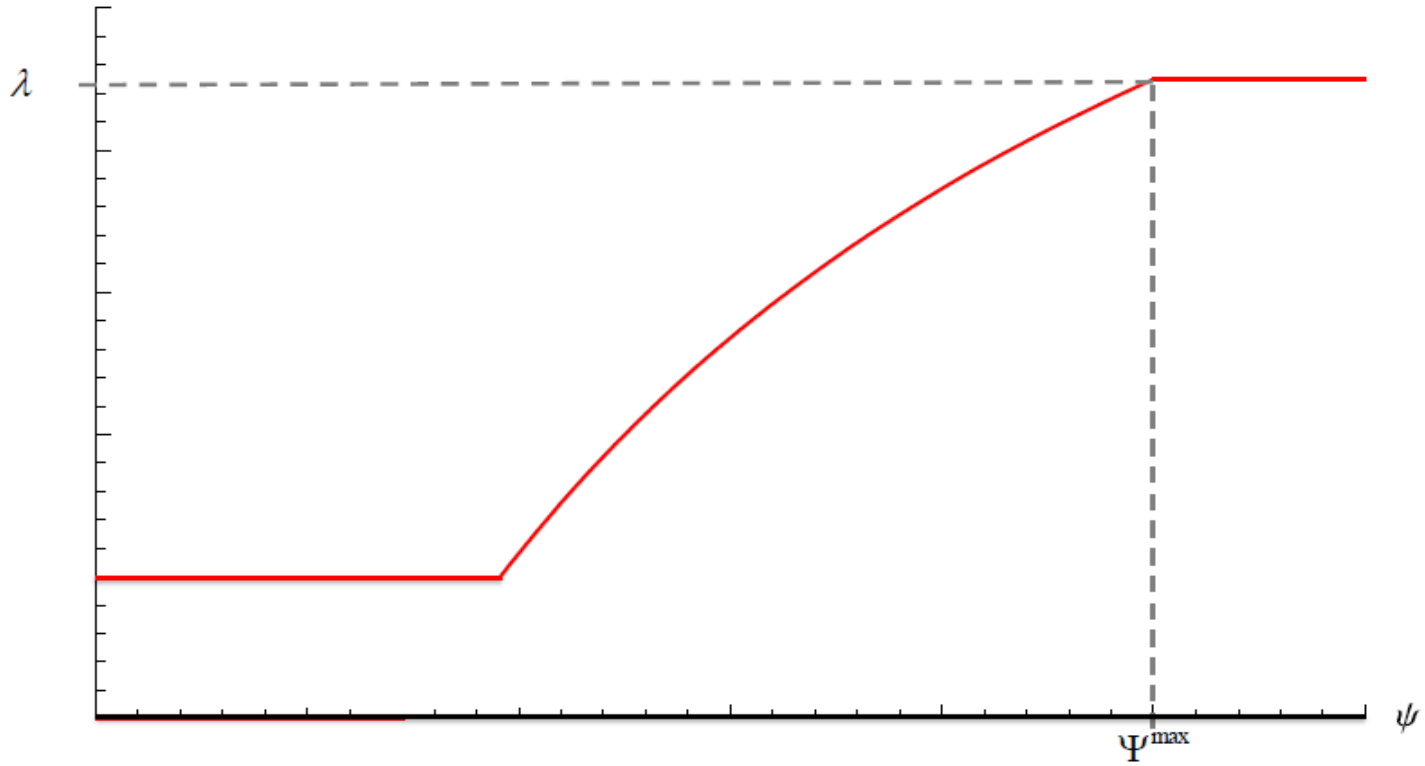
- Optimal k is a function of bank default externalities Ψ

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

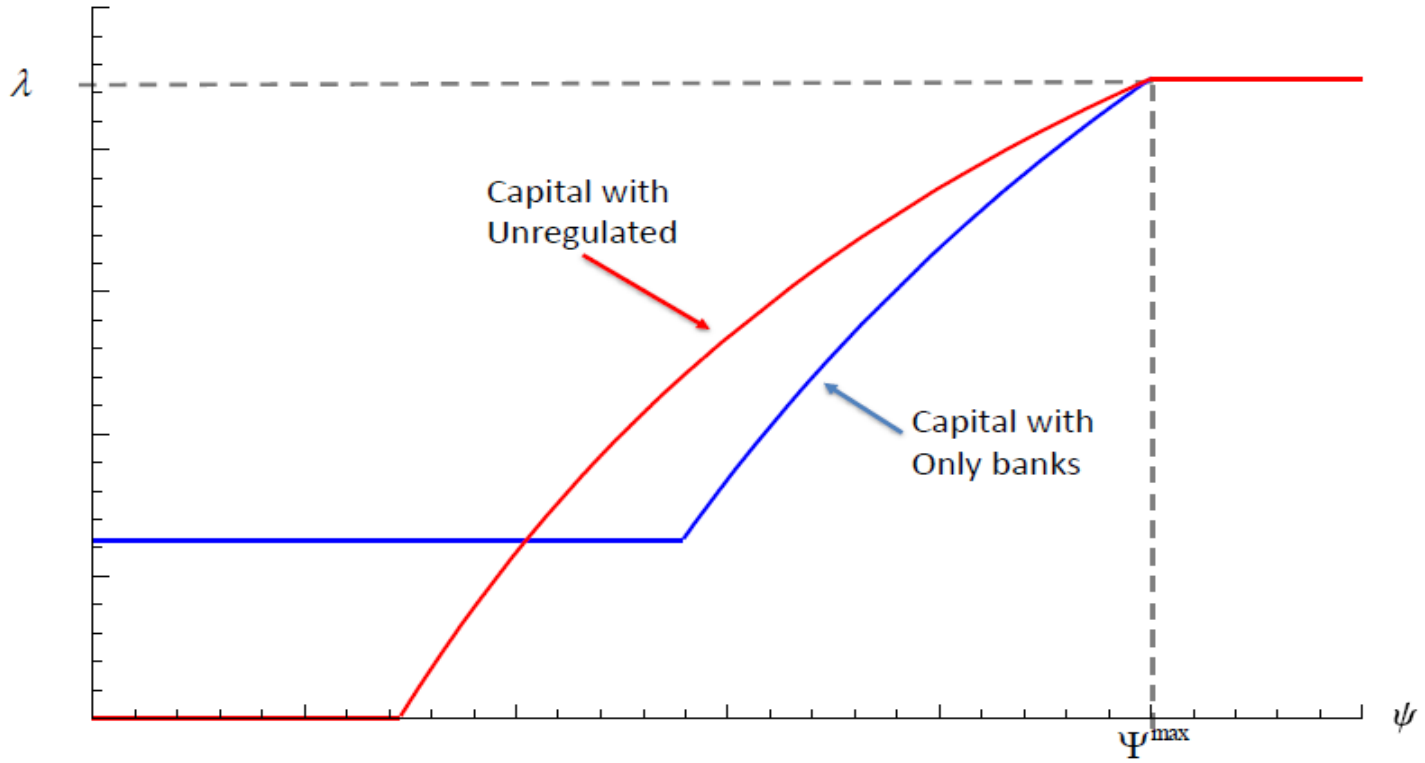
- Where

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

Capital with SB



Optimal Capital with/without SB - intermediate n -



SB + intermediate n

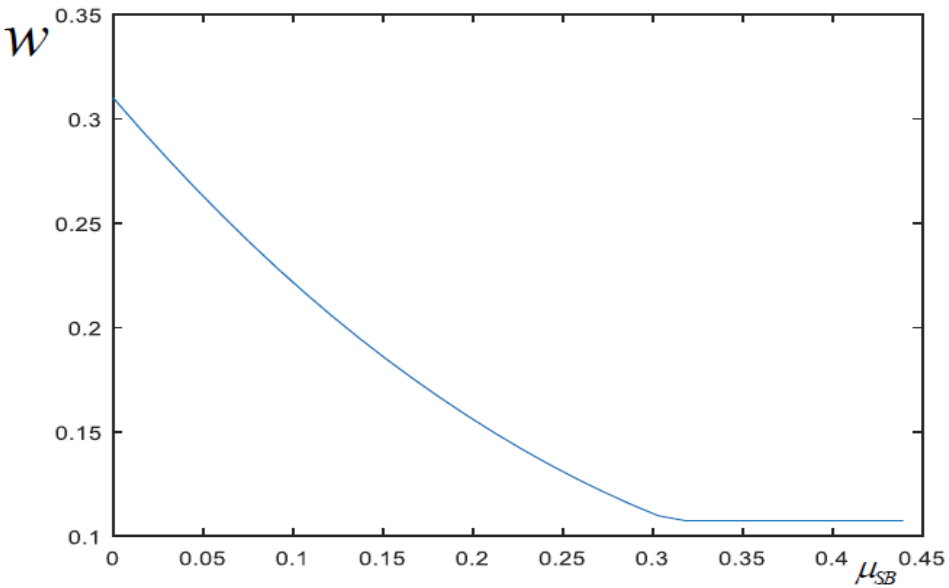
- Covered banking market for $k = 0$
  - Also covered banking market for $k = k_B^{=}$
- For $k = k_B^{=}$ some entrepreneurs shift to SB
  - $\hat{\theta}_s < \hat{\theta}_B$
  - Pay travel costs μ_{sb} instead of $\mu\theta_i$ but pay $r_{SB} < r_B$
- Welfare trade-off of such shift
  - Pay travel costs μ_{sb} instead of $\mu\theta_i$
  - Save on DI costs $\hat{\theta}_s < \hat{\theta}_B$

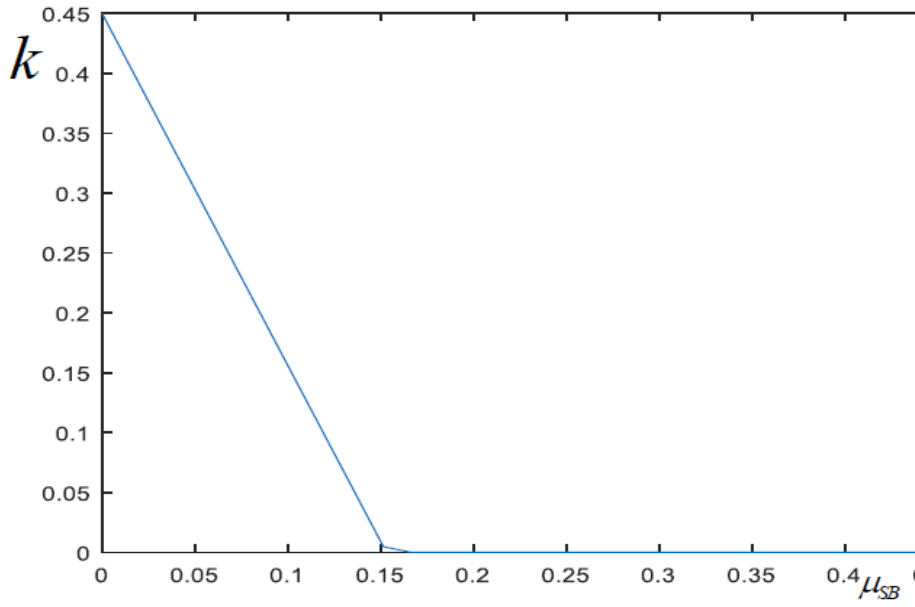
$$\underbrace{\left(\left(1 - 2\,n\,\hat{\theta}_s\right) \left[\mu_{SB}\right] - 2\,n \int_{\hat{\theta}_s}^{\frac{1}{2n}} \mu\theta \, d\theta \right)}_{\Delta \, Transport \;\; Costs} \overset{\leq}{\geq} \underbrace{\left(1 - 2\,n\,\hat{\theta}_s\right) \left[\left(\Psi - 1\right) p \left(\lambda - k_B^{crit}\right) \right]}_{\Delta \, DI \;\; Costs}$$

SB + intermediate n

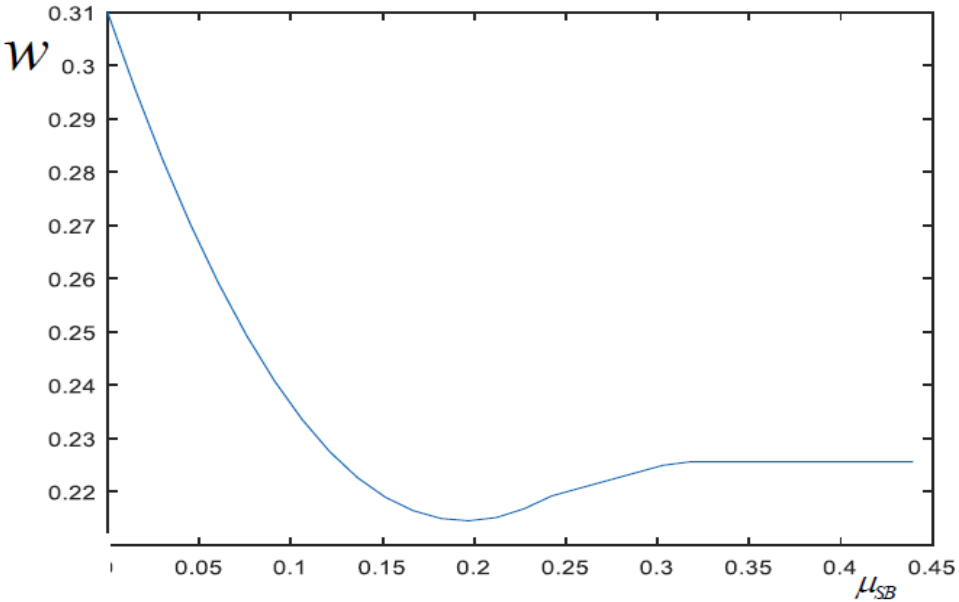
- Main trade-off
  - If you set $k = k_B^*$ some entrepreneurs shift to SB
  - This can have higher travel costs (more inefficient lending)
  - Regulator has to set lower k to prevent that shift
- This is bad for society (compared to no SB)
  - Does not increase production (market was covered)
  - But increases cost of bank failure

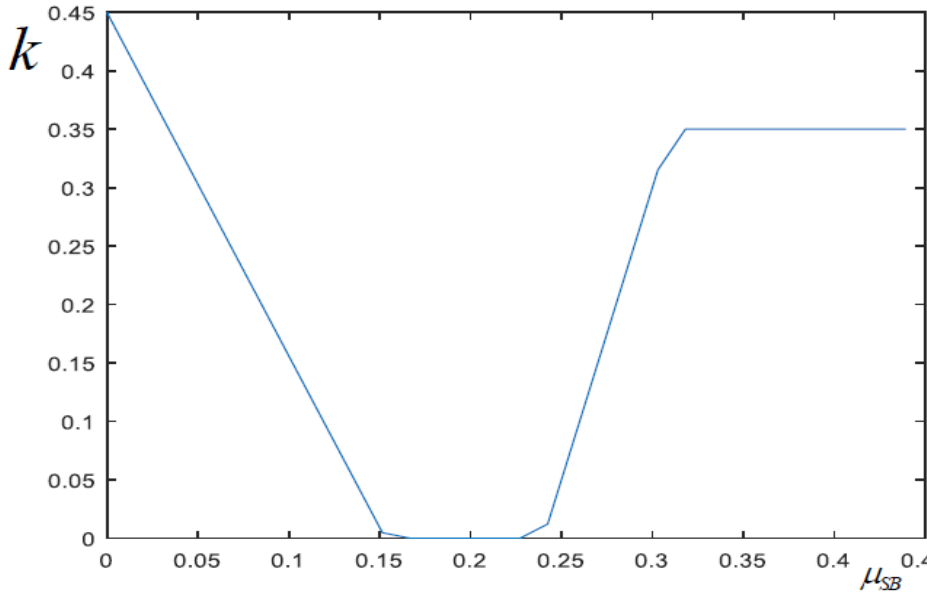
More efficient Unregulated Institutions- low n



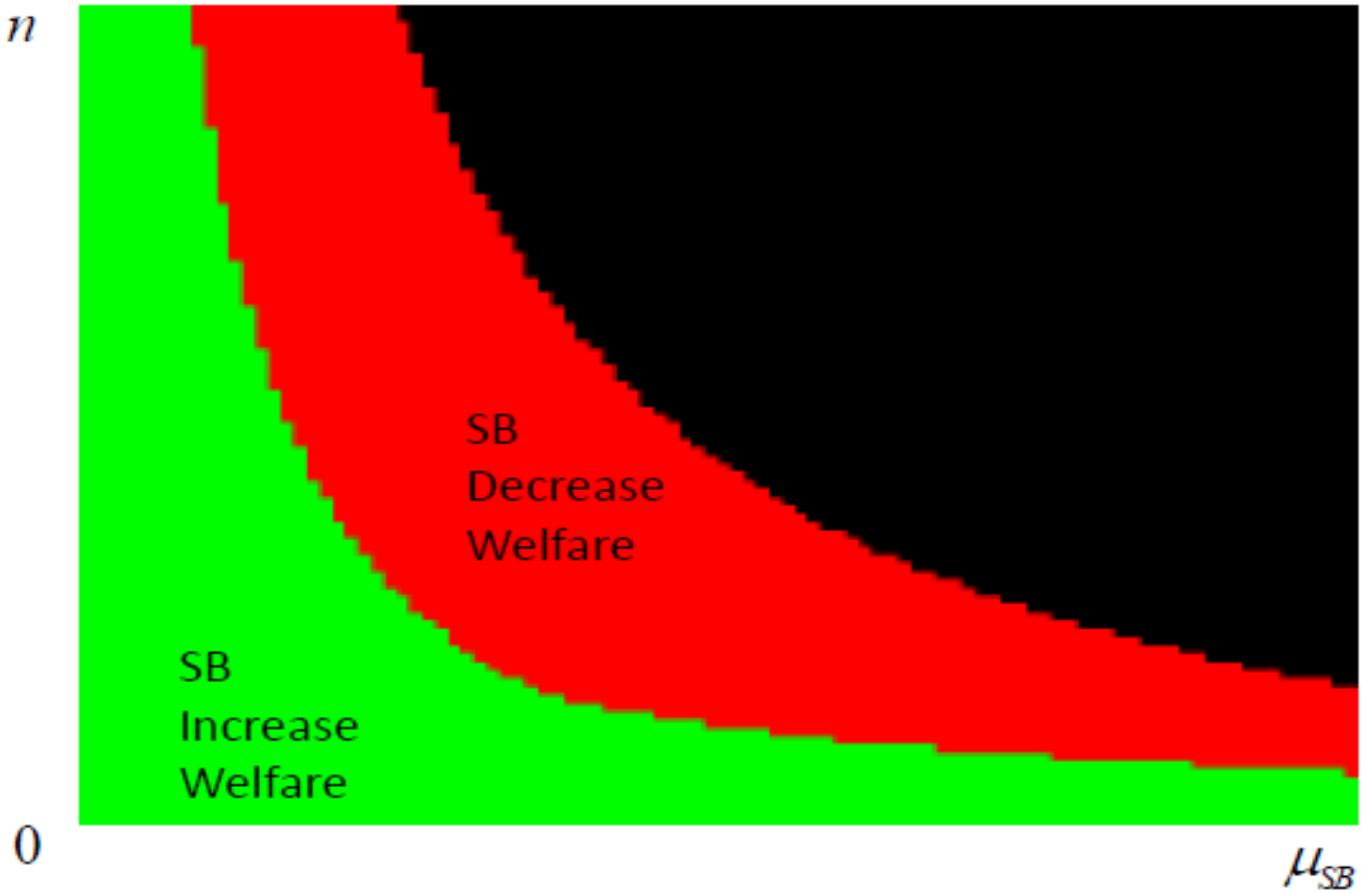


More efficient Unregulated Institutions - medium n

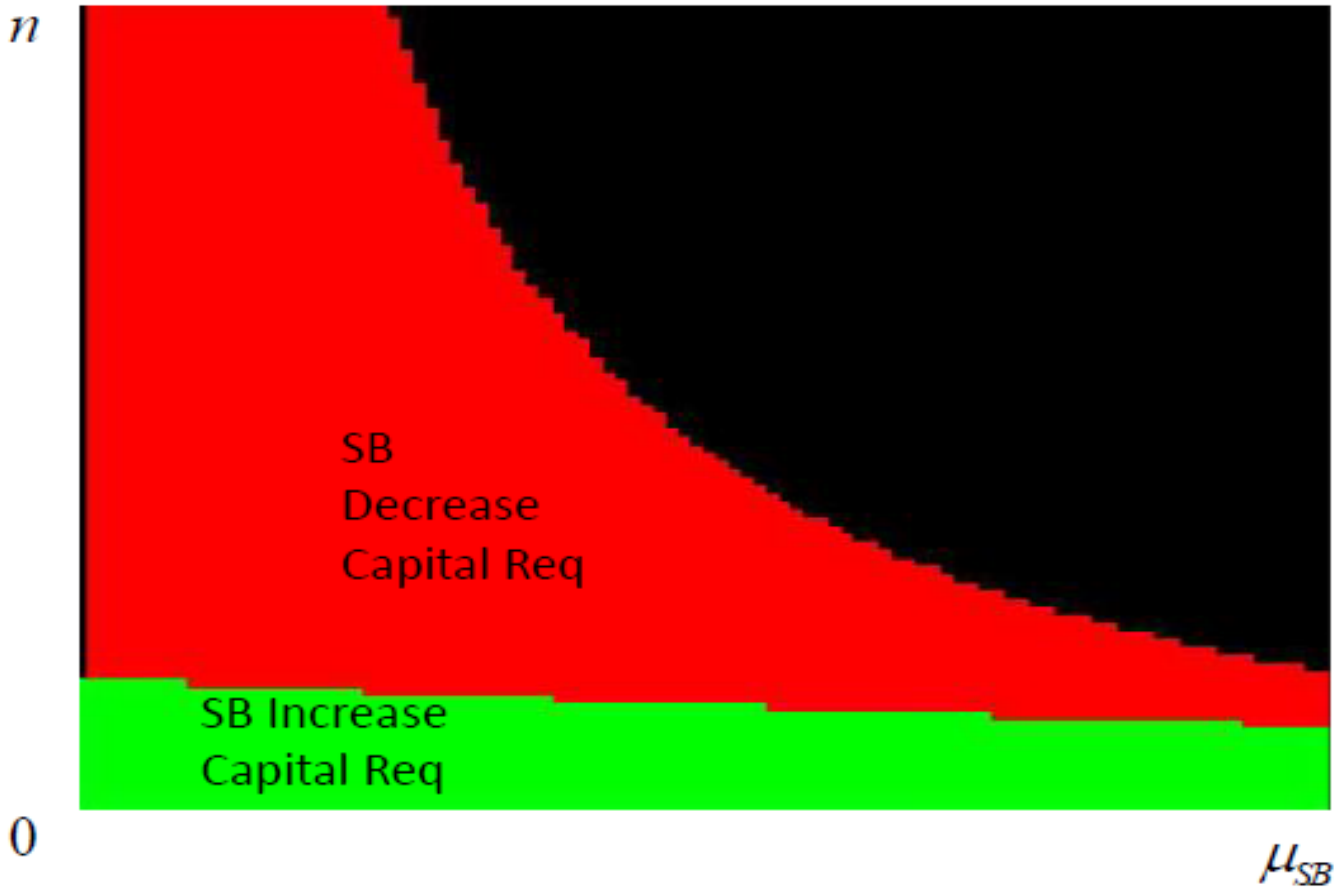




Welfare results



Welfare results



Conclusion

- 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