Efficient or systemic banks: Can regulation strike a deal?

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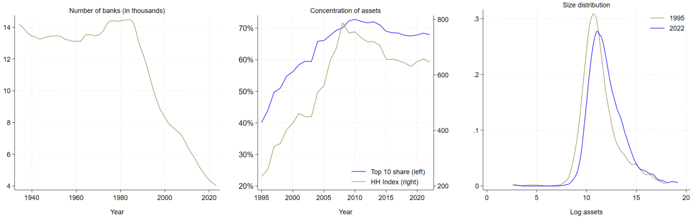
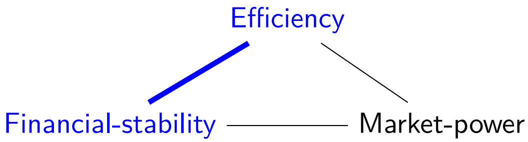
Evolution of US banks



- 1990s: Branching deregulation
  - Led to consolidation and bigger banks
- 2008: Recognition of too-big-to-fail risks
  - Led to reforms that create disincentives for bigger banks
- Should there be few big or many small banks?

Efficiency vs financial-stability trade-off

- Large bank failures are socially more costly
  - Resolution related losses e.g. fire sales
  - Systemic losses (Kang et al, 2015)
  - Complexity externality (Caballero & Simsek, 2013)
  - Lehman failure & the GFC wiped around 4% of global GDP
- Larger banks tend to be more efficient
  - Diversify risks and spread costs (Diamond, 1984)
  - Operational synergies (Kanatas and Qi, 2003)
  - Even after considering risk-taking (Hughes and Mester, 2013)
  - Even for the largest US banks (Wheelock and Wilson, 2018)



This paper

- Model
  - Embed heterogeneous banks in a macro framework
  - Endogenous size distribution and entry-exit
  - Calibrate using micro-data on US banks
- Analysis
  - Capital regulation $\rightarrow$ shape banking dynamics
  - Characterise optimal size-dependent regulation

Stylized model for intuition

Main takeaways

- Tighter regulation has opposing effects on bank distribution
  - Lower leverage $\rightarrow$ banks grow more slowly
  - Lower failure rate $\rightarrow$ banks survive longer
  - Bank dynamics channel of capital regulation
- Equating either of these across banks is sub-optimal
  - leverage
  - riskiness
  - expected default losses
- To optimally balance the trade-off, regulation should be flexibly size-dependent
  - Tighter for larger banks
  - Features more middle-sized banks

Related Literature

- **Banking dynamics / bank heterogeneity:** Competition for loans (Boyd and De Nicolo, 2005), imperfect competition among banks (Corbae and D' Erasmo, 2021; Jamilov, 2021), impact of risk-based capital and leverage requirements on heterogeneous banks (Muller, 2022) etc.

- **Industry dynamics more generally:** Productivity shocks in Hopenhayn (1992), Learning in Jovanovic (1982); Cost shocks in Asplund and Nocke (2006); Borrowing constraint due to limited enforcement and limited liability: Albuquerque and Hopenhayn (2004), Clementi and Hopenhayn (2006), Cooley and Quadrini (2006), etc.

- **Macro-finance models:** Gertler and Karadi (2010), Gertler and Kiyotaki (2010), Adrian & Boyarchenko (2012), etc.

- **Capital regulation:** Heuvel (2008), Begenau (2015), Nguyen (2014), Corbae and D' Erasmo (2014), Covas and Driscoll (2014), Christiano and Ikeda (2013), Passmore and Hafften (2019), etc.

Dynamic Model

Setup

- Time is discrete
- Horizon is infinite
- No aggregate uncertainty, only bank-level shocks
- Entities:
  - Household Description
  - Banks
  - Government Description
  - Regulator (sets bank capital regulation)

Bankers

Choose balance sheet components so as to maximize the stream of dividend payouts while satisfying capital regulation

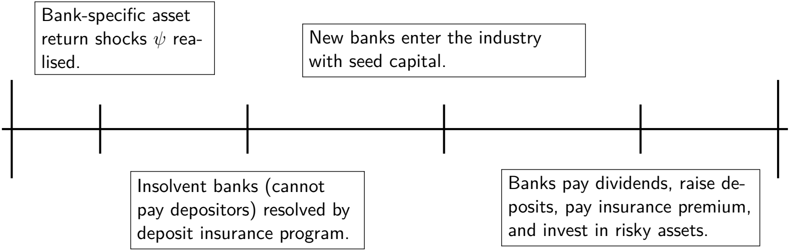
$$V(n) = \max_{s,d,e} \quad \left(\mathcal{H}(e) + \beta \int_{\psi^c} V(n') dF_s(\psi') \right)$$

$$\text{where} \quad \underbrace{n' = \psi' s - R.d}_{\text{Evolution of capital}}; \qquad n' \leq \tau \implies \psi^c = \frac{R.d + \tau}{s};$$

$$s.t. \quad \underbrace{n + d = s + e + t.d}_{\text{Cash-flow constraint}}; \qquad \underbrace{\chi(n) \leq \frac{n - e}{s};}_{\text{Regulatory constraint}} \qquad \underbrace{0 \leq e.}_{\text{Limited liability}}$$

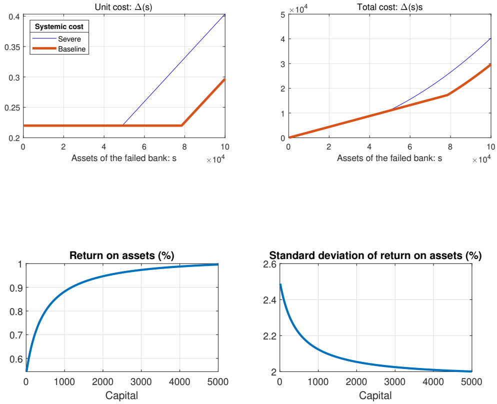
where $F_s(\psi') \sim N(\theta(s), \sigma(s))$

Timeline



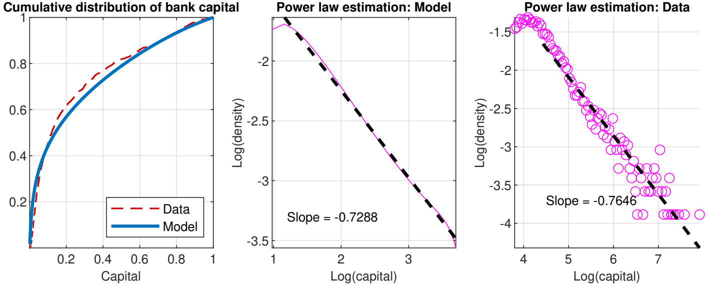
Definition of the Stationary Competitive Equilibrium ‣ show

Key aspects of the calibration



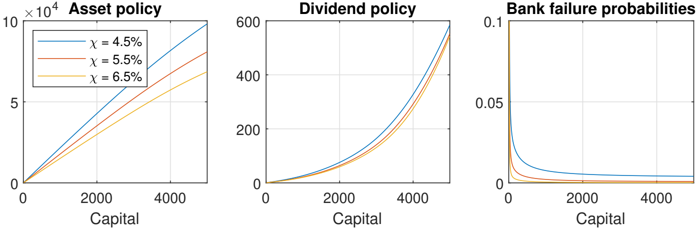
Calibration details

Bank capital distribution: Model vs data



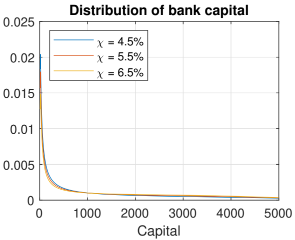
Tighter regulation → Output vs financial-stability

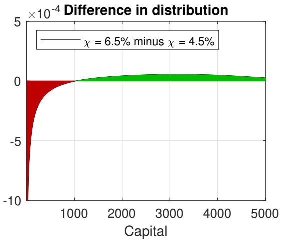
- Lower bank lending
- Lower dividends (capital preservation)
- Lower PD



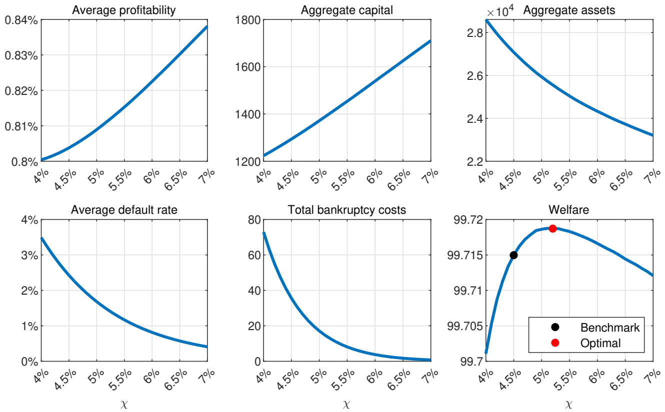
Tighter regulation → Industry dynamics trade-off

- Lower rate of growth in bank size
- Higher probability of survival
- $\Longrightarrow$ More middle-sized banks





Normative analysis

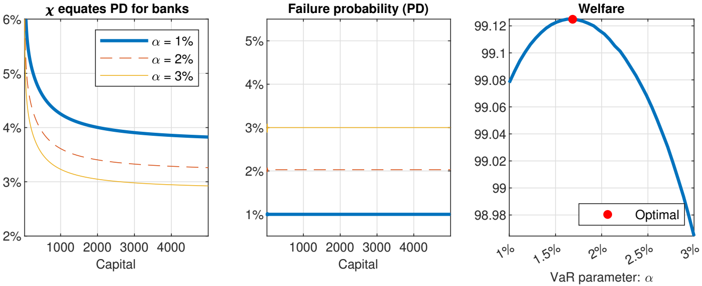


- Welfare profile reflects the trade-offs
- No welfare gain if distribution were exogenous ▸ show
- Higher risk / failure cost justify tighter regulation ▸ show

Bank-specific capital regulation:
A tale of three regimes

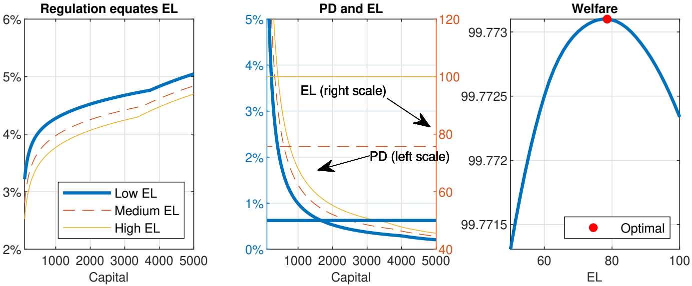
Regime I: Equating PD across banks

- Comparable to Basel-II risk-weighted requirements
- Requires tighter regulation on smaller (riskier) banks
- Highest welfare achieved is *lower* than the baseline regime



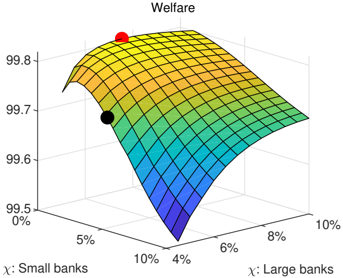
Regime II: Equating EL = PD x EAD x LGD across banks

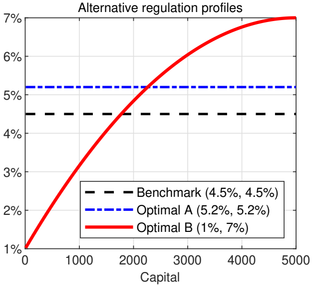
- Comparable to the Basel-III G-SIB framework
- Requires tighter regulation on larger banks (higher EAD, LGD)
- Highest welfare achieved is *greater* than the baseline regime



Regime III: Flexible size-dependent regulation

- Takes *both* efficiency and risks into account
- Highest welfare among *all* previous regimes
- Optimal requirement is 7% for big and 1% for small banks





Comparative statics

Extensions

To summarise

- Should regulation **encourage or discourage large banks**?
  - Trade-off: efficiency versus financial-stability

- Develop a **tractable model** to study this trade-off
  - Endogenous size distribution $\rightarrow$ **bank dynamics channel**
  - Explicit role of regulation $\rightarrow$ **normative analysis**

- Main takeaways
  - Regulation has **opposing effects** on bank size-distribution
  - Size-dependent regulation needed to deal with **size-sensitive trade-off**
  - Optimal regulation is **tighter** for larger banks ...
  - ... and induces more **middle-sized** banks

Thank You

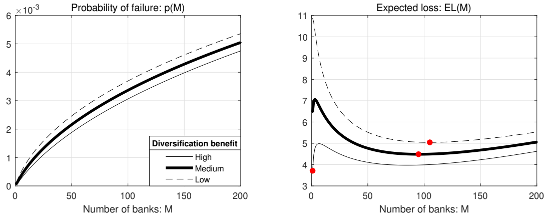
Appendix

How to distribute capital across banks

- Planner distributes capital K across M banks: $\sum_{i=1}^{M} k_i = K$
- Bank i with capital k_i raises deposits f_i at rate R
  - Invest in $s_i = k_i + f_i$ projects such that $k_i/s_i \geq \chi$
- Project returns are identical $\rightarrow$ total return $z_i \sim \mathbb{N}(\mu s_i, \sigma^2 s_i^{d})$
- Bank fails when $z_i \leq R(s_i - k_i)$
  - Unit cost of large bank failure is higher: $\Delta'(s_i) \geq 0$

How to distribute capital across banks

Assuming equal capital allocation, $k_i = K/M$:



$$\max_M \underbrace{\sum_{i=1}^{M} \Big(\mu s_i - R(s_i - k_i)\Big)}_{\text{Expected Return}} - \underbrace{\sum_{m=0}^{M} \Delta(ms)ms.\mathcal{B}(m; M; p(M))}_{\text{Expected Loss}}$$

▸ Back

Household

Consists of

- Representative worker
- Unit mass of atomistic bankers

Maximizes utility under perfect consumption insurance:

$$\max_{C_t, D_t} \quad \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(C_t)$$

$$\text{s.t.} \qquad C_t + D_t = W_t + E_t + R_{t-1} D_{t-1} - T_t$$

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Government

- Runs deposit insurance scheme
  - Mis-pricing $\rightarrow$ banks over-borrow $\rightarrow$ justify capital regulation
- Covers shortfall in liabilities of failing banks
  - Resolving a larger bank is costlier
- Provide (random) seed-funding $n^e \sim G$ to entrant banks
- Runs a balanced budget

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Stationary competitive equilibrium

1. $V(n), s(n), d(n)$ and $e(n)$ solve the bank's problem given R:
2. Deposit market clears at interest rate R

$$\int d(n)d\mu(n) = D$$

3. Goods market clears

$$Y = \int \int_{\psi_c} \psi' s(n) dF_s(\psi') d\mu(n) = C + S + O - W$$

$$S = \int s(n) d\mu(n); \; O = \int \int^{\psi_c} \Delta(\psi' s(n)) dF_s(\psi') d\mu(n)$$

4. The distribution of bank capital is the unique fixed point of the distribution evolution operator T given entrant mass M:

$$\mu = T(\mu, M);$$

5. Government runs balanced budget: T + tD = start-up funding + liabilities of failed banks

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Main parameters

Parameters	Symbol	Value
Discount factor	β	0.99
Resolution cost (percent of assets)	$\Delta(s)$	22%
Systemic cost (percent of GDP)	$\Delta(s)$	23% to 63%
Benchmark regulation	χ	4.5%
Insurance premium rate	t	20 bps
Mean of asset returns	θ_ψ	$1.02 - 0.0051/(1+s)$
S.d. of asset returns	σ_ψ	$0.0195 + 0.0055/(1+s)$
Entrant distribution (lognormal)	$G(\theta_G, \sigma_G)$	$165, 7.49$
Default threshold	τ	7.01
Moments	**Data**	**Model**
Mean of ROA	0.76%	0.80%
S.d. of ROA	0.72%	2.20%
Mean of ROA, larger versus smaller banks	17.3 bps	27.5 bps
S.d. of ROA, larger versus smaller banks	-32.7 bps	-29.7 bps
Dividend payout to capital ratio	4.61%	3.60%
Exit rate	3.96%	2.46%
Ratio to smallest to median bank	1.45%	1.03%
KS statistic	0.0	0.0515
Power-law exponent	-0.764	-0.729

- Solve using global solution methods
- Bank value and policy functions show
- Size and efficiency show

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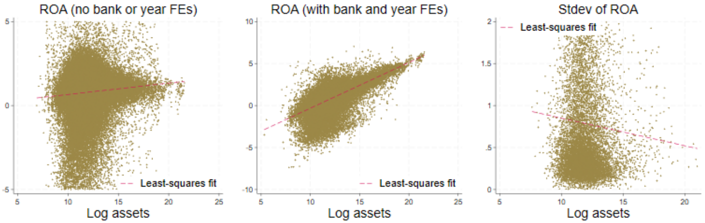
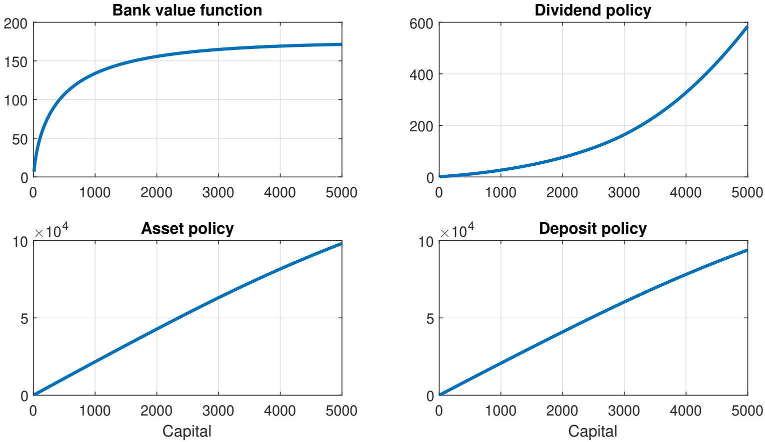
Size and efficiency



Notes: US commercial and savings banks. Pooled annual data from 2000 to 2019. Source: SNL. Back

Value and policy functions



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Stationary size-distribution of banks ...

... computed as the fixed point of the distribution evolution:

$$\mu(N) = \underbrace{M \int_{\tau}^{N} dG(n^e)}_{Entrants} +$$

$$\underbrace{\int \left(\int_{\underline{\psi}}^{\overline{\psi}} \mathbb{1}\Big[\tau \leq \psi s(n) - Rd(n) \leq N\Big] dF_s(\psi) \right) d\mu_{-1}(n)}_{\text{Transition of incumbents net of exits}}$$

- M: mass of entrants (same as mass of failures in steady state)
- μ: cumulative distribution function for bank capital

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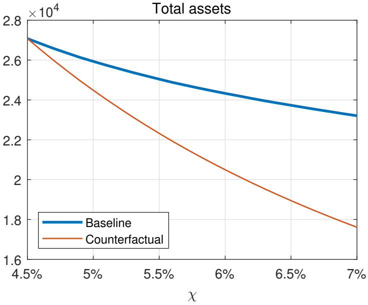
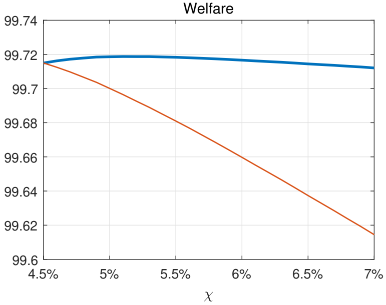
Role of distribution





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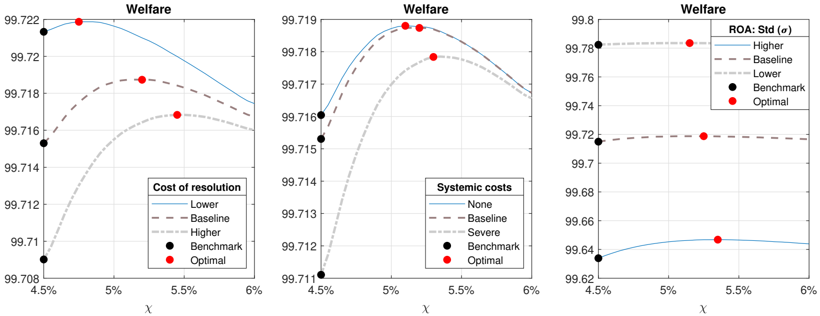
Comparative statics



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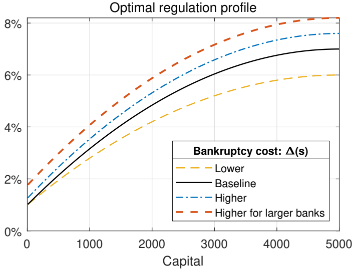
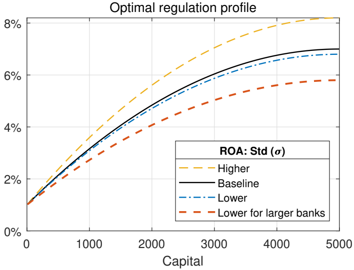
Comparative statics

Higher failure costs or greater riskiness justify tighter / steeper regulation





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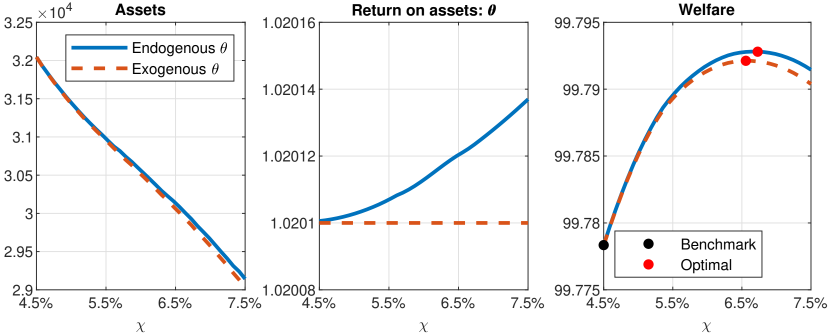
Endogenous return on assets



Note: The size-dependence of asset returns is switched off in this extension.

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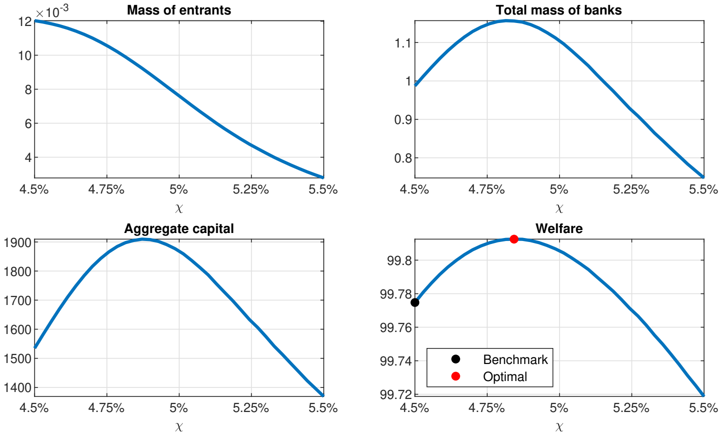
Endogenous mass of banks



Note: Asset returns are also endogenous in this extension.

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