

Watch what they do, not what they say: Estimating regulatory costs from revealed preferences

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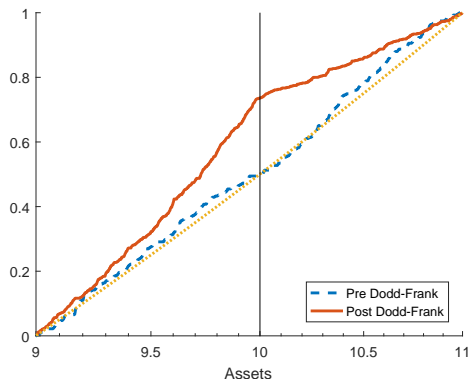
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The Cost of Financial Regulation: Too High?

- Aftermath of the 2008-09 financial crisis is one of the most active periods of financial regulation in U.S. history; the Dodd–Frank Act as a centerpiece.
- Dodd–Frank regulations have become targets of repeal on the basis of excessive regulatory cost. “Dodd–Frank alone has resulted in more than \$39.3 billion in compliance costs.” — The 2016 House Concurrent Budget Resolution
- How to quantify regulatory costs? Current method relies on asking regulated parties directly in surveys. Problems:
 - ▶ Distorted incentives: cost estimates in the 2016 Budget Resolution were funded by “organizations having a strong financial stake in the outcome” and were based on “fundamentally flawed” methodologies” (Parker 2018).
 - ▶ Data availability: Financial statements may not capture regulatory costs
- A need for academic research to quantify regulatory costs, necessary to perform cost-benefit analysis (CBA)

Our Approach

- Revealed preference approach: watch what they do, not what they say!
- Exploit banks' incentive to bunch around regulatory thresholds to estimate regulatory costs



Summary of the paper

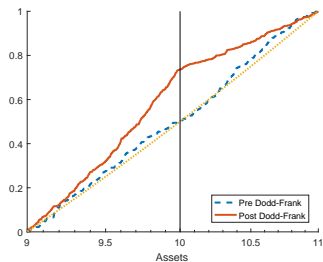
- Quantify regulatory costs of the Dodd–Frank Act. We estimate:
 - ▶ **Direct costs** for banks with a partial equilibrium model estimated via MLE.
Main results:
 - ★ \$10B threshold: 0.41% of annual profits
 - ★ \$50B threshold: 0.11% of annual profits
 - ★ For a \$50B bank, total cost of 0.52% of annual profits represents \$4.16 million per year, equivalent to the annual expense of hiring additional 52 compliance officers
 - ▶ **Indirect costs** for firms that borrow from banks with a general equilibrium model estimated by calibration and moment matching.
Main results:
 - ★ Total mass of banks decreases by 0.18%
 - ★ Lending rate increases by 0.046% and lending quantity decreases by 0.065%
 - ★ Total output of bank-dependent firms decreases by 0.02%
- The estimated costs are substantial, but are much lower than most survey estimates

The Dodd–Frank Wall Street Reform and Consumer Protection Act of 2010

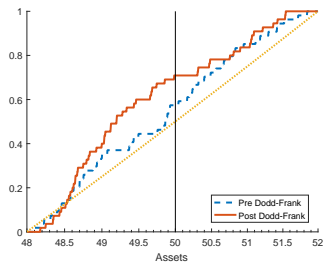
- A centerpiece of the post-crisis financial reform
- A tiered regulatory approach
- Banks whose assets exceed the \$10 billion threshold
 - ▶ conduct annual stress tests
 - ▶ comply with the Durbin Amendment
 - ▶ report to the Consumer Financial Protection Bureau (CFBP)
 - ▶ create risk committees with independent directors
- Banks whose assets exceed the \$50 billion threshold
 - ▶ additional risk-based capital and liquidity requirements, stress tests
 - ▶ annual resolution plans

Bank Size Distribution around Regulatory Thresholds before and after Dodd-Frank

(a) \$10 billion

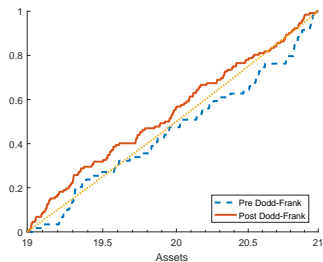


(b) \$50 billion

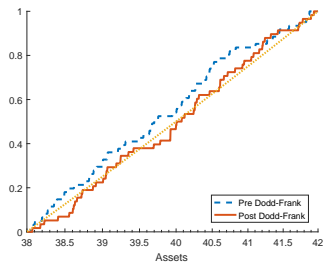


Bank Size Distribution around Non-regulatory Thresholds before and after Dodd-Frank

(a) \$20 billion



(b) \$40 billion



Model Setup

- Heterogeneous banks indexed by their productivity z , distributed according to power law.
- Banks face a tiered regulation which classifies banks into $l + 1$ categories based on l size thresholds, \underline{q}_i , where $i = 1, \dots, l$.
- If a bank's assets cross threshold \underline{q}_i , it will incur an additional regulatory cost that is equivalent to τ_i fraction of its profits (Posner, 1971)
- Banks' problem

$$\max_q \pi(q|z) = \max_q (R - r(q|z)) \exp(q) \cdot \prod_{i=1}^l (1 - \tau_i \mathbb{1}_{q \geq \underline{q}_i}).$$

where R is lending rate, r is deposit rate, z is productivity, τ_i is regulatory cost, q is log assets, \underline{q}_i is the i 's regulatory threshold

- $r(q|z) = \frac{1}{\theta}(q - z)$: a more productive bank can raise more funding for a given rate r

Model Solutions

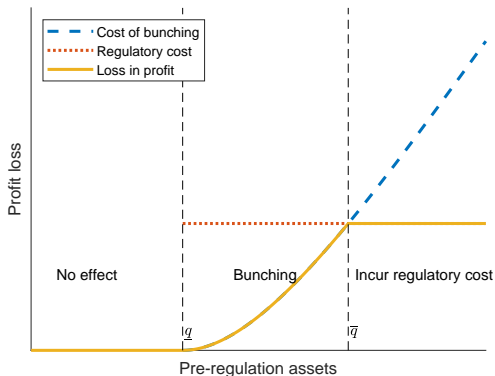
- Without regulation

$$q_0(z) \equiv z + \theta R - 1.$$

- With regulation

$$q^*(z) = \begin{cases} \underline{q}_i & z \in [\underline{z}_i, \bar{z}_i] \\ q_0(z) & z \notin \cup [\underline{z}_i, \bar{z}_i] \end{cases}$$

- \underline{z}_i : productivity of a bank whose undistorted assets just reach the regulatory threshold
- \bar{z}_i : productivity of a marginal bank that is indifferent between remaining small or paying the regulatory cost



Estimation: Maximum likelihood estimator of regulatory costs

- Profit indifference condition of the marginal bank provides sufficient statistic formula for regulatory cost τ_i :

$$\tau_i = 1 - [(\bar{q}_i - \underline{q}_i + 1)] \exp(\underline{q}_i - \bar{q}_i) .$$

- Undistorted asset follows a power-law distribution:

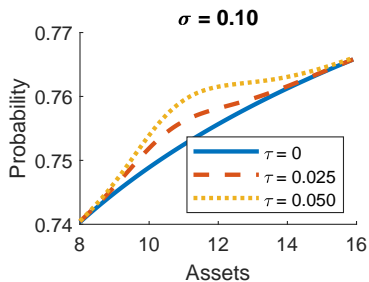
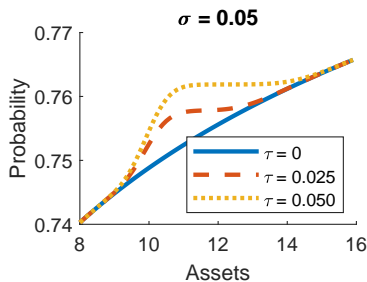
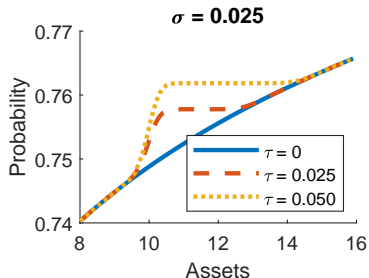
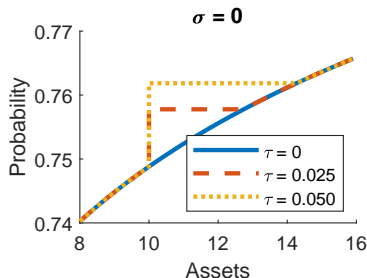
$$\exp(q) \sim c \cdot \exp(q)^{-\beta}$$

- Assets are observed with a structural error $u \sim N(0, \sigma^2)$

$$a = q + u$$

- Estimate the regulatory cost parameter by maximizing the likelihood to observe bank assets a

Maximum likelihood estimator of regulatory costs: intuition



Estimation results: direct costs of regulation

Panel A: \$10 billion threshold

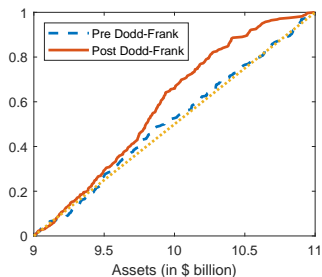
		Estimated value	S.E.
β	Exponent of the power law distribution	1.112	[0.001]
σ	Measurement error volatility (in %)	4.258	[0.386]
$\exp(\bar{q})$	Assets of marginal bank (\$ Billion)	10.973	[0.086]
τ	Cost of regulation (% of profit)	0.405	[0.066]

Panel B: \$50 billion threshold

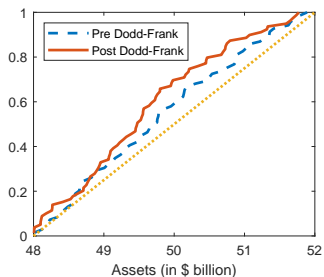
		Estimated value	S.E.
β	Exponent of the power law distribution	1.084	[0.002]
σ	Measurement error volatility (in %)	2.291	[0.498]
$\exp(\bar{q})$	Assets of marginal bank (\$ Billion)	52.393	[0.528]
τ	Cost of regulation (% of profit)	0.106	[0.046]

Simulated Bank Size Distribution

(a) \$10 billion



(b) \$50 billion



Conclusion

- This paper proposes a revealed preference approach to estimate regulatory costs
 - ▶ Key idea: higher regulatory costs, more banks try to avoid regulation
 - ▶ Regulatory distortion in bank size distribution reveals the regulatory costs
- Quantify the regulatory costs of the Dodd–Frank Act
 - ▶ \$10 billion threshold: 0.41% of annual profits
 - ▶ \$50 billion threshold: 0.11% of annual profits
 - ▶ For a \$50B bank, total cost of 0.52% of annual profits represents \$4.16 million per year, equivalent to the annual expense of hiring additional 52 compliance officers
 - ▶ The regulatory costs are substantial, but still lower than most survey estimates
- Policy implication
 - ▶ Cost-benefit analysis of financial regulation

Appendix

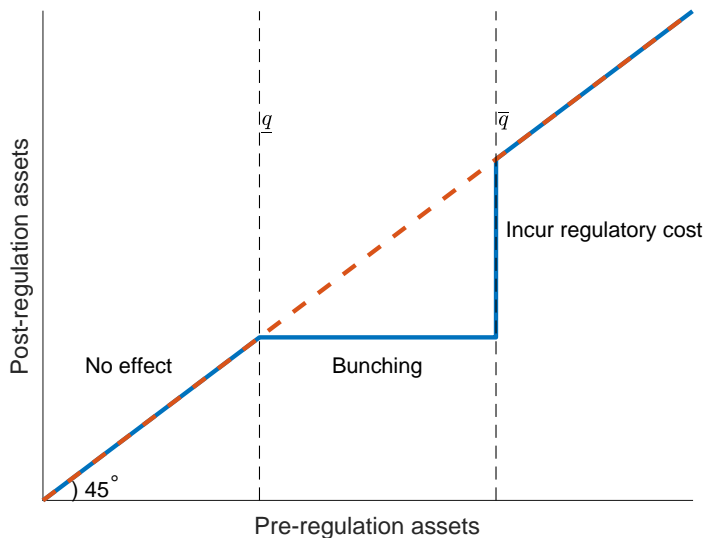
Cost-Benefit Analysis (CBA) on Financial Regulation

- CBA is an economical or statistical assessment of the social benefits of the regulation and the regulatory costs borne by the regulated parties
- Goals of CBA
 - ▶ advance regulators' ability to increase welfare
 - ▶ allow the public to detect and push back against regulations that fail to do so
 - ▶ often forms the basis of judicial review and Congressional oversight of regulatory actions

Direct v.s. Indirect Regulatory Costs

- The partial equilibrium model introduced so far is sufficient to estimate the direct costs of regulation (compliance costs borne by banks)
- To quantify the indirect costs of regulation requires a general equilibrium model
- We now embed banks' optimal size choice in a general equilibrium model with firms

Banks' Optimal Size



Model setup

- Firms' problem

$$Y = AK^\alpha - RK, \quad (1)$$

where Y is the output, K is the capital, and A is the total-factor productivity

- The aggregate supply of capital

$$K^s(R) \equiv N \int \exp(q^*(z|R))g(z)dz, \quad (2)$$

where N is the number of banks, $g(z)$ is the distribution of banks' productivity, $q^*(z|R)$ is banks' optimal size choice

- The equilibrium lending rate R is determined by the market-clearing condition of the lending market:

$$K^s(R) = \left(\frac{R}{A\alpha} \right)^{\frac{1}{\alpha-1}}. \quad (3)$$

Model setup: endogenize distribution of bank productivity

- The value function v of a bank with a current productivity z_0 is defined by

$$v(z_0) \equiv \mathbb{E} \left[\int_0^\infty e^{-(\rho+\lambda)t} \pi(q^*(z_t)|z_t) dt \mid z_0 \right], \quad (4)$$

where ρ is the discount rate, λ is the exogenous exit rate, and π is the profits

- The equilibrium entry rate is given by the following condition

$$m = \bar{m} \exp \left(\eta \left(\int v(z) \psi(z) dz - c_e \right) \right) \quad (5)$$

- The distribution of the productivity evolves according to the following Kolmogorov forward equation:

$$\frac{\partial g(z, t)}{\partial t} = -\frac{\partial}{\partial z} [\mu_z g(z, t)] + \frac{1}{2} \frac{\partial^2}{\partial z^2} [\sigma_z^2 g(z, t)] - \lambda g(z, t) + \frac{m}{N} \psi(z). \quad (6)$$

Model setup: stationary equilibrium

- A stationary equilibrium exists, and is defined by the banks' value function $v(z)$, the distribution function $g(z)$, the number of banks N , the equilibrium lending rate R , and the aggregate capital K such that:
 - 1 Incumbent banks optimally choose their credit supply
 - 2 Potential entrants optimally choose to enter the economy
 - 3 Firms optimally choose their credit demand
 - 4 Aggregate credit supply equals aggregate credit demand.
 - 5 The distribution of banks reaches steady states

Estimation: overview

- Direct costs of regulation on banks
 - ▶ Use a maximum likelihood estimator
 - ▶ Data: bank size distribution
- Indirect costs of regulation on borrowers and depositors
 - ▶ Calibrate parameters to values in the literature or corresponding moments in the data

Indirect costs of regulation: conjectures

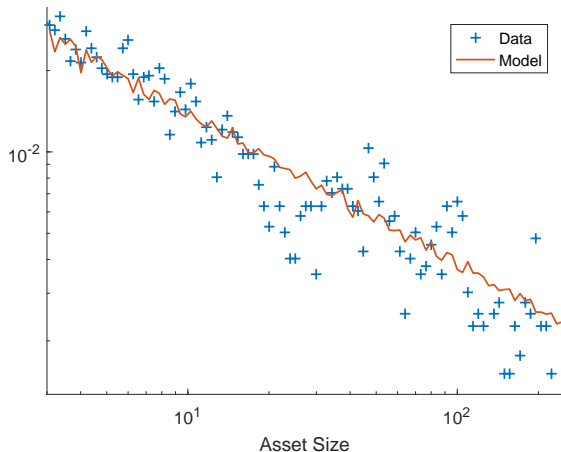
- Regulation should increase lending rate and decrease firm output
 - ▶ by how much?
- Effects on bank entry
 - ▶ incumbent banks reduce their lending to avoid the regulation: increases entry
 - ▶ reduce bank valuation: decrease entry
- Distribution effects on banks
 - ▶ Dodd–Frank imposes tighter regulation on big banks
 - ▶ Would the market shares of big banks shrink?

Data and Summary Statistics

- Data sources: Call Reports, FRY-9C
- Sample period: 2001-2010 (pre-Dodd-Frank), 2010 to 2019 (post-Dodd-Frank)
- Sample size: 40,000 bank-quarter observations
- The average asset size: \$28 billion
- Highly skewed size distribution
 - ▶ Small banks ($< \$10\text{B}$) account for 84% of the banks and 6% of the assets
 - ▶ Medium banks ($\$10\text{B}-\50B) account for 8% of banks and 4% of the assets
 - ▶ Big banks ($> \$50\text{B}$) account for 7% of the banks and 89% of the assets

Asset size distribution follows a power law

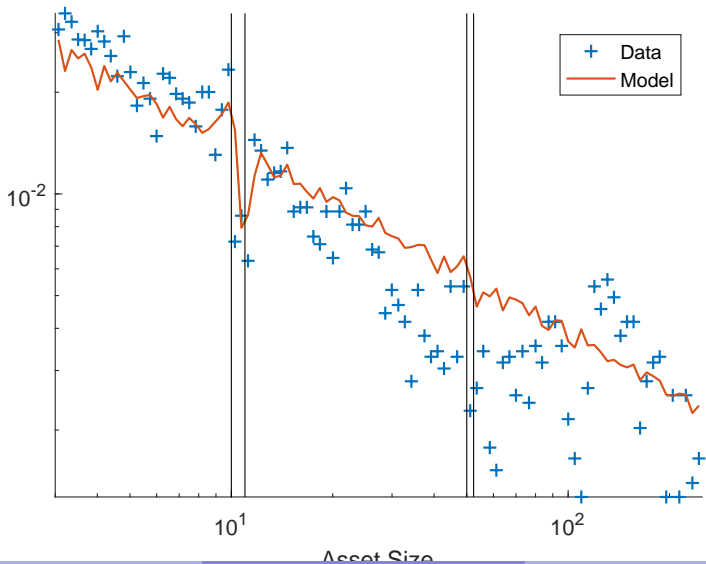
- The log-log plot of a power law, $f(q) = c \exp(q)^{-\beta}$, is a straight line (Gabaix, 2016)



Indirect costs of regulation: calibrated parameters

Parameter	Value	Definition
μ_z	7.700	Productivity growth
σ_z	8.700	Productivity diffusion
θ	61.728	Elasticity of funding supply
ρ	7.000	Discount rate
λ	4.400	Exit rate
z_n	-3.470	Productivity of new entrants
c_e	0.120	Entry costs
A	8.000	Total factor productivity
α	0.300	Curvature of the production function
η	100.000	Elasticity of entry

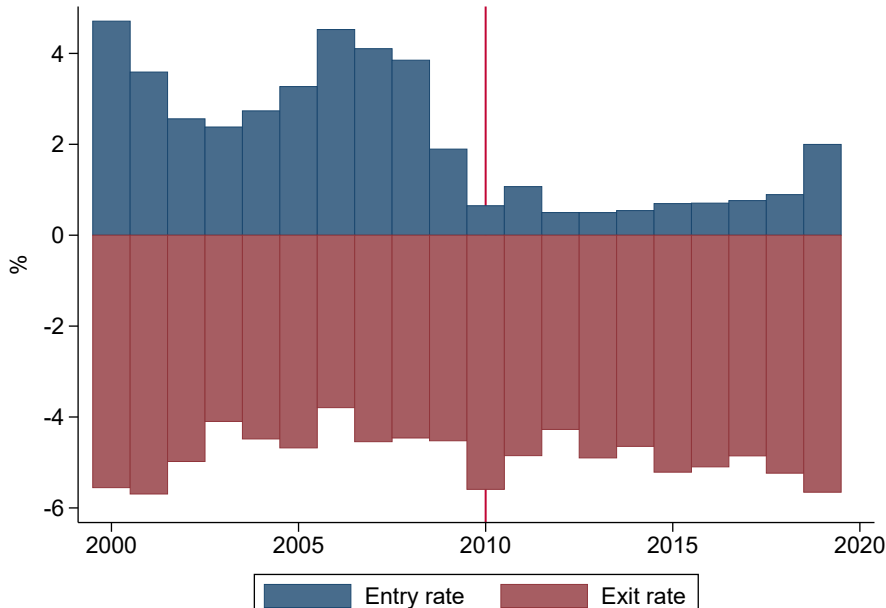
Simulated bank size distribution



Indirect costs of regulation: counterfactual simulation

Counterfactual	Baseline	Dodd-Frank	Regulatory relief
<i>Panel (a): all banks</i>			
Mass of banks	11.836	-0.184 %	-0.094 %
Market-to-book	1.228	-0.221 %	-0.104 %
Lending quantity	257.805	-0.065 %	-0.032 %
Lending rate	0.049	0.046 %	0.023 %
Output	42.313	-0.020 %	-0.010 %
<i>Panel (b): annual profits by size group</i>			
Small banks	0.023	0.068 %	0.033 %
Medium banks	0.358	-0.399 %	-0.221 %
Big banks	6.150	-1.268 %	-0.593 %
<i>Panel (c): asset shares by size group</i>			
Small banks	0.057	-0.061 %	-0.034 %
Medium banks	0.073	-0.216 %	-0.123 %
Big banks	0.870	0.022 %	0.013 %
<i>Panel (d): shares of banks by size group</i>			
Small banks	0.878	-0.012 %	-0.006 %
Medium banks	0.072	0.089 %	0.042 %
Big banks	0.050	0.075 %	0.042 %

Bank Entry Rates before and after Dodd-Frank



Robustness check

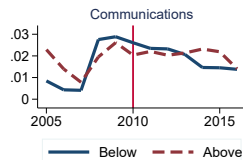
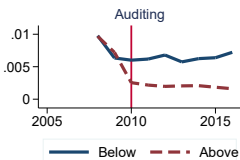
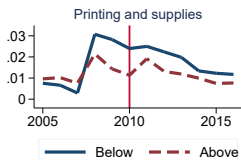
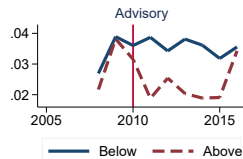
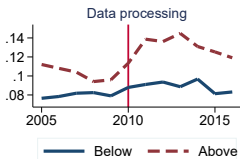
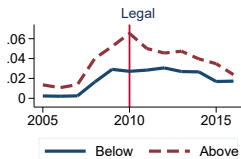
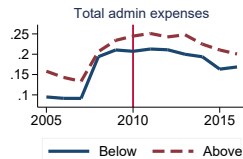
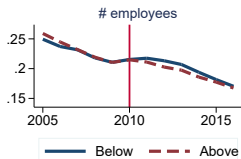
- Alternative distribution assumption
 - ▶ Assume undistorted assets follow lognormal distribution
- Placebo tests
 - ▶ No regulatory cost at \$20 billion and \$40 billion
 - ▶ No regulatory cost at \$10 billion and \$50 billion before Dodd–Frank
- Merger and acquisition
 - ▶ there are only around 2 banks between \$10 billion and \$13 billion threshold involving in a M&A in a given year

Comparison with Existing Approaches

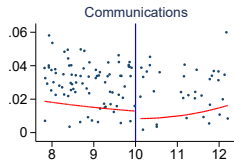
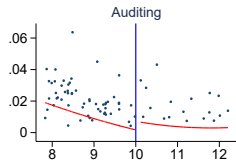
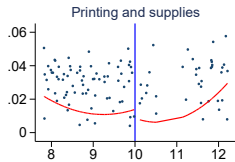
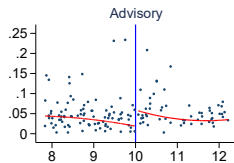
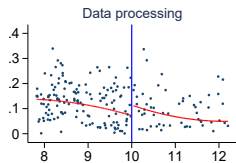
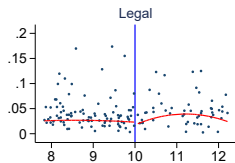
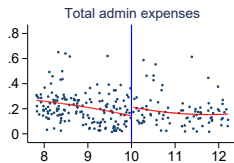
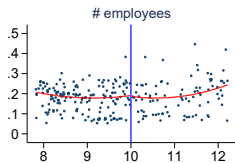
Survey

Source	Sample	Estimate
Bank Director Magazine	Survey of 10 banks	9.9
American Action Forum	Estimation from Federal Register	1.8
JPMorgan and Citigroup	Survey of 2 banks	0.9
Federal Reserve Bank of Minneapolis	Estimation of cost of new hires	1.1
Bank Director and Grant Thornton LLP Survey	Survey of 130 senior executives	Qualitative
KPMG 2013 Community Banking Survey	Survey of 100 senior executives	Qualitative
Florida Chamber Foundation	Survey of 75 banks	Qualitative
Mercatus Center's Small Bank Survey	Survey of 200 banks	Qualitative
Risk Management Association Survey	Survey of 230 senior executives	Qualitative

Difference-in-differences



Regression discontinuity



Comparison with existing approach

- Survey: magnitude varies enormously: 0.9%-9.9%
 - ▶ Banks have incentive to inflate the estimates (Parker, 2018)
- DID and RD: close to zero
 - ▶ Some regulatory costs may not be captured by expenses
 - ▶ Banks endogenously select to be regulated
- Our approach: 0.41%-0.52%
 - ▶ Caveats: requires assumption on the size distribution