The Shadow Cost of Bank Capital Requirements

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How Costly Are Capital Requirements for Banks?

Banks' *private costs* shape regulation, but they have not been measured empirically

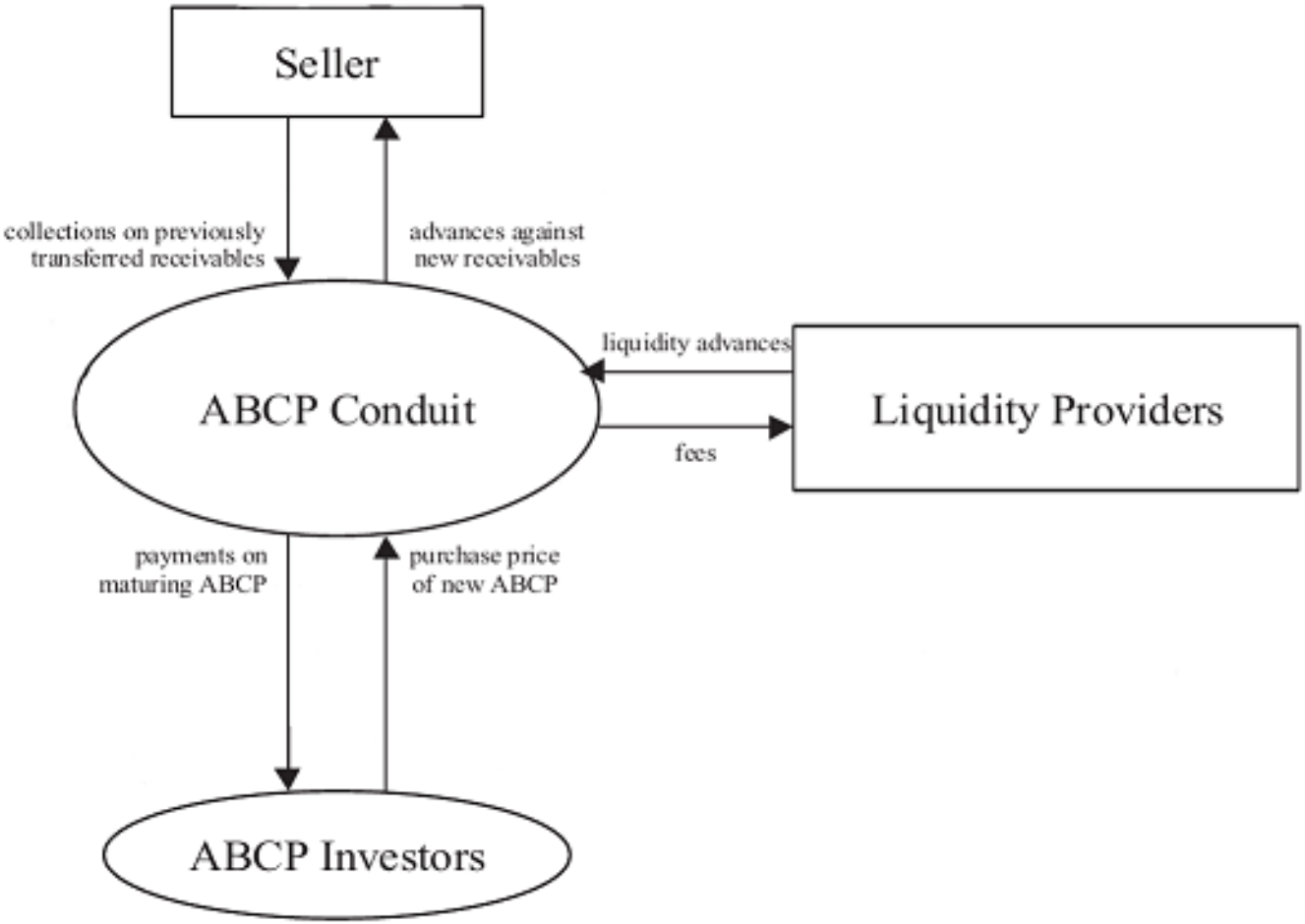
Revealed Preference Approach

Banks used a costly ABCP loophole to bypass capital constraints (Acharya, Schnabl, and Suarez, 2013)

Banks trade off the benefit of reduced capital vs. the cost of the loophole

Loophole usage reveals the *shadow costs of capital requirements* (Anderson and Sallee, 2011)

The Loophole: Asset-backed Commercial Paper Conduits



ABCP stops rolling over before assets stop performing, but conduit assets are not counted toward *regulatory* assets (10% after 2004)

The Loophole: Conduit Assets and Capital Requirements

US Banks are considered *well-capitalized* by their regulator if

1. Leverage ratio $= \dfrac{\text{Tier 1 capital}}{\textbf{Average Total Assets}} \geq 3\%$ to 5%
2. Tier 1 risk-based ratio $= \dfrac{\text{Tier 1 capital}}{\textbf{Risk-weighted Assets}} \geq 6\%$
3. Total risk-based ratio $= \dfrac{\text{Total risk based capital}}{\textbf{Risk-weighted Assets}} \geq 10\%$

Banks hold the assets, without decreasing capital ratios

Who Used the Loophole?

18 US bank holding companies (out of $2,500+$)

About 100 times larger than the average BHC

60% of US total bank assets

Loophole Usage Reveals the Shadow Cost

$$\max_{\mathbf{r},k,\theta} \Pi = \sum_j \left[r_j - c\left(k\right) - \alpha\theta\right] q_j\left(\boldsymbol{r}\right) - I\left(\theta > 0\right) \times F$$

s.t. regulatory capital constraint: $K\left(\boldsymbol{q}, k, \theta\right) \geq \sigma$

$$-\frac{\partial \Pi^*}{\partial \sigma}\frac{1}{Q} = \lambda \leq \frac{\alpha}{K_\theta}$$

For banks with interior solution $\theta \in (0, 1)$

$$\underbrace{\alpha}_{\text{cost}} = \underbrace{\lambda K_\theta}_{\text{benefit}} \Rightarrow \lambda = \frac{\alpha}{K_\theta}$$

$\theta \equiv$ share of assets in ABCP

$\alpha \equiv$ incremental marginal cost of loophole use

$k \equiv$ true (economic) capital ratio

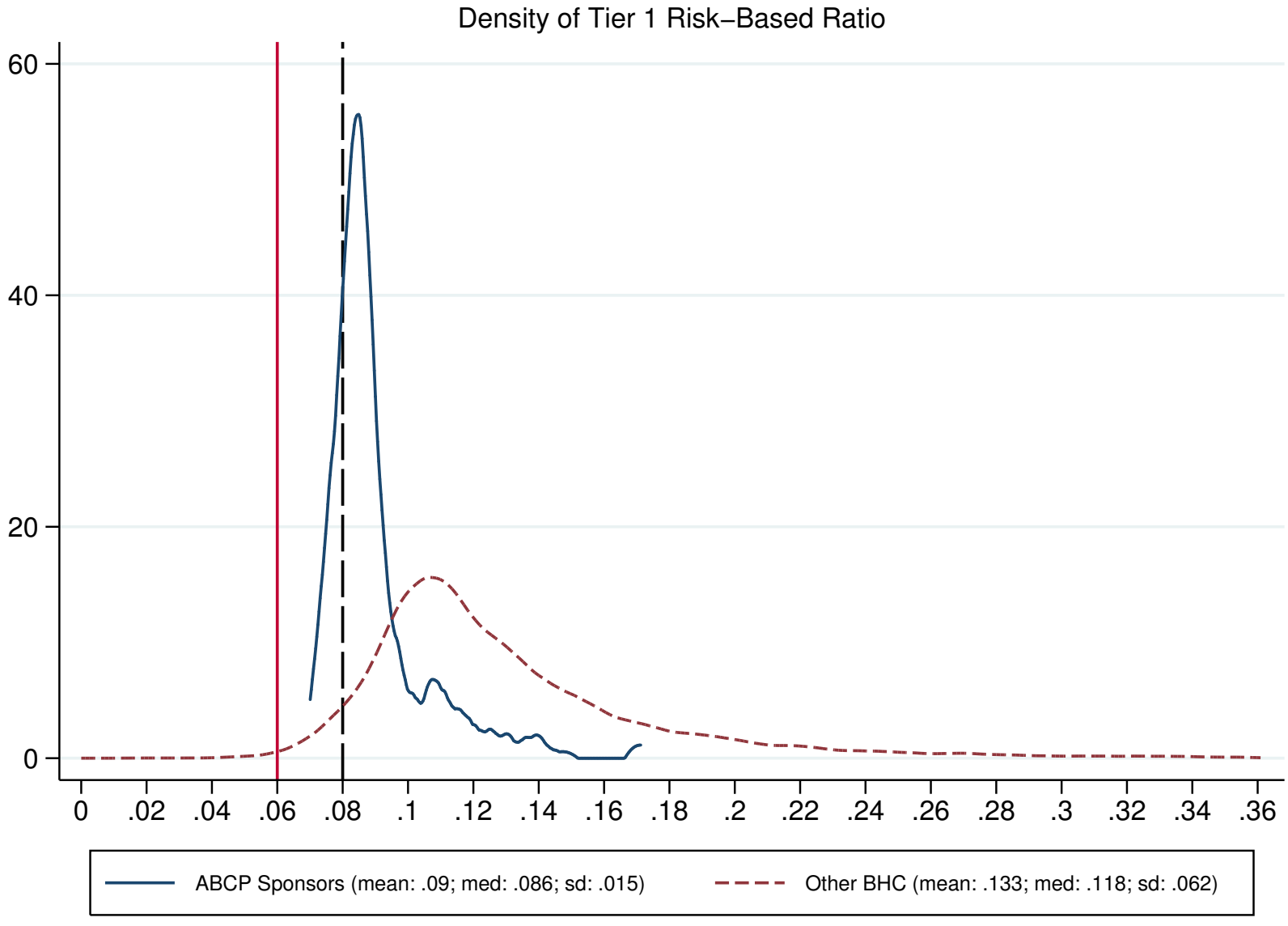
Sufficient Conditions for Identification

For banks with interior solution $\theta \in (0,1)$

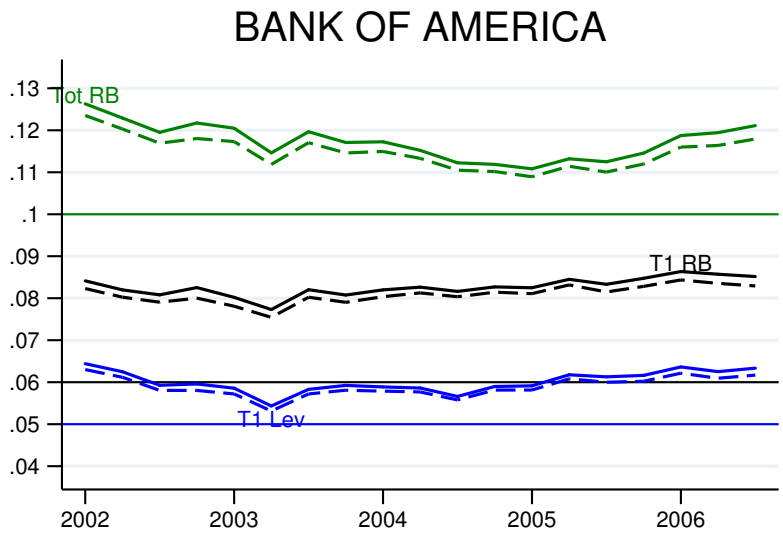
$$\underbrace{\alpha}_{\text{cost}} = \underbrace{\lambda K_\theta}_{\text{benefit}} \Rightarrow \lambda = \frac{\alpha}{K_\theta}$$

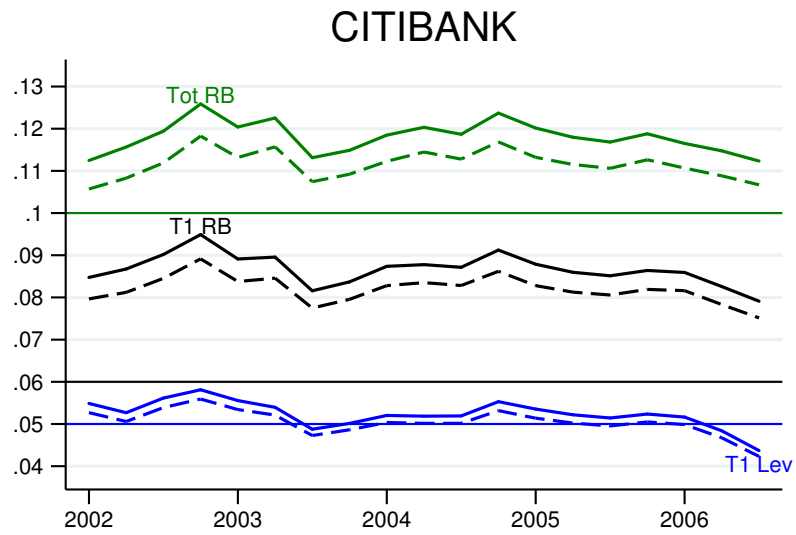
- C1 Constrained banks exploit the loophole
- C2 Constrained banks do not exhaust the loophole ($\theta \in (0,1)$)
- C3 Marginal borrowers do not value loans financed with ABCP conduits differently from those financed with other sources

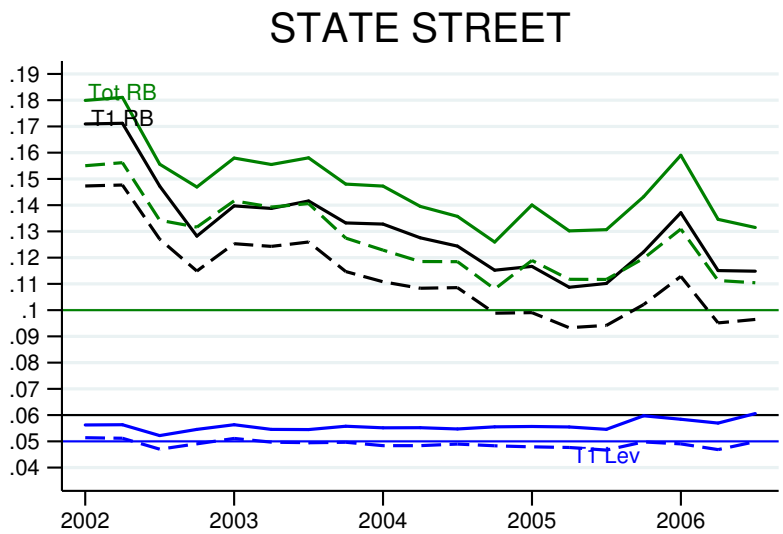
C1: Constrained Banks Exploit the Loophole (Fig 3)

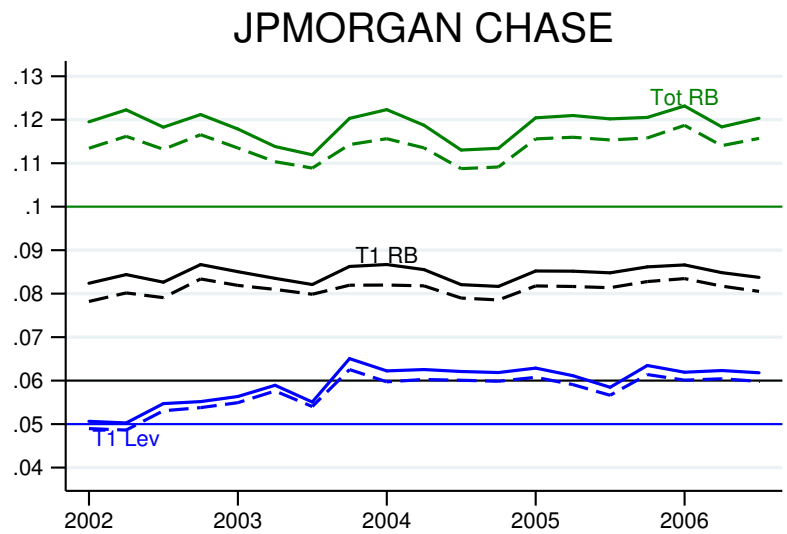


C1 (cont'd): Zooming in on Specific Banks (Fig 4)

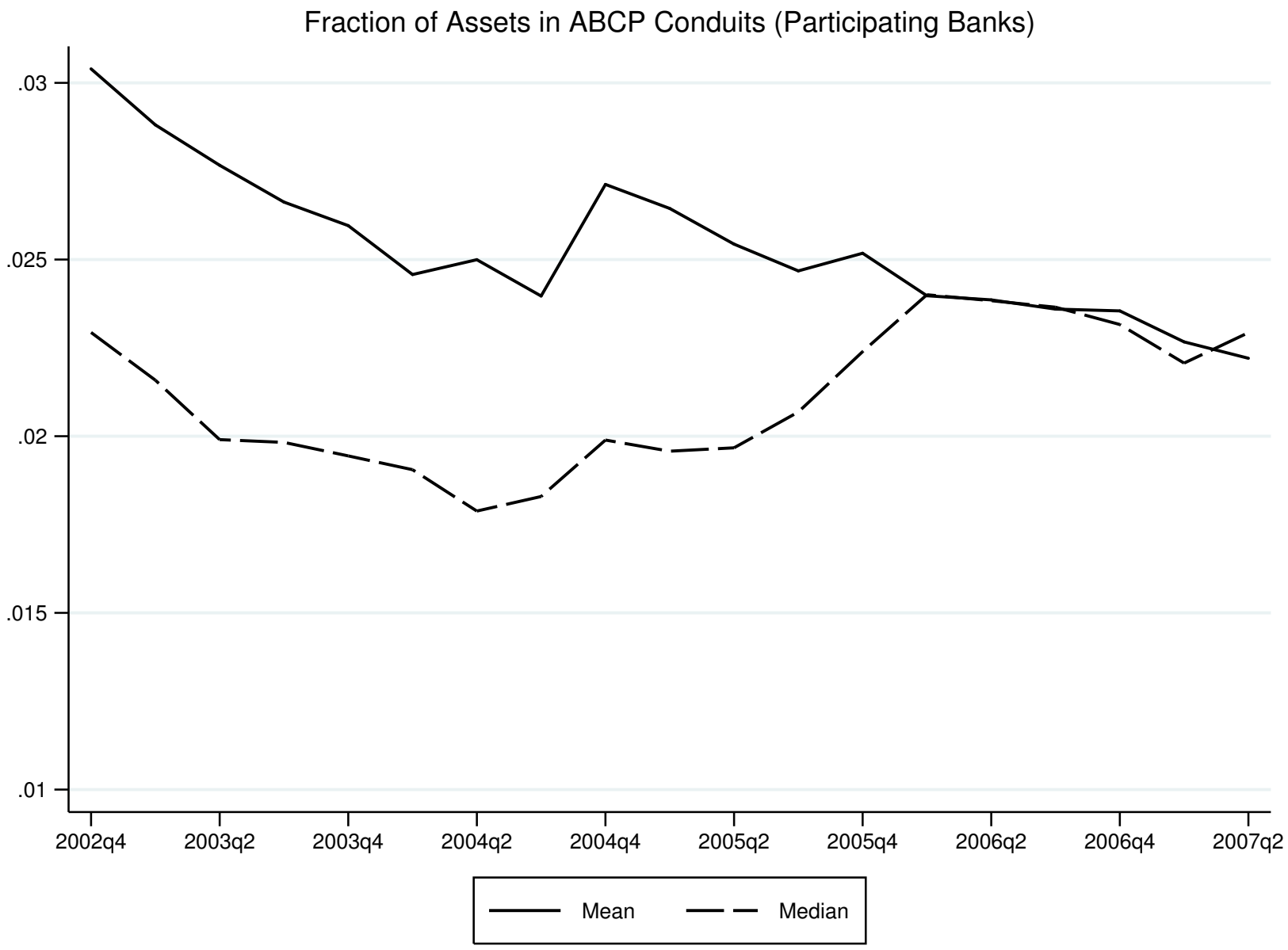








C2: Constrained Banks do not Exhaust the Loophole



Estimating the Shadow Cost: Estimating Expressions

$$\lambda_{it}^{s} = \frac{\alpha_t}{K_{\theta,it}^{s}}$$

$$d\Pi_{it} = -\lambda_{it}^{s} \times Q_{it} \times d\sigma$$

Leverage ratio:

$$\lambda_{it}^{T1Lev} = \frac{\alpha_t}{K_{it}^{T1Lev}} \times \frac{A_{it}}{Q_{it}}$$

Tier-1 risk-based ratio:

$$\lambda_{it}^{T1RB} = \frac{\alpha_t}{K_{it}^{T1RB}} \times \frac{Q_{it}^{r}}{(1-\beta_{ABCP})\sum_j w_j q_{ijt}}$$

Total risk-based ratio:

$$\lambda_{it}^{TotRB} = \frac{\alpha_t}{K_{it}^{TotRB}} \times \frac{Q_{it}^{r}}{(1-\beta_{ABCP})\sum_j w_j q_j}$$

Estimating the Shadow Cost: Measuring the Inputs

$$\lambda_{it} = \frac{\alpha_t}{K_{\theta,it}} = \frac{\alpha_t}{K_{it}} \times \frac{Q_{it}^r}{(1-\beta_{ABCP})\sum_j w_j q_{ijt}}$$

Marginal benefits are easy to measure:

$$K_{\theta,it} = \frac{K_{it}(1-\beta_{ABCP})\sum_j w_j q_{ijt}}{Q_{it}^r}$$

Marginal costs (α_t) are harder to measure

Marginal Cost of the Loophole (α_t): Direct Measure

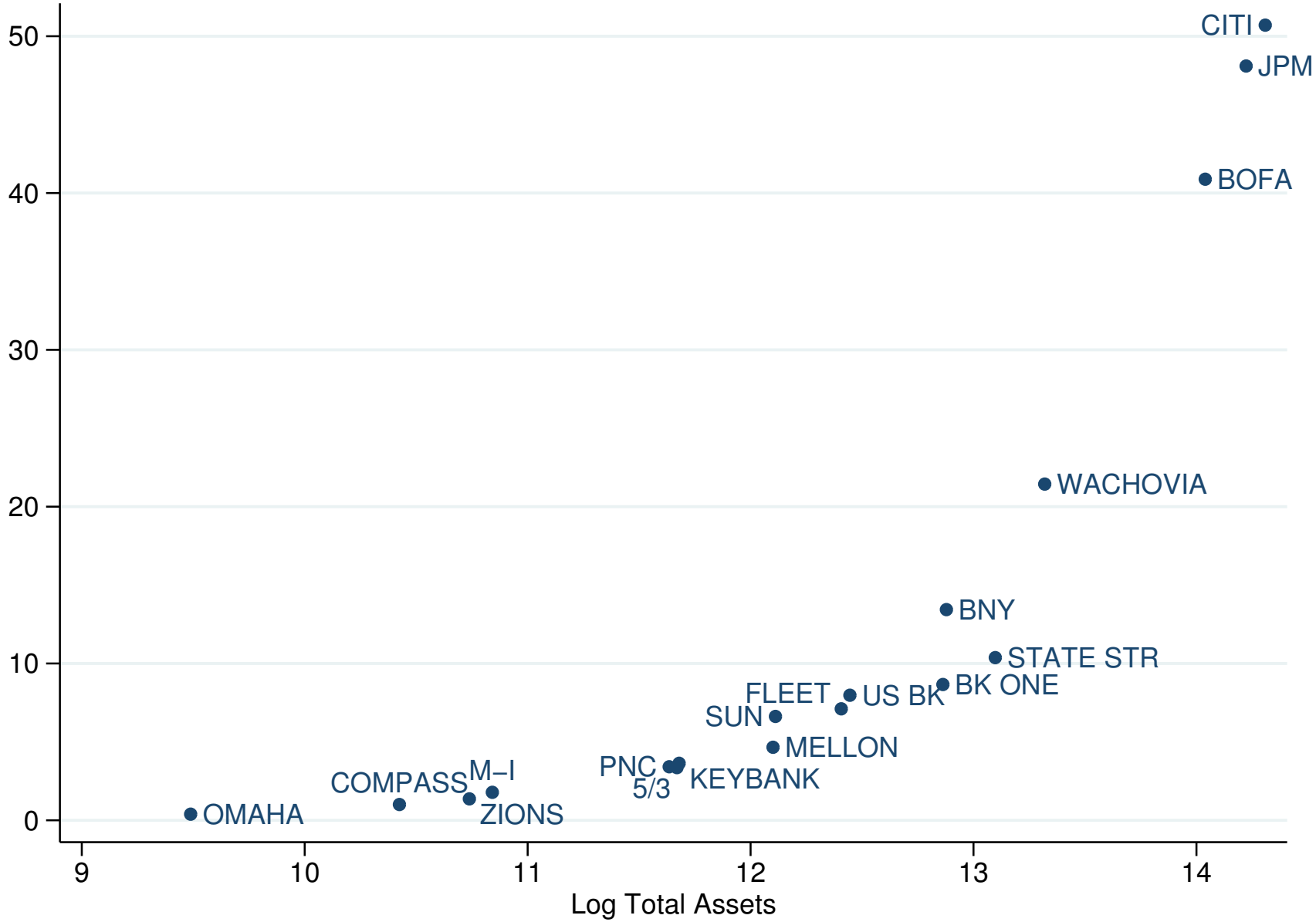
$$\alpha_t = \left(r_t^{ABCP} - r_t^{CP}\right)(1-\tau)$$

r_t^{ABCP} is 30-day AA ABCP rate from the Fed
r_t^{CP} is 30-day AA financial CP rate from the Fed
$\tau = 35\%$ is corporate tax rate

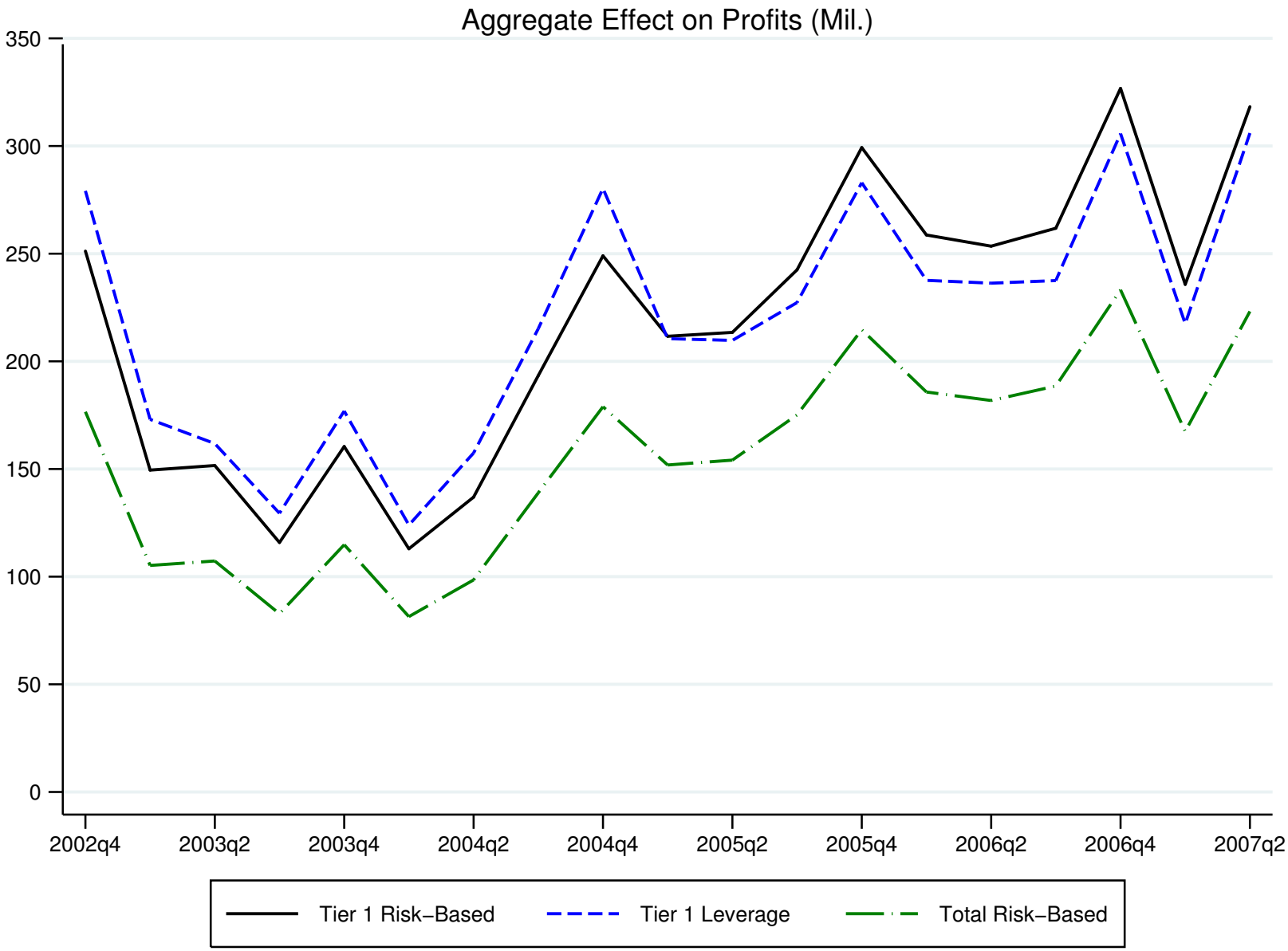
Shadow Costs of 1 pp Increase in Regulatory Ratios (Tbl 3)

	Shadow Cost			Change in Profit (Mil.)			N
	T1 RB	Tot RB	T1 Lev	T1 RB	Tot RB	T1 Lev	
BANK OF AMERICA	0.0032	0.0023	0.0038	-40.9	-29.2	-47.6	19
BANK OF NEW YORK	0.0034	0.0022	0.0010	-13.4	-8.81	-3.83	19
BANK ONE	0.0023	0.0016	0.0021	-8.66	-6.30	-7.87	7
CITIBANK	0.0031	0.0023	0.0044	-50.7	-37.1	-71.9	19
COMPASS BANK	0.0030	0.0022	0.0029	-1.01	-0.76	-0.97	19
FIFTH THIRD BANK	0.0028	0.0023	0.0024	-3.36	-2.71	-2.83	19
FLEET	0.0029	0.0021	0.0023	-7.11	-5.15	-5.68	6
FNB OMAHA	0.0030	0.0023	0.0028	-0.39	-0.30	-0.36	8
JPMORGAN CHASE	0.0032	0.0022	0.0031	-48.1	-34.2	-45.2	19
KEYBANK	0.0031	0.0020	0.0021	-3.63	-2.37	-2.47	8
MARSHALL-ILSLEY	0.0034	0.0023	0.0029	-1.78	-1.21	-1.46	19
MELLON BANK	0.0027	0.0017	0.00071	-4.66	-3.02	-1.10	19
PNC BANK	0.0030	0.0021	0.0024	-3.41	-2.42	-2.65	19
STATE STREET	0.0021	0.0018	0.0010	-10.4	-9.10	-4.39	19
SUNTRUST	0.0036	0.0024	0.0029	-6.62	-4.49	-5.36	19
US BANK	0.0031	0.0021	0.0025	-7.97	-5.28	-6.29	19
WACHOVIA	0.0034	0.0024	0.0031	-21.4	-14.8	-18.9	19
ZIONS	0.0028	0.0019	0.0024	-1.36	-0.90	-1.11	19
Mean	0.0030	0.0022	0.0025	-14.3	-10.2	-14.1	
Std. Error	[0.00020]	[0.00013]	[0.00028]	[4.39]	[3.16]	[5.42]	

Change in Profits ($Mil): 1pp Increase in Tier 1 Risk-Based Ratio



Aggregate Cost for Participating Banks (Fig 7)



Upper Bound for the Shadow Cost

Goal: Allow for measurement error in α in $\lambda = \frac{\alpha}{K_\theta}$

$$\text{FOC in } k_{it}: \qquad \alpha_{it} = \frac{K_{\theta,it}}{K_{k,it}} c'\left(k_{it}\right)$$

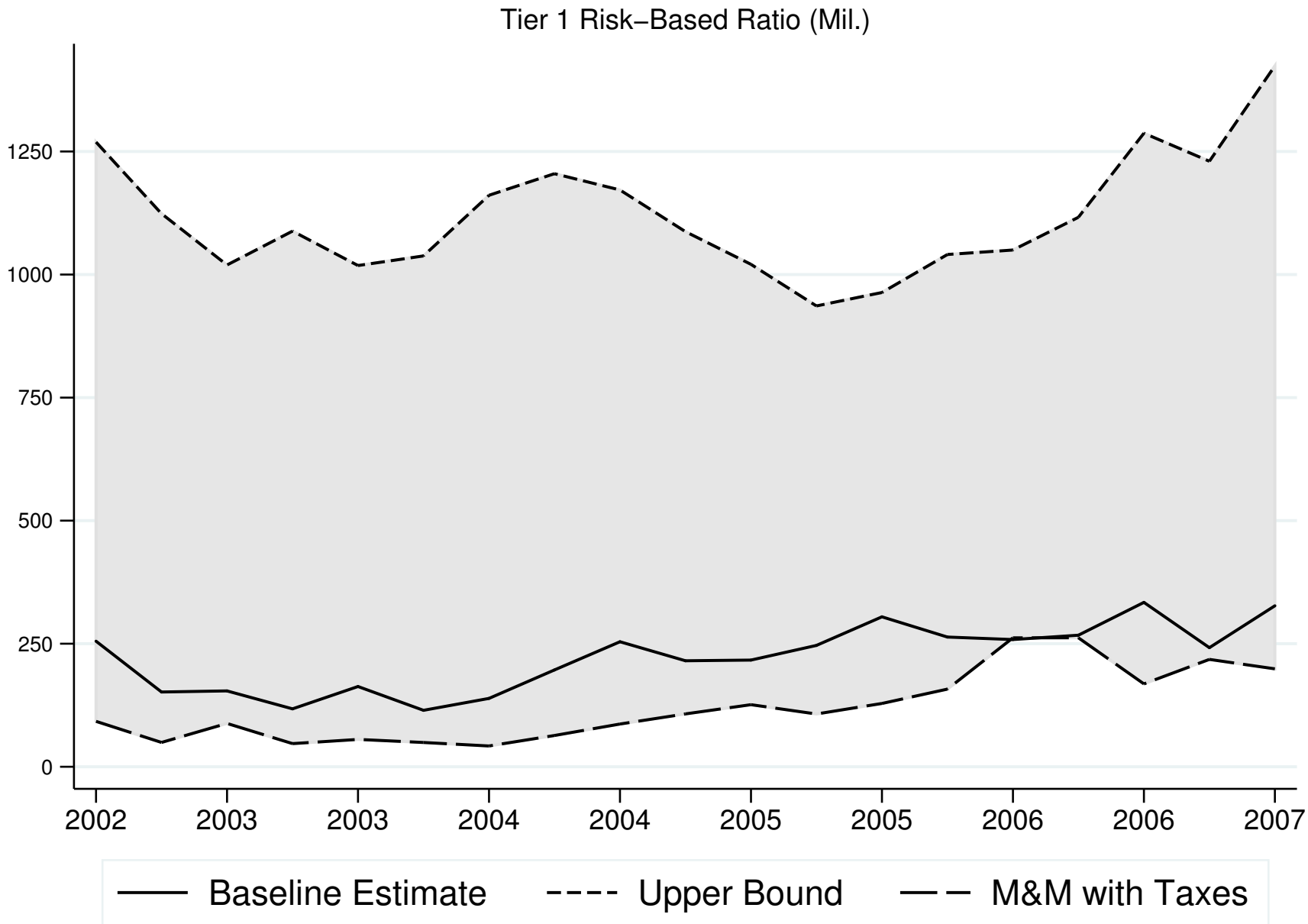
$c'\left(k_{it}\right)$ is hard to measure but can be bounded

$$\begin{aligned} c'\left(k\right) &= r_e - \left(1-\tau\right) r_d + k\frac{\partial r_e}{\partial k} + \left(1-\tau\right)\left(1-k\right)\frac{\partial r_d}{\partial k} \\ &\leq r_e - \left(1-\tau\right) r_d \end{aligned}$$

Assuming uniform α

$$\boxed{\alpha_t \leq \min_i \frac{K_{\theta,it}}{K_{k,it}} \left[r_{e,it} - \left(1-\tau\right) r_{d,it}\right]}$$

Range of Aggregate Effects on Profits (Fig 9)



Discussion

λ is an individual marginal compliance cost
of a small increase in capital requirements
in equilibrium

Marginal compliance costs are first-order effects on profits of a small increase in capital requirements

What about *substantial* changes?

Discussion: Substantial Changes in Capital Requirements

If indirect profits are non-increasing and weakly convex in σ, then the marginal cost is an upper bound for the total cost. (sufficient condition)

Holds, for example,

- if capital requirements reduce the tax benefit of debt (M&M)
- if government guarantees of debt are important (Merton, 1977)
- if credit demand is convex enough (Kashyap et al., 2010)

How Can the Costs Be So Modest?

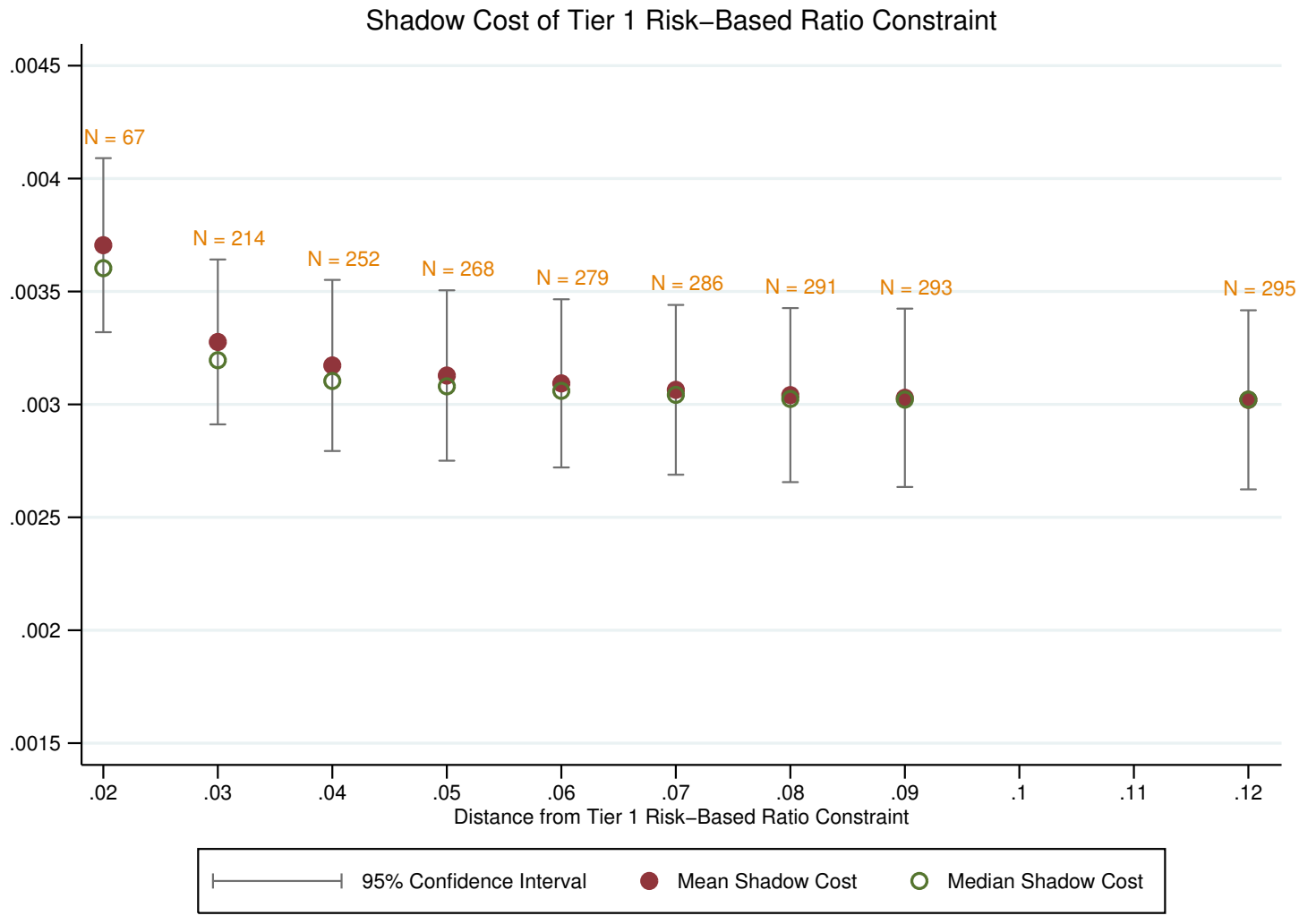
The aggregate cost is $220 million per year, with an upper bound of about $1 billion

These are effects on profits during an economic expansion, after banks use all available tools to mitigate the impact

Banks either neutralize or overstate the effect of capital requirements on cost of capital

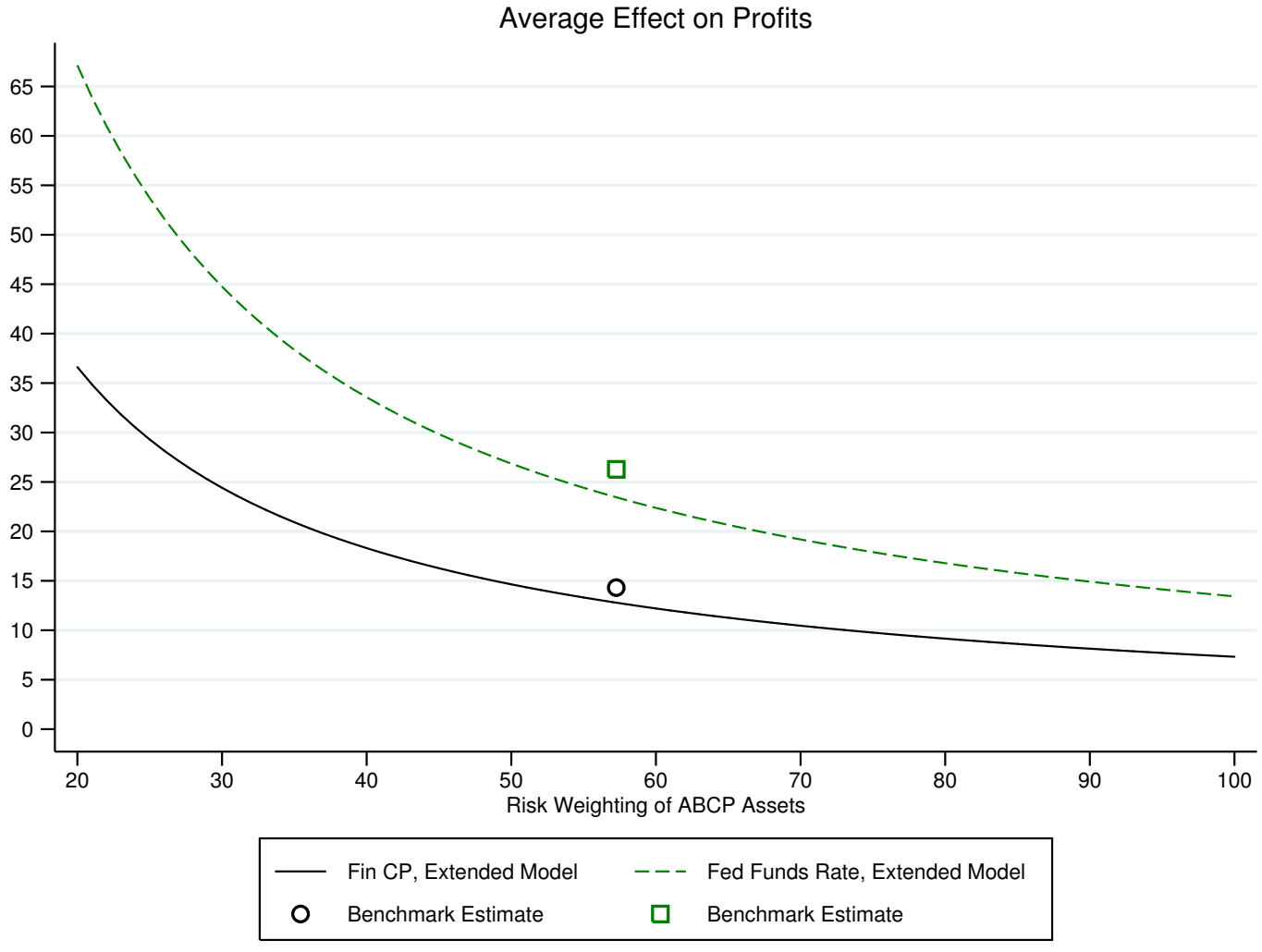
Alternative Definitions of a "Binding Constraint"

Fig. 7: Estimates increase only slightly as we focus on banks closer to threshold



Risk Weighting of Conduit Assets

Fig. 8: Estimates are 50% smaller if most assets have high risk-weights to 150% larger for the lowest risk-weight



Potential Value from ABCP Financing

If the ABCP arrangement created additional value for banks, our benchmark would *overestimate* the shadow cost

Suppose ABCP financing reduce the marginal cost by $\gamma > 0$. Shadow cost becomes

$$\lambda = \frac{\alpha}{K_{\theta_j}} - \frac{\gamma}{K_{\theta_j}}$$

Conclusion

1 pp increase costs $220 million per year in aggregate, with an upper bound of about $1 billion

Latest revision of US bank regulation increased capital requirements by similar amounts

We expect a hardly noticeable effect on bank profitability

Our approach could be applied more broadly to study regulation of financial intermediaries and provides calibration targets for structural macroeconomic models

Related Literature

We show how bank capital regulation loopholes can be used to produce estimates of its shadow cost

- Hasnon, Kashyap and Stein (2011): M&M with taxes
- Baker and Wurgler (2013): implication of low-risk anomaly

Macro-finance studies of constrained financial intermediaries

- Koijen and Yogo (2013): the shadow cost of statutory reserve regulation for life insurers
- Loophole approach avoids fully specifying the competitive equilibrium and estimating demand elasticities, markups, etc.

Recent calibrations can use our estimates as calibration target

- Begenau (2014)
- Gornall and Strebulaev (2014)
- Nguyen (2014)

Risk-weighted Assets

- Risk weight w_j applied to each asset of risk group j
- Four major risk weights groups:
  - 0% (cash)
  - 20% (OECD sovereign debt)
  - 50% (residential mortgages)
  - 100% (corporate loans)
- Securitized assets get 20–200% weights based on ratings
- Conversion factor $\beta \in [0, 1]$ converts off-balance sheet items
- Leverage ratio denominator is on-balance sheet assets ($w = 100\%$, $\beta = 0$)

Role of ABCP loophole was widely recognized at the time

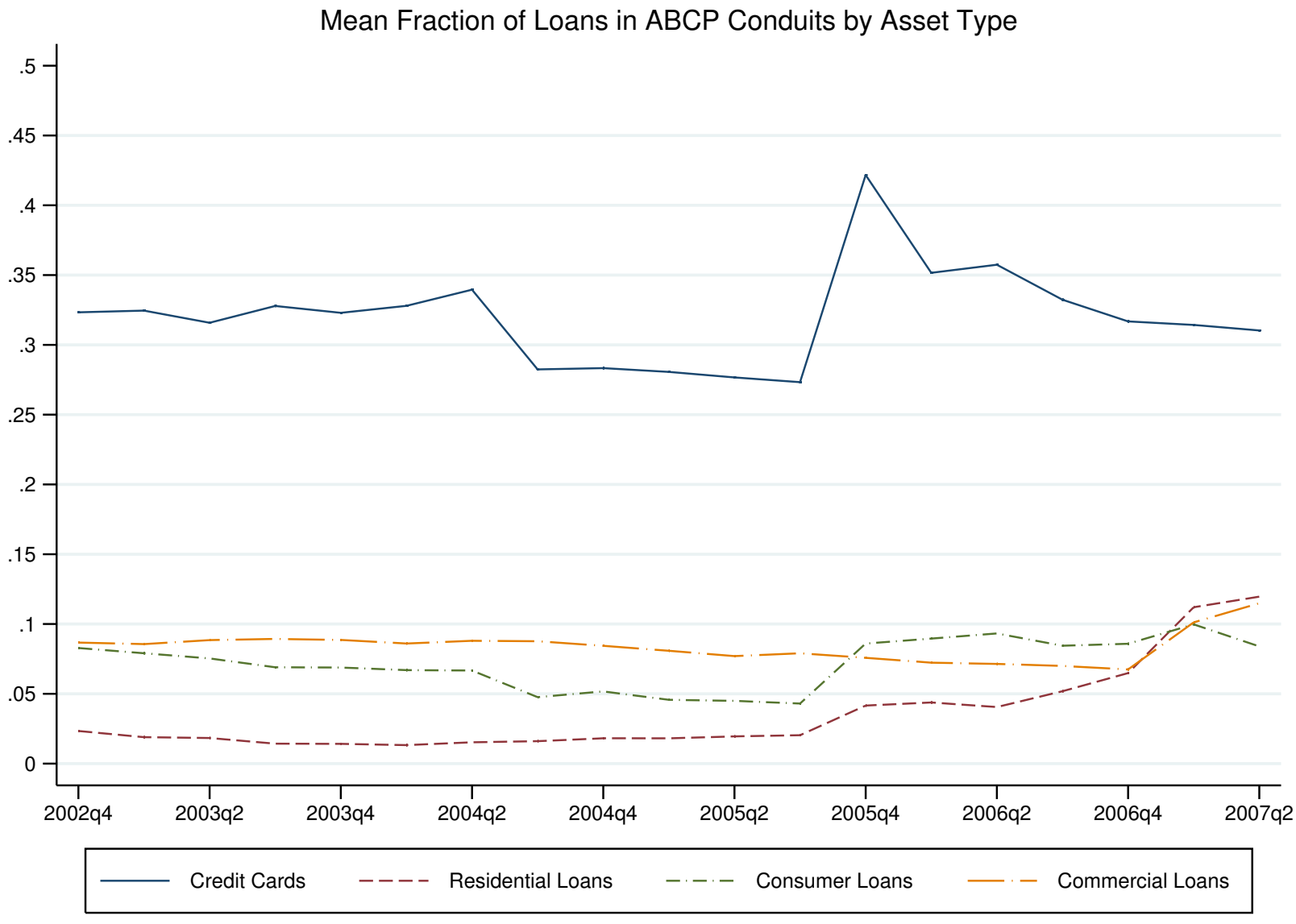
"If the bank were to provide a direct corporate loan, even one secured by the same assets, it would appear on the bank's balance sheet as an asset and the bank would be obligated to maintain regulatory capital for it. An ABCP program permits the Sponsor (i.e., the commercial bank) to offer receivable financing services to its customers without using the Sponsor's balance sheet or holding incremental regulatory capital."

Moody's (2003)

"We don't simply look at the assets, although we do due diligence. We know the sponsors, the entity. But we also look through to the liquidity support providers. And we wouldn't buy any asset-backed commercial paper conduit unless we're 100 percent sure that they are fully supported by a bank institution."

Steven Meier, Chief Investment Officer, State Street

C2: Constrained Banks do not Exhaust the Loophole



Loophole Use in a Dynamic Model

Not much changes in the dynamic model, but adjustment costs can bias results

- λ_t captures per-period shadow cost of compliance
- The effect of a permanent increase in σ on the bank's *present value* of profits discounted at rate $\delta \in (0,1)$ is

$$-\frac{\partial V_t}{\partial \sigma}\frac{1}{Q_t} = E_t\left[\sum_{s=0}^{\infty}\delta^s \lambda_{t+s}\frac{Q_{t+s}}{Q_t}\right] = \frac{\lambda_t}{1-\delta(1+g)} \tag{1}$$

- Costs of a permanent increase accrue long after rules revision
- Allowing for loophole use adjustment costs κ

$$\lambda_t \leq \frac{\alpha_t + \kappa\left\{L_t - L_{t-1} - \delta E_t\left[L_{t+1} - L_t\right]\right\}}{\frac{\partial K_t}{\partial \theta_{t+1}}} \tag{2}$$

- Allowing for anticipation of financial crisis

$$\lambda_t = \frac{\alpha_t + \pi_t \kappa \delta E_t\left[L_{t+1} | z_{t+1} = 0\right]}{\frac{\partial K_t}{\partial \theta_{t+1}}} \tag{3}$$