The Shadow Cost of Bank Capital Requirements

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Capital Requirements Policy Debate

- Proposals to increase capital requirements met fierce and successful opposition from banks
- Banks' *private costs* play a central role in shaping regulation
- But, these costs have not been measured empirically

What Do We Do? Revealed Preference Approach

- Banks used the ABCP loophole to bypass capital constraints
  - Acharya, Schnabl, and Suarez (2013)
- Banks trade off the cost of the loophole vs. benefit of reduced capital
- Loophole use reveals the shadow costs of capital requirements
  - Anderson and Sallee (2011)

Results Summary

10 pp increase (e.g., from 6% to 16%) would cost all banks that exploited the loophole combined:

- $2.2 billion for Tier 1 risk-based capital ratio and Tier 1 leverage ratio
  - $1.6 billion for Total risk-based capital ratio
- Average reduction in profits is $143 million, or 4% of profits
- No more than $4 billion for all US banks combined

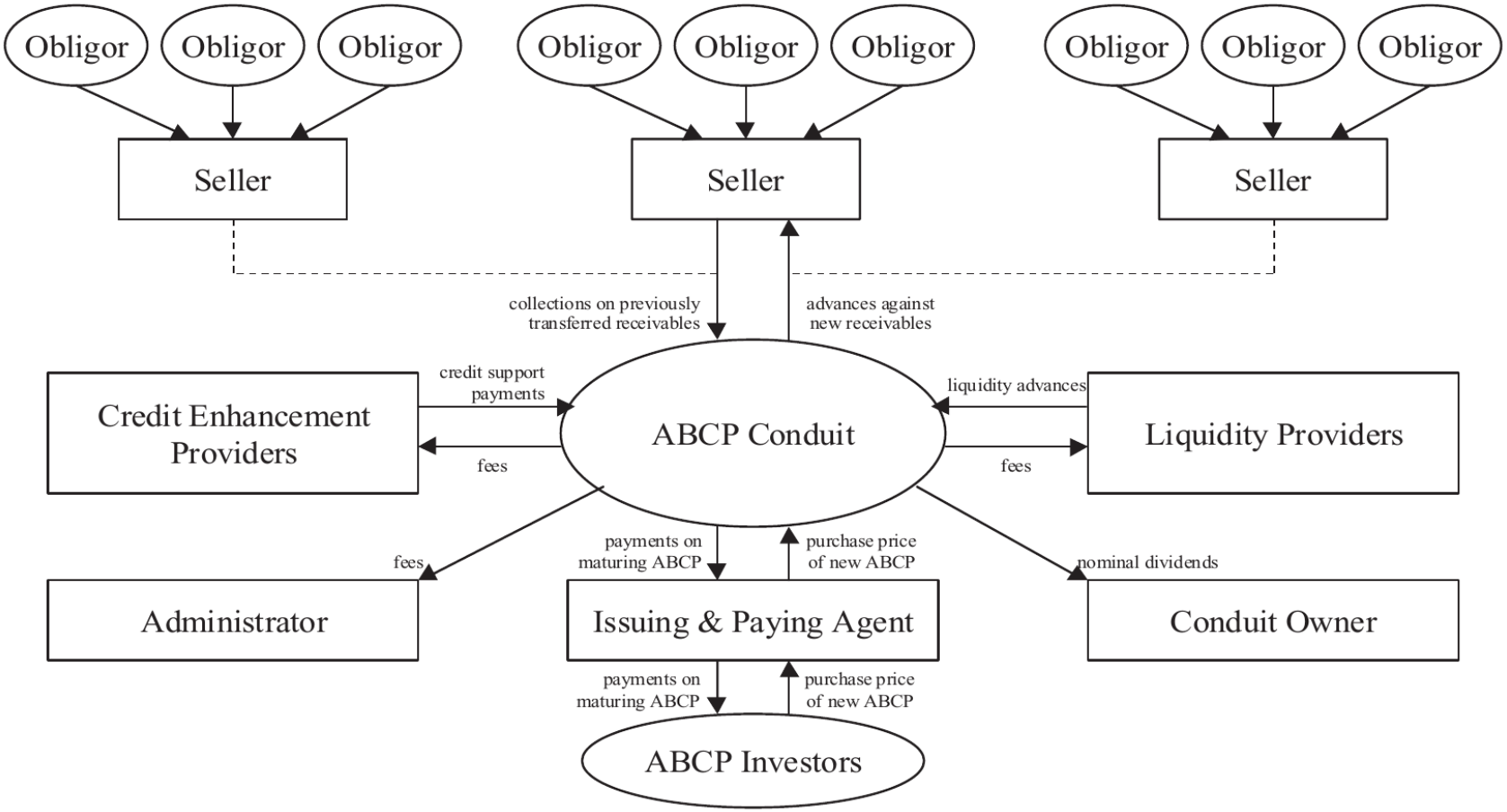
Regulatory Capital Ratios

Banks are considered well-capitalized if

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

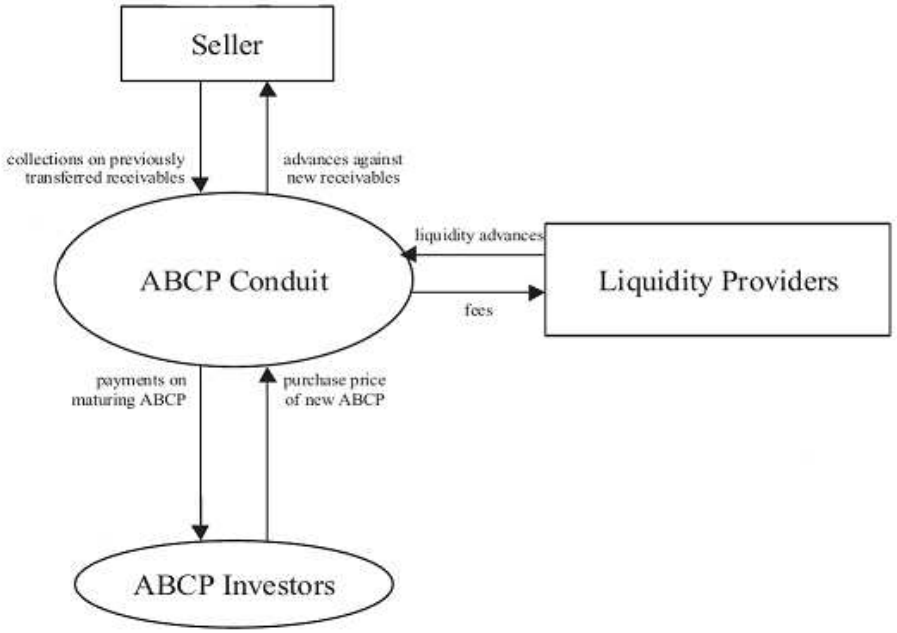
$\boxed{\text{The ABCP loophole was about the denominators}}$

Asset-backed Commercial Paper (ABCP) Programs



Source: Moody's (2003)

Liquidity Guarantees and the Capital Ratios



- Zero percent count toward assets (10% after 2004)
- Why? "Conditionality" of guarantees
- But ABCP stops rolling over before assets stop performing
- **Banks bear the risk in the loans, without a capital charge**

Banks

- Oligopolistic banks maximize profits

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

subject to a regulatory capital constraint

$$K\left(\boldsymbol{q}, k, \theta\right) \geq \sigma$$

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- For banks with interior ABCP share of total assets $\theta \in (0, 1)$:

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

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- Banks' use of the loophole reveals the shadow cost

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

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Shadow Costs of Regulatory Capital Constraints

- Leverage ratio shadow cost

$$\lambda^{T1Lev} = \frac{\alpha}{K^{T1Lev}} \times \frac{A}{Q}$$

- Tier 1 risk-based capital ratio shadow cost

$$\lambda^{T1RB} = \frac{\alpha}{K^{T1RB}} \times \frac{Q^r}{(1-\beta_{ABCP})\sum_j w_j q_j}$$

- Total risk-based capital ratio shadow cost

$$\lambda^{TotRB} = \frac{\alpha}{K^{TotRB}} \times \frac{Q^r}{(1-\beta_{ABCP})\sum_j w_j q_j}$$

- Shadow costs of binding constraints are positive, and zero otherwise

Discussion

$$-\frac{\partial \Pi^*}{\partial \sigma}\frac{1}{Q} = \lambda = \frac{\alpha}{K_\theta} \text{ if } \theta \in (0,1)$$

1. λ is each bank's marginal compliance costs in equilibrium
   - If regulatory changes apply to the whole industry, each bank would suffer *less* because competitors also suffer
2. Envelope theorem holds constant the endogenous choice variables (interest rates, capital structure, ABCP share)
   - Second-order effects would *mitigate* the loss in profits

- In both cases, we would likely *overestimate* the total effect

Sufficient Conditions for Identification

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 and C2 are verified empirically
- C3 holds if many marginal borrowers are indifferent
  - Dollars are dollars...
  - If conduits created additional value, shadow cost is *overestimated*

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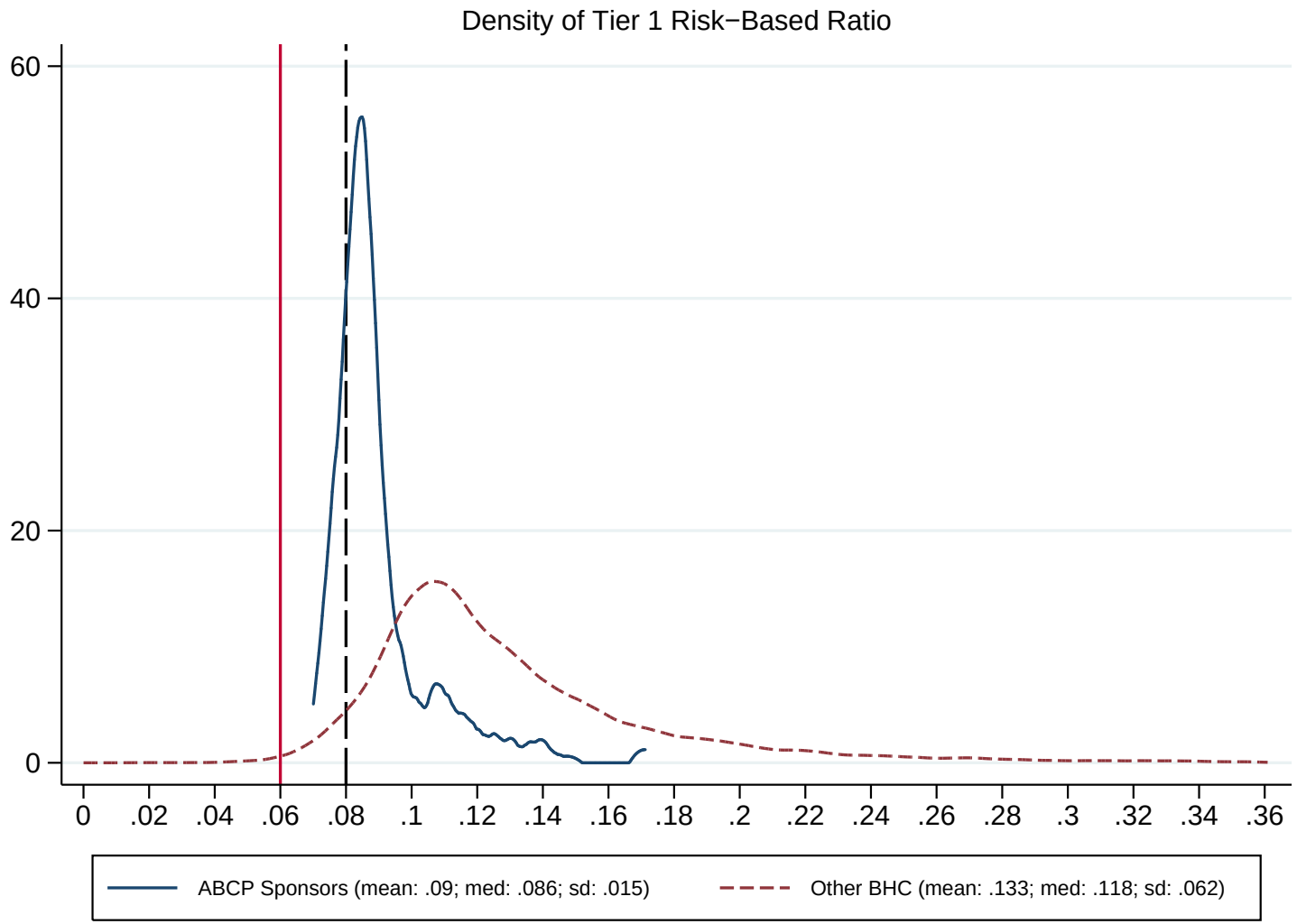
Condition 1: Constrained Banks Exploit the Loophole

Fig. 3: ABCP sponsors bunch-up closer to the regulatory "well-capitalized" threshold



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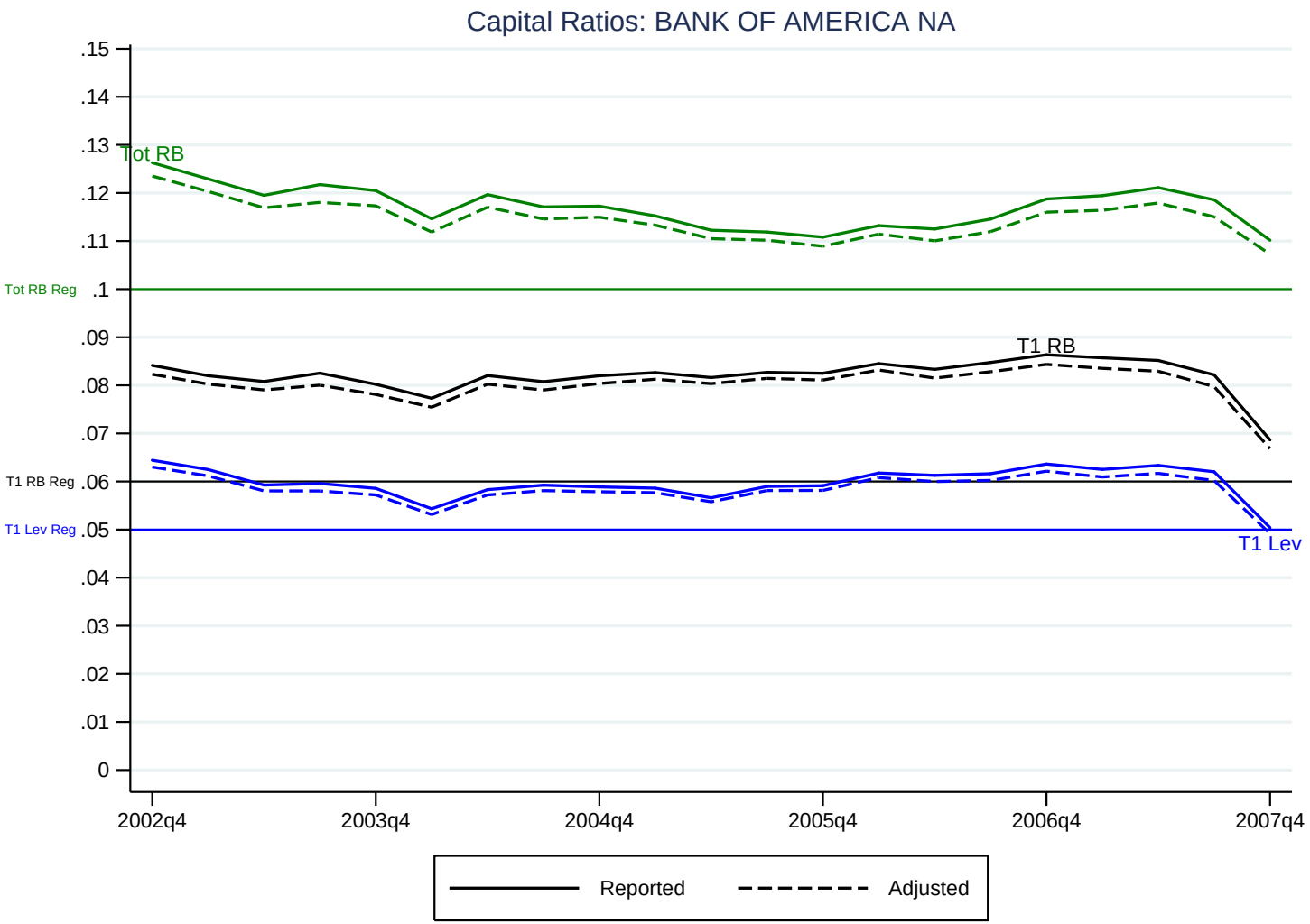

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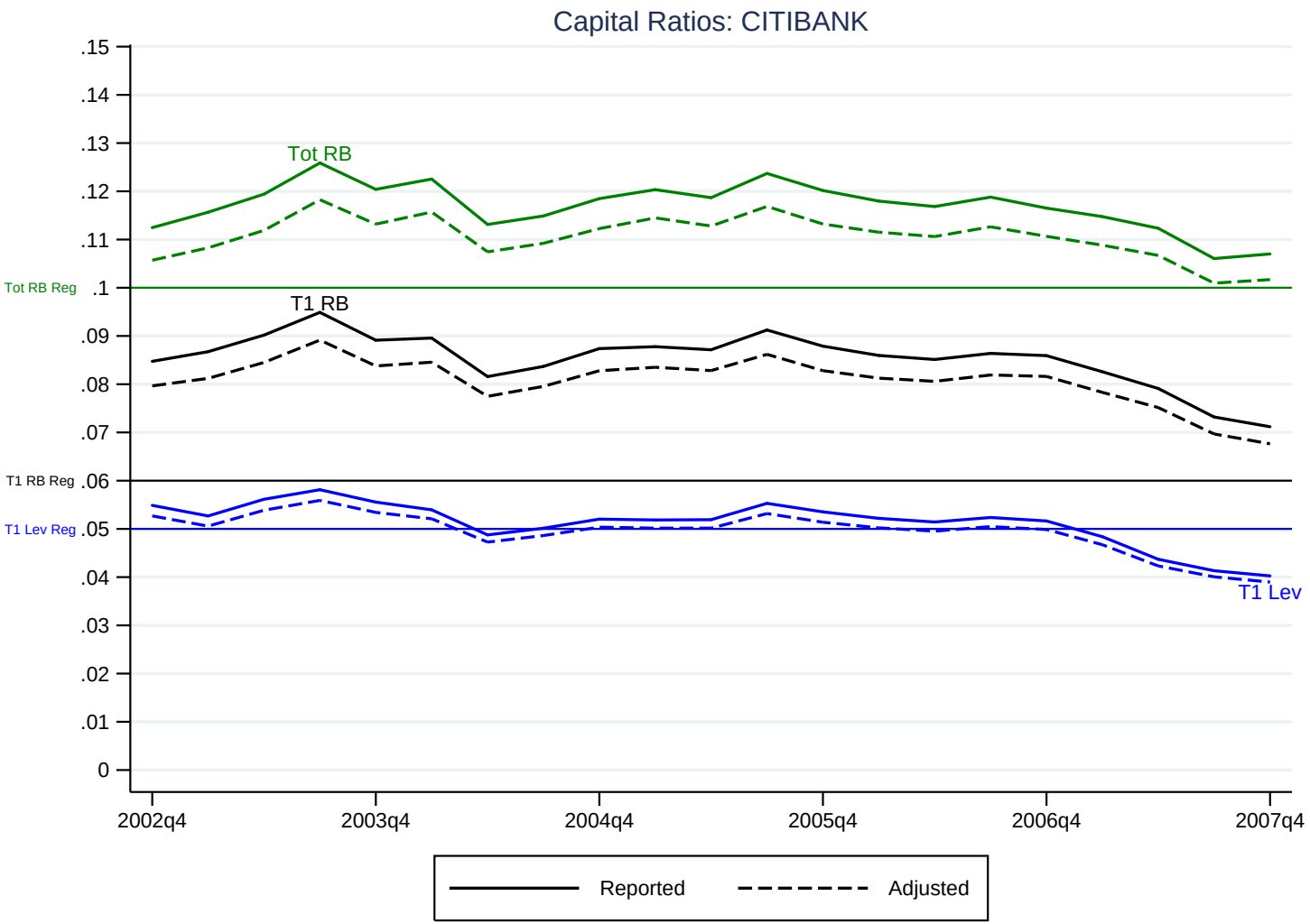

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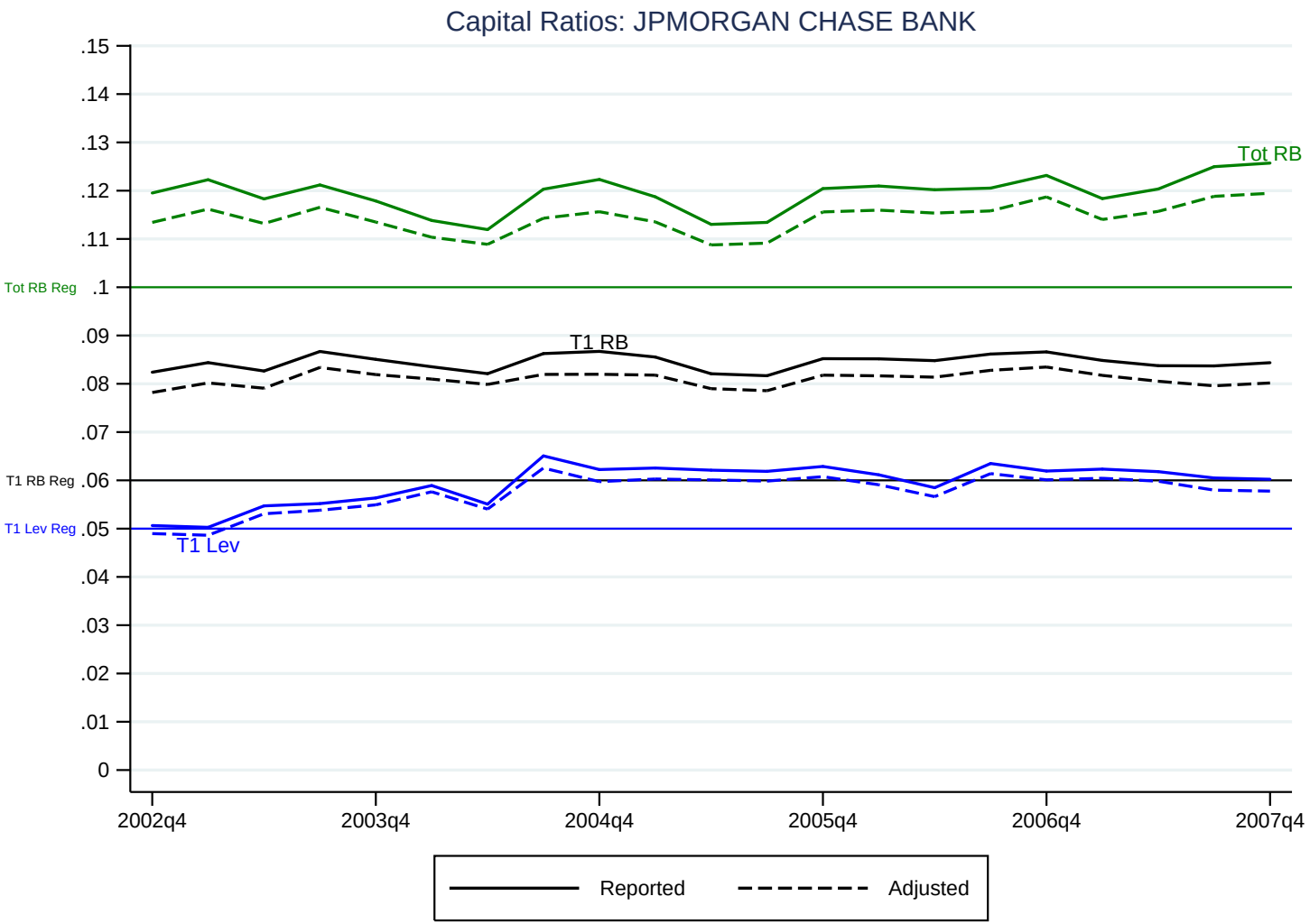
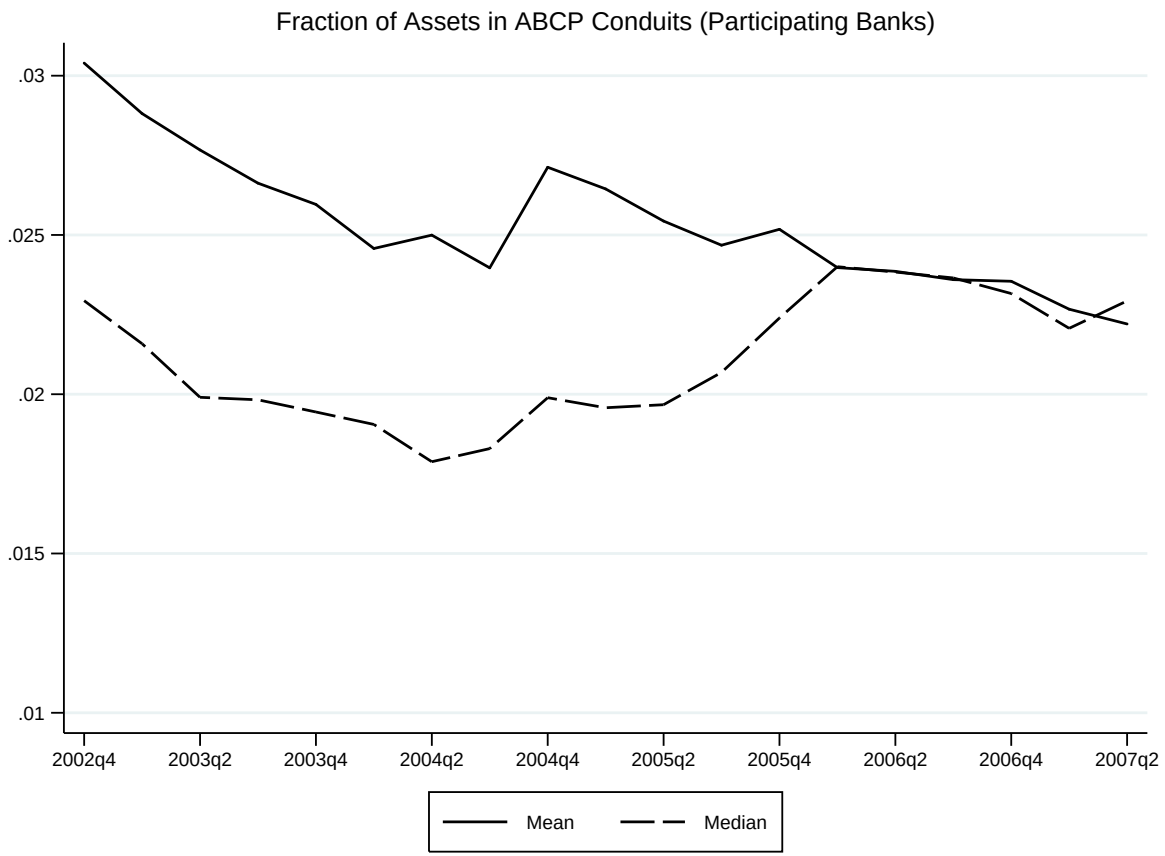


Condition 2: Constrained Banks do not Exhaust the Loophole

Fig. 5: Average share of total assets financed with ABCP $\theta \approx 3\%$



- ABCP shares for different asset types are also interior

Estimating the Shadow Cost of Capital Requirements

Shadow cost for bank i in quarter t:

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

- Risk-weighted assets Q_{it}^r, capital ratio K_{it}, β_{ABCP} are public
- q_{ijt} are total reported assets + liquidity guarantees (Moody's)
- Risk Weights w_j:
  - Assume ABCP assets have the distribution as rest of assets
  - Estimates are not sensitive to this assumption

Estimating the Shadow Cost (cont'd)

Shadow cost for bank i in quarter t:

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

- The incremental cost of conduit assets:

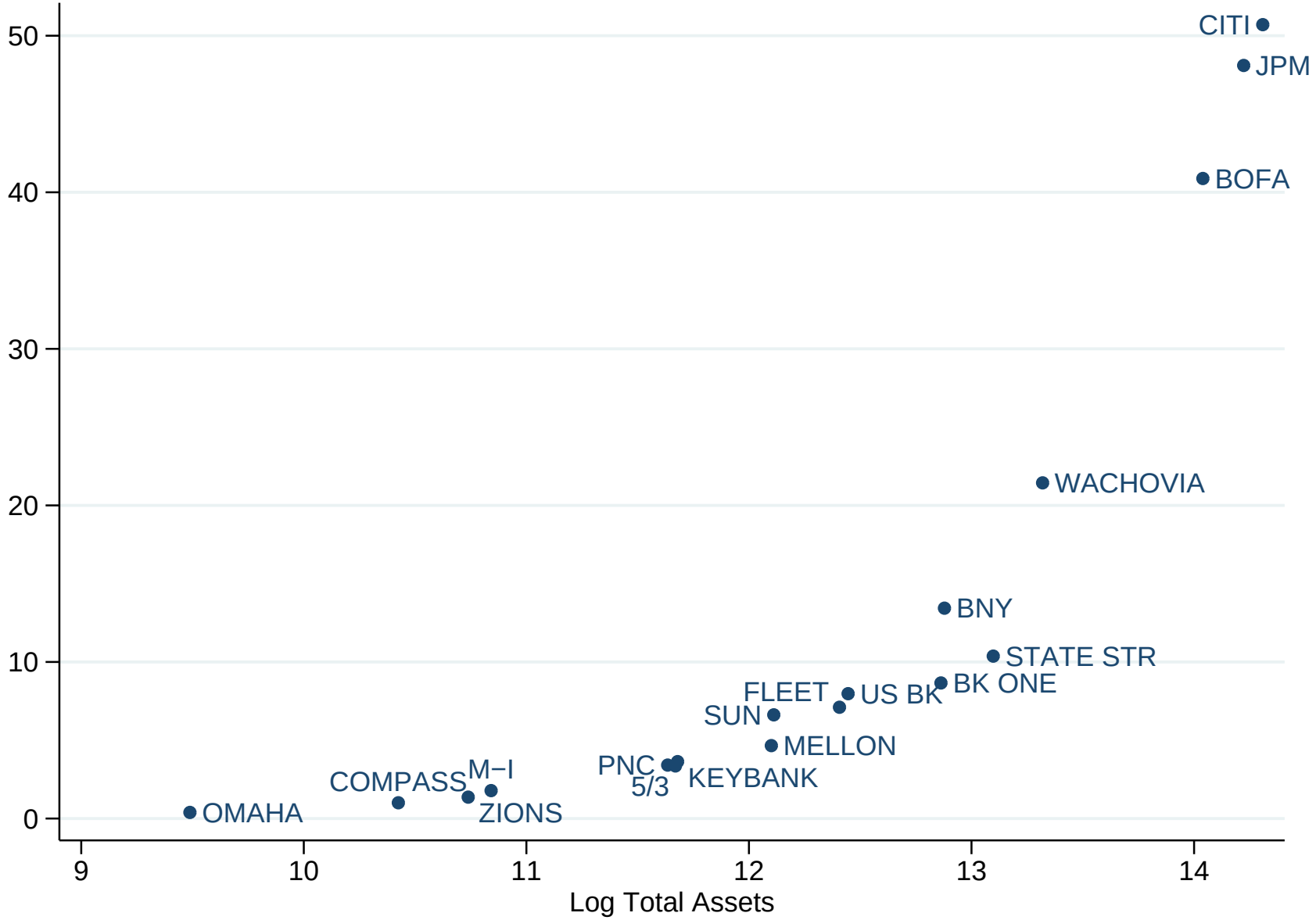
$$\alpha_t = \left(r_t^{ABCP,30d} - r_t^{CP,30d}\right)(1-\tau)$$

- $r_t^{ABCP,30d}$ is 30-day AA ABCP rate from the Fed
- $r_t^{CP,30d}$ is 30-day AA financial CP rate from the Fed
  - Robustness: overnight Fed Funds as alternative rate
- $\tau = 35\%$ is corporate tax rate

Tbl. 2: Shadow Costs of 1 pp Increase in Regulatory Ratios

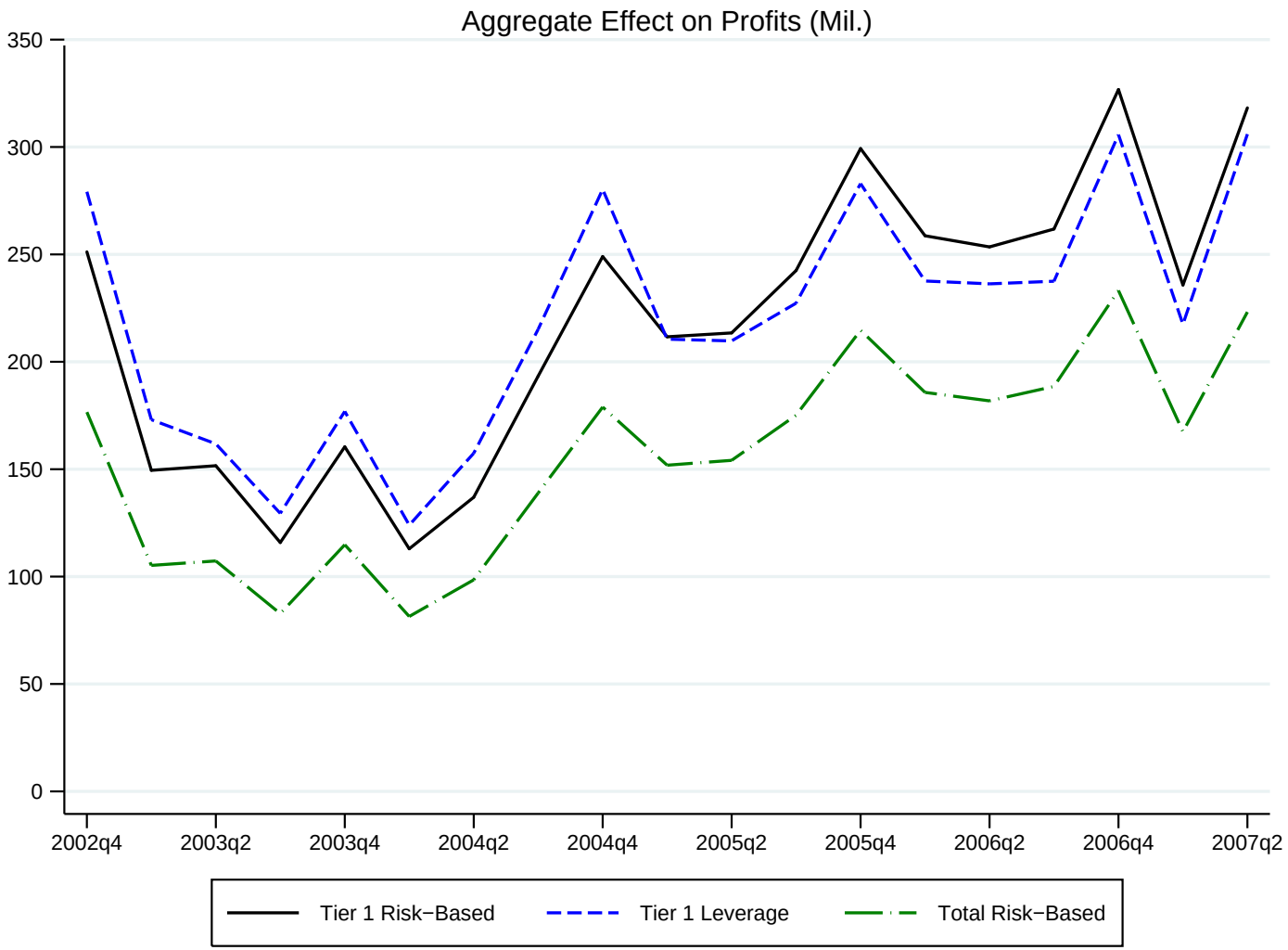
	Shadow Cost			Change in Profit (Mil.)			Change in Profit/Profit			N
	T1 RB	Tot RB	T1 Lev	T1 RB	Tot RB	T1 Lev	T1 RB	Tot RB	T1 Lev	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
BANK OF AMERICA	0.0032	0.0023	0.0038	-40.9	-29.2	-47.6	-0.0025	-0.0018	-0.0030	19
BANK OF NEW YORK	0.0034	0.0022	0.0010	-13.4	-8.81	-3.83	-0.0097	-0.0063	-0.0030	19
BANK ONE	0.0023	0.0016	0.0021	-8.66	-6.30	-7.87	-0.0024	-0.0017	-0.0021	7
CITIBANK	0.0031	0.0023	0.0044	-50.7	-37.1	-71.9	-0.0028	-0.0021	-0.0041	19
COMPASS BANK	0.0030	0.0022	0.0029	-1.01	-0.76	-0.97	-0.0025	-0.0019	-0.0024	19
FIFTH THIRD BANK	0.0028	0.0023	0.0024	-3.36	-2.71	-2.83	-0.0031	-0.0025	-0.0025	19
FLEET	0.0029	0.0021	0.0023	-7.11	-5.15	-5.68	-0.0039	-0.0028	-0.0031	6
FNB OMAHA	0.0030	0.0023	0.0028	-0.39	-0.30	-0.36	-0.0037	-0.0028	-0.0035	8
JPMORGAN CHASE	0.0032	0.0022	0.0031	-48.1	-34.2	-45.2	-0.0067	-0.0047	-0.0068	19
KEYBANK	0.0031	0.0020	0.0021	-3.63	-2.37	-2.47	-0.0038	-0.0025	-0.0026	8
MARSHALL-ILSLEY	0.0034	0.0023	0.0029	-1.78	-1.21	-1.46	-0.0025	-0.0017	-0.0021	19
MELLON BANK	0.0027	0.0017	0.00071	-4.66	-3.02	-1.10	-0.0058	-0.0037	-0.0014	19
PNC BANK	0.0030	0.0021	0.0024	-3.41	-2.42	-2.65	-0.0026	-0.0018	-0.0020	19
STATE STREET	0.0021	0.0018	0.0010	-10.4	-9.10	-4.39	-0.011	-0.0096	-0.0048	19
SUNTRUST	0.0036	0.0024	0.0029	-6.62	-4.49	-5.36	-0.0037	-0.0025	-0.0030	19
US BANK	0.0031	0.0021	0.0025	-7.97	-5.28	-6.29	-0.0019	-0.0012	-0.0015	19
WACHOVIA	0.0034	0.0024	0.0031	-21.4	-14.8	-18.9	-0.0034	-0.0024	-0.0031	19
ZIONS	0.0028	0.0019	0.0024	-1.36	-0.90	-1.11	-0.0028	-0.0019	-0.0024	19
Mean	0.0030	0.0022	0.0025	-14.3	-10.2	-14.1	-0.0043	-0.0031	-0.0030	
Std. Error	[0.00020]	[0.00013]	[0.00028]	[4.39]	[3.16]	[5.42]	[0.00073]	[0.00058]	[0.00041]	

Effect on Profits, 1 pp Increase in Tier 1 Risk-Based Ratio



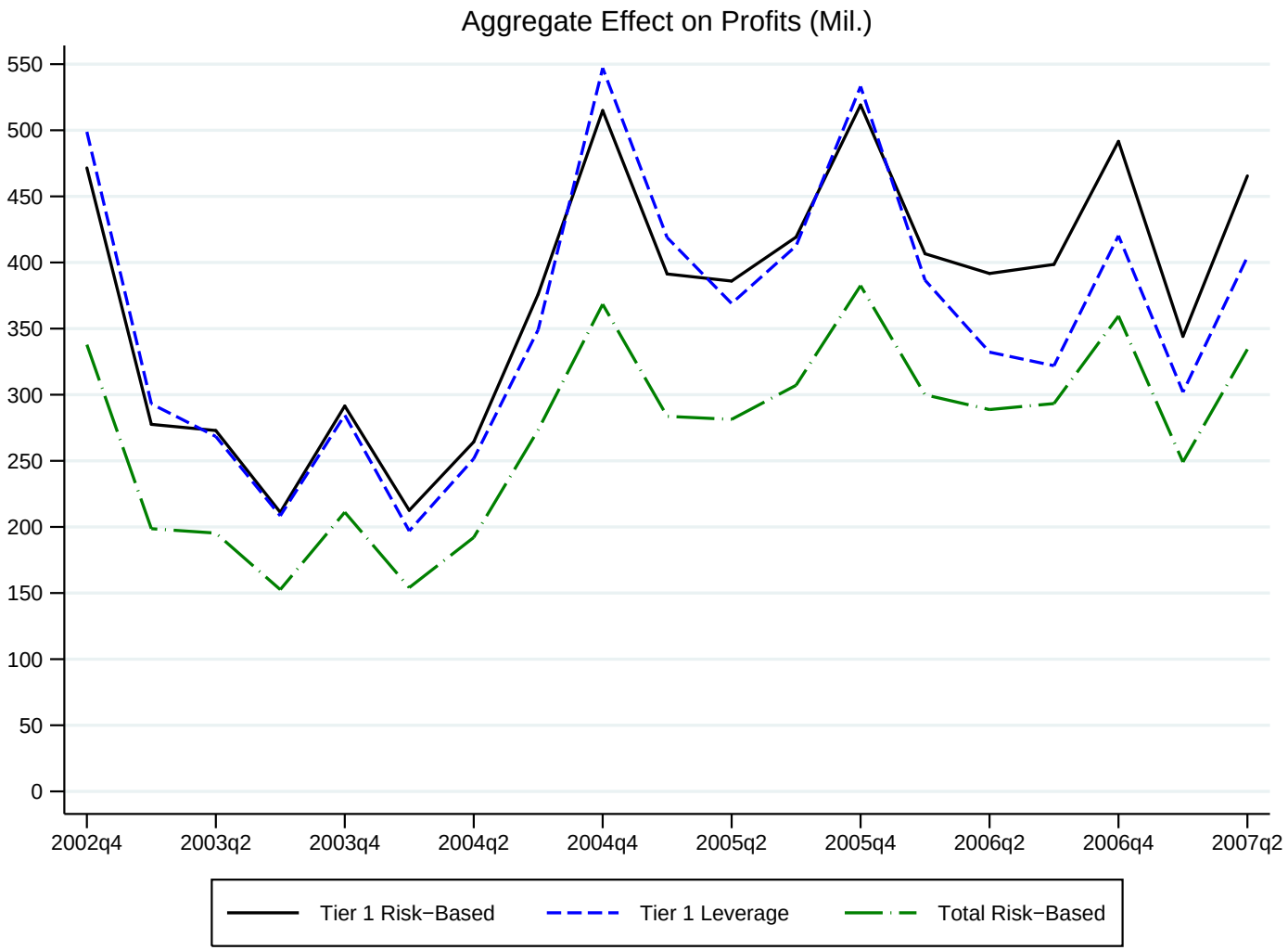
Aggregate Cost for ABCP-participating Banks

Fig. 6: Stable quarterly estimates from 0.8 to 3 billion dollars for a 10 pp increase



Aggregate Cost for All U.S. Banks, Upper Bound Estimate

Fig. 6: $3.7 billion on average for a 10 pp increase



Aggregate Cost During the Financial Crisis

Same 10pp increase at height of crisis period costs $55 billion

- We focus on the pre-crisis period because it reveals the shadow cost of regulation during normal times
- More relevant for the current debate
- Adjustment costs play a minor role pre-crisis
  - But, during the crisis banks would probably reduce their ABCP exposure quickly, if they could do so cheaply

How can these costs be so modest?

- Effect on profits during an economic expansion
- After banks used all available tools to mitigate the impact

- Not cost of issuing additional equity
  - Hanson, Kashyap and Stein (2011), Baker and Wurgler (2013)
- Not effect of distressed deleveraging
  - Peek and Rosengren (1997)

- A small shadow cost means
  - Banks significantly overstate the cost of capital effect, or
  - Banks can neutralize the effects of higher requirements

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Cost of Capital and Interest Rates

- What is the effect on interest rates and the cost of capital?
- Suppose the bank was forced to raise equity to comply
- We get an upper bound on the effect on the cost of capital

$$\frac{dc}{d\sigma} \leq \lambda$$

- Implies a 10 pp increase in tier 1 risk-based ratio would increase the cost of capital by at most 3 bp
- Also bounds the increase in lending interest rates to 3 bp

What is the effect on the quantity of lending Q?

- Make an extreme assumption that the bank passes all of the increase in costs to borrowers

$$\frac{dQ}{Q} = -\frac{\lambda}{r-c} \times d\sigma$$

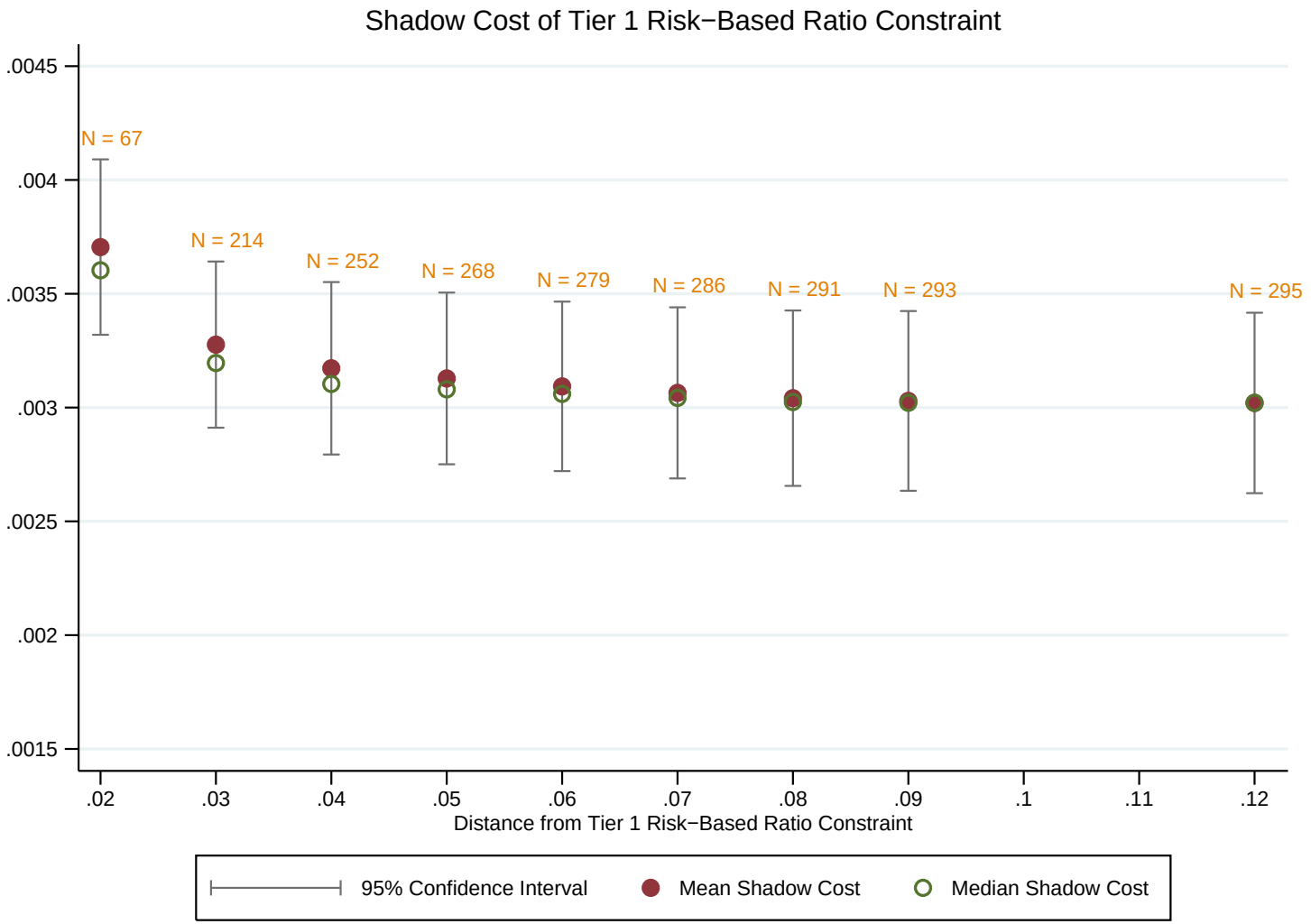
- Then a 10 pp increase in tier 1 risk-based capital ratio would reduce bank assets by 1.5%

Comparison with Prior Estimates

- Literature estimates the increase in the cost of capital (dc)
- Kashyap, Hanson and Stein (2010): 10 pp increase would raise WACC by 25-45 bp
  - Modigliani-Miller model with taxes
  - Banks comply by increasing their equity ratio (cannot avoid)
- They provide an important benchmark if assumptions hold
- Our estimates show effect after banks act to mitigate costs

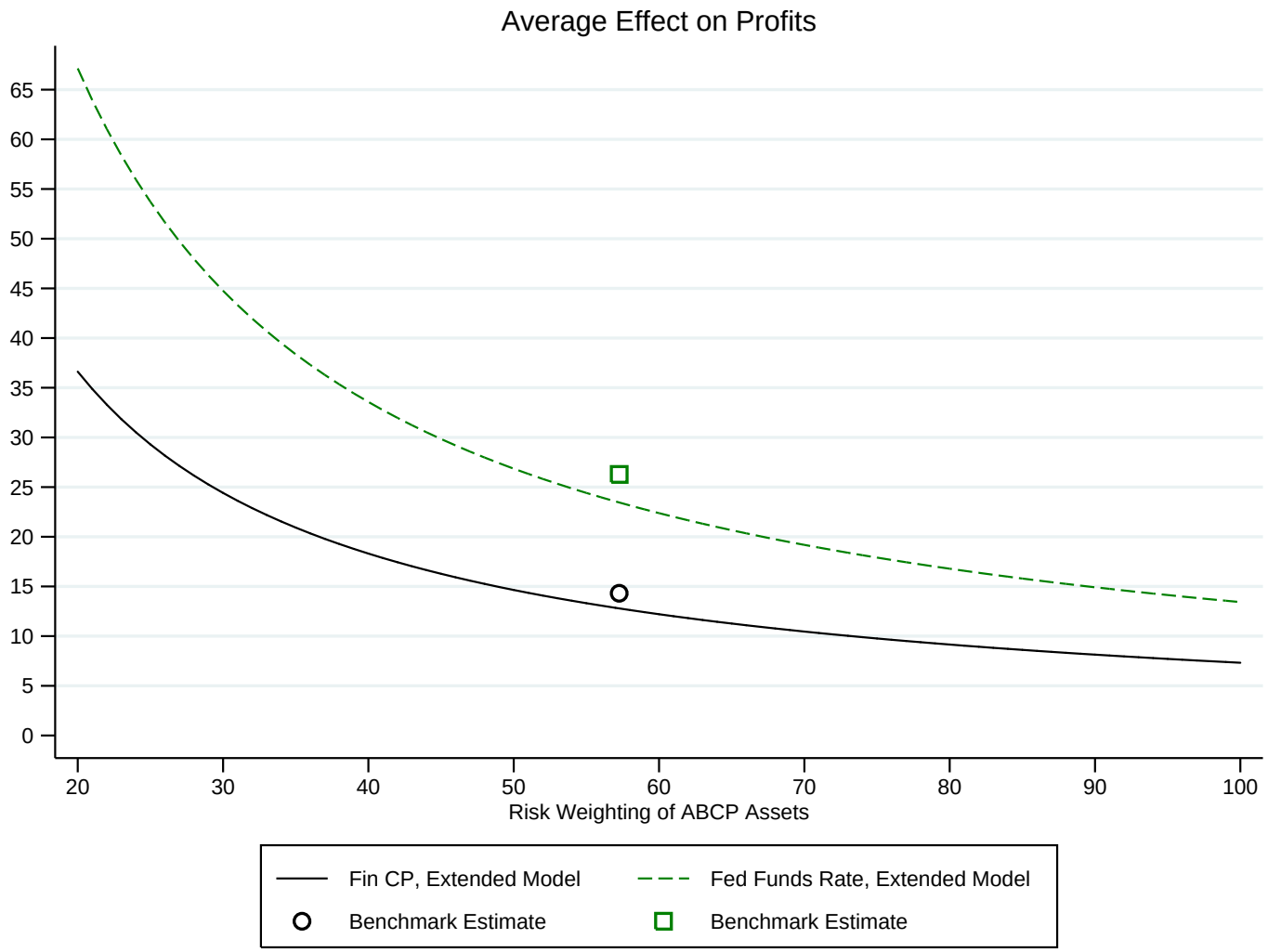
Alternative Definitions of a "Binding Constraint"

Fig. 7: Estimates increase only slightly as we shrink the sample



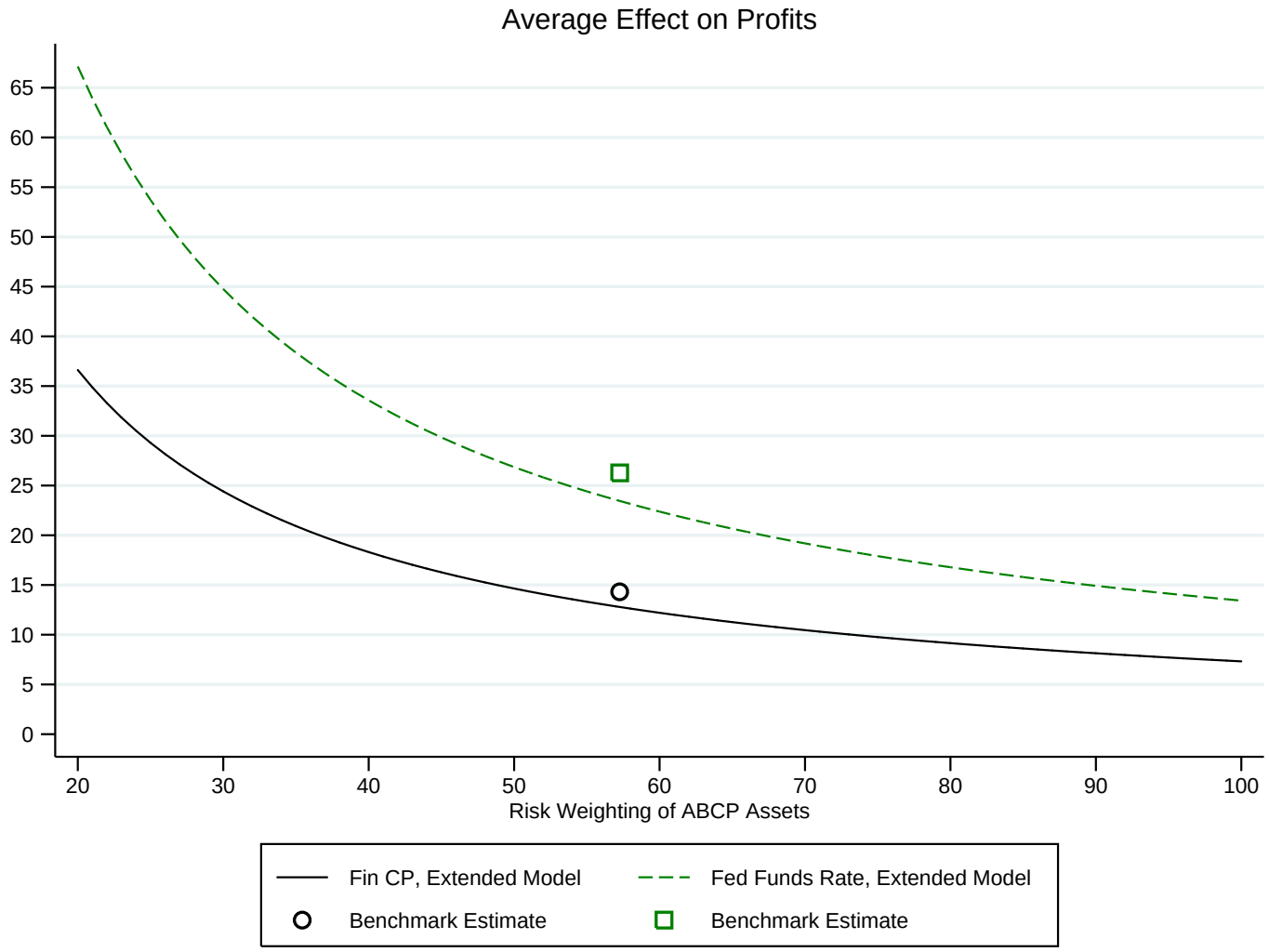
Risk Weighting of Conduit Assets

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



Incremental Costs of ABCP Conduits

Fig. 8: Assuming the ABCP rate alternative is overnight Fed Funds rate our estimates increase by 80%



Potential Value from ABCP Financing

- So far assumed regulatory constraints are the only reason to use ABCP conduits
- What if the arrangement created additional value?
- Let ABCP financing reduce the marginal cost by $\gamma > 0$

$$\mathcal{L} = \sum_j \left[r_j - \left(c\left(k\right) - \gamma\theta_j\right) - \alpha\theta_j\right] q_j\left(\mathbf{r}\right) + \lambda Q\left[K\left(\boldsymbol{q}, k, \theta\right) - \sigma\right]$$

- Shadow cost becomes

$$\lambda = \frac{\alpha}{K_{\theta_j}} - \frac{\gamma}{K_{\theta_j}} \tag{2}$$

- Our benchmark estimates *overestimate* the shadow cost

European Banks

- Due to the low quality of international data, we exclude European banks from our main analysis
- European ABCP-participating banks
  - Face similar rules, so interesting to compare with US estimates
  - Have a significant US presence
- The average shadow cost estimate for the tier 1 risk-based ratio is 0.0038, compared to 0.0030 for US banks

Broader Context and Conclusion

- Estimate the shadow cost of capital requirements
  - Without fully specifying the equilibrium and estimating demand elasticities, markups, etc. (Koijen and Yogo, 2013)
- Add to micro literature on the effects of regulations:
  - Anderson and Sallee (2011): fuel-economy standards
- May be used to calibrate macro-finance models
  - He and Krishnamurthy (2013); Brunnermeier and Sannikov

- New rules increased capital requirements by small amounts:
- Same total risk-based capital ratio (10%), 2 pp higher tier 1 risk-based capital ratio (8%), 2 pp higher leverage ratio (5%)
- We expect a hardly noticeable effect on bank profitability

Many Opinions and Theories, But No Empirical Estimates

The costs are ...

High. "a more restrictive leverage ratio [...] will negatively impact affected banking organizations' earnings and profitability" (Bankers Associations on 2012 Proposal)

Zero. "High equity requirements are such an incredible bargain to society: the significant benefits of more equity are actually free!" (Admati and Hellwig, 2013)

Negative? (Allen, Carletti, and Marquez, 2009; Mehran and Thakor, 2011)

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

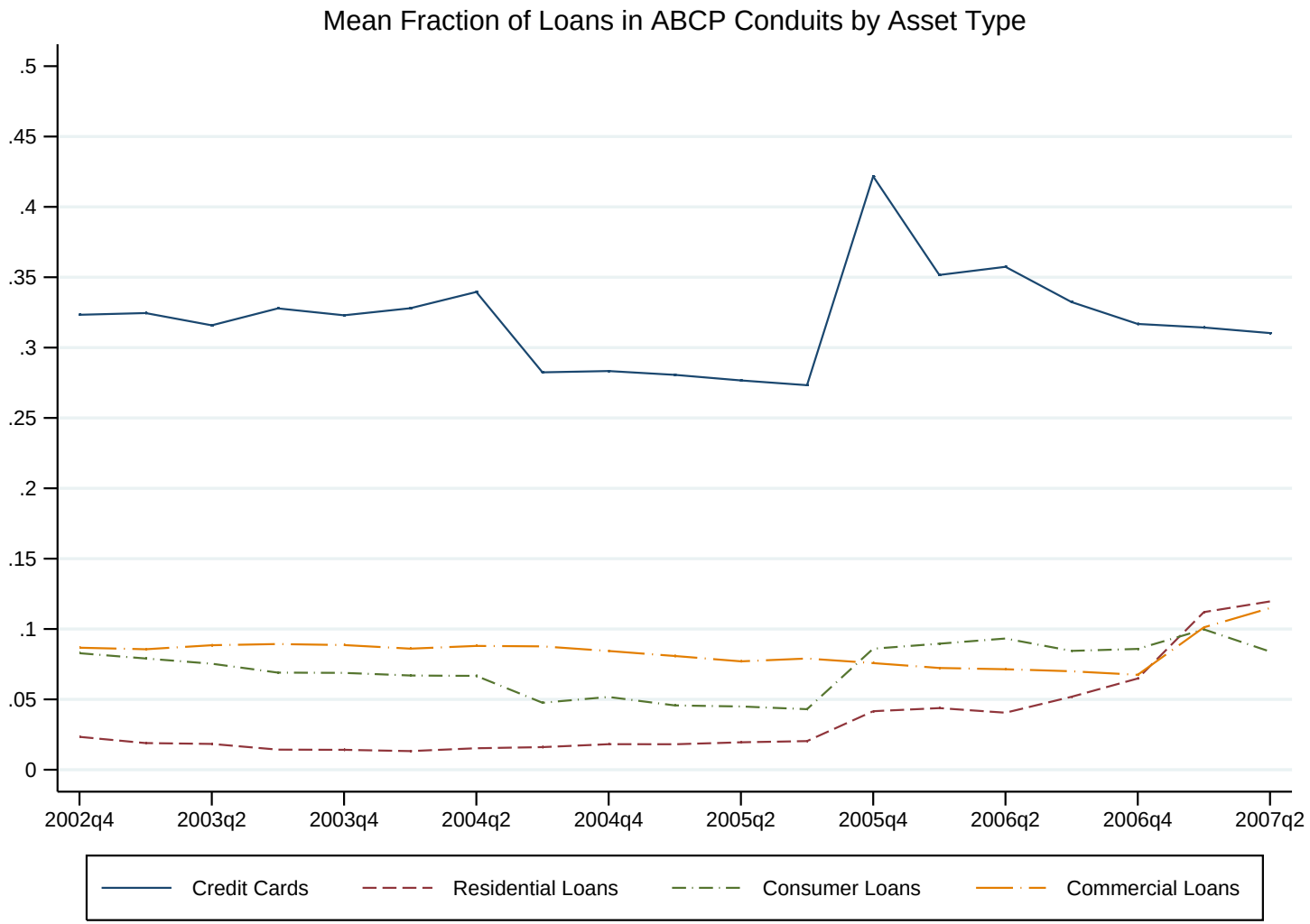



Fig. 5: ABCP shares for different asset types are also interior