

The Spillover Effects of Forced Bank Recapitalizations and Government Guarantees*

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Abstract

How do bank conglomerates choose to respond when regulators enforce capital requirements *at the subsidiary level*? Using novel internal capital market microdata, I find evidence that well-capitalized bank conglomerates shifted risk onto the deposit insurance fund by undercapitalizing weak subsidiaries. In response to an unexpected law change in 1989 that pressured parents to recapitalize their weak subsidiaries by reducing the government put option, I find that credit growth consequently declined at *both* weak and healthy subsidiaries. *Instead of raising capital in the external markets*, parents chose to inject new equity into weak subsidiaries using capital transferred away from healthy siblings. This extraction led to a 6% contraction in lending growth at healthy subsidiaries over the following three years. Through revealed preference, these adjustment choices imply a high cost of external equity issuance. When regulators enhance the enforcement of capital requirements at a weak subsidiary by eliminating the exploitation of the deposit insurance scheme, the parent's reluctance to issue results in a spillover effect through the internal capital market.

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1 Introduction

With the onset of the recent financial crisis, bank capital requirements have become the primary macroprudential tool of regulators around the world. This has led to an intense debate amongst academics, regulators, and practitioners as to whether such policy measures pose negative externalities for the real economy through a contraction in lending. Former Federal Reserve Chairman Ben Bernanke has stated that “tougher capital requirements for the world’s largest banks will make the financial system safer while having a limited impact on the economy.”

In a world where minimal frictions exist, the traditional Modigliani-Miller view says that capital structure choices should have little impact on the real economy through lending (Admati et al., 2010; Hanson et al., 2009). For the opposing view, a variety of frictions have been proposed as to why the relative cost of equity is high, i.e. asymmetric information (Myers and Majluf, 1984), agency costs of management (Diamond and Rajan, 2000), convenience yield on safe debt (Gorton and Metrick, 2012), etc. However, two challenges have impeded the ability of empirical studies to cleanly identify the existence of a causal impact between the enforcement of capital requirement and lending.¹ Firstly, because capital accords have been traditionally introduced as *target* requirements to be satisfied at a pre-specified date years into the future, this implementation does not allow for a sharp *announcement* effect. Identifying the parent’s response thus becomes challenging as any marginal adjustments are diluted through time. Secondly, it is difficult to find variation in the enforcement of capital requirements that is exogenous to a bank’s unobserved loan demand. When comparing the lending outcomes of banks around the enhanced enforcement of capital requirements, the natural selection mechanism assigns banks with binding capital requirements (undercapitalized) to the treatment group. This leads to an omitted variable bias, as undercapitalized banks are likely to be located in areas suffering from relatively poor loan demand.

¹Papers such as Peek and Rosengren (1995) and Aiyar et al. (2012) address this by using regulatory actions where supervisors force banks to change their leverage ratios.

As detailed below, this study overcomes both obstacles using an unanticipated regulatory intervention in the internal capital markets of bank holding companies. Rather than studying banks at the consolidated level, this paper exploits the sibling structure of subsidiaries in multi-bank holding companies to solve traditional endogeneity concerns. To address the first challenge, this study utilizes an unexpected law change that pressures holding companies to immediately recapitalize weak subsidiaries. This provides the sharp announcement effect desired. Identification comes from comparing the lending outcomes of (1) a strong, highly capitalized subsidiary that has a weak, undercapitalized sibling in its family versus that of (2) a similarly strong, highly capitalized subsidiary that does not.² While regressing loan growth on one's own capital ratio falls prey to the endogeneity of capital with regards to loan demand, the identification in this study takes advantage of the fact that the capital shock occurs in a different legal entity and location as compared to the investment opportunity set. In other words, the enhanced enforcement of capital requirements occurs in one (weak) subsidiary and yet has an economically and statistically significant effect on the lending decisions of a legally separate, high capital institution residing in a different locality. Thus, the undercapitalized entity never directly enters the main specification as an observation, but is used in the identification to impose a internal cost on the rest of the organization. This novel sibling setup allows me to trace how adjustments to forced recapitalizations take place in the internal capital markets.

To provide background on the empirical setting, consider the following scenario. A bank holding company has two subsidiaries: one strong and the other weak. The strong one resides in a region experiencing a local boom and has thus become profitable and highly capitalized. The weak one resides in a different region experiencing a local recession and has thus become undercapitalized (in violation of its capital requirement) due to sustained losses. *Assume the parent holding company itself is well-capitalized*, meaning it has enough excess equity capital to allocate evenly, such that both subsidiaries could meet their minimum capital requirements

²The treatment (1) and control (2) subsidiaries are owned by different parents.

if the parent so desired. Given that the government insures deposits at both subsidiaries, I show evidence that the parent chooses *not* to replenish the capital of the weak subsidiary using the excess capital of the sibling. To the ire of regulators, this is consistent with a story where parents are shifting risk onto the deposit insurance fund by starving the weak entity of capital. The regulator could threaten to remove the charter of the weak subsidiary, however the deposit fund would then be liable to pay off the subsidiary's insured deposits since the parent is protected by limited liability. The question then emerges: if the regulator were to enhance enforcement of the weak subsidiary's capital requirement, how would the parent *choose* to respond? The weak subsidiary can be recapitalized either through the numerator or the denominator. This leads to three options: (1) the parent can issue new equity shares in the external capital market and internally inject those funds into the weak subsidiary as new equity, (2) the parent could perform an internal capital transfer, providing internal capital injections into the weak subsidiary using equity extracted from the strong sibling, or (3) shrink the weak subsidiary. This paper finds that the parent chooses *not* to issue external shares (1), but rather adjusts using options (2) and (3). A fourth, and more intriguing, finding emerges: the internal capital transfer leads the parent to contract lending at its strong subsidiary (compared to local competition). These adjustment choices reveal the parent's preferences: the cost of issuing new equity in the external capital market must have been high enough to justify the choice of adjusting internally and contracting lending at the strong subsidiary (spillover effect).

I show these effects using the context of a surprise law announced in early 1989. During the 1980s, the US banking system had become fragile with the advent of the savings and loans crisis. As was evident in a landmark bank resolution case, the Federal Deposit Insurance Corporation (FDIC) struggled to deal with a particular parent holding company, First Republic Bank, that refused to recapitalize its struggling subsidiaries.³ Even though a

³A government agency, known as the Federal Insurance Deposit Corporation (FDIC), provided deposit insurance for the first \$100,000 (at that time) per retail deposit account held at commercial bank subsidiaries. Thus, as I show in Section 5.1, holding companies preferred to keep excess capital at strong subsidiaries and persistently undercapitalize weak subsidiaries in order to exploit the government insurance scheme.

regulatory minimum capital ratio of 5.5% was required at every subsidiary, enforcement had become a serious issue since the only penalties for noncompliance were an inconsequential fine and a requirement to submit documents outlining a (nonbinding) plan for future capital restoration. Holding companies found these penalties to be a worthwhile price for the ability to starve weak subsidiaries and allocate excess capital to strong siblings. The regulator's inability to legally force parents to downstream capital enabled the exploitation of the deposit insurance scheme: In the event that the FDIC decided to remove the weak subsidiary's charter, it would then have been liable to cover any losses on insured deposits residing in the failed subsidiary. In the meantime, the parent could survive through the protection of limited liability. The outcomes of this case provided a clear precedent to the banking industry that the ultimate decision of whether to recapitalize weak entities was controlled solely by the parent.

In a surprise turn of events, the status quo was overturned when President Bush announced the Federal Deposit Insurance Corporation's cross-guarantee authority as part of the Financial Institutions Reform, Recovery, and Enforcement Act of 1989 (FIRREA).⁴ These cross-guarantee provisions granted the FDIC unilateral authority to bill *sibling* depository institutions for any ex-post losses incurred to the insurance fund in the event of a commercial bank subsidiary closure. *This law constituted an unexpected rise in subsidiary bankruptcy costs*, i.e. the costs incurred to the holding company if the weak, undercapitalized entity were allowed to fail while the rest of the organization lived on. Given the regulator's prior lack of success using *direct* forms of discipline (i.e. fines), this law was designed as an *indirect* method to enforce compliance with the 5.5% subsidiary capital requirement by increasing the cost of leaving a subsidiary undercapitalized. Not only did these provisions increase the costs of a subsidiary bankruptcy, but it also meant the FDIC would now be more willing to close undercapitalized subsidiaries, since its claim on the parent had increased. In order to mitigate the new risk of the undercapitalized subsidiary being closed and a bill being assessed,

⁴Figure 5

parents now found it in their best interest to bite the bullet and recapitalize these entities. The *optimal* capital ratio for weak subsidiaries had been raised. This unexpected regulatory intervention provides a unique opportunity to observe the parent's response function when they were pressured to recapitalize bad subsidiaries.

It is important to note that the cross-guarantee authority is an ex-post regulatory tool, meaning the FDIC could only bill affiliates once a depository institution is closed and placed into receivership.⁵ I have excluded from the analysis any bank holding companies with subsidiaries in receivership. Thus, none of the sample is associated with cases where the FDIC actually exercised its cross-guarantee authority. All analyses capture a change in the *parent's ex-ante behavior* with respect to the new costs associated with allowing a subsidiary to violate its subsidiary capital requirement.

Using detailed regulatory filings, I decompose each consolidated bank holding company into a set of subsidiary- and parent-level quarterly balance sheets. This allows me to observe how parents reacted to the change in incentives associated with the new law. Using the unanticipated arrival of the cross-guarantee authority as a natural experiment, I employ a difference-in-differences approach to explore how the law impacted ex-ante behavior. How did parents respond to the unexpected rise in the cost of keeping a subsidiary undercapitalized? As hypothesized, the parent chose to recapitalize the subsidiary. Given that this could have been accomplished either by adjusting the numerator or denominator (the capital ratio is $\frac{\text{Equity}}{\text{Assets}}$), I find that parents predominantly solved this problem in the denominator by shrinking the undercapitalized subsidiary (lending growth decreased at an average rate of 1.5% per quarter for the following 3 years). To a secondary extent, they also increased the numerator through internal capital injections in the first year after the law announcement.

⁵It is important to note that the regulator has discretion to decide when to close a weak subsidiary. A weak subsidiary's capital ratio does not have to reach 0% to be closed. The FDIC can choose to close a subsidiary at 3% capital ratio if it deems there is no scope to recover (in which case it is better to maximize recovery value by not delaying the closure). *Not only did the law increase the loss given (subsidiary) default for holding companies, but it also increased the probability that the FDIC would close any weak subsidiaries whose holding companies refused to recapitalize* (increasing the probability of the "subsidiary closure" state occurring if the subsidiary is left undercapitalized).

Roughly 50% of sample of subsidiaries that were undercapitalized as of the law change became fully recapitalized within one year.

I next ask where this injection was sourced from? Consistent with the idea that external capital markets are imperfect (Stein, 2003; Hubbard, 1998; Lamont, 1997; Fazzari et al., 1988), I show that parents chose to avoid the high costs of external equity issuance. Since internal capital markets are less costly, I show that parents were left with no choice but to burden the high capital siblings through increased dividends (this led to an average decrease of 0.16 percentage points in the capital ratio of strong subsidiaries). This internal transfer leads to the paper's key finding: a spillover effect where healthy, high capital subsidiaries shrank their lending growth by an average of 0.7 percentage points per quarter over the next three years. This subsidiary recapitalization experiment resulted in a *net* lending effect across the consolidated bank holding company, as opposed to a distributional lending effect across siblings. Across all holding companies, this roughly amounts to \$36 billion in consolidated lending eliminated.

To the best of my knowledge, this paper is the first to identify the internal capital market and lending spillover effects that occur when parent holding companies are pressured to recapitalize weak subsidiaries. While this experiment occurred thirty years ago, the results have a particularly important application to a modern macroprudential problem. The international transmission of the recent 2008 financial crisis has pushed regulators across the world to consider protectionist policies that enhance the enforcement of *subsidiary-level capital requirements* on the local operations of foreign banks (Goldberg and Gupta, 2013). However, given how new these ring fencing measures are, very little analysis exists on the implications of enforcing subsidiary-level capital requirements on the rest of the organization. I posit that the arrival of the cross-guarantee authority constitutes a useful natural experiment that can provide intuition for the spillover effects of such policy measures.

The paper is organized as follows. Section 2 provides institutional background on the bank holding company structure. Section 3 provides a background of the cross-guarantee authority.

Section 4 delivers an overview of the data, empirical specifications, and identification strategy. Section 5 presents results on the internal capital market response as well as lending effects at subsidiaries. Finally, Section 6 concludes.

2 Institutional Details of Bank Holding Companies

For institutional background, this section provides an overview of the holding company structure and enumerates the kinds of regulatory frictions impacting bank subsidiaries at that time. Figures 1 and 2 demonstrate how to visualize the relationship between the consolidated balance sheet representing the global assets of the bank holding company and the decomposed sets of balance sheets representing the assets of each subsidiary separately (I take the stylized case of a holding company that owns two commercial bank subsidiaries). The top panel of Figure 1 represents an example of what a consolidated balance sheet looks like in a standard 10-K annual report or FR Y-9C filing. In the bottom panel of the same figure, total assets and liabilities are then broken down by each legal entity's ownership (holding company, subsidiary 1, or subsidiary 2). Notice that because total equity represents the total outstanding shares held by market shareholders, this represents claims on the parent holding company only. Internal equity allocation, the key variable concerning this study, is not visible in the consolidated format, but is unveiled only in Figure 2.

Figure 1: Consolidated Balance Sheet View of Bank Holding Companies

This and the next figure illustrate how to visualize the relationship between a consolidated balance sheet and the decomposed “internal capital markets” view of the parent and subsidiary balance sheets within that firm. Assume a bank holding company has two subsidiaries. The top panel in this figure represents a traditional consolidated balance sheet of a bank holding company (similar to what might be presented in a SEC 10-K annual filing). The bottom panel then breaks down each asset and liability by legal entity ownership. Figure 2 continues this process with a final step.

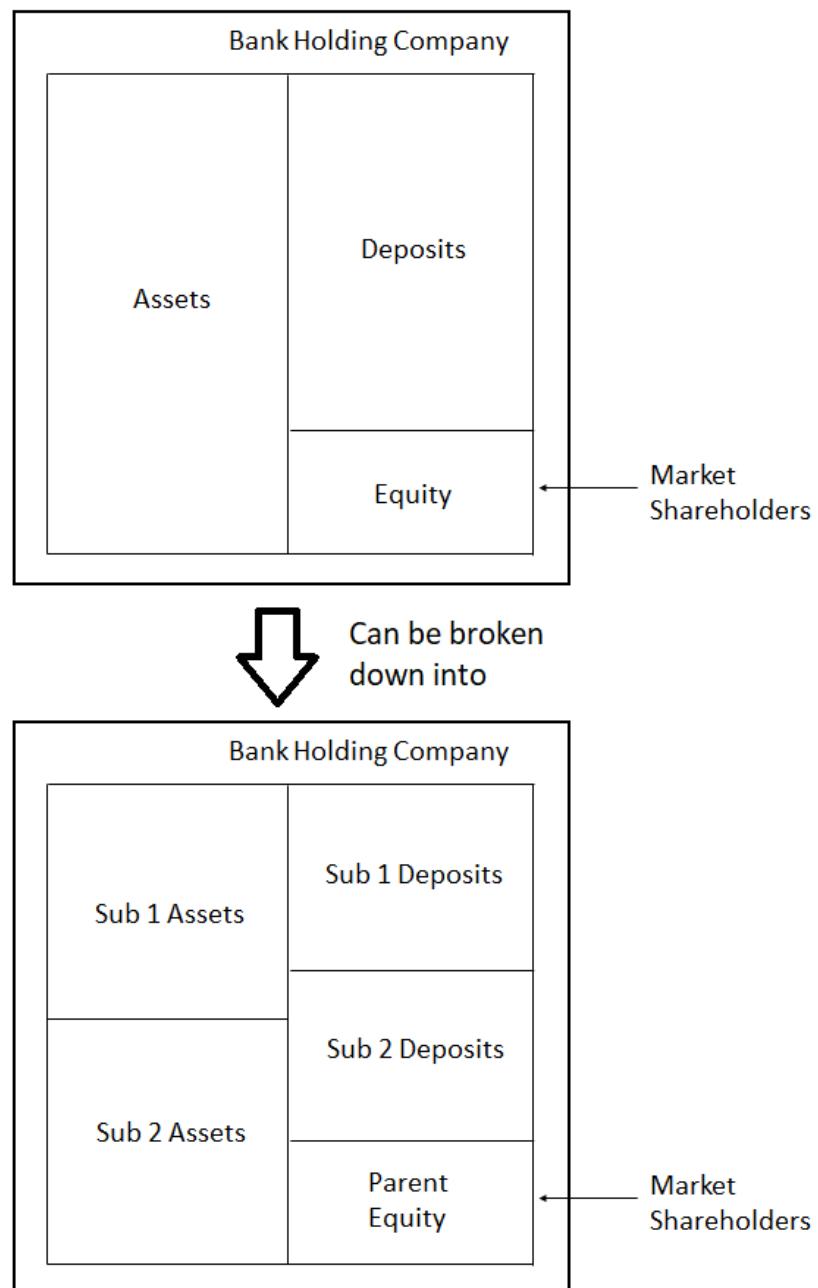
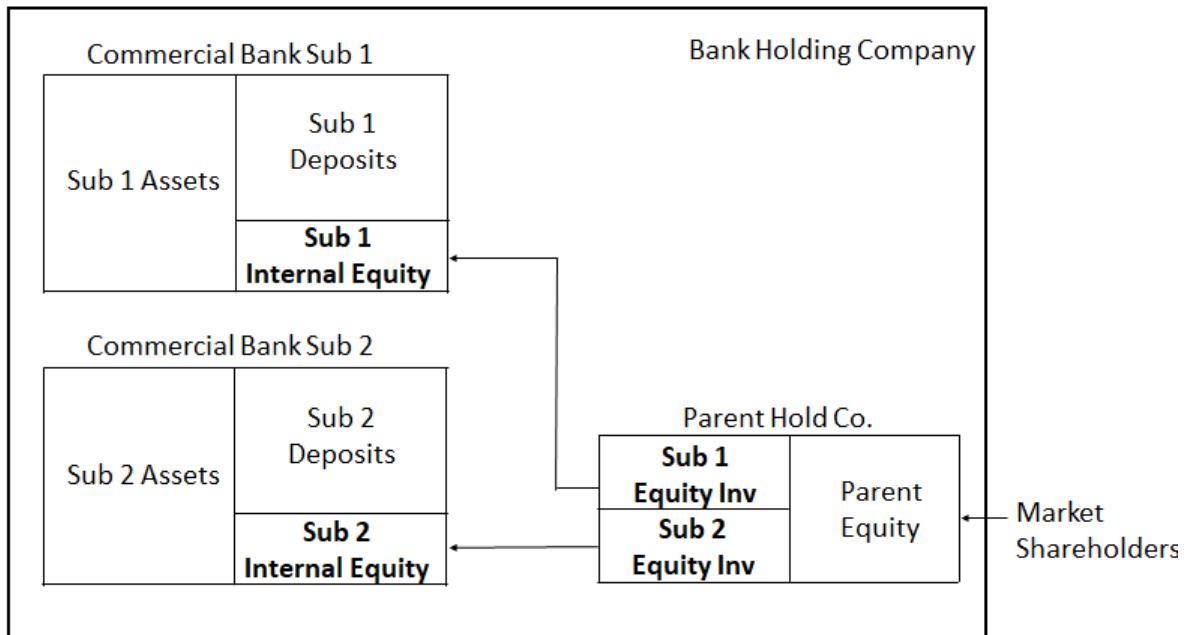


Figure 2: Internal Capital Markets View of Bank Holding Companies

This figure completes the final step of the decomposition started in Figure 1. After breaking down each asset and liability by legal entity, this figure separates them into three individual balance sheets (holding company-only, subsidiary 1, and subsidiary 2). It is important to note that the key variables of my study, the holding company's allocations of internal capital across subsidiary 1 and 2, are hidden in the consolidated balance sheet format of Figure 1. As shown below, the parent's primary assets are the equity shares of its subsidiaries.



Parent holding companies do not typically perform any external business on their own, but can raise a variety of non-deposit unsecured funding (commercial paper and long term corporate bonds) from debt markets as well as issue shares to equity investors. These funds are then downstreamed to subsidiaries either as internal equity injections, cash deposits (debt claim), long term loans, or simply held in the form of liquid external securities. Holding companies almost always own 100% of the equity of their operating subsidiaries. Market participants can own claims on either the parent holding company (through stock, long term corporate bonds, and commercial paper) or directly on the commercial bank subsidiary in the form of either FDIC-insured or uninsured deposits. Claims on the holding company are derived from the upstreamed interest and dividend income of all subsidiaries.

Commercial bank subsidiaries come in three varieties. National banks are federally chartered and overseen by the Office of the Comptroller of the Currency as well as the Federal Reserve. State-member banks are chartered and regulated by the local state banking authority in addition to being members of the Federal Reserve System. Finally, state nonmember banks are state-chartered, but have elected not to be members of the Federal Reserve System, and thus are regulated by the FDIC. Because the FDIC provides insurance of up to \$100,000 (at that time) per account holder for deposits at the commercial bank, regulators prioritize financial health at the bank subsidiary over that of the parent holding company or nonbank subsidiaries.

As shown in Figure 3, minimum capital requirements at both the consolidated firm and individual bank subsidiary were 5.5% during the 1980s. All analyses in this study exclude bank holding companies that were not in compliance with their consolidated 5.5% capital requirement in order to focus on the case where parents had enough equity to allocate evenly but strategically chose to keep particular subsidiaries undercapitalized. I do this in order to avoid a confounding scenario where the capitalization problem occurs at both the subsidiary and parent levels.

Figure 3: Consolidated and Subsidiary Capital Requirements

This figure provides a visual representation of the existing capital requirements during the late 1980s. The consolidated capital requirement of 5.5% is presented in the top panel, while the 5.5% subsidiary-level capital requirement is shown in the bottom panel. Note that in all analyses of the paper, the sample includes only holding companies that were in compliance with their consolidated capital requirement as of the law change.

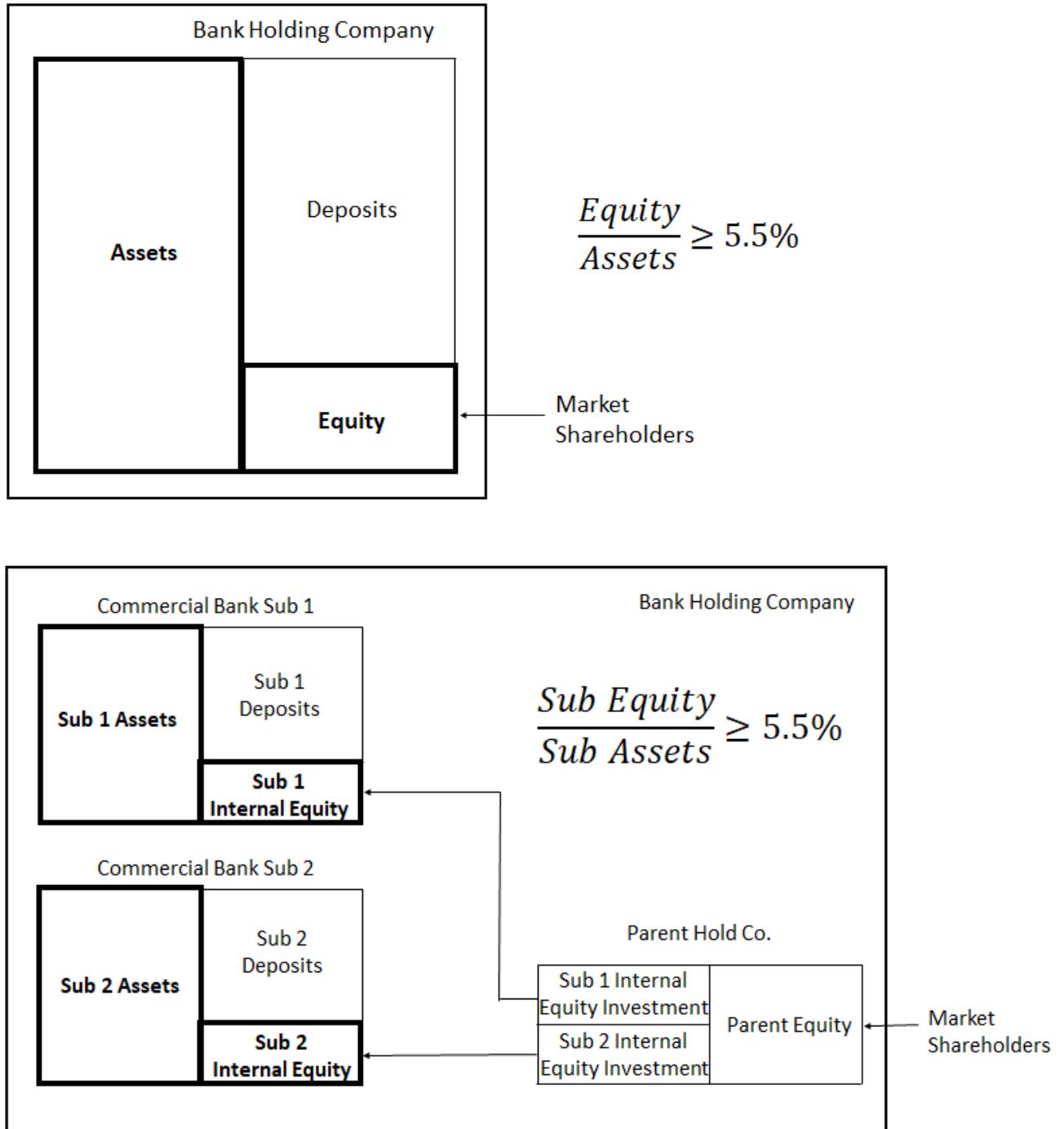
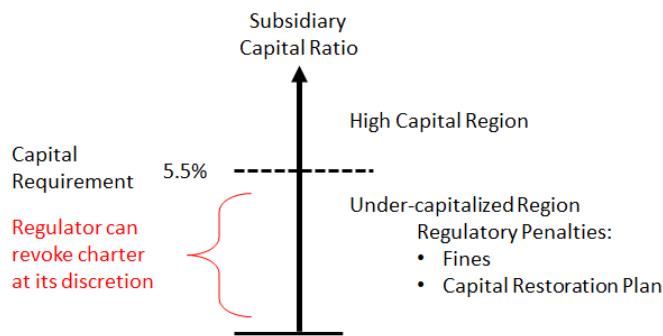


Figure 4 summarizes the regions of subsidiary capitalization. A subsidiary is considered high capital if its capital ratio exceeded the regulatory minimum of 5.5% and undercapitalized if it was below 5.5%. If the parent allowed a subsidiary to reside in the undercapitalized region, regulators imposed fines and required the holding company to submit documents outlining a (nonbinding) plan for future capital restoration. If the capital ratio persistently remained undercapitalized (even if greater than 0%) and the regulator foresaw no chance of recovery, the FDIC had full discretion to close the subsidiary and place it into receivership to maximize the recovery value. Due to the deposit insurance system, the FDIC would then be liable for any losses incurred by the insured depositors - up to \$100,000 (at that time) per account holder. Although holding companies were expected to obey pre-existing subsidiary capital requirements, regulators struggled to enforce this. Holding companies found the fines to be a worthwhile price for the ability to exploit the government put option.⁶

Figure 4: Subsidiary Capital Regimes

This figure summarizes the regions of subsidiary capitalization. Regulators mandated a subsidiary-level minimum capital requirement of 5.5%. Above this, the subsidiary was considered “high capital”. Below this, it was defined as undercapitalized. If the parent allowed a subsidiary to reside in the undercapitalized region, regulators imposed fines and required the holding company to submit documents outlining a (nonbinding) plan for future capital restoration. If the capital ratio persistently remained undercapitalized (even if greater than 0%) and the regulator foresaw no chance of recovery, the FDIC had full discretion to close the subsidiary and place it into receivership to maximize the recovery value. Due to the deposit insurance system, the FDIC would then be liable for any losses incurred by insured depositors - up to \$100,000 (at that time) per account holder.



⁶This capital requirement enforcement issue was a primary driver for the arrival of the cross-guarantee authority.

While my paper focuses on internal capital allocations between parents and subsidiaries (vertical exposures), it is important to note that a commercial bank's ability to sell low quality assets to siblings is restricted by Section 23A of the Federal Reserve Act. "A member bank... may not purchase low-quality assets from an affiliate..."⁷ This prevented an extreme version of risk shifting where the parent transfers distressed assets from various subsidiaries to create a "dumpster" sibling that leans on the FDIC.

Section 23A also tightly limited internal *loans* to other parts of the organization (horizontal exposures), imposing a strict one-way ring fence on funds being lent by commercial bank subsidiaries to nonbank affiliates or the parent holding company. Enacted in 1933 in the aftermath of the Great Depression, regulators implemented Section 23A to prevent the transfer of the federal subsidy to non-depository financial institutions. The law imposed quantitative limitations and collateral requirements on commercial bank extensions of credit to non-bank affiliates or the holding company. Specifically, this section states:

- The aggregate amount of internal loans to any one non-bank affiliate or holding company

of the member bank will not exceed 10% of the capital of the member bank.

- The aggregate amount of internal loans to all non-bank affiliates and holding company of the member bank will not exceed 20% of the capital of the member bank.

Member banks can, however, utilize two particularly useful exemptions to circumvent these limits:

- Any internal loan collateralized by US Government and agency securities is exempt.
- Any internal loan collateralized by highly liquid, marketable securities is exempt.

While my paper aims to contribute to the literature on capital requirements, it also relates to the topic of bank internal capital markets. Studies in this field can be divided into those exploring questions on (horizontal exposure) internal loans between siblings (Gilje et al., 2016; Campello, 2002; Cetorelli and Goldberg, 2012) versus those exploring questions on (vertical

⁷<https://www.federalreserve.gov/aboutthefed/section23a.htm>

exposure) capital allocation decisions between the holding company and its subsidiaries. Houston and James (1998a, 1998b) as well as Houston et al. (1997) establish some of the first empirical results in the internal bank capital line. These studies present evidence that loan growth at bank subsidiaries are more sensitive to the holding company's cash flow and capital position than to the subsidiary's own cash flow and capital. This finding suggests that bank holding companies establish internal capital markets for the purpose of allocating scarce capital among their various subsidiaries. Gilton (1991) finds that the subsidiaries of relatively large bank holding companies have a lower probability of failure than other banks with similar characteristics. More recently, Ashcraft (2008) shows that the arrival of the cross-guarantee authority had a significant impact on the holding company's willingness to act as a source of strength to its subsidiaries, which is consistent with my findings.⁸ Pogach and Unal (2018) speak to the dark side of bank internal capital markets, showing evidence that holding companies had a tendency to extract capital from bank subsidiaries in order to finance the acquisitions of risky, nonbank lines of business.⁹

3 The FDIC's Cross-Guarantee Authority

In February of 1989, President George Bush announced the Financial Institutions Reform, Recovery, and Enforcement Act of 1989 (FIRREA), which was eventually written into law on August 9, 1989 as 12 U.S.C. § 1815. As part of this package, the FDIC was granted cross-guarantee authority under Section 1815(e). This unprecedented provision gave the FDIC unilateral authority to offset any ex-post losses incurred from the closure of a depository institution by billing the healthy, depository siblings controlled by a common parent holding company. The official provisions under Section 1815(e), "Liability of commonly controlled depository institutions," state that

⁸In contrast, my study explores the implications for spillover effects across siblings.

⁹Thus, federally insured banks acted as a source of strength to nonbank lines of business within the holding company.

"Any insured depository institution shall be liable for any loss incurred by the [FDIC], or any loss which the [FDIC] reasonably anticipates incurring ... in connection with-

- (i) the default of a commonly controlled insured depository institution; or
- (ii) any assistance provided by the [FDIC] to any commonly controlled insured depository institution in danger of default."

Figure 5: Article on Cross-Guarantee Authority

This is an excerpt from an 1989 article written by David L. Glass in the American Banker. Given the strong precedent set by the courts in several landmark cases, the arrival of the cross-guarantee caught the banking industry by surprise, representing a regime-change for multi-bank holding companies.

COMMENT / *By David L. Glass*

Cross-Guarantee Is Seen as Risk to Holding Companies

Last Aug. 9, President Bush signed into law the Financial Institutions Reform, Recovery, and Enforcement Act, a complex of regulatory reforms aimed at resolving the thrift crisis and strengthening the hand of the regulators to prevent future crises.

A major provision of FIRREA imposes liability on "sister" in-

sured banks and thrifts for losses incurred by the Federal Deposit Insurance Corp. in liquidating or assisting affiliated banks and thrifts under "common control" — typically, those that belong to the same holding company system.

This "cross-guarantee" provision was sought by the FDIC in response to its costly multibank holding company transactions in Texas — with MCorp, First RepublicBank Corp., and First City Bancorp.

Particularly at MCorp, the

Mr. Glass is general counsel for the New York State Bankers Association. He was formerly a partner in the New York law firm of Hawkins, Delafield & Wood.

It was not until the wave of closures associated with the savings and loan crisis of the 1980s

that the FDIC became motivated to find new ways to offset resolution costs incurred from failing institutions (since they did not yet have the unilateral authority to cross-guarantee siblings). The 1988 failure of First Republic Bank's lead subsidiary represents an illustrative case. During its resolution, the FDIC agreed to loan the lead bank \$1 billion only after negotiating loan guarantees from its siblings. The lead bank subsequently failed, and the siblings, unable to satisfy the guarantees, were taken over by the FDIC. The holding company sued, and the case was eventually settled on terms satisfactory to the parent. Ultimately, the precedent for limited liability was strong enough to nullify the sibling-guarantee contracts that were previously agreed upon.

Through strenuous lobbying efforts, the FDIC was eventually granted full cross-guarantee authority through Congress. The first application of the cross-guarantee authority occurred in January of 1991 with surprising speed and ease, when the FDIC issued a Notice of Assessment of \$1,015,900,000 against the healthy Maine National Bank (MNB) for losses incurred from the failure of MNB's weak sibling bank, the Bank of New England, N.A. Because the bill vastly exceeded MNB's \$65 million of subsidiary capital, MNB was declared insolvent, closed, and placed into receivership the same day BNE was closed (Sheehan and McConville, 1995).

In a 1991 statement to the Senate Committee on Banking, Housing, and Urban Affairs, FDIC Chairman Lewis William Seidman attested to the strong precedent for limited liability that preceded the passage of FIRREA. "Immediately after the closure of the Bank of New England... we for the first time used the cross-guarantee authority to, in effect, fail the Maine National Bank which was otherwise in sound financial condition. *Let me assure you that this would have been impossible five years ago, that only because new legislation was put in place . . . which allowed cross-guarantees . . . were we able to handle this situation the way we did*" (emphasis added).¹⁰

¹⁰Failure of the Bank of New Eng.: Hearings Before the Senate Comm. on Banking, Housing and Urban Affairs, 102d Cong., 1st Sess. 11 (Jan. 9, 1991) (Statement of Chairman William Seidman), at pp. 26-27.

4 Empirical Setup

4.1 Data Summary

To decompose each US bank holding company into its component pieces, I organize quarterly balance sheet information on parent holding companies and commercial bank subsidiaries to create a panel dataset that traces the capital and lending decisions of each legal entity within the bank holding company. Parent holding company information is obtained from the FR Y-9LP, known as the Parent Company Only Financial Statements for Large Holding Companies, while information on commercial bank subsidiaries are obtained from the FFIEC 031/041 Call Reports.¹¹

¹¹Information on the Call Reports can be found at <https://www.ffiec.gov/forms031.htm> and <https://www.ffiec.gov/forms041.htm>. Information on the FR Y-9LP can be found at <https://www.federalreserve.gov/apps/reportforms/reportdetail.aspx?sOoYJ+5BzDYeK/+NsOyV7PkVi3bV1QrX>.

Table 1: 25 Largest Bank Holding Companies, as of 1988Q4

This table presents the 25 largest bank holding companies in the United States as of 1988Q4, which is one quarter before the announcement of the cross-guarantee authority. Information is reported on the total consolidated assets, number of bank subsidiaries owned, as well as total number of states spanned. Note that because of interstate branching restrictions, a bank subsidiary cannot span or collect deposits across state lines. This is why the total number of states never exceeds the number of subsidiaries.

Rank	Bank Holding Company	Assets (\$Billions)	Bank Subsidiaries	States
1	CITICORP	208	12	11
2	CHASE MANHATTAN CORP	98	9	8
3	BANKAMERICA CORP	95	2	2
4	J P MORGAN & CO	84	2	2
5	SECURITY PACIFIC CORP	78	8	6
6	CHEMICAL BKG CORP	67	29	5
7	MANUFACTURERS HAN CORP	67	2	2
8	FIRST INTRST BC	58	27	14
9	BANKERS TR NY CORP	58	4	4
10	BANK OF NY CO	47	17	3
11	FIRST CHICAGO CORP	44	20	2
12	PNC FNCL CORP	43	25	6
13	BANK OF BOSTON CORP	36	5	5
14	BANK OF NEW ENGLAND CORP	32	9	4
15	MELLON BC	31	7	3
16	NCNB CORP	30	8	7
17	FIRST FIDELITY BC	30	7	3
18	SUNTRUST BANKS	29	53	3
19	FLEET/NORSTAR FNCL GROUP	29	13	6
20	FIRST UNION CORP	29	5	5
21	SHAWMUT NAT CORP	29	12	3
22	BARNETT BKS	26	34	2
23	BANC ONE CORP	25	60	6
24	FIRST BK SYS	24	41	7
25	NBD BANCORP INC	24	34	3

Table 1 presents the 25 largest bank holding companies in the United States as of 1988Q4, which is one quarter before the announcement of the cross-guarantee authority. Information is reported on the total consolidated assets, number of bank subsidiaries owned, as well as total number of states spanned. Note that because of restrictions on interstate branching

during this time, a bank subsidiary could not span or collect deposits across state lines. This is why the total number of states never exceeds the number of subsidiaries.

Table 2: Summary Statistics, as of 1988Q4

This table presents distributional summary statistics on the sample of bank holding companies included in this study. I have excluded all holding companies that were not in compliance with their consolidated-level capital requirement of 5.5% as of 1988Q4. I have also excluded single-subsidiary holding companies as those are not relevant to the announcement of the cross-guarantee authority. The study contains a total of 730 bank holding companies, of which 131 owned at least one subsidiary that was undercapitalized as of 1988Q4 and 599 that do not. There were a total of 2852 bank subsidiaries that were “high capital” as of the 1988Q4, of which 1135 had an undercapitalized sibling. As of the same date, there were 179 subsidiaries that were undercapitalized.

Summary Stats	Min	5th perc	25th perc	50th perc	75th perc	95th perc	Max
BHC Size (Mill USD)	6	19	90	211	674	9,496	57,942
BHC Capital Ratio (%)	5.5	5.7	6.5	7.2	8.5	11.4	15.4
Subs per BHC	2	2	2	2	4	14	60
States per BHC	1	1	1	1	1	3	8
Counties per BHC	1	2	4	7	21	198	758
Subsidiary Assets (Mill USD)	3	12	35	73	185	1,619	16,741
Subsidiary Capital Ratio (%)	2.0%	5.4%	6.6%	7.6%	8.8%	12.4%	27.2%
Subsidiary Loan Growth (%)	-16.4%	-6.6%	-1.0%	1.8%	5.0%	16.0%	52.3%

Table 2 provides summary statistics for the entire sample of multi-bank holding companies used in this study. All bank holding companies that are undercapitalized at the consolidated level have been excluded, as it is important to focus on cases where the capital inadequacy problem occurs only at the subsidiary level, and not the parent level. There were a total of 730 bank holding companies, out of which 131 owned at least one subsidiary that was undercapitalized as of 1988Q4 and 599 did not. There were a total of 179 subsidiaries that were undercapitalized, comprising roughly 5% of all commercial bank institutions that filed the Call Report, and 2852 subsidiaries that were “high capital” as of the same date. Of these 2852 high capital subsidiaries, 1135 were in the treatment group (i.e. siblings of the 179 undercapitalized subsidiaries).

4.2 Empirical Specification

Using detailed data that captures the internal capital market dynamics of bank holding companies, this study examines whether the forced recapitalization of an undercapitalized subsidiary places a burden on its high capital siblings. Specifically, in response to the heightened cost of leaving a weak subsidiary undercapitalized, I test whether this resulted in an extraction of capital and a precautionary contraction in lending activity at high capital siblings.

Here, I preview the general baseline setup that will be employed in Section 5. Using the sample of subsidiaries that were high capital as of 1988Q4, Specification 1 sets up a standard difference-in-differences estimation to compare the response between the treatment group (high capital subsidiaries that had an undercapitalized sibling as of 1988Q4) and the control group (high capital subsidiaries that did not have an undercapitalized sibling as of 1988Q4). This comparison is visually represented in Figure 6. $POST_{t \geq 1989q1}$ is a dummy variable equal to 1 for all quarters after the introduction of the cross-guarantee authority in 1989Q1. The treatment group dummy is represented by $HasLowCapSibling_{i,j,t=1988q4}$. High capital subsidiaries are placed into these two groups based on if they had an undercapitalized sibling *as of 1988Q4* (i.e. groups are not re-sorted through time). Control variables $X_{i,j,t-1}$ include the following lagged variables at both the subsidiary and consolidated levels: ROA, log size, capital ratio, asset liquidity, and problem asset share. The time period for the regression spans 1987-1993. The sample excludes bank holding companies that are in violation of their consolidated 5.5% capital requirement to avoid the confounding scenario where an undercapitalization problem occurs at both the subsidiary and consolidated levels simultaneously.

$$Y_{ijt} = \beta_0 + \beta_1 (POST_{t \geq 1989q1}) (HasLowCapSibling_{i,j,t=1988q4}) + \gamma X_{i,j,t-1} + \delta_i + \mu_j + \eta_t + \varepsilon_{ijt} \quad (1)$$

In Specification 1, i indexes the commercial bank subsidiary owned by parent holding company j in quarter t. This analysis uses the sample of all subsidiaries that are considered high capital as of 1988Q4. Standard errors are clustered at the holding company level. Depending on the particular analysis in Section 5, Y_{ijt} can refer to $\frac{InternalCapitalInjections_{ijt} - InternalDividends_{ijt}}{TotalAssets_{i,j,t-1}}$ or $LoanGrowth_{ijt}$.

Figure 6: Difference-in-Differences Setup

This figure presents a stylized example of the difference-in-differences setup employed in Section 5. The top holding company owns a high capital subsidiary and one undercapitalized subsidiary. The bottom holding company owns two high capital subsidiaries. It is important to note that the capital portion of the treatment subsidiary is higher than the undercapitalized subsidiary in family 1, but does not have to be higher than the control subsidiaries in family 2. The difference-in-differences analysis compares the capital allocation and lending growth at the high capital subsidiary that has an undercapitalized sibling (in family 1) versus the high capital subsidiaries that have no undercapitalized siblings (in family 2) around the arrival of the law change. It is important to note that both holding companies are compliant with their consolidated-level capital requirements, so neither the treatment or control subsidiaries belong to distressed parents.

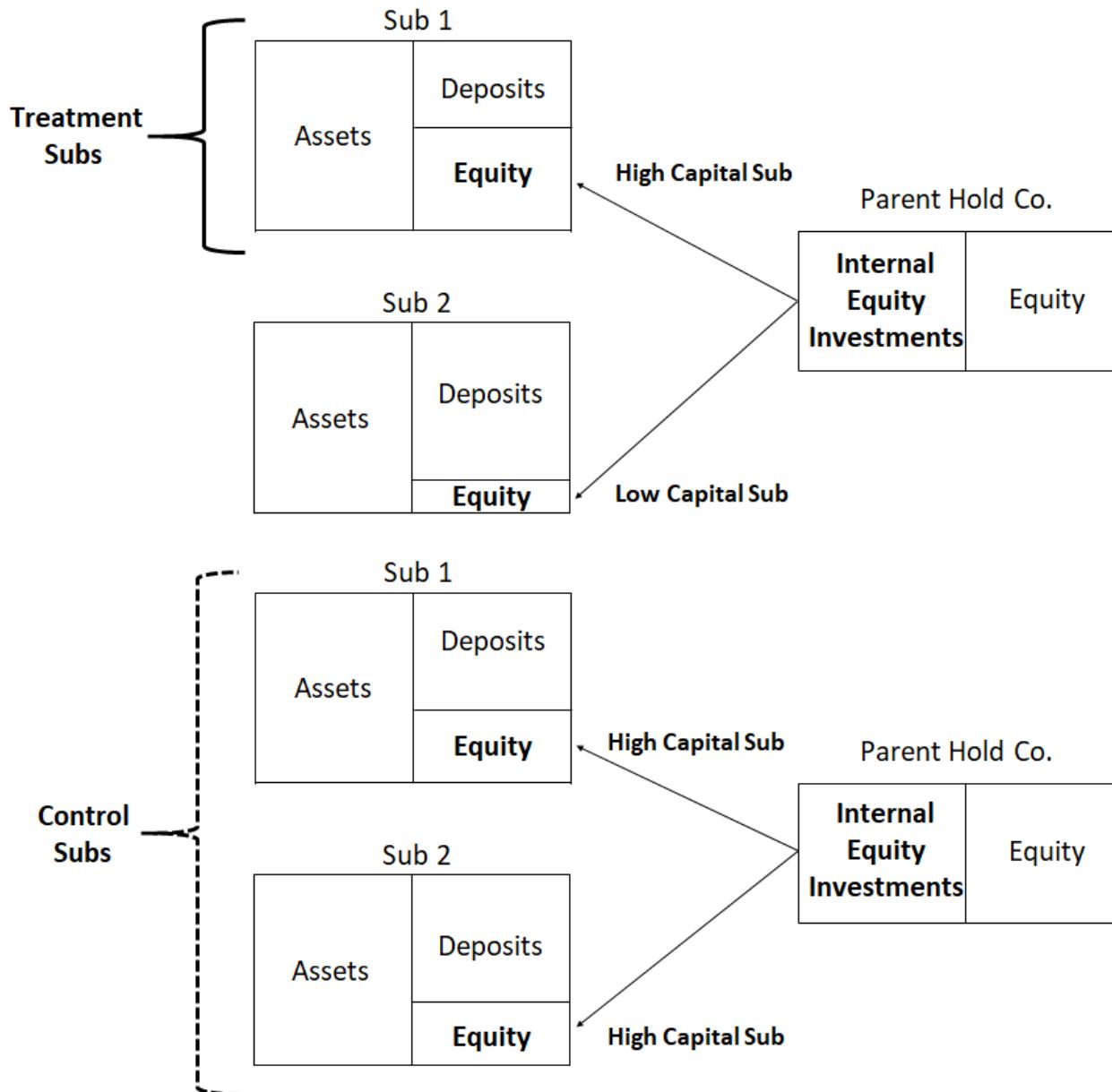
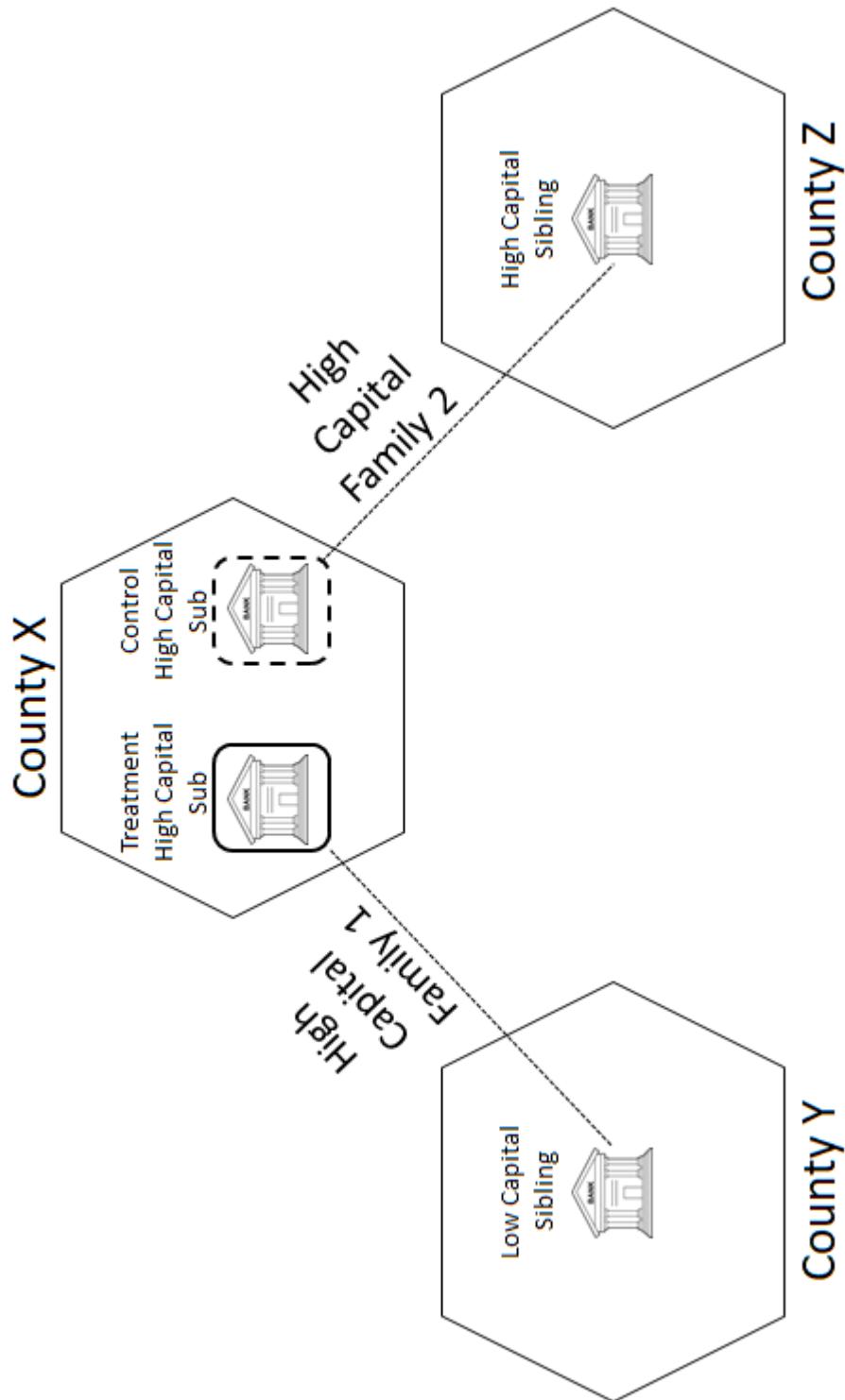


Figure 7: Robustness - Location Matching Setup

This figure presents a stylized illustration of the additional robustness specification I employ in all my main results. This adds a restriction to the above difference-in-differences comparison that the treatment and control subsidiaries (both high capital) must be competing in the same county as of the arrival of the cross-guarantee authority.



As illustrated in Figure 7, I perform an additional robustness test that matches treatment and control subsidiaries by county in order to further control for any local macro shocks that would affect the loan demand of both groups. In this stylized example, high capital parent 1 owns one low capital subsidiary in county Y and a high capital subsidiary in county X. High capital parent 2 owns a high capital subsidiary in county X (that competes with parent 1's high capital subsidiary located in the same county) as well as another high capital subsidiary in county Z. As I will show in Section 4.3, the reason that the subsidiary in county Y is undercapitalized is likely due to losses emanating from a history of persistently negative macro shocks occurring in county Y.

4.3 Why did parents leave subsidiaries undercapitalized pre-law?

In this natural experiment, a high capital subsidiary is assigned to the treatment if it had at least one undercapitalized sibling somewhere in its family as of 1988Q4. The key identifying assumption is that the characteristic of “having an undercapitalized sibling in 1988Q4” was uncorrelated with differences in the expectations for future loan demand across high capital subsidiaries that had undercapitalized siblings in 1988Q4 versus high capital subsidiaries that did not. Towards this end, I provide evidence for the parallel trends assumption between treatment and control groups, in addition to performing the robustness check represented in Figure 7 that matches treatment and control subsidiaries by location.¹²

To better understand the rationale for the identifying assumption, it becomes important to ask the following question: in the pre-law period, why were the undercapitalized subsidiaries undercapitalized in the first place?

Table 3 finds that prior to the law, undercapitalized subsidiaries tended to be worse performers as compared to their high capital siblings. Specifically, they had lower profitability (0.32% quarterly ROA as compared to 1.18%) and higher exposure to delinquent assets

¹² The evidence suggesting parallel trends can be previewed by looking ahead at Figure 14.

(1.36% average balance sheet share as compared to 0.85%). Figure 8 categorizes the 179 subsidiaries that were undercapitalized as of 1988Q4 by how long they have been in this undercapitalized status prior to the arrival of the cross-guarantee authority. More than 60% of this sample had been in this status for two or more years prior. This suggests that, unlike their high capital siblings, undercapitalized entities suffered from persistent local problems, such as bad subsidiary managers or depressed local economic conditions that were unlikely to improve in the near future. Figure 9 suggests evidence for the latter, as it appears that the locations of the undercapitalized sample were geographically clustered around Texas, Massachusetts, Florida and parts of the Midwest - all areas famously known to have suffered regional shocks in the mid 1980s. Texas experienced a significant boom and bust cycle in its commercial real estate sector, while New England and the Midwest were some of the hardest hit regions during the slow down in the late 1980s and early 1990s. This clustering could suggest that the reasons for undercapitalization might relate to bad local economic outcomes in addition to the parent's desire to shift risk onto the government.

Table 3: Summary Statistics on Low Capital Subsidiaries, as of 1988Q4

This table compares the summary statistics of profitability and asset quality for the undercapitalized sample versus high capital subsidiaries as of 1988Q4. High capital means a subsidiary that meets its 5.5% capital requirement and undercapitalized means it does not. All subsidiaries included were owned by holding companies that were in compliance with their consolidated-level capital requirement as of 1988Q4.

as of 1988Q4	Undercapitalized Subsidiaries	High Capital Subsidiaries	Difference
Quarterly ROA (basis points)	32	118	-86***
Problem Assets / Total Assets	1.36%	0.85%	0.51%***
Problem Assets / Total Equity	25%	11%	14%***

Figure 8: Persistence of Low Capital Status

This figure categorizes the 179 subsidiaries that were undercapitalized as of 1988Q4 by how long they have been in this undercapitalized status prior to the arrival of the cross-guarantee authority. More than 60% of the sample had been kept in this status by their holding companies for two or more years prior. I include only undercapitalized subsidiaries that were owned by well-capitalized holding companies (i.e. that were in compliance with their consolidated-level capital requirements as of 1988Q4).

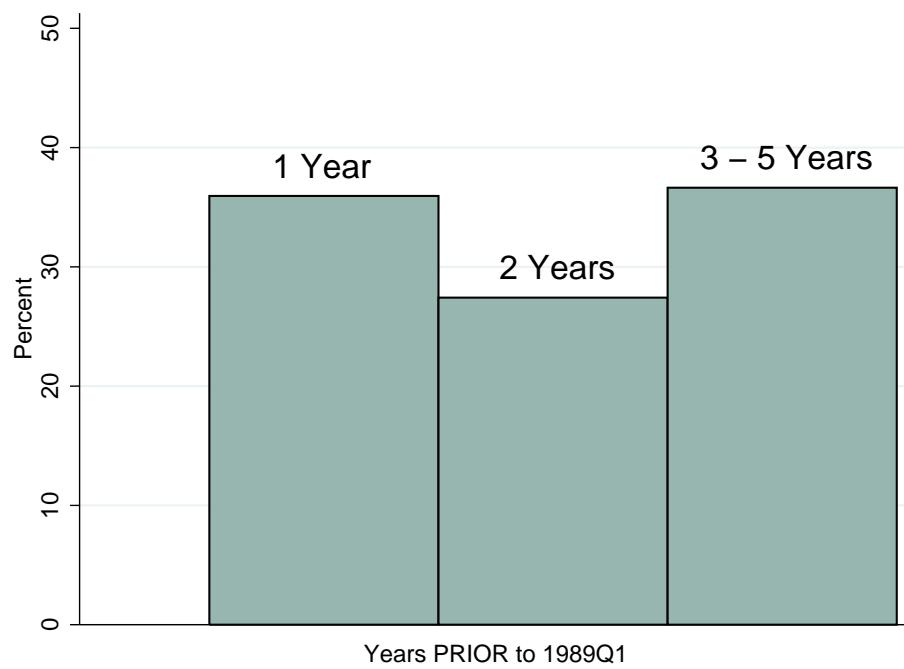
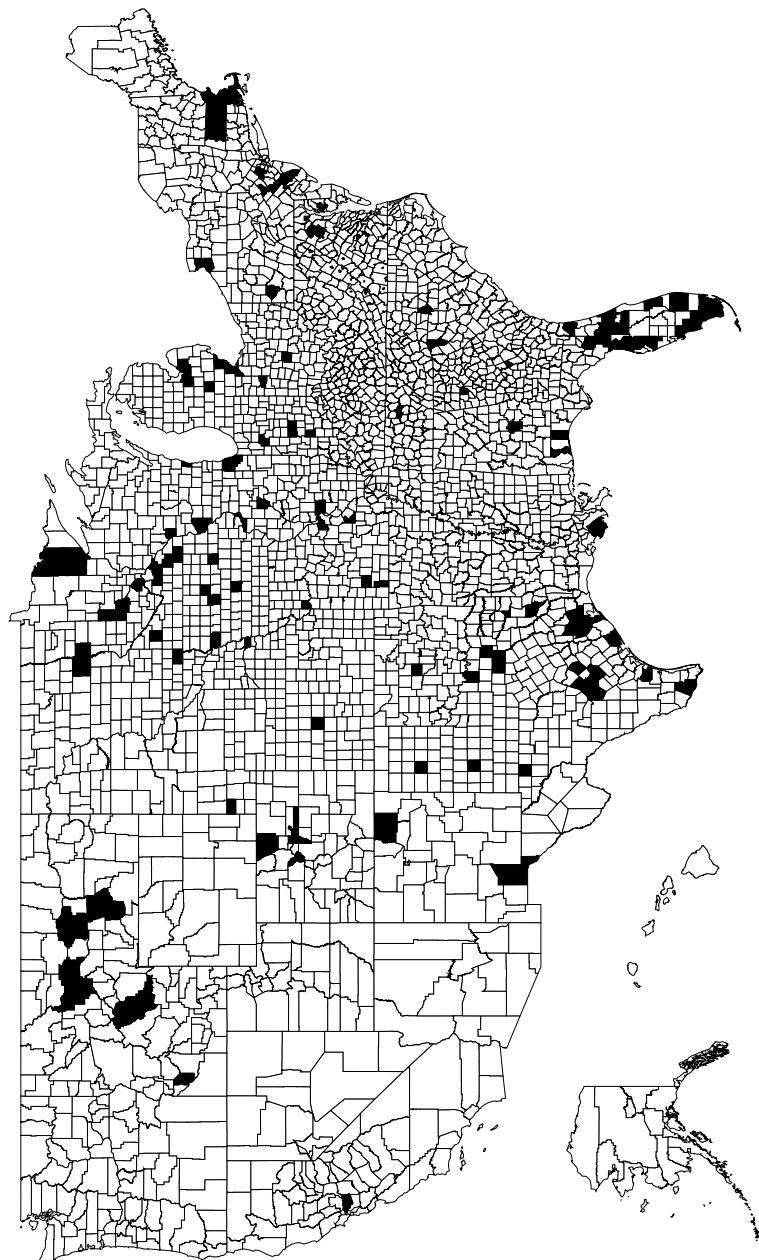


Figure 9: Locations of Undercapitalized Subsidiaries

This figure presents the locations of the 179 subsidiaries that were undercapitalized as of 1988Q4. All of these entities were owned by holding companies that were in compliance with their consolidated-level capital requirements, meaning the parent was strategically choosing to starve them of capital and place excess capital with healthy siblings. The gradient color represents the market share of undercapitalized subsidiaries in that county. The locations of undercapitalized subsidiaries appear to be somewhat geographically clustered around Texas, Florida, Massachusetts, as well as the Midwest. This is consistent with the story that the undercapitalized subsidiaries became undercapitalized due to a history of bad local economic conditions. Parents with excess capital appeared to exploit the government put option by choosing not to recapitalize these subsidiaries until the arrival of the cross-guarantee authority.



If undercapitalized subsidiaries were located in underperforming regions of the country, why then did holding companies choose not to replenish the capital of these weak entities before the law? Recall that this study only considers holding companies that were in compliance with their consolidated-level capital requirements, meaning they possessed enough capital to fully recapitalize each subsidiary if desired. The issue is not that there was insufficient capital to allocate, but that a strategic reason must have existed for why they chose to undercapitalize the weak subsidiary. In a frictionless world, internal capital should be allocated in a way such that its marginal product is equated across every project available in the subsidiaries (Stein, 2003). If every subsidiary had equal growth opportunities, parents would have redistributed equity to achieve equal capitalization across all subsidiaries. It is likely that the parent had a pessimistic view of the future growth prospects in these down-trodden areas and was attempting to shift risk onto the insurance fund by leaving these weak subsidiaries undercapitalized. As the results in Section 5 demonstrate, the law change incentivized holding companies to bite the bullet and finally recapitalize the weak subsidiaries, since the cost of undercapitalization had increased.

5 Results

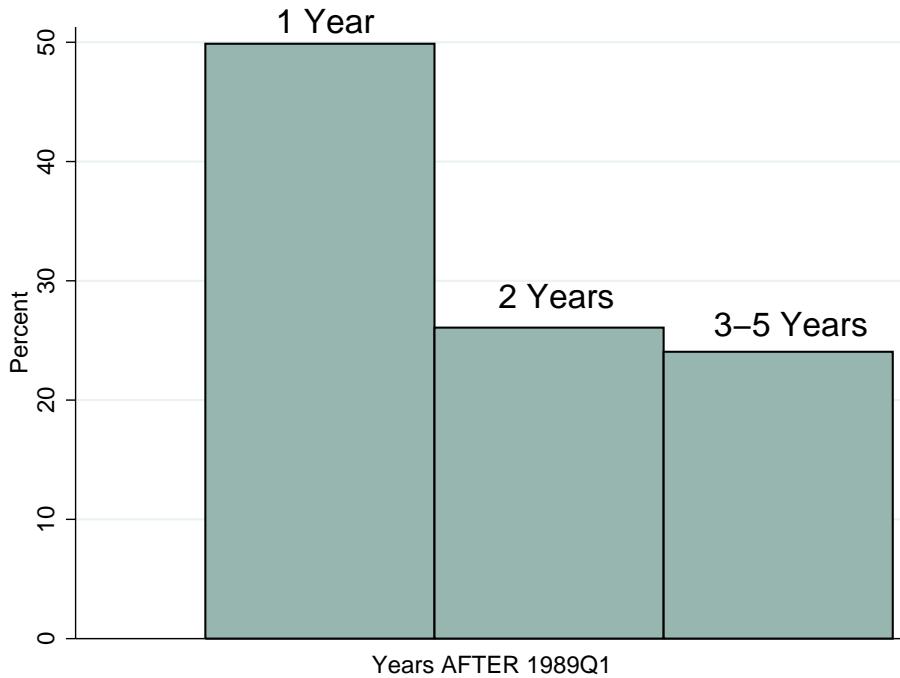
5.1 Change in Internal Capital Allocation Behavior

Given that the announcement of the cross-guarantee authority was a surprise to the banking industry, holding companies that owned at least one undercapitalized subsidiary in 1988Q4 were faced with an unanticipated rise in the costs of leaving it undercapitalized. Figure 10 categorizes the 179 subsidiaries that were undercapitalized as of 1988Q4 by how long they continued to be in this status after the law change. Within one year of the FDIC

law, parent holding companies had fully recapitalized 50% of the undercapitalized sample. As the FDIC had long been concerned with parents starving weak subsidiaries of capital in an attempt to exploit the government put option, the following results show that the arrival of the cross-guarantee provisions was very successful in helping solve this immediate issue.

Figure 10: Recapitalization Speed of Low Capital Subsidiaries

This figure categorizes the 179 subsidiaries that were undercapitalized as of 1988Q4 by how long they continued to be in this status after the arrival of the cross-guarantee authority. It appears that the cross-guarantee authority did in fact pressure holding companies to recapitalize these subsidiaries, as 50% of the sample was completely recapitalized within the first year. Note that I have included only undercapitalized subsidiaries that were owned by well-capitalized holding companies (i.e. in compliance with their consolidated-level capital requirements as of 1988Q4).

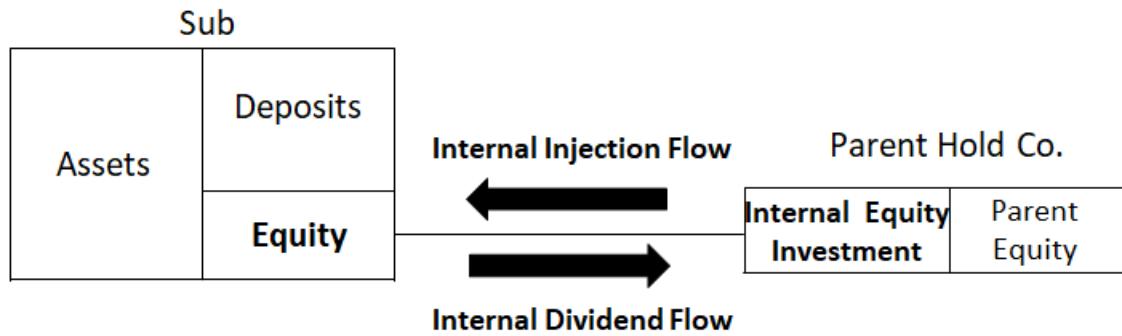


How did the parent choose to implement the recapitalization of these entities? Parents had the option to adjust the subsidiary's capital ratio $\frac{\text{TotalEquity}_{ijt}}{\text{TotalAssets}_{ijt}}$ either through the numerator (injecting new equity) or through the denominator (shrinking the subsidiary). Results

in this and the next section show that the parent adjusted both simultaneously. Although Section 5.2 finds that the strongest adjustment was through the denominator, I focus here on the adjustments in the numerator. Figure 11 illustrates how the mechanics of an internal capital injection work in practice. Internal capital injections from the parent to the subsidiary (arrow pointing left) occur through a sale of new subsidiary shares to the parent in exchange for cash. Extractions of internal capital from the subsidiary to the parent (arrow pointing right) occur through upstreamed dividends paid on existing subsidiary shares owned by the parent. Since the parent typically owned 100% of each subsidiary's equity, it had full discretion on injections and extractions. I define net internal capital injections as $\frac{InternalCapitalInjections_{ijt} - InternalDividends_{ijt}}{TotalAssets_{i,j,t-1}}$, i.e. the creation of new subsidiary equity shares issued to the parent minus any dividends paid upstream from the subsidiary to the parent, calculated as a share of lagged subsidiary assets. This ratio provides a measure for how the subsidiary's capital ratio changes (in percentage points) due to an injection or extraction of internal capital.

Figure 11: The Mechanics of *Internal* Capital Flows

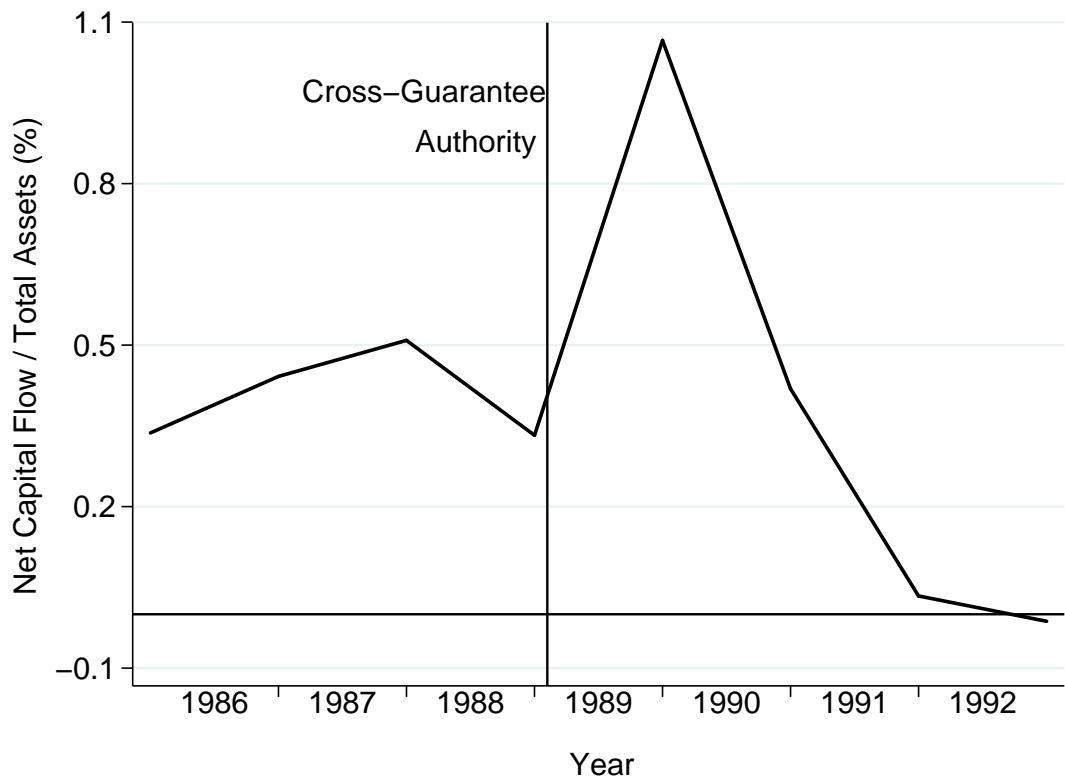
This figure demonstrates the mechanics of internal capital flows. Internal capital injections from the parent to the subsidiary (arrow pointing left) occur through the sale of new subsidiary shares to the parent in exchange for cash. Extractions of internal capital from the subsidiary to the parent (arrow pointing right) occur through upstreamed dividends paid on existing subsidiary shares owned by the parent. Since the parent typically owned 100% of each subsidiary's equity, it had full discretion on injections and extractions. I define net internal capital injections as $\frac{\text{Internal Capital Injections}_{ijt} - \text{Internal Dividends}_{ijt}}{\text{Total Assets}_{i,j,t-1}}$, i.e. the creation of new subsidiary equity shares issued to the parent minus any dividends paid upstream from the subsidiary to the parent, calculated as a share of lagged subsidiary assets. This ratio provides a measure for how the subsidiary's capital ratio changes (in percentage points) due to an injection or extraction of internal capital.



$$\frac{\text{Internal Injection Flow} - \text{Internal Dividend Flow}}{\text{Sub Assets}}$$

Figure 12: Internal Capital Flows at Severely Undercapitalized Subsidiaries

This figure plots the average net internal capital injection at subsidiaries that were severely undercapitalized as of 1988Q4 (less than 4.5%). The black line corresponds to the announcement of the cross-guarantee authority. Net internal capital injections are defined as the creation of new subsidiary equity shares issued to the parent minus any internal dividends paid upstream from the subsidiary to the parent, calculated as a share of lagged subsidiary assets. It captures the percentage point increase in the subsidiary's capital ratio resulting from an injection. Consistent with Figure 10 above, parents responded to the law change by recapitalizing weak subsidiaries. I have included only entities that were owned by well-capitalized holding companies (i.e. in compliance with their consolidated-level capital requirements as of 1988Q4).



Analyzing the sample of subsidiaries that were severely undercapitalized (less than 4.5%) as of 1988Q4, Figure 12 shows that parents injected a significant amount of internal capital into these subsidiaries within the first year after the cross-guarantee was announced. It appears that the law spurred holding companies to accelerate their injection plans, as parents provided these weak subsidiaries with 3 years worth of internal capital injections in the first

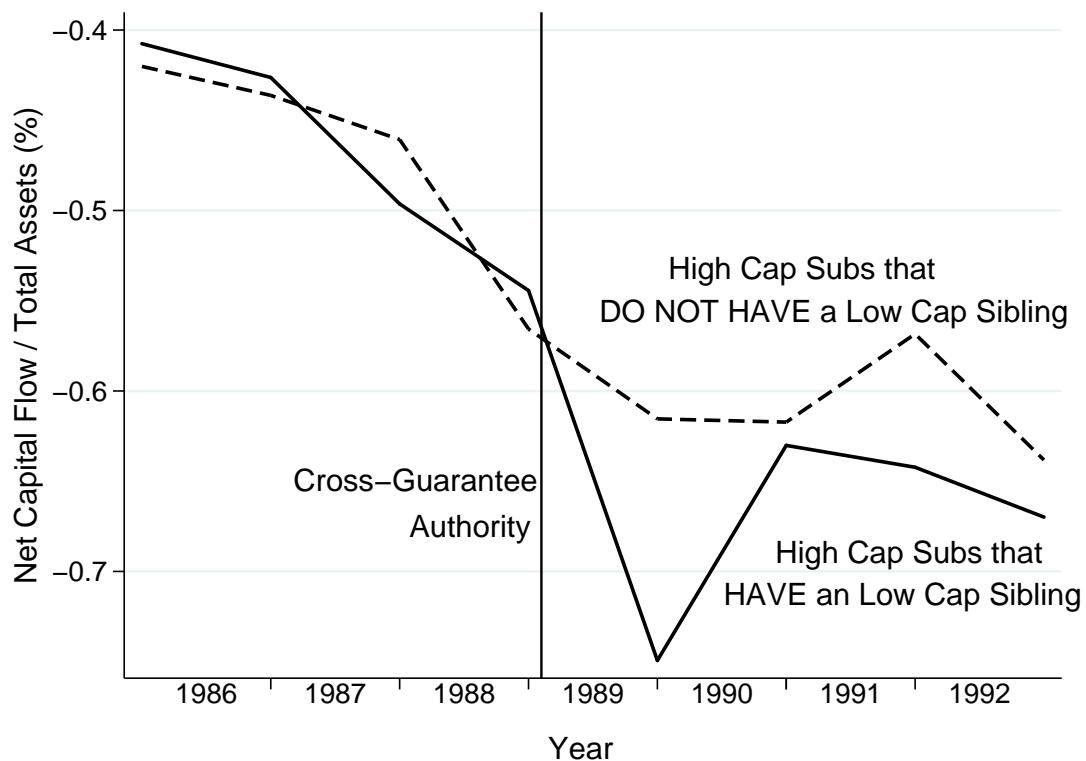
year after the law change. It is also interesting to note that net internal capital injections reduced to 0 by the end of 1991. This is likely due to the fact that the majority of the undercapitalized sample had become fully recapitalized by this time (Figure 10), and there was thus no need to inject further. Note that internal capital injections and dividend payments were, at that time, reported at an annual frequency on the FFIEC 031/041 Call Report.

Where was this new injection of capital sourced from? It could have been acquired either by issuing new holding company shares to the market, or extracting excess capital from healthy sibling subsidiaries. Figure 13 finds evidence of the latter. Comparing the net internal capital injections for very high capital subsidiaries (capital ratios above 6.5%) that had undercapitalized siblings as of 1988Q4 versus those that did not, I find that the parent burdened the former group by extracting more dividends the year after the law.¹³ The combination of Figures 12 and 13 constitute one of the major findings of this study: pressuring holding companies to recapitalize weak subsidiaries induced parents to transfer internal capital away from healthy, high capital subsidiaries. As Section 5.2 will show, this extraction was associated with a contraction in lending growth at high capital subsidiaries in the three years following the law change.

¹³This graph shows the case of subsidiaries whose capital ratios are at least 6.5% (1% above the minimum) as they had excess capital to spare.

Figure 13: Internal Capital Flows at Very High Capital Subsidiaries

This figure graphs the average quarterly net internal capital injection at very high capital subsidiaries (larger than 6.5% capital ratio) that had an undercapitalized sibling as of 1988Q4 versus very high capital subsidiaries that did not, around the announcement of the cross-guarantee authority. Net internal capital injections are defined as the creation of new subsidiary equity shares issued to the parent minus any internal dividends paid upstream from the subsidiary to the parent, calculated as a share of lagged subsidiary assets. It captures the percentage point increase in the subsidiary's capital ratio resulting from an injection. Parents that owned an undercapitalized subsidiary as of 1988Q4 burdened healthy siblings by extracting more dividends the year after the arrival of the law. This occurred at the same time parents injected new capital into severely undercapitalized entities (Figure 12). All subsidiaries included in this graph are owned by well-capitalized holding companies (i.e. in compliance with their consolidated-level capital requirement as of 1988Q4).



$$\frac{IntCapInj_{ijt} - IntDiv_{ijt}}{TotalAssets_{ij,t-1}} = \beta_0 + \beta_1 (POST_{t \geq 1989}) (Very High Cap Sub that has Low Cap Sibling_{i,j,t=1988}) \\ + \gamma X_{i,j,t-1} + \delta_i + \mu_j + \eta_t + \varepsilon_{ijt} \quad (2)$$

In Specification 2, i indexes the commercial bank subsidiary owned by parent holding company j in quarter t. This analysis uses the sample of all subsidiaries that were considered very high capital as of 1988Q4. Standard errors are clustered at the holding company level.

Table 4: Net Internal Capital Injection Regressions

This table combines the results presented in Figure 12 and Figure 13. It reports the difference-in-differences estimate for the effect of the cross-guarantee authority on net internal capital injections at very high capital subsidiaries that have low capital siblings versus those that do not. $BankControls_{i,j,t-1}$ are lagged control variables that include the following variables at both the subsidiary and consolidated levels: ROA, capital ratio, asset liquidity, delinquent asset share, and the log of assets. This analysis includes only holding companies that are in compliance with their consolidated-level capital requirement as of 1988Q4. The time period for the regression spans 1987-1990. The last column adds robustness by location matching. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively. Standard errors are clustered at the holding company level and presented in parentheses. Winsorization of continuous variables has been applied at the 1% level.

	Net Internal Capital Injections (as % of Total Assets)		
	(1)	(2)	(3)
POST * (Very High Cap Sub that has Low Cap Sibling)	-0.16** (0.06)	-0.16*** (0.06)	-0.16*** (0.06)
Bank and Time FEs	YES	YES	YES
Controls	NO	YES	YES
Location Matching	NO	NO	YES
Observations	10,440	10,170	9,956
R2	0.32	0.35	0.35

Specification 2 performs a difference-in-differences estimate for the effect of the cross-guarantee authority on net internal capital injections at the treatment group (very high capital subsidiaries that had an undercapitalized sibling) in comparison to the control group (very high capital subsidiaries that had no undercapitalized sibling). The controls, fixed effects, and standard error clustering are the same as in the Specification 1. The first column represents the estimated coefficients with only fixed effects, the second column adds the standard control variables, while the third column provides robustness by matching treatment and control groups by location.

Table 4 establishes that, in comparison to the control group, parents responded to the announcement of the law change by extracting capital from high capital siblings, reducing their capital ratio by an average of 0.16 percentage points. These effects are robust to matching treatment and control groups by location.

$$\frac{ParentExtEqIss_{jt} - ParentExtDiv_{jt}}{ConsolidatedAssets_{j,t-1}} =$$

$$\beta_0 + \beta_1 (POST_{t \geq 1989q1}) \cdot (Parent Owns Low Cap Sub_{j,t=1988q4}) + \gamma X_{j,t-1} + \mu_j + \eta_t + \varepsilon_{jt} \quad (3)$$

In Specification 3, j indexes the bank holding company in quarter t. This analysis includes bank holding companies that were in compliance with their consolidated-level capital requirements as of 1988Q4. Standard errors are clustered at the holding company level.

Table 5: Parent External Issuance Regressions

This table reports the difference-in-differences estimate for the effect of the cross-guarantee authority on the external equity issuance of well-capitalized holding companies that owned an undercapitalized subsidiary as of 1988Q4 versus well-capitalized holding companies that did not. (*Parent Owns Low Cap Sub_{j,t=1988q4}*) is a dummy that equals 1 if the holding company has an undercapitalized sibling as of 1988Q4. *BankControls_{j,t-1}* are lagged control variables that include the following variables at the consolidated level: ROA, capital ratio, asset liquidity, delinquent asset share, and the log of assets. This analysis only includes holding companies that were in compliance with their consolidated-level capital requirement as of 1988Q4. The time period for the regression spans 1987-1990. The last column adds robustness by location matching. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively. Standard errors are clustered at the holding company level and presented in parentheses. Winsorization of continuous variables has been applied at the 1% level.

	Parent External Equity Issuance (as % of Consolidated BHC Assets)		
	(1)	(2)	(3)
POST * (Parent Owns Low Cap Sub)	-0.0004 (0.0045)	-0.0028 (0.0047)	0.003 (0.0059)
Bank and Time FE	YES	YES	YES
Controls	NO	YES	YES
Location Matching	NO	NO	YES
Observations	13,710	13,054	12,136
R2	0.18	0.25	0.38

Rather than transferring capital internally, another option could have been for holding companies to issue new shares to the market. This would have had the benefit of avoiding any disruptive spillover effects that occur when internal capital markets are accessed. Specification 3 tests this by comparing the effect of the cross-guarantee authority on the external equity issuance of holding companies that owned at least one undercapitalized subsidiary as of 1988Q4 versus those that did not. (*Parent Own Low Cap Sub_{j,t=1988q4}*) is a dummy that equals 1 for treated parents. Table 5 shows that treated parents chose not to raise new capital from the external markets after the law change. When pressured to recapitalized the weak subsidiary, holding companies showed a revealed preference to use internal

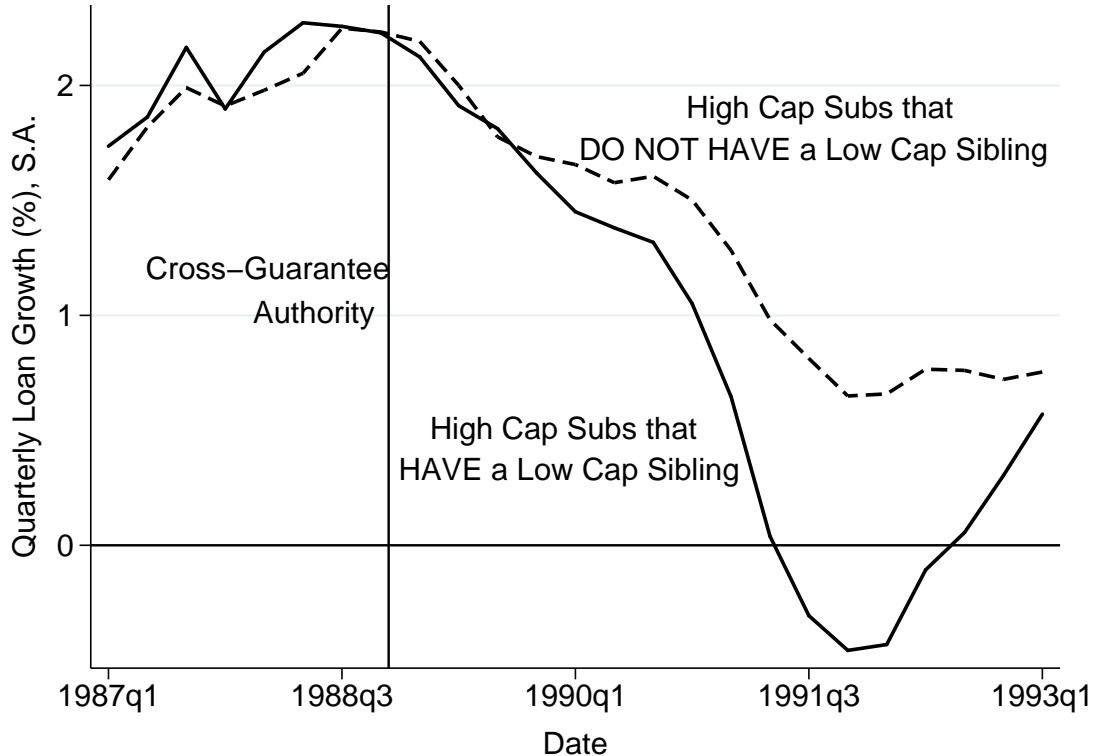
capital markets rather than external. This is consistent with the well-documented pecking order theory that asymmetric information frictions between shareholders and managers makes external issuance expensive (Myers and Majluf, 1984; Hubbard, 1998). Since data on the subsidiary-level capital ratios inside holding companies was unknown to market participants at the time, it is likely that parents were also concerned that issuing new shares right after the law change might signal to the markets that it had an internal problem (i.e. owned an undercapitalized subsidiary even though it was highly capitalized at the parent level). This might have made external issuance even more expensive than usual.

5.2 Lending Effects

If regulators enhanced the enforcement of capital requirements at the weak subsidiary, did this lead parents to curb lending growth at the strong sibling? The answer is yes. This is summarized by Figure 14, which graphs the average quarterly lending growth of high capital subsidiaries that had an undercapitalized sibling as of 1988Q4 versus high capital subsidiaries that did not. This figure suggests the existence of parallel trends in loan growth prior to the announcement of the cross-guarantee authority. It is also important to note that the lending effect was long-lasting, persisting for nearly 3.5 years from the end of 1989 to 1992. By mid-1991, lending growth at the treatment institutions even turned negative. Due to the long duration of the lending effect, this likely reflected a tightened policy on future loan application approvals - a far less disruptive option than shrinking through the asset fire sales. Especially during the 1980s, the secondary market for loans was very illiquid and the market for securitizing loans did not develop until the mid-1990s.

Figure 14: Contraction in Lending Growth at High Capital Subsidiaries

This figure graphs the average quarterly lending growth of the treatment group (high capital subsidiaries that had an undercapitalized sibling as of 1988Q4) and control group (high capital subsidiaries that did not) around the announcement of the cross-guarantee authority. Lending growth has been seasonally adjusted. All subsidiaries included in this graph are owned by holding companies that were in compliance with their consolidated-level capital requirement as of 1988Q4.



I test this using Specification 4, which estimates the effect of the cross-guarantee authority on the rates of lending growth across the respective treatment and control groups.

$$\text{LoanGrowth}_{ijt} = \beta_0 + \beta_1 (\text{POST}_{t \geq 1989q1}) (\text{HasLowCapSibling}_{i,j,t=1988q4}) + \gamma X_{i,j,t-1} + \delta_i + \mu_j + \eta_t + \varepsilon_{ijt} \quad (4)$$

Here, i indexes the commercial bank subsidiary owned by parent holding company j in quarter t . This analysis uses the sample of all subsidiaries that are considered high capital and owned by holding companies that were in compliance with their consolidated-level capital

requirements as of 1988Q4. Standard errors are clustered at the holding company level.

Table 6: Lending Growth Regressions - High Capital Subsidiaries

This table reports the difference-in-differences estimate for the effect of the cross-guarantee authority on quarterly lending growth at high capital subsidiaries that had undercapitalized siblings as of 1988Q4 versus high capital subsidiaries that did not. $BankControls_{i,j,t-1}$ are lagged control variables that include the following variables at both the subsidiary and consolidated levels: ROA, capital ratio, asset liquidity, delinquent asset share, and the log of assets. The time period for the regression spans 1987-1993. The last column adds robustness by location matching. This analysis only includes holding companies that are in compliance with their consolidated-level capital requirement. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively. Standard errors are clustered at the holding company level and presented in parentheses. Winsorization of continuous variables has been applied at the 1% level.

Sample: High Cap Subs	Qtrly Loan Growth (%)		
	(1)	(2)	(3)
POSTFIRREA * (High Cap Sub that has a Low Cap Sibling)	-0.77*** (0.29)	-0.70*** (0.26)	-0.62** (0.25)
Bank and Time FEs	YES	YES	YES
Controls	NO	YES	YES
Location Matching	NO	NO	YES
Observations	55,315	54,620	54,620
R2	0.16	0.23	0.27

As evidenced by Table 6, high capital subsidiaries that had an undercapitalized sibling as of 1988Q4 contracted their lending growth by an average of 0.7% per quarter in the post-law period as compared to high capital subsidiaries that were free from this sibling burden. This result is robust to matching treatment and control groups by location. This resulted in a 6% reduction in lending growth at these treated strong subsidiaries from 1989 to 1992. Given that the treated high capital subsidiaries comprised \$474 billion in aggregate total loans as of 1988Q4, this roughly amounted to \$25 billion of new loans being eliminated during this post-period. If one also incorporates the shrinkage in lending that occurred at the weak subsidiaries (presented later in Figure 16), the total becomes \$36 billion.

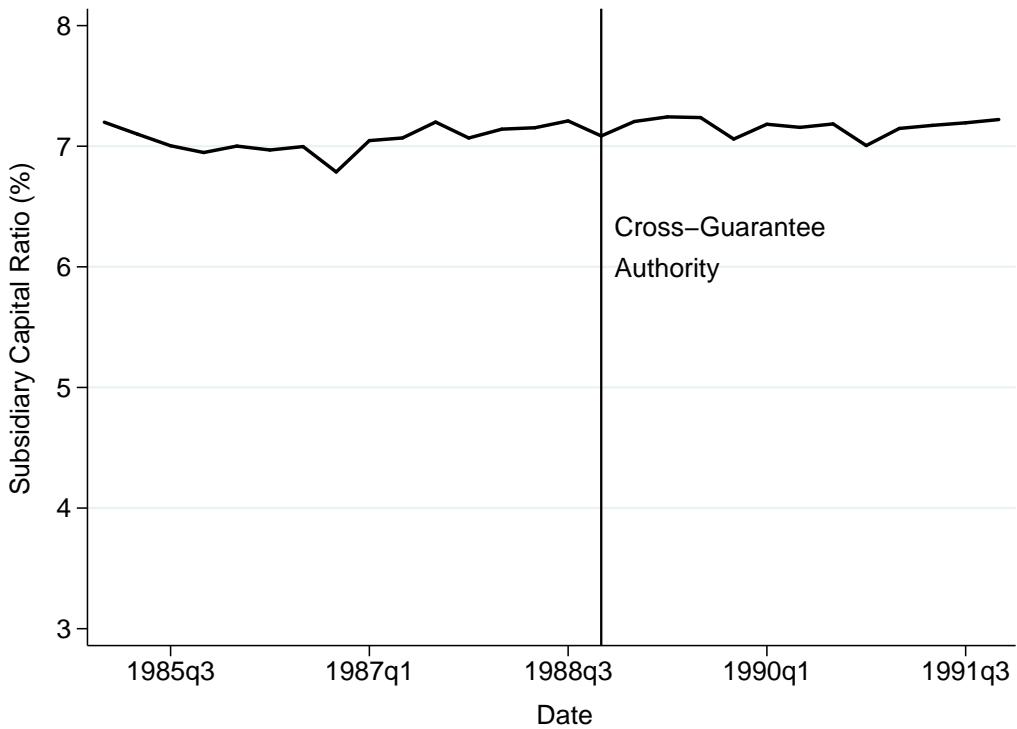
What is particularly interesting about this result is that an extraction of 0.16 percentage

points of capital (result from Table 4) led to a contraction in lending growth despite the fact that this subsidiary, by definition, had an excess of regulatory capital to spare. If a high capital subsidiary had a capital ratio far above the 5.5% regulatory minimum, extracting 0.16 percentage of capital through dividends would not place it against its regulatory minimum, so then why would lending growth need to fall? Without more granular data, it is difficult to answer this conclusively. However, Figure 15 provides a suggestive hint. It appears that holding companies exhibited a revealed preference for keeping precautionary excess capital at their healthy subsidiaries. As much as four years prior to the arrival of the cross-guarantee authority, holding companies had persistently maintained their high capital subsidiaries at an equilibrium capital ratio of 7%, or an excess buffer of 1.5%. Thus, if equity was extracted in such a way that the subsidiary's capital ratio were to fall below this steady state, the holding company would likely curb lending in order to return to this capital ratio.¹⁴

¹⁴This is very analogous to the view presented in Hancock and Wilcox (1994).

Figure 15: Precautionary Excess Capital at High Capital Subsidiaries

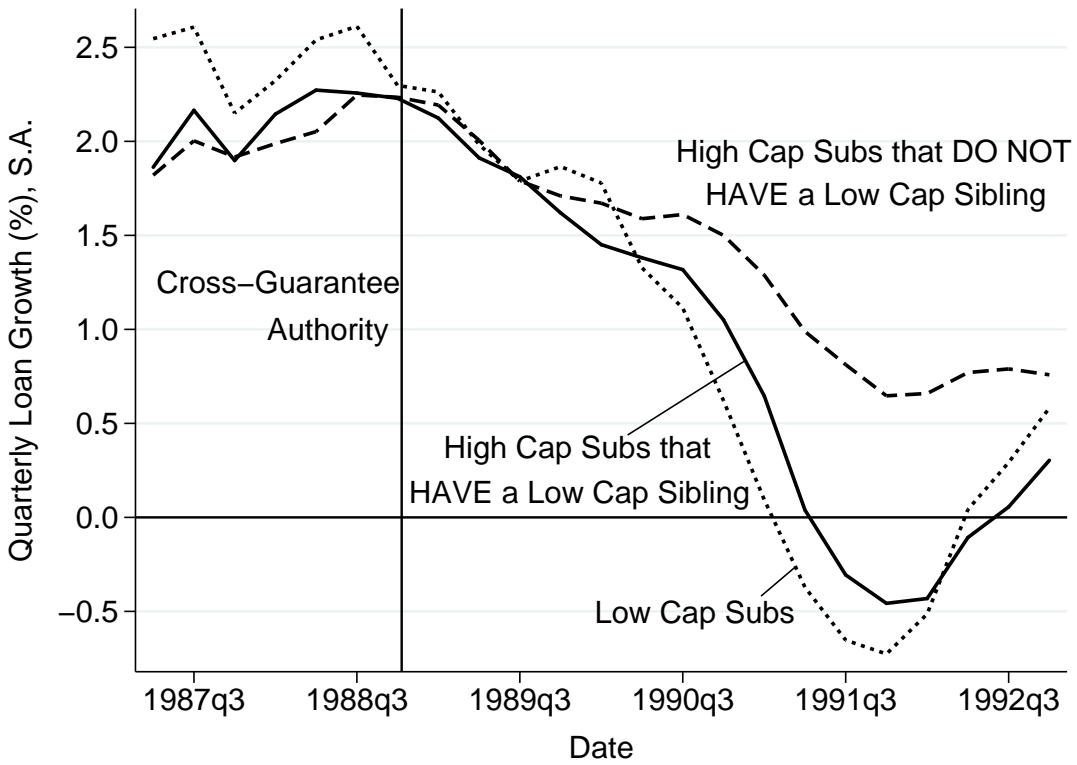
This figure presents the average capital ratio for high capital subsidiaries through time. High capital means a subsidiary exceeds its 5.5% capital requirement as of 1988Q4. This figure suggests that holding companies have had a long-standing preference for keeping precautionary excess capital at their high capital subsidiaries. This fact is important for understanding why the capital extraction shown in Figure 13 would lead to an underinvestment problem in healthy, high capital subsidiaries. All subsidiaries included in this graph are owned by holding companies that are in compliance with their consolidated-level capital requirement.



Next, I shift focus to the response in lending growth at the undercapitalized subsidiary. As I alluded to in the text of Section 5.1, the parent had two options by which it could recapitalize an weak entity: inject new capital (numerator) or shrink the subsidiary (denominator). Figure 12 established that the parent increased the capital ratio through an internal capital injection, however Figure 16 reveals that shrinking was the first-order method.

Figure 16: Contraction in Lending Growth at Low Capital Subsidiaries

This figure graphs the average quarterly lending growth of treatment group one (high capital subsidiaries that had an undercapitalized sibling as of 1988Q4), treatment group two (their undercapitalized siblings as of 1988Q4) and control group (high capital subsidiaries that did not have an undercapitalized sibling as of 1988Q4) around the announcement of the cross-guarantee authority. High capital means a subsidiary that meets its 5.5% capital requirement and undercapitalized means it does not. Lending growth has been seasonally adjusted. All subsidiaries included in this graph are owned by holding companies that are in compliance with their consolidated-level capital requirement.



I test this in Specification 5, using two sets of treatment groups, in order to emphasize the surprising result that both high and low capital subsidiaries in treated holding companies shrank in response to FIRREA. The first treatment group consists of, as usual, the high capital subsidiaries that had an undercapitalized sibling as of 1988Q4, and the second treatment group (the group of interest here) consisted of the respective undercapitalized siblings. As before, the control group comprises high capital subsidiaries that had no undercapitalized siblings as of the law change. The results in Table 7 indicate that in comparison to the

control group, parents contracted the growth rate of lending at undercapitalized subsidiaries by an average of 1.5% per quarter upon announcement of the law change. This shrinkage was at nearly twice the speed of their high capital siblings.

$$\begin{aligned} \text{LoanGrowth}_{ijt} = & \beta_0 + \beta_1 (\text{POST}_{t \geq 1989}) (\text{High Cap Sub that has Low Cap Sibling}_{i,j,t=1988}) \\ & + \beta_2 (\text{POST}_{t \geq 1989}) (\text{Low Cap Sub}_{i,j,t=1988}) + \gamma X_{i,j,t-1} + \delta_i + \mu_j + \eta_t + \varepsilon_{ijt} \end{aligned} \quad (5)$$

Here, i indexes the commercial bank subsidiary owned by parent holding company j in quarter t. This analysis uses the subsample of all subsidiaries that are considered well-capitalized as of 1988Q4. Standard errors are clustered at the holding company level.

Table 7: Lending Growth Regressions - Low Capital Subsidiaries

This table reports the difference-in-differences estimate for the effect of the cross-guarantee authority on quarterly lending growth at the high and undercapitalized subsidiaries of treated holding companies. The control group includes high capital subsidiaries that did not have an undercapitalized sibling as of 1988Q4. $\text{BankControls}_{i,j,t-1}$ are lagged control variables that include the following variables at both the subsidiary and consolidated levels: ROA, capital ratio, asset liquidity, delinquent asset share, and the log of assets. The time period for the regression spans 1987-1993. The last column adds robustness by location matching. This analysis only includes holding companies that are in compliance with their consolidated-level capital requirement. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively. Standard errors are clustered at the holding company level and presented in parentheses. Winsorization of continuous variables has been applied at the 1% level.

	Loan Growth (%)		
	(1)	(2)	(3)
POST * (High Cap Sub that has Low Cap Sibling)	-0.76*** (0.29)	-0.69*** (0.26)	-0.60** (0.25)
POST * (Low Cap Sub)	-1.06*** (0.40)	-1.50*** (0.51)	-1.49*** (0.53)
Bank and Time FEs	YES	YES	YES
Controls	NO	YES	YES
Location Matching	NO	NO	YES
Observations	58,787	58,056	56,870
R2	0.16	0.23	0.27

Table 7 demonstrates the surprising result of my study: enforcing capital requirements at the subsidiary level led to net reduction in lending growth across the *entire consolidated firm*. I perform a sanity-check in Specification 6, utilizing data from the consolidated organization's balance sheets.¹⁵ Controlling for a host of control variables at the consolidated level in Table 8, well-capitalized holding companies that owned an undercapitalized subsidiary as of 1988Q4 experienced a contraction in lending growth of 1.13% per quarter after the announcement of the cross-guarantee authority. In aggregate, this yielded a 6% decline in credit for treated holding companies in the three years following the law. Since treated holding companies held roughly \$578 billion worth of outstanding loans as of 1988Q4, I estimate that this subsidiary recapitalization experiment led to an consolidated reduction of \$36 billion worth of lending in treated holding companies from 1989 to 1992. This amounted to roughly 1.5% of total credit in the economy at the time.

$$BHCLoanGrowth_{jt} = \beta_0 + \beta_1 (POST_{t \geq 1989q1}) \cdot (Parent Owns Low Cap Sub_{j,t=1988q4}) + \gamma X_{j,t-1} + \mu_j + \eta_t + \varepsilon_{jt} \quad (6)$$

Here, j indexes the bank holding company in quarter t . This analysis includes bank holding companies that met their consolidated-level capital requirements as of 1988Q4. Standard errors are clustered at the holding company level.

¹⁵This uses data on the Consolidated Financial Statements for Holding Companies, also known as the FR Y-9C.

Table 8: Lending Growth Regressions - Consolidated Holding Company

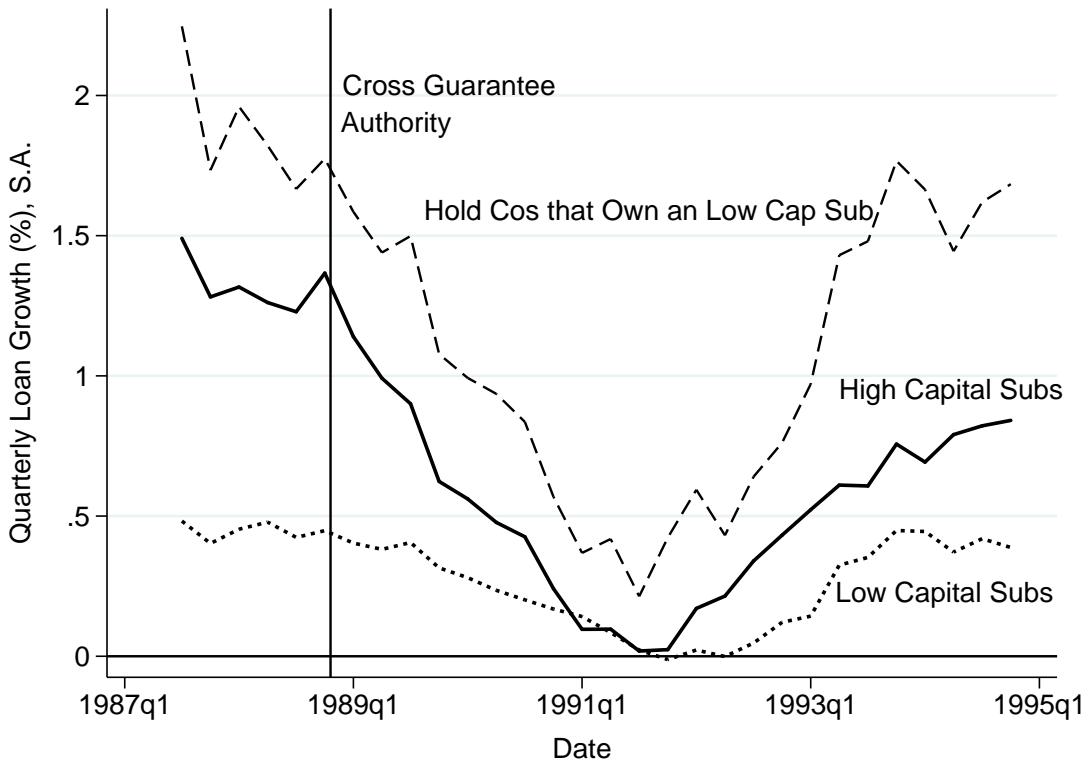
This table reports the difference-in-differences estimate for the effect of the cross-guarantee authority on the consolidated lending growth of well-capitalized holding companies that owned an undercapitalized subsidiary as of 1988Q4 versus well-capitalized holding companies that did not. Consolidated lending growth means the growth in lending across all subsidiaries owned by a holding company. $BankControls_{j,t-1}$ are lagged control variables that include the following variables at consolidated levels: ROA, capital ratio, asset liquidity, delinquent asset share, and the log of assets. The time period for the regression spans 1987-1993. The last column adds robustness by location matching. This analysis includes only holding companies that are in compliance with their consolidated-level capital requirement. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively. Standard errors are clustered at the holding company level and presented in parentheses. Winsorization of continuous variables has been applied at the 1% level.

Sample: High-Capital Bank Holding Cos	Loan Growth (%)		
	(1)	(2)	(3)
POST * Parent Owns Low Cap Sub	-0.94*** (0.34)	-1.13*** (0.32)	-1.17*** (0.37)
Bank and Time FEs	YES	YES	YES
Controls	NO	YES	YES
Location Matching	NO	NO	YES
Observations	12,684	12.577	11,697
R2	0.14	0.21	0.34

A natural follow up question emerges: which set of subsidiaries contributed most to this net contraction in consolidated lending growth? The decline in consolidated lending growth at treated holding companies can be decomposed into the aggregated contraction in lending growth at all their high capital subsidiaries and the aggregated contraction in lending growth at all their undercapitalized subsidiaries.

Figure 17: Which Subsidiaries Explain the Decline in Consolidated Lending Growth?

This figure plots the average quarterly consolidated lending growth of treated holding companies (well-capitalized holding companies that owned an undercapitalized subsidiary as of 1988Q4) and breaks this series down into the contribution by subsidiary type. It is interesting that the majority of the contraction in consolidated holding company lending came from the high capital subsidiaries, as opposed to the undercapitalized subsidiaries. The spillover effect explains the majority of the decline in credit across the consolidated holding company. Note that all holding companies in this graph are in compliance with their consolidated-level capital requirement.



This is addressed in Figure 17, which plots the average quarterly consolidated lending growth of treated holding companies (high capital holding companies that owned at least one undercapitalized subsidiary as of 1988Q4) and breaks this series down into the contribution by subsidiary type. The high capital subsidiary series is constructed as $\frac{\sum_i^{All\ HighCap\ Subs\ in\ BHC\ j} (\Delta\ Loans_{ijt})}{ConsolidatedLoans_{j,t-1}}$ and the undercapitalized subsidiary series is constructed as $\frac{\sum_i^{All\ LowCap\ Subs\ in\ BHC\ j} (\Delta\ Loans_{ijt})}{ConsolidatedLoans_{j,t-1}}$. This analysis reveals that the majority of the contraction in loan growth at the consolidated level

came from the high capital subsidiaries, as opposed to the weak, undercapitalized siblings. Even though Table 7 revealed that the rate of lending fell twice as fast in undercapitalized subsidiaries as compared to their high capital siblings, high capital subsidiaries held roughly 75% of a holding company’s consolidated assets at the time. This led to larger decline in terms of total loans. Note that this is also consistent with my earlier estimates that, from 1989-1992, treated high capital subsidiaries experienced a \$25 billion reduction in lending, as compared to \$11 billion at the undercapitalized siblings. This finding indicates that when regulators pressured holding companies to recapitalize the weak entity, the spillover effect to the healthy siblings explained a larger share of the firm’s consolidated loan contraction, as compared to the shrinkage that occurred at the undercapitalized, “problem” subsidiaries themselves.

5.3 Discussion

Tying together the capital and lending results in Sections 5.1 and 5.2, this study finds evidence that raising the optimal level of capital at the subsidiary-level had a causal impact on their lending decisions. The arrival of the cross-guarantee authority constituted an unexpected increase in the costs associated with allowing a subsidiary to remain undercapitalized (raising the optimal level of subsidiary capital). This ultimately pressured parents to recapitalize their weak subsidiaries. Holding companies had three options by which to recapitalize bad entities: (1) provide an internal injection of capital by issuing shares to the market, (2) provide an internal injection of capital by transferring equity away from healthy sibling institutions, or (3) shrink the weak subsidiary. Studying the effects of this law allows me to trace the parent’s response along these three margins of adjustment. The relative magnitudes of adjustment unveil the parent’s revealed preference for each action (and likely implies their relative costs). Listing each option from most to least costly (based on the results in Section 5.1 and 5.2):

	Option	Use	Action
1	Increase numerator	External Capital Markets	Issue external shares and inject new capital into the weak subsidiary
2	Increase numerator	Internal Capital Markets	Transfer capital away from healthy siblings and inject into the weak subsidiary
3	Decrease denominator	-	Shrink the weak subsidiary

There are two important institutional features that likely drove this set of outcomes. Firstly, well-documented information frictions in the external capital markets means that option (1), the external issuance of equity, was too expensive. Parents had no choice but to shrink the subsidiary (3) and internally transfer capital away from healthy siblings (2). Changing the weak subsidiary’s lending policy going forward (i.e. tightening standards for the acceptance of future loan applications) was likely the most cost efficient solution to shrinking, since there would be no disruptive balance sheet adjustments involved (unlike fire sales). A second feature is that holding companies appeared to exhibit a revealed preference for maintaining a precautionary buffer of excess capital at their healthy subsidiaries. This implies that an extraction of internal capital would likely lead to a negative shock to lending as the healthy subsidiary attempts to revert back to its prior steady state capital ratio. This brings us to the overarching result of this paper: raising the optimal capital ratio at the subsidiary level led to a net contraction in lending growth across all subsidiaries, *good and bad*. While the benefit of enhancing the enforcement of subsidiary-level capital requirements is difficult to quantify (i.e. parents now internalize the true bankruptcy cost of all their subsidiaries), I estimate that the cost of this recapitalization experiment roughly amounted to \$36 billion of consolidated lending lost across all treated holding companies. Estimating how this transmitted to the economy through real effects will require further analysis, as it was possible that competitor banks or other forms of intermediation stepped in to partially fill the gap.

To the best of my knowledge, this paper is the first to identify the internal capital market and lending spillover effects that occur when parent holding companies recapitalize weak subsidiaries. Although this experiment occurred many decades ago in the late 1980s, the

effect I identify is by no means a one time thing. While the unexpected passage of this law in 1989 provides a clean setting for identification, the fact that the cross-guarantee authority is still in place has many implications for banks and regulators today. Anytime a subsidiary becomes weak due to regional shocks or bad local management, etc., the impending risk of cross-guarantees forces the well-capitalized parents to internalize their *true* firm-wide bankruptcy cost and continually replenish capital at the weak subsidiary. Due to the higher cost of external equity issuance, parents will have no choice but to shrink and transfer capital away from healthy siblings. It is difficult to make welfare claims about this outcome, since one cannot easily quantify the long term benefit to the government of the cross-guarantee authority (in terms of the reduction in risk shifting incentives). However, the goal of this study was to document the cost in terms of a spillover lending response.

6 Conclusion

This paper provides granular evidence on how bank holding companies choose to respond when regulators enforce capital requirements *at the subsidiary level*. Using an unexpected law change in 1989 that pressured holding companies to recapitalize their weak subsidiaries, I find that a 6% contraction in lending growth resulted at strong, high capital subsidiaries that had undercapitalized siblings versus those that did not. The cross-guarantee authority was a unique experiment because it constituted an enhanced enforcement of capital requirements at the *subsidiary-level*, holding the capital requirements at the parent level fixed. This provided a valuable opportunity to learn about the parent's response function by documenting how the holding company chose to adjust through shrinking, internal capital reallocations, and external equity issuances. This experiment is particularly important for questions relating to the post-crisis macroprudential regulation of global banks. As regulators around the world weigh the tradeoffs of protectionist policies that enforce subsidiary-level capital requirements

on the local operations of foreign banks (“capital ring fencing”), the results of this study suggest that such policies could lead to a sizeable, international spillover effect through the bank’s internal capital market.

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