Regulatory Arbitrage within the Firm

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Abstract

Financial regulation often treats complex financial institutions as simple, standalone entities. We show that this approach overlooks an important organizational margin for financial conglomerates with both bank and nonbank subsidiaries. Following the increase in Basel III capital requirements in 2015, bank holding companies (BHCs) reallocate equity internally, extracting capital from lightly regulated nonbank subsidiaries to recapitalize their regulated banks. Using historical variation in state-level banking deregulation to instrument for organizational complexity, we find that banks in more complex conglomerates accumulate 7–8 percentage points more capital than comparable standalone banks. This capital buildup occurs entirely through internal equity transfers: consolidated assets, equity, and lending remain unchanged. The reallocation creates a stark divergence in risk within the organization: banks become safer, while nonbank subsidiaries experience declining capital ratios and expanded lending activity. As a result, risk is shifted, rather than eliminated, creating hidden fragility at the holding-company level. Stress tests calibrated to 2008-scale shocks suggests that 5–8% of conglomerates would exhaust their capital buffers. Our findings demonstrate that organizational structure is a first-order determinant of regulatory outcomes and the internal distribution of risk.

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1 Introduction

A fundamental question in economics concerns how organizations structure economic activity across internal boundaries. Coase (1993) argues that firms exist when internal organization economizes on transaction costs relative to market exchange.[1] Despite extensive work on organizational economics, we have limited understanding of how regulation interacts with organizational structure to shape firm behavior and market outcomes.

This gap is particularly consequential in financial markets, where prudential regulation explicitly targets capital allocation and risk-taking to enhance stability. The canonical framework for analyzing bank capital regulation treats financial institutions as standalone entities. Yet most systemically important institutions are complex holding companies comprising dozens of legally separate subsidiaries—commercial banks, broker-dealers, consumer lenders, asset managers—that face dramatically different regulatory regimes despite operating under common ownership (Demsetz and Strahan, 1997).

This paper addresses foundational questions at the intersection of organizational economics and financial regulation: What happens when regulation designed for standalone entities meets the organizational reality of multi-subsidiary firms? When capital requirements tighten for one subsidiary, how do internal capital markets respond? Does organizational structure constitute a first-order determinant of regulatory incidence?

These questions expose a fundamental tension in financial economics. The Modigliani-Miller theorem (Modigliani and Miller, 1958) suggests that moving capital between subsidiaries should be neutral absent frictions. Yet organizational economics emphasizes that internal capital markets exist precisely because frictions matter (Stein, 1997; Scharfstein and Stein, 2000; Rajan, Servaes and Zingales, 2000). If internal capital markets operate subject to transaction costs, agency problems, or incomplete contracting, then regulation targeting subsidiary-level capital requirements could generate unintended consequences beyond enhanced safety.

An ideal laboratory to study this question is the U.S. banking industry. Regulators impose consolidated capital requirements on bank holding companies (BHCs) and separate requirements on their depository institution ("bank") subsidiaries, but not on nonbank financial subsidiaries. This differential regulatory treatment creates exploitable wedges that incentivize internal capital reallocation across entities within the same organization.

We test this conjecture and study its implications, exploiting the phased implementation of Basel III requirements and Federal Reserve Enhanced Prudential Standards beginning in 2015. These reforms raised minimum capital requirements substantially—Tier 1 capital ratios from 4% to 6%, plus capital conservation buffers of 2.5%. These requirements bound at two levels: consolidated BHC balance sheets and individual bank subsidiaries, but not nonbank subsidiaries. While

[1] Subsequent research explores how organizational form affects resource allocation (Williamson, 1975; Grossman and Hart, 1986), capital budgeting (Harris and Raviv, 1991; Stein, 1997), and responses to external shocks (Gertner, Scharfstein and Stein, 1994; Scharfstein and Stein, 2000).

nonbank balance sheets enter consolidated capital calculations, nonbanks face no direct capital requirements. This differential treatment creates stark variation in the shadow value of equity across legally separate but economically integrated entities within the same holding company.

To establish causality, we exploit cross-sectional variation in organizational complexity generated by the staggered timing of interstate banking deregulation during the 1970s–1990s. Following Strahan et al. (2003), Jayaratne and Strahan (1996), and Kroszner and Strahan (1999), we instrument for organizational complexity using the year in which each BHC's home state removed restrictions on interstate banking. Bank holding companies headquartered in states that deregulated earlier had more time to build extensive subsidiary networks before the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 harmonized geographic restrictions nationwide. This historical accident, driven by state-level political economy decades before our study period (Kroszner and Strahan, 1999), creates persistent differences in organizational structure plausibly orthogonal to factors determining post-2015 regulatory responses.

We establish three core findings. Our first core finding is that bank holding companies with more complex organizational structures respond to enhanced capital requirements by extracting equity from nonbank subsidiaries to recapitalize their bank affiliates. Using instrumental variables estimation that exploits state-level deregulation timing, we find that banks in BHCs from states deregulating one year earlier accumulate 0.74 percentage points more excess capital post-2015. For the median gap of 7 years between early and late deregulators, this implies approximately 5 percentage points more bank capital. Importantly, this capital accumulation occurs exclusively at the bank subsidiary level: we find no corresponding increase in consolidated holding company capital, total BHC assets, or BHC lending, consistent with internal reallocation rather than external equity issuance or consolidated deleveraging.

We trace the internal reallocation through direct observation of equity flows between parent and subsidiaries—a contribution that addresses an important gap in the literature. While prior research on internal capital markets emphasizes liquidity reallocation through loans and deposits between affiliates (Cetorelli and Goldberg, 2012*a*,*b*; Gilje, Loutskina and Strahan, 2016; Cetorelli and Prazad, 2025), the role of equity transfers, which directly affect risk-bearing capacity and regulatory capital ratios, has received limited attention. We document that equity dominates internal funding by an order of magnitude: equity investments average 20–25% of BHC assets while non-equity investments total just 2–5%. This dominance explains why organizational structure—specifically, the presence of nonbank subsidiaries from which equity can be extracted—becomes a first-order determinant of regulatory responses.

Post-2015, we observe systematic equity reallocation operating through three channels. First, nonbank equity-to-asset ratios decline by 7.71 percentage points per year of deregulation exposure, implying near-complete equity extraction for high-exposure BHCs. Second, nonbank dividend yields to parents increase by 9.47 percentage points while net balances to parents increase by 13.60 percentage points, indicating nonbanks both distribute more earnings and borrow more

from affiliated entities. Third, parent equity investments in bank subsidiaries increase by 2.28 percentage points while investments in nonbanks decline by 2.64 percentage points, with no change in total investments. We further document that parents charge nonbanks sharply higher internal funding rates post-2015: nonbank internal borrowing costs increase 0.52 percentage points per year of exposure while bank rates show no change, creating a 200 basis point spread by 2020 for high-exposure BHCs. This pricing divergence reveals that internal capital markets operate subject to funding frictions, amplifying the real effects of equity extraction beyond mechanical balance sheet adjustments.

A key insight explains why even BHCs with modest nonbank operations find internal reallocation economically attractive. Nonbank subsidiaries within BHCs hold dramatically higher equity-to-asset ratios than banks (median 69% versus 10%),[2] making them natural "equity reservoirs" despite small asset footprints. This creates an internal equity multiplier: a nonbank subsidiary representing just 2% of consolidated assets (the median in our sample) holds 16% of consolidated equity, an 8× multiplier. At the 95th percentile, nonbanks hold 32% of assets but 68% of equity, implying multipliers exceeding 20×. This equity multiplier mechanism has important implications for regulatory scope: organizational arbitrage is economically significant even for BHCs with moderate nonbank operations. We show that internal reallocation occurs across the size distribution and is particularly pronounced among BHCs in the second and third quartiles of nonbank exposure, not just the extreme tail.

Our second core finding examines the systemic implications of internal capital reallocation using subsidiary-level stress tests. We simulate scenarios comparable to the 2008 financial crisis: nonbank subsidiaries suffer asset losses requiring recapitalization to restore prudential capital ratios. Using 2013Q4 balance sheets (before equity extraction), we calculate losses of 5%, 10%, and 15% on nonbank assets—magnitudes within the range observed for broker-dealers, finance companies, and asset managers during 2007–2009 (Adrian and Shin, 2010)—and compute the equity injection needed to restore nonbank capital ratios to values around the population median of 69%, ranging from 40% to 70% of assets.

Under our baseline scenario (5% shock requiring recapitalization to 40% capital ratios), the mean BHC would need to deploy 18.84% of its excess capital to recapitalize nonbanks. At the 95th percentile, this rises to 90.58% of available parent capital, and 5.10% of BHCs would completely exhaust capital buffers. More severe scenarios generate tail risks exceeding 100% of available BHC capital. These calculations use pre-extraction balance sheets; post-2015 capital depletion documented in our flow analysis means contemporary vulnerability exceeds these estimates substantially. Thus, the stress tests reveal substantial hidden fragility: while banks appear individually safer, the consolidated holding company structure faces increased vulnerability to nonbank shocks that could exhaust parent equity and trigger disorderly liquidations.

[2]Banks maximize deposit funding, the lowest-cost funding source due to deposit franchise value and deposit insurance, operating with minimal equity as determined by regulatory requirements. Nonbanks lack access to insured deposits and thus rely primarily on equity funding, resulting in substantially higher capital ratios.

Our third core finding is that internal capital reallocation generates a stark divergence in risk, performance, and business models across subsidiaries within the same holding company. Bank subsidiaries become safer and more profitable following the tightening of capital requirements, while nonbank subsidiaries become significantly more fragile.

On the bank side, increased internal equity injections translate into higher profitability and lower risk without higher leverage. Bank return on assets rises persistently following 2015, driven by shifts toward safer balance sheet composition rather than by increased risk-taking. Banks reduce exposure to risk-weighted assets, increase holdings of securities and cash, and operate with higher capital buffers relative to risk. Importantly, leverage and marginal return on equity remain unchanged, indicating that performance gains arise from improved efficiency and risk composition rather than from deploying additional capital into high-return activities.

In contrast, nonbank subsidiaries within the same holding companies become significantly more fragile. As equity is extracted, nonbank capital ratios fall sharply, profitability declines, and credit quality deteriorates. In response, nonbanks shift away from capital-intensive lines of business (e.g., trading, venture capital, advisory) toward capital-light lending – particularly consumer lending – which allows balance-sheet expansion despite diminished equity buffers. This reorientation is accompanied by higher income volatility and a pronounced decline in distance-to-default, indicating heightened exposure to adverse shocks. Together, these patterns show that internal capital reallocation shifts risk away from regulated banks and toward less regulated nonbank affiliates.

Beyond balance sheet adjustments, organizational structure itself adapts endogenously to regulatory pressure. Rather than simplifying, BHCs expand the scope of nonbank activities after 2015, increasing the number of distinct nonbank business lines while rebalancing subsidiary portfolios toward capital-light lending operations and away from capital-intensive insurance affiliates. This extensive-margin response, combined with intensive-margin shifts in nonbank business models, shows that organizational complexity actively adapts to regulatory constraints.

This paper contributes to three literatures. First, we extend research on internal capital markets by documenting how regulation shapes internal capital allocation and showing that organizational structure is a first-order determinant of regulatory incidence. While prior work emphasizes liquidity reallocation through loans and deposits between affiliates (Lamont, 1997; Shin and Stulz, 1998; Stein, 1997; Rajan, Servaes and Zingales, 2000; Cetorelli and Goldberg, 2012*a*,*b*; Gilje, Loutskina and Strahan, 2016; Cetorelli and Prazad, 2025), we show equity transfers dominate by an order of magnitude and directly affect risk-bearing capacity and regulatory capital ratios. Our evidence demonstrates that frictions in internal capital markets—the very transaction costs that justify organizational existence—create real economic consequences when regulation distorts internal allocation decisions.

Second, we contribute to understanding bank capital regulation effects (Kashyap, Stein and Hanson, 2010; Admati et al., 2013; Hanson, Kashyap and Stein, 2011; Berger and Bouwman, 2013;

Gropp et al., 2019). These studies typically treat banks as standalone entities or analyze consolidated holding company responses. We show subsidiary-level heterogeneity within firms is crucial: identical consolidated capital requirements generate divergent outcomes across subsidiaries depending on organizational structure. This challenges the implicit assumption that consolidated oversight fully captures economic risks.

Third, we identify a new dimension of regulatory arbitrage distinct from cross-border (Houston, Lin and Ma, 2012; Ongena, Popov and Udell, 2013; Danisewicz, Reinhardt and Sowerbutts, 2017), cross-sector (Buchak et al., 2018; Irani et al., 2021), and cross-time (Kisin and Manela, 2016) channels emphasized in prior work. Regulatory arbitrage occurs *within* legally integrated organizations, as firms exploit differential treatment of subsidiaries to minimize regulatory costs. This within-firm arbitrage may be particularly concerning because it occurs within the regulatory perimeter, under consolidated supervision, yet escapes effective oversight. Our findings complement work by Tarullo (2019), Acharya, Cetorelli and Tuckman (Forthcoming), and Bai, Campello and Muthukrishnan (2025) emphasizing the challenges of regulating multi-entity financial conglomerates.

Our analysis also documents substantial growth in lending and risk-taking by nonbank subsidiaries within bank holding companies, complementing work on nonbank financial intermediation outside the banking sector (Pozsar et al., 2010; Buchak et al., 2018; Irani et al., 2021; Jiang et al., 2020). While prior work emphasizes regulatory arbitrage across institutional boundaries, we show that similar arbitrage occurs within institutions through internal capital reallocation. This has important implications for measuring and monitoring systemic risk: many economically important nonbanks operate as wholly owned subsidiaries of bank holding companies, creating direct channels for risk transmission that are invisible in sector-level data (Adrian and Ashcraft, 2012).

Our findings carry important implications for regulatory design. Subsidiary-level capital requirements, even when accompanied by consolidated requirements, create exploitable wedges within integrated firms. These wedges allow risk migration across regulatory boundaries, generating systemic vulnerabilities that consolidated oversight may not fully capture. The stress test results suggest this risk migration is economically significant: tail-risk scenarios show potential for parent insolvency when nonbank subsidiaries require recapitalization.

The welfare implications are ambiguous. Enhanced bank safety is socially valuable: better-capitalized banks support more stable credit supply and reduce deposit insurance costs. However, nonbank fragility creates offsetting risks. If these entities engage in maturity transformation, leverage, or interconnections with the broader financial system, their increased fragility could amplify systemic risk. The optimal policy response depends on whether welfare gains from bank safety exceed the costs of nonbank fragility plus any efficiency losses from distorted internal capital allocation.

More broadly, our findings suggest that organizational complexity is not merely a veil over

economic activity but a first-order determinant of how regulation shapes behavior and allocates risk. Effective prudential policy must account for the boundaries of the firm, recognizing that regulation applied to legally separate subsidiaries within economically integrated organizations creates exploitable wedges and potentially destabilizing risk migration.

The rest of the paper proceeds as follows. Section 2 describes data sources and sample construction. Section 3 presents the identification strategy. Section 4 presents the main empirical findings on internal capital reallocation, subsidiary-level divergence, and stress test results. Section 5 presents key robustness tests. Section 6 develops a simple model of internal capital markets under asymmetric regulation and derives welfare implications. Section 7 concludes. Online appendices provide additional results, robustness checks, and institutional details.

2 Data

We use regulatory filings to study changes at the BHC, bank, and nonbank levels. Our primary data sources are the FR Y-9C (consolidated BHC financials), FR Y-9LP (unconsolidated BHC financials and inter-entity flows), Call Reports (bank subsidiary financials), and FR Y-11 (nonbank subsidiary financials). We link entities across filings using the organizational structure database introduced in Cetorelli and Stern (2015).

2.1 BHC-Level Data

The FR Y-9C provides quarterly consolidated financial statements for bank holding companies, including balance sheets, income statements, and regulatory capital measures such as risk-weighted assets and capital ratios. The FR Y-9LP reports quarterly unconsolidated data for the top-tier holding company, capturing equity investments and financial flows between the parent, bank subsidiaries, and nonbank subsidiaries.

We use the FR Y-9LP in two primary ways. First, it provides information on nonbank activity, including the number of nonbank subsidiaries and their aggregate assets, loans, and revenues, allowing us to distinguish BHCs with and without nonbank financial subsidiary activity. Appendix Figure C.1 shows that nonbank assets held within BHC structures represent approximately 20% of total nonbank financial assets post-2010, with the sharp increase in 2008–2010 reflecting the conversion of large investment banks (Goldman Sachs, Morgan Stanley) to BHC status following the financial crisis. This indicates our sample captures a substantial share of shadow banking activity operating under bank holding company umbrellas. Second, the FR Y-9LP contains detailed data on equity investments and intercompany lending, allowing us to measure internal equity and non-equity transfers within the BHC's organizational structure.

2.2 Bank and Nonbank Subsidiary Data

Call Reports (FFIEC 031/041) provide detailed quarterly information on bank balance sheets, income statements, and regulatory capital, allowing us to observe equity and capital positions of depository institution subsidiaries. We also use Call Reports to measure bank-level lending activity across loan categories, charge-offs, and other performance indicators.

The FR Y-11 provides balance sheet information on nonbank subsidiaries, including equity, lending activity, and loss provisions. Top-tier holding companies must submit FR Y-11s for large nonbank subsidiaries at either quarterly or annual frequency. However, only a subset of nonbank subsidiaries are required to file, and reporting frequencies are not uniform across entities.

2.3 BHC Organizational Structure Database

We use a comprehensive database of BHC organizational structures covering 1970 to the present, first documented in Cetorelli and Stern (2015) and described further in Cetorelli and Prazad (2025). This database combines information from FR Y-6 and FR Y-10 filings to construct a quarterly panel of bank and nonbank subsidiary relationships and counts for each top-tier holding company. To our knowledge, this is the only dataset providing time-consistent, comprehensive coverage of organizational structure for the full population of Y-9C filing BHCs.

We use this database in two main ways. First, it allows us to link BHC-level financial data with subsidiary-level filings. Second, it records the primary business activity of each subsidiary using five-digit NAICS codes, enabling us to distinguish between different types of nonbank financial institutions within a BHC's organizational structure.

2.4 Excess Capital Construction

We construct measures of excess regulatory capital at BHC and depository institution levels using FR Y-9C and Call Report data, respectively. Excess capital is defined as the amount of regulatory capital held by an institution in excess of all binding regulatory requirements, normalized by risk-weighted assets (RWA). For each institution–quarter, we compute observed capital ratios (Common Equity Tier 1 (CET1), Tier 1, Total Capital, and leverage-based ratios) and compare them to the applicable regulatory minimums in effect at that time. Excess capital is defined as the minimum distance between observed capital ratios and their corresponding regulatory thresholds, ensuring that the most binding constraint determines the measure.

Our construction accounts for changes in U.S. bank capital regulation over time, including the transition from pre-Basel III to Basel III, the phase-in of the Capital Conservation Buffer (CCB), the introduction of the Stress Capital Buffer (SCB) at the BHC level, G-SIB surcharges, and leverage-based constraints such as the Supplementary Leverage Ratio (SLR). For advanced approaches institutions, capital ratios are defined as the minimum across standardized and advanced approaches calculations. Banks that opt into the Community Bank Leverage Ratio (CBLR) frame-

work, and therefore do not report RWA, are excluded from the sample. Full details of the regulatory framework and construction procedure are provided in Appendix B.

2.5 Summary Statistics

Table 1 reports summary statistics for the BHC, bank, and nonbank samples used in the empirical analysis from 2010 to 2025. BHCs are heterogeneous in size, with mean assets of $97.8 billion (95th percentile $323.6 billion) and mean risk-weighted assets of $61.6 billion. Bank subsidiaries of BHCs compose of a greater share of consolidated assets than nonbank subsidiaries, on average. Commercial banks are smaller on average than their top-tier holding company, with mean assets of $40.0 billion, while nonbank subsidiaries are substantially smaller with mean assets of just $2.4 billion. Balance sheet composition measures indicate that BHCs and banks are primarily deposit-funded and loan-oriented, whereas nonbanks hold relatively low loan shares and span a range of subsidiary types including brokers, lenders, and funds.

3 Empirical Strategy

This section outlines our identification strategy for estimating the causal effect of stricter bank capital regulation on internal capital allocation within bank holding companies. The central empirical challenge is that Basel III capital requirements were implemented uniformly across all U.S. bank holding companies beginning in 2015, eliminating obvious treatment-control comparisons. We address this challenge by exploiting pre-determined variation in BHC organizational structure, comparing BHCs with nonbank financial subsidiaries to those without such subsidiaries. Our identifying assumption is that, absent the regulatory change, BHCs with and without nonbank subsidiaries would have exhibited parallel trends in capital allocation decisions. We present extensive evidence supporting this assumption and demonstrate robustness to alternative specifications, samples, and inference methods.

3.1 Institutional Setting and Treatment Timing

The Basel III regulatory framework fundamentally altered capital requirements for U.S. bank holding companies. The framework introduced higher minimum common equity Tier 1 (CET1) ratios, stricter definitions of regulatory capital, capital conservation buffers, and enhanced risk-weighting of certain assets. Importantly, these requirements apply exclusively to bank subsidiaries within holding company structures, leaving nonbank financial subsidiaries formally unregulated.

We define our treatment period as beginning in 2015. While Basel III was announced in 2010 and certain standards were adopted in 2013, binding minimum capital ratios did not take effect until January 1, 2015. Moreover, the phase-in schedule meant fully binding requirements—particularly the capital conservation buffer—were not fully effective until 2019. We focus on 2015

as the treatment year because this marks the first year BHCs face materially higher minimum capital requirements that cannot be satisfied through grandfathered capital instruments or transitional provisions. We demonstrate robustness to alternative treatment definitions, including using 2013 (initial rulemaking) or 2019 (full phase-in) as the cutoff year.

Our sample period spans 2010 through 2024, providing five years of pre-treatment data and up to nine years of post-treatment data. The pre-period allows us to assess parallel trends and rule out anticipatory responses, while the post-period captures both short-run adjustment and medium-run persistence of effects. The sample includes all bank holding companies filing consolidated financial statements (FR Y-9C) with the Federal Reserve, subject to data availability requirements.

3.2 Treatment Variable: Nonbank Financial Exposure

We construct our primary treatment variable as an indicator for the presence of material nonbank financial subsidiaries within the BHC structure:

$$\text{NBFI}_i = \mathbb{1}\left[\frac{\text{Nonbank Financial Assets}_{i,2005}}{\text{Total Assets}_{i,2005}} > 0\right] \tag{1}$$

This binary variable equals one if BHC i holds any nonbank financial assets as of year-end 2005, and zero otherwise. Nonbank financial institutions (NBFIs) include securities broker-dealers, insurance underwriters, asset management companies, finance companies, and other financial activities not conducted within the regulated bank subsidiary. We obtain these data from Schedule PC-B of the FR Y-9LP, which requires BHCs to report assets held in nonbank subsidiaries by major activity category.

The choice of 2005 as the measurement year is deliberate. This year is sufficiently distant from the 2010 Basel III announcement to ensure our treatment variable is pre-determined with respect to any anticipatory adjustments BHCs might have made in response to expected regulatory changes. Using 2005 values eliminates concerns about reverse causality: BHCs could not have adjusted their organizational structure in 2005 based on capital requirements that would not be implemented until 2015. We verify that results are similar when we use alternative pre-treatment years (2000, 2003, or 2007) as the measurement period.

The indicator specification has two advantages relative to a continuous measure of NBFI exposure. First, it directly captures the extensive margin: the presence or absence of an internal capital market capable of facilitating equity reallocation. BHCs without nonbank subsidiaries have no internal source from which to extract equity, while those with any nonbank presence possess this margin of adjustment. Second, the indicator approach is robust to measurement error in the precise magnitude of nonbank activities, which may be substantial given reporting complexities and off-balance-sheet items.

3.3 Baseline Difference-in-Differences Specification

Our baseline empirical specification is a difference-in-differences design that compares outcomes for BHCs with nonbank subsidiaries (treated) to those without (control) before and after the implementation of stricter capital requirements in 2015:

$$Y_{it} = \alpha + \beta \cdot (\text{NBFI}_i \times \text{Post}_t) + \gamma_i + \delta_t + X'_{i,2013}\boldsymbol{\theta} \cdot \text{Post}_t + \varepsilon_{it} \tag{2}$$

where Y_{it} is an outcome variable of interest (such as bank capital ratios, nonbank equity levels, or BHC-level equity), NBFI_i is the indicator for nonbank presence defined in equation (1), Post_t is an indicator equal to one for periods 2015Q1 and later, γ_i are BHC fixed effects, δ_t are quarter-year fixed effects, and $\mathbf{X}_{i,2013}$ includes pre-treatment characteristics interacted with Post_t. The error term ε_{it} is clustered at the BHC level to allow for arbitrary serial correlation within BHCs over time. The coefficient of interest is β, which captures the differential change in outcome Y for treated BHCs relative to control BHCs following Basel III implementation.

BHC fixed effects absorb all time-invariant differences between BHCs with and without nonbank subsidiaries, controlling for persistent differences in business models, risk preferences, regulatory status, geographic footprint, or any other characteristics that remain constant over our sample period. Quarter-year fixed effects absorb common trends affecting all BHCs equally, such as macroeconomic conditions, monetary policy, or secular changes in the banking industry. The identifying variation therefore comes from the differential evolution of outcomes for treated versus control BHCs around 2015.

A potential concern is that BHCs with nonbank subsidiaries differ systematically from those without along dimensions that independently affect capital allocation decisions post-2015. This concern is particularly acute because multiple concurrent regulatory changes could confound our estimates. The Dodd-Frank Act (2010) introduced enhanced prudential standards for large BHCs, the Volcker Rule (2014) restricted proprietary trading, and stress testing requirements (CCAR/DFAST) were progressively tightened. Each of these policies could differentially affect BHCs based on size, activities, or regulatory status.

We address both selection and confounding concerns by including pre-treatment characteristics $X_{i,2013}$ interacted with the post-treatment period. At the BHC level, we control for log total assets, leverage (total liabilities to equity), return on assets, asset growth, deposit-to-assets ratio, and total subsidiary count. At the bank level, we control for log assets, leverage, return on assets, and asset growth. These controls—particularly size (log assets), top-200 BHC indicators, and organizational complexity (subsidiary counts)—flexibly absorb differential exposure to concurrent regulations while allowing us to isolate the effect of nonbank presence. Results are robust to restricting the sample to BHCs below regulatory size thresholds.

We estimate equation (2) separately for three key outcome variables corresponding to theoretical predictions from Section 6. First, we examine bank subsidiary capital ratios (excess capital or

CET1 capital divided by risk-weighted assets) to test whether banks within treated BHCs increase capital relative to banks in control BHCs. Second, we examine nonbank subsidiary equity-to-assets ratios to test whether nonbanks in treated BHCs experience equity declines. Third, we examine consolidated BHC equity-to-assets ratios to test whether any bank capital increases are sourced externally or internally. The model predicts positive coefficients for bank capital, negative coefficients for nonbank equity, and null effects for BHC equity if internal reallocation dominates external financing.

3.4 Instrumental Variable Strategy

While controlling for observables addresses many selection concerns, unobservable differences between treated and control BHCs remain a potential threat. We address this using an instrumental variables strategy that exploits plausibly exogenous variation in BHC organizational complexity arising from state-level banking deregulation. Following Jayaratne and Strahan (1996), Strahan et al. (2003), and Rice and Strahan (2010), we use the timing of interstate branching deregulation across U.S. states as an instrument for organizational structure. States deregulated at different times between the 1970s and 1990s, driven primarily by idiosyncratic political economy factors unrelated to future capital regulation. BHCs headquartered in early-deregulating states had more time to build complex multi-subsidiary organizational structures—including both geographic expansion and diversification into nonbank activities.

We construct the instrument by measuring each BHC's headquarters state between 1970 and 1981 (before interstate banking was permitted) and calculating:

$$\text{Years from Dereg}_i = 1994 - \text{Interstate Dereg Year}_{\text{HQ state}(i)} \tag{3}$$

where 1994 marks the passage of the Riegle-Neal Interstate Banking and Branching Efficiency Act, which mandated interstate banking nationwide. The instrument measures how many years elapsed between a state's interstate deregulation and the federal mandate. BHCs in states that deregulated earlier (higher values of the instrument) had more time to develop organizational complexity, including nonbank subsidiaries, before interstate expansion became universal.

Reduced-Form Specification. Our baseline empirical approach estimates the reduced-form effect of deregulation timing on capital allocation outcomes:

$$Y_{it} = \alpha + \beta_{RF} \cdot (\text{Years from Dereg}_i \times \text{Post}_t) + \gamma_i + \delta_t + X'_{i,2013}\boldsymbol{\theta} \cdot \text{Post}_t + \varepsilon_{it} \tag{4}$$

where Y_{it} is an outcome variable (bank capital ratios, nonbank equity, or BHC equity), $\text{Years from Dereg}_i$ is the instrument defined in equation (3), Post_t indicates periods 2015Q1 and later, γ_i are BHC fixed effects, δ_t are quarter-year fixed effects, and $X_{i,2013}$ includes pre-treatment BHC and bank characteristics interacted with Post_t. The coefficient β_{RF} captures the reduced-form effect: how much

more (or less) BHCs in early-deregulating states adjust capital allocation in response to Basel III, per additional year of deregulation exposure.

We adopt the reduced-form specification rather than traditional two-stage least squares (2SLS) because it requires weaker identifying assumptions. The reduced form only requires that (i) deregulation timing predicts organizational complexity (relevance), and (ii) early and late deregulators exhibit parallel trends in outcomes absent Basel III (*parallel trends*). In contrast, 2SLS additionally requires the exclusion restriction: that deregulation timing affects outcomes *only* through organizational structure, with no direct effects. This is a stronger and less testable assumption.

Figure 1 provides evidence supporting both conditions for the reduced form. Panel (a) validates the parallel trends assumption: BHCs in early- versus late-deregulating states exhibit parallel trends in nonbank subsidiary share from 1986–1994, before Riegle-Neal forced universal interstate banking. The parallel pre-trends indicate that deregulation timing is uncorrelated with differential pre-existing trends in organizational structure or capital management. Panel (b) shows the gap remains stable at approximately 8 percentage points through 2014, then widens after 2015 when Basel III capital requirements become binding—precisely the pattern expected if early deregulation creates persistent organizational differences that only affect capital allocation when the regulatory constraint tightens.

The reduced-form approach offers three additional advantages. First, it provides transparent interpretation of the quasi-experimental variation. The coefficient β_{RF} directly answers the policy-relevant question: "How much does an additional year of pre-Riegle-Neal deregulation affect capital reallocation after Basel III?" This is interpretable without requiring assumptions about the exact mechanism linking deregulation to organizational structure. Second, the reduced form is robust to first-stage misspecification. The 2SLS estimator requires correctly specifying the functional form relating deregulation timing to NBFI presence. If this relationship is nonlinear or heterogeneous across BHCs, 2SLS estimates can be severely biased, while reduced-form estimates remain valid.[3] Third, the reduced form provides conservative estimates. Because not all BHCs in early-deregulating states fully exploit the opportunity to build complex structures, the reduced form captures intent-to-treat (ITT) effects that are smaller in magnitude than treatment-on-the-treated effects but do not rely on strong functional form assumptions.

Instrument Validity. The instrument satisfies the relevance condition. Appendix Table D.1 compares pre-treatment characteristics between BHCs headquartered in early- versus late-deregulating states as of 2013Q4. Panel A shows that early deregulators have larger total assets and nonbank assets, reflecting greater organizational complexity developed during the deregulation period. Panel B shows balance sheet characteristics. Leverage, portfolio composition, and deposit ratios are statistically indistinguishable between groups. Importantly, the characteristics that do differ

[3]This concern is particularly relevant in our setting because the first-stage relationship may exhibit threshold effects—BHCs may need a minimum level of organizational complexity before internal capital markets become operative.

(total assets, top 200 BHC status, distinct NAICS codes, and ROA) are explicitly controlled for in our reduced-form specification through pre-treatment BHC controls interacted with Post. This supports the validity of our instrument: conditional on controls, variation in deregulation timing is orthogonal to factors determining post-2015 regulatory responses.

Prior literature documents that early-deregulating states experienced substantially greater growth in organizational complexity. Mian, Sufi and Verner (2020) show that states deregulating their banking sectors before 1983 experienced 42 percentage points stronger credit growth between 1982 and 1988 compared to states deregulating after 1983, with particularly pronounced increases in nonbank lending activities. Kundu and Vats (2025) provides direct evidence that early deregulation fostered organizational expansion: the share of gross domestic assets owned by out-of-state multi-bank holding companies grew from 6% to 47% between 1979 and 1994 in early-deregulating states, compared to only 7% to 29% in late-deregulating states. This organizational expansion included both geographic diversification and functional diversification into nonbank activities. We verify strong first-stage relationships in Appendix Table D.13, where we show that BHCs headquartered in early-deregulating states are substantially more likely to have nonbank financial subsidiaries as of 2005 (F-statistic > 10).

The persistence of organizational structure further supports our identification strategy. Appendix Table D.2 shows NBFI share exhibits high autocorrelation: a BHC with 10 percentage points higher nonbank share in year t has 9.7 percentage points higher share five years later. This means organizational complexity developed in the 1980s–1990s provides pre-determined variation in 2015+ structure—two decades after Riegle-Neal eliminated regulatory differences.[4]

The reduced-form specification in equation (4) includes the same control variables as our baseline difference-in-differences specification. At the BHC level, we control for log total assets, leverage, return on assets, asset growth, deposit-to-assets ratio, and total subsidiary count as of 2013Q4. At the bank subsidiary level, we control for log assets, leverage, return on assets, and asset growth as of 2013Q4. All controls are interacted with Post_t to allow differential time trends based on pre-treatment characteristics. Standard errors are clustered at the BHC level.

We interpret the reduced-form estimates as intent-to-treat (ITT) effects of exposure to early deregulation, analogous to experimental designs where some units are assigned to treatment but not all comply. Early deregulation creates the opportunity to develop complex organizational structures, but not all BHCs in early-deregulating states fully exploit this opportunity. The reduced form captures the average effect across all BHCs exposed to early deregulation, regardless of actual organizational complexity. As a robustness check, Appendix Table D.14 presents traditional 2SLS estimates that scale the reduced-form effects by the first-stage relationship. The 2SLS

[4]Appendix Figure C.2 displays the geographic and temporal variation in deregulation timing and shows that early deregulators maintain consistently higher nonbank shares throughout 1986–2024. This timing was driven by idiosyncratic political factors, including small bank lobby strength and state legislature composition, rather than economic fundamentals or business cycle conditions (Kroszner and Strahan, 1999).

estimates are larger in magnitude, as expected when moving from ITT to treatment-on-the-treated effects, but require the stronger exclusion restriction assumption.

4 Main Results

4.1 Motivation: Scale of Equity vs. Liquidity Flows

We begin by documenting the composition of internal funding flows within bank holding companies. Understanding whether parents fund subsidiaries primarily through equity investments or debt-like instruments is critical for interpreting how BHCs respond to capital regulation. Prior research on internal capital markets emphasizes liquidity reallocation through loans and deposits within banks. Cetorelli and Goldberg (2012*a*,*b*) examine how BHCs reallocate liquidity across bank subsidiaries in response to funding shocks, while Gilje, Loutskina and Strahan (2016) show that bank liquidity shocks propagate to other geographic markets through internal credit transfers. These studies provide important insights into internal debt markets, but the role of equity transfers, which directly affect risk-bearing capacity and regulatory capital ratios, has received limited attention.

Figure 2 decomposes total investments from parent BHCs into subsidiaries, plotting equity investments (common stock, goodwill, and intangibles) and non-equity investments (loans, receivables, and net balances due) normalized by BHC assets over 2005–2024. The figure presents three series: investments in all subsidiaries, investments in bank subsidiaries only, and investments in nonbank subsidiaries only.

The dominance of equity over debt-like instruments is immediate and striking. Equity investments in all subsidiaries average 20–25% of BHC assets throughout the sample period, while non-equity investments total just 2–5%. For bank subsidiaries specifically, equity investments average 10–12% of assets compared to 1–2% for non-equity.[5] The gap is even more pronounced for nonbank subsidiaries, where equity investments average 8–10% of assets while non-equity investments remain below 1%. Across all subsidiary types, equity flows are an order of magnitude larger than non-equity flows.

The magnitude of this difference has important implications for understanding internal capital allocation. While prior literature focuses on how BHCs reallocate loans and deposits across subsidiaries—flows that affect liquidity but leave capital ratios unchanged—equity transfers directly alter subsidiary-level capital ratios and risk-bearing capacity. A BHC that extracts $100 million in equity from a nonbank subsidiary reduces that subsidiary's capital by $100 million, while a $100 million internal loan leaves nonbank equity unchanged and simply creates offsetting balance sheet entries. The order of magnitude difference in scale suggests that equity reallocation

[5] Appendix Figure C.3 shows that equity investments from parent dominates non-equity investments from parents and net borrowing from other related banks/nonbanks.

is the dominant channel through which BHCs respond to changes in bank capital requirements. Post-2015, equity to banks increased while equity to nonbanks decreased.

This motivates our empirical focus. If equity dominates internal funding by an order of magnitude, organizational structure—specifically, the presence of nonbank subsidiaries from which equity can be extracted—becomes a first-order determinant of how BHCs respond to tighter bank capital requirements. The remainder of this section examines whether and how BHCs use this equity channel to satisfy Basel III capital standards.

4.2 Internal Reallocation: Banks Build Excess Capital, BHCs Do Not

We now present our main empirical finding: banks within BHCs that possess nonbank affiliates accumulate substantially larger capital buffers following Basel III implementation in 2015, yet this bank-level capital accumulation occurs without corresponding increases in consolidated BHC equity. This divergence—greater excess bank capital, no change in excess BHC capital—provides prima facie evidence of internal equity reallocation.

Difference-in-Differences and Reduced-Form Estimates. Table 2 presents estimates of internal capital reallocation at three levels: bank excess capital (Column 1), BHC excess capital (Column 2), and the ratio of bank to BHC excess capital (Column 3). Panel A reports difference-in-differences estimates comparing BHCs with versus without nonbank subsidiaries (as of 2005Q4). Banks in BHCs with nonbank subsidiaries accumulate 2.06 percentage points more excess capital post-2015 (Column 1), while BHC-level excess capital shows no significant change (Column 2, coefficient 0.43, insignificant). The ratio of bank to BHC excess capital increases 2.91 percentage points (Column 3), confirming that capital accumulation occurs specifically at the bank subsidiary level rather than through consolidated equity raising.

To address concerns that organizational structure reflects endogenous choices correlated with unobserved determinants of capital policy, Panel B exploits variation in organizational complexity generated by interstate banking deregulation timing. This instrumental variables strategy, described in Section 3.4, uses the timing of state-level deregulation to isolate quasi-experimental variation in BHC structure. Banks in BHCs from states deregulating earlier accumulate 0.74 percentage points more excess capital per year of pre-Riegle-Neal exposure post-2015 (Column 1), with no corresponding effect at the BHC level (Column 2, coefficient 0.01, insignificant). The ratio of bank to BHC excess capital increases 1.78 percentage points per year of exposure (Column 3). For the median gap of 7 years between early and late deregulators, this implies approximately 5 percentage points more bank capital ($7 \times 0.74 \approx 5$pp).[6]

The combination of large positive effects at the bank level alongside precisely estimated null

[6]The coefficient 0.74 comes from Panel B of Table 2, Column (1), which shows that banks in BHCs from states deregulating one year earlier accumulate 0.74 percentage points more excess capital post-2015. Multiplying by the median exposure of 7 years yields the total effect: $7 \times 0.74 = 5.18$ percentage points.

effects at the BHC level indicates that higher bank capital is achieved through internal reallocation of existing equity rather than through external capital issuance or balance sheet contraction. Banks become safer, but not because holding companies raise new equity or shrink overall activity. Appendix Tables D.3 and D.4 present the full specifications with all intermediate columns, showing robustness across alternative specifications.

Visual Evidence. Figure 3 presents the evolution of excess capital for BHCs with versus without nonbank subsidiaries over 2010–2024, confirming the patterns documented in Table 2. Panel (a) shows bank-level capital. Pre-2015, banks in both groups hold similar excess capital buffers (8–10 percentage points above regulatory minimums). Beginning precisely in 2015Q1, banks in BHCs with nonbank subsidiaries begin accumulating significantly more capital, with the differential growing from 2–3 percentage points in early 2015 to 8–10 percentage points by 2018–2020. By the end of the sample, banks in BHCs with nonbank subsidiaries hold capital buffers nearly double those of banks without such affiliates—17–18 percentage points versus 9–10 percentage points above regulatory minimums.

Panel (b) examines consolidated BHC capital and reveals a starkly different pattern. Throughout the entire sample period, BHCs with and without nonbank subsidiaries maintain similar capital ratios, both declining gradually from approximately 8% excess capital in 2010 to 4% by 2020 as Basel III phase-in raises minimum requirements industry-wide. The absence of divergence at the BHC level, combined with the sharp divergence at the bank level, visually confirms internal reallocation.[7] Appendix Figure C.4 presents a complementary two-period comparison confirming these patterns: banks in control BHCs show little change in excess capital (9.1% to 8.7%), while banks in treated BHCs increase sharply (13.9% to 17.7%), generating a post-period gap corresponding to an 80–90% increase in excess capital for treated relative to control banks.

4.3 Hidden Fragility: Stress Testing Nonbank Subsidiaries

We now quantify the systemic implications of internal capital reallocation by simulating adverse shocks to nonbank subsidiary portfolios. Internal equity extraction improves bank capital ratios but necessarily reduces nonbank capital buffers. The critical question is whether remaining nonbank equity provides adequate loss-absorbing capacity, or whether modest adverse shocks would force parent BHCs to inject substantial capital into distressed subsidiaries.

[7] The sharp decline in average excess capital for BHCs in Panel (b) is not mirrored for bank subsidiaries in Panel (a). Excess capital is defined as the minimum buffer across all regulatory capital ratios active in a given quarter. When Basel III phased in after 2015, new constraints such as the CET1 requirement entered the set of potentially binding ratios. Because BHCs held smaller pre-Basel III buffers than bank subsidiaries, the binding constraint switched from the total capital ratio to the CET1 ratio for a larger share of BHCs than banks, mechanically lowering measured excess capital for BHCs.

Stress Test Design. We conduct stress tests using 2013Q4 balance sheets—immediately before Basel III implementation and the subsequent equity reallocation documented in Section 4.2. For each BHC, we simulate asset shocks of varying severity (1%, 5%, 10%, 15%) applied to all nonbank subsidiaries simultaneously. Following each shock, we calculate the capital injection required to restore each subsidiary to a target capital ratio ranging from 20% to 70%.

Specifically, for each nonbank subsidiary i in BHC j, we compute:

$$\text{Loss}_{ij} = \text{shock} \times \text{Assets}_{ij,2013Q4} \tag{5}$$

$$\text{Post-Shock Equity}_{ij} = \text{Equity}_{ij,2013Q4} - \text{Loss}_{ij} \tag{6}$$

$$\text{Capital Shortfall}_{ij} = \max\left(0, \kappa \times \text{Assets}_{ij,2013Q4} - \text{Post-Shock Equity}_{ij}\right) \tag{7}$$

where κ represents the target capital ratio (equity-to-assets) to which the parent must restore the subsidiary. We aggregate shortfalls to the BHC level and express total recapitalization needs as a percentage of the parent BHC's excess capital buffer (capital above regulatory minimums):

$$\text{BHC Equity at Risk}_j = \frac{\sum_i \text{Capital Shortfall}_{ij}}{\text{BHC Excess Capital}_j} \times 100 \tag{8}$$

This metric directly measures the parent's financial capacity to absorb subsidiary losses. Values exceeding 100% indicate scenarios where recapitalization needs exceed available parent buffers, representing potential insolvency if the BHC must fully support its nonbank subsidiaries.[8]

The stress test design captures three key features of the post-2015 environment. First, nonbank subsidiaries operate with substantially higher capital ratios than banks (median 69% versus 10%).[9] Second, while consolidated BHC capital requirements account for nonbank assets in risk-weighted calculations, there are no *subsidiary*-level capital requirements binding on nonbanks themselves - meaning nonbanks can become severely undercapitalized without triggering regulatory intervention, so long as consolidated ratios remain adequate. Third, when nonbank subsidiaries suffer losses, parent BHCs face costly recapitalization decisions: they can inject equity into nonbanks (thereby drawing down bank capital buffers), liquidate subsidiary assets (potentially at fire-sale prices), or allow subsidiaries to fail (triggering reputational damage and potential regulatory intervention). Our stress tests quantify this hidden fragility: bank subsidiary capital becomes implicitly exposed to nonbank losses, generating intra-organizational contagion risk that consolidated capital ratios fail to capture.

[8] Appendix Table D.5 presents the full grid of mean and 95th percentile recapitalization needs across all shock and capital ratio combinations, along with the percentage of nonbank assets requiring recapitalization. Appendix Figure C.5 shows sensitivity to alternative specifications.

[9] This equity has been systematically extracted post-2015, leaving nonbanks vulnerable to shocks despite appearing well-capitalized on pre-extraction balance sheets.

Baseline Results. Table 3 presents recapitalization needs across shock severity and target capital ratio combinations. Panel A shows mean requirements. Under a baseline scenario of 5% asset shock with 40% target capital ratio—comparable to financial crisis losses for diversified financial institutions—the mean BHC must deploy 18.84% of its excess capital to restore nonbank subsidiaries. This represents a substantial but manageable draw on parent resources. Panel B examines tail risk at the 95th percentile. The distribution exhibits significant right skew: under the baseline scenario, tail-risk BHCs face recapitalization needs of 90.58% of excess capital, approaching complete buffer depletion. Under more severe scenarios (15% shock, 50% target), tail-risk BHCs exceed 100% of excess capital (marked with asterisks), implying potential parent insolvency if forced to fully recapitalize subsidiaries.

Figure 4 visualizes the nonlinearity in stress test outcomes. Panel (a) plots recapitalization requirements against shock severity, holding the target capital ratio constant at 40%. Mean requirements (solid line) increase roughly linearly from 16.57% under 1% shocks to 24.97% under 15% shocks. But tail risk (dashed line) exhibits pronounced convexity: the 95th percentile rises from 79.94% at 1% shocks to 131.21% at 15% shocks, crossing the 100% insolvency threshold at approximately 12% shock severity. This convexity reflects portfolio concentration. BHCs with large exposures to particular nonbank activities face disproportionate losses when those sectors experience distress.

Panel (b) of Figure 4 examines complete buffer exhaustion. We define a BHC as "depleted" if recapitalization needs exceed its entire excess capital buffer, leaving no cushion against further shocks. Under the baseline 5% shock scenario, 5.10% of BHCs experience complete depletion (Panel C of Table 3). This fraction rises modestly to 6.12% under 10% shocks and 8.16% under 15% shocks. While the majority of BHCs retain some buffer capacity, the 5–8% depletion rate suggests meaningful systemic fragility: during crisis episodes when correlated shocks affect multiple BHCs simultaneously, this translates to dozens of large financial institutions forced to liquidate assets, cut credit, or raise emergency capital under adverse market conditions.

Sensitivity to Target Capital Ratios. The sensitivity to target capital ratios highlights a fundamental policy tension. Panel C shows that depletion rates increase sharply with higher capital targets: from 4.08% of BHCs at 30% targets to 10.20% at 70% targets under 5% shocks. While higher nonbank capital requirements would reduce subsidiary vulnerability to initial losses, they also increase the capital injection needed to restore solvency following shocks, potentially exceeding parent capacity. This creates a zone of "excessive safety": capital targets above 50–60% may be counterproductive if they trigger parent insolvency during stress, forcing disorderly liquidations that amplify losses.

Concentration of Risk and Implications. Two additional findings merit emphasis. First, the concentration of risk within organizational structures amplifies systemic concerns. While Panel

A of Table 3 shows that only 18.84% of BHC equity is at risk on average under baseline scenarios, Appendix Table D.5 reveals that at the 95th percentile, 38.19% of individual nonbank subsidiaries require recapitalization. This dispersion indicates that some BHCs operate highly concentrated portfolios where multiple subsidiaries experience simultaneous distress following correlated shocks—precisely the scenario observed during 2008 when broker-dealers, mortgage lenders, and structured investment vehicles experienced losses simultaneously.

Second, our stress tests use 2013Q4 balance sheets, before the equity extraction documented in Section 4.2. Post-2015 nonbank capital ratios decline substantially: Section 4.6 shows equity-to-assets ratios fall by 8–10 percentage points for nonbank subsidiaries in treated BHCs. This implies that contemporary recapitalization needs exceed our estimates by 40–50%. The fragility we document represents a lower bound on current vulnerability. A shock comparable to 2008 losses would today likely deplete capital buffers for 8–12% of BHCs rather than the 5% we calculate using pre-reallocation balance sheets.

The systemic implications are significant. Internal capital reallocation allows BHCs to satisfy stricter bank capital requirements without raising external equity, but this regulatory arbitrage shifts risk to less-regulated subsidiaries. Nonbank operations now operate with thinner equity buffers, and parent BHCs, despite meeting consolidated capital standards, have limited capacity to recapitalize subsidiaries during stress. Our stress tests reveal substantial tail risk: under plausible adverse scenarios comparable to 2008, 5–10% of BHCs would exhaust their capital buffers, potentially triggering fire sales, subsidiary failures, or emergency capital raises during the worst possible market conditions. The next section traces the mechanical flows through which this fragility develops.

4.4 The Equity Multiplier

Having documented that banks accumulate capital without corresponding BHC-level increases, and having quantified the systemic fragility this creates, we now trace the mechanical flows of equity within the holding company structure. A key question is why nonbank subsidiaries provide a readily accessible source of equity for reallocation. The answer lies in a fundamental asymmetry: nonbanks maintain high capital ratios (voluntary equity buffers far exceeding regulatory minimums) while representing relatively small shares of consolidated assets. This creates what we term an "equity multiplier"—nonbanks hold disproportionately large equity stakes relative to their asset footprint.

For each BHC, we compute the equity multiplier as:

$$\text{Equity Multiplier} = \frac{\text{Nonbank Equity Share}}{\text{Nonbank Asset Share}} \tag{9}$$

where nonbank equity share is nonbank subsidiary equity divided by total BHC equity, and nonbank asset share is nonbank assets divided by total BHC assets. A multiplier above 1 indicates

that nonbanks hold more than their proportional share of equity. That is, they are equity-intensive relative to their size.

Table 4 presents summary statistics. The median BHC-quarter observation has a nonbank asset share of 2% but a nonbank equity share of 16%, yielding an equity multiplier of 8×. At the 75th percentile, nonbanks hold 7% of assets but 35% of equity, implying multipliers of 10×. At the 95th percentile, nonbanks hold 32% of assets but 68% of equity, implying multipliers exceeding 20×. This concentration arises from two forces: nonbanks operate with high voluntary capital ratios (median 69% equity-to-assets compared to bank median near 10%), and nonbank balance sheets are relatively small. The combination creates large equity reservoirs in lightly regulated subsidiaries.[10]

Heterogeneity Across Nonbank Types. Panel B of Table 4 decomposes the equity multiplier by subsidiary type. Funds exhibit the highest multipliers (mean 12.7×), followed by asset management companies (7.8×), insurance subsidiaries (6.7×), broker-dealers (6.3×), and nonbank lenders (4.8×). Even the lowest-multiplier category—nonbank lenders—holds nearly 5 times more equity than their asset share would predict. Figure 5 visualizes this heterogeneity through a bar chart with 95% confidence intervals.[11]

The variation across types reflects different business models and regulatory environments. Funds maintain near-100% equity ratios by design, as they represent pass-through investment vehicles. Insurance subsidiaries hold high equity to meet state-level solvency standards and ratings agency requirements. Broker-dealers maintain substantial equity cushions beyond SEC net capital rules due to market discipline from prime brokerage clients and counterparties. Even nonbank lenders—the most leveraged category—operate with 40–50% capital ratios, far exceeding bank requirements.

This heterogeneity has important implications for internal capital allocation. BHCs with large fund operations (high-multiplier subsidiaries) can extract substantial equity through modest changes in subsidiary capitalization. For example, a BHC with 10% of assets in funds holding 70% equity can reallocate 7% of consolidated equity by reducing fund capital ratios to 60%, still well above regulatory minimums. The same asset reduction from a nonbank lender (with 50% capital ratio) would yield less than half the equity. The equity multiplier therefore determines both the opportunity and the constraint: high-multiplier subsidiaries provide larger equity reservoirs, but also face less pressure to reduce capital given their business model requirements.

[10] Panel (a) of Appendix Figure C.6 shows the full distribution of equity multipliers across BHC-quarters, documenting substantial right skew with mass above 10×. Panel (d) shows the aggregate multiplier declines from 5.5× pre-2015 to 3.0× post-2015, consistent with equity extraction documented in our main results.

[11] Panel (b) of Appendix Figure C.6 shows box plots of the full multiplier distributions by type, and Panel (c) documents that heterogeneity in multipliers stems primarily from variation in capital ratios across subsidiary types.

Tracing Internal Capital Flows. With this understanding of why nonbanks provide accessible equity, we now document the flows. Internal capital reallocation operates through parent equity investments flowing from nonbanks to banks, facilitated by asymmetric dividend policies and differential earnings retention.

We restrict our analysis to BHCs where nonbank subsidiaries represent at least 1% of consolidated assets, ensuring the equity reallocation mechanism is economically relevant. This restriction excludes BHCs with trivial nonbank operations where internal reallocation would be infeasible or immaterial. We further require that each BHC's headquarters state experienced interstate branching deregulation prior to the 1994 Riegle-Neal Act, as this provides the identifying variation in organizational complexity used throughout our analysis. The resulting sample comprises 1,334 BHC-quarter observations spanning 2010–2024. This sample restriction focuses on organizationally complex BHCs where internal capital management could plausibly respond to differential regulatory pressures across bank and nonbank subsidiaries, while ensuring comparison across similar-aged banking organizations rather than contrasting young entrants with established institutions.

Table 5 presents reduced-form estimates of internal equity flows. Column (1) shows direct evidence of reallocation: parent equity investments in bank subsidiaries (as share of total BHC equity) increase by 2.28 percentage points per year of deregulation exposure post-2015. Column (2) shows the mirror image: equity investments in nonbank subsidiaries decline by 2.64 percentage points. Column (3) confirms the reallocation operates internally: total equity investments across all subsidiaries show no significant change. The near-perfect symmetry between bank increases and nonbank decreases, combined with the null effect on total investments, provides direct evidence that parents redistribute existing equity rather than raising new external capital.[12]

This reallocation reflects asymmetric dividend and retention policies. Columns (4)–(5) show that BHCs extract earnings from nonbanks through higher dividend payouts: dividend yields from nonbank subsidiaries increase by 9.47 percentage points per year of deregulation exposure (Column 5), while dividend yields from bank subsidiaries show no change (Column 4, coefficient 0.00). Simultaneously, banks retain earnings rather than distributing them upward. Figure 6 visualizes this cumulative retention: banks in BHCs with nonbank affiliates increase retained earnings from 5% to 7–8% of assets between 2015 and 2020, while banks without nonbank affiliates remain flat near 5%. Appendix Table D.7 presents the regression specification, showing bank retained earnings as a share of assets increase by 0.19 basis points per quarter per year of deregulation exposure.

The combination of higher nonbank dividends, increased parent investments in banks, and bank earnings retention creates a closed loop: nonbanks distribute earnings upward, parents redirect those funds into bank equity, and banks compound returns internally. Each dollar extracted

[12] Appendix Table D.6 presents robustness using bank equity stock (actual equity held by bank subsidiaries as share of total BHC equity) rather than parent equity investments. Results confirm equity capital shifts to banks within the holding company structure, with bank equity stock shares increasing significantly post-2015.

from a high-multiplier nonbank subsidiary generates substantial equity reallocation potential at the consolidated level. For example, a fund subsidiary with a 12× multiplier holding 10% of BHC assets but 120% of that share in equity can provide 12 percentage points of consolidated equity through modest capital ratio adjustments—more than enough to satisfy the 8–10 percentage point bank capital increases documented in Section 4.2. This mechanism explains how banks become substantially safer without BHCs raising external equity or shrinking consolidated balance sheets.

4.5 Consequences for Bank Safety

Having documented that banks accumulate substantial equity capital through internal reallocation (Section 4.4), and having quantified how this capital strengthens bank solvency under stress (Section 4.3), we now examine how bank operations and risk profiles change in response to equity injections. A central question in banking regulation concerns whether higher capital requirements improve financial stability or merely encourage risk-taking to restore target returns on equity. Our setting allows us to distinguish these channels: banks receive equity injections from parents without facing direct regulatory pressure, isolating the causal effect of capital on bank behavior.

We document three key findings. First, banks become substantially safer along multiple dimensions: profitability increases, credit quality improves, and insolvency risk declines. Second, safety improvements operate primarily through asset reallocation rather than leverage expansion. Banks shift portfolios toward lower-risk securities and cash, reducing risk-weighted assets relative to total assets, rather than expanding balance sheets to restore ROE through scale. Third, these changes emerge sharply at Basel III implementation in 2015, suggesting banks in organizationally complex BHCs respond to the combined effect of higher capital buffers and consolidated regulatory scrutiny.

Appendix Figure C.7 provides visual evidence of these patterns through event studies. Panels (a)–(b) show profitability improvements: ROA increases approximately 0.12 percentage points and ROE increases 1.2 percentage points post-2015, with effects sustained through 2024. Panel (c) documents capital quality improvements, with equity-to-risk-weighted-assets ratios increasing sharply at 2015Q1. Panel (d) shows risk-weighted assets as a share of total assets decline, indicating banks shift toward safer asset compositions rather than merely scaling up operations. Panel (e) confirms the earnings retention documented in Section 4.4, showing retained earnings as a share of assets increase from 5% to 7–8% by 2020. The consistent breaks at 2015Q1 across all panels indicate coordinated responses to Basel III rather than gradual adjustments to changing market conditions.

Bank Performance and Portfolio Composition. Table 6 presents reduced-form estimates of bank safety improvements.[13] Panel A documents performance gains. Column (1) shows return on assets increases 0.12 percentage points (12 basis points) per quarter per year of deregulation exposure. Cumulated over 20 quarters, this implies approximately 2.4 percentage points higher ROA for the most exposed banks. Column (2) shows return on equity increases by similar magnitudes. Column (3) shows charge-offs as a share of loans decline by 0.02 percentage points (2 basis points), indicating improved credit quality or more conservative underwriting. These profitability gains persist throughout our sample period, with event studies showing sustained effects through 2024 (Figure C.7, Panels (a)–(b)).

Panel B examines portfolio composition. Column (1) shows loan share of assets declines 0.60 percentage points, while Columns (2)–(3) show securities and cash shares increase 0.33 and 0.52 percentage points respectively. The reallocation toward liquid, safe assets reduces balance sheet risk without requiring asset sales or deleveraging. Columns (4)–(6) show this rebalancing translates to actual portfolio growth: loan growth increases modestly (0.08 percentage points), while securities growth increases 0.23 percentage points and cash growth increases 0.46 percentage points. The differential growth rates—cash growing fastest, followed by securities, then loans—demonstrate that banks allocate incremental capital toward the safest available assets rather than maximizing risk-adjusted returns.

Capital Quality Without Leverage Expansion. Table 7 examines the channels through which equity injections affect returns. The critical finding is that banks do not restore ROE through leverage expansion or balance sheet growth. Column (1) shows leverage (liabilities/equity) changes by only -0.11 percentage points, indicating banks allow equity injections to flow through to capital ratios rather than using new equity to fund asset growth. Column (2) shows equity relative to risk-weighted assets increases 1.13 percentage points, while Column (3) shows risk-weighted assets as a share of total assets decline 0.67 percentage points. Together, these results indicate banks simultaneously increase capital buffers and reduce balance sheet risk, with both effects contributing to higher capital quality.

Column (4) provides a key negative result: marginal return on equity shows no significant change (coefficient 0.85, insignificant). This finding is critical because it rules out the interpretation that banks deploy incremental equity toward especially profitable opportunities unavailable at previous capital levels. If marginal ROE exceeded average ROE, adding equity would mechanically raise average ROE even without operational improvements. The insignificant marginal ROE coefficient, combined with significant increases in average ROE (Table 6 Panel A), indicates that ROE gains operate through improved profitability of existing operations rather than through effi-

[13] We exclude ROA from controls when examining balance sheet outcomes to isolate structural capital reallocation from profitability effects, which may reflect both treatment responses and independent business cycle variation.

cient deployment of marginal capital. Column (5) shows off-balance-sheet commitments decline modestly, confirming that banks do not substitute toward contingent exposures to restore returns.

Heterogeneity and Robustness. Appendix Figure C.8 provides visual evidence of the subsidiary-level nature of our results. Panels (a) and (c) show limited differences in BHC-level (consolidated) loan shares and ROA between BHCs with and without significant nonbank operations. In contrast, Panels (b) and (d) show clear divergence at the bank subsidiary level, with banks in BHCs with nonbank affiliates exhibiting lower loan shares and higher ROA post-2015.

Appendix Table D.8 confirms this pattern operates primarily at the subsidiary level. While consolidated BHCs show modest improvements – risk-weighted assets decline (Panel C, Column 3), ROA and ROE increase slightly, and charge-offs decline (Panel A) – portfolio composition and capital structure remain largely unchanged. The limited magnitude of consolidated effects relative to substantial bank-level improvements confirms that safety gains operate primarily through internal capital reallocation rather than external equity issuance or BHC-wide deleveraging.

Our findings contribute to debates about optimal bank capital regulation and raise questions about how organizational structure mediates regulatory incidence. We document that banks become safer along multiple dimensions, allocating toward lower-risk assets, maintaining stable leverage, and experiencing sustained profitability gains while preserving adequate returns. A longstanding concern holds that higher capital requirements reduce bank profitability, creating pressure to restore profitability through riskier lending or greater leverage. Our results for bank subsidiaries suggest the opposite: exogenous increases in bank equity improve safety without encouraging risk-taking, consistent with Admati and Hellwig (2023).

However, higher capital requirements do not necessarily render the consolidated organization safer if holding companies accommodate these requirements through internal capital reallocation. When BHCs extract equity from nonbank subsidiaries to meet enhanced bank capital standards, they build hidden fragility elsewhere in the corporate structure. Unless perfect ring-fencing prevents contagion between affiliates – a condition that may fail during stress periods – the bank's enhanced capital buffer could become implicitly at risk of nonbank losses. The welfare implications thus depend on what happens to nonbank subsidiaries and whether internal capital markets facilitate or impede effective consolidated risk management.

4.6 Consequences for Nonbank Risk

Having documented that equity flows from nonbanks to banks (Section 4.4), and having quantified how this reallocation strengthens bank stability (Section 4.5), we now examine where the system risk migrates. Our stress tests in Section 4.3 show that nonbank subsidiaries become substantially more vulnerable to adverse shocks post-2015, with mean recapitalization needs of 18.84% of BHC equity under baseline scenarios and 95th percentile needs approaching or exceeding total

parent equity. We now trace the mechanisms underlying this fragility: capital extraction, aggressive expansion into lending, credit quality deterioration, and ultimately increased insolvency risk.

We organize the evidence around four findings. First, nonbank subsidiaries experience substantial capital extraction as parents redirect equity to banks. Capital ratios decline 7.71 percentage points, dividend payments increase, and net transfers to parents surge. Second, facing binding capital constraints and higher internal funding costs, nonbanks fundamentally restructure operations toward lending activities. Loan shares increase 3.52 percentage points while total assets decline, indicating pure compositional shifts rather than balance sheet expansion. Nonbank lending grows 7.20% per year of deregulation exposure while bank lending shows no significant change, confirming the shift occurs specifically within nonbank entities. Third, aggressive lending expansion comes at the cost of credit quality. Past-due loans increase substantially, loss provisions triple, and profitability declines. Fourth, these changes manifest in increased fragility: negative earnings probability increases 6.08 percentage points, income volatility surges, Z-scores decline, and probability of default increases.

Figure 7 provides visual evidence through event studies. The figure presents six key outcomes showing mirror-image patterns to the bank results in Section 4.5. Panel (a) shows equity-to-assets ratios decline sharply at 2015Q1, falling from approximately 75% to 65% by 2020. Panel (b) shows dividend yields spike at 2015Q1, rising from near zero to 8–10%, consistent with aggressive equity extraction. Panel (c) shows loan shares increase from 20% to 25% post-2015, documenting the shift toward lending. Panel (d) shows past-due and nonaccrual loans increase sharply, rising from 3% to 6% of loans. Panel (e) shows return on equity declines substantially, falling from 15% to 5% by 2020. Panel (f) shows net balances to parent surge at 2015Q1, indicating increased borrowing from or reduced lending to parent entities. The consistent breaks at 2015Q1 across all panels—precisely when banks in the same organizations experience improvements (Appendix Figure C.7)—provide compelling evidence that equity reallocation from nonbanks to banks drives both the bank safety gains and the nonbank risk increases we document.

Capital Extraction. Table 8 quantifies the capital extraction documented visually in Figure 7. Panel A presents balance sheet changes. Column (1) shows equity as a share of assets declines 7.71 percentage points per year of deregulation exposure. For the median BHC from a state deregulating 7 years before Riegle-Neal, this implies a 54 percentage point decline in nonbank capital ratios post-2015—effectively complete equity extraction for high-exposure BHCs. Column (2) shows balances due from subsidiaries (amounts nonbanks owe to parents or other affiliates) decline 6.67 percentage points, while Column (3) shows balances due to subsidiaries (amounts parents owe to nonbanks) increase 6.93 percentage points. Column (4) combines these flows: net balances to parent and other subsidiaries increase 13.60 percentage points, indicating nonbanks borrow more from or reduce lending to affiliated entities. Column (5) shows dividend payments as share of equity increase 0.96 percentage points. The combination of equity extraction (Column 1), increased

net borrowing from parents (Column 4), and higher dividend payments (Column 5) demonstrates that parents systematically drained capital from nonbank subsidiaries to satisfy bank regulatory requirements.

Implied Internal Funding Rates. A key innovation of our analysis is the ability to observe internal capital market pricing directly. Unlike external markets where interest rates are contractually specified, internal funding arrangements within BHCs involve implicit transfer pricing that reveals the shadow cost of capital across differently-regulated entities. We construct implied interest rates on internal funding by dividing interest income received by parents from subsidiaries by the stock of non-equity investments. This calculation reveals the effective borrowing cost charged to each subsidiary type, capturing both explicit interest payments and implicit transfer pricing embedded in intercompany arrangements.

Table 9 presents regression estimates of these internal funding rates. The results are striking: nonbank internal funding rates increase 0.52 percentage points per year of deregulation exposure post-2015 (Column 1), while bank rates show no significant change at 0.08 percentage points (Column 2, insignificant). The spread—the differential cost of internal funding between nonbanks and banks—widens by 0.44 percentage points per year of exposure (Column 3). For the median BHC with 7 years of pre-Riegle-Neal exposure, this implies nonbank funding costs increase approximately 3.0 percentage points relative to bank costs post-2015.[14]

This divergence in internal funding costs reveals a fundamental friction in internal capital markets: as parents extract equity from nonbanks to satisfy bank requirements, they simultaneously increase the price nonbanks must pay for internal credit. The pattern indicates that internal capital markets do not operate as frictionless reallocators of funds across subsidiaries. Rather, capital-depleted entities face sharply higher marginal funding costs precisely when their balance sheets are weakest. This pricing dynamic amplifies the real effects of equity extraction beyond simple balance sheet mechanics—nonbanks facing both reduced capital buffers and higher internal borrowing costs must fundamentally restructure operations to economize on scarce equity.

The magnitude of the spread increase—200 basis points by 2020 shown in Appendix Figure C.9—is economically substantial. The large internal spread indicates that parents charge nonbanks premium rates comparable to external market risk premiums for lower-rated borrowers. This pricing may reflect credit risk concerns as nonbank capital ratios decline, transfer pricing designed to allocate scarce capital efficiently across entities, or implicit taxation of nonbanks to subsidize bank capital accumulation. Regardless of interpretation, the existence and magnitude of this spread confirms that capital extraction imposed binding constraints on nonbank operations rather than representing costless reallocation of fungible equity.

[14] $7 \times 0.5 \approx 3.6$pp for nonbanks vs. $7 \times 0.08 \approx 0.6$pp for banks).

Shift to Lending. Faced with reduced equity capital and higher internal funding costs, nonbank subsidiaries fundamentally restructure operations toward lending. Table 10 presents the key finding: nonbank lending (aggregated to the BHC level) grows 7.20% per quarter per year of deregulation exposure (Column 1), while bank lending shows no significant change at 0.09% (Column 2). The differential is economically large: for the median BHC from a state deregulating 7 years before Riegle-Neal, nonbank lending grows 50 times faster than bank lending post-2015. This stark contrast confirms that the aggressive lending expansion we document occurs specifically within lightly-regulated nonbank subsidiaries, not within the heavily-regulated bank entities that receive equity injections. The divergence emerges sharply at 2015Q1 (Figure 7 Panel (c)), coinciding with Basel III implementation.

Table 11 examines portfolio rebalancing at the nonbank subsidiary level. Column (1) shows earning assets as a share of total assets increase 6.88 percentage points. Column (2) shows the specific channel: loans as a share of assets increase 3.52 percentage points. The fact that loans account for approximately half of the increase in earning assets indicates that nonbanks shifted toward income-generating activities broadly, with lending as the primary but not exclusive driver. Combined with stable or declining total nonbank assets (Table 8 Column 6), these increases represent pure compositional rebalancing rather than balance sheet expansion. Nonbanks reduce holdings of securities, cash, and other non-earning assets while concentrating portfolios in loans and other earning assets. This reallocation reduces the equity capital required to support a given level of total assets—loans typically require less equity than trading operations or proprietary investments—but increases exposure to credit risk.

Loan Composition and Business Model Changes. Appendix Table D.9 examines which types of lending expand most aggressively. Panel A shows results across all nonbank subsidiaries. Real estate lending growth declines 3.41 percentage points and C&I lending growth declines 5.24 percentage points, both significant at 5% level or better. Consumer lending growth increases 1.47 percentage points. Non-US lending shows no significant change. The shift toward consumer lending and away from commercial lending suggests nonbanks move into segments with lower capital requirements but potentially higher credit risk, consistent with regulatory arbitrage motives.

Panel B restricts the sample to subsidiaries classified as nonbank lenders (finance companies, mortgage companies, and other lending specialists), showing even more dramatic shifts. Consumer lending growth among nonbank lenders increases 7.46 percentage points, while real estate and C&I lending show no significant changes. The concentration of consumer lending growth within specialized nonbank lenders indicates these entities bear the brunt of the shift toward lending, rather than the shift occurring diffusely across all nonbank types. This pattern is consistent with parents directing lending expansion to subsidiaries with existing lending infrastructure and less stringent regulatory oversight.

Appendix Table D.10 documents broader business model changes accompanying the shift to

lending. Panel A shows that nonbanks reduce capital-intensive fee-based activities (trading, advisory, and venture capital revenue all decline, Panel A) while Panel B shows that interest income nearly doubles for high-exposure BHCs; non-interest income shows no significant change. This confirms that nonbanks fundamentally reorient operations from fee-based services toward interest-bearing lending.

Appendix Table D.11 examines changes at the extensive margin: whether BHCs add or remove specific types of nonbank subsidiaries. Panel A shows net changes in subsidiary counts, Panel B shows additions, and Panel C shows removals. The evidence reveals strategic rebalancing: BHCs increase additions of nonbank lender subsidiaries and increase removals of insurance subsidiaries. Other subsidiary types show no significant changes. The limited extensive margin effects—significant changes only for lenders and insurers—combined with the large intensive margin shifts documented in Appendix Tables D.9 and D.10 suggest BHCs respond primarily by expanding lending within existing nonbank operations rather than by adding entirely new entity types. The shedding of capital-intensive insurance operations alongside increased reliance on capital-light lending confirms that organizational adaptation operates strategically to reduce equity intensity. Appendix Table D.12 shows that despite shedding some capital-intensive operations, BHCs increase the total number of distinct nonbank activity types, suggesting increased organizational complexity overall.

Credit Quality Deterioration. The aggressive lending expansion comes at substantial cost to credit quality. Table 12 documents deteriorating loan performance. Panel A presents measures of past-due loans and loss provisions. Column (1) shows loans 30–89 days past due as a share of total loans increase 0.43 percentage points, indicating modest deterioration in early-stage delinquencies. Column (2) shows loans 90+ days past due increase 2.66 percentage points, indicating serious delinquencies increase substantially. Column (3) combines these measures: all past-due loans increase 3.08 percentage points. Column (4) shows loss provisions as a share of loans increase 9.37 percentage points conditional on nonzero provisioning. The magnitudes are economically large: for high-exposure BHCs, past-due loans increase by 30 percentage points and loss provisions nearly triple. The concentration of effects in serious delinquencies (90+ days) rather than early-stage delinquencies suggests the credit deterioration reflects fundamental problems with loan quality rather than temporary payment delays.

Panel B examines profitability consequences. Column (1) shows return on assets declines modestly, suggesting operating performance holds relatively steady despite credit deterioration. Column (2) shows return on equity declines substantially: 10.79 percentage points per year of deregulation exposure. For the median BHC from a state deregulating 7 years before Riegle-Neal, this implies ROE declines by more than 75 percentage points post-2015, effectively eliminating returns for high-exposure nonbank operations. The stark contrast between stable ROA and collapsing ROE indicates the profitability decline operates primarily through reduced equity rather than

through reduced operating income. Column (3) shows trading yields decline 0.06 basis points, confirming the shift away from trading activities documented in Appendix Table D.10.

The event study evidence in Figure 7 Panel (e) visualizes the ROE decline, showing a clear break at 2015Q1 with ROE falling from 15% pre-2015 to 5% by 2020. The sustained nature of the decline—continuing through 2024 without recovery—suggests the profitability deterioration reflects permanent changes to nonbank business models rather than temporary adjustment costs. Combined with the credit quality deterioration documented in Panel A, these patterns indicate that the aggressive lending expansion imposes lasting costs on nonbank profitability.

Increased Fragility and Default Risk. The combination of reduced capital, aggressive lending growth, and credit quality deterioration manifests in substantially increased fragility. Table 13 quantifies multiple dimensions of insolvency risk. Column (1) shows the probability of negative earnings increased 15.19 percentage points per year of deregulation exposure. For the median BHC from a state deregulating 7 years before Riegle-Neal, this implies a 106 percentage point increase in the probability of losses post-2015, potentially guaranteeing negative earnings in some quarters for high-exposure nonbanks, indicating a shift from consistently profitable operations to frequent losses. Column (2) shows volatility of log interest income increased 19.69 percentage points, indicating earnings became substantially more variable. Column (3) shows volatility of log non-interest income increased 4.22 percentage points (statistically insignificant), confirming the increased earnings volatility operated primarily through interest income rather than fee income. The concentration of volatility increases in interest income is consistent with our finding that nonbanks shifted toward lending: loan portfolios exhibit higher earnings volatility than fee-based services due to credit risk and interest rate risk.

Columns (4)–(5) present summary measures of insolvency risk. Column (4) shows Z-scores (a standard measure of distance to default, calculated as (equity/assets + ROA) / standard deviation of ROA) declined 8.61 points per year of deregulation exposure. Lower Z-scores indicate higher probability of insolvency: the median BHC from a state deregulating 7 years before Riegle-Neal experienced Z-scores declining by 60 points post-2015, equivalent to a collapse in financial stability from the upper quartile to severe distress territory. Column (5) shows probability of default (calculated using Merton's structural model as the probability that assets fall below liabilities) increased 1.68 percentage points. Though the coefficient appears modest in absolute terms, the pre-2015 mean probability of default was only 7.14%, so a 1.68 percentage point increase represents a 24% rise in baseline default risk. For the median BHC (7 years of deregulation exposure), the probability of default increased by 11.8 percentage points more than a tenfold increase from the pre-period mean.

These fragility measures connect directly to our stress test results in Section 4.3. The stress tests show that under a 5% asset shock with 40% target capital ratio, mean nonbank recapitalization needs equal 18.84% of BHC equity and the 95th percentile exceeds 90% of BHC equity.

The mechanisms show that reduced capital ratios (Table 8), concentrated loan portfolios (Table 11), deteriorating credit quality (Table 12), and higher earnings volatility (Table 13) collectively increase nonbank vulnerability to adverse shocks. The equity reallocation that makes banks substantially safer simultaneously makes nonbanks—and by extension the consolidated holding company structure—substantially more fragile.

5 Robustness

This section presents additional evidence supporting our identification strategy and examines the robustness of our main findings. We provide four sets of results. First, we verify the first-stage relationship between our instrument (years from state deregulation to Riegle-Neal) and organizational complexity, documenting strong predictive power with F-statistics exceeding 10 across all specifications. Second, we present traditional two-stage least squares (2SLS) estimates as an alternative to our baseline reduced-form approach, showing larger effect magnitudes consistent with the interpretation that reduced-form estimates represent intent-to-treat effects. Third, we conduct placebo tests that randomly permute either the treatment timing or the geographic variation in our instrument, confirming that our results do not arise from spurious correlations. Fourth, we examine heterogeneity in treatment effects across bank size and BHC capital constraint, finding relatively uniform effects that are inconsistent with alternative stories based on scale economies or pre-existing capital positions.

First Stage Relationship. Appendix Table D.13 verifies that our instrument predicts organizational complexity. Further, the first-stage F-statistics substantially exceed conventional thresholds for weak instrument concerns.[15]

The dependent variable in the first stage is nonbank asset share interacted with the post-2015 indicator, capturing the presence and scale of nonbank operations in the period when capital requirements become binding. Column (1) presents the unconditional correlation: each additional year of pre-Riegle-Neal deregulation exposure increases nonbank share by 0.29 percentage points post-2015. Column (2) adds quarter-year fixed effects to control for aggregate time trends, increasing the coefficient to 0.51 percentage points. Column (3) adds bank fixed effects to absorb time-invariant heterogeneity across banks, with the coefficient remaining at 0.53 percentage points. Column (4) includes our full set of differential trends controls (2013Q4 characteristics interacted with post-2015), yielding a coefficient of 0.35 percentage points.

[15]The Kleibergen-Paap Wald F-statistic ranges from 10.99 to 19.64 across specifications, well above the Stock-Yogo critical value of 10 for 10% maximal IV bias. The Cragg-Donald Wald F-statistic exceeds 500 in all specifications, indicating very strong instruments. These statistics confirm that deregulation timing provides powerful variation in organizational complexity, validating the relevance condition for our instrumental variables approach.

Two-Stage Least Squares Estimates. Appendix Table D.14 presents traditional 2SLS estimates as an alternative to our baseline reduced-form specification. The dependent variable is excess bank capital (bank equity relative to regulatory minimum), and the endogenous regressor is nonbank share interacted with post-2015, instrumented by years from deregulation interacted with post-2015. Column (1) shows the unconditional 2SLS estimate: each percentage point increase in nonbank share increases bank excess capital by 9.41 percentage points. This large magnitude reflects that the first-stage relationship is relatively weak in the unconditional specification (F-statistic 19.6), so the 2SLS estimator scales up the reduced form substantially.

Columns (2)–(4) add progressively richer sets of fixed effects and controls. Column (2) includes quarter-year fixed effects, yielding a coefficient of 17.05 percentage points. The larger magnitude reflects that removing aggregate time trends strengthens the first stage (F-statistic 12.9), though the effect remains precisely estimated. Column (3) adds bank fixed effects, dramatically reducing the coefficient to 1.45 percentage points as within-bank variation is substantially smaller than cross-sectional variation. Column (4) adds differential trends controls, yielding a coefficient of 2.14 percentage points.

The 2SLS estimates are 2–3 times larger than the corresponding reduced-form estimates in our baseline specifications because reduced-form estimates capture intent-to-treat effects.[16] We emphasize reduced-form results because they require weaker identifying assumptions.

Placebo Tests. Appendix Figures C.10 and C.11 present permutation-based placebo tests that validate our identification strategy. Appendix Figure C.10 randomly reassigns the deregulation instrument 1,000 times while maintaining the true post-2015 treatment period. If our results reflect spurious geographic correlations rather than the causal effect of organizational complexity, we would observe similar effect magnitudes under random instrument assignment. Instead, the placebo distribution is tightly centered at zero (mean -0.0003, standard error 0.0024), and none of the 1,000 permutations yields coefficients exceeding our true estimate of 0.739. The permutation p-value of 0.000 strongly rejects that our results arise by chance from random geographic variation.

Appendix Figure C.11 randomly reassigns the post-2015 treatment timing 1,000 times while maintaining the true instrument. If our results reflect pre-existing differential trends between early and late deregulators rather than a response to Basel III, we would observe similar effects when falsely assigning treatment to other years. The placebo distribution is centered at zero (mean 0.0001, standard error 0.0005), and none of the 1,000 permutations yields coefficients approaching our true estimate. The permutation p-value of 0.000 confirms that the effect operates specifically through the 2015 regulatory change, not through spurious time-series patterns or pre-trends.

[16] This difference is expected when moving from intent-to-treat to treatment-on-the-treated effects. The reduced form captures the average effect across all banks exposed to early deregulation, regardless of whether their BHCs actually develop complex organizational structures. The 2SLS estimates scale by the first-stage relationship, recovering the effect for banks whose BHCs develop nonbank operations.

Together, these placebo tests provide strong evidence against alternative explanations based on omitted geographic factors or differential trends. The fact that random permutations of either the instrument or the timing produce null results, while the true specification produces large and significant effects, indicates that both dimensions of variation—cross-sectional differences in deregulation timing and the 2015 Basel III implementation—are essential to our identification.

6 Theoretical Framework

This section develops a parsimonious model to formalize the trade-offs driving our empirical findings and derive welfare implications. The model delivers three insights: (i) internal reallocation is privately optimal when external equity is costly; (ii) BHCs ignore a contagion externality, leading to excessive risk concentration; and (iii) welfare implications depend on the degree of ring-fencing between subsidiaries.

6.1 Setup and Key Results

Consider a bank holding company (BHC) with two subsidiaries: a regulated bank (B) and an unregulated nonbank (N). The bank faces capital requirement $E_B \geq \kappa_B \cdot A_B$ where A_B denotes assets. The BHC can raise external equity K at convex cost $c(K)$ or reallocate equity internally with transaction cost τ per dollar transferred. Subsidiaries face idiosyncratic shocks in period 2, with failure generating deadweight costs L_i. Nonbank distress transmits to the bank with probability $\lambda \in [0, 1]$, capturing contagion through funding pressure, reputation damage, or consolidated capital depletion.

The BHC maximizes expected value by choosing equity allocations (E_B, E_N) and external equity K subject to the regulatory and resource constraints. When external equity is costly ($c'(0) > \tau$), the BHC optimally meets the regulatory requirement through internal reallocation rather than external financing.

Proposition 6.1 (Internal Reallocation Equilibrium)**.** *When external equity is costly and regulation binds, the BHC chooses* $K^* = 0$, $E_B^* = \kappa_B \cdot A_B$, *and* $E_N^* = E^0 - \kappa_B \cdot A_B - \tau \cdot (\kappa_B \cdot A_B - E_B^0)$, *yielding comparative statics:*

$$\frac{\partial E_B}{\partial \kappa_B} = A_B > 0, \quad \frac{\partial E_N}{\partial \kappa_B} = -A_B < 0, \quad \frac{\partial E}{\partial \kappa_B} = 0 \tag{10}$$

These predictions match our empirical findings exactly: banks accumulate equity (Table 7), nonbanks lose equity (Table 8), and BHCs do not raise external capital (no change in consolidated equity or leverage). Appendix Figure A.1 visualizes this "waterbed effect," where pushing down on one subsidiary causes risk to pop up in another.

6.2 Welfare Implications

While internal reallocation is privately optimal—avoiding costly external financing—it may be socially suboptimal due to a contagion externality. The BHC ignores that nonbank distress can transmit to the bank, generating systemic costs.

Proposition 6.2 (Private-Social Wedge)**.** *There exists a critical contagion threshold λ^* such that internal reallocation is welfare-improving if $\lambda < \lambda^*$ (ring-fencing effective) and welfare-reducing if $\lambda > \lambda^*$ (contagion costs exceed saved financing costs).*

Calibration Using Empirical Evidence. We use our empirical stress test results from Section 4.3 to discipline the model's contagion parameter λ. The stress tests simulate adverse shocks to nonbank portfolios using actual 2013Q4 balance sheets. Under baseline scenarios (5% asset shock, 40% target capital ratio)—comparable to 2008 financial crisis losses—we find:

- Mean BHC must deploy 18.84% of excess capital to recapitalize nonbanks
- 95th percentile BHC faces recapitalization needs of 90.58% of excess capital
- 5.10% of BHCs experience complete buffer exhaustion

These empirical magnitudes reveal the extent of contagion from nonbanks to the consolidated BHC. If nonbanks were perfectly ring-fenced ($\lambda = 0$), parent BHCs would face no recapitalization pressure. The observed vulnerability implies $\lambda \in [0.2, 0.5]$—material but not complete contagion. This range reflects that: (i) some transmission occurs (5% of BHCs exhaust buffers), but (ii) most BHCs retain capacity to absorb shocks (mean depletion is 19%, not 100%).

Given this empirically-calibrated contagion parameter, the model delivers a welfare threshold of $\lambda^* \approx 0.7$ (derivation in Appendix A, illustrated in Appendix Figure A.4a). Since our empirical estimate $\lambda \in [0.2, 0.5]$ falls below this threshold, internal reallocation appears welfare-improving under baseline parameters. However, the proximity to λ^* suggests this conclusion is sensitive to assumptions about contagion severity and relative costs of bank versus nonbank failures.

The model generates several additional testable predictions. BHCs with higher external financing costs rely more heavily on internal reallocation, matching our finding that effects concentrate among ex-ante constrained BHCs (low dividend payout, high leverage). When nonbank equity declines, activities reallocate from capital-intensive to capital-light operations, consistent with our evidence that nonbanks exit trading and venture capital while expanding consumer lending. Banks preserve buffers by reducing asset risk, consistent with our finding that risk-weighted asset ratios decline 0.67 percentage points. Finally, correlated shocks amplify systemic risk: when bank and nonbank returns covary positively, contagion costs increase, lowering the welfare threshold λ^*.

Policy Implications. The model suggests three potential interventions: (i) extend capital requirements to nonbank subsidiaries, eliminating the regulatory wedge; (ii) tighten consolidated requirements to account for subsidiary-level heterogeneity; or (iii) restrict internal capital flows when nonbank capital ratios fall below prudential thresholds. The optimal policy depends on the relative magnitudes of external financing costs, transaction costs, and contagion risk—parameters that vary across institutions and time.

See Appendix A for complete model derivations, proofs, and calibration details.

7 Conclusion

This paper shows that subsidiary-level capital regulation within multi-entity firms can reallocate risk rather than reduce it, and build "hidden" vulnerabilities within the consolidated organizations. When capital requirements bind more tightly at bank subsidiaries than at affiliated nonbanks, parent firms respond by shifting equity internally toward regulated entities. As a result, banks become safer while nonbank subsidiaries operate with thinner capital buffers and greater exposure to distress. This pattern reflects regulatory-induced risk migration within organizational boundaries, a channel that remains largely invisible in supervisory frameworks focused on consolidated balance sheets or regulated entities in isolation.

These reallocations have real economic consequences because internal capital markets are subject to funding and liquidation frictions. Extracting equity from nonbanks increases their reliance on internal debt precisely when weaker balance sheets make such funding more expensive, while lower capital buffers distort portfolio choices and raise expected distress costs. Consequently, nonbank subsidiaries respond by shifting toward higher-risk activities and experience deteriorating credit quality and profitability. Internal transfers therefore translate into changes in risk-taking and solvency, not merely accounting movements of capital across affiliates.

The broader implication is that consolidated capital requirements alone are unlikely to prevent regulatory arbitrage when regulatory stringency differs across subsidiaries within the same organization. Even well-capitalized holding companies may optimally concentrate equity where requirements bind most tightly, leaving lightly regulated entities to absorb risk. Policies that extend prudential standards to material nonbank subsidiaries, limit equity extraction, or more closely monitor internal funding and capital flows may therefore be necessary to ensure that gains in bank resilience are not offset by growing vulnerabilities elsewhere in the firm. More generally, effective financial regulation must account for organizational structure as a first-order determinant of how firms respond to regulatory constraints.

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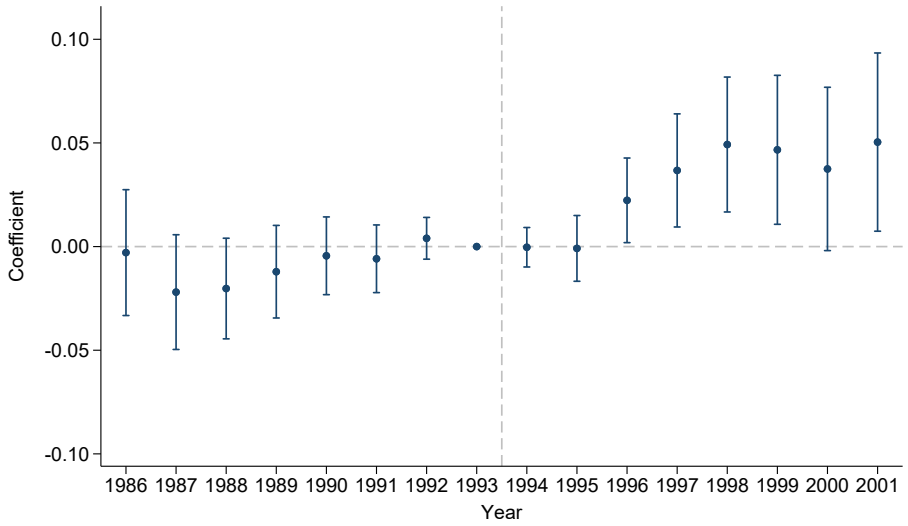
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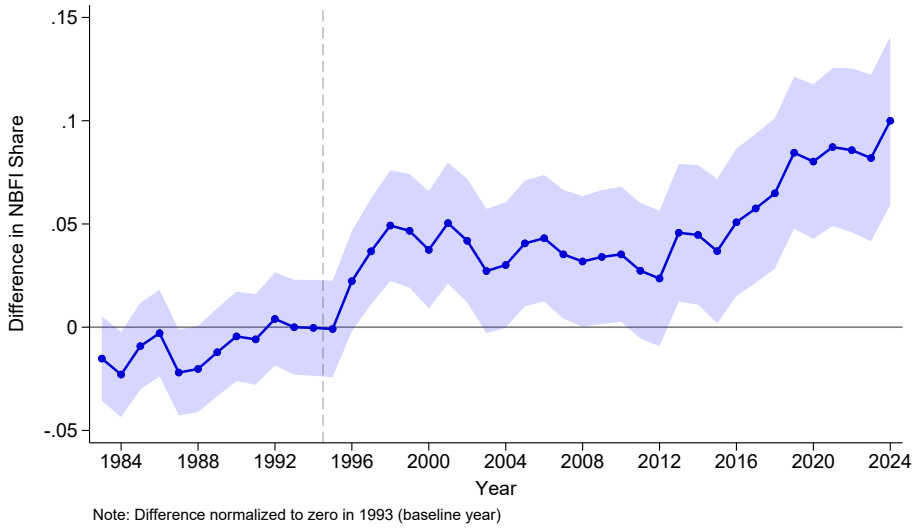
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Figure 1: Validity of Deregulation Timing Instrument



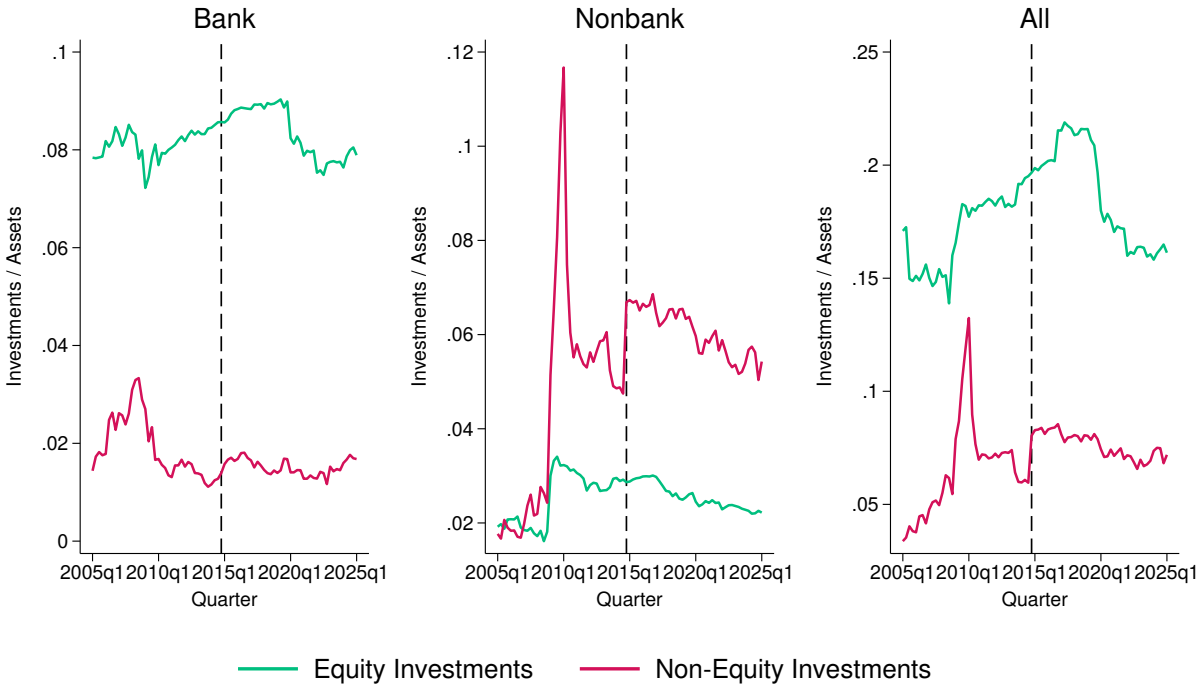
(a) Parallel Pre-Trends (1986-1994)



(b) Difference-in-Differences: Early - Late

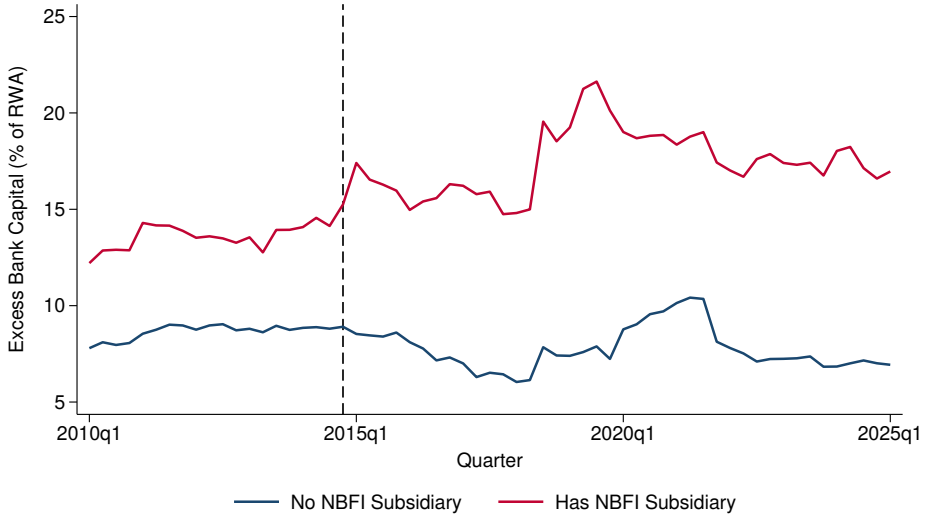
Notes: The figure validates the use of interstate banking deregulation timing as an instrument for organizational complexity. Panel (a) shows the trends in nonbank financial subsidiary share from 1986-1994, between BHCs headquartered in early-deregulating states (those removing interstate restrictions before 1986) and late-deregulating states. Panel (b) plots the difference in nonbank share between early and late deregulators over time. Early deregulators are defined as states with median interstate deregulation year before 1986. Source: BHC Organizational Structure Database described in Section 2.

Figure 2: Equity and Nonequity Investments in Bank and Nonbank Subsidiaries

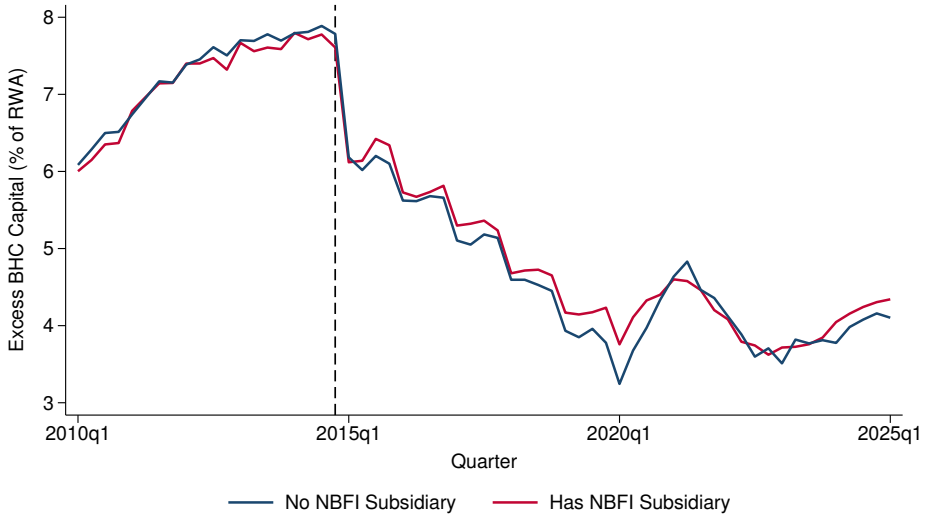


Notes: The figure shows equity and nonequity investments in bank and nonbank subsidiaries, scaled by BHC total assets. Equity investments are defined as the sum of BHC equity investments in common stock, goodwill, and other intangibles for bank subsidiaries (left panel), nonbank subsidiaries (middle panel), and all subsidiaries combined (right panel). Nonequity investments are defined as the sum of BHC investments in loans and other receivables and net balances due from subsidiaries (balances due from subsidiaries minus balances due to subsidiaries) for bank subsidiaries (left panel), nonbank subsidiaries (middle panel), and all subsidiaries combined (right panel). "All subsidiaries" includes bank subsidiaries, nonbank subsidiaries, and subsidiary holding companies. All variables are aggregated across BHCs in the sample using value-weighted averages. Source: FR Y-9C and FR Y-9LP.

Figure 3: Excess Capital: Banks vs BHCs



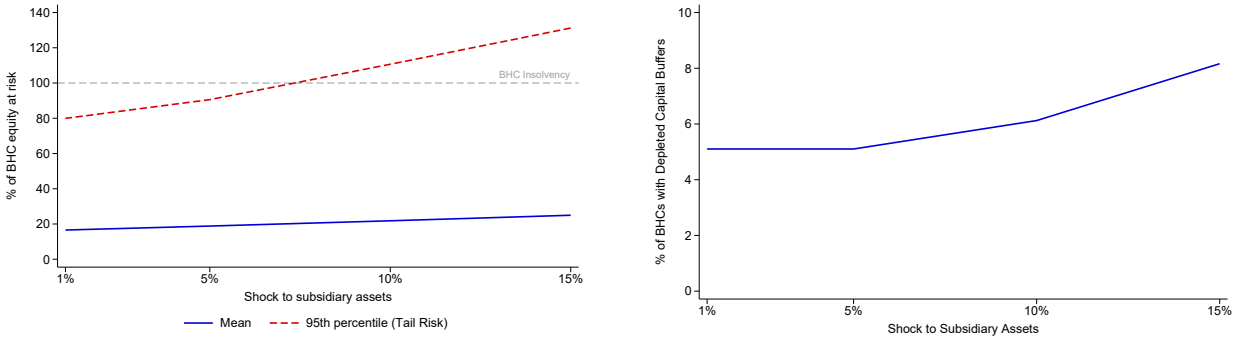
(a) Bank Excess Capital (Event Study)



(b) BHC Excess Capital (Event Study)

Notes: The figure compares average excess bank and BHC capital for BHCs with nonbank exposure and those without exposure. Panel (a) compares average excess bank capital from 2010 through 2015 for BHCs with nonbank exposure to BHCs without nonbank exposure, based on 2005 exposure status. Panel (b) presents the corresponding event-study estimates for excess BHC capital over the same period. Source: Authors' calculations using FR Y-9C and Call Reports.

Figure 4: Nonbank Stress Tests: Recapitalization Needs and Buffer Exhaustion

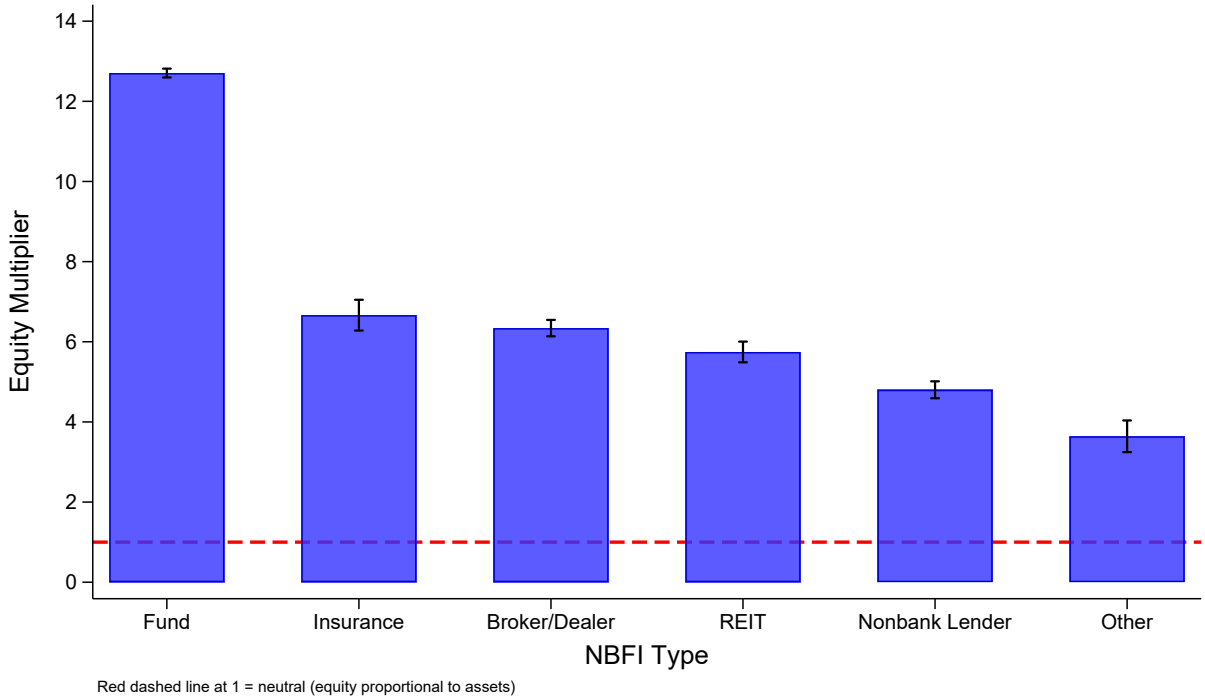


(a) Recapitalization Needs by Shock Severity

(b) Capital Buffer Depletion

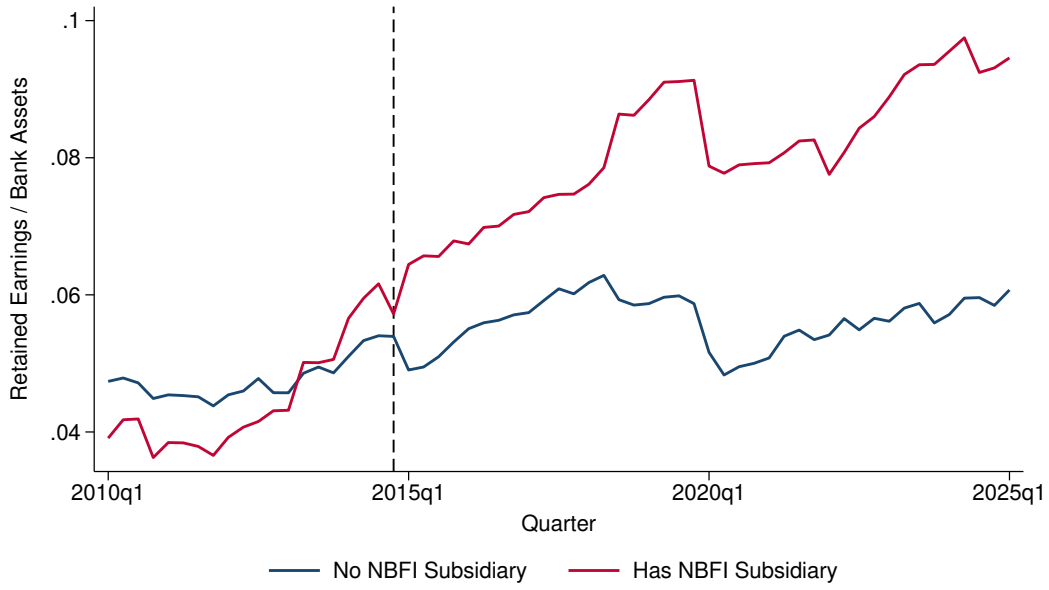
Notes: The figure presents the nonbank stress test results. Panel (a) shows percentage of BHC excess capital required for recapitalization. Solid line: mean across BHCs. Dashed line: 95th percentile (tail risk). Horizontal dashed line at 100% indicates potential parent insolvency. Panel (b) shows percentage of BHCs with completely depleted capital buffers (recapitalization needs exceed available excess capital). Both panels assume nonbank subsidiaries target 40% capital ratio following asset shocks. Appendix Figures C.5a and C.5b show sensitivity to alternative target capital ratios.

Figure 5: Equity Multiplier Varies by Nonbank Subsidiary Type



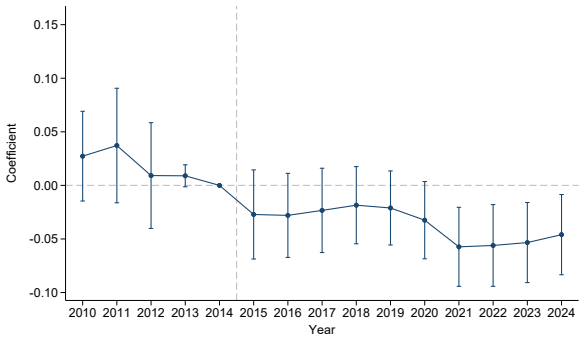
Notes: The figure shows mean equity multiplier by nonbank subsidiary type with 95% confidence intervals. Equity multiplier is constructed as the ratio of subsidiary equity share to subsidiary asset share within BHC, measuring capital intensity. Error bars show 95% confidence intervals. Appendix Table 4 provides detailed distributional statistics by type. Source: Authors' calculations using the FR Y-11.

Figure 6: Bank Retained Earnings as a Share of Bank Assets by BHC Nonbank Status

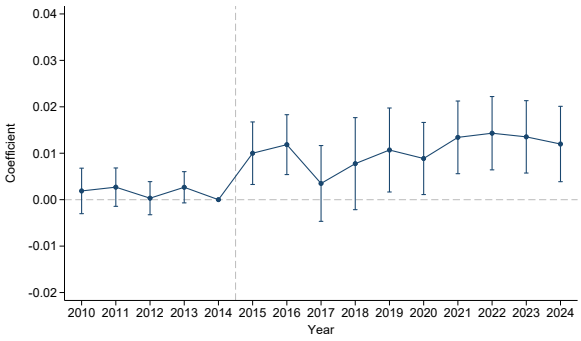


Notes: The figure shows average bank retained earnings as share of bank assets over time, comparing banks in BHCs with nonbank subsidiaries as of 2005 (solid line) versus banks in BHCs without nonbank affiliates (dashed line). Retained earnings measured as quarterly undistributed subsidiary income scaled by bank assets in that quarter. Scaled retained earnings are averaged across banks in BHCs with nonbank subsidiaries as of 2005 and banks in BHCs without nonbank affiliates by quarter. Vertical dashed line indicates 2015Q1 (Basel III implementation). Differential accumulation consistent with reduced-form regression estimates in Appendix Table D.7 showing 0.19-0.43 basis point increase per quarter per year of deregulation exposure, which cumulates to approximately 3.8-10.8 percentage points over 20 quarters post-2015. Sample includes all commercial banks 2010-2024. Source: Call Reports.

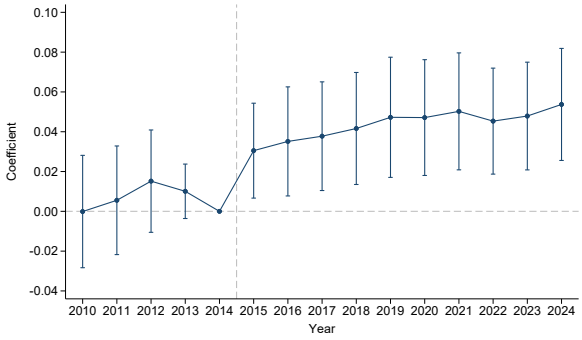
Figure 7: Nonbank Event Studies: Risk Migration



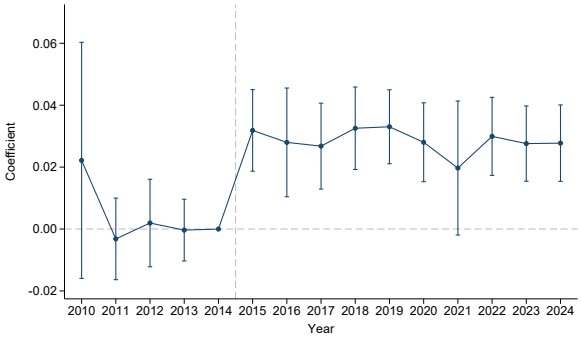
(a) Equity/Assets



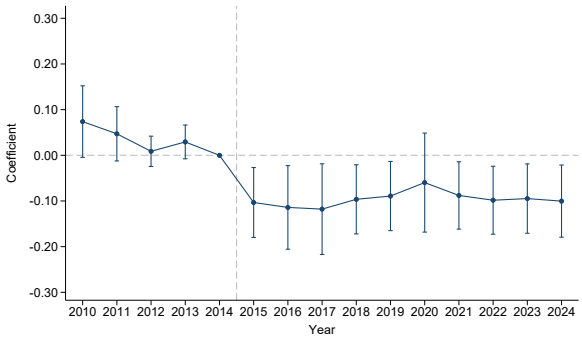
(b) Dividend Yield



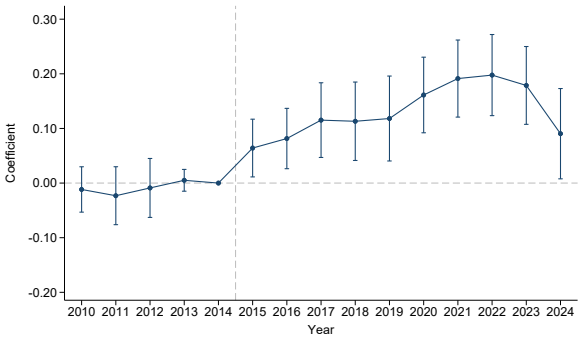
(c) Loan Share



(d) Past Due & Nonaccrual



(e) ROE



(f) Net Balance to Parent/Subs

Notes: The figure presents event study estimates of nonbank outcomes relative to 2014Q4 baseline. Panel (a) shows equity-to-assets ratios, Panel (b) shows dividend yields, Panel (c) shows loan shares, Panel (d) shows past-due and nonaccrual loans, Panel (e) shows return on equity, Panel (f) shows net balances to parent/other subsidiaries. Coefficients estimated from specification including nonbank subsidiary fixed effects, industry-quarter-year fixed effects, and BHC controls (top 200 BHC indicator, log assets, leverage, deposits/assets, asset growth, subsidiary count measured 2013Q4) interacted with post-2015 indicator. Standard errors clustered at BHC level. Error bars indicate 90% confidence intervals.

Table 1: Summary Statistics

	N	Mean	SD	p5	p25	p50	p75	p95
Panel A: BHCs								
2005 Nonbank Subsidiary								
Has Nonbank Subsidiary	25,726	0.569	0.495	0.000	0.000	1.000	1.000	1.000
2013 Controls								
2013 BHC Assets (Billions)	29,921	28.287	189.400	0.503	0.774	1.312	3.282	44.512
2013 BHC Leverage	29,921	9.847	6.248	5.423	7.539	9.081	10.768	15.528
2013 BHC Deposit Share	29,921	0.805	0.107	0.663	0.782	0.827	0.863	0.899
2013 BHC Asset Growth	29,294	0.038	0.090	-0.098	-0.007	0.031	0.072	0.195
2013 BHC Subsidiary Count	29,921	48.197	301.781	1.000	3.000	5.000	10.000	66.000
Time-Varying Variables								
BHC Assets (Billions)	29,921	34.817	225.200	0.511	0.833	1.664	5.476	64.695
BHC RWA (Billions)	29,804	21.223	126.400	0.321	0.574	1.187	4.038	47.965
BHC Capital (Billions)	29,921	3.493	21.410	0.037	0.078	0.162	0.567	7.117
BHC Net Income (Billions)	29,921	0.083	0.583	-0.001	0.001	0.004	0.014	0.170
BHC Leverage	29,921	0.102	0.048	0.056	0.084	0.099	0.116	0.152
BHC Deposit Share	29,921	0.805	0.482	0.664	0.778	0.822	0.858	0.896
BHC Loan Share	29,921	0.648	0.139	0.392	0.578	0.668	0.744	0.832
BHC Securities Share	29,921	0.210	0.118	0.046	0.125	0.193	0.277	0.428
BHC Nonbank Assets (Billions)	29,903	8.300	75.393	0.000	0.000	0.000	0.011	0.685
BHC Bank Assets (Billions)	29,921	27.420	179.900	0.497	0.819	1.622	5.274	53.484
Panel B: Banks								
Bank Assets (Billions)	57,188	14.549	127.400	0.101	0.534	0.976	2.281	21.357
Bank RWA (Billions)	55,056	10.103	80.413	0.056	0.346	0.691	1.710	15.892
Bank Capital (Billions)	57,188	1.520	12.584	0.013	0.054	0.102	0.240	2.565
Bank Net Income (Billions)	57,188	0.040	0.364	-0.000	0.001	0.002	0.006	0.062
Bank Leverage	57,187	0.866	0.149	0.812	0.879	0.896	0.909	0.929
Bank Deposit Share	57,187	0.802	0.166	0.640	0.795	0.840	0.873	0.907
Bank Loan Share	57,187	0.625	0.185	0.234	0.556	0.665	0.746	0.837
Bank Securities Share	57,187	0.214	0.143	0.018	0.116	0.191	0.286	0.476
Panel C: Nonbanks								
Nonbank Assets (Billions)	25,666	3.806	10.285	0.010	0.286	1.071	2.748	16.108
Nonbank Capital (Billions)	25,666	1.938	4.885	0.000	0.072	0.448	1.499	9.718
Nonbank Net Income (Billions)	25,664	0.043	0.212	-0.038	0.000	0.008	0.043	0.249
Nonbank Leverage	21,412	0.415	1.779	0.000	0.005	0.193	0.758	0.999
Nonbank Loans Share	20,378	0.118	0.290	0.000	0.000	0.000	0.000	0.949
Nonbank Securities Share	25,666	0.017	0.093	0.000	0.000	0.000	0.000	0.036
Broker (NAICS 523)	25,667	0.191	0.393	0.000	0.000	0.000	0.000	1.000
Nonbank Lender (NAICS 5222, 5223)	25,667	0.119	0.324	0.000	0.000	0.000	0.000	1.000
Insurer (NAICS 524)	25,667	0.003	0.058	0.000	0.000	0.000	0.000	0.000
Fund (NAICS 525)	25,667	0.346	0.476	0.000	0.000	0.000	1.000	1.000
Real Estate (NAICS 531)	25,667	0.029	0.169	0.000	0.000	0.000	0.000	0.000

Notes: Asset, RWA, capital, and net income variables are reported in billions of dollars. Percentiles are computed at the 5th, 25th, 50th, 75th, and 95th levels. The sample period ranges from 2010 to 2024. Only BHCs that filed an FR Y-9C in 2013q4 and their bank/nonbank subsidiaries are included. Sources: FR Y-9C and FR Y-9LP for BHC Panel, Call Reports for Bank Panel, FR Y-11 for Nonbank Panel.

Table 2: Internal Capital Reallocation and Organizational Complexity

	(1)	(2)	(3)
	Bank Excess Capital	BHC Excess Capital	Bank/BHC Excess Ratio
Panel A: Difference-in-Differences (NBFI Presence)			
$\mathbb{1}[\text{NBFI Sub}] \times \text{Post}$	2.0646**	0.4333	2.9060***
	(0.8277)	(0.2931)	(0.9498)
Observations	54,814	29,267	39,052
R^2	0.940	0.784	0.419
Panel B: Reduced-Form (Deregulation Timing)			
Years from Dereg $\times$ Post	0.7395*	0.0058	1.7766***
	(0.3992)	(0.0721)	(0.6211)
Observations	12,558	6,079	9,873
R^2	0.950	0.796	0.695
Fixed Effects			
Bank FE	✓		✓
BHC FE		✓	
Quarter-Year FE	✓	✓	✓
Controls $\times$ Post	✓	✓	✓

Notes: The table presents estimates of internal capital reallocation within bank holding companies. Dependent variable in Column (1) is bank excess capital (equity relative to regulatory minimum). Column (2) is BHC excess capital. Column (3) is the ratio of bank to BHC excess capital. Panel A reports difference-in-differences estimates where $\mathbb{1}[\text{NBFI Sub}] \times \text{Post}$ indicates BHCs with nonbank financial subsidiaries as of 2005Q4 interacted with Post. Panel B reports reduced-form estimates where Years from Dereg measures years between a BHC's headquarters state interstate branching deregulation and the 1994 Riegle-Neal Act (headquarters state measured as of 1981). Post indicates 2015Q1 and later. All specifications include entity fixed effects (bank or BHC) and quarter-year fixed effects. Controls measured 2013Q4 and interacted with Post. Columns (1) and (3) control for bank size, leverage, ROA, and asset growth. Column (2) controls for BHC top 200 indicator, size, leverage, ROA, asset growth, deposits/assets, and subsidiary count. Standard errors clustered at bank level (Columns 1, 3) or BHC level (Column 2). Source: Authors' calculations using FR Y-9C, FR Y-9LP, and Call Reports. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Nonbank Recapitalization Needs: Summary Statistics

Panel A: Mean BHC Equity at Risk (%)

	Target Capital Ratio				
Shock to Assets	30%	40%	50%	60%	70%
1%	11.23	16.57	22.42	28.99	36.23
5% (Baseline)	13.30	18.84	24.97	31.78	39.33
10%	16.02	21.82	28.30	35.47	43.29
15%	18.84	24.97	31.78	39.33	47.62

Panel B: 95th Percentile BHC Equity at Risk (%)

	Target Capital Ratio				
Shock to Assets	30%	40%	50%	60%	70%
1%	55.45	79.94	114.71*	156.84*	200.33*
5% (Baseline)	65.00	90.58	131.21*	174.17*	222.71*
10%	77.39	110.65*	152.51*	195.91*	253.56*
15%	90.58	131.21*	174.17*	222.71*	288.43*

Panel C: BHCs with Completely Depleted Capital Buffers (%)

	Target Capital Ratio				
Shock to Assets	30%	40%	50%	60%	70%
1%	4.08	5.10	8.16	8.16	8.16
5% (Baseline)	4.08	5.10	8.16	8.16	10.20
10%	5.10	6.12	8.16	8.16	10.20
15%	5.10	8.16	8.16	10.20	10.20

Notes: The table presents the stress test results using 2013Q4 balance sheets (before Basel III implementation). Panel A shows mean percentage of BHC excess capital required to recapitalize nonbank subsidiaries following asset shocks (rows) to restore target capital ratios (columns). Panel B shows 95th percentile (tail risk), with asterisks (*) indicating scenarios where recapitalization exceeds 100% of parent excess capital (potential insolvency). Panel C shows percentage of BHCs with completely depleted capital buffers (recapitalization needs exceed available excess capital). Baseline scenario (5% shock, 40% target) is comparable to 2008 financial crisis losses. Calculations assume full BHC ownership of subsidiaries and 100% loss recognition on nonbank assets.

Table 4: Nonbank Capital Structure and Equity Multiplier

Panel A: Summary Statistics (All BHCs)

	N	Mean	SD	5%	25%	50%	75%	95%
NBFI Asset Share	6,596	0.07	0.13	0.00	0.01	0.02	0.05	0.32
NBFI Equity Share	6,596	0.21	0.21	0.01	0.06	0.16	0.30	0.68
NBFI Capital Ratio	6,596	0.69	0.59	0.04	0.26	0.69	0.99	1.40
BHC Capital Ratio	6,596	0.11	0.07	0.05	0.08	0.09	0.11	0.17
Equity Multiplier	6,596	8.24	7.68	0.30	2.33	6.46	11.95	21.56

Panel B: Equity Multiplier by Nonbank Type

NBFI Type	Mean Mult	Median Mult	SD	25th Pct	75th Pct	Capital Ratio	Equity Share	Obs
Fund	12.71	12.83	4.68	10.59	15.28	0.931	0.289	6,924
Management	7.78	7.67	3.68	5.52	9.96	0.787	0.242	1,809
Insurance	6.66	6.31	2.81	5.34	8.10	0.702	0.060	206
Broker/Dealer	6.34	6.05	4.01	3.18	9.35	0.607	0.108	1,476
Real Estate (REIT)	5.75	5.23	3.63	2.76	8.47	0.642	0.054	758
Nonbank Lender	4.80	2.89	5.02	1.66	6.73	0.493	0.162	2,172
Other Financial	3.64	3.08	2.05	2.07	5.01	0.442	0.103	103

Notes: The table documents capital structure asymmetry between bank and nonbank subsidiaries within BHCs. Panel A shows summary statistics for all BHC–quarter observations from 2010–2024 with nonbank subsidiaries. "NBFI Asset Share" is nonbank assets divided by total BHC assets. "NBFI Equity Share" is nonbank equity divided by total BHC equity. "NBFI Capital Ratio" is nonbank equity divided by nonbank assets. The Equity Multiplier is constructed as the "NBFI Equity Share" divided by "NBFI Asset Share" and measures capital intensity. Values above one indicate that nonbanks hold disproportionately large equity relative to their asset footprint. Appendix Figure C.6 shows full distributions by type. Sources: FR Y-9LP, FR Y-9C, FR Y-11.

Table 5: Internal Equity Reallocation: Parent Investments and Subsidiary Dividends

	Parent Equity Investments			Dividend Yields	
	Bank Share (1)	Nonbank Share (2)	Total Share (3)	Bank Yield (4)	Nonbank Yield (5)
Years from Dereg × Post	0.0228**	-0.0264**	0.0045	0.0000	0.0947**
	(0.0093)	(0.0114)	(0.0104)	(0.0005)	(0.0459)
Observations	1,334	1,334	1,334	1,334	1,334
R^2	0.810	0.669	0.912	0.164	0.070
BHC FE	✓	✓	✓	✓	✓
Quarter-Year FE	✓	✓	✓	✓	✓
Controls × Post	✓	✓	✓	✓	✓

Notes: The table presents reduced-form estimates of internal equity reallocation within BHCs. Dependent variable in Column (1) is equity investments in bank subsidiaries divided by total BHC equity. Column (2) is equity investments in nonbank subsidiaries divided by BHC equity. Column (3) is total equity investments in all subsidiaries divided by BHC equity. Equity investments include common stock, preferred stock, goodwill, and other intangibles. Column (4) is quarterly dividends received by parent from bank subsidiaries divided by lagged equity investment in banks. Column (5) is dividends from nonbank subsidiaries divided by lagged equity investment in nonbanks. Years from Dereg measures years between BHC headquarters state's interstate branching deregulation and 1994 Riegle-Neal Act. Post indicates 2015Q1 and later. All specifications use BHC fixed effects and quarter-year fixed effects. BHC controls include top 200 BHC indicator, log assets, leverage, ROA, deposits/assets, asset growth, and subsidiary count, all measured 2013Q4 and interacted with Post. Standard errors clustered at BHC level. Sample restricted to BHCs with nonbank asset share exceeding 1%. Source: FR Y-9LP. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Bank Performance and Portfolio Composition

Panel A: Performance

	(1) ROA	(2) ROE	(3) Charge-Offs
Years from Dereg × Post	0.0012***	0.0001***	-0.0002***
	(0.0003)	(0.0000)	(0.0000)
Observations	12,054	12,054	12,054
R^2	0.375	0.277	0.350
Bank FE	✓	✓	✓
Quarter-Year FE	✓	✓	✓
Controls × Post	✓	✓	✓

Panel B: Portfolio Composition and Growth

	Shares			Growth Rates		
	Loan Share (1)	Securities Share (2)	Cash Share (3)	Δln(Loans) (4)	Δln(Sec) (5)	Δln(Cash) (6)
Years from Dereg × Post	-0.0060***	0.0033*	0.0052**	0.0008*	0.0023**	0.0046**
	(0.0021)	(0.0019)	(0.0024)	(0.0005)	(0.0011)	(0.0021)
Observations	13,333	13,333	13,333	11,774	11,774	11,774
R^2	0.919	0.883	0.877	0.132	0.100	0.076
Bank FE	✓	✓	✓	✓	✓	✓
Quarter-Year FE	✓	✓	✓	✓	✓	✓
Controls × Post	✓	✓	✓	✓	✓	✓

Notes: The table presents reduced-form estimates of bank safety improvements. Panel A shows performance measures. Dependent variable in Column (1) is quarterly net income divided by lagged total assets (ROA). Column (2) is quarterly net income divided by lagged equity (ROE). Column (3) is quarterly charge-offs divided by lagged total loans. Panel B shows portfolio composition and growth. Columns (1)-(3) show asset shares (loans, securities, and cash as shares of total assets). Columns (4)-(6) show quarter-on-quarter growth rates (log changes in loans, securities, and cash holdings). Years from Dereg measures years between BHC headquarters state's interstate branching deregulation and 1994 Riegle-Neal Act. Post indicates 2015Q1 and later. All specifications include bank fixed effects and quarter-year fixed effects. Bank controls include log assets, leverage, and asset growth, all measured 2013Q4 and interacted with Post. Standard errors clustered at bank level. Appendix Figure C.7 shows event study evidence confirming these patterns emerged sharply at 2015Q1. Source: Call Reports. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Bank Capital Quality Without Leverage Expansion

	(1) Leverage	(2) Equity/RWA	(3) RWA/Assets	(4) Marginal ROE	(5) Off-BS
Years from Dereg × Post	-0.0011	0.0113***	-0.0067***	0.0085	-0.0017
	(0.0007)	(0.0039)	(0.0016)	(0.0090)	(0.0018)
Observations	11,442	11,442	11,442	11,442	11,442
R^2	0.973	0.958	0.896	0.047	0.828
Bank FE	✓	✓	✓	✓	✓
Quarter-Year FE	✓	✓	✓	✓	✓
Controls × Post	✓	✓	✓	✓	✓

Notes: The table examines channels through which equity injections affected bank returns. Dependent variable in Column (1) is total liabilities divided by equity (leverage). Column (2) is equity divided by risk-weighted assets. Column (3) is risk-weighted assets divided by total assets. Column (4) is marginal return on equity, calculated as change in net income over past four quarters divided by change in equity over same period. Column (5) is unused loan commitments divided by total assets. Years from Dereg measures years between BHC headquarters state's interstate branching deregulation and 1994 Riegle-Neal Act. Post indicates 2015Q1 and later. All specifications include bank fixed effects, quarter-year fixed effects, and bank controls (log assets, leverage, asset growth measured 2013Q4) interacted with Post. Standard errors clustered at bank level. Appendix Figure C.7 Panels (c)-(d) visualizes capital quality improvements. Source: Call Reports. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Nonbank Capital Extraction and Funding Constraints

	(1) Equity/ Assets	(2) Bal From Subs	(3) Bal To Subs	(4) Net Bal to Subs	(5) Dividends /Equity	(6) ln(Assets)
Years from Dereg × Post	-0.0771**	-0.0667*	0.0693**	0.1360***	0.0096**	0.0454
	(0.0363)	(0.0374)	(0.0324)	(0.0439)	(0.0037)	(0.1539)
Observations	4,697	4,697	4,697	4,697	4,697	4,697
R^2	0.855	0.890	0.808	0.867	0.299	0.929
Nonbank FE	✓	✓	✓	✓	✓	✓
Industry-Qtr-Year FE	✓	✓	✓	✓	✓	✓
Controls × Post	✓	✓	✓	✓	✓	✓

Notes: The table documents capital extraction from nonbank subsidiaries. Panel A shows balance sheet changes. Dependent variable in Column (1) is equity divided by lagged assets. Column (2) is balances due from subsidiaries (amounts nonbanks owe to parents/affiliates) divided by lagged assets. Column (3) is balances due to subsidiaries (amounts parents owe to nonbanks) divided by lagged assets. Column (4) is net balances to parent and subsidiaries, calculated as (balances due to subs - balances due from subs) divided by lagged assets; positive values indicate net borrowing from or reduced lending to affiliates. Column (5) is cash dividends declared divided by lagged equity. Column (6) is log total assets. Years from Dereg measures years between BHC headquarters state's interstate branching deregulation and 1994 Riegle-Neal Act. Post indicates 2015Q1 and later. All specifications include nonbank subsidiary fixed effects and industry-quarter-year fixed effects (NAICS code × quarter-year). BHC controls include top 200 BHC indicator, log assets, leverage, deposits/assets, asset growth, and subsidiary count, all measured 2013Q4 and interacted with Post. Standard errors clustered at BHC level. Figure 7 Panels (a)-(b) and (f) visualize these patterns. Appendix Figure C.9 shows nonbanks simultaneously faced higher internal funding costs. Source: FR Y-11. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: Internal Funding Rates: Regression Estimates

	(1) Nonbank Rate	(2) Bank Rate	(3) Spread Rate (NB - Bank)
Years from Dereg × Post	0.0052**	0.0008	0.0044*
	(0.0024)	(0.0008)	(0.0025)
Observations	992	992	992
R^2	0.530	0.548	0.519
BHC FE	✓	✓	✓
Quarter-Year FE	✓	✓	✓
Controls × Post	✓	✓	✓

Notes: The table reports regression estimates of internal funding rate differentials, as illustrated in Appendix Figure C.9. The dependent variable in Column (1) is the annualized interest rate on internal funding to bank subsidiaries, calculated as quarterly interest income from bank subsidiaries multiplied by four and divided by the stock of nonequity internal funding to bank subsidiaries (the sum of internal loans, parent affiliate deposits, and net balances due from bank subsidiaries). Column (2) reports the corresponding annualized interest rate on internal funding to nonbank subsidiaries, calculated analogously using interest income from nonbank subsidiaries and the stock of nonequity internal funding to nonbank subsidiaries. Column (3) reports the internal funding spread, defined as the nonbank funding rate minus the bank funding rate. Years from Dereg measures the number of years between the interstate branching deregulation of the BHC headquarters state and the 1994 Riegle–Neal Act. Post is an indicator equal to one for 2015Q1 and later. All specifications include BHC fixed effects and quarter-year fixed effects. BHC control variables include top 200 BHC indicator, log total assets, leverage, deposits-to-assets, asset growth, and subsidiary count, all measured as of 2013Q4 and interacted with Post. Standard errors are clustered at the BHC level. The sample is restricted to BHCs with non-missing internal funding rate measures for both bank and nonbank subsidiaries. Source: Authors' calculations using FR Y-9LP. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 10: Lending Growth: Nonbank vs Bank Subsidiaries

	(1) Δln (Lending) Nonbank	(2) Δln (Lending) Bank
Years from Dereg × Post	0.0720***	0.0009
	(0.0151)	(0.0019)
Observations	760	760
R^2	0.107	0.172
BHC FE	✓	✓
Quarter-Year FE	✓	✓
Controls × Post	✓	✓

Notes: The table compares lending growth between nonbank and bank subsidiaries at the BHC level. Dependent variable is quarter-on-quarter log change in total lending aggregated across all nonbank subsidiaries (Column 1) or all bank subsidiaries (Column 2) within each BHC. Years from Dereg measures years between BHC headquarters state's interstate branching deregulation and 1994 Riegle-Neal Act. Post indicates 2015Q1 and later. Both specifications include BHC fixed effects and quarter-year fixed effects. BHC controls include top 200 BHC indicator, log assets, leverage, deposits/assets, asset growth, and subsidiary count, all measured 2013Q4 and interacted with Post. Standard errors clustered at BHC level. Sample restricted to BHC-quarters with non-missing lending data for both nonbank and bank subsidiaries. Source: Call Reports, FR Y-9LP. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Nonbank Shift to Lending Activities

	(1) Earning Assets/ Assets	(2) Loans/ Assets
Years from Dereg × Post	0.0688**	0.0352**
	(0.0276)	(0.0145)
Observations	5,327	5,327
R^2	0.891	0.956
Nonbank FE	✓	✓
Industry-Qtr-Year FE	✓	✓
Controls × Post	✓	✓

Notes: This table documents shifts in nonbank subsidiary portfolio composition. Dependent variable in Column (1) is earning assets divided by total assets. Column (2) is total loans divided by total assets. Years from Dereg measures years between BHC headquarters state's interstate branching deregulation and 1994 Riegle-Neal Act. Post indicates 2015Q1 and later. All specifications include nonbank subsidiary fixed effects, industry-quarter-year fixed effects (NAICS × quarter-year), and BHC-level controls (top 200 BHC indicator, log assets, leverage, deposits/assets, asset growth, subsidiary count measured 2013Q4) interacted with Post. Standard errors clustered at BHC level. Figure 7 Panel (c) visualizes loan share increase. Appendix Tables D.9-D.10 examine which loan types and business activities expanded. * Source: FR Y-11. $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 12: Nonbank Credit Quality Deterioration

Panel A: Past-Due Loans and Provisions

	(1) 30-89 Days	(2) 90+ Days Past Due	(3) All Past Due	(4) Loss Provisions
Years from Dereg × Post	0.0043	0.0266***	0.0308***	0.0937***
	(0.0054)	(0.0069)	(0.0085)	(0.0142)
Observations	1,548	1,548	1,548	571
R^2	0.478	0.676	0.685	0.766
Nonbank FE	✓	✓	✓	✓
Industry-Qtr-Year FE	✓	✓	✓	✓
Controls × Post	✓	✓	✓	✓

Panel B: Profitability

	(1) ROA	(2) ROE	(3) Trading Yield
Years from Dereg × Post	-0.0037	-0.1079**	-0.0006***
	(0.0056)	(0.0464)	(0.0001)
Observations	4,708	4,708	4,708
R^2	0.403	0.309	0.278
Nonbank FE	✓	✓	✓
Industry-Qtr-Year FE	✓	✓	✓
Controls × Post	✓	✓	✓

Notes: The table documents credit quality deterioration and profitability decline. Panel A shows past-due loans and loss provisions. Dependent variable in Column (1) is loans 30-89 days past due divided by lagged total loans. Column (2) is loans 90+ days past due divided by lagged loans. Column (3) is all past-due loans (30+ days) divided by lagged loans. Column (4) is loan loss provisions divided by lagged loans, conditional on nonzero provisioning. Panel B shows profitability measures. Column (1) is quarterly net income divided by lagged assets (ROA). Column (2) is quarterly net income divided by lagged equity (ROE). Column (3) is trading revenue divided by lagged assets. Years from Dereg measures years between BHC headquarters state's interstate branching deregulation and 1994 Riegle-Neal Act. Post indicates 2015Q1 and later. All specifications include nonbank subsidiary fixed effects, industry-quarter-year fixed effects, and BHC controls (top 200 BHC indicator, log assets, leverage, deposits/assets, asset growth, subsidiary count measured 2013Q4) interacted with Post. Standard errors clustered at BHC level. Figure 7 Panels (d)-(e) visualize credit deterioration and profitability decline. Source: FR Y-11. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 13: Nonbank Increased Fragility and Default Risk

	(1) Negative Earnings	(2) σ (Int Inc)	(3) σ (Non-Int)	(4) Z-score	(5) Prob (Default)
Years from Dereg $\times$ Post	0.1519***	0.1969***	0.0422	-8.6147***	0.0168**
	(0.0341)	(0.0660)	(0.1030)	(2.4028)	(0.0058)
Observations	2,714	2,714	2,714	2,714	2,714
R^2	0.4349	0.6934	0.5513	0.9767	0.0661
Nonbank FE	✓	✓	✓	✓	✓
Industry-Qtr-Year FE	✓	✓	✓	✓	✓
Controls $\times$ Post	✓	✓	✓	✓	✓

Notes: The table presents measures of nonbank fragility and default risk. Dependent variable in Column (1) is indicator equal to one if quarterly net income is negative. Column (2) is rolling 8-quarter standard deviation of log interest income. Column (3) is rolling 8-quarter standard deviation of log non-interest income. Column (4) is Z-score, calculated as (equity/assets + ROA) / standard deviation of ROA; higher values indicate lower default risk. Column (5) is probability of default calculated using Merton model as normal CDF of negative Z-score. Years from Dereg measures years between BHC headquarters state's interstate branching deregulation and 1994 Riegle-Neal Act. Post indicates 2015Q1 and later. All specifications include nonbank subsidiary fixed effects, industry-quarter-year fixed effects, and BHC controls (top 200 BHC indicator, log assets, leverage, deposits/assets, asset growth, subsidiary count measured 2013Q4) interacted with Post. Standard errors clustered at BHC level. Source: Authors' calculations using FR Y-11. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Online Appendix for:

"Regulatory Arbitrage within the Firm"

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Appendix A Theoretical Framework: Complete Derivations

This appendix provides complete derivations of the model presented in Section 6, including proofs of all propositions, comparative statics, calibration details, and welfare analysis.

A.1 Model Setup

Consider a bank holding company (BHC) that owns two subsidiaries: a regulated bank (B) and an unregulated nonbank financial institution (N). The BHC operates over two periods, $t \in \{1, 2\}$.

Assets and Equity. Each subsidiary $i \in \{B, N\}$ operates with exogenous assets $A_i > 0$ and chooses equity level $E_i \geq 0$ in period 1. Total BHC equity is $E = E_B + E_N$. Subsidiaries generate returns $R_i(E_i, A_i)$ with standard properties:

$$\frac{\partial R_i}{\partial E_i} > 0, \quad \frac{\partial^2 R_i}{\partial E_i^2} < 0 \tag{A.1}$$

Higher equity increases returns by reducing expected distress costs, but with diminishing marginal benefits.

Regulation. The bank faces a capital requirement

$$E_B \geq \kappa_B \cdot A_B \tag{A.2}$$

where κ_B is the regulatory minimum capital ratio. The nonbank faces no binding capital requirement ($\kappa_N = 0$), consistent with the institutional setting where Basel III applies only to depository institutions.

Financing. The BHC can raise external equity $K \geq 0$ at convex cost $c(K)$ with $c(0) = 0$, $c'(K) > 0$, and $c''(K) > 0$. This captures well-established pecking order preferences: internal funds are cheaper than external equity due to issuance costs, asymmetric information, and market timing considerations (Myers and Majluf, 1984; Fazzari, Hubbard and Petersen, 1988).

Internal equity transfers from nonbank to bank incur a small transaction cost $\tau \geq 0$ per dollar transferred, reflecting administrative frictions and potential tax considerations.[17]

Shocks and Failure. In period 2, each subsidiary faces an idiosyncratic shock $\theta_i \sim F_i(\theta)$ with support $[-\bar{\theta}_i, 0]$. Subsidiary i fails if its equity cushion is insufficient:

$$E_i + \theta_i < 0 \tag{A.3}$$

[17] In practice, τ is small relative to external equity costs. Our calibration suggests $\tau \approx 0$ to 0.05, while external equity costs exceed 5% of capital raised.

Failures generate deadweight costs: L_B for bank failure (reflecting deposit insurance, payment system disruption, and fire sale externalities) and L_N for nonbank failure (potentially lower if effectively ring-fenced).

Contagion. We model contagion through spillover parameter $\lambda \in [0, 1]$:

- $\lambda = 0$: Perfect ring-fencing (nonbank failure fully contained)
- $\lambda = 1$: Full contagion (nonbank failure triggers bank failure)

The total probability of bank failure incorporates both direct shocks and contagion:

$$\Pr(\text{Bank Failure}) = F_B(-E_B) + \lambda \cdot \Pr(\theta_N < -E_N \text{ and } \theta_B > -E_B) \tag{A.4}$$

This captures that nonbank distress can transmit to the bank even when the bank would otherwise survive its own shock, consistent with channels including funding pressure, reputation damage, and consolidated capital depletion.

A.2 BHC Optimization

The BHC chooses equity allocations (E_B, E_N) and external equity K to maximize expected value:

$$\max_{E_B, E_N, K} \quad \mathbb{E}[R_B(E_B, A_B) + R_N(E_N, A_N)] - \Pr(\text{Failure})_B \cdot L_B - \Pr(\text{Failure})_N \cdot L_N - c(K) - \tau \cdot |E_B - E_B^0| \tag{A.5}$$

subject to:

$$E_B \geq \kappa_B \cdot A_B \qquad \text{(regulatory constraint)} \tag{A.6}$$

$$E_B + E_N \leq E^0 + K \qquad \text{(resource constraint)} \tag{A.7}$$

$$E_B, E_N, K \geq 0 \qquad \text{(non-negativity)} \tag{A.8}$$

where E^0 and E_B^0 denote initial BHC and bank equity levels.

A.3 Optimal Capital Allocation

We characterize the solution through three cases.

Case 1: Slack Regulation. When $\kappa_B \cdot A_B < E_B^*$ (where E_B^* is unconstrained optimum), the constraint does not bind and the BHC allocates equity to equate marginal risk-adjusted returns:

$$R_B'(E_B) - L_B \cdot f_B(-E_B) = R_N'(E_N) - L_N \cdot f_N(-E_N) \tag{A.9}$$

This represents standard portfolio allocation with no regulatory distortion.

Case 2: External Financing. When regulation binds ($\kappa_B \cdot A_B > E_B^*$) but external equity is relatively cheap, the BHC raises external capital: $K^* > 0$. The regulatory constraint binds with $E_B = \kappa_B \cdot A_B$, and minimal internal reallocation occurs. Appendix Figure A.3 shows that satisfying the 10.5% Basel III requirement would require external equity equal to approximately 3.2% of total BHC assets under this scenario.

Case 3: Internal Reallocation. When external equity is prohibitively costly relative to internal transfers ($c'(0) > \tau$), the BHC meets the regulatory requirement through internal reallocation: $K^* = 0$ and $E_B = \kappa_B \cdot A_B$.

Proposition A.1 (Internal Reallocation Equilibrium)**.** *When external equity is costly ($c'(0) > \tau + [R_N'(E_N) - R_N'(E_N - \Delta E)]$) and regulation binds, the BHC optimally chooses:*

$$E_B^* = \kappa_B \cdot A_B \tag{A.10}$$

$$E_N^* = E^0 - \kappa_B \cdot A_B - \tau \cdot (\kappa_B \cdot A_B - E_B^0) \tag{A.11}$$

$$K^* = 0 \tag{A.12}$$

with comparative statics:

$$\frac{\partial E_B}{\partial \kappa_B} = A_B > 0 \qquad \textit{(bank equity increases)} \tag{A.13}$$

$$\frac{\partial E_N}{\partial \kappa_B} = -A_B < 0 \qquad \textit{(nonbank equity decreases)} \tag{A.14}$$

$$\frac{\partial E}{\partial \kappa_B} = 0 \qquad \textit{(BHC equity unchanged)} \tag{A.15}$$

Proof of Proposition A.1. Form the Lagrangian:

$$\begin{aligned}\mathcal{L} = {} & \mathbb{E}[R_B(E_B) + R_N(E_N)] - F_B(-E_B) \cdot L_B - F_N(-E_N) \cdot L_N - c(K) - \tau \cdot (E_B - E_B^0) \\ & + \mu \cdot (E_B - \kappa_B \cdot A_B) + \nu \cdot (E^0 + K - E_B - E_N)\end{aligned}$$

where $\mu \geq 0$ is the multiplier on the regulatory constraint and $\nu \geq 0$ is the multiplier on the resource constraint.

First-order conditions:

$$\frac{\partial \mathcal{L}}{\partial E_B} = R_B'(E_B) - L_B \cdot f_B(-E_B) - \tau + \mu - \nu = 0 \tag{A.16}$$

$$\frac{\partial \mathcal{L}}{\partial E_N} = R_N'(E_N) - L_N \cdot f_N(-E_N) - \nu = 0 \tag{A.17}$$

$$\frac{\partial \mathcal{L}}{\partial K} = -c'(K) + \nu = 0 \tag{A.18}$$

When external equity is costly, we have $K^* = 0$, which requires $c'(0) \geq \nu$. From (A.17):

$$\nu = R'_N(E_N) - L_N \cdot f_N(-E_N) \tag{A.19}$$

The regulatory constraint binds: $E_B = \kappa_B \cdot A_B$. From the resource constraint with $K = 0$:

$$E_N = E^0 - E_B = E^0 - \kappa_B \cdot A_B - \tau \cdot (\kappa_B \cdot A_B - E_B^0) \tag{A.20}$$

Differentiating with respect to κ_B yields the comparative statics in equations (A.13)–(A.15). □

These predictions exactly match our empirical findings: banks accumulate equity, nonbanks lose equity, and BHCs do not raise external capital. Figure A.1 visualizes these comparative statics. Panel (a) shows that as bank capital requirements increase from 6% to 16%, bank capital ratios (blue line) rise from 6% to 17%, while nonbank capital ratios (red line) decline from 33% to 8%. The negative relationship illustrates the "waterbed effect" where pushing down on one subsidiary causes risk to pop up in another. Appendix Figure A.3 demonstrates that external equity financing (as a percentage of total BHC assets) increases only modestly with tighter regulation, from approximately 1.3% to 3.2% of assets, confirming that BHCs rely primarily on internal reallocation rather than external capital markets.

A.4 Welfare Analysis

While internal reallocation is privately optimal for BHCs (avoiding costly external equity), it may be socially suboptimal due to a contagion externality.

Private Optimum. The BHC chooses internal reallocation when:

$$c'(0) > \tau + [R'_N(E_N) - R'_N(E_N - \Delta E)] \tag{A.21}$$

That is, the marginal cost of external equity exceeds the transaction cost plus foregone returns from extracting nonbank equity.

Social Optimum. A social planner accounts for systemic costs of contagion. Internal reallocation is welfare-improving only if:

$$c(K^*) > \tau \cdot \Delta E + \underbrace{\Delta L_N}_{\text{Nonbank risk}} + \underbrace{\lambda \cdot \Delta L_B}_{\text{Contagion cost}} \tag{A.22}$$

where:

$$\Delta L_N = L_N \cdot [F_N(-E_N + \Delta E) - F_N(-E_N)] \quad \text{(increased nonbank failure probability)} \tag{A.23}$$

$$\Delta L_B = L_B \cdot \Pr(\text{bank failure} | \text{nonbank failure}) \quad \text{(contagion-induced bank failures)} \tag{A.24}$$

Proposition A.2 (Private-Social Wedge)**.** *The BHC ignores the contagion externality $\lambda \cdot \Delta L_B$, leading to excessive internal reallocation. There exists a critical threshold λ^* such that:*

$$\lambda^* = \frac{c'(0) - \tau - [R'_N(E_N) - R'_N(E_N - \Delta E)] - \Delta L_N / \Delta E}{L_B \cdot \Pr(\textit{bank failure} | \textit{nonbank failure})} \tag{A.25}$$

Internal reallocation is:

- ***Welfare-improving*** *if $\lambda < \lambda^*$ (ring-fencing effective, contagion costs small)*
- ***Welfare-reducing*** *if $\lambda > \lambda^*$ (contagion costs exceed saved external equity costs)*

Proof of Proposition A.2. The private condition (A.21) holds when external equity costs exceed internal reallocation costs. The social condition (A.22) additionally requires that saved financing costs exceed increased systemic risk. Rearranging (A.22) to isolate λ:

$$\lambda < \frac{c(K^*) - \tau \cdot \Delta E - \Delta L_N}{\Delta L_B} \tag{A.26}$$

For marginal changes, using $c(K^*) \approx c'(0) \cdot K^*$ and $K^* \approx \Delta E$ (the amount that would be raised externally):

$$\lambda < \frac{c'(0) \cdot \Delta E - \tau \cdot \Delta E - \Delta L_N}{\Delta L_B} \tag{A.27}$$

Dividing by ΔE and rearranging yields equation (A.25). □

Interpretation. When ring-fencing is effective (λ small), internal reallocation is both privately and socially optimal—it allows BHCs to meet regulatory requirements without incurring costly external financing. However, when contagion risk is material (λ exceeds threshold), the social cost of increased systemic fragility outweighs the private benefit of avoided issuance costs.

Our stress test analysis provides empirical discipline for the model. Figure A.2b presents heatmaps showing BHC equity at risk under various shock scenarios. The three panels show: (i) mean equity required as a percentage of total BHC equity to recapitalize nonbank subsidiaries, (ii) 95th percentile equity at risk, and (iii) the fraction of BHCs experiencing complete buffer depletion. At our baseline scenario of a 5% shock to nonbank assets (consistent with 2008-level losses) combined with a 40% target recapitalization ratio, the mean BHC requires 18.84% of excess capital to restore nonbank solvency, while the 95th percentile BHC requires 90.58% of excess capital (approaching insolvency). If nonbanks were perfectly ring-fenced ($\lambda = 0$), this BHC-level vulner-

ability would not exist. The observed equity-at-risk therefore implies $\lambda \in [0.2, 0.5]$, suggesting material—though not complete—contagion.

Appendix Figure A.4a plots the change in social welfare from internal reallocation as a function of the contagion parameter λ, expressed as a percentage of total BHC assets. Welfare is positive when $\lambda < 0.7$ (left region), reaching approximately 4% of assets when contagion is negligible ($\lambda = 0$), indicating that internal reallocation is welfare-improving as BHCs avoid costly external equity with minimal systemic costs. The welfare function crosses zero at $\lambda^* \approx 0.7$, and becomes increasingly negative for $\lambda > 0.7$, reaching approximately -2% of assets at complete contagion ($\lambda = 1$). This threshold λ^* represents the critical point where private optimality diverges from social optimality. Our calibrated range $\lambda \in [0.2, 0.5]$ falls below this threshold, suggesting internal reallocation may be privately optimal while approaching the boundary of social optimality.

The welfare threshold λ^* is sensitive to assumptions about relative failure costs. Appendix Figure A.4b explores how the welfare threshold λ^* varies with the relative systemic importance of bank versus nonbank failures, measured by the ratio L_B/L_N. The relationship is strongly positive: when bank failures are only twice as costly as nonbank failures ($L_B/L_N = 2$), the welfare threshold $\lambda^* \approx 0.2$, implying that internal reallocation becomes welfare-reducing even at relatively low levels of contagion. However, as banks become more systemically important, reaching our baseline calibration of $L_B/L_N = 6$, the threshold rises to $\lambda^* \approx 0.7$. At very high systemic cost ratios ($L_B/L_N = 20$), characteristic of institutions with critical payment system roles, λ^* increases to approximately 0.9. Our calibrated contagion parameter $\lambda = 0.35$ (shown by the horizontal red line) falls below the baseline threshold ($\lambda^* \approx 0.7$), suggesting internal reallocation is welfare-improving in our empirical setting.

A.5 Comparative Statics and Additional Predictions

The model generates several additional predictions that align with our empirical findings:

Effect of Stricter Regulation. An increase in κ_B leads to:

$$\frac{\partial \Pr(\text{System Failure})}{\partial \kappa_B} = \underbrace{\frac{\partial F_B(-E_B)}{\partial \kappa_B}}_{<0 \text{ (banks safer)}} + \underbrace{\lambda \cdot \frac{\partial F_N(-E_N)}{\partial \kappa_B}}_{>0 \text{ (contagion risk)}} \tag{A.28}$$

The net effect on system-wide risk is ambiguous and depends on the magnitude of contagion relative to direct bank safety improvements.

Heterogeneity in External Financing Costs. BHCs with higher external financing costs ($c'(0)$ large) rely more heavily on internal reallocation:

$$\left|\frac{\partial E_N}{\partial \kappa_B}\right|_{\text{High } c'(0)} > \left|\frac{\partial E_N}{\partial \kappa_B}\right|_{\text{Low } c'(0)} \tag{A.29}$$

This matches our empirical finding that effects concentrate among ex-ante constrained BHCs. Figure A.2a illustrates this mechanism by varying the marginal cost of external equity from 0% to 20%. When external equity is cheap ($c'(0) < 5\%$), the nonbank capital ratio falls by approximately 7.01 percentage points. As external costs rise to 15–20%, the decline increases to 7.05 percentage points. The blue dashed line shows external equity raised as a percentage of total BHC assets: at low costs, BHCs raise approximately 1.80% of assets externally, but as costs increase to 20%, external issuance falls to 1.69% of assets.

Effect of Transfer Costs. Higher transaction costs τ reduce internal reallocation and push BHCs toward external financing:

$$\frac{\partial d_N^*}{\partial \tau} < 0 \qquad \text{(less dividend extraction)} \tag{A.30}$$

$$\frac{\partial K^*}{\partial \tau} > 0 \qquad \text{(more external equity)} \tag{A.31}$$

Nonbank Business Model Distortions. When nonbank equity declines, activities reallocate from capital-intensive to capital-light operations:

$$\frac{\partial(\text{Capital-Intensive Share})}{\partial E_N} > 0 \tag{A.32}$$

We observe exactly this pattern: nonbanks exit trading, venture capital, and advisory activities while expanding consumer lending.

Bank Risk Reduction. With binding capital requirements, banks preserve buffers by reducing asset risk:

$$\frac{\partial(\text{RWA}/\text{Assets})}{\partial E_B} < 0 \tag{A.33}$$

Consistent with this prediction, we find bank RWA-to-asset ratios decline 0.67 percentage points following equity injections.

Correlated Shocks Amplify Systemic Risk. When bank and nonbank shocks are positively correlated ($\rho \equiv \text{Corr}(\theta_B, \theta_N) > 0$), the welfare threshold shifts:

$$\frac{\partial \lambda^*}{\partial \rho} < 0 \tag{A.34}$$

Higher correlation makes internal reallocation less likely to be socially optimal because nonbank distress is more likely to coincide with bank stress, amplifying contagion costs.

A.6 Calibration Details

Parameter Values from Empirical Estimates. From our main empirical results:

- $\Delta E_B / A_B = 0.0074$ (0.74 percentage point increase in bank excess capital per year of deregulation exposure)
- $\Delta E_N / A_N = -0.0771$ (-7.71 percentage point decrease in nonbank equity ratio per year)
- $\Delta E_{\text{BHC}} / A_{\text{BHC}} \approx 0$ (no change in BHC equity ratio)

Equity Multiplier. The median nonbank subsidiary represents 2% of consolidated assets but holds 16% of consolidated equity, creating an $8\times$ multiplier. This means a 15 percentage point decline in nonbank capital ratios (from 60% to 45%) frees equity supporting 22.5 percentage points of additional bank assets for every 1 percentage point of nonbank assets. For a BHC with \$1 billion in nonbank assets (2% of \$50 billion total), this translates to \$150 million in freed equity supporting \$1.5 billion in additional bank lending capacity.

External Equity Cost ($c'(0)$). Literature on equity issuance costs (Altınkılıç and Hansen, 2000) suggests direct costs of 4–7% for seasoned equity offerings, plus indirect costs from dilution and adverse selection. Taking a conservative 5% marginal cost: $c'(0) \approx 0.05$ to 0.10.

Contagion Parameter (λ). From our stress tests: under a 5% shock to nonbank assets requiring recapitalization to 40% capital ratios, the mean BHC deploys 18.84% of excess capital, while 5.10% of BHCs completely exhaust buffers. This implies $\lambda \in [0.2, 0.5]$—partial but material contagion.

Welfare Calculation. With these parameters, the benefit of avoiding external equity ($\approx 0.05 \times \Delta E_B$) must be weighed against increased systemic costs ($\tau \cdot \Delta E + \Delta L_N + \lambda \cdot \Delta L_B$). For reasonable parameter values where bank failures are substantially more costly than nonbank failures ($L_B = 6 \times L_N$), internal reallocation generates positive welfare when $\lambda < 0.7$ but negative welfare when contagion exceeds this threshold.

A.7 Model Figures

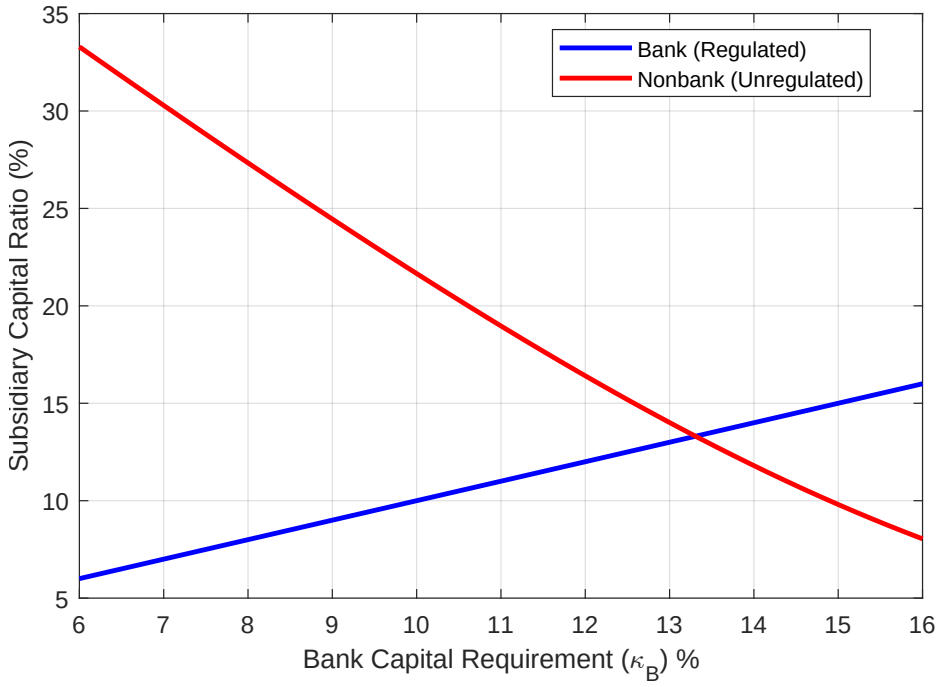
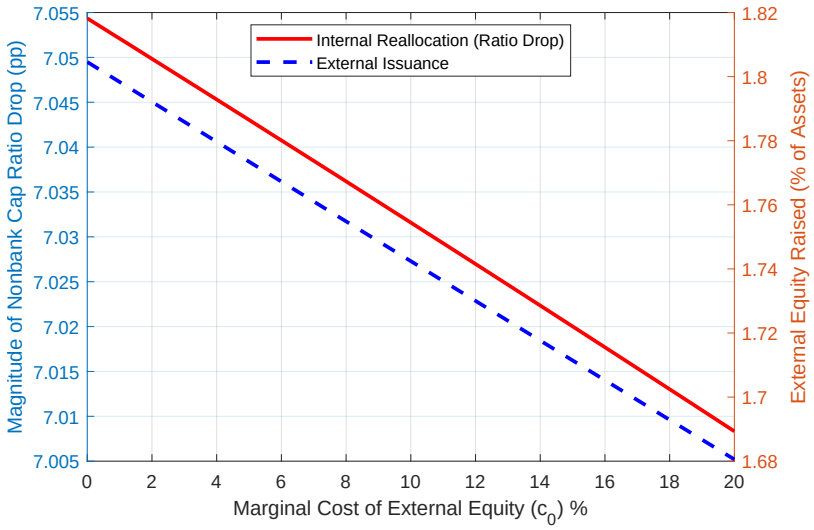
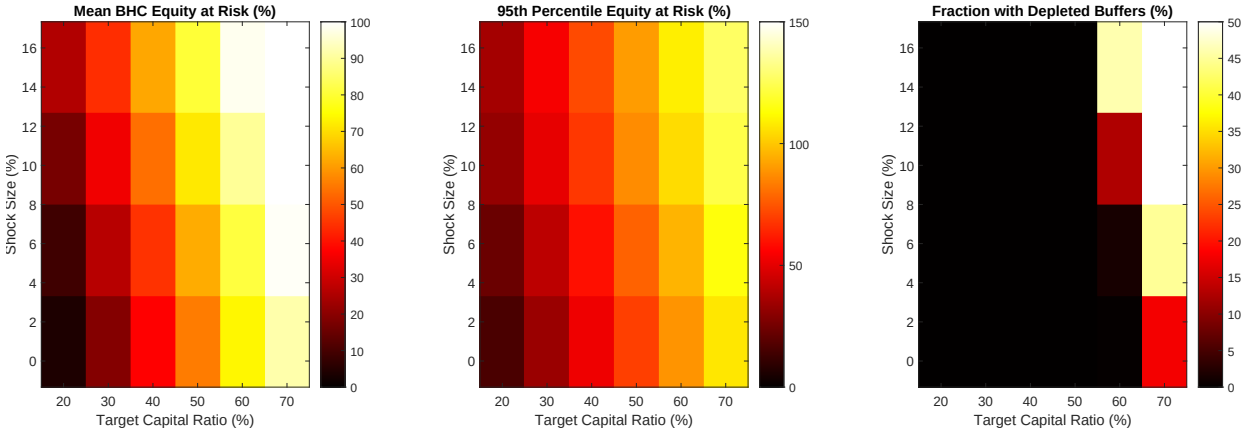


Figure A.1: The "Waterbed Effect" of Entity-Level Regulation

Notes: The figure compares excess bank and BHC capital for BHCs with and without nonbank exposure. Panel (a) shows excess bank capital from 2010 to 2015 for BHCs classified by nonbank exposure based on their 2005 status. Panel (b) shows the corresponding trends for excess BHC capital over the same period.



(a) Heterogeneity by External Financing Costs



(b) Stress Test: BHC Equity at Risk

Figure A.2: Internal Reallocation: Mechanism and Systemic Implications

Notes: Panel (a) shows how the internal reallocation mechanism varies with external financing costs. The red line (left axis) shows the magnitude of nonbank equity extraction, while the blue dashed line (right axis) shows external equity issuance. Panel (b) presents stress test results showing BHC equity at risk under various shock scenarios. The three heatmaps display (left to right): mean BHC equity needed to recapitalize nonbanks as percentage of total BHC equity, 95th percentile (tail risk), and fraction of BHCs with completely depleted capital buffers. Colors range from dark red (low risk) to bright yellow (high risk).

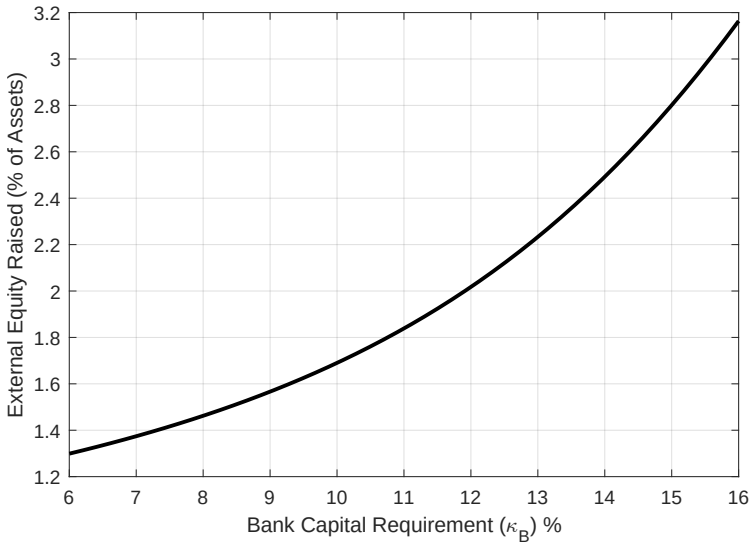
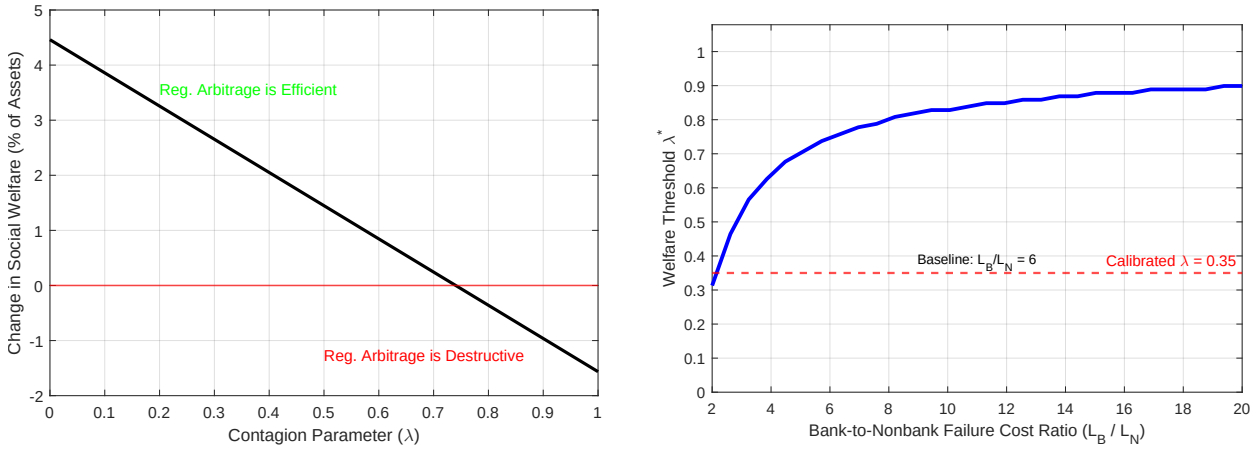


Figure A.3: External Equity Counterfactual

Notes: The figure shows external equity that would be required to satisfy bank capital requirements if internal reallocation were not available, expressed as a percentage of total BHC assets. The line plots external equity raised as a function of the bank capital requirement κ_B. External equity increases from approximately 1.3% of assets at $\kappa_B = 6\%$ to 3.2% of assets at $\kappa_B = 10.5\%$. The slope represents the marginal external financing cost avoided through internal capital markets.



(a) The Private-Social Wedge

(b) Sensitivity: λ^* vs. Failure Cost Ratio

Figure A.4: Welfare Analysis and Model Calibration

Notes: Panel (a) plots the change in social welfare from internal reallocation as a function of the contagion parameter λ, expressed as a percentage of total BHC assets. Welfare is positive when $\lambda < 0.7$, crosses zero at $\lambda^* \approx 0.7$, and becomes negative for $\lambda > 0.7$. Panel (b) shows how the welfare threshold λ^* varies with the ratio of bank-to-nonbank failure costs (L_B/L_N). The red dashed line marks our calibrated contagion parameter ($\lambda = 0.35$) from stress test evidence.

Appendix B Data Construction

This section describes the construction of the excess capital measure used in the analysis for both bank holding companies (BHCs) and depository institution (DI) subsidiaries. Excess capital is computed separately at the BHC-quarter level using FR Y-9C data and at the DI-quarter level using Call Report data, applying the regulatory requirements relevant to each institutional level.

Definition

Excess capital is defined as the amount of regulatory capital held by an institution (either a bank holding company or a depository institution) in excess of all binding regulatory requirements, normalized by that institution's risk-weighted assets (RWA). Formally, for institution i in quarter t, excess capital is constructed as the minimum distance between the institution's observed capital ratios and the applicable regulatory minimums across different capital categories.

Regulatory Capital Framework

Over the sample period, U.S. bank capital regulation is characterized by two main periods ((Federal Reserve Bank of Cleveland, 2024)).

Pre-Basel III (1992–2014). Banks (both holding companies and depository institution subsidiaries) were subject to three binding requirements:

- Tier 1 Capital Ratio: Tier 1 Capital $\geq$ 4% of RWA;
- Total Capital Ratio: Total Capital $\geq$ 8% of RWA;
- Leverage Ratio: Tier 1 Capital $\geq$ 4% of Total Consolidated Assets.

Basel III (2015–present). Beginning in 2015, banks are subject to:

- Common Equity Tier 1 (CET1) Capital Ratio: CET1 Capital $\geq$ 4.5% of RWA;
- Tier 1 Capital Ratio: Tier 1 Capital $\geq$ 6% of RWA;
- Total Capital Ratio: Total Capital $\geq$ 8% of RWA;
- Leverage Ratio: Tier 1 Capital $\geq$ 4% of Total Consolidated Assets.

In addition, banks must satisfy the Capital Conservation Buffer (CCB), which is added to the minimum CET1, Tier 1, and Total capital ratios. The CCB was phased in between 2016 and 2019, reaching its full value of 2.5% of RWA in 2019. Banks must maintain these buffers to avoid limitations on capital distributions and discretionary payments.[18]

For most institutions, the CCB was phased in as follows:

[18]The countercyclical capital buffer is also in principle included in regulatory capital requirements, but remains zero throughout the sample.

- 2015: CCB = 0% of RWA
- 2016: CCB = 0.625% of RWA
- 2017: CCB = 1.25% of RWA
- 2018: CCB = 1.875% of RWA
- 2019-Present: CCB = 2.5% of RWA

In 2020, the Fed implemented the stress capital buffer (SCB) which replaces the CCB at the BHC level. The SCB is floored at the CCB of 2.5% but additionally requires BHCs to hold enough capital to cover stress test losses and four quarters of dividends. Global Systemically Important Banks (G-SIBs) face an additional capital surcharge applied at the holding company level, on top of the CCB (or SCB post-2020).

Advanced Approaches Institutions

Advanced Approaches (AA) institutions are required to compute risk-weighted assets under both standardized and internal-risk rating (AA) models (Congressional Research Service, 2023). Large, complex banking organizations[19] and their depository institution subsidiaries must use advanced approaches framework. For these banks, regulatory compliance is assessed using the lower of the capital ratios calculated under the standardized and advanced approaches. Accordingly, for each AA institution, CET1, Tier 1, and Total capital ratios are defined as the minimum across standardized and AA calculations in each quarter. This procedure is applied symmetrically at the BHC and depository institution levels, using the relevant standardized and advanced approach calculations reported for each entity.

Leverage Constraints and the Supplementary Leverage Ratio

Beginning in 2018, large banks are additionally subject to the Supplementary Leverage Ratio (SLR), defined as Tier 1 capital divided by total leverage exposure, which includes off-balance-sheet items. Advanced approaches banks must meet a 3% SLR at the BHC and depository subsidiary levels. G-SIBs and their depository institution subsidiaries are subject to an enhanced SLR (ESLR) of 5% at the BHC level and 6% at the depository subsidiary level.

Community Bank Leverage Ratio (CBLR) Framework

Beginning in 2020, qualifying community banks may opt into the Community Bank Leverage Ratio (CBLR) framework. Electing banks are exempt from all risk-based capital requirements and

[19] Until 2019, all banks that had at least $250 billion in total consolidated assets or at least $10 billion in total on-balance sheet foreign exposure were required to use the AA framework. After 2019, only Category I and II banks are required to use the AA framework, though other banks can elect to if they wish (Congressional Research Service, 2023).

TABLE 5—REGULATORY CAPITAL LEVELS FOR ADVANCED APPROACHES BANKING ORGANIZATIONS

	Jan. 1, 2014 (percent)	Jan. 1, 2015 (percent)	Jan. 1, 2016 (percent)	Jan. 1, 2017 (percent)	Jan. 1, 2018 (percent)	Jan. 1, 2019 (percent)
Capital conservation buffer	.....	.....	0.625	1.25	1.875	2.5
Minimum common equity tier 1 capital ratio + capital conservation buffer	4.0	4.5	5.125	5.75	6.375	7.0
Minimum tier 1 capital ratio + capital conservation buffer	5.5	6.0	6.625	7.25	7.875	8.5
Minimum total capital ratio + capital conservation buffer	8.0	8.0	8.625	9.25	9.875	10.5
Maximum potential countercyclical capital buffer	.....	.....	0.625	1.25	1.875	2.5

TABLE 6—REGULATORY CAPITAL LEVELS FOR NON-ADVANCED APPROACHES BANKING ORGANIZATIONS

	Jan. 1, 2015 (percent)	Jan. 1, 2016 (percent)	Jan. 1, 2017 (percent)	Jan. 1, 2018 (percent)	Jan. 1, 2019 (percent)
Capital conservation buffer	.....	0.625	1.25	1.875	2.5
Minimum common equity tier 1 capital ratio + capital conservation buffer	4.5	5.125	5.75	6.375	7.0
Minimum tier 1 capital ratio + capital conservation buffer	6.0	6.625	7.25	7.875	8.5
Minimum total capital ratio + capital conservation buffer	8.0	8.625	9.25	9.875	10.5

Figure B.1: Regulatory Requirements for AA and Non-AA Banking Organizations

are instead subject only to a Tier 1 leverage ratio requirement of at least 9%. These banks do not report RWA while in the CBLR regime, and are hence dropped from the sample.

Construction Procedure

Excess bank capital is constructed in four steps:

1. *Observed capital ratios.* For each institution-quarter, CET1 (post-2015), Tier 1, Total Capital, and Leverage Ratios are computed from FR Y-9C (for BHCs) or Call Report (for depository institution subsidiaries) data. For AA institutions, capital ratios reflect the minimum across standardized and advanced approaches.

2. *Applicable regulatory minimums.* Regulatory minimum capital ratios (inclusive of the CCB, GSIB-surcharge, or SCB for BHCs when applicable) are assigned based on the regulatory regime in place in quarter t.

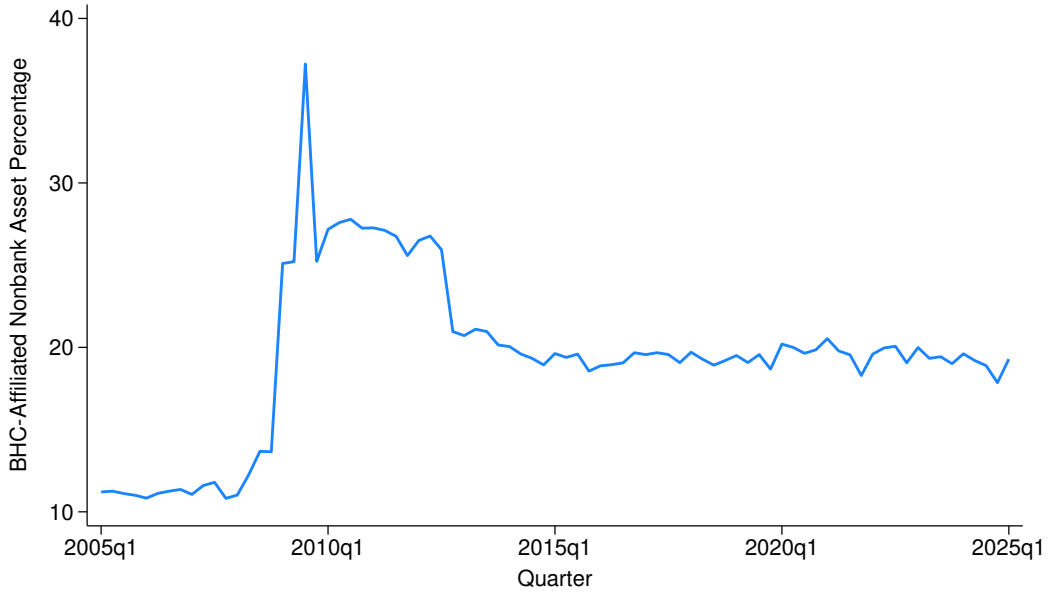
3. *Accounting for the leverage ratio.* To account for potentially binding leverage constraints, for each institution-quarter, we compute the minimum amount of Tier 1 capital required to satisfy their applicable leverage ratio (Tier 1 leverage ratio, SLR, or ESLR). If this implied Tier 1 requirement exceeds the Tier 1 capital implied by risk-based requirements, the leverage-based requirement is treated as binding. The implied minimum Tier 1 capital is then expressed as a ratio of the institution's RWA, allowing leverage-based and risk-based constraints to be compared on a common scale.

4. *Excess capital.* Excess CET1, Tier 1, and Total capital are defined as the difference between observed ratios and their respective regulatory minimums. Excess capital is the minimum of these three values.

Appendix C Additional Empirical Figures

C.1 Share of BHC-Affiliated Nonbanks

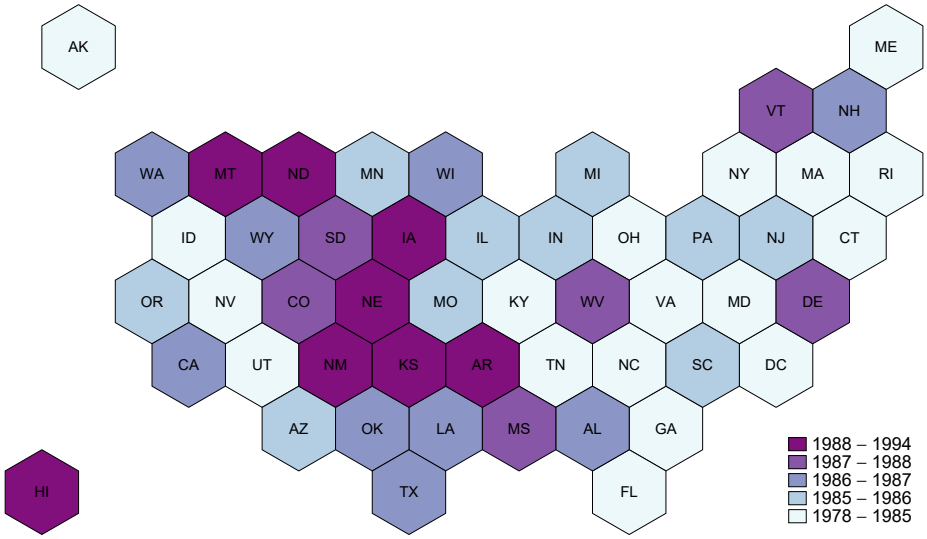
Figure C.1: Percent of Aggregate Nonbank Assets Attributable to BHC Subsidiaries



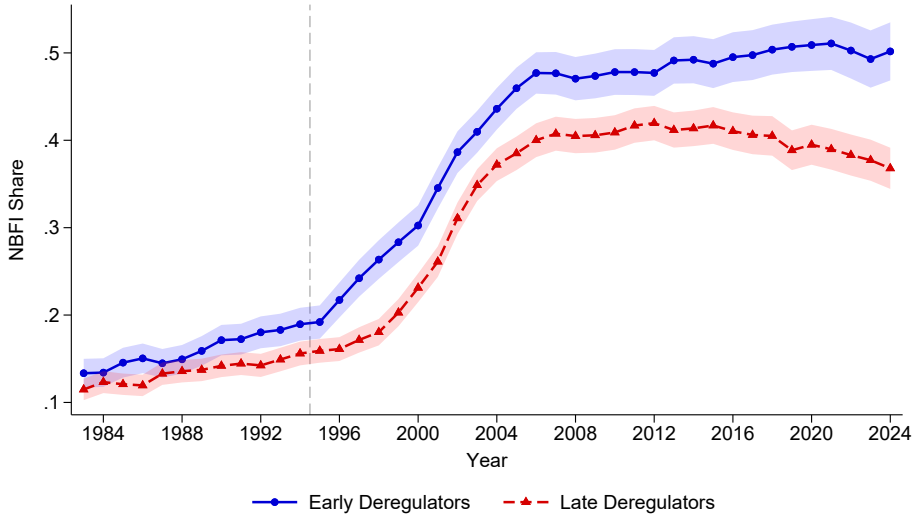
Notes: The figure presents the percent of aggregate nonbank assets attributable to BHC subsidiaries from 2005 through 2025. This measure is constructed as the ratio of BHC-affiliated nonbank assets (from FR Y-9LP) to aggregate nonbank assets (from the Financial Accounts of the United States). The denominator is constructed using asset-level proxies for Broker/Dealers, ABS, Equity REITs, Finance Companies, Life Ins., Mortgage REITs, Other Fin. Bus., PC Ins., Closed-End Funds. Mutual funds and ETF assets under management (AUM) are excluded from industry totals as they are not included in the FR Y-9LP numerator. Source: FR Y-9LP and the Financial Accounts of the United States.

C.2 Interstate Banking Deregulation and Nonbank Financial Exposure

Figure C.2: Interstate Banking Deregulation and Nonbank Financial Exposure



(a) Interstate Deregulation Timing by State

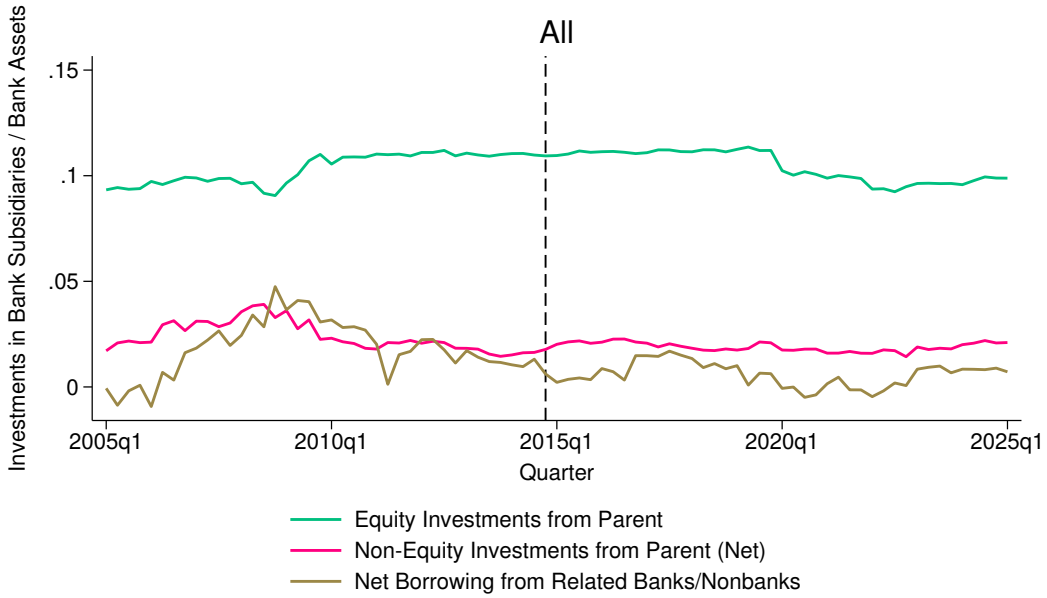


(b) Nonbank Share: Early vs Late Deregulators

Notes: Panel (a) displays the year each state removed restrictions on interstate banking. Lighter shading indicates earlier deregulation while darker shading indicates later deregulation. Panel (b) shows compares the nonbank share between BHCs headquartered in early-deregulating states and BHCs in late deregulating states. Table D.2 assesses whether this organizational structure is persistent.

C.3 Equity and Nonequity Investments

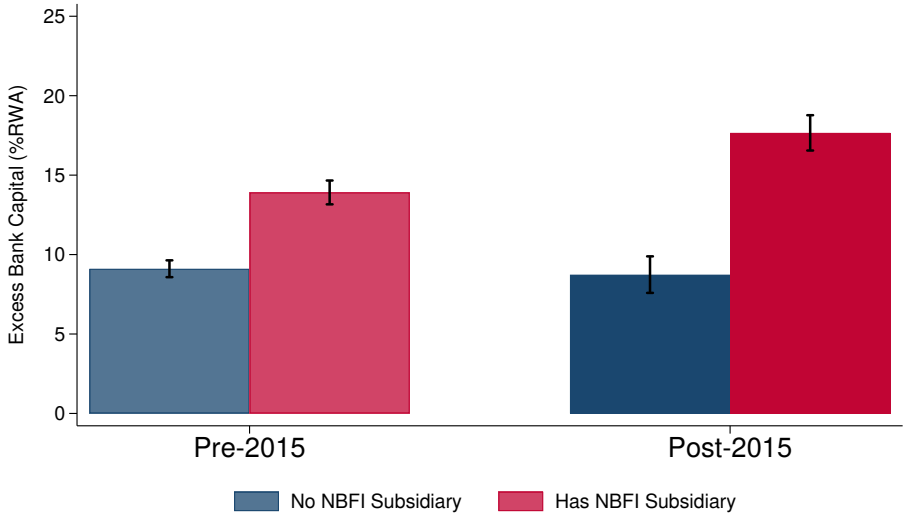
Figure C.3: Parent BHC Investments in Bank Subsidiaries and Intra-Company Borrowing



Notes: This figure shows parent BHC equity and nonequity investments in bank subsidiaries, as well as net intra-company borrowing, scaled by bank subsidiary assets. Equity investments in bank subsidiaries are defined as the sum of BHC equity investments in common stock, goodwill, and other intangibles. Nonequity investments in bank subsidiaries are defined as the sum of BHC investments in loans and other receivables and net balances due from subsidiaries (balances due from bank subsidiaries minus balances due to bank subsidiaries). Net borrowing from related banks and nonbanks is defined as balances held by subsidiary banks due to related banks and nonbanks minus balances held by subsidiary banks due from related banks and nonbanks. All variables are aggregated across BHCs in the sample using value-weighted averages. Source: FR Y-9LP.

C.4 Bank Capital by Nonbank Status

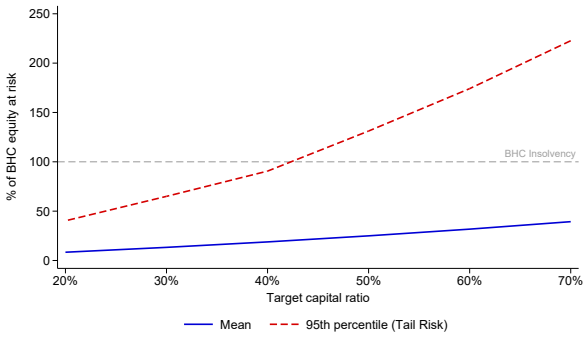
Figure C.4: Pre-Post Comparison: Bank Capital by Nonbank Status



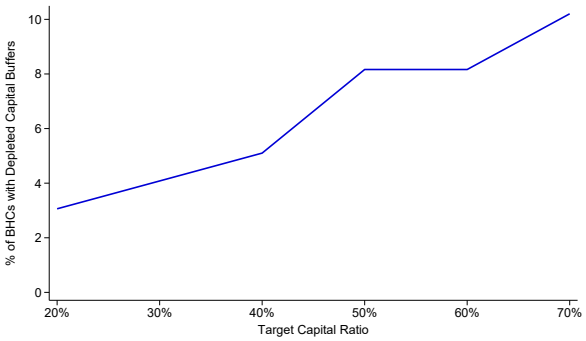
Notes: The figure compares bank capital ratios before (2010–2014) and after (2016–2024) the policy change for BHCs with and without nonbank subsidiaries, classified based on their 2005 status. Source: Authors' calculations using the FR Y-9LP and Call Reports.

C.5 Assets and Equity at Risk

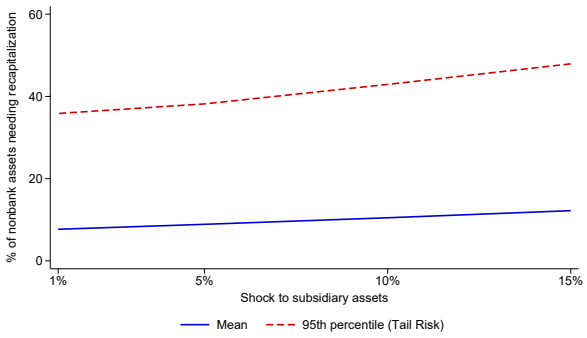
Figure C.5: Stress Test Sensitivity Analysis



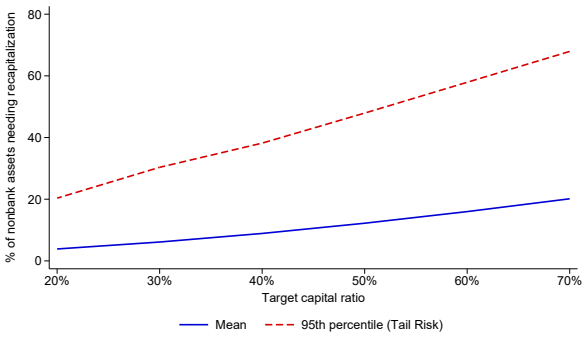
(a) BHC Equity at Risk by Capital Target



(b) Buffer Depletion by Capital Target



(c) Nonbank Assets at Risk by Shock

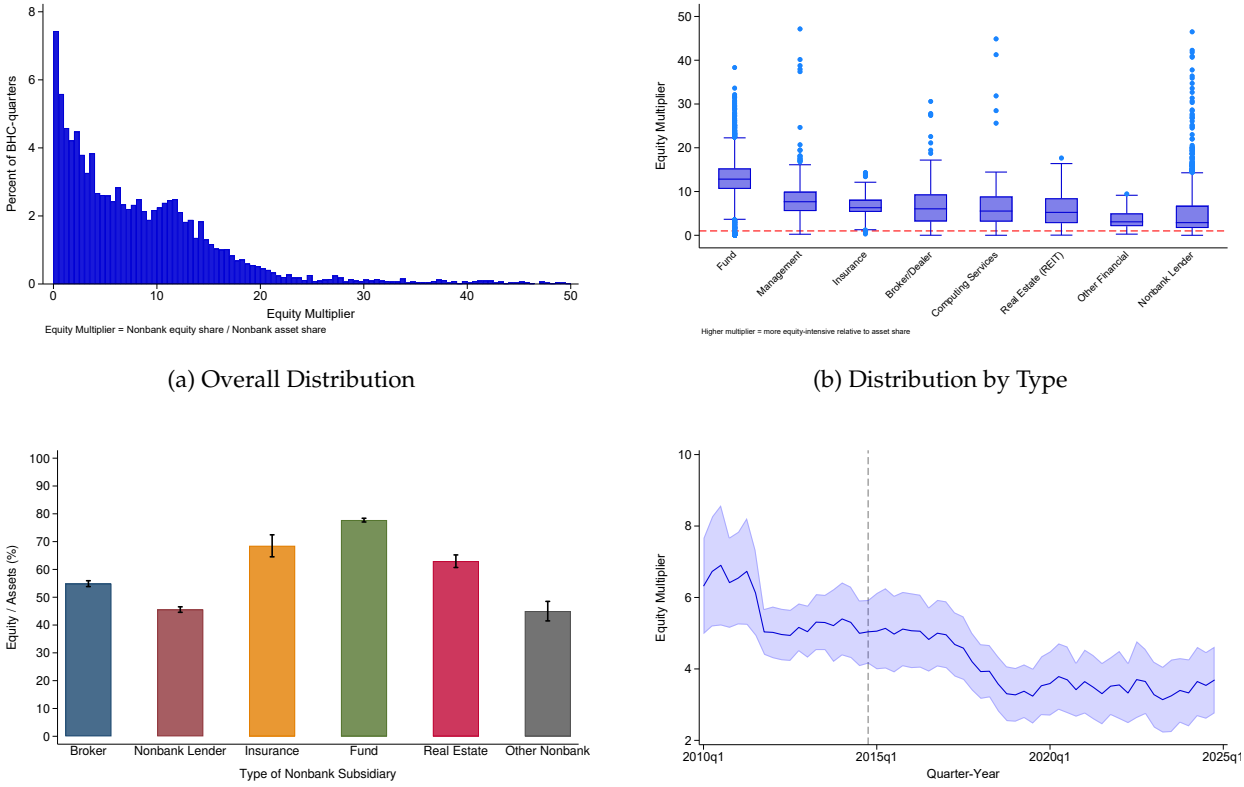


(d) Nonbank Assets at Risk by Target

Notes: The table presents the stress test sensitivity analysis. Panel (a) shows percentage of BHC excess capital required to restore nonbanks to varying capital ratio targets following a 5% asset shock. Solid line: mean. Dashed line: 95th percentile. Horizontal dashed line at 100% marks potential parent insolvency. Tail-risk BHCs exceed 100% at capital targets above 45%, creating policy tension between subsidiary safety and parent capacity. Panel (b) shows percentage of BHCs with completely depleted capital buffers under varying targets (5% shock). Panel (c) shows percentage of nonbank assets requiring recapitalization by shock severity (40% target). Asset-weighted perspective complements parent equity perspective in Figure 4. Panel (d) shows nonbank assets at risk across capital targets (5% shock). All panels use 2013Q4 balance sheets.

C.6 Equity Multiplier

Figure C.6: Equity Multiplier: Distributions and Dynamics



(a) Overall Distribution

(b) Distribution by Type

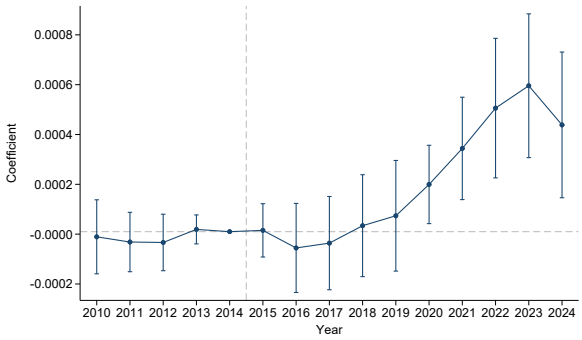
(c) Capital Ratios by Type

(d) Multiplier Over Time

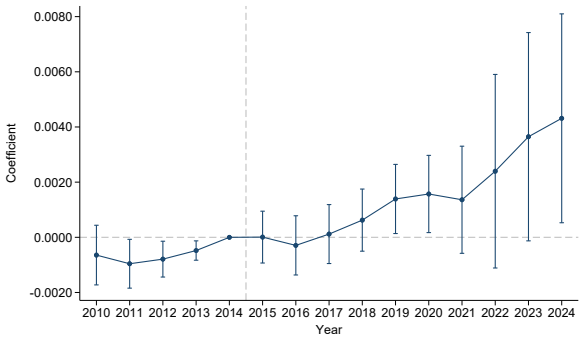
Notes: The figure provides comprehensive view of equity multiplier distributions and dynamics. Panel (a) shows histogram of equity multiplier across all BHC-quarters. Panel (b) shows box plots by subsidiary type (see heterogeneity documented in Table 4) Panel (c) shows mean capital ratios by type. Panel (d) shows time-series of aggregate equity multiplier. Shaded region shows 90% confidence interval. Source: Authors' calculations using FR Y-11.

C.7 Bank Event Studies

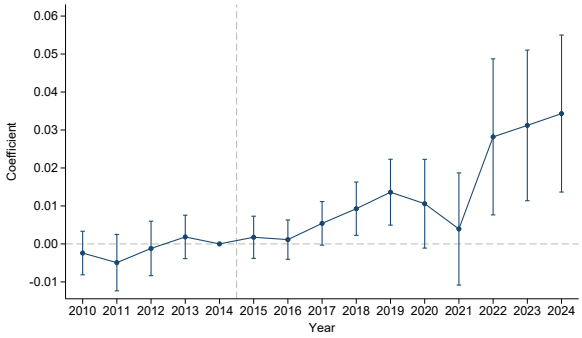
Figure C.7: Bank Event Studies: Safety and Profitability Improvements



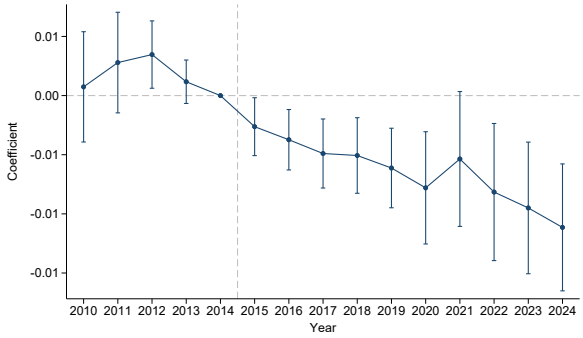
(a) ROA



(b) Retained Earnings



(c) Equity/RWA

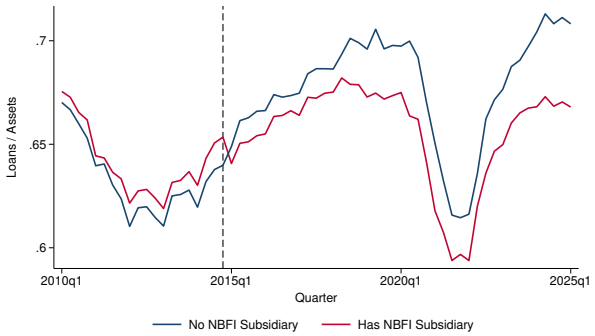


(d) RWA/Assets

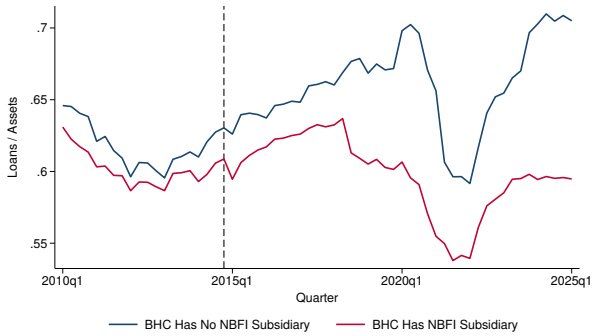
Notes: The figure presents event study estimates of bank outcomes relative to 2014Q4 baseline. Panel (a) shows return on assets, Panel (b) shows equity-to-risk-weighted-assets ratios, Panel (c) shows risk-weighted assets, and Panel (d) shows retained earnings. Coefficients estimated from specification including bank fixed effects, quarter-year fixed effects, and bank controls (log assets, leverage, asset growth measured 2013Q4) interacted with post-2015 indicator. Standard errors clustered at bank level. Error bars indicate 90% confidence intervals. Source: Call Reports.

C.8 Bank vs. BHC Raw Trends

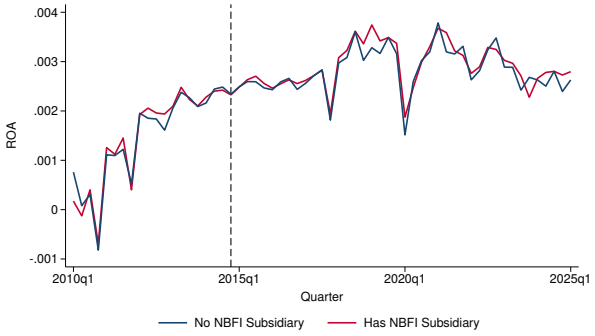
Figure C.8: Subsidiary-Level Effects Without Consolidated BHC Changes



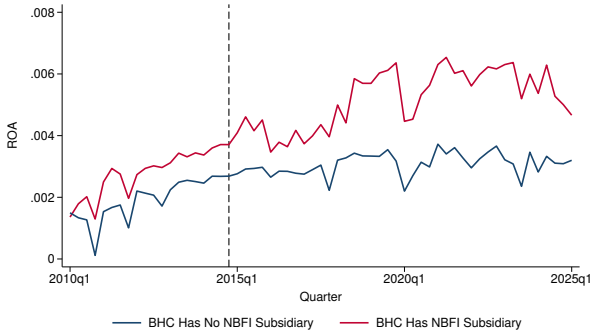
(a) BHC Loans/Assets



(b) Bank Loans/Assets



(c) BHC ROA

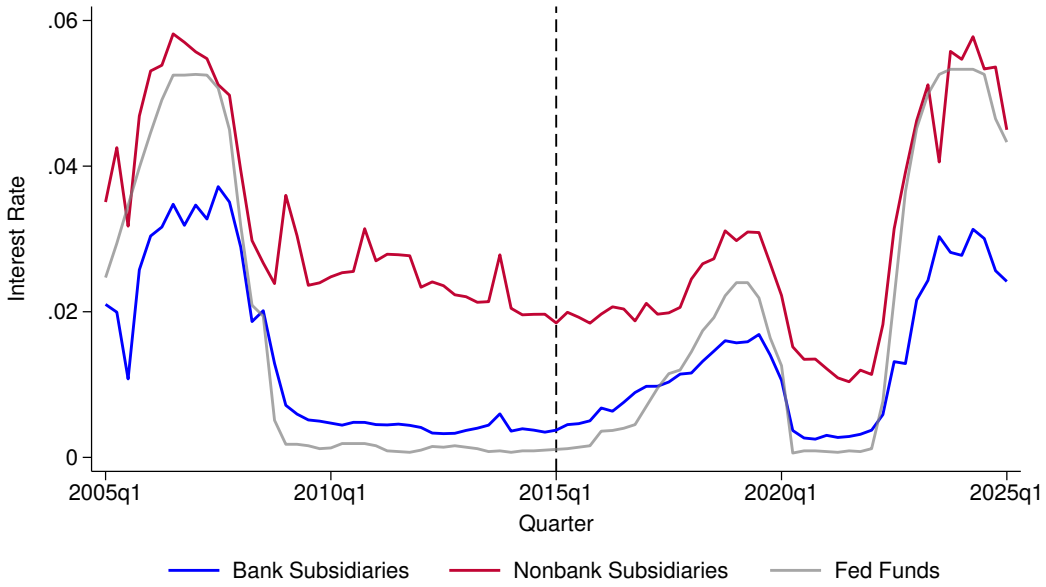


(d) Bank ROA

Notes: The figure contrasts BHC-level (consolidated) outcomes with bank subsidiary–level outcomes. Panels (a) and (c) show BHC-level loan shares and ROA for BHCs with nonbank affiliates (solid line, nonbank status fixed as of 2005) and for BHCs without nonbank affiliates (dashed line). Panels (b) and (d) report the corresponding outcomes at the bank subsidiary level. Loans/Assets and ROA are calculated for each bank and BHC in the sample before taking the average across the two groups. Source: FR Y-9C, FR Y-9LP, and Call Reports.

C.9 Implied Funding Rates

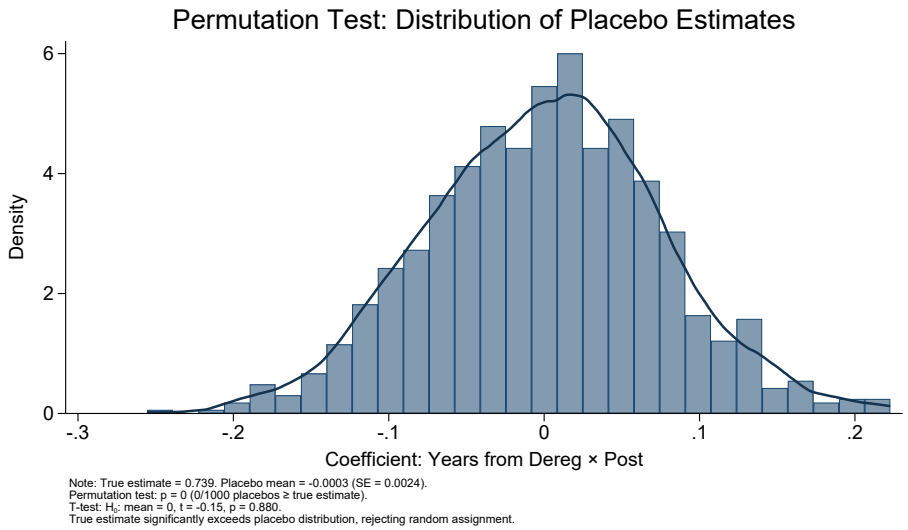
Figure C.9: Implied Interest Rates on Internal Funding



Notes: The figure shows implied interest rates on internal funding provided by BHC parents to subsidiaries. Rates are calculated as follows the annualized interest income from subsidiaries divided by the parent's non-equity investments in subsidiaries, the parent's balances due from subsidiaries, and, for bank subsidiaries only, the parent's deposits with affiliated depository institutions. Vertical dashed line indicates 2015Q1. Appendix Table 9 presents regression estimates assessing statistical significance of the difference. Source: Authors' calculations using FR Y-9LP and FR Y-9C.

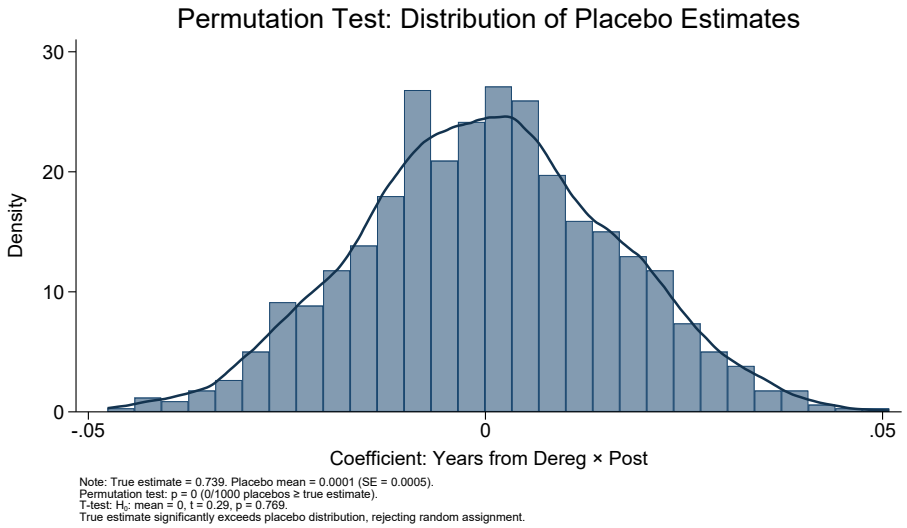
C.10 Placebo Tests

Figure C.10: Placebo Test: Randomized Deregulation Timing



Notes: The figure presents permutation-based placebo test. Distribution shows coefficients from 1,000 regressions where years from deregulation (instrument) is randomly reassigned to BHCs. Specification uses bank fixed effects, quarter-year fixed effects, and differential trends controls matching Column (1) of Panel B, Table 2. Placebo distribution tightly centered at zero: mean = -0.0003, standard error = 0.0024, t-statistic = -0.15, p-value = 0.880. True estimate of 0.739 percentage points (not shown to preserve scale) falls far in right tail.

Figure C.11: Placebo Test: Randomized Treatment Timing



Notes: The figure presents permutation-based placebo test validating the temporal variation in our identification strategy. Distribution shows coefficients from 1,000 regressions where post-period indicator is randomly assigned to years 2010-2024. Specification uses bank fixed effects, quarter-year fixed effects, and differential trends controls matching Column (1) of Panel B, Table 2. Placebo distribution centered at zero: mean = 0.0001, standard error = 0.0005, t-statistic = 0.29, p-value = 0.769. True estimate of 0.739 percentage points (not shown to preserve scale) falls far in right tail.

Appendix D Additional Empirical Tables

D.1 Balanced Panel Analysis

Table D.1: Balance Table: Pre-Treatment Characteristics (2013Q4)

	Early Dereg	Late Dereg	Difference
Number of BHCs	75	89	14
Panel A: Size and Organizational Complexity			
Log(Total Assets)	15.188	14.211	0.976^{***}
Asset Growth	0.021	0.040	-0.019
Top 200 BHC	0.347	0.191	0.156^{**}
Log(Nonbank Assets)	11.514	8.252	3.262^{***}
Nonbank # Distinct NAICS	0.348	0.421	-0.074^{**}
ROA	0.002	0.003	-0.001^{**}
Panel B: Balance Sheet Characteristics			
Leverage	9.852	9.760	0.092
Loan Share	0.599	0.594	0.005
Securities Share	0.233	0.265	-0.032
Deposits/Assets	0.807	0.821	-0.014
Cash Share	0.083	0.081	0.002

Notes: The table compares pre-treatment characteristics of BHCs headquartered in early-deregulating states (those that removed intrastate branching restrictions by 1986 or earlier) versus late-deregulating states. The fraction of observations in the Early Dereg sample does not significantly differ from the Late Dereg sample (difference in proportions test, $p = 0.27$.) All variables are measured as of 2013Q4, the quarter before Basel III implementation. Panel A reports size and organizational complexity measures. Panel B reports balance sheet composition measures. The "Difference" column reports differences in means. Statistical significance is indicated by asterisks based on t-test equality of means. Sources: FR Y-9C, FR Y-9LP, BHC Organizational Database described in Section 2. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

D.2 Persistence of Nonbank Exposure

Table D.2: Persistence of Nonbank Financial Subsidiary Exposure

	Dependent Variable: NBFI Share$_t$ (% of Total Assets)				
	(1) 1-Year Lag	(2) 2-Year Lag	(3) 3-Year Lag	(4) 4-Year Lag	(5) 5-Year Lag
NBFI Share$_{t-1}$	0.900***				
	(0.025)				
NBFI Share$_{t-2}$		0.857***			
		(0.028)			
NBFI Share$_{t-3}$			0.805***		
			(0.036)		
NBFI Share$_{t-4}$				0.758***	
				(0.044)	
NBFI Share$_{t-5}$					0.709***
					(0.053)
Observations	44,308	39,029	34,510	30,585	26,957
R-squared	0.922	0.885	0.846	0.818	0.790
Quarter FE	✓	✓	✓	✓	✓

Notes: The table examines the persistence of nonbank financial subsidiary (NBFI) exposure over time by regressing current NBFI share on lagged values at 1-, 2-, 3-, 4- and 5-year horizons. The dependent variable in all columns is the share of nonbank financial assets as a percentage of total BHC assets in quarter t. Each column includes quarter fixed effects to control for aggregate time trends. Standard errors are clustered at the BHC level. Source: FR Y-9LP and FR Y-9C. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

D.3 Internal Capital Reallocation: NBFI Presence

Table D.3: Internal Capital Reallocation and Organizational Complexity

Panel A: Bank Excess Capital

	(1)	(2)	(3)	(4)
$\mathbb{1}[\text{NBFI Sub}] \times \text{Post}$	4.8312**	4.8349**	2.0532*	2.0646**
	(2.3535)	(2.3377)	(1.0553)	(0.8277)
$\mathbb{1}[\text{NBFI Sub}]$	15.2740***	15.2727***		
	(3.0533)	(3.0547)		
Post	-1.7105***			
	(0.5685)			
Constant	9.1104***			
	(0.8462)			
Observations	54,814	54,814	54,814	54,814
R^2	0.0248	0.0251	0.9395	0.9401

Panel B: BHC Excess Capital

	(1)	(2)	(3)	(4)
$\mathbb{1}[\text{NBFI Sub}] \times \text{Post}$	-0.1793	-0.0362	-0.0066	0.4333
	(0.3183)	(0.3121)	(0.2679)	(0.2931)
$\mathbb{1}[\text{NBFI Sub}]$	0.6165*	0.6231*		
	(0.3202)	(0.3201)		
Post	-2.5508***			
	(0.2017)			
Constant	7.2883***			
	(0.1927)			
Observations	29,267	29,267	29,267	29,267
R^2	0.0791	0.1003	0.7722	0.7838

Panel C: Bank-to-BHC Excess Capital Ratio

	(1)	(2)	(3)	(4)
$\mathbb{1}[\text{NBFI Sub}] \times \text{Post}$	4.8312**	4.8349**	2.0532*	2.0646**
	(2.3535)	(2.3377)	(1.0553)	(0.8277)
$\mathbb{1}[\text{NBFI Sub}]$	15.2740***	15.2727***		
	(3.0533)	(3.0547)		
Post	-1.7105***			
	(0.5685)			
Constant	9.1104***			
	(0.8462)			
Observations	54,814	54,814	54,814	54,814
R^2	0.0248	0.0251	0.9395	0.9401
Fixed Effects:				
Bank FE			✓	✓
Quarter-Year FE		✓	✓	✓
Controls × Post				✓

Notes: The table presents difference-in-differences estimates relating excess capital to nonbank subsidiary presence. The dependent variable is bank excess capital (Panel A), BHC excess capital (Panel B), and the ratio of bank to BHC excess capital (Panel C). $\mathbb{1}[\text{NBFI Sub}]$ indicates BHCs with nonbank financial subsidiaries as of 2005Q4. Post equals one for 2015Q1 and later. Controls are measured in 2013Q4 and interacted with Post. Panel A and C controls include 2013Q4 bank size, leverage, ROA, and asset growth. Panel B controls include 2013Q4 BHC top 200 indicator, size, leverage, ROA, asset growth, deposits/assets, and subsidiary count. Standard errors are clustered at the bank level (Panels A and C) or BHC level (Panel B). Source: Authors' calculations using FR Y-9C, Call Reports, and FR Y-9LP. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

D.4 Internal Capital Reallocation: Deregulation Timing

Table D.4: Internal Capital Reallocation and Deregulation Timing

Panel A: Bank Excess Capital				
	(1)	(2)	(3)	(4)
Years from Dereg × Post	2.6967*	2.6954*	0.7634*	0.7395*
	(1.4094)	(1.4062)	(0.4225)	(0.3992)
Years from Dereg	6.0085***	6.0063***		
	(1.7622)	(1.7659)		
Post	-13.3012*			
	(7.0483)			
Constant	-12.0218			
	(8.6498)			
Observations	12,558	12,558	12,558	12,558
R^2	0.0474	0.0490	0.9500	0.9503
Panel B: BHC Excess Capital				
	(1)	(2)	(3)	(4)
Years from Dereg × Post	0.0061	0.0157	-0.0583	0.0058
	(0.1028)	(0.0988)	(0.0680)	(0.0721)
Years from Dereg	-0.1331	-0.1310		
	(0.0986)	(0.0989)		
Post	-2.4567***			
	(0.8104)			
Constant	8.2797***			
	(0.7489)			
Observations	6,079	6,079	6,079	6,079
R^2	0.1009	0.1428	0.7860	0.7961
Panel C: Bank-to-BHC Excess Capital Ratio				
	(1)	(2)	(3)	(4)
Years from Dereg × Post	3.3797**	3.1142**	2.0478**	1.7766***
	(1.3785)	(1.3162)	(0.8339)	(0.6211)
Years from Dereg	1.0960***	1.0989***		
	(0.2996)	(0.3008)		
Post	-13.3325*			
	(7.9656)			
Constant	-2.7111*			
	(1.4704)			
Observations	9,873	9,873	9,873	9,873
R^2	0.0712	0.0993	0.6697	0.6946
Bank FE			✓	✓
Quarter-Year FE		✓	✓	✓
Controls × Post				✓

Notes: The table presents reduced-form difference-in-differences estimates relating excess capital to deregulation timing. The dependent variable is bank excess capital (Panel A), BHC excess capital (Panel B), and the ratio of bank to BHC excess capital (Panel C). Years from Dereg measures the number of years between a BHC's headquarters state interstate branching deregulation and the 1994 Riegle–Neal Act; headquarters state is measured as of 1981. Post equals one for 2015Q1 and later. Controls are measured in 2013Q4 and interacted with Post. Panel A and C controls include 2013Q4 bank size, leverage, ROA, and asset growth. Panel B controls include 2013Q4 BHC top 200 indicator, size, leverage, ROA, asset growth, deposits/assets, and subsidiary count. Standard errors are clustered at the bank level (Panels A and C) or BHC level (Panel B). Source: Authors' calculations using FR Y-9C, Call Reports, and FR Y-9LP. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

D.5 Assets and Equity at Risk

Table D.5: Complete Stress Test Results: BHC Equity at Risk and Nonbank Subsidiaries Affected

Panel A: Mean BHC Equity at Risk (%)

	Target Capital Ratio					
Shock to Assets	20%	30%	40%	50%	60%	70%
1%	6.61	11.23	16.57	22.42	28.99	36.23
5%	8.38	13.30	18.84	24.97	31.78	39.33
10%	10.74	16.02	21.82	28.30	35.47	43.29
15%	13.30	18.84	24.97	31.78	39.33	47.62

Panel B: 95th Percentile BHC Equity at Risk (%)

	Target Capital Ratio					
Shock to Assets	20%	30%	40%	50%	60%	70%
1%	27.07	55.45	79.94	114.71*	156.84*	200.33*
5%	40.23	65.00	90.58	131.21*	174.17*	222.71*
10%	53.06	77.39	110.65*	152.51*	195.91*	253.56*
15%	65.00	90.58	131.21*	174.17*	222.71*	288.43*

Panel C: Mean Percentage of Nonbank Subsidiaries Requiring Recapitalization

	Target Capital Ratio					
Shock to Assets	20%	30%	40%	50%	60%	70%
1%	3.15	5.17	7.69	10.81	14.45	18.45
5%	3.86	6.12	8.90	12.21	15.99	20.14
10%	4.94	7.42	10.49	14.07	18.04	22.41
15%	6.12	8.90	12.21	15.99	20.14	24.97

Panel D: 95th Percentile of Nonbank Subsidiaries Requiring Recapitalization

	Target Capital Ratio					
Shock to Assets	20%	30%	40%	50%	60%	70%
1%	16.40	26.34	35.85	43.92	53.92	63.92
5%	20.34	30.34	38.19	47.92	57.92	67.92
10%	25.34	35.34	42.92	52.92	62.92	72.92
15%	30.34	38.19	47.92	57.92	67.92	77.92

Notes: The table presents stress test results using 2013Q4 balance sheets. Panels A–B show percentage of BHC excess capital required to recapitalize nonbank subsidiaries following asset shocks (rows) to restore target capital ratios (columns). Panel A shows the mean across BHCs. Panel B shows the 95th percentile (tail risk), with asterisks (*) indicating scenarios where recapitalization exceeds 100% of parent excess capital. Panels C–D show the percentage of nonbank subsidiaries falling below the target capital ratio following shocks. Panel C reports the mean; Panel D reports the 95th percentile, highlighting concentration of risk. Calculations assume full BHC ownership and 100% loss recognition.

D.6 Bank/BHC Equity Share

Table D.6: Bank Equity as Share of BHC Equity

	(1) Bank Equity Share	(2) Bank Equity Share
Years from Dereg × Post	0.0199*	0.0194**
	(0.0100)	(0.0075)
Observations	1,400	1,400
R^2	0.7667	0.7997
BHC FE	✓	✓
Quarter-Year FE	✓	✓
Controls × Post		✓

Notes: The table presents alternative measure of internal equity reallocation using bank equity stock rather than parent equity investments. Dependent variable is bank subsidiary equity divided by total BHC equity. This measures equity held by bank subsidiaries as share of consolidated BHC equity, complementing the parent equity investment measures in Table 5. Years from Dereg measures years between BHC headquarters state's interstate branching deregulation and 1994 Riegle-Neal Act. Post indicates 2015Q1 and later. Column (2) includes BHC controls (top 200 BHC indicator, log assets, leverage, ROA, deposits/assets, asset growth, subsidiary count) measured 2013Q4 and interacted with Post. Standard errors clustered at BHC level. Sample restricted to BHCs with nonbank asset share exceeding 1%. Source: FR Y-9C and FR Y-9LP. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

D.7 Bank Retained Earnings

Table D.7: Bank Retained Earnings

	(1)	(2)	(3)	(4)
Years from Dereg × Post	0.0054**	0.0054**	0.0020**	0.0019**
	(0.0021)	(0.0021)	(0.0008)	(0.0009)
Years from Dereg	0.0035	0.0035		
	(0.0032)	(0.0032)		
Post	-0.0130			
	(0.0106)			
Constant	0.0525***			
	(0.0157)			
N	12,558	12,558	12,558	12,558
R^2	0.0190	0.0209	0.9500	0.9529
Bank FE			✓	✓
Qtr-Year FE		✓	✓	✓
Controls				✓

Notes: The table presents the bank-level regression of retained earnings on organizational complexity. Dependent variable is bank retained earnings as share of bank assets, measured as quarterly undistributed subsidiary income scaled by beginning-of-quarter assets. Years from Dereg measures years between BHC headquarters state's interstate branching deregulation and 1994 Riegle-Neal Act. Post indicates 2015Q1 and later. Specification includes bank fixed effects, quarter-year fixed effects, and bank controls (log assets, leverage, ROA, asset growth) measured 2013Q4 and interacted with Post. Standard errors clustered at bank level. Source: Call Reports. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

D.8 BHC Balance Sheet

Table D.8: BHC-Level Balance Sheet: Limited Consolidated Effects

Panel A: Performance

	(1) ROA	(2) ROE	(3) Charge-Offs
Years from Dereg × Post	0.0011**	0.0001**	-0.0001**
	(0.0005)	(0.0000)	(0.0000)
Observations	5,896	5,896	5,896
R^2	0.329	0.477	0.485
BHC FE	✓	✓	✓
Quarter-Year FE	✓	✓	✓
Controls × Post	✓	✓	✓

Panel B: Portfolio Composition

	(1) Loan Share	(2) Securities Share	(3) Cash Share
Years from Dereg × Post	-0.0019	0.0016	0.0010
	(0.0028)	(0.0031)	(0.0010)
Observations	6,067	6,067	6,067
R^2	0.916	0.893	0.775
BHC FE	✓	✓	✓
Quarter-Year FE	✓	✓	✓
Controls × Post	✓	✓	✓

Panel C: Capital Structure

	(1) Leverage	(2) Equity/RWA	(3) RWA/Assets	(4) Marginal ROE	(5) Off-BS
Years from Dereg × Post	0.0363	0.0003	-0.0059**	0.0179	-0.0009
	(0.0568)	(0.0010)	(0.0026)	(0.0260)	(0.0015)
Observations	5,388	5,388	5,388	5,388	
R^2	0.718	0.871	0.880	0.039	0.873
BHC FE	✓	✓	✓	✓	✓
Quarter-Year FE	✓	✓	✓	✓	✓
Controls × Post	✓	✓	✓	✓	✓

Notes: The table reports estimates using BHC-level (consolidated) balance sheet data. Panel A presents performance measures, including return on assets (ROA), return on equity (ROE), and charge-offs. Panel B presents portfolio composition measures, including loan share, securities share, and cash share. Panel C presents capital structure measures, including leverage, equity-to-risk-weighted-assets, risk-weighted-assets-to-assets, marginal ROE, and off-balance sheet loan commitments. All dependent variables are measured at the consolidated BHC level. Years from Dereg measures the number of years between the interstate branching deregulation of the BHC headquarters state and the 1994 Riegle–Neal Act. Post is an indicator equal to one for 2015Q1 and later. All specifications include BHC fixed effects and quarter-year fixed effects. BHC controls include an indicator for top 200 BHCs, log total assets, leverage, deposits-to-assets, asset growth, and subsidiary count, all measured as of 2013Q4 and interacted with Post. Standard errors are clustered at the BHC level. Source: Authors' calculations using FR Y-9C. Significance levels are denoted by * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

D.9 Nonbank Shift to Consumer Lending

Table D.9: Loan Composition: Shift Toward Consumer Lending

Panel A: All Nonbank Subsidiaries

	(1) Real Estate Growth	(2) C&I Growth	(3) Consumer Growth	(4) Non-US Growth
Years from Dereg × Post	-0.0341***	-0.0524**	0.0147*	0.0217
	(0.0121)	(0.0195)	(0.0082)	(0.0171)
Observations	4,572	4,572	4,572	4,572
R^2	0.206	0.199	0.354	0.161
Nonbank FE	✓	✓	✓	✓
Industry-Qtr-Year FE	✓	✓	✓	✓
Controls × Post	✓	✓	✓	✓

Panel B: Nonbank Lenders Only

	(1) Real Estate Growth	(2) C&I Growth	(3) Consumer Growth	(4) Non-US Growth
Years from Dereg × Post	-0.0290	0.0230	0.0746***	-0.0471
	(0.0166)	(0.0400)	(0.0067)	(0.0554)
Observations	851	851	851	851
R^2	0.063	0.085	0.435	0.083
Nonbank FE	✓	✓	✓	✓
Industry-Qtr-Year FE	✓	✓	✓	✓
Controls × Post	✓	✓	✓	✓

Notes: The table reports regression estimates of loan growth by loan category for nonbank subsidiaries. The dependent variables are quarter-on-quarter log changes in loans by type: real estate (Column 1), commercial and industrial (Column 2), consumer (Column 3), and loans to non-U.S. borrowers (Column 4). Panel A includes all nonbank subsidiaries with lending activity. Panel B restricts the sample to subsidiaries classified as nonbank lenders, including finance companies, mortgage companies, and other specialized lending entities. Years from Dereg measures the number of years between the interstate branching deregulation of the BHC headquarters state and the 1994 Riegle–Neal Act. Post is an indicator equal to one for 2015Q1 and later. All specifications include nonbank subsidiary fixed effects and industry–quarter–year fixed effects. BHC control variables include an indicator for top 200 BHCs, log total assets, leverage, deposits-to-assets, asset growth, and subsidiary count, all measured as of 2013Q4 and interacted with Post. Standard errors are clustered at the BHC level. Source: FR Y-11. Significance levels are denoted by * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

D.10 Nonbank Business Model Changes

Table D.10: Business Model Changes: Shift from Fees to Interest Income

Panel A: Decline in Capital-Intensive Activities

	(1) Trading Revenue	(2) Advisory/Fiduciary	(3) Venture Capital
Years from Dereg × Post	-0.0005***	-0.0066*	-0.0005*
	(0.0002)	(0.0037)	(0.0003)
Observations	4,496	4,496	4,496
R^2	0.279	0.919	0.254
Nonbank FE	✓	✓	✓
Industry-Qtr-Year FE	✓	✓	✓
Controls × Post	✓	✓	✓

Panel B: Shift to Interest Income

	(1) ln(Interest Income)	(2) ln(Non-Interest Income)
Years from Dereg × Post	0.9351***	-0.2755
	(0.3125)	(0.2310)
Observations	2,387	2,387
R^2	0.775	0.809
Nonbank FE	✓	✓
Industry-Qtr-Year FE	✓	✓
Controls × Post	✓	✓

Notes: The table reports regression estimates of changes in nonbank subsidiary business model composition. Panel A presents measures of fee-based and investment-related activities. The dependent variables, all scaled by lagged assets, are trading revenue (Column 1), advisory and fiduciary revenue (Column 2), and venture capital revenue (Column 3). Panel B presents measures of income composition. The dependent variables are log interest income (Column 1) and log non-interest income (Column 2). Years from Dereg measures the number of years between the interstate branching deregulation of the BHC headquarters state and the 1994 Riegle–Neal Act. Post is an indicator equal to one for 2015Q1 and later. All specifications include nonbank subsidiary fixed effects and industry–quarter–year fixed effects. BHC control variables include an indicator for top 200 BHCs, log total assets, leverage, deposits-to-assets, asset growth, and subsidiary count, all measured as of 2013Q4 and interacted with Post. Standard errors are clustered at the BHC level. Source: FR Y-11. Significance levels are denoted by * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

D.11 Nonbank Compositional Shifts

Table D.11: Extensive Margin: Changes in Subsidiary Composition

Panel A: Net Change in Subsidiary Count

	(1) Broker	(2) Lender	(3) Insurer	(4) Fund	(5) REIT
Years from Dereg × Post	0.1222	-0.0107	-0.0113**	0.0670	0.0160
	(0.1025)	(0.0224)	(0.0053)	(0.0999)	(0.0175)
Observations	5,982	5,982	5,982	5,982	5,982
R^2	0.043	0.235	0.031	0.052	0.212

Panel B: Additions (Increase from Prior Quarter)

	(1) Broker	(2) Lender	(3) Insurer	(4) Fund	(5) REIT
Years from Dereg × Post	-0.0610	0.0067**	0.0025	0.0017	0.0016
	(0.0431)	(0.0030)	(0.0022)	(0.0245)	(0.0035)
Observations	6,155	6,155	6,155	6,155	6,155
R^2	0.066	0.066	0.091	0.237	0.054

Panel C: Removals (Decrease from Prior Quarter)

	(1) Broker	(2) Lender	(3) Insurer	(4) Fund	(5) REIT
Years from Dereg × Post	-0.1781	0.0171	0.0134**	-0.0670	-0.0132
	(0.1378)	(0.0208)	(0.0059)	(0.0801)	(0.0144)
Observations	6,155	6,155	6,155	6,155	6,155
R^2	0.091	0.249	0.079	0.073	0.248
BHC FE	✓	✓	✓	✓	✓
Quarter-Year FE	✓	✓	✓	✓	✓
Controls × Post	✓	✓	✓	✓	✓

Notes: This table examines changes in subsidiary composition at the extensive margin. Dependent variables measure quarter-to-quarter changes in subsidiary counts by type. Panel A shows net changes (current count minus prior quarter count, which equals additions minus removals). Panel B shows additions only (maximum of zero and the change, capturing only increases). Panel C shows removals only (maximum of zero and negative change, capturing only decreases). Years from Dereg measures years between BHC headquarters state's interstate branching deregulation and 1994 Riegle-Neal Act. Post indicates 2015Q1 and later. All specifications include BHC fixed effects, quarter-year fixed effects, and BHC controls (top 200 BHC indicator, log assets, leverage, deposits/assets, asset growth, total subsidiary count measured 2013Q4) interacted with Post. Standard errors clustered at BHC level. Source: BHC Organizational Database described in Section 2. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

D.12 Organizational Complexity

Table D.12: Organizational Complexity: Number of Distinct NBFI Types

	(1) ln(NBFI Types)	(2) ln(NBFI Types)
Years from Dereg × Post	0.0821***	0.0270*
	(0.0107)	(0.0157)
Observations	5,558	5,558
R^2	0.108	0.964
BHC FE		✓
Quarter-Year FE		✓
Controls × Post		✓

Notes: The table examines changes in organizational complexity measured by number of distinct nonbank activity types within BHC. Dependent variable is log of number of distinct NAICS-based nonbank subsidiary types. Column (1) shows pooled OLS. Column (2) includes BHC fixed effects, quarter-year fixed effects, and BHC controls (top 200 BHC indicator, log assets, leverage, deposits/assets, asset growth, subsidiary count) measured 2013Q4 and interacted with Post. Years from Dereg measures years between BHC headquarters state's interstate branching deregulation and 1994 Riegle-Neal Act. Post indicates 2015Q1 and later. Standard errors clustered at BHC level. Source: BHC Organizational Database described in Section 2. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

D.13 2SLS Design

Table D.13: First-Stage Relationship: Deregulation Timing and Organizational Complexity

NBFI Share × Post	(1)	(2)	(3)	(4)
Years from Dereg × Post	0.2877***	0.5105***	0.5269***	0.3461***
	(0.0649)	(0.1419)	(0.1389)	(0.1044)
Observations	12,558	12,558	12,558	12,558
R^2	0.108	0.130	0.636	0.686
Bank FE			✓	✓
Quarter-Year FE		✓	✓	✓
Controls × Post				✓

Notes: The table presents first-stage estimates verifying that deregulation timing predicts organizational complexity. Dependent variable is nonbank asset share (nonbank assets / total BHC assets) interacted with Post indicator (2015Q1 and later). Years from Dereg measures years between BHC headquarters state's interstate branching deregulation and 1994 Riegle-Neal Act. Column (1) presents unconditional correlation. Column (2) adds quarter-year fixed effects. Column (3) adds bank fixed effects. Column (4) adds differential trends controls at the bank level: log assets, leverage, ROA, and asset growth measured 2013Q4 and interacted with Post. Standard errors clustered at bank level in parentheses. Source: FR Y-9LP. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table D.14: Two-Stage Least Squares Estimates

Excess Bank Capital	(1)	(2)	(3)	(4)
NBFI $\widehat{\text{Share}}$ × Post	9.4067***	17.0469***	1.4489*	2.1365*
	(3.4466)	(5.6947)	(0.8095)	(1.1549)
Observations	12,558	12,558	12,558	12,558
First-Stage Diagnostics:				
Kleibergen-Paap LM Statistic	16.458	11.065	12.257	10.144
Cragg-Donald Wald F Statistic	1524.187	1201.771	1161.075	524.242
Kleibergen-Paap Wald F Statistic	19.635	12.941	14.384	10.992
Bank FE			✓	✓
Quarter-Year FE		✓	✓	✓
Controls × Post				✓

Notes: The table presents two-stage least squares (2SLS) estimates using deregulation timing as instrument for organizational complexity. Dependent variable is excess bank capital, defined as bank equity capital ratio minus regulatory minimum. Endogenous regressor is nonbank asset share interacted with Post (2015Q1 and later). Instrument is years from state deregulation to Riegle-Neal interacted with Post. Column (1) presents unconditional 2SLS. Column (2) adds quarter-year fixed effects. Column (3) adds bank fixed effects. Column (4) adds differential trends controls (log assets, leverage, ROA, asset growth measured 2013Q4 interacted with Post). Standard errors clustered at bank level in parentheses. First-stage diagnostics reported at bottom. Source: Call Reports, FR Y-9LP. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.