Regulatory Arbitrage within the Firm

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Abstract

Regulation shapes the boundaries of firms. When prudential standards bind asymmetrically across subsidiaries of an integrated organization, internal capital markets become a mechanism for regulatory arbitrage. We study this in U.S. banking, where holding companies encompass both heavily regulated depository institutions and lightly regulated nonbank affiliates. Following Basel III in 2015, holding companies extract equity from nonbank subsidiaries to recapitalize their banks. Bank subsidiaries accumulate 5–8 percentage points more excess capital than comparable standalone banks, through internal transfers; consolidated equity, assets, and lending are unchanged. Within the same organization, banks become safer while nonbank affiliates experience declining capital ratios, deteriorating credit quality, and aggressive expansion into consumer lending. Risk is shifted rather than eliminated, leaving the consolidated organization exposed to nonbank distress. We calibrate stress scenarios to 2008-scale losses on nonbank assets. If parents were to recapitalize distressed subsidiaries, 4—6% of holding companies would exhaust their capital buffers. For the most exposed institutions, the apparent improvement in bank safety is substantially overstated once the implicit liability to nonbank affiliates is accounted for. Organizational structure is a fundamental determinant of regulatory outcomes.

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1 Introduction

A fundamental question in economics is how organizations allocate resources across internal boundaries. Coase (1937) argues that firms emerge when internal coordination economizes on transaction costs relative to market exchange, and subsequent work has shown that organizational form shapes resource allocation (e.g., Williamson, 1975; Grossman and Hart, 1986), capital structure (e.g., Harris and Raviv, 1991; Stein, 1997), and responses to external shocks (e.g., Gertner, Scharfstein and Stein, 1994; Scharfstein and Stein, 2000). Far less is known, however, about how regulation interacts with organizational structure. Regulation imposes constraints that might affect a firm's choice of activities, but in turn firms can endogenously adapt its organizational boundaries, with implications on the efficacy of the regulation itself.

This interaction is particularly consequential for the banking firm, which is subject to stringent prudential requirements, with capital adequacy being its central component. The canonical framework behind this regulation specifies minimum equity ratios, leverage constraints, and risk-weighted buffers for "the bank" as if it were a standalone entity. This framework reflects the organizational structure of mid-twentieth-century banking, but modern banking firms are complex holding companies comprising dozens of legally separate subsidiaries—depository institutions, but also broker-dealers, consumer lenders, asset managers, insurers—that face dramatically different regulatory regimes despite operating under common ownership and integrated management. When regulation designed for standalone entities confronts this organizational reality, a natural question arises: do tighter capital requirements on bank subsidiaries reduce risk at the organizational level, or do they induce reallocation of risk to lightly regulated nonbank affiliates within the same firm?

The answer depends on how internal capital markets respond. In a frictionless world, reallocating equity across subsidiaries would be neutral; a dollar of capital is a dollar of capital regardless of where it sits in the organizational chart. But when raising external equity is costly (Myers and Majluf, 1984; Altınkılıç and Hansen, 2000), a profit-maximizing holding company facing tighter requirements on its bank subsidiary has a cheaper alternative: extract equity from lightly regulated nonbank affiliates and redeploy it internally, consistent with broader evidence that organizations expand internal capital markets when external markets are impaired (Matvos and Seru, 2014; Matvos, Seru and Silva, 2018). This avoids costly external issuance, satisfies regulatory requirements, and raises consolidated profitability. The same reallocation, however, strips nonbank affiliates of capital and loads risk onto the less regulated side of the firm. This organizational adaptation has broader implications that in fact may undo the efficacy of the regulation. If the parent recapitalizes a distressed nonbank subsidiary, it draws down the capital buffer that backstops the bank. The bank's improved capital position is therefore not fully insulated from nonbank risk: distress at the nonbank can propagate to the bank through the parent's balance sheet.

The U.S. banking industry provides an ideal laboratory for studying the interaction between regulation and organizational structure. Subsidiary-level financial disclosures, sharply differentiated regulatory regimes across affiliates within the same firm, and well-identified policy shocks combine to make BHCs a setting where the response of organizational structure to regulatory frictions can be cleanly identified. However, these dynamics have implications that extend well beyond banking, applicable to any multi-entity organization where regulation, taxation, or supervision binds asymmetrically across affiliates.[1] We exploit the phased implementation of Basel III capital requirements beginning in 2015, which substantially tightened minimum capital ratios for bank subsidiaries while leaving nonbank affiliates formally unregulated. We show that bank holding companies (BHCs) respond precisely as the mechanism predicts: rather than issuing new equity, they extract equity from nonbank subsidiaries and reallocate it to their banks. BHC profitability rises, external equity issuance falls, and bank capital ratios improve, but the same reallocation strips nonbank affiliates of capital, raises their internal funding costs, and induces them to shift aggressively into riskier lending. Risk is not eliminated; it is relocated to the less regulated, less protected side of the firm.

These findings reframe a growing literature on regulatory arbitrage. Prior work documents how stricter bank regulation drives credit intermediation outside the banking sector toward fintech lenders, shadow banks, and nonbank financial institutions that compete with regulated depository institutions.[2] We show that the same migration occurs *within* the boundaries of bank holding companies. Rather than losing market share to external nonbank competitors, BHCs grow nonbank affiliates inside their own organizational boundaries. The migration of risk from regulated to unregulated entities is therefore not only an inter-firm phenomenon but an intra-firm one,

[1] For example, Gandhi and Olenski (2024) document an analogous mechanism in nursing homes, where operators tunnel profits to commonly-owned real estate and management companies to obscure profitability from price regulators. Kakani et al. (2026) similarly show that vertically integrated insurers respond to profit caps in Medicare Part D by raising prices at their owned pharmacies. Giroud and Rauh (2019) document within-firm reallocation across U.S. states in response to differential taxation.

[2] See, e.g., Buchak et al. (2018), Irani et al. (2021), and Buchak et al. (2024).

and one that operates under consolidated supervision rather than escaping it.

To establish causality, we exploit cross-sectional variation in organizational complexity (the extent a BHC controls nonbank affiliates) generated by the staggered timing of interstate banking deregulation during the 1970s–1990s. Following Strahan (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 geographic restrictions on interstate banking. States that deregulated earlier allowed BHCs more time to expand and build multi-subsidiary structures before the Riegle–Neal Act of 1994 harmonized restrictions nationwide. This historically determined variation, shaped by state-level political economy decades before our study period (Kroszner and Strahan, 1999), generates persistent differences in organizational structure plausibly orthogonal to factors determining post-2015 regulatory responses. Permutation-based placebo tests confirm that neither random reassignment of the instrument nor random reassignment of the treatment timing produces significant effects.

We establish three core findings. First, BHCs with more complex organizational structures respond to enhanced capital requirements by extracting equity from nonbank subsidiaries to recapitalize their bank affiliates. Using a reduced-form specification within an instrumental variables strategy 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; Bai, Campello and Muthukrishnan, 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 10–11% of bank assets while non-equity investments total just 1–2%. This dominance explains why organizational structure, specifically, the presence of nonbank subsidiaries from which equity can be extracted, becomes a fundamental determinant of regulatory responses.

Post-2015, we observe systematic equity reallocation operating through three channels. First, nonbank equity-to-asset ratios decline sharply with regulation exposure, while net balances and dividend payments to parents rise. Second, parent equity investments shift from nonbanks toward banks in equal and offsetting amounts, with no change in total investments, providing direct evidence of internal redistribution rather than external capital raising. Third, parents charge nonbanks sharply higher internal funding rates while leaving bank rates unchanged, generating an internal spread of roughly 300 basis points for the median BHC. 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. Rather than turning to external markets to satisfy stricter requirements, organizationally complex BHCs sharply reduce common stock issuance.

The key mechanism underlying these patterns is the asymmetric distribution of equity within BHCs, which makes nonbank subsidiaries natural sources of internal capital. Nonbank subsidiaries within BHCs hold dramatically higher equity-to-asset ratios than banks (median 69% versus 10%), making them natural "equity reservoirs" despite small asset footprints. This creates an internal equity multiplier: the median nonbank subsidiary represents just 2% of consolidated assets but holds 16% of consolidated equity, meaning each dollar of nonbank assets supports a disproportionately large share of consolidated equity available for reallocation. We confirm that the reallocation response scales directly with this extractability: BHCs with higher equity multipliers inject disproportionately more equity into banks and reduce external issuance more aggressively post-2015. In contrast, BHCs with lower multipliers, lacking accessible internal equity reservoirs, increase their reliance on external capital markets.

Our second core finding examines the systemic implications of internal capital reallocation using subsidiary-level stress tests. While internal equity extraction that avoids costly external financing is privately optimal for BHCs, it can create two channels for systemic fragility. First, depleted nonbank capital buffers may make subsidiaries vulnerable to shocks that would have been absorbed under higher pre-extraction capitalization. Second, nonbank distress may transmit to banks through contagion: when parents must inject equity to recapitalize distressed nonbanks, they draw down the very bank buffers regulators sought to protect through stricter requirements. Historical episodes of intra-firm transmission, rating-agency methodology that prices implicit parent support, and our own empirical evidence on bank lending, bond spreads, and parent equity flows around nonbank distress events all illustrate how distress at non-depository affiliates can deplete parent capital and indirectly weaken the affiliated bank.

We quantify these risks by simulating scenarios comparable to the 2008 financial crisis: nonbank subsidiaries suffer asset losses requiring recapitalization to restore prudential capital ratios. Using 2013Q1 balance sheets (before equity extraction), we calculate losses of 5%, 10%, and 15% on nonbank assets, magnitudes consistent with the substantial mark-to-market losses and balance sheet contractions experienced by broker-dealers during 2007–2009 (Adrian and Shin, 2010), and compute the equity injection needed to restore nonbank capital ratios to values around the population median, ranging from 40% to 70% of assets.

Under our baseline scenario (5% shock requiring recapitalization to 40% capital ratios), the average BHC would need to deploy 18% of its excess capital to recapitalize nonbanks. At the 95th percentile, this rises to 99% of available parent capital, and 4% of BHCs would completely exhaust capital buffers. More severe scenarios generate tail risks exceeding 100% of available BHC capital. Accounting for the contagion channel, the net improvement in bank safety is modest for the typical BHC. The implied offset is approximately 8% of the gross capital gain, but nearly complete for tail-risk institutions, where the contagion channel offsets up to 71% of the apparent bank capital improvement. Our findings demonstrate that organizational structure shapes the transmission of risk: while banks appear safer along standard prudential metrics, the consolidated organization remains exposed to nonbank-side shocks through internal capital reallocation.

A natural question is why BHCs pursue internal reallocation rather than external equity issuance. The answer is that internal reallocation is privately profitable for the BHC. By avoiding the issuance costs that external capital raising would impose, BHCs preserve consolidated returns: ROA and ROE rise following Basel III while charge-offs decline, even as consolidated equity, portfolio composition, and capital structure remain unchanged. The improvement in profitability does not reflect a shift toward riskier consolidated assets; it reflects the BHC arbitraging the regulatory wedge between its subsidiaries.

At the subsidiary level, our third core finding is that the same regulatory wedge that drives internal reallocation also produces 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 after 2015, driven by reduced charge-offs and improved asset quality rather than by deploying capital into higher-return activities. 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. The resulting shift toward consumer lending is an endogenous response to this equity extraction; the same regulatory force that drives internal reallocation also forces portfolio reoptimization under tighter equity constraints. In response, nonbanks shift away from high-equity-ratio lines of business (e.g., trading, venture capital, advisory) toward higher-leverage 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, safety-net-protected banks toward less regulated, uninsured 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 through compositional churn, adding nonbank lender subsidiaries while shedding high-equity-ratio insurance affiliates. This extensive-margin response, combined with intensive-margin shifts in nonbank business models, shows that organizational complexity actively adapts to regulatory constraints.

More broadly, our findings highlight that regulation interacts with firm boundaries in fundamental ways. When prudential standards bind asymmetrically across subsidiaries within integrated organizations, internal capital markets mediate the incidence of regulation, potentially increasing fragility at the organizational level. Banks become safer while nonbanks performing identical economic functions become more fragile, shifting credit provision from entities with regulatory oversight and safety nets to entities with neither.

1.1 Related Literature

This paper contributes to three strands of literature. First, we extend research on internal capital markets by documenting how regulation shapes internal capital allocation and showing that organizational structure is a fundamental determinant of regulatory incidence. While prior work emphasizes liquidity reallocation through loans and deposits and repo transactions between affiliates (Lamont, 1997; Shin and Stulz, 1998; Stein, 1997; Houston, James and Marcus, 1997; Rajan, Servaes and Zingales, 2000; Stein, 2002; Campello, 2002; Ashcraft and Campello, 2007; Cetorelli and Goldberg, 2012*a*,*b*; Gilje, Loutskina and Strahan, 2016; Cetorelli and Prazad, 2025; Bai, Campello and Muthukrishnan, 2025; Bai et al., 2025), we show equity transfers dominate by an order of magnitude and directly affect risk-bearing capacity and regulatory capital ratios. More broadly, firm boundaries shape how resources are reallocated and how shocks propagate within organizations (Giroud and Mueller, 2015, 2019). A closely related literature shows that organizations rely on internal capital markets when external markets are impaired: diversified firms reallocate capital internally during financial dislocations (Matvos and Seru, 2014; Kuppuswamy and Villalonga, 2016; Almeida, Kim and Kim, 2015), and firms expand and diversify their scope to facilitate internal reallocation when external frictions tighten (Matvos, Seru and Silva, 2018). We document an analogous response to regulatory frictions: BHCs adjust internal capital allocation in response to regulatory wedges across subsidiaries, using nonbank affiliates as equity reservoirs when bank-level capital requirements bind. Our evidence demonstrates that internal capital markets, whose transaction costs justify organizational existence, create real economic consequences when regulation distorts internal allocation decisions.

Second, we contribute to understanding the effects of bank capital regulation (Kashyap, Stein and Hanson, 2010; Admati et al., 2013, 2018; Hanson, Kashyap and Stein, 2011; Berger and Bouwman, 2013; Gropp et al., 2019; Begenau, 2020). These studies typically treat banks as standalone entities or examine consolidated holding company responses. We show subsidiary-level heterogeneity within firms is important: 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. Three features differentiate it. First, within-firm arbitrage occurs *under consolidated supervision*: the same regulator that tightens bank capital requirements also oversees the holding company within which risk migrates to nonbank affiliates, yet this migration can still occur within the remit of consolidated oversight. Second, the contagion channel is direct: nonbank distress transmits to the bank through the parent's balance sheet, not through market-mediated linkages, making within-firm risk migration more immediately salient to the entities regulation seeks to protect. Third, the equity channel we document is quantitatively dominant, meaning internal capital markets reallocate risk-bearing capacity itself, not merely liquidity. Our findings complement work by Acharya, Schnabl and Suarez (2013); Tarullo (2019); Bai, Campello and Muthukrishnan (2025) emphasizing the challenges of regulating multi-entity financial conglomerates. Our work is closest to Albuquerque et al. (2026), who document lending reallocation from bank to nonbank subsidiaries within banking groups following macroprudential tightening. In contrast, we identify an equity channel that is quantitatively dominant and creates potential contagion risk from nonbank distress back to affiliated banks.

We also document substantial growth in lending and risk-taking by nonbank subsidiaries within BHCs, 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; Acharya, Cetorelli and Tuckman, Forthcoming). Buchak et al. (2024) document the secular decline of banks' share of credit intermediation as nonbanks expand. We show that regulatory pressure accelerates this migration even within the boundaries of BHCs: BHCs reallocate lending activity from regulated bank subsidiaries to lightly-regulated nonbank affiliates in response to stricter capital requirements. This organizational channel for regulatory arbitrage operates alongside the cross-sector reallocation emphasized in prior work, and has important implications for measuring and monitoring systemic risk. Many economically important nonbanks operate as wholly owned subsidiaries of BHCs, creating direct channels for risk transmission that are invisible in sector-level data (Adrian and Ashcraft, 2012; Cetorelli and Prazad, 2025).

The rest of the paper proceeds as follows. Section 2 presents the theoretical framework that organizes our empirical analysis. Section 3 describes data sources and sample construction. Section 4 presents the identification strategy. Section 5 documents internal capital reallocation. Section 6 documents the divergent consequences for subsidiary outcomes: banks become safer while nonbanks become more fragile, with implications for the consolidated holding company's systemic risk profile. Section 7 presents key robustness tests. Section 8 concludes.

2 A Framework for Internal Capital Reallocation

We develop a model to organize our empirical analysis and formalize the mechanism. A profit-maximizing BHC owns two subsidiaries: a regulated bank B and an unregulated nonbank N. The bank faces a capital requirement $E_B \geq \kappa_B \cdot A_B$; the nonbank faces none. The BHC can meet a tightening requirement either by raising costly external equity K at convex cost $c(K)$, or by transferring equity internally from the nonbank to the bank at transaction cost τ per dollar. When external equity is sufficiently costly the BHC's optimal response is fully internal.[3] This is privately optimal: the BHC avoids costly external issuance and consolidated profitability rises. Later, in Section 6, we show that BHC profitability increases following Basel III, consistent with this prediction.

Proposition 2.1 (Internal Reallocation Equilibrium)**.** *When $c'(0) > \tau$ and regulation binds, the BHC optimally sets $K^* = 0$, $E_B^* = \kappa_B \cdot A_B$, and $E_N^* = E^0 - \kappa_B \cdot A_B$, yielding:*

$$\frac{\partial E_B^*}{\partial \kappa_B} = A_B > 0, \quad \frac{\partial E_N^*}{\partial \kappa_B} = -A_B < 0, \quad \frac{\partial (E_B^* + E_N^*)}{\partial \kappa_B} = 0 \tag{1}$$

We focus on the empirically relevant region in which marginal issuance costs at zero are sufficiently high to generate a corner solution, consistent with observed reliance on internal capital markets. Bank equity rises one-for-one with the regulatory requirement; nonbank equity falls in equal proportion; consolidated BHC equity is unchanged.[4]

This prediction reflects the absence of adjustment along other margins (e.g., external issuance, asset growth, or retained earnings), and provides a benchmark for assessing the extent to which BHCs rely on internal capital markets in the data. The model predicts bank equity at exactly the regulatory minimum ($E_B^* = \kappa_B \cdot A_B$), implying zero excess capital. Empirically, banks hold substantial buffers above regulatory minimums. This gap reflects forces outside the model's scope: precautionary motives under uncertainty, time-varying requirements (e.g., stress capital buffer phase-in), the minimum-across-ratios measurement of excess capital, and the fact that multiple regulatory constraints (CET1, leverage, TLAC) bind at different points. The model's key testable prediction is not the level of excess capital but its *differential* change: internal reallocation increases

[3] A large literature documents that external equity issuance is costly. See Myers and Majluf (1984); Altınkılıç and Hansen (2000).

[4] The precise endogenous condition for the corner solution $K^* = 0$ is $c'(0) > v + \tau$, where v is the shadow value of internal funds. We state the condition as $c'(0) > \tau$ as a sufficient condition when the shadow value is small relative to the transaction cost, which is the empirically relevant case.

bank capital without increasing consolidated equity, and this differential prediction is what we test.

The systemic implications of this reallocation depend on a second consideration. When a nonbank subsidiary suffers losses, the parent must choose between injecting equity to recapitalize it, liquidating assets at potentially fire-sale prices, or allowing failure. If the parent recapitalizes, it draws down the same capital buffer that backstops the bank. The bank's improved balance sheet may therefore be partially offset by a weakened parent: the additional excess capital accumulated by the bank is implicitly at risk if the nonbank encounters distress and the parent responds by injecting equity.

We capture this through a contagion parameter $\lambda \in [0,1]$, where $\lambda = 0$ denotes perfect ring-fencing and $\lambda = 1$ denotes full transmission of nonbank distress to the bank through the parent. The parameter λ should be interpreted as a reduced-form sufficient statistic summarizing all channels through which nonbank distress depletes resources available to support the bank, including capital transfers, funding pressures, and reputational spillovers.[5] The probability of bank failure incorporates both direct shocks and contagion:

$$\Pr(\text{Bank Failure}) = F_B(-E_B) + \lambda \cdot \Pr(\theta_N < -E_N \text{ and } \theta_B > -E_B) \tag{2}$$

The second term captures the channel of interest: nonbank distress transmits to the bank even in states where the bank would otherwise survive its own shock, because the parent depletes its buffer to recapitalize the nonbank.

Proposition 2.2 (Contagion Externality)**.** *There exists a threshold λ^* such that internal reallocation is privately and socially aligned when $\lambda < \lambda^*$, and generates unpriced systemic costs when $\lambda > \lambda^*$. The BHC internalizes direct failure costs of its own subsidiaries, but not the full social cost of contagion-induced bank failure ($\lambda \cdot \Delta L_B$), leading to excessive internal reallocation when contagion is material.*

This wedge arises because the full social cost of bank failure exceeds the BHC's private losses. In the formalization, L_B denotes the loss parameter in the BHC's objective; the externality arises because contagion-induced bank failure imposes systemic costs, i.e., credit supply disruption, interbank contagion, and fiscal backstop costs, that exceed the BHC's private exposure. The BHC therefore underweights the marginal contagion cost $\lambda \cdot \Delta L_B$ relative to the social planner, leading to excessive internal reallocation when contagion is material.

[5] In section 5.5 we argue in more detail why we should expect a nonzero λ.

The model delivers three testable predictions that organize our empirical analysis. First, tighter bank capital requirements should raise bank excess capital without any corresponding increase in consolidated BHC equity through internal reallocation rather than external issuance. Second, nonbank subsidiaries in the same organizations should experience declining capital ratios, higher internal funding costs, and endogenous shifts away from high-equity-ratio activities as equity extraction forces portfolio reoptimization under tighter equity constraints. Third, the systemic implications depend on λ: the degree to which nonbank distress depletes the parent resources that backstop the bank. We calibrate λ empirically by simulating adverse shocks to nonbank portfolios and measuring the implied draw on parent capital buffers. Our estimates imply $\lambda \in [0.2, 0.5]$, indicating material but not complete contagion, placing the system below but close to the threshold $\lambda^* \approx 0.7$, with the post-2015 depletion of nonbank capital buffers narrowing this margin. Complete derivations, proofs, and calibration details are in Appendix B.

3 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).

3.1 BHC-Level Data

The FR Y-9C provides quarterly consolidated financial statements for BHCs, 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 E.1 shows that nonbank assets held within BHC structures represent approximately 25–30% of total nonbank financial assets post-2010, with the sharp increase in 2008–2010 reflecting the conversion of large investment banks (e.g., Goldman Sachs, Morgan Stanley) to BHC status following the financial crisis. This indicates our sample captures a substantial share of shadow banking activity. 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.

3.2 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.

3.3 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.

3.4 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, 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 value.

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. We exclude banks that opt into the Community Bank Leverage Ratio (CBLR) framework, as they do not report RWA. Full details of the regulatory framework and construction procedure are provided in Appendix C.

3.5 Summary Statistics

Table 2 reports summary statistics for the BHC, bank, and nonbank samples used in the empirical analysis from 2010 to 2024. BHCs are heterogeneous in size, with mean assets of $34.8 billion and mean risk-weighted assets of $21.2 billion. On average, bank subsidiaries of BHCs comprise a greater share of consolidated assets than nonbank subsidiaries. Commercial banks are typically smaller than their top-tier holding company, with mean assets of $14.5 billion, while nonbank subsidiaries are substantially smaller with mean assets of just $3.8 billion. Balance sheet composition measures indicate that BHCs and banks are primarily deposit-funded and loan-oriented, whereas nonbanks historically hold relatively low loan shares and span a range of subsidiary types including brokers, lenders, and funds.

4 Empirical Strategy

This section outlines our identification strategy for estimating the effect of stricter bank capital regulation on internal capital allocation within BHCs. The central empirical challenge is that Basel III capital requirements were implemented uniformly for all U.S. BHCs beginning in 2015, precluding a simple cross-sectional comparison between treated and control institutions. 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 and samples.

4.1 Institutional Setting and Treatment Timing

The Pre-Basel III Regime. Prior to 2015, U.S. BHCs and their depository institution subsidiaries faced three binding capital requirements: a Tier 1 capital ratio of at least 4% of risk-weighted assets (RWA), a Total Capital ratio of at least 8% of RWA, and a leverage ratio of at least 4% of total assets. These requirements applied symmetrically to both the consolidated BHC and its bank subsidiaries. Nonbank subsidiaries within BHCs faced no analogous capital requirements: their capitalization was governed only by market discipline, counterparty requirements, and in some cases, state-level solvency standards for insurance affiliates.

Basel III Regime. Basel III introduced four changes that are material for our analysis. First, it added a new Common Equity Tier 1 (CET1) ratio requirement of 4.5% of RWA, a constraint that did not exist before and that could not be satisfied with hybrid capital instruments such as trust preferred securities that counted toward pre-Basel III Tier 1. Second, the Tier 1 minimum was raised from 4% to 6% of RWA. Third, a CCB of up to 2.5% of RWA was phased in between 2016 and 2019, raising the effective CET1 minimum to 7% at full implementation. Fourth, stricter definitions of qualifying capital excluded instruments that previously counted toward regulatory minimums, meaning many institutions that appeared adequately capitalized under pre-Basel III rules faced shortfalls under the new framework. Table 1 summarizes these changes. See Appendix C for more details.

Regulatory Wedge. The critical asymmetry for our analysis is that Basel III requirements apply at the subsidiary level for bank affiliates but not for nonbank affiliates. Bank subsidiaries file Call Reports, are examined by bank supervisors, and must independently satisfy minimum capital ratios. Nonbank subsidiaries such as broker-dealers, consumer lenders, asset managers, and insurance affiliates face *none* of these requirements at the subsidiary level, regardless of their size or

Table 1: Capital Requirements Before and After Basel III

Requirement	Pre-2015	2015 Minimum	Full Phase-In (2019)
CET1 / RWA	—	4.5%	7.0% (incl. CCB)
Tier 1 / RWA	4.0%	6.0%	8.5% (incl. CCB)
Total Capital / RWA	8.0%	8.0%	10.5% (incl. CCB)
Leverage (Tier 1 / Assets)	4.0%	4.0%	4.0%

Notes: The Capital Conservation Buffer (CCB) was phased in from 0.625% in 2016 to 2.5% in 2019. G-SIB surcharges and the Stress Capital Buffer (post-2020) apply additional requirements at the BHC level only. Nonbank subsidiaries faced none of these requirements.

activities. To see how this wedge creates an incentive for internal reallocation, consider a stylized BHC with a bank subsidiary at a 6% CET1 ratio and a nonbank subsidiary holding excess capital (Appendix Figure A.1). Before Basel III, both are adequately capitalized under the 4.5% CET1 minimum. When the effective minimum rises to 7% (inclusive of the CCB), the bank subsidiary falls short while the consolidated BHC remains compliant. The BHC can either raise costly external equity or transfer equity internally from the nonbank, which faces no regulatory minimum, to the bank. The internal transfer satisfies the bank's CET1 requirement without changing consolidated equity, and is preferred whenever internal transfer costs fall below external issuance costs.

Treatment Timing. We define our treatment period as beginning in 2015Q1, when binding minimum capital ratios first took effect for the majority of banks. While the Basel III framework was initially proposed in 2010 and finalized in the U.S. via rules published in the Federal Register in October 2013, binding minimum capital ratios did not take effect until January 1, 2015. Our pre-treatment controls are measured as of 2013Q1, several quarters before the final rules were published and nearly two years before they became binding, ensuring that neither organizational structure nor BHC characteristics reflect anticipatory responses to the regulatory change. Our sample spans 2010 through 2024, covering the full pre- and post-treatment period for all BHCs filing consolidated financial statements with the Federal Reserve.

4.2 Instrumental Variable Strategy

The central empirical challenge is that Basel III capital requirements were implemented uniformly for all U.S. BHCs in 2015, precluding a simple cross-sectional comparison between treated and control institutions. We address this by exploiting pre-determined variation in BHC organizational complexity arising from state-level banking deregulation. Following Jayaratne and Strahan (1996), Strahan (2003), and Rice and Strahan (2010), we use the timing of interstate branching deregulation across U.S. states as a source of quasi-experimental variation in organizational structure.[6] 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, before the Riegle–Neal Act of 1994 harmonized geographic restrictions nationwide.[7]

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:

[6] Matvos, Seru and Silva (2018) use a related deregulation index, originally constructed by Black and Strahan (2001), as a contemporaneous shock to external credit supply for non-financial firms, finding that scope contracts as cheaper external credit lowers the demand for internal capital markets. Our setting differs because BHCs are the intermediaries directly governed by interstate deregulation, not non-financial firms responding to changes in credit supply. Pre-1994 geographic restrictions limited BHCs' ability to grow in scale, and deregulation removed those scale constraints. Cross-state variation in deregulation timing thus generates pre-determined variation in BHCs' realized organizational complexity by 2013, which we exploit in a setting where Basel III subsequently created the asymmetric capital wedge we study. The two strategies are complementary uses of the same source of regulatory variation, operating through different channels.

[7] A natural concern is that our instrument captures organizational complexity generated by Glass-Steagall's repeal in 1999 rather than by earlier interstate banking deregulation. The timing is mechanical: our instrument measures years elapsed between state-level deregulation and Riegle-Neal (1994), so the variation we exploit was built in the 1980s and early 1990s, predating Glass-Steagall's repeal. More fundamentally, Glass-Steagall imposed weaker constraints on BHC nonbank activity than the common narrative suggests. Cetorelli and Prazad (2025) document that the Bank Holding Company Act of 1956 granted regulators broad discretion over the permissible boundaries of banking, and that by the mid-1980s regulators were exercising this discretion expansively, inviting banks to become "financial supermarkets" (Markham, 2009). The Senate voted 94–0 to propose repealing Glass-Steagall as early as 1988. The 1999 legislation therefore ratified an organizational reality that had already emerged.

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

where Y_{it} is an outcome variable (bank capital ratios, nonbank equity, or BHC equity), 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. At the BHC level, we control for log total assets, leverage, return on assets, asset growth, deposit-to-assets ratio, top-200 BHC indicator, and total subsidiary count. At the bank level, we control for log assets, leverage, return on assets, and asset growth. These controls flexibly absorb differential exposure to concurrent regulations (Dodd-Frank, Volcker Rule, CCAR/DFAST) that might differentially affect BHCs based on size, activities, or regulatory status. The coefficient β captures how much more (or less) BHCs in early-deregulating states adjust capital allocation in response to Basel III, per additional year of deregulation exposure. For analyses of balance sheet outcomes, we exclude return on assets from the controls to isolate structural capital effects from contemporaneous profitability variation.

This reduced form specification offers a transparent interpretation: the coefficient β directly answers the policy-relevant question of how an additional year of pre-Riegle-Neal deregulation exposure affects capital reallocation after Basel III. Because not all BHCs in early-deregulating states fully exploit the opportunity to build complex structures, β captures intent-to-treat (ITT) effects that are conservative relative to treatment-on-the-treated but do not rely on strong functional form assumptions. As a robustness check, Appendix Table F.17 reports 2SLS estimates that scale the reduced-form effects by the first-stage relationship. These estimates are larger in magnitude, as expected when moving from ITT to treatment-on-the-treated effects, but rely on the stronger exclusion restriction.[8]

Difference-in-Differences Benchmark. As a complement to the reduced-form specification, we also report difference-in-differences estimates comparing BHCs that held any nonbank financial subsidiaries as of 2013Q1 (treated) to those that did not (control), interacted with the Post-2015

[8] The reduced form requires only that (i) deregulation timing predicts organizational complexity (*relevance*) and (ii) early and late deregulators would exhibit parallel trends in outcomes absent Basel III (*parallel trends*). Under these assumptions, the reduced-form coefficient identifies the causal effect of deregulation exposure on outcomes, an ITT effect. 2SLS goes further by rescaling this coefficient to recover the effect of organizational complexity itself, but does so under the additional *exclusion restriction*: that deregulation timing affects outcomes *only* through organizational structure. The exclusion restriction is stronger and less testable than parallel trends. We adopt the reduced form because it identifies a clean causal effect under weaker assumptions, while acknowledging that interpreting this effect as operating specifically through internal capital reallocation requires the exclusion restriction to hold as well.

indicator. This binary specification captures the extensive margin of organizational structure, i.e., whether a BHC possessed any internal capital market from which equity could be extracted, and provides a simple complement to the reduced-form estimates that exploit variation in the intensity of deregulation exposure. The DiD indicator is pre-determined: 2013Q1 precedes the publication of final Basel III rules in July 2013. We report both specifications throughout the paper to demonstrate robustness.

Instrument Validity. Three sets of evidence support the validity of the instrument. First, parallel pre-trends: Figure 1 shows that BHCs in early- versus late-deregulating states exhibit parallel trends in nonbank subsidiary share from 1986 to 1994, before Riegle-Neal harmonized interstate banking nationwide. These parallel pre-trends indicate that deregulation timing is uncorrelated with differential trends in organizational structure or capital management. Appendix Figure E.2 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 affect capital allocation only when the regulatory constraint tightens.

Second, balance on observables: Appendix Table F.1 compares pre-treatment characteristics between BHCs headquartered in early- versus late-deregulating states as of 2013Q1. 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 (total assets, top 200 BHC status, distinct NAICS codes, and ROA) are directly accounted 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.

Third, persistence of organizational structure: Appendix Table F.2 shows NBFI share exhibits high autocorrelation: a BHC with 10 percentage points higher nonbank share in year t has 7.1 percentage points higher share five years later. This means organizational complexity developed in the 1980s–1990s provides pre-determined variation today, almost three decades after Riegle-Neal eliminated regulatory differences.[9]

[9] Appendix Figure E.2 displays the geographic and temporal variation in deregulation timing and shows that early

The instrument's relevance is supported by direct first-stage evidence as well as prior work documenting differential organizational expansion in early-deregulating states. 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 (2026) show that the share of gross domestic assets owned by out-of-state multi-BHCs 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 F.16, where we show that BHCs headquartered in early-deregulating states are substantially more likely to have nonbank financial subsidiaries.

5 Main Results

5.1 Motivation: Scale of Equity vs. Liquidity Flows

We begin by documenting the composition of internal funding flows within BHCs. Understanding whether parents fund subsidiaries primarily through equity investments or debt-like instruments is important 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 between domestic and foreign affiliates 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.[10] These studies provide important insights into internal debt markets, but the role of direct 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 bank subsidiaries, plotting three components normalized by bank assets over 2005–2024: (1) equity investments (common stock, goodwill, and intangibles), (2) non-equity investments (loans, receivables, and other direct expo-

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, size of local non-bank sector, or business cycle conditions (Kroszner and Strahan, 1999; Rice and Strahan, 2010).

[10] Relatedly, Schnabl (2012) shows that the 1998 Russian default transmitted to Peru through international interbank lending, with multinational banks reallocating funds to their foreign affiliates.

sures), and (3) net borrowing from related banks and nonbanks (intracompany debt positions). The dominance of equity over debt-like instruments is immediate and striking. Equity investments (green line) average 10–11% of bank assets throughout the sample period and increase to 12–13% post-2015. In contrast, non-equity investments (red line) average just 1–2% of bank assets with no discernible trend, while net borrowing from related entities (brown line) hovers near zero throughout. Equity investments are an order of magnitude larger than non-equity investments.[11]

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 key 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.

5.2 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 3 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 reduced-form estimates exploiting variation in organizational complexity from deregulation timing. 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). For the median gap of 7 years between early and late deregulators, this implies approximately 5 percentage points more bank capital.[12] The ratio of bank to BHC excess capital nearly doubles per year of exposure (Column 3). Panel B reports benchmark difference-in-differences estimates: banks in BHCs with nonbank subsidiaries accumulate more excess capital post-2015,

[11] Equity investments as reported on the FR Y-9LP include common stock, goodwill, and intangibles. Because goodwill and most intangibles are deducted from CET1, the regulatory capital available for reallocation is somewhat smaller than the reported aggregate.

[12] Multiplying the coefficient of 0.74 by the median exposure of 7 years yields $7 \times 0.74 = 5.18$ percentage points.

with no change at the consolidated BHC level, and the bank-to-BHC excess capital ratio nearly triples. The combination of large positive effects at the bank level alongside insignificant 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. Appendix Tables F.3 and F.4 present the full specifications with all intermediate columns.

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 3. Panel (a) shows bank-level capital. Pre-2015, banks in treated BHCs hold higher baseline excess capital (approximately 13.9%) than control BHCs (approximately 9.1%). 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.[13] Appendix Figure E.3 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.

Ruling Out External Equity Issuance. The bank-BHC divergence documented above is consistent with two explanations: BHCs raise external equity and channel it to bank subsidiaries, or BHCs reallocate existing internal equity from nonbank to bank subsidiaries. The null effect at the

[13] 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. Whether CET1 becomes the binding constraint depends on the composition of the capital stack: specifically, whether Additional Tier 1 plus Tier 2 capital exceeds the gap between the total capital requirement and the CET1 requirement (approximately 3.5% of RWA). BHCs with less AT1 and T2 capital relative to RWA were more likely to become CET1-constrained after 2015, mechanically lowering their measured excess capital.

consolidated BHC level suggests the former is unlikely; external issuance would raise consolidated equity alongside bank equity.

Appendix Table F.5 confirms this directly. Across all three measures of external equity activity, direct common stock issuance, net issuance, and total external equity, all normalized by lagged equity, BHCs with greater deregulation exposure significantly *reduce* external equity issuance post-2015.[14] Rather than accessing external markets to satisfy stricter capital requirements, organizationally complex BHCs reduce their reliance on outside investors. This is only possible if an internal margin of adjustment exists, which we trace in the following section.

5.3 Tracing Internal Capital Flows.

Having established the bank-BHC divergence, we next trace the specific internal flows through which this reallocation occurs. Internal capital reallocation operates through parent equity investments flowing from nonbanks to banks, facilitated by asymmetric dividend policies and differential earnings retention.[15] We restrict this 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.

Table 4 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

[14] For the median BHC with 7 years of deregulation exposure, direct issuance declines by 0.77 percentage points of equity per quarter, and net issuance declines by 1.82 percentage points.

[15] This mechanism is legally distinct from direct lateral transactions between bank and nonbank affiliates, which are heavily restricted. Section 23A of the Federal Reserve Act (1913), implemented through Regulation W, limits covered transactions (loans, asset purchases, guarantees) between a commercial bank and any single affiliate to 10% of the bank's capital stock and surplus, with an aggregate limit of 20% across all affiliates, and requires full collateralization. Section 23B imposes arm's-length requirements on all affiliate transactions. Importantly, however, these restrictions govern transactions *between* the commercial bank and its affiliates. They do not generally constrain equity capital allocation decisions made by the parent holding company and their subsidiaries. The parent's authority to set dividend policies for nonbank subsidiaries and to inject equity into bank subsidiaries operates largely outside the scope of Sections 23A and 23B.

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.[16]

This reallocation is facilitated by 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). Simultaneously, banks retain earnings rather than distributing them upward. Appendix Figure E.4 visualizes this cumulative retention: banks in BHCs with nonbank affiliates increase retained earnings from 5% to 10% of assets between 2015 and 2020, while banks without nonbank affiliates remain flat near 5%. Appendix Table F.7 presents the regression specification, showing bank retained earnings as a share of assets increase by 0.19 percentage points per quarter per year of deregulation exposure.

The combination of higher nonbank dividends, increased parent equity injections into banks, and bank earnings retention creates a self-reinforcing internal capital reallocation mechanism. Nonbanks transfer equity upward to the parent through dividends and net transfers; the parent redeploys this capital into bank subsidiaries; and banks, which operate with substantially lower equity-to-asset ratios than nonbanks, translate each injected dollar into a larger expansion of assets than would be possible at the nonbank level. Each dollar extracted from a highly capitalized nonbank subsidiary therefore supports a multiple of bank assets at the consolidated level. This mechanism explains how bank capital ratios improve substantially without external equity issuance or reductions in consolidated balance sheets, as we quantify in the following section.

5.4 The Equity Multiplier

Having documented the internal equity flows, a natural question is why nonbank subsidiaries provide such an accessible source of equity for reallocation. The answer lies in a fundamental asymmetry: nonbanks maintain high capital ratios 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.

[16] Appendix Table F.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.

For each BHC, we compute the equity multiplier as:

$$\text{Equity Multiplier} = \frac{\text{Nonbank Equity Share}}{\text{Nonbank Asset Share}} \tag{5}$$

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 5 presents summary statistics. The median equity multiplier is 6.5×, meaning the typical nonbank subsidiary holds more than six times its proportional share of consolidated equity relative to its asset footprint. This concentration arises from two forces. First, nonbanks operate with high voluntary capital ratios (median 69% equity-to-assets compared to a bank median near 10%). Second, nonbank balance sheets are relatively small, so even modest absolute equity holdings represent large equity shares. The multiplier distribution exhibits substantial right skew: the 75th percentile is 12× and the 95th percentile exceeds 21×, reflecting BHCs where small nonbank subsidiaries hold especially concentrated equity positions.[17]

Heterogeneity Across Nonbank Types. Panel B of Table 5 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×). Figure 4 visualizes this.[18] The variation across types reflects different business models and regulatory environments.[19]

Heterogeneity: Reallocation Scales with the Equity Multiplier. The equity multiplier framework predicts that BHCs with greater extractable nonbank equity reallocate internally in response to tighter bank capital requirements, while BHCs without internal reservoirs must rely on exter-

[17] Panel (a) of Appendix Figure E.5 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.

[18] Panel (b) of Appendix Figure E.5 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.

[19] 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.

nal markets. Table 6 tests this prediction by interacting the continuous equity multiplier with an indicator for early deregulation timing.

The triple interaction confirms the predicted asymmetry. Each unit increase in the equity multiplier is associated with a 6.6 percentage point larger increase in the bank share of parent equity investments among early-deregulating BHCs post-2015 in column 1, and a 1.0 percentage point greater reduction in external equity issuance in column 2. Both effects are highly statistically significant.

The contrast among early-deregulating BHCs sharpens the interpretation. The level interaction on Early Dereg. $\times$ Post in Column 2 shows that early-deregulating BHCs with low equity multipliers significantly increase external equity issuance by 8.4 percentage points per year of exposure. Facing the same regulatory pressure as high-multiplier BHCs but lacking extractable internal equity, they turn to external markets instead. The asymmetry of internal reallocation among BHCs with high multipliers, external issuance among BHCs with low multipliers demonstrates that extractable nonbank equity determines whether BHCs satisfy Basel III internally or externally.

Internal reallocation toward banks is not a uniform response to organizational complexity. It operates only when both deregulation-era infrastructure and extractable nonbank equity are present. With the mechanism documented at both aggregate and cross-sectional levels, we now turn to the systemic implications: whether the equity extraction that strengthens banks simultaneously creates hidden fragility at the nonbank level.

5.5 Stress Testing Nonbank Subsidiaries

We quantify the contagion parameter, λ, from Proposition 2.2 by simulating adverse shocks to nonbank portfolios and measuring the implied draw on parent capital buffers.

5.5.1 External Evidence on the Contagion Mechanism

The model's contagion mechanism: nonbank distress depleting the parent's equity buffer and indirectly weakening the affiliated bank, is supported by three sets of evidence: historical episodes, market and rating-agency expectations, and direct empirical tests using our data.

Historical episodes. Several well-documented cases illustrate how distress at non-depository affiliates can deplete parent capital and indirectly weaken the affiliated bank. In 2007–2008, Citigroup absorbed approximately $49 billion of structured investment vehicle assets back onto its consolidated balance sheet, depleting parent capital and contributing to its eventual reliance on TARP support (Pozsar et al., 2010). In mid-2007, Bear Stearns extended a $1.6 billion rescue loan to its affiliated hedge funds when they collapsed, with parent funding pressures culminating in the firm's 2008 failure. Wachovia's 2006 acquisition of Golden West Financial, a nonbank thrift specializing in option-ARM mortgages, generated severe consolidated losses in 2007–2008 that depleted parent capital and contributed to Wachovia's near-failure and emergency acquisition by Wells Fargo. In each of these episodes, nominally separate non-depository entities were absorbed by the consolidated organization in distress, with the parent's capital position (and ultimately the bank subsidiary's) impaired as a result.

Rating-agency methodology and observed uplift. Major credit rating agencies explicitly incorporate expected parent support into their ratings of nonbank affiliates of bank holding companies.[20] The economic significance of implicit parent support has also been litigated: in General Electric Capital Canada, Inc. v. The Queen (2009), the court accepted that implicit parent support is a meaningful economic phenomenon and based the valuation of an explicit guarantee fee on the incremental benefit above implicit support that markets already priced in. This methodology produces observable rating differentials. As of late 2024, S&P rated J.P. Morgan Securities LLC, JPMorgan Chase & Co.'s broker-dealer subsidiary, at AA-, two notches above the parent BHC's A rating. The differential is even larger at Goldman Sachs: S&P rated Goldman Sachs & Co. LLC, the broker-dealer subsidiary, at A+, three notches above the parent group's BBB+ rating.[21] These differentials reflect rating agencies' assessments that the broker-dealer affiliates would be supported by their parent BHCs in distress — precisely the contagion-direction transmission the model formalizes.

Empirical tests. Appendix D provides direct empirical evidence on three margins. First, commercial lending growth at affiliated banks contracts in the quarter following nonbank-affiliate loss events at the parent, by 0.63 percentage points in a horse-race specification controlling for the

[20]Moody's Banks Methodology assigns a Support Indicator to subsidiary obligations; S&P's Group Rating Methodology categorizes subsidiaries on a five-tier scale of strategic importance, with "Core" subsidiaries effectively rated at the group credit profile and others receiving up to several notches of uplift; Fitch's bank holding company criteria distinguish "Support-Driven" from "Standalone" ratings on the same logic.

[21]Ratings as of late 2024 from S&P Global Ratings. Goldman Sachs & Co. LLC and J.P. Morgan Securities LLC are the SEC-registered broker-dealer subsidiaries through which their parent BHCs conduct U.S. securities and trading activities. Both are non-depository affiliates and would carry lower standalone credit profiles absent expected parent support.

bank's own loss history. Second, credit spreads on affiliated BHC bonds widen by approximately 30 basis points more than non-affiliated BHC bonds during system-wide stress windows. Third, in stress windows, parent equity flows reallocate toward distressed nonbank affiliates and away from bank affiliates: equity injections to the nonbank rise to 1.1–1.4 percent of lagged BHC equity over the post-event quarters, while parent equity investment in the bank affiliate falls by roughly 2 percent of lagged BHC equity at the peak. Together, these results provide direct evidence that the contagion channel operates in the data.

5.5.2 Stress Test Design.

We conduct stress tests using 2013Q1 balance sheets, before Basel III implementation. 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%.[22]

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

$$\text{Loss}_{ij} = \text{shock} \times \text{Assets}_{ij,2013Q1} \tag{6}$$

$$\text{Post-Shock Equity}_{ij} = \text{Equity}_{ij,2013Q1} - \text{Loss}_{ij} \tag{7}$$

$$\text{Capital Shortfall}_{ij} = \max\left(0, \kappa \times \text{Assets}_{ij,2013Q1} - \text{Post-Shock Equity}_{ij}\right) \tag{8}$$

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):

$$\text{BHC Equity at Risk}_j = \frac{\sum_i \text{Capital Shortfall}_{ij}}{\text{BHC Excess Capital}_j} \times 100 \tag{9}$$

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.

The stress test design captures three key features of the sample. First, nonbank subsidiaries

[22] Our recapitalization formula applies the target capital ratio to the pre-shock asset base, a standard fixed-denominator approximation in stress-testing models. Because an equity injection simultaneously increases both equity (numerator) and total assets (denominator), the exact injection required to reach the target ratio is slightly larger than our estimate. This approximation slightly underestimates recapitalization needs but does not affect the qualitative findings.

operate with substantially higher capital ratios than banks (median 69% versus 10%). 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.

Baseline Results. Table 7 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 17.85% of its excess capital to restore nonbank subsidiaries. This represents a substantial 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 99.45% of excess capital, approaching complete buffer depletion. Under more severe scenarios, defined by either larger asset shocks or higher recapitalization targets, tail-risk BHCs exceed 100% of excess capital (marked with asterisks), implying potential parent insolvency if forced to fully recapitalize subsidiaries.[23] Appendix Figure E.6 shows sensitivity to alternative specifications.

Figure 5 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 15.62% under 1% shocks to 23.85% under 15% shocks, but tail risk (dashed line) exhibits pronounced convexity: the 95th percentile rises from 89.36% at 1% shocks to 128.60% at 15% shocks.

Panel (b) examines complete buffer exhaustion. We define a BHC as "depleted" if recapitaliza-

[23] For instance, under a moderate 1% asset shock but a conservative 50% target capital ratio, the 95th percentile BHC already exhausts its entire excess capital buffer (116.79%). Similarly, under a 5% shock with a 40% target our baseline scenario, the 95th percentile BHC deploys 99.45% of available capital, approaching complete depletion. This highlights that hidden fragility depends not only on the severity of the initial shock but also on the capitalization standard to which nonbank subsidiaries must be restored.

tion needs exceed its entire excess capital buffer, leaving no cushion against further shocks. Under the baseline 5% shock scenario, 4.26% of BHCs experience complete depletion (see Panel E of Table 7). This fraction rises modestly to 5.32% under 10% shocks and 6.38% under 15% shocks. While the majority of BHCs retain some buffer capacity, the 4–6% 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.

The sensitivity to target capital ratios highlights a fundamental policy tension. 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.

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 7 shows that only 17.85% of BHC equity is at risk on average under baseline scenarios, Panel D shows that at the 95th percentile, 38.20% of individual nonbank subsidiaries require recapitalization. This heterogeneity indicates that some BHCs operate highly concentrated portfolios where multiple subsidiaries experience simultaneous distress following correlated shocks, similar to the scenario observed during 2008 when broker-dealers, mortgage lenders, and structured investment vehicles experienced losses simultaneously.

Second, our stress tests use 2013Q1 balance sheets, before equity extraction accelerated post-2015. As nonbank capital ratios decline in subsequent years, contemporary recapitalization needs exceed our estimates, and the 4.26% buffer depletion rate understates current vulnerability: a shock comparable to 2008 losses would today likely deplete capital buffers for a larger percentage of BHCs.

The stress tests reveal that internal reallocation creates a fundamental tension: the equity extraction that satisfies bank capital requirements simultaneously depletes the nonbank buffers that provide loss-absorbing capacity at the consolidated level. The magnitude of this tension depends on subsidiary-level outcomes, how much safer banks actually become, and how much more fragile nonbanks become as a result. We now examine each in turn.

6 Consequences of Internal Capital Reallocation

Internal equity reallocation reshapes the organization at every level. We begin at the top. From the perspective of the holding company, internal reallocation represents the profit-maximizing response to tighter regulation. Rather than accessing costly external equity markets, the BHC exploits an internal margin by extracting equity from lightly regulated nonbank affiliates and redeploying it where regulation binds. This strategy satisfies regulatory requirements while avoiding the issuance costs that would otherwise depress consolidated profitability.

Table 8 provides evidence consistent with this interpretation: consolidated ROA and ROE rise following Basel III, while charge-offs decline. Importantly, these gains are not accompanied by meaningful changes in consolidated portfolio composition or capital structure. Appendix Table F.8 shows that both remain largely unchanged, with the exception of a modest decline in the ratio of risk-weighted to total assets. This pattern rules out the interpretation that profitability improvements reflect a shift toward riskier consolidated assets, and instead indicates that BHCs achieve higher returns by arbitraging the regulatory wedge between subsidiaries rather than by expanding overall risk-taking.

Below the consolidated level, however, the consequences are asymmetric. Bank subsidiaries become substantially safer as injected equity improves capital ratios, reduces asset risk, and enhances profitability. Nonbanks, stripped of equity and facing higher internal funding costs, expand aggressively into riskier lending while abandoning high-equity-ratio fee-based activities. We document these divergent trajectories in turn.

6.1 Consequences for Bank Safety

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 after the 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 E.7 provides visual evidence of these patterns through event studies.

Bank Performance and Portfolio Composition. Table 9 presents reduced-form estimates of bank safety improvements. Panel A documents performance gains. Column (1) shows that post-2015 ROA is 12 basis points higher for each additional year of deregulation exposure. Column (2) shows that ROE also rises, though by a much smaller magnitude (1 basis point per year of exposure). The divergence between large ROA effects and modest ROE effects is consistent with the equity-injection mechanism: as parent equity flows into banks, ROE denominators rise, dampening the increase in returns to equity even as profitability on assets improves. Column (3) shows that charge-offs as a share of loans decline by 0.02 percentage points per year of exposure, indicating that ROA gains reflect improved asset quality rather than increased risk-taking.

Panel B examines portfolio composition. Column (1) shows that the loan share of assets declines by 0.60 percentage points per year of deregulation exposure, while Columns (2)–(3) show that securities and cash shares increase by 0.33 and 0.52 percentage points, respectively. This shift toward liquid, safe assets reduces balance sheet risk without requiring asset sales or deleveraging. Columns (4)–(6) demonstrate that these compositional changes are driven by differential rates of expansion rather than contraction of risky assets; loan growth increases only modestly at 0.08 percentage points per year of exposure, whereas securities and cash grow more rapidly, by 0.23 and 0.46 percentage points, respectively. In other words, incremental balance sheet growth is disproportionately allocated to the safest assets. The pattern of growth, i.e., cash expanding fastest, followed by securities, then loans, indicates that banks deploy additional capital conservatively rather than using higher capital ratios to support greater risk-taking. The modest expansion of bank loans is consistent with the well-documented direct effect of tighter capital requirements on bank lending growth (Gropp et al., 2019). What distinguishes our setting is that the lending slowdown does not translate into reduced credit supply at the consolidated BHC level: nonbank affiliates within the same organizations sharply expand lending, shown next, absorbing the activity that contracts at the bank. These findings speak to a longstanding concern that higher capital requirements may reduce bank profitability and induce risk-shifting behavior. Instead, we find that exogenous increases in bank equity strengthen safety without encouraging risk-taking, consistent with Admati and Hellwig (2024).

Panel C of Table 9 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/assets) changes by only −0.11 percentage points per year of exposure, 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 per year of exposure, while Column (3) shows risk-weighted assets as a share of total assets decline 0.67 percentage points per year of exposure. Together, these results indicate banks simultaneously increase capital buffers and reduce balance sheet risk, with both effects contributing to higher capital quality.

Why does internal equity injection produce safer banks rather than risk-shifting? A key distinction is the absence of external shareholder ROE pressure. When banks issue equity externally, new investors require returns commensurate with their cost of capital, creating ROE-target pressure that can incentivize risk-taking to restore returns to pre-issuance levels. Internal injections from the parent face no such pressure: the parent optimizes across the entire holding company, with no separate bank-level ROE constraint. The null on marginal ROE in Column (4) of Table 9 is consistent with this interpretation: banks do not deploy injected equity into high-return activities because the parent is not demanding a separate return on the marginal dollar.

An alternative interpretation is that banks deploy incremental equity toward especially profitable opportunities that were previously constrained by lower capital levels. If the marginal ROE exceeds the average ROE, adding equity would mechanically raise average ROE even in the absence of operational improvements. Column (4) tests this mechanism directly and finds no significant change in marginal ROE. This null result indicates that net income scaled approximately proportionally with injected equity, ruling out the interpretation that banks deployed incremental capital toward unusually profitable opportunities. Combined with the positive (though economically small) average ROE effect in Panel A, the evidence suggests that ROE improvements arise from reduced charge-offs and improved asset quality rather than from superior deployment of marginal capital. Column (5) further shows that off-balance-sheet commitments decline modestly, suggesting banks do not substitute toward contingent exposures to restore returns.

6.2 Consequences for Nonbank Risk

While bank subsidiaries become safer through equity injections, this capital must come from somewhere within the organization. Our stress tests reveal that nonbank subsidiaries become substantially more vulnerable post-2015, with mean recapitalization needs of 17.85% of BHC excess capital under baseline scenarios. We now trace how capital extraction from nonbanks creates this fragility.

Figure 6 provides visual evidence through event studies. All coefficients represent the marginal effect per additional year of deregulation exposure. The synchronized breaks at 2015Q1 are striking: equity-to-assets ratios drop by 5–6 percentage points, dividend yields spike by 1–2 percentage points, and net balances to parent surge by almost 20 percentage points, a coordinated pattern of capital extraction operating through multiple channels simultaneously. As nonbank balance sheets weaken, operational consequences follow. Loan shares expand by 5 percentage points as nonbanks shift toward lending, but this expansion comes at a cost: past-due and nonaccrual loans rise by 3 percentage points, and return on equity declines by more than 10 percentage points by the end of the sample. That these breaks occur precisely when banks in the same organizations experience capital improvements provides compelling evidence that the same underlying force, internal equity reallocation, drives both the bank-level gains and the nonbank-level deterioration.

Capital Extraction. Table 10 quantifies the capital extraction documented visually. Panel A presents balance sheet changes. Equity as a share of assets declines 7.71 percentage points per year of deregulation exposure, shown in Column (1). Simultaneously, net balances to parent and other subsidiaries increase 13.60 percentage points, indicating nonbanks increasingly borrow from or reduce lending to affiliated entities, shown in Column (4). This pattern aligns with evidence from Acharya, Cetorelli and Tuckman (Forthcoming) showing how banks remain exposed to nonbanks through credit lines. Dividend payments as a share of equity increase 0.96 percentage points, shown in Column 5, consistent with the systematic draining of capital from nonbank subsidiaries to satisfy bank regulatory requirements.

This capital extraction creates funding stress that extends beyond simple balance sheet effects. We construct implied interest rates on internal funding by dividing interest income received by parents from subsidiaries by the stock of non-equity investments, revealing the shadow cost of capital across differently-regulated entities. Appendix Table F.9 shows nonbank internal funding rates increase 0.52 percentage points per year of deregulation exposure post-2015, while bank rates show no significant change. The spread widens by 0.44 percentage points per year. For the median BHC with 7 years of exposure, this implies nonbank funding costs increase approximately 300 basis points relative to bank costs. This divergence creates a vicious cycle where capital-depleted entities face sharply higher marginal funding costs precisely when their balance sheets are weakest.

Operational Restructuring toward Lending. Faced with reduced equity capital and higher internal funding costs, we find that nonbank subsidiaries fundamentally restructure operations toward lending. Table 11 documents that quarterly nonbank lending (aggregated to the BHC level) grows 7.20 log points per year of deregulation exposure, while bank lending shows no significant change at 0.09%. The large differential between nonbank and bank lending growth confirms that aggressive lending expansion occurs specifically within lightly-regulated nonbank subsidiaries. This migration of credit provision from banks to nonbanks within the same holding company parallels the broader secular decline in bank market share documented by Buchak et al. (2024), but occurs through internal organizational reallocation rather than competitive displacement across independent institutions. Appendix Table F.10 shows that this lending expansion is accompanied by a broader portfolio rebalancing toward earning assets, with lending accounting for approximately half of the increase.

The composition of this lending expansion is revealing. Nonbanks do not expand uniformly across loan categories. Instead, they shift aggressively into consumer lending while pulling back from commercial and real estate loans as shown in Appendix Table F.11. The reorientation is particularly pronounced among specialized nonbank lenders, where consumer lending growth reaches 7.46 percentage points per year of exposure compared to 1.47 percentage points for nonbanks overall. This pivot toward higher-yield, higher-risk segments reflects a broader business model transformation: as equity buffers thin, nonbanks abandon activities that require large capital cushions such as trading, advisory, venture capital, and interest income nearly doubles for the most affected BHCs.[24]

Credit Quality Deterioration and Increased Fragility. 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 90+ days past due increase 2.66 percentage points, indicating serious delinquencies increase substantially. Column (2) shows all past-due loans increase 3.08 percentage points. Column (3) shows loss provisions as a share of loans increase 9.37 percentage points conditional on nonzero provisioning.

[24] Appendix Table F.12 documents these broader business model changes. At the extensive margin, Appendix Table F.13 shows that BHCs simultaneously add nonbank lender subsidiaries and shed high-equity-ratio insurance affiliates, though the net change for nonbank lenders is statistically indistinguishable from zero, suggesting strategic recomposition rather than pure expansion. Despite this shedding, Appendix Table F.14 shows that the total number of distinct nonbank activity types increases, indicating that organizational complexity adapts to regulatory pressure rather than contracting.

These credit quality problems translate into profitability declines, presented in Panel B. ROE falls 1.87 percentage points per year of deregulation exposure, while ROA shows no statistically significant change. The asymmetry reflects the mechanical amplification of leverage: as equity extraction reduces nonbank capital ratios, the equity denominator shrinks while operating performance per dollar of assets remains roughly stable, generating a substantial decline in equity returns even in the absence of measurable operating deterioration. This pattern is consistent with the capital extraction documented above, thinner equity buffers magnify the impact of credit quality deterioration on returns to equity holders, and the operating channel may materialize more fully over a longer horizon as loss recognition catches up with the underlying credit deterioration.

The combination of reduced capital, aggressive lending growth, and credit quality deterioration materializes in measures of financial fragility. Specifically, Panel C of Table 12 quantifies several dimensions of insolvency risk. The probability of negative earnings rises by 15.19 percentage points per year of deregulation exposure, Z-scores decline by 8.75 points, and the probability of default increases by 1.15 percentage points.[25] Appendix Table F.15 further shows that interest income volatility increases by 19.69 percentage points while non-interest income volatility remains unchanged, suggesting that the rise in overall earnings instability is driven primarily by interest-generating activities. This concentration of volatility in interest income is consistent with the earlier finding that nonbanks reallocate toward lending, as loan portfolios inherently carry greater earnings variability due to credit and interest rate risk compared to fee-based services.

Overall, these fragility measures connect directly to our stress test results, where the mechanisms of reduced capital ratios, concentrated loan portfolios, and higher earnings volatility collectively increase nonbank vulnerability to adverse shocks, making the equity reallocation that strengthens banks simultaneously weaken the broader organizational structure.

Taken together, these patterns mean that nonbank subsidiaries within BHCs are increasingly performing functions traditionally associated with depository institutions, i.e., originating, underwriting, and holding consumer loans on balance sheet, while operating outside the regulatory perimeter that governs banks.[26] Unlike their bank affiliates within the same holding company, these nonbank lenders have no access to deposit insurance, the Federal Reserve discount window, or direct prudential supervision. The regulatory wedge that drives internal equity reallocation

[25] Z-score is a standard measure of distance to default, calculated as (equity/assets + ROA) / (standard deviation of ROA).

[26] For example, within large BHCs, nonbank consumer lending subsidiaries include captive finance companies, mortgage origination entities operating under state licenses rather than bank charters, and specialty consumer lending platforms that originate and hold credit outside the depository institution.

thus also drives a migration of credit provision: the same force that makes banks safer pushes lending activity toward entities with thinner capital buffers and no safety net.

7 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.

First Stage Relationship. Appendix Table F.16 verifies that our instrument predicts organizational complexity.

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 (2013Q1 characteristics interacted with post-2015), yielding a coefficient of 0.35 percentage points. The first-stage F-statistics substantially exceed conventional thresholds for weak instrument concerns.[27]

Two-Stage Least Squares Estimates. Appendix Table F.17 reports conventional 2SLS estimates as a complement to our baseline reduced-form specification. We instrument the endogenous re-

[27] The Kleibergen-Paap Wald F-statistic ranges from 9.8 to 19.6 across specifications, near or above the rule-of-thumb threshold of 10.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.

gressor (nonbank asset share interacted with post-2015) using the interaction of years since deregulation interacted with post-2015.

Column (1) presents the unconditional 2SLS estimate: a one-percentage-point increase in nonbank share raises bank excess capital by 9.41 percentage points. Columns (2)–(4) introduce progressively richer sets of fixed effects and controls. Across all specifications, the estimates remain statistically significant and economically large.

Our most conservative 2SLS estimates are approximately two to three times larger, at 1.96 percentage points, than the corresponding reduced-form estimates in the baseline specifications, consistent with the reduced-form coefficients capturing intent-to-treat effects.[28] We emphasize the reduced-form results because they rely on weaker identifying assumptions.

Placebo Tests. Appendix Figures E.8 and E.9 present permutation-based placebo tests that validate our identification strategy. Appendix Figure E.8 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 effect of organizational complexity, we would observe similar effects under random instrument assignment. Instead, the placebo distribution is tightly centered at zero, 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 E.9 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, 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.

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

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

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.

8 Conclusion

This paper demonstrates that subsidiary-level capital regulation within multi-entity financial firms can reallocate risk rather than eliminate it, generating hidden vulnerabilities inside consolidated organizations. When capital requirements bind more tightly at bank subsidiaries than at affiliated nonbanks, parent firms respond by reallocating equity internally toward the regulated entities. Banks consequently appear safer, while nonbank subsidiaries operate with thinner capital buffers and heightened exposure to distress. This regulatory-induced risk migration occurs within organizational boundaries and remains largely invisible to regulatoryframeworks that focus on consolidated capital ratios or evaluate regulated entities in isolation.

These reallocations have real economic consequences. Extracting equity from nonbanks increases their reliance on 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. Stress tests calibrated to 2008-scale shocks reveal that while the contagion channel offsets only 8% of bank capital gains for the typical BHC, it offsets nearly 71% for tail-risk institutions, meaning that for the most exposed banks, the apparent improvement in bank safety is substantially overstated once the implicit liability to nonbank subsidiaries is accounted for.

The regulatory architecture creates an inconsistency. Entity-level capital requirements successfully improve bank subsidiary safety, but simultaneously incentivize the migration of traditional lending activities to nonbank affiliates within the same holding company. These nonbank lenders now originate and hold consumer credit, performing bank functions, yet operate without deposit insurance, Federal Reserve discount window access, or the comprehensive prudential oversight applied to depository institutions. Banks that hold consumer loans maintain capital ratios, face regular examinations, and access emergency liquidity. Nonbank affiliates performing identical activities face none of these requirements despite operating with lower capital buffers after 2015.

This creates channels for financial instability that bypass the safety net designed to protect depositors and maintain credit availability during stress.

The broader implication is that consolidated capital requirements alone are unlikely to eliminate regulatory arbitrage when regulatory stringency differs across subsidiaries within the same holding company. Even well-capitalized groups may optimally concentrate equity where constraints bind most tightly, leaving lightly regulated affiliates to absorb risk. Ensuring that gains in bank resilience are not offset by growing vulnerabilities elsewhere in the organization may require extending prudential standards to material nonbank subsidiaries, constraining equity extraction, and more closely monitoring internal capital and funding flows. More generally, effective financial regulation must treat organizational structure as a fundamental determinant of regulatory incidence and systemic risk. The narrative of credit migrating from banks to nonbanks understates that much of the migration occurs within the very holding companies that consolidated supervision was designed to oversee.

While our analysis focuses on banking, the mechanism is general. Any multi-entity organization facing asymmetric regulation, taxation, or supervision across affiliates has reason to use internal capital markets to relocate activity toward less constrained units. Banking provides an unusually clean setting because subsidiary-level financials are disclosed and regulatory wedges are sharp, but the lesson that organizational structure shapes the incidence of policy applies wherever firm boundaries cross regulatory boundaries.

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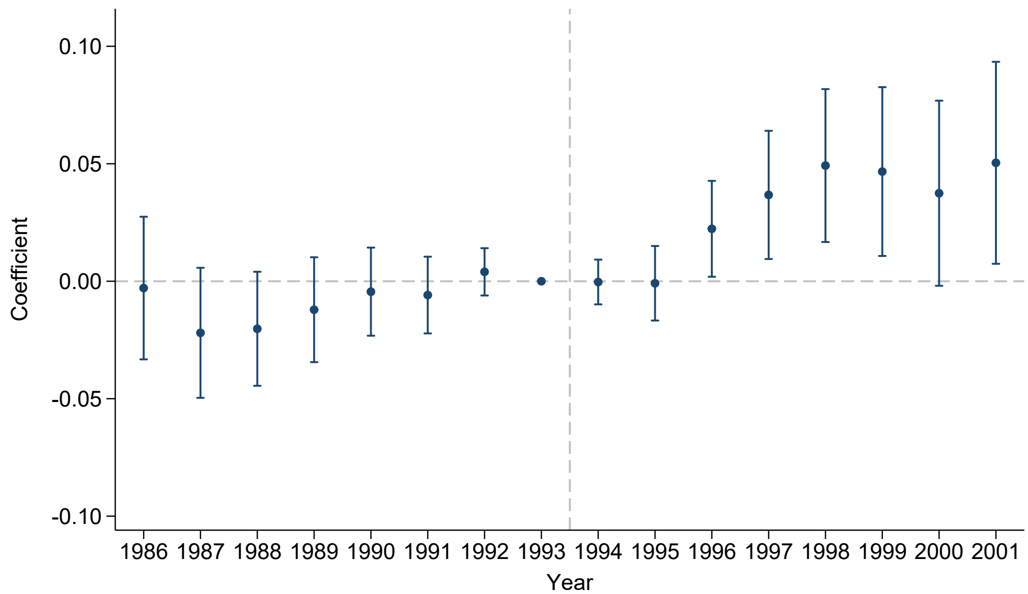
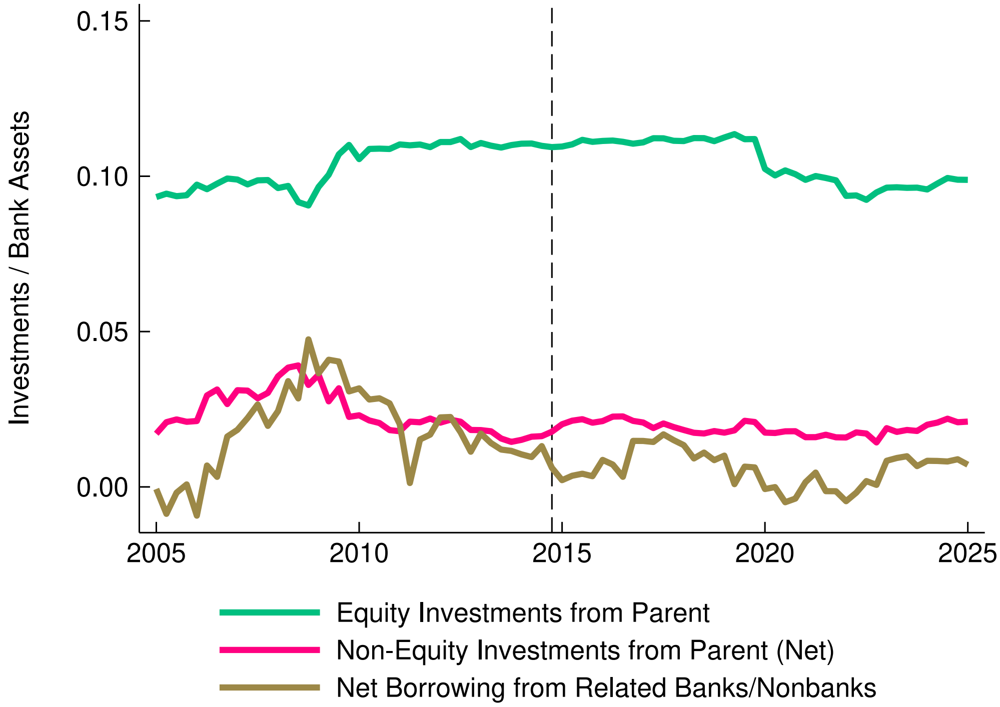
Figure 1: Deregulation Timing as an Instrument for Organizational Complexity



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

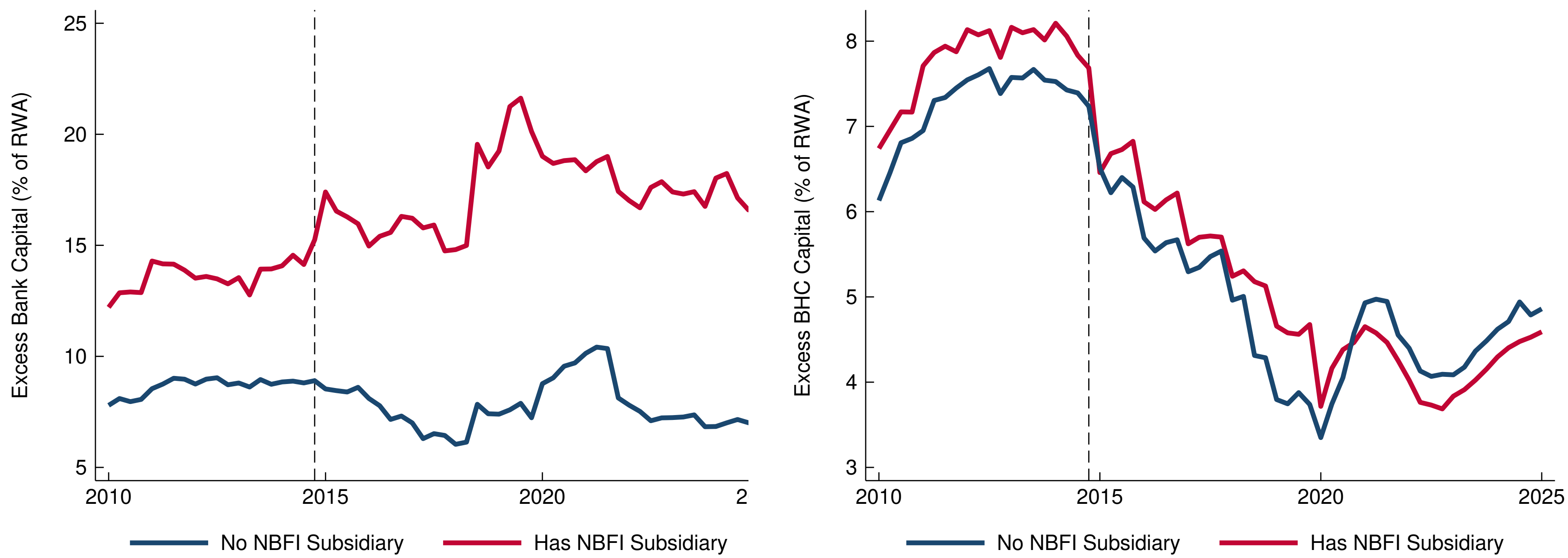
Notes: The figure shows the trends in nonbank financial subsidiary share from 1986-1994, between BHCs headquartered in early-deregulating states and late-deregulating states. Early deregulators are defined as states with median interstate deregulation year before 1986. Source: BHC Organizational Structure Database described in Section 3.

Figure 2: 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. Variables are aggregated across all BHCs in the sample using value-weighted averages. Source: FR Y-9LP.

Figure 3: Excess Capital: Banks vs BHCs

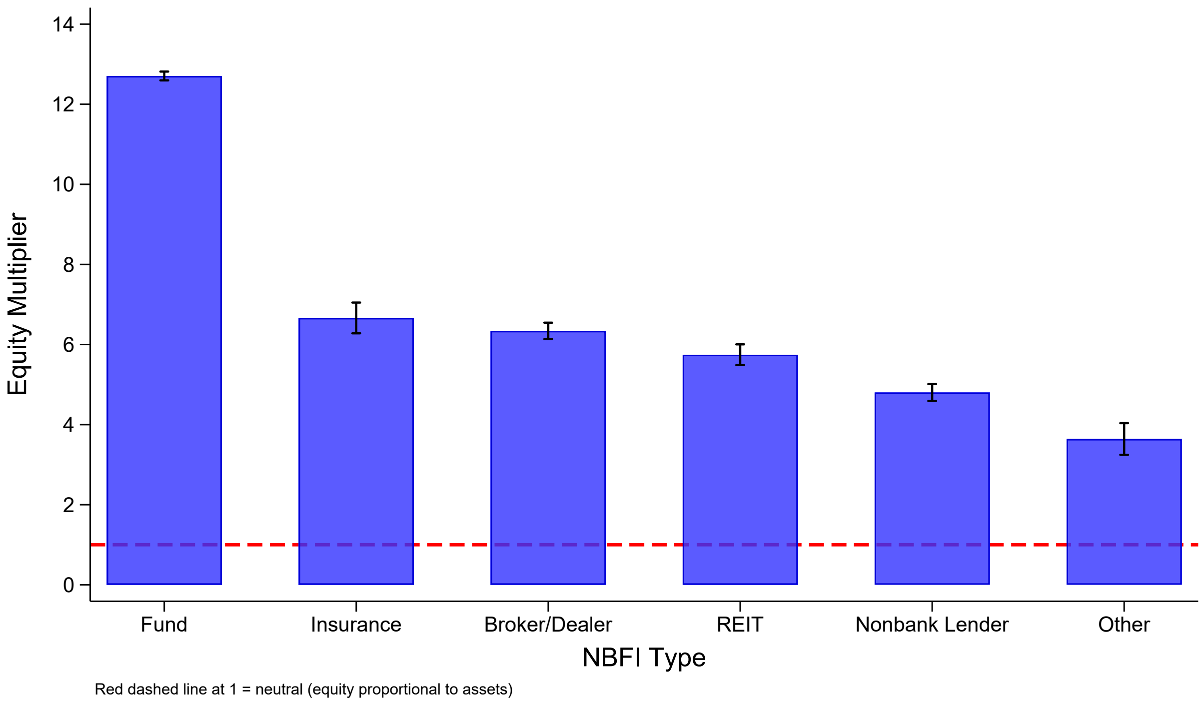


(a) Bank Excess Capital

(b) BHC Excess Capital

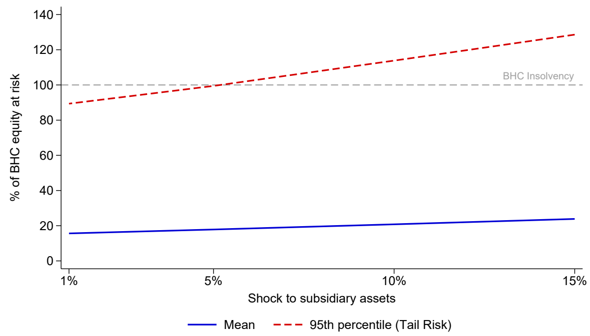
Notes: The figure compares average excess bank and BHC capital for BHCs with nonbank exposure and those without exposure. Panel (a) compares average excess bank capital from 2010 through 2024 for BHCs with nonbank exposure to BHCs without nonbank exposure, based on 2005 exposure status, which ensures the classification is pre-determined relative to both the 2013Q1 baseline used in regressions and the 2015Q1 treatment date. Panel (b) presents the corresponding event-study estimates for excess BHC capital over the same period. Source: Authors' calculations using FR Y-9C, FR Y-9LP, and Call Reports.

Figure 4: Equity Multiplier Varies by Nonbank Subsidiary Type

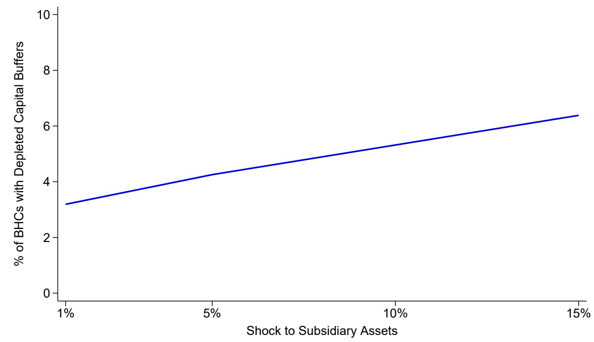


Notes: The figure presents the mean equity multiplier by nonbank subsidiary type with 95% confidence intervals. Equity multiplier is constructed as the ratio of subsidiary equity share to subsidiary asset share within BHC, measuring capital intensity. Error bars show 95% confidence intervals. Appendix Table 5 provides detailed distributional statistics by type. Source: Authors' calculations using the FR Y-11.

Figure 5: Nonbank Stress Tests: Recapitalization Needs and Buffer Exhaustion



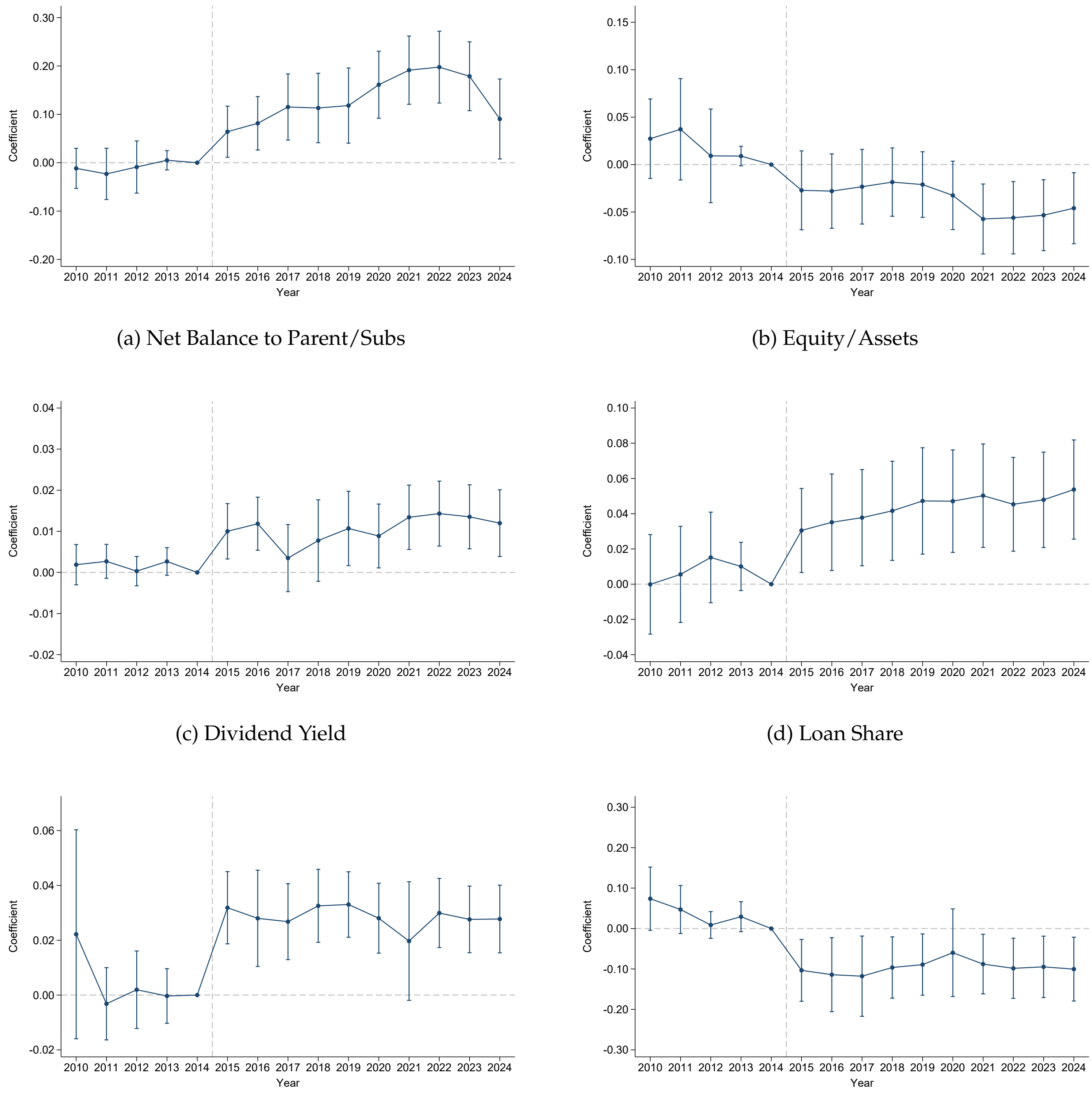
(a) Recapitalization Needs by Shock Severity



(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 E.6a and E.6b show sensitivity to alternative target capital ratios.

Figure 6: Nonbank Event Study around Basel III Implementation



(a) Net Balance to Parent/Subs

(b) Equity/Assets

(c) Dividend Yield

(d) Loan Share

(e) Past Due & Nonaccrual

(f) ROE

Notes: The figure presents event study estimates of nonbank outcomes relative to 2014 baseline. Panel (a) shows equity-to-assets ratios, Panel (b) shows dividend yields, Panel (c) shows net balances to parent/other subsidiaries, Panel (d) shows loan shares, Panel (e) shows past-due and nonaccrual loans, and Panel (f) shows return on equity. 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 2013Q1) interacted with post-2015 indicator. Standard errors clustered at BHC level. Error bars indicate 90% confidence intervals.

Table 2: Summary Statistics: BHCs in IV Sample (Active Pre-1994)

	N	Mean	SD	p5	p25	p50	p75	p95
Panel A: BHCs								
2013 Controls								
2013 BHC Assets (Billions)	6,086	78.950	347.246	0.532	1.027	2.415	11.520	217.853
2013 BHC Leverage	6,086	9.760	5.257	5.981	7.573	8.685	11.047	16.469
2013 BHC Deposit Share	6,086	0.805	0.089	0.673	0.781	0.822	0.853	0.901
2013 BHC Asset Growth	6,067	0.036	0.072	-0.091	-0.001	0.036	0.074	0.141
2013 BHC Subsidiary Count	6,086	103.919	409.576	1.000	4.000	7.000	18.000	628.000
Has Nonbank Subsidiary	6,086	0.568	0.495	0.000	0.000	1.000	1.000	1.000
Time-Varying Variables								
BHC Assets (Billions)	6,086	97.842	421.591	0.529	1.061	3.268	15.884	323.587
BHC RWA (Billions)	6,086	60.949	239.729	0.330	0.713	2.286	10.548	257.297
BHC Capital (Billions)	6,086	9.667	40.060	0.041	0.101	0.299	1.652	35.045
Excess BHC Capital (%)	6,086	6.184	3.977	1.298	3.632	5.500	7.920	13.146
BHC Net Income (Billions)	6,086	0.237	1.114	-0.000	0.002	0.008	0.040	0.823
BHC Leverage	6,086	0.100	0.031	0.057	0.083	0.100	0.116	0.148
BHC Deposit Share	6,086	0.801	0.080	0.676	0.767	0.814	0.853	0.896
BHC Loan Share	6,086	0.616	0.149	0.351	0.537	0.637	0.719	0.820
BHC Securities Share	6,086	0.239	0.130	0.054	0.145	0.221	0.316	0.489
BHC Nonbank Assets (Billions)	6,086	14.594	90.103	0.000	0.000	0.000	0.036	9.600
BHC Bank Assets (Billions)	6,086	86.695	358.393	0.521	1.057	3.271	15.556	319.482
BHC Direct Issuance	6,086	0.005	0.032	0.000	0.000	0.000	0.000	0.010
BHC Net Issuance	6,086	0.002	0.039	-0.033	-0.001	0.000	0.000	0.025
BHC External Equity	6,086	0.009	0.038	0.000	0.000	0.000	0.003	0.044
BHC Equity Inv. Bank Share	6,086	1.051	0.352	0.803	0.954	1.009	1.125	1.509
BHC Equity Inv. Nonbank Share	6,086	0.031	0.066	0.000	0.000	0.006	0.026	0.148
BHC Equity Inv. Total Share	6,086	1.215	0.557	0.881	0.986	1.056	1.239	2.189
BHC Div. Yield Bank	5,913	0.015	0.019	0.000	0.000	0.012	0.021	0.045
BHC Div. Yield Nonbank	4,533	0.025	0.180	0.000	0.000	0.000	0.011	0.094
Panel B: Banks								
Bank Assets (Billions)	10,086	52.167	274.008	0.046	0.374	1.141	6.180	157.290
Bank RWA (Billions)	10,085	34.172	167.106	0.012	0.214	0.768	4.263	111.788
Bank Capital (Billions)	10,086	5.314	26.754	0.013	0.050	0.132	0.728	17.937
Excess Bank Capital (%)	10,085	37.350	100.365	1.823	4.085	6.190	10.097	330.314
Excess Bank to BHC Capital Ratio (%)	9,962	9.910	36.370	0.476	0.801	0.961	1.263	64.406
Bank Net Income (Billions)	10,086	0.143	0.787	0.000	0.001	0.003	0.019	0.482
Bank Leverage	10,086	0.804	0.255	0.027	0.867	0.892	0.907	0.926
Bank Deposit Share	10,086	0.727	0.265	0.000	0.759	0.819	0.860	0.902
Bank Loan Share	10,086	0.551	0.241	0.000	0.463	0.613	0.718	0.836
Bank Securities Share	10,086	0.223	0.164	0.000	0.101	0.208	0.314	0.529
Panel C: Nonbanks								
Nonbank Assets (Billions)	6,738	4.474	10.522	0.011	0.380	1.419	3.809	17.761
Nonbank Capital (Billions)	6,738	2.514	5.942	0.000	0.078	0.570	1.920	13.112
Nonbank Net Income (Billions)	6,738	0.054	0.289	-0.067	-0.000	0.008	0.056	0.364
Nonbank Leverage	5,776	0.421	0.481	0.000	0.031	0.302	0.761	0.998
Nonbank Loans Share	5,762	0.119	0.292	0.000	0.000	0.000	0.007	0.983
Nonbank Securities Share	6,738	0.013	0.070	0.000	0.000	0.000	0.000	0.049
Broker (NAICS 523)	6,738	0.255	0.436	0.000	0.000	0.000	1.000	1.000
Nonbank Lender (NAICS 5222, 5223)	6,738	0.182	0.386	0.000	0.000	0.000	0.000	1.000
Insurer (NAICS 524)	6,738	0.009	0.094	0.000	0.000	0.000	0.000	0.000
Fund (NAICS 525)	6,738	0.115	0.319	0.000	0.000	0.000	0.000	1.000
Real Estate (NAICS 531)	6,738	0.037	0.189	0.000	0.000	0.000	0.000	0.000

Notes: Percentiles are computed at the 5th, 25th, 50th, 75th, and 95th levels. The sample period ranges from 2010 to 2024. Only BHCs alive prior to the year 1994 (Deregulation year) and that filed an FR Y-9C in 2013Q1 and their bank/nonbank subsidiaries are included in the samples. Sources: FR Y-9C and FR Y-9LP for BHC Panel, Call Reports for Bank Panel, FR Y-11 for Nonbank Panel.

Table 3: Internal Capital Reallocation and Organizational Complexity

	Bank Excess Capital (1)	BHC Excess Capital (2)	Bank/BHC Excess Ratio (3)
Panel A: Reduced-Form (Deregulation Timing)			
Years from Dereg × 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
Panel B: Difference-in-Differences (NBFI Presence)			
$\mathbb{1}$[NBFI Sub] × 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
Bank FE	✓		✓
BHC FE		✓	
Quarter-Year FE	✓	✓	✓
Controls × Post	✓	✓	✓

Notes: The table presents estimates of internal capital reallocation within BHCs. 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 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). Panel B reports difference-in-differences estimates where $\mathbb{1}$[NBFI Sub] × Post indicates BHCs with nonbank financial subsidiaries as of 2013Q1 interacted with Post. Post indicates 2015Q1 and later. All specifications include entity fixed effects (bank or BHC) and quarter-year fixed effects. Controls measured 2013Q1 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). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: 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 include 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 as of 2013Q1 and interacted with Post. Standard errors clustered at BHC level. Sample restricted to BHCs with nonbank asset share exceeding 1%. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: 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	N
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 E.5 shows full distributions by type. Sources: FR Y-9LP, FR Y-9C, FR Y-11.

Table 6: Equity Reallocation Heterogeneity: Role of the Equity Multiplier

	Multiplier Mechanism	
	Bank Equity Share	External Issuance
	(1)	(2)
Eq. Mult. × Early Dereg. × Post	0.0658***	−0.0101***
	(0.0167)	(0.0012)
Early Dereg. × Post	−0.3866	0.0836***
	(0.2268)	(0.0161)
Eq. Mult. × Post	−0.0593***	0.0082***
	(0.0109)	(0.0008)
Observations	616	616
R^2	0.832	0.172
BHC FE	✓	✓
Quarter FE	✓	✓
Controls × Post	✓	✓

Notes: This table presents heterogeneity in internal capital reallocation by equity multiplier and deregulation timing. Eq. Mult. is the continuous ratio of nonbank equity share to nonbank asset share, measured at 2013Q1. Early Dereg. is an indicator equal to 1 if the BHC's headquarters state deregulated interstate banking eight or more years before the 1994 Riegle-Neal Act. Post indicates 2015Q1 and later. The sample includes BHCs with at least 1% nonbank assets in 2013Q1 over the period 2010–2024. BHC controls include top 200 BHC indicator, log assets, leverage, ROA, deposits/assets, asset growth, and subsidiary count, all measured 2013Q1 and interacted with Post. Standard errors clustered at BHC level in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Stress Test Results: BHC Equity at Risk and Nonbank Recapitalization Needs

Panel A: Mean BHC Equity at Risk (%)

	Target Capital Ratio					
Shock to Assets	20%	30%	40%	50%	60%	70%
1%	6.86	10.81	15.62	21.40	27.66	34.89
5%	8.40	12.67	17.85	23.85	30.47	38.07
10%	10.40	15.10	20.79	26.99	34.12	42.29
15%	12.67	17.85	23.85	30.47	38.07	46.80

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

	Target Capital Ratio					
Shock to Assets	20%	30%	40%	50%	60%	70%
1%	42.52	65.59	89.36	116.79*	146.30*	175.81*
5%	51.75	74.82	99.45	128.60*	158.11*	194.28*
10%	63.28	86.84	113.84*	143.35*	172.86*	233.94*
15%	74.82	99.45	128.60*	158.11*	194.28*	274.64*

Panel C: Mean Percentage of Nonbank Subsidiaries Requiring Recapitalization

	Target Capital Ratio					
Shock to Assets	20%	30%	40%	50%	60%	70%
1%	2.93	4.44	6.53	9.10	12.05	15.53
5%	3.47	5.21	7.53	10.23	13.34	17.09
10%	4.27	6.28	8.83	11.73	15.15	19.28
15%	5.21	7.53	10.23	13.34	17.09	21.68

Panel D: 95th Percentile of Nonbank Subsidiaries Requiring Recapitalization

	Target Capital Ratio					
Shock to Assets	20%	30%	40%	50%	60%	70%
1%	17.06	27.06	36.78	44.20	54.20	64.20
5%	21.06	31.06	38.20	48.20	58.20	68.20
10%	26.06	36.06	43.20	53.20	63.20	73.20
15%	31.06	38.20	48.20	58.20	68.20	78.20

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

	Target Capital Ratio					
Shock to Assets	20%	30%	40%	50%	60%	70%
1%	2.13	3.19	3.19	5.32	7.45	9.57
5%	3.19	3.19	4.26	6.38	9.57	10.64
10%	3.19	3.19	5.32	7.45	9.57	10.64
15%	3.19	4.26	6.38	9.57	10.64	10.64

Notes: The table presents stress test results using 2013Q1 balance sheets (FR Y-9C and FR Y-9LP). 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. Panel E shows percentage of BHCs with completely depleted capital buffers (recapitalization needs exceed available excess capital). Calculations assume full BHC ownership and 100% loss recognition.

Table 8: Internal Reallocation and BHC Profitability

	ROA	ROE	Charge-Offs
	(1)	(2)	(3)
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	✓	✓	✓

Notes: The table presents reduced-form estimates of BHC-level profitability. 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. 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 2013Q1 and interacted with Post. Standard errors are clustered at the BHC level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: Bank Performance, Portfolio Composition, and Capital Quality

Panel A: Performance

	ROA (1)	ROE (2)	Charge-Offs (3)
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	✓	✓	✓	✓	✓	✓

Panel C: Capital Quality

	Leverage (1)	Equity/RWA (2)	RWA/Assets (3)	Marginal ROE (4)	Off-BS (5)
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: Panel A shows bank 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). Panel C 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. Bank controls include log assets, leverage, and asset growth, all measured as of 2013Q1 and interacted with Post. Standard errors clustered at bank level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 10: Nonbank Capital Extraction and Funding Constraints

	Equity/ Assets (1)	Bal From Subs (2)	Bal To Subs (3)	Net Bal to Subs (4)	Dividends /Equity (5)	ln(Assets) (6)
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 as of 2013Q1 and interacted with Post. Standard errors clustered at BHC level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 11: Lending Growth: Nonbank vs Bank Subsidiaries

Δ ln(Lending)	Nonbank Lending (1)	Bank Lending (2)
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, ROA, asset growth, and subsidiary count, all measured as of 2013Q1 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. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 12: Nonbank Credit Quality and Fragility

Panel A: Credit Quality

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

Panel B: Profitability

	ROA (1)	ROE (2)
Years from Dereg × Post	0.0010	-0.0187*
	(0.0014)	(0.0107)
Observations	4,711	4,711
R^2	0.5178	0.3678
Nonbank FE	✓	✓
Industry-Qtr-Year FE	✓	✓
Controls × Post	✓	✓

Panel C: Fragility

	Negative Earnings (1)	Z-Score (2)	Prob(Default) (3)
Years from Dereg × Post	0.1519***	-8.7521***	0.0115*
	(0.0341)	(2.4354)	(0.0060)
Observations	2,714	2,714	2,714
R^2	0.4349	0.9767	0.0580
Nonbank FE	✓	✓	✓
Industry-Qtr-Year FE	✓	✓	✓
Controls × Post	✓	✓	✓

Notes: The table documents nonbank credit quality deterioration, profitability decline, and increased fragility. Panel A shows credit quality measures. Column (1) is loans 90+ days past due divided by lagged loans. Column (2) is all past-due loans (30+ days) divided by lagged loans. Column (3) 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). Panel C shows fragility and default risk measures. Column (1) is an indicator equal to one if quarterly net income is negative. Column (2) is Z-score, calculated as (equity/assets + ROA) / standard deviation of ROA; higher values indicate lower default risk. Column (3) is probability of default calculated using the Merton model as the normal CDF of the 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 as of 2013Q1) interacted with Post. Standard errors clustered at BHC level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Online Appendix for:

"Regulatory Arbitrage within the Firm"

Contents

Appendix A Example of Internal Capital Reallocation

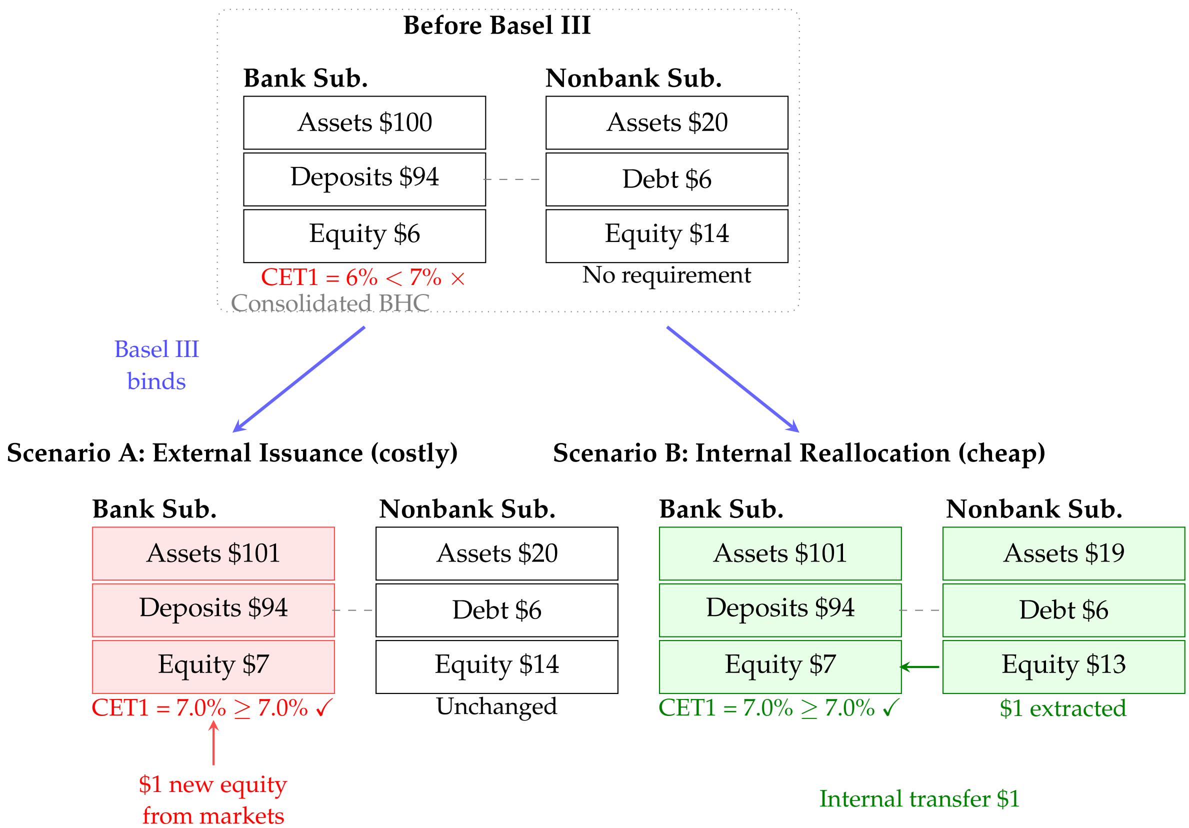


Figure A.1: Internal Capital Reallocation in Response to Basel III. The top panel shows a stylized BHC before Basel III. The bank subsidiary holds $6 in equity against $100 in assets (CET1 = 6%), which falls short of the new 7% minimum (inclusive of the Capital Conservation Buffer) introduced by Basel III. Importantly, the requirement applies at both the bank and consolidated BHC level; here the consolidated BHC is already compliant, so the binding constraint is at the bank subsidiary level alone. At the consolidated level, the BHC already holds $20 in total equity ($6 in the bank sub and $14 in the nonbank sub), which is more than sufficient to cover the $1 shortfall. The problem is not a lack of capital, but that the capital is sitting in the wrong entity. When the 7% CET1 minimum becomes binding, the BHC faces two options. Scenario A: raise $1 in costly external equity from markets, expanding consolidated assets. Scenario B: transfer $1 in equity from the nonbank subsidiary, which faces no capital requirement, to the bank subsidiary, satisfying the CET1 constraint without external issuance and without changing consolidated equity or assets. Both scenarios achieve identical bank-level capital ratios; the difference lies entirely in whether the BHC exploits its internal capital market (Scenario B) or turns to external markets (Scenario A).

Appendix B Theoretical Framework: Complete Derivations

This appendix provides complete derivations and proofs for the propositions stated in Section 2, along with comparative statics, calibration details, and model figures. The notation follows Section 2 throughout.

B.1 Model Setup

Consider a 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:

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

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

Regulation. The bank faces a capital requirement

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

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.[29]

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:

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

Failure of subsidiary i generates a deadweight social loss $L_i > 0$, where $L_B > L_N$ reflects the greater systemic importance of regulated depository institutions.

We assume shocks are independent across subsidiaries: $\theta_B \perp \theta_N$. Under independence, the joint probability $\Pr(\theta_N < -E_N \text{ and } \theta_B > -E_B) = F_N(-E_N) \cdot [1 - F_B(-E_B)]$, which simplifies the externality expressions below.

[29] 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.

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:

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

The probability of nonbank failure is:

$$\Pr(\text{Nonbank Failure}) = F_N(-E_N). \tag{B.5}$$

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.

B.2 BHC Optimization

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

$$\max_{E_B, E_N, K} \quad \mathbb{E}[R_B(E_B, A_B) + R_N(E_N, A_N)] - \Pr(\text{Failure})_B \cdot L_B - \Pr(\text{Failure})_N \cdot L_N - c(K) - \tau \cdot |E_B - E_B^0| \tag{B.6}$$

subject to:

$$E_B \geq \kappa_B \cdot A_B \qquad \text{(regulatory constraint)} \tag{B.7}$$

$$E_B + E_N \leq E^0 + K \qquad \text{(resource constraint)} \tag{B.8}$$

$$E_B, E_N, K \geq 0 \qquad \text{(non-negativity)} \tag{B.9}$$

where E^0 and E_B^0 denote initial BHC and bank equity levels. Internal equity transfers from nonbank to bank incur a transaction cost $\tau \geq 0$ per dollar transferred, reflecting administrative frictions and potential tax considerations associated with intercompany transfers.

B.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:

$$R'_B(E_B) - L_B \cdot f_B(-E_B) = R'_N(E_N) - L_N \cdot f_N(-E_N) \tag{B.10}$$

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 B.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 B.1 (Internal Reallocation Equilibrium)**.** *When external equity is costly ($c'(0) > \tau$) and regulation binds ($\kappa_B \cdot A_B > E_B^{unc}$), where E_B^{unc} denotes the unconstrained optimal bank equity, the BHC optimally chooses:*

$$E_B^* = \kappa_B \cdot A_B \tag{B.11}$$

$$E_N^* = E^0 - \kappa_B \cdot A_B \tag{B.12}$$

$$K^* = 0 \tag{B.13}$$

with comparative statics:

$$\frac{\partial E_B^*}{\partial \kappa_B} = A_B > 0 \qquad \textit{(bank equity increases with requirements)} \tag{B.14}$$

$$\frac{\partial E_N^*}{\partial \kappa_B} = -A_B < 0 \qquad \textit{(nonbank equity decreases one-for-one)} \tag{B.15}$$

$$\frac{\partial (E_B^* + E_N^*)}{\partial \kappa_B} = 0 \qquad \textit{(consolidated BHC equity unchanged)} \tag{B.16}$$

Proof of Proposition B.1. Form the Lagrangian, incorporating the contagion term from equation (B.4):

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

where $\mu \geq 0$ is the multiplier on the regulatory constraint (B.7) and $\nu \geq 0$ is the multiplier on the resource constraint (B.8). The term $\tau \cdot (E_B - E_B^0)$ captures internal reallocation costs, which are positive when regulation binds and equity flows from nonbank to bank ($E_B > E_B^0$).

The first-order conditions are:

$$\frac{\partial \mathcal{L}}{\partial E_B} = R_B'(E_B) - L_B \cdot f_B(-E_B) - \lambda \cdot \frac{\partial \Pr(\theta_N < -E_N, \theta_B > -E_B)}{\partial E_B} \cdot L_B - \tau + \mu - \nu = 0 \tag{B.17}$$

$$\frac{\partial \mathcal{L}}{\partial E_N} = R_N'(E_N) - L_N \cdot f_N(-E_N) - \lambda \cdot \frac{\partial \Pr(\theta_N < -E_N, \theta_B > -E_B)}{\partial E_N} \cdot L_B - \nu = 0 \tag{B.18}$$

$$\frac{\partial \mathcal{L}}{\partial K} = -c'(K) + \nu = 0 \tag{B.19}$$

Let $\Phi(E_B, E_N) \equiv \Pr(\theta_N < -E_N, \theta_B > -E_B)$ denote the joint probability of nonbank distress and bank survival. Note that $\partial\Phi/\partial E_B > 0$: higher bank equity expands the set of states in which the bank survives its own shock, increasing the probability that nonbank distress coincides with bank survival and thus raises exposure to contagion.

Step 1: Show $K^* = 0$. When external equity is costly, $c'(0) > \tau$. From equation (B.19), any interior solution with $K^* > 0$ requires $\nu = c'(K^*)$. Since c' is increasing, $K^* > 0$ implies $\nu > c'(0)$.

But from equation (B.18), the shadow value of funds is:

$$\nu = R_N'(E_N) - L_N \cdot f_N(-E_N) - \lambda \cdot \frac{\partial \Phi}{\partial E_N} \cdot L_B \tag{B.20}$$

For $K^* > 0$ to be optimal, we would need $\nu > c'(0)$—that is, the marginal benefit of additional funds (captured by ν) must exceed the marginal cost of external equity. When $c'(0)$ is sufficiently large relative to the marginal returns and risk reduction benefits in equation (B.20), this condition fails and the BHC optimally chooses $K^* = 0$. With $K^* = 0$, the complementary slackness condition holds with inequality: $c'(0) \geq \nu$.

Step 2: Show the regulatory constraint binds. Suppose the constraint does not bind ($\mu = 0$). From (B.17) and (B.18):

$$R_B'(E_B) - L_B \cdot f_B(-E_B) - \lambda \cdot \frac{\partial \Phi}{\partial E_B} \cdot L_B - \tau = R_N'(E_N) - L_N \cdot f_N(-E_N) - \lambda \cdot \frac{\partial \Phi}{\partial E_N} \cdot L_B \tag{B.21}$$

This is the unconstrained optimum E_B^*. When regulation binds ($\kappa_B \cdot A_B > E_B^*$), the constraint must bind at the optimum, so $E_B = \kappa_B \cdot A_B$ and $\mu > 0$.

Step 3: Solve for E_N^*. With $K^* = 0$ and $E_B^* = \kappa_B \cdot A_B$, the resource constraint (B.8) gives:

$$E_N^* = E^0 - E_B^* = E^0 - \kappa_B \cdot A_B \tag{B.22}$$

Step 4: Comparative statics. Differentiating (B.11)–(B.12) with respect to κ_B:

$$\frac{\partial E_B^*}{\partial \kappa_B} = A_B > 0 \tag{B.23}$$

$$\frac{\partial E_N^*}{\partial \kappa_B} = -A_B < 0 \tag{B.24}$$

$$\frac{\partial (E_B^* + E_N^*)}{\partial \kappa_B} = A_B - A_B = 0 \tag{B.25}$$

These hold for any $A_B > 0$. □

These predictions match our empirical findings exactly: banks accumulate equity (Column 1 of Table 3), nonbanks lose equity (Column 1 of Table 10), and BHCs do not raise external capital (Column 2 of Table 3). Appendix Figure B.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 "waterbed effect" where regulatory pressure on one subsidiary causes risk to migrate to another. Appendix Figure B.3 presents the model's counterfactual prediction that external equity financing would increase only modestly with tighter regulation (from approximately 1.3% to 3.2% of BHC assets), consistent with the empirical finding that BHCs rely primarily on internal reallocation rather than external capital markets.

B.4 Systemic Implications and Externalities

While internal reallocation is privately optimal for BHCs (avoiding costly external equity), it may be socially suboptimal due to a contagion externality. Let $\Delta E \equiv \kappa_B \cdot A_B - E_B^0 > 0$ denote the required equity transfer from nonbank to bank—the gap between the regulatory requirement and the bank's initial equity.

Private Optimum. From the Case 3 analysis, the BHC chooses internal reallocation over external equity when the marginal cost of external financing exceeds the transaction cost of internal transfer:

$$c'(0) > \tau \tag{B.26}$$

Social Optimum. A regulator additionally accounts for the systemic costs of contagion. Internal reallocation reduces E_N by ΔE, increasing the probability of nonbank failure and, through contagion, the probability of bank failure. Internal reallocation is efficient only if the saved external financing costs exceed the increase in expected systemic losses. Holding bank capital at the regulatory minimum, internal reallocation affects the externalities through changes in nonbank risk and contagion, while the direct stability benefits of higher bank equity are already embedded in the binding regulatory constraint.

$$c'(0) \cdot \Delta E > \tau \cdot \Delta E + \Delta L_N + \lambda \cdot \Delta L_B \tag{B.27}$$

where:

$$\Delta L_N \equiv L_N \cdot [F_N(-E_N + \Delta E) - F_N(-E_N)] \geq 0 \quad \text{(expected nonbank failure costs)} \tag{B.28}$$

$$\Delta L_B \equiv L_B \cdot [F_N(-E_N + \Delta E) - F_N(-E_N)] \cdot \Pr(\theta_B > -E_B) \geq 0 \quad \text{(expected bank failure costs via contagion)} \tag{B.29}$$

ΔL_N captures the direct increase in expected nonbank failure costs from reducing nonbank equity by ΔE. ΔL_B captures the increase in expected bank failure costs through contagion: the additional probability of nonbank failure $[F_N(-E_N + \Delta E) - F_N(-E_N)]$ multiplied by the probability the bank would otherwise survive $\Pr(\theta_B > -E_B)$, scaled by bank failure costs L_B.

Proposition B.2 (Contagion Externality)**.** *The BHC internalizes the private costs of contagion within the organization, but does not internalize the full social costs of bank failure. This generates a wedge between private and social incentives that increases with λ. There exists a critical contagion threshold:*

$$\lambda^* = \frac{(c'(0) - \tau) \cdot \Delta E - \Delta L_N}{L_B \cdot [F_N(-E_N + \Delta E) - F_N(-E_N)] \cdot \Pr(\theta_B > -E_B)} \tag{B.30}$$

such that internal reallocation is:

- ***Privately and Socially Aligned*** *if $\lambda < \lambda^*$ (ring-fencing effective, contagion costs small relative to saved financing costs)*
- ***Socially Costly*** *if $\lambda > \lambda^*$ (contagion costs exceed saved external equity costs)*

Proof of Proposition B.2. The social condition (B.27) requires saved financing costs $(c'(0) - \tau) \cdot \Delta E$ to exceed increased systemic risk costs $\Delta L_N + \lambda \cdot \Delta L_B$. Rearranging to isolate λ, internal reallocation is efficient if and only if:

$$\lambda < \frac{(c'(0) - \tau) \cdot \Delta E - \Delta L_N}{\Delta L_B} \tag{B.31}$$

Substituting the definition of ΔL_B from (B.29) yields equation (B.30). The BHC's private condition (B.26) does not fully internalize ΔL_N and $\lambda \cdot \Delta L_B$ insofar as these reflect social costs of failure exceeding private losses. □

Interpretation. When ring-fencing is effective (λ small), internal reallocation is both privately and socially optimal. BHCs meet regulatory requirements without incurring costly external financing, and contagion costs are contained. However, when contagion risk is material ($\lambda > \lambda^*$), the social cost of increased systemic fragility outweighs the private benefit of avoided issuance costs.

Empirical Calibration. Our stress test analysis provides empirical discipline for the model. Appendix Figure B.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 average BHC requires 18.84% of total equity to restore nonbank solvency, while the 95th percentile BHC requires 90.58% of total equity. If nonbanks were perfectly ring-fenced ($\lambda = 0$), this BHC-level vulnerability would not exist. The observed equity-at-risk implies $\lambda \in [0.2, 0.5]$, suggesting material, though not complete, contagion.

Appendix Figure B.4a plots the change in systemic costs from internal reallocation as a function of λ, expressed as a percentage of total BHC assets. Externalities are low when $\lambda < \lambda^* \approx 0.7$, reaching approximately 4% of assets when contagion is negligible ($\lambda = 0$). The externalities function crosses zero at $\lambda^* \approx 0.7$ and becomes increasingly negative for $\lambda > \lambda^*$, reaching approximately -2% of assets at complete contagion ($\lambda = 1$). Our calibrated range $\lambda \in [0.2, 0.5]$ falls below this threshold, suggesting internal reallocation is efficient under baseline parameters.

The externality threshold λ^* is sensitive to assumptions about relative failure costs. Appendix Figure B.4b explores how λ^* varies with the ratio L_B/L_N. When bank failures are only twice as costly as nonbank failures ($L_B/L_N = 2$), $\lambda^* \approx 0.2$, implying reallocation becomes socially costly even at low contagion. At our baseline calibration of $L_B/L_N = 6$, the threshold rises to $\lambda^* \approx 0.7$. At very high systemic cost ratios ($L_B/L_N = 20$), λ^* increases to approximately 0.9. Our calibrated range $\lambda \in [0.2, 0.5]$ falls below the baseline threshold across all panels of Figure B.4b, suggesting internal reallocation is efficient in our empirical setting under baseline assumptions about failure costs.

B.5 Comparative Statics and Additional Predictions

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

Effect of Stricter Regulation. Define system-wide expected failure costs as:

$$\mathcal{S} \equiv F_B(-E_B) \cdot L_B + F_N(-E_N) \cdot L_N + \lambda \cdot F_N(-E_N) \cdot [1 - F_B(-E_B)] \cdot L_B \tag{B.32}$$

The first two terms capture direct failure costs; the third captures contagion, the probability that the nonbank fails while the bank survives its own shock, triggering bank failure through the parent's balance sheet.

Using $E_B^* = \kappa_B \cdot A_B$ and $E_N^* = E^0 - \kappa_B \cdot A_B$ from Proposition B.1, and applying the chain rule (including the product rule on the contagion term):

$$\frac{\partial \mathcal{S}}{\partial \kappa_B} = A_B \Bigg[\underbrace{-f_B \cdot L_B(1 - \lambda F_N)}_{<0 \text{ (banks safer)}} + \underbrace{f_N \cdot [L_N + \lambda \cdot L_B(1 - F_B)] + \lambda \cdot F_N \cdot f_B \cdot L_B}_{>0 \text{ (nonbank risk, contagion, exposure)}} \Bigg] \tag{B.33}$$

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

Heterogeneity in External Financing Costs. The condition $c'(0) > \tau$ determines whether a BHC operates in Case 3 (internal reallocation) or Case 2 (external financing). BHCs with higher external financing costs are more likely to satisfy this condition, and therefore more likely to rely on internal reallocation rather than raising external equity. Appendix Figure B.2a illustrates this mechanism by varying the marginal cost of external equity $c'(0)$ from 0% to 20%. When external equity is cheap ($c'(0) < 5\%$), BHCs raise approximately 1.80% of assets externally and the nonbank capital ratio falls by 7.01 percentage points. As external costs rise to 15–20%, external issuance falls to 1.69% of assets and the nonbank capital ratio decline increases to 7.05 percentage points.

B.6 Calibration Details

Parameter Values. Table B.1 summarizes the baseline parameter values. The model is a stylized framework intended to illustrate the internal reallocation mechanism and derive qualitative comparative statics; it is not a structural estimation. Parameters are chosen to be broadly consistent with the data and existing literature where possible, and assumed otherwise.

Regulatory Parameters. $\kappa_{\text{low}} = 0.08$ and $\kappa_{\text{high}} = 0.105$ match pre- and post-Basel III total capital requirements exactly, including the 2.5% capital conservation buffer.

External Equity Cost ($c'(0)$). Altınkılıç and Hansen (2000) estimates direct costs of 4–7% for seasoned equity offerings, with additional indirect costs from dilution and adverse selection. We set $c'(0) = 0.07$, consistent with this range.

Transaction Cost (τ). Internal equity transfers incur administrative and tax frictions. We set $\tau = 0.02$, consistent with the assumption that internal transfer costs are small relative to external equity costs. The condition $c'(0) = 0.07 > \tau = 0.02$ confirms that Case 3 (internal reallocation) applies at baseline.

Contagion Parameter (λ). We calibrate λ directly from our stress tests. Under a 5% shock to nonbank assets requiring recapitalization to 40% capital ratios, the mean BHC deploys 18.84% of total equity while 5.10% completely exhaust buffers. If nonbanks were perfectly ring-fenced ($\lambda = 0$), no BHC-level vulnerability would exist. The observed equity-at-risk implies $\lambda \in [0.2, 0.5]$; we use the midpoint $\lambda = 0.35$ as our baseline.

Failure Costs and Remaining Parameters. $L_B/L_N = 6$ is assumed as a baseline reflecting the greater systemic importance of regulated depository institutions. Appendix Figure B.4b shows that the externality threshold λ^* is robust across a wide range of L_B/L_N ratios. Asset parameters (A_B, A_N), return parameters (α_B, α_N), and shock parameters ($\bar{\theta}_B$, $\bar{\theta}_N$) are chosen to produce capital ratios and failure probabilities broadly consistent with the data, and are not calibrated to specific empirical moments.

Table B.1: Model Calibration

Parameter	Description	Value	Source
Assets and Initial Equity			
A_B	Bank assets (normalized)	100	—
A_N	Nonbank assets	30	Illustrative; see notes
$E^0/(A_B + A_N)$	Initial consolidated equity ratio	11%	Sample mean, pre-2015
Regulatory Parameters			
κ_{low}	Pre-Basel III capital requirement	8%	Basel I/II
κ_{high}	Post-Basel III capital requirement	10.5%	Basel III + CCB
Return Function: $R_i(E_i) = \alpha_i \log(1 + E_i)$			
α_B	Bank return parameter	15	Chosen to produce qualitatively reasonable capital ratios
α_N	Nonbank return parameter	12	Chosen to produce qualitatively reasonable capital ratios
Frictions and Costs: $c(K) = c'(0) \cdot K + 0.5 \cdot K^2$			
τ	Internal transfer cost per dollar	0.02	Assumed small; $\tau \in [0, 0.05]$
$c'(0)$	Marginal cost of external equity	0.07	Altınkılıç and Hansen (2000); range $[0.05, 0.10]$
Failure Costs and Shock Distribution: $\theta_i \sim Uniform[-\bar{\theta}_i, 0]$			
L_B	Social cost of bank failure	60	Assumed; $L_B/L_N = 6$ baseline
L_N	Social cost of nonbank failure	10	Normalized
$\bar{\theta}_B$	Maximum bank shock magnitude	20	Assumed; sensitivity in Appendix Figure B.4b
$\bar{\theta}_N$	Maximum nonbank shock magnitude	15	Assumed; sensitivity in Appendix Figure B.4b
Contagion			
λ	Contagion parameter	0.35	Midpoint of $[0.2, 0.5]$; calibrated from stress tests

Notes: The model is a stylized framework intended to illustrate the internal reallocation mechanism and derive qualitative comparative statics; it is not a structural estimation. Assets are normalized so $A_B = 100$. $A_N = 30$ is chosen to produce economically meaningful nonbank operations and is not calibrated to a specific sample moment. Return parameters α_B and α_N are chosen so the model produces capital ratios broadly consistent with the data (pre-period bank capital ratios of approximately 8% and nonbank capital ratios substantially higher). Regulatory parameters κ_{low} and κ_{high} match Basel I/II and Basel III total capital requirements exactly. The contagion parameter $\lambda = 0.35$ is the midpoint of the range $[0.2, 0.5]$ calibrated from stress test results in Section 5.5. The condition $c'(0) = 0.07 > \tau = 0.02$ confirms that Case 3 (internal reallocation) applies at baseline. Appendix Figure B.4b reports sensitivity of the externality threshold λ^* to L_B/L_N and shock parameters.

B.7 Model Figures

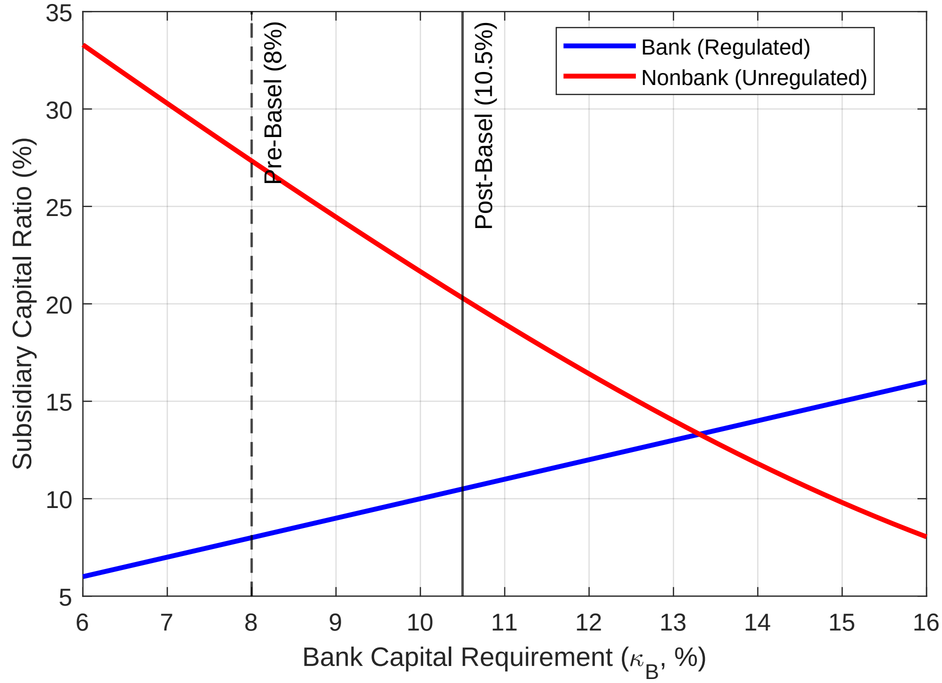
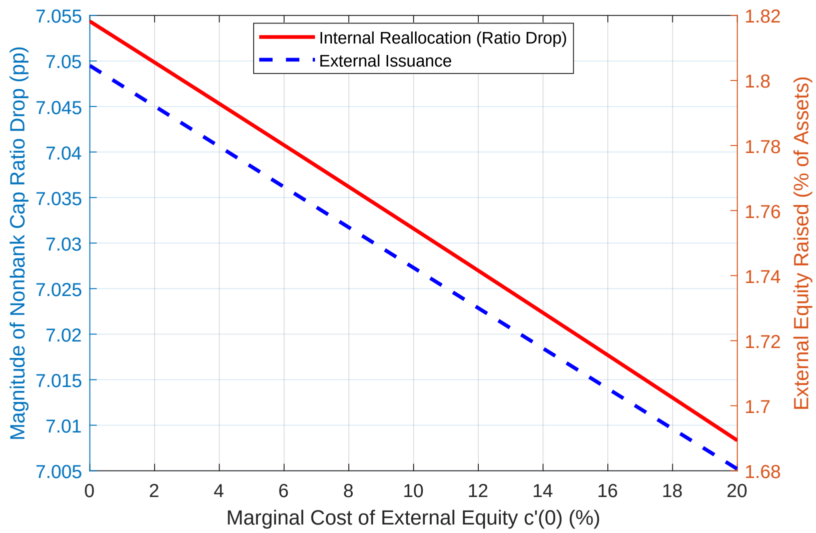
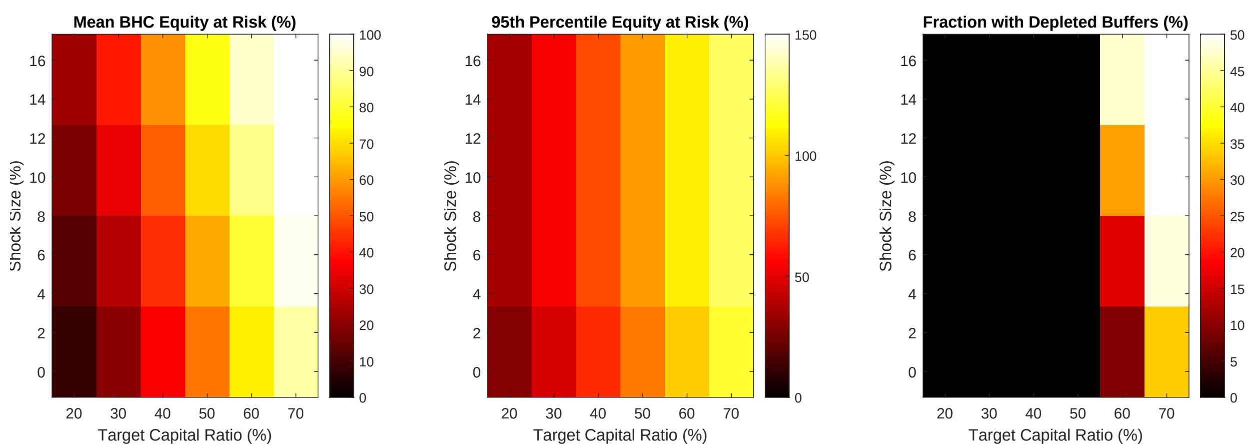


Figure B.1: The "Waterbed Effect" of Entity-Level Regulation

Notes: The figure compares the subsidiary capital ratio for bank and nonbank subsidiaries as a function of the bank capital requirement.



(a) Heterogeneity by External Financing Costs



(b) Stress Test: BHC Equity at Risk

Figure B.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).

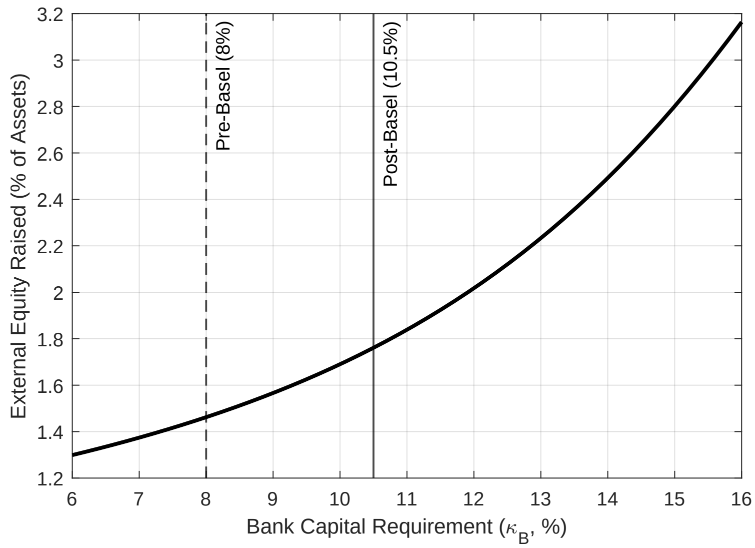
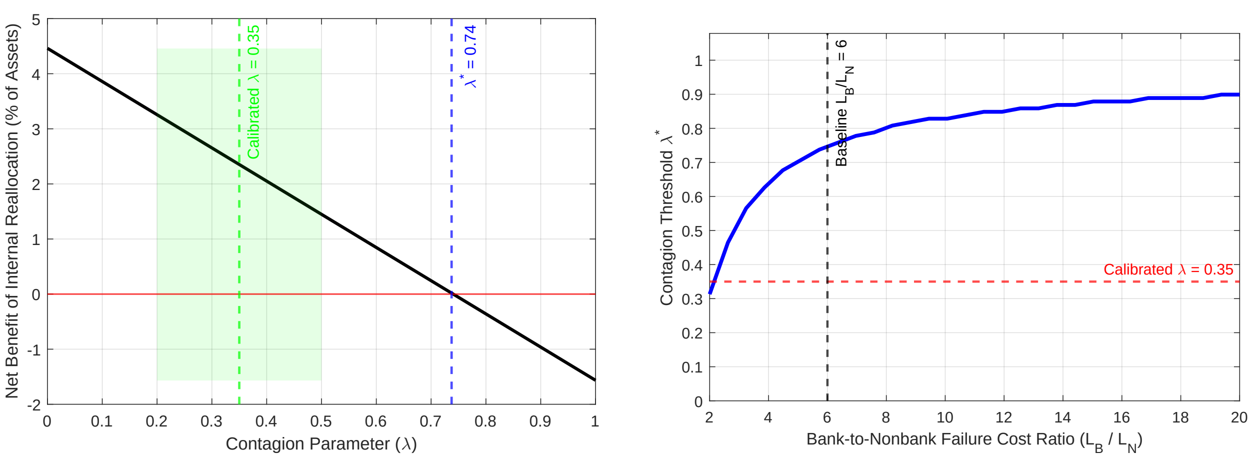


Figure B.3: External Equity Counterfactual

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. The slope represents the marginal external financing cost avoided through internal capital markets.



(a) Contagion Externality

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

Figure B.4: Systemic Implications Analysis and Model Calibration

Notes: Panel (a) plots the change in systemic costs from internal reallocation as a function of the contagion parameter λ, expressed as a percentage of total BHC assets. The net benefit of internal reallocation is positive when $\lambda < 0.74$ (saved financing costs exceed contagion risk), crosses zero at $\lambda^* \approx 0.74$, and becomes negative for $\lambda > 0.74$ (contagion costs dominate). Panel (b) shows how the externality 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 C Data Construction

This section describes the construction of the excess capital measure used in the analysis for both 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 BHC 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.[30]

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

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

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

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

- 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[31] 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.

[31] 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).

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 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 D Empirical Tests of Contagion

The model predicts that nonbank-affiliate losses transmit to the affiliated bank through depletion of the parent's equity buffer. This section tests the prediction directly using three outcomes at the affiliated bank: commercial lending growth, the credit spread on outstanding bond debt, and the parent's internal equity-flow response. The unit of observation, the source of identifying variation, and the stress windows are common across the three tests.

Stress windows. We define stress as the union of two episodes of system-wide intermediary distress: COVID 2020Q1–Q3 and the 2023 financial conditions regime, 2023Q1–2024Q4. The first is a pandemic-driven shock affecting both bank and nonbank intermediaries: mortgage REIT margin calls, money-market fund outflows, BDC NAV declines, and securities lending dislocations. The second, while widely associated with the March 2023 regional bank failures (Silicon Valley Bank, Signature Bank, First Republic), is more accurately understood as a system-wide intermediary stress episode that affected bank and nonbank entities throughout the period. Nonbank-specific manifestations include sustained commercial real estate writedowns at office-heavy nonbank lenders and CMBS-related vehicles, redemption gates at open-end real estate funds, declining mortgage origination volumes at nonbank originators, distress at fixed-income asset managers exposed to duration risk, and elevated default rates in private credit and middle-market lending. Bank-specific manifestations include the regional bank failures themselves, the Bank Term Funding Program, persistent deposit-pricing pressure, AOCI realization at affiliated BHCs, and the New York Community Bancorp episode in early 2024. Both windows therefore capture stress affecting bank- and nonbank-affiliated intermediaries simultaneously; the 2023 regime is not a bank-specific event but a sustained period of intermediary fragility with parallel bank and nonbank channels.

Affiliation indicator. The affiliation indicator AFFILIATION_j is a pre-determined cross-sectional measure equal to one if BHC j had a nonbank financial subsidiary as of 2013, zero otherwise. Fixing affiliation in 2013 mirrors the identification strategy used elsewhere in the paper and rules out endogenous changes in BHC structure during the sample window (2010–2024).

D.1 Lending Contagion

We test whether commercial lending growth at affiliated banks contracts following nonbank-affiliate loss events at the parent BHC. The unit of observation is the bank-quarter; the outcome is the quarterly change in log total loans, $\Delta \ln(\text{LOANS})_{i,t}$. Treatment is the binary indicator $\text{LAG1\_NB}_{j(i),t}$, equal to one if BHC $j(i)$ had a nonbank-loss event in the prior quarter. The estimating equation is

$$\Delta \ln(\text{LOANS})_{i,t} = \beta \cdot \text{NB Loss}_{j(i),t} + \gamma' X_i + \alpha_i + \alpha_t + \varepsilon_{i,t}, \tag{D.1}$$

where α_i and α_t are bank and quarter fixed effects, X_i is a vector of 2013 bank controls (log assets, leverage, asset growth, ROA), and standard errors are clustered at the BHC level. The sample is restricted to BHCs with nonbank affiliates, so that β identifies the within-affiliated-BHC response.

Appendix Table D.1 reports five specifications: NB-loss alone (Col. 1), bank-loss placebo (Col. 2), horse-race against bank-side loss (Col. 3), the clean subset where the bank itself did not also have a loss in the same quarter (Col. 4), and the clean-window restriction excluding bank-quarters with overlapping prior NB events (Col. 5). The point estimate is robust across specifications. In the horse-race column, lending growth contracts by 0.63 percentage points in the quarter following a nonbank-affiliate loss, controlling for the bank's own loss history. The clean-window restriction confirms the result is not driven by overlapping prior episodes at the same BHC. Notably, the lending result does not depend on stress-window definitions. It identifies off any nonbank-loss event at the parent BHC and is therefore robust to alternative stress framings used in subsequent tests.

Table D.1: Lending Contagion: Bank Loan Growth on Lag-1 Nonbank Loss Event

	(1) NB only	(2) Bank only	(3) Horse race	(4) NB w/o bank loss	(5) Clean window
NB Loss_{t-1}	-0.0065***		-0.0063***		-0.0074*
	(0.0024)		(0.0024)		(0.0042)
Bank Loss_{t-1}		-0.0180***	-0.0178***		-0.0173***
		(0.0058)	(0.0058)		(0.0061)
Loss_{t-1}				-0.0056**	
				(0.0024)	
Observations	23,848	23,848	23,848	23,848	22,102
R^2	0.1807	0.1815	0.1818	0.1806	0.1867
Bank FE	✓	✓	✓	✓	✓
Quarter FE	✓	✓	✓	✓	✓

Notes: The dependent variable is the quarterly change in log total loans, $\Delta \ln(\text{loans})$, at the bank-quarter level. The sample comprises bank-quarters between 2010Q1 and 2024Q4 at bank holding companies (BHCs) with at least one nonbank financial subsidiary. NB Loss_{t-1} is an indicator equal to one if the BHC's nonbank affiliate(s) experienced a loss event in the prior quarter. Bank Loss_{t-1} is an indicator equal to one if the bank itself recorded a loss in the prior quarter. Loss_{t-1} equals one if NB $\text{Loss}_{t-1} = 1$ and Bank $\text{Loss}_{t-1} = 0$. Column (3) is the horse-race specification, identifying the contagion effect controlling for the bank's own loss history. Column (4) restricts the sample to bank-quarters where the BHC's nonbank had a loss at $t-1$ but the bank itself did not. Column (5) restricts to bank-quarters with no nonbank-loss event at $t-2$, $t-3$, or $t-4$, isolating focal events from overlapping prior episodes. All specifications include bank and quarter fixed effects and the 2013 bank-level controls (log assets, leverage, asset growth, return on assets). Standard errors, in parentheses, are clustered at the BHC level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Figure D.1 reports a non-parametric event study using a first-spell event indicator (the BHC's first NB-loss quarter following at least four quarters of non-distress), with the omitted base period at $t = -1$. We use the first nonbank-loss event to avoid mechanical pre-trends from clustered prior events at the same BHC, following the convention in event-study designs with recurring treatments. The contraction is concentrated in the immediate post-event quarters. This pattern provides direct event-study evidence that nonbank distress at the BHC transmits to bank lending in subsequent quarters, consistent with the contagion mechanism we model.

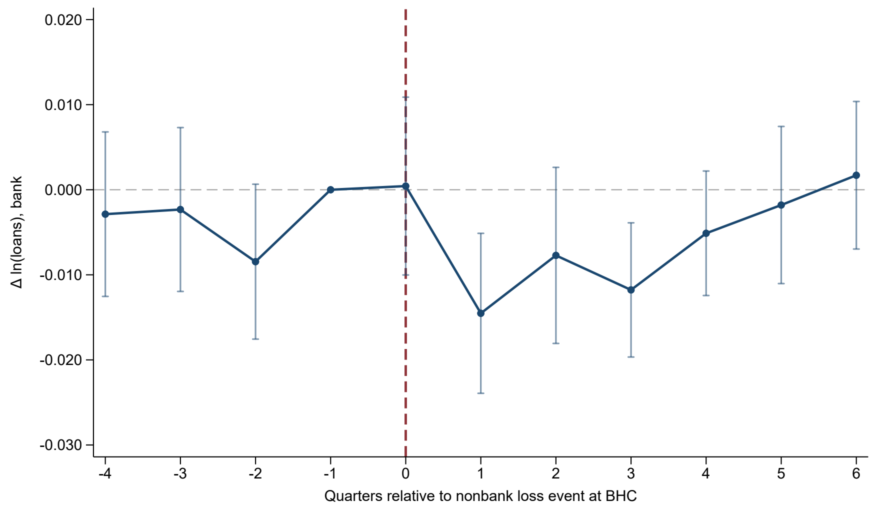


Figure D.1: Lending event study around nonbank-loss events at the BHC. Two-way fixed effects estimator on first-spell events. Base period $t = -1$. 90% confidence intervals clustered at the BHC level.

D.2 Bond Market Contagion

We test whether the credit spreads on outstanding bonds of affiliated BHCs widen in stress periods relative to non-affiliated BHC bonds. The outcome is the change in credit spread (in basis points), measured as the corporate yield less the duration-matched Svensson-fitted Treasury yield. We estimate

$$\Delta s_{c,t} = \beta \cdot \text{AFFILIATION}_{j(c)} \times \text{STRESS}_t + \delta \cdot \text{AFFILIATION}_{j(c)} + \alpha_t + \alpha_b + \alpha_s + \varepsilon_{c,t}, \tag{D.2}$$

where $j(c)$ is the issuing BHC of cusip c, α_t is the month fixed effect, α_b is the bond-type fixed effect, α_s is the security-level fixed effect, and STRESS_t takes one of three definitions across columns: COVID-only, 2022-only, and the union. Standard errors are clustered at the BHC level.

Appendix Figure D.2 reports the three specifications. The interaction Affiliation × Stress identifies the differential widening in spreads at affiliated bonds during stress, relative to non-affiliated bonds in the same months. The COVID-only window produces a 25 basis-point differential widening, statistically significant at the 1% level. The post-Q1 2023 distress regime alone produces a directionally consistent point estimate of 32 basis points but the cluster-robust standard errors are wide given the heterogeneity of BHC-level exposure during the regime. The union of the two stress windows recovers a 30 basis-point widening at conventional significance levels.

D.3 Stress-Window Event Study: Parent Equity Flows

To document the mechanism directly, we examine the parent's internal equity-flow response. Restricting to BHCs whose nonbank-loss event $t = 0$ falls in a stress window (COVID 2020Q1–Q3 or the post-Q1 2023 intermediary distress regime), we estimate event-study regressions of two affiliate-level flow outcomes around the event quarter: the change in the parent's equity investment in the nonbank affiliate, and the change in the parent's equity investment in the bank affiliate, both normalized by lagged BHC equity.

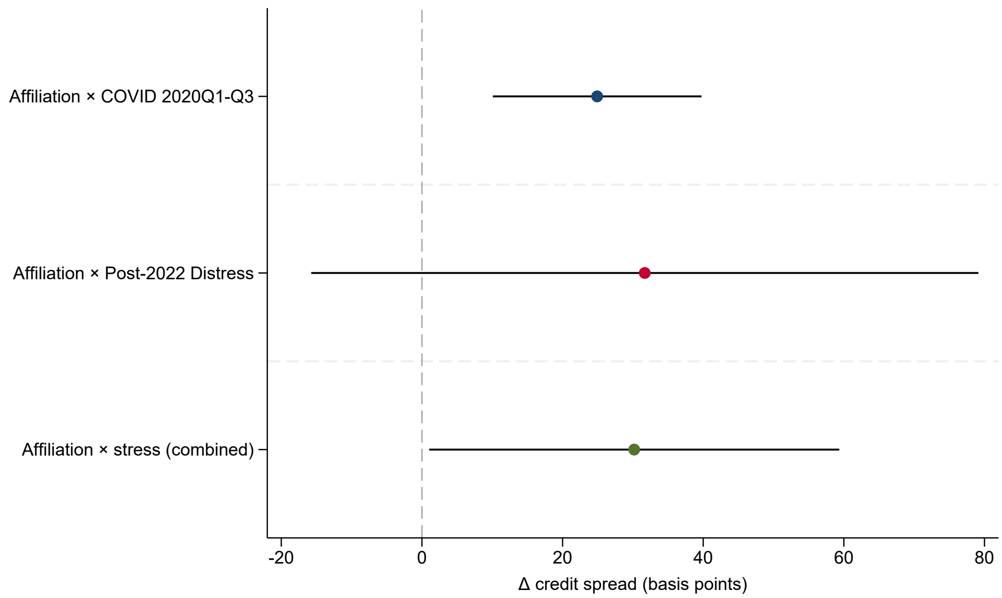


Figure D.2: Bond contagion: differential spread reaction at affiliated bonds during stress. Each marker is the affiliation × stress coefficient with 90% confidence interval.

Figure D.3 reports the leads and lags. Pre-event coefficients at $t = -4$ through $t = -2$ are not statistically distinguishable from zero on either panel, ruling out pre-trends in either nonbank or bank-affiliate flows ahead of the loss event. Beginning at $t = +1$, the offsetting reallocation pattern emerges and is the central evidence of this subsection: equity injections into the distressed non-bank affiliate rise to approximately 1.1 to 1.4 percent of lagged BHC equity over $t = +2$ through $t = +4t$, while parent equity investment in the bank affiliate moves in the opposite direction over the same window, with the largest negative coefficient at $t = +2t$ of roughly -2 percent of lagged BHC equity. The flow-side evidence pairs with the lending result in Appendix Section D.1: as the parent shifts equity from the bank to the distressed nonbank, commercial lending growth at the bank contracts by 0.65 percentage points in the following quarter, providing the precisely identified estimate of the downstream cost at the bank.

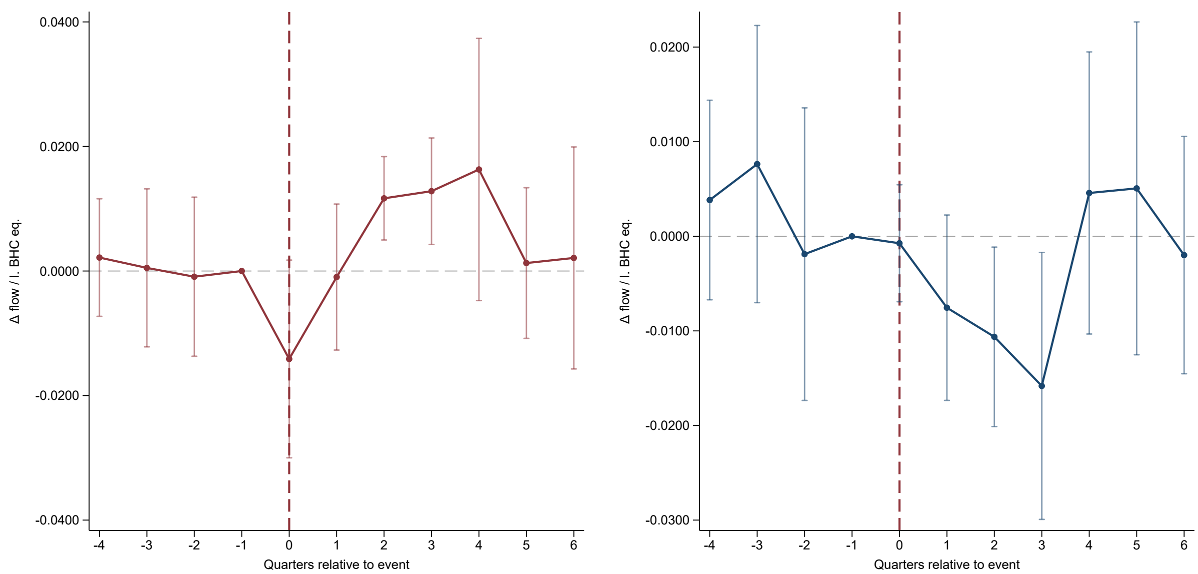
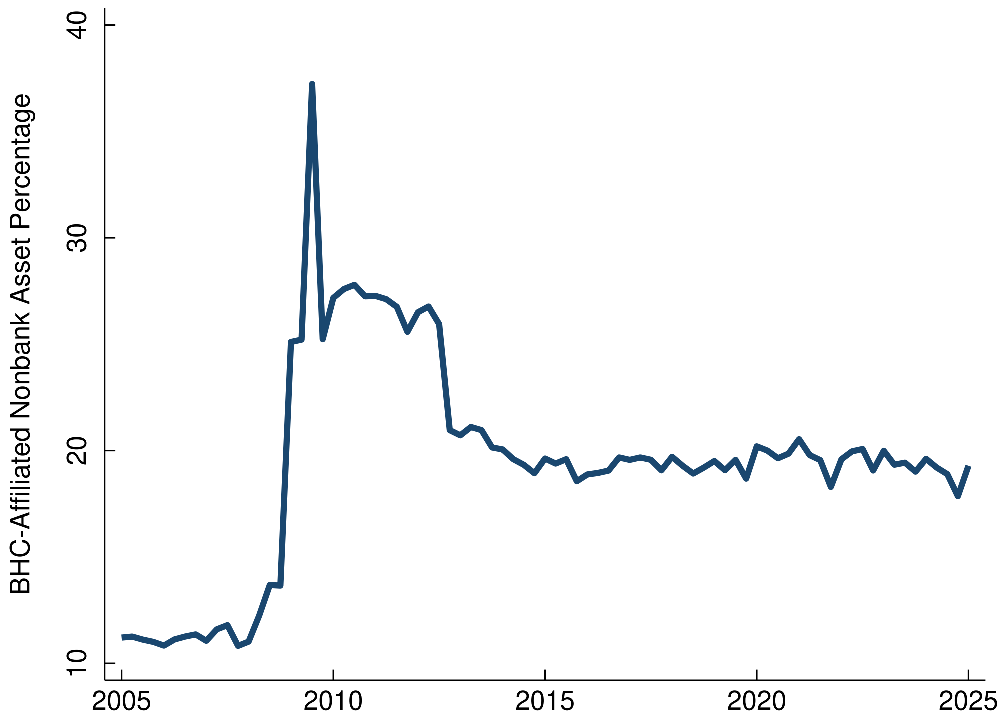


Figure D.3: Parent equity flows: nonbank recapitalization vs. bank drain. Sample restricted to BHCs with nonbank-loss events whose $t = 0$ falls in COVID 2020Q1–Q3 or the post-Q1 2023 intermediary distress regime (2023Q1–2024Q4). Base $t = -1$, 90% CI clustered at BHC level.

Appendix E Additional Empirical Figures

E.1 Share of BHC-Affiliated Nonbanks

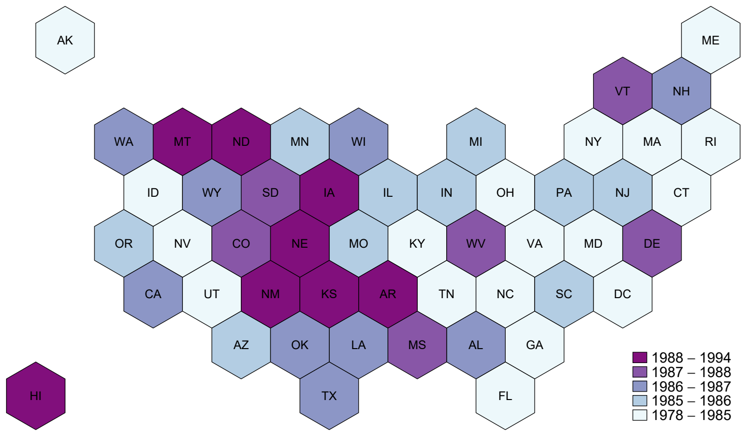
Figure E.1: Percent of Aggregate Nonbank Assets Attributable to BHC Subsidiaries



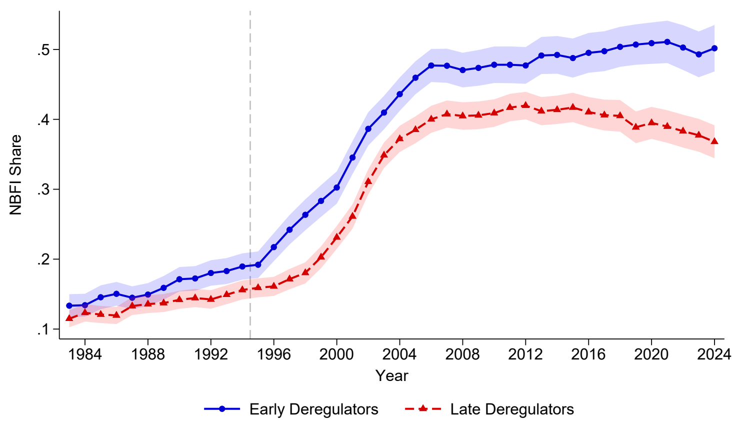
Notes: The figure presents the percent of aggregate nonbank assets attributable to BHC subsidiaries from 2005 through 2025. This measure is constructed as the ratio of BHC-affiliated nonbank assets (from the FR Y-9LP form) to aggregate nonbank assets (from the Financial Accounts of the United States). 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.

E.2 Interstate Banking Deregulation and Nonbank Financial Exposure

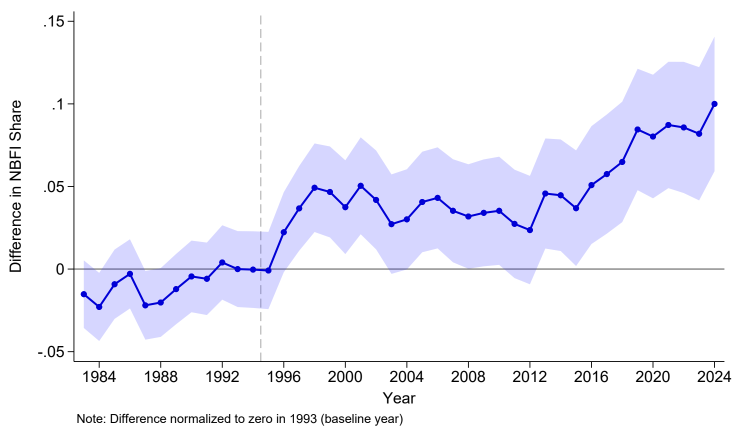
Figure E.2: Interstate Banking Deregulation and Nonbank Financial Exposure



(a) Interstate Deregulation Timing by State



(b) Nonbank Share: Early vs Late Deregulators

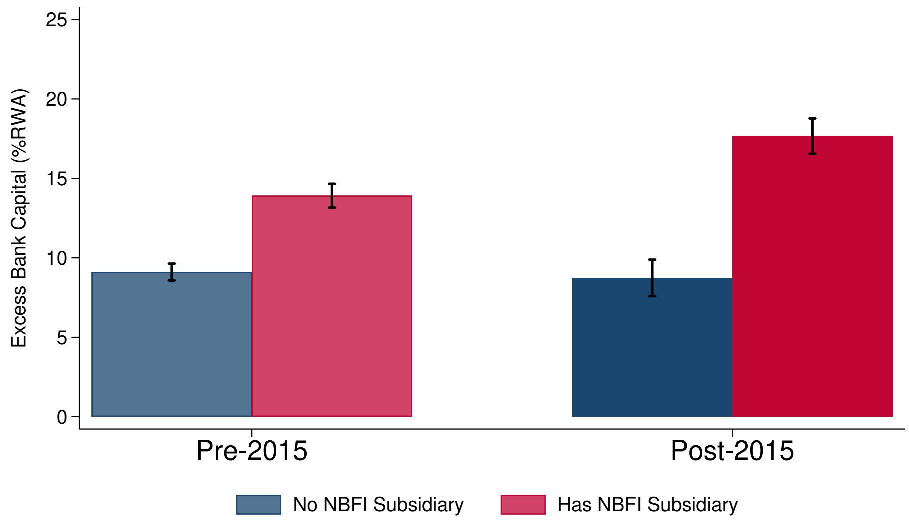


(c) Difference-in-Differences: Early - Late

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. Panel (c) plots the difference in nonbank share between early and late deregulators over time.

E.3 Bank Capital by Nonbank Status

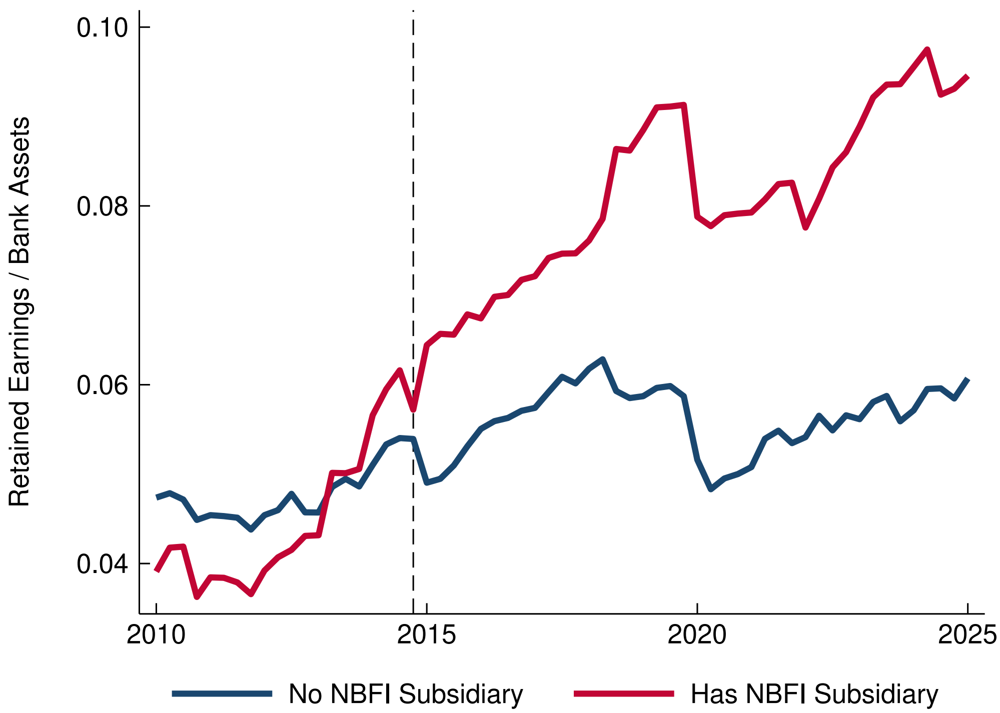
Figure E.3: Pre-Post Comparison: Bank Capital by Nonbank Status



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.

E.4 Retained Earnings by BHC Nonbank Status

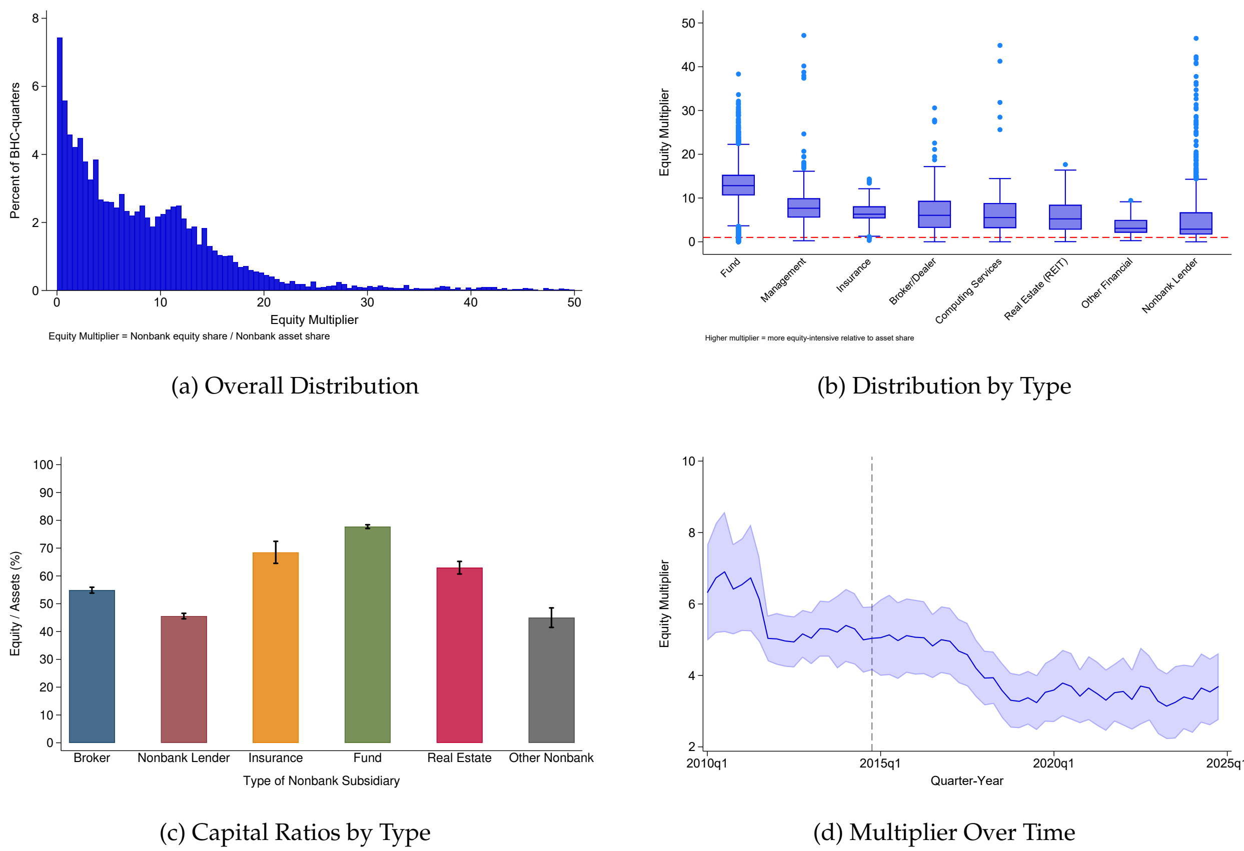
Figure E.4: Bank Retained Earnings as a Share of Bank Assets by BHC Nonbank Status



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 (red line) versus banks in BHCs without nonbank affiliates (blue 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). Source: Call Reports.

E.5 Equity Multiplier

Figure E.5: Equity Multiplier: Distributions and Dynamics



(a) Overall Distribution

(b) Distribution by Type

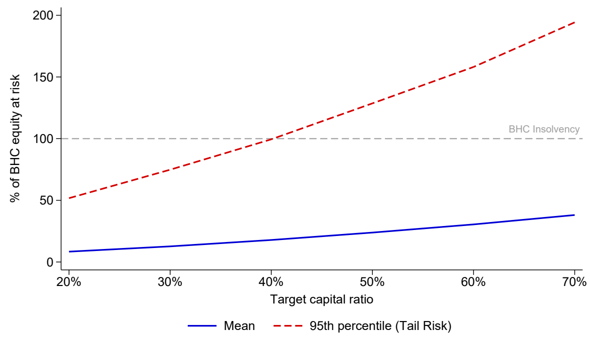
(c) Capital Ratios by Type

(d) Multiplier Over Time

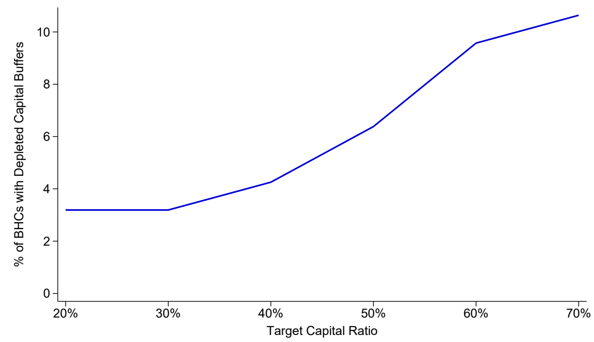
Notes: The figure provides a comprehensive view of equity multiplier distributions and dynamics. Panel (a) shows a histogram of equity multiplier across all BHC-quarters. Panel (b) shows box plots by subsidiary type (see heterogeneity documented in Table 5) Panel (c) shows mean capital ratios by type. Panel (d) shows time-series of aggregate equity multiplier. Shaded region shows 90% confidence interval. Source: Authors' calculations using FR Y-11.

E.6 Assets and Equity at Risk

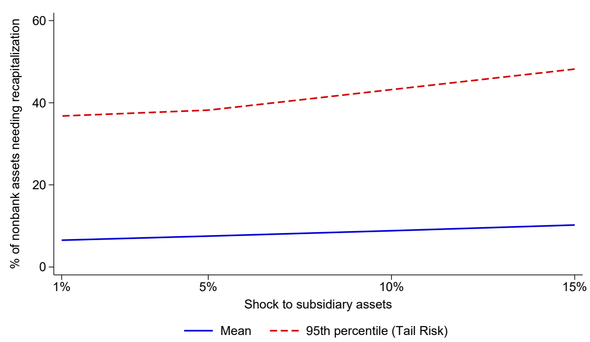
Figure E.6: Stress Test Sensitivity Analysis



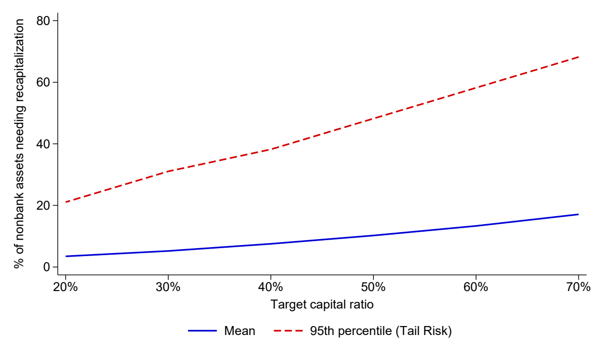
(a) BHC Equity at Risk by Capital Target



(b) Buffer Depletion by Capital Target



(c) Nonbank Assets at Risk by Shock

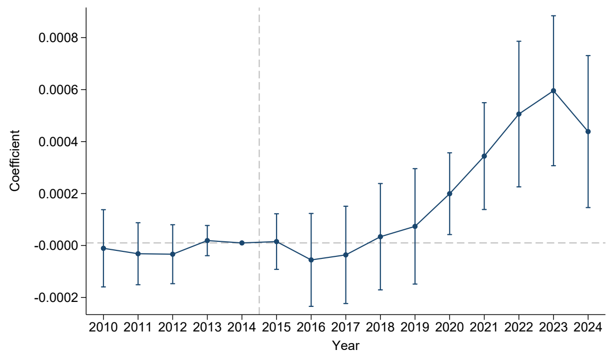


(d) Nonbank Assets at Risk by Target

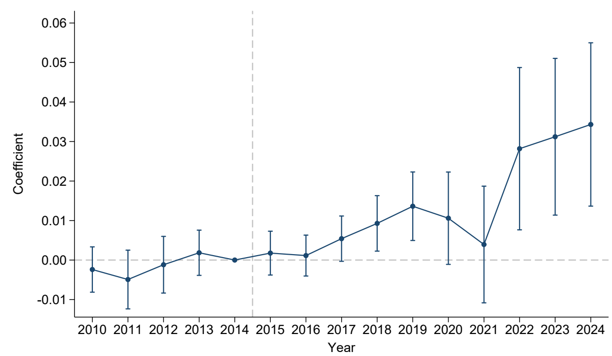
Notes: The table presents the stress test sensitivity analysis. Panel (a) shows percentage of BHC excess capital required to restore nonbanks to varying capital ratio targets following a 5% asset shock. Panel (b) shows percentage of BHCs with completely depleted capital buffers under varying targets (5% shock). Panel (c) shows percentage of nonbank assets requiring recapitalization by shock severity (40% target). Panel (d) shows nonbank assets at risk across capital targets (5% shock). Solid line: mean. Dashed line: 95th percentile. Horizontal dashed line at 100% marks potential parent insolvency. All panels use 2013Q1 balance sheets.

E.7 Bank Event Studies

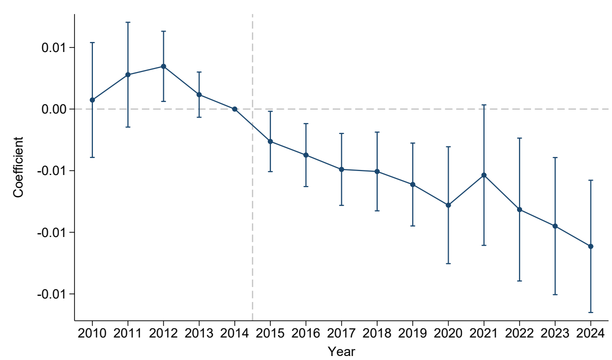
Figure E.7: Bank Event Studies: Safety and Profitability Improvements



(a) ROA



(b) Equity/RWA

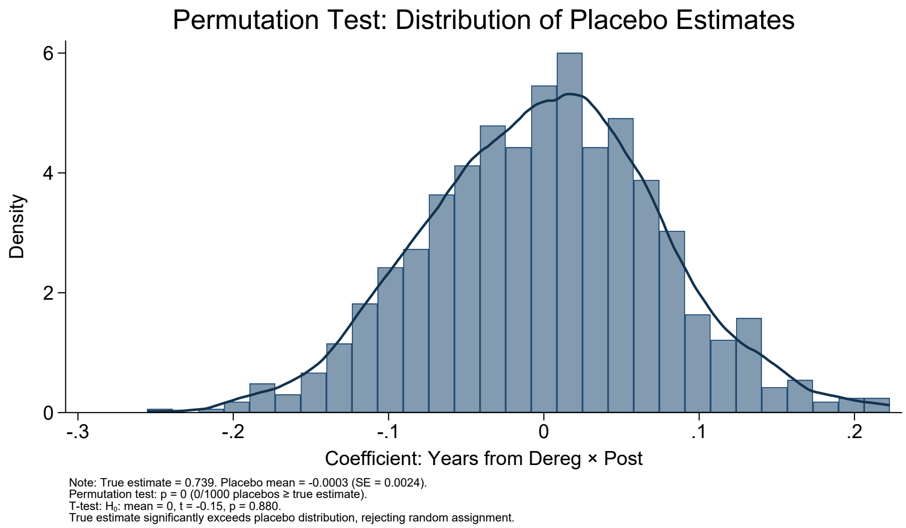


(c) RWA/Assets

Notes: The figure presents event study estimates of bank outcomes relative to 2014 baseline. Panel (a) shows return on assets, Panel (b) shows equity-to-RWA ratios, and Panel (c) shows RWA-to-assets ratio. Coefficients estimated from specification including bank fixed effects, quarter-year fixed effects, and bank controls (log assets, leverage, asset growth measured as of 2013Q1) interacted with post-2015 indicator. Standard errors clustered at bank level. Error bars indicate 90% confidence intervals. Source: Call Reports.

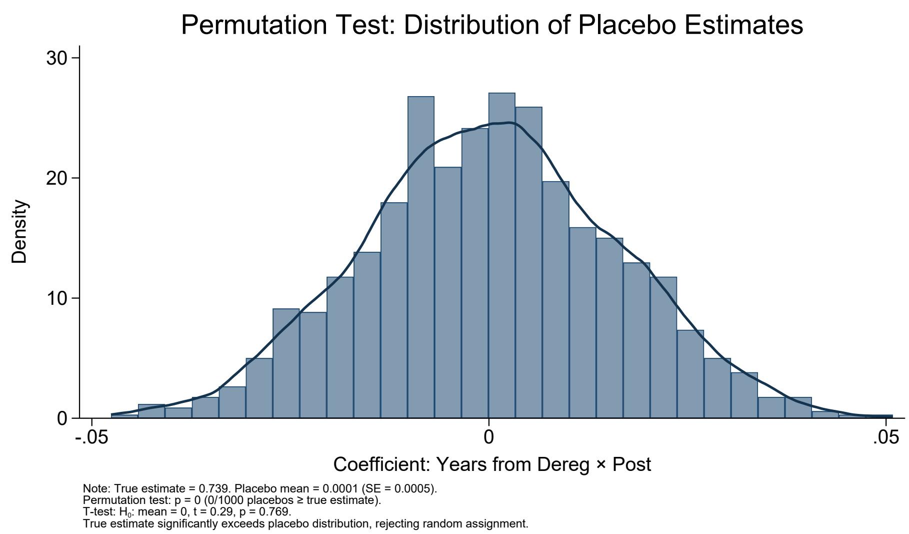
E.8 Placebo Tests

Figure E.8: 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 A, Table 3. 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 E.9: 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 A, Table 3. 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 F Additional Empirical Tables

F.1 Balanced Panel Analysis

Table F.1: Balance Table: Pre-Treatment Characteristics as of 2013Q1

	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 interstate 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 2013Q1, before the publication of final Basel III rules (July 2013) and approximately two years before they became binding in 2015Q1. 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

F.2 Persistence of Nonbank Exposure

Table F.2: Persistence of Nonbank Financial Subsidiary Exposure

	Dependent Variable: NBFI Share$_t$ (% of Total Assets)				
	1-Year Lag (1)	2-Year Lag (2)	3-Year Lag (3)	4-Year Lag (4)	5-Year Lag (5)
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. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

F.3 Internal Capital Reallocation: Deregulation Timing

Table F.3: Internal Capital Reallocation and Deregulation Timing

	(1)	(2)	(3)	(4)
Panel A: Bank Excess Capital				
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 2013Q1 and interacted with Post. Panel A and C controls include 2013Q1 bank size, leverage, ROA, and asset growth. Panel B controls include 2013Q1 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). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

F.4 Internal Capital Reallocation: NBFI Presence

Table F.4: Internal Capital Reallocation and Organizational Complexity

Panel A: Bank Excess Capital

	(1)	(2)	(3)	(4)
$\mathbb{1}$[NBFI Sub] × Post	4.8312**	4.8349**	2.0532*	2.0646**
	(2.3535)	(2.3377)	(1.0553)	(0.8277)
$\mathbb{1}$[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)
$\mathbb{1}$[NBFI Sub] × Post	-0.1793	-0.0362	-0.0066	0.4333
	(0.3183)	(0.3121)	(0.2679)	(0.2931)
$\mathbb{1}$[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)
	7.0487***	6.2209***	4.3940***	2.7992***
	(2.1444)	(1.9713)	(1.3482)	(0.8818)
$\mathbb{1}$[NBFI Sub]	2.3418***	2.3474***		
	(0.5530)	(0.5548)		
Post	0.9498			
	(0.7599)			
Constant	1.4756***			
	(0.1615)			
Observations	39,231	39,231	39,207	39,052
R^2	0.0162	0.0253	0.4031	0.4187
Bank FE			✓	✓
Quarter-Year FE		✓	✓	✓
Controls × Post				✓

Notes: 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). $\mathbb{1}$[NBFI Sub] indicates BHCs with nonbank financial subsidiaries as of 2013Q1. Post equals one for 2015Q1 and later. Controls are measured in 2013Q1 and interacted with Post. Panel A and C controls include 2013Q1 bank size, leverage, ROA, and asset growth. Panel B controls include 2013Q1 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). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

F.5 External Equity Issuance Following Basel III

Table F.5: External Equity Issuance Following Basel III

	Direct Issuance (1)	Net Issuance (2)	External Equity (3)
Years from Dereg × Post	−0.0011***	−0.0026***	−0.0015***
	(0.0004)	(0.0006)	(0.0005)
Observations	6,155	6,155	6,155
R^2	0.171	0.217	0.186
BHC FE	✓	✓	✓
Quarter FE	✓	✓	✓
Controls × Post	✓	✓	✓

Notes: This table presents reduced-form estimates of the effect of organizational complexity on external equity issuance following Basel III implementation. The dependent variables are: direct common stock issuance normalized by lagged equity (Column 1), net equity issuance (gross issuance minus buybacks) normalized by lagged equity (Column 2), and total external equity normalized by lagged equity (Column 3). 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. BHC controls include top 200 BHC indicator, log assets, leverage, ROA, deposits/assets, asset growth, and subsidiary count, all measured as of 2013Q1 and interacted with Post. Standard errors clustered at the BHC level in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

F.6 Bank/BHC Equity Share

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

Bank Equity Share	(1)	(2)
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 4. 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 as of 2013Q1 and interacted with Post. Standard errors clustered at BHC level. Sample restricted to BHCs with nonbank asset share exceeding 1%. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

F.7 Bank Retained Earnings

Table F.7: Bank Retained Earnings

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)			
Observations	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) all measured as of 2013Q1 and interacted with Post. Standard errors clustered at bank level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

F.8 BHC Balance Sheet

Table F.8: BHC-Level Balance Sheet: Consolidated Effects

Panel A: Portfolio Composition

	Loan Share (1)	Securities Share (2)	Cash Share (3)
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 B: Capital Structure

	Leverage (1)	Equity/RWA (2)	RWA/Assets (3)	Marginal ROE (4)	Off-BS (5)
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	5,388
R^2	0.718	0.871	0.880	0.039	0.873
BHC FE	✓	✓	✓	✓	✓
Quarter-Year FE	✓	✓	✓	✓	✓
Controls × Post	✓	✓	✓	✓	✓

Panel C: Consolidated Scale

	Log Assets (1)	Asset Growth (2)
Years from Dereg × Post	0.0114	0.0003
	(0.0097)	(0.0004)
Observations	5,388	5,387
R^2	0.994	0.134
BHC FE	✓	✓
Quarter-Year FE	✓	✓
Controls × Post	✓	✓

Notes: The table reports estimates using BHC-level (consolidated) balance sheet data. Panel A presents portfolio composition measures: loan share, securities share, and cash share. Panel B presents capital structure measures: leverage, equity-to-risk-weighted-assets, risk-weighted-assets-to-assets, marginal ROE, and off-balance-sheet loan commitments. Panel C presents consolidated scale measures: log total assets and quarterly asset growth. Controls in Panel C exclude log total assets from the control interactions to avoid controlling for the pre-period level of the dependent variable. BHC profitability results are reported separately in Table 8. 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 2013Q1 and interacted with Post, except where noted. Standard errors are clustered at the BHC level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

F.9 BHC Internal Funding Rates

Table F.9: BHC Internal Funding Rates: Banks and Nonbanks

	Nonbank Rate (1)	Bank Rate (2)	Spread Rate (NB - Bank) (3)
Years from Dereg × Post	0.0052** (0.0024)	0.0008 (0.0008)	0.0044* (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. The dependent variable in Column (1) is the annualized interest rate on internal funding to nonbank subsidiaries, calculated as quarterly interest income from nonbank subsidiaries multiplied by four and divided by the stock of nonequity internal funding to nonbank subsidiaries (the sum of internal loans, parent affiliate deposits, and net balances due from nonbank subsidiaries). Column (2) reports the corresponding annualized interest rate on internal funding to bank subsidiaries, calculated analogously using interest income from bank subsidiaries and the stock of nonequity internal funding to bank 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 2013Q1 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. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

F.10 Nonbank Shift to Lending Activities

Table F.10: Nonbank Shift to Lending Activities

	Earning Assets/ Assets (1)	Loans/ Assets (2)
Years from Dereg × Post	0.0688** (0.0276)	0.0352** (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 as of 2013Q1) interacted with Post. Standard errors clustered at BHC level. Panel (d) of Figure 6 visualizes loan share increase. Appendix Tables F.11-F.12 examine which loan types and business activities expanded. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

F.11 Nonbank Shift to Consumer Lending

Table F.11: Loan Composition: Shift Toward Consumer Lending

Panel A: All Nonbank Subsidiaries

	Real Estate Growth (1)	C&I Growth (2)	Consumer Growth (3)	Non-US Growth (4)
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

	Real Estate Growth (1)	C&I Growth (2)	Consumer Growth (3)	Non-US Growth (4)
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 2013Q1 and interacted with Post. Standard errors are clustered at the BHC level. Source: FR Y-11. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

F.12 Nonbank Business Model Changes

Table F.12: Business Model Changes: Shift from Fees to Interest Income

Panel A: Decline in High-Equity-Ratio Activities

	Trading Revenue (1)	Advisory/Fiduciary (2)	Venture Capital (3)
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

	ln(Interest Income) (1)	ln(Non-Interest Income) (2)
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 2013Q1 and interacted with Post. Standard errors are clustered at the BHC level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

F.13 Nonbank Compositional Shifts

Table F.13: Extensive Margin: Changes in Subsidiary Composition

Panel A: Net Change in Subsidiary Count

	Broker (1)	Lender (2)	Insurer (3)	Fund (4)	REIT (5)
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)

	Broker (1)	Lender (2)	Insurer (3)	Fund (4)	REIT (5)
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)

	Broker (1)	Lender (2)	Insurer (3)	Fund (4)	REIT (5)
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 as of 2013Q1) interacted with Post. Standard errors clustered at BHC level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

F.14 Organizational Complexity

Table F.14: Organizational Complexity: Number of Distinct NBFI Types

ln(NBFI Types)	(1)	(2)
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 as of 2013Q1 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. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table F.15: Nonbank Income Volatility

	σ(Int Inc) (1)	σ(Non-Int) (2)
Years from Dereg × Post	0.1969***	0.0422
	(0.0660)	(0.1030)
Observations	2,714	2,714
R^2	0.6934	0.5513
Nonbank FE	✓	✓
Industry-Qtr-Year FE	✓	✓
Controls × Post	✓	✓

Notes: The table presents rolling income volatility measures. Column (1) is the rolling 8-quarter standard deviation of log interest income. Column (2) is the rolling 8-quarter standard deviation of log non-interest income. 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 as of 2013Q1) interacted with Post. Standard errors clustered at BHC level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

F.15 2SLS Design

Table F.16: 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 as of 2013Q1 and interacted with Post. Standard errors clustered at bank level in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table F.17: Two-Stage Least Squares Estimates

Excess Bank Capital	(1)	(2)	(3)	(4)
NBFI $\widehat{\text{Share}}$ × Post	9.4067***	5.2805*	1.4489*	1.9582*
	(3.4466)	(2.7473)	(0.8095)	(1.0279)
Observations	12,558	12,558	12,558	12,558
First-Stage Diagnostics:				
Kleibergen-Paap LM Statistic	16.458	11.385	12.257	8.894
Cragg-Donald Wald F Statistic	1524.187	534.417	1161.075	505.361
Kleibergen-Paap Wald F Statistic	19.635	12.940	14.384	9.784
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 as of 2013Q1 interacted with Post). Standard errors clustered at bank level in parentheses. First-stage diagnostics reported at bottom. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.