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Nicola Cetorelli | Saketh Prazad

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Abstract

U.S. bank holding companies (BHCs) have developed a very significant nonbank footprint over the years, adding thousands of specialty lenders, brokers and dealers, asset management, and insurance subsidiaries to their organizations. These nonbank subsidiaries represent a sizeable share of aggregate BHC assets and a significant component of the entire U.S. nonbank industry. We argue that liquidity management synergies are an important driver of the coexistence of commercial banks and nonbank subsidiaries within BHCs. Using unique data on BHC organizational structure and financial reports, we show that in the unrestricted pre-crisis regulatory environment, commercial banks within BHCs with a large nonbank footprint hold fewer liquid assets and more loans on their balance sheet. We show that our results are driven by explicit and implicit intracompany funding arrangements between affiliated banks and nonbanks. Post-GFC banking regulation, like resolution planning and liquidity regulation, has disrupted liquidity synergies and has caused BHCs to scale back their nonbank footprint.

JEL classification: G01, G21, G23, G28
Key words: banking firm, bank holding companies, firm boundaries, nonbank financial institutions, liquidity synergies, bank regulation

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Cetorelli: Federal Reserve Bank of New York (email: nicola.cetorelli@ny.frb.org). Prazad: Harvard University (email: sprazad@gmail.com). The authors thank seminar participants at the New York Fed, Bank of Italy, and CEBRA (Central Banking Research Association), and especially Viral Acharya, Matt Plosser, and Chuck Fang for their valuable comments.

1 Introduction

What is a bank? And what are the activities that define the boundaries of a banking firm? In light of the rapid growth of nonbank financial institutions (NBFIs), a large literature has argued that bank-led financial intermediation, with banks defined based on their traditional deposit-taking and loan-making operations, is on the decline. We do not dispute this general observation. However, we argue that for the last few decades, deposit taking and loan making have not properly characterized the U.S. banking firm. We propose that absent regulatory restrictions, banks will naturally expand their boundaries to include NBFI subsidiaries, and that engaging in their complementary activities allows banks to exploit significant liquidity synergies.

We use a unique dataset of the organizational structure and financial reports of bank holding companies (BHCs), the dominant legal entity used to conduct the business of banking in the U.S., to present new evidence on the expansion of the boundaries of the banking firm over the last few decades. Since the 1980s, BHCs have been adding thousands of NBFI subsidiaries representing the full array of intermediation activities, including investment funds, securities dealers, insurers, and specialty lenders. These subsidiaries contribute meaningfully to the business model of BHCs. BHC-held nonbank subsidiaries constitute at least 20% of aggregate BHC assets and 11% of the aggregate NBFI industry in the United States. NBFI holdings are widespread across the banking industry, indicating that this has been an industry-wide phenomenon rather than an exceptional pattern confined to just a few "universal banks".

Why have the boundaries of the banking firm expanded? We acknowledge the existence of alternative drivers behind banks' motivation to expand into nonbank territory. For example, banks may be expanding in nonbank territory searching for benefits from vertical integration.[1] There may also be benefits from broader economies of scope in bringing under a common organizational umbrella separate but *related* activities.[2] And of course scope expansion may be the result of agency frictions internal to the organizations.[3] While there may be multiple factors at play explaining the organizational choices of banking firms, in this paper we argue, and provide robust, consistent

[1] E.g., for the purpose of economizing on transaction costs *a la* Williamson (1989).

[2] As proposed in the management theory literature (e.g., Penrose (1959), Rumelt (1982), and with a specific application to banking, Cetorelli, Jacobides and Stern (2021).

[3] For applications to banking, see, e.g., Laeven and Levine (2007).

evidence for, the crucial importance of synergies related to *liquidity management*. Our argument builds off of the canonical contribution of Kashyap, Rajan and Stein (2002) (KRS), who show that there are important benefits to extending credit lines and taking deposits under the same roof. Both activities involve providing contingent liquidity through the satisfaction of deposit withdrawals and credit line drawdowns. Both activities therefore require the holding of liquid asset buffers. However, as long as deposit outflows and credit line drawdowns are not perfectly correlated, then jointly conducting both activities allows banks to economize on liquid asset holdings. In other words, a traditional bank should be a "superior" organizational structure to specialist institutions.

KRS interprets this bank as an institution operating with two distinct *divisions* - deposit collection and credit line extension - but their intuition and theoretical construct extend naturally to the organizational choices of more modern U.S. banking firms that control a diversified array of bank and nonbank *subsidiaries*. Just as commercial banks are vulnerable to deposit outflows and credit line drawdowns, nonbank intermediaries can also be vulnerable to sudden liquidity demands. As long as affiliated banks and nonbanks experience relatively uncorrelated liquidity outflows, then diversified BHCs can redistribute liquid assets among subsidiaries in order to economize on their overall liquid asset holdings. Consequently, we posit that banking firms with a more extensive nonbank footprint can more efficiently manage their liquidity needs. We provide extensive empirical evidence in support of this hypothesis.

Of course, in order for BHCs to seek potential benefits from having a nonbank footprint, they have to be able to freely choose their organizational structure in the first place. This is a non-trivial observation, considering the long history of activity restrictions on U.S. banks dating back to the Glass-Steagall Act of 1933. However, in the mid 1980s, bank regulators adopted an interpretation of the concept of banks' "permissible activities" that effectively gave banks the freedom to expand their boundaries if they so chose. This permissible environment remained in operation through the global financial crisis (GFC). Hence, the decades leading up to and including the GFC represent an ideal laboratory to test the importance of liquidity synergies.

Post-GFC regulation changed that environment through explicit liquidity requirements (liquidity coverage ratio) and restrictions on interconnections within BHCs (living wills). Thus, we should expect any liquidity synergies we detect in the pre-GFC period to be attenuated in the post-GFC period because regulation reduces the scope for banks to exploit those synergies. Later in the paper, we use a synthetic difference-in-differences design (Arkhangelsky et al., 2021) to show that post-GFC regulation indeed reduced interconnectedness between BHC subsidiaries, causing banks to scale

back their nonbank footprint.

We begin our analysis of liquidity synergies in the pre-GFC environment by testing the relationship between the size and scope of banks' nonbank affiliates and the size of their liquid asset buffers. Using within-BHC variation, we show that a 1 percentage point increase in the ratio of nonbank assets to consolidated BHC assets leads to a 10 basis point reduction in the ratio of cash and securities to assets for commercial bank subsidiaries. We also find an 8 basis point increase in banks' loans-to-assets ratio, suggesting that banks who reduce liquidity holdings choose to re-balance their portfolio towards lending. But in the post-GFC period, these estimates are greatly attenuated, consistent with our hypothesis on the effects of regulation. Our results are robust to controlling for a wide range of bank balance sheet characteristics and determinants of liquidity risk, including the ratio of deposits to assets, the ratio of demandable deposits to total deposits, and the ratio of unused commitments to assets.

The theory developed by KRS suggests that the correlation between liquidity outflows experienced by different business lines within a bank is a key determinant of the scope for liquidity synergies. Applied to our setting, if the liquidity outflows experienced by affiliated banks and nonbanks are highly correlated, then commercial banks cannot rely on their affiliates for liquidity support during times of need. Consistent with this theoretical insight, we show that holding the size of nonbank affiliates constant, commercial banks with a more *diversified* set of nonbank affiliates experience further reductions in liquidity buffers and further increases in lending. We measure the diversification of nonbank affiliates using the BHC-level count of nonbank subsidiaries and unique nonbank business lines.[4] These metrics capture the extent to which the BHC is exposed to the idiosyncratic liquidity risk of particular nonbank entities or, more broadly, particular nonbank business lines.

The economic magnitudes of our estimates are large: imagine a full reinstatement of Glass-Steagall, forcing a separation between most commercial banking and nonbank activities. A back-of-the-envelope calculation using our estimates suggests that for a large pre-GFC bank holding company with a significant nonbank footprint, a Glass-Steagall-esque policy that forced the divestment of nonbank subsidiaries would result in an increase in commercial bank liquid asset shares of 366 basis points, equivalent to approximately 60% of the effect of the post-GFC liquidity coverage ratio.

To mitigate concerns that our results are driven by endogenous selection, we sharpen our

[4] As captured by the count of unique 5-digit NAICS codes describing nonbank subsidiaries' business activities.

hypothesis by testing one of the specific mechanisms that should drive liquidity synergies. According to our theory, affiliates can use intracompany transfers to redistribute liquid assets across the organization, provided that affiliates experience uncorrelated liquidity demands. Note that the existence of an active internal capital market is implicit in the reasoning of KRS, but the authors are unable to explicitly analyze intracompany funding flows because such flows are inherently unobservable for divisions that are integrated under one firm. In contrast, our setting involves flows between distinct legal entities, which are observable using the (highly underutilized for research purposes) unconsolidated financial reports of BHCs from the FR Y9-LP, as well as financial reports for a subset of individual nonbank subsidiaries from the FR Y-11.

We document simple aggregate time series evidence of intracompany funding flows between bank and nonbank subsidiaries of BHCs. We note two key observations of these time series that are strongly suggestive of liquidity synergies. First, these funding flows are often large in size. For example, commercial bank borrowing from affiliates is often more than 5% of bank assets, particularly in the pre-GFC period. If banks' decisions to affiliate with nonbanks were driven by non-liquidity factors like profitability, there would be no particular reason for intracompany funding volumes to be so large. Second, most intracompany funding flows occur directly between bank and nonbank subsidiaries rather than between holding companies and subsidiaries. This allows us to rule out the possibility that observed intracompany borrowing is simply a means for parents to distribute external market funding to their subsidiaries.

To more formally test our hypothesis, we show using within-BHC variation in the pre-GFC period that as commercial banks become more reliant on funding from their nonbank affiliates, they shrink their liquid asset buffers and increase their lending. Importantly, our findings hold even when we control for the asset size, diversification, and composition of nonbank affiliates and for bank-level indicators of liquidity risk like exposure to demandable deposits and credit lines. In other words, we find that if two banks have functionally identical nonbank affiliates and liquidity risk profiles, the bank that borrows more from those affiliates will experience more benefits. We continue to find that these estimates reverse in sign during the post-GFC period.

We find similar dynamics from the perspective of *nonbank* subsidiaries in the pre-GFC period. Specifically, we find in the cross-section that those who use more intracompany funding *from* affiliated commercial banks also hold smaller liquid asset buffers and engage in more productive activities like lending or securities intermediation. Note that these complementary findings for nonbank subsidiaries are not just a mechanical reflection of our results on commercial bank subsidiaries.

Instead, these findings suggest that liquidity synergies may be experienced by all BHC subsidiaries rather than experienced only by commercial banks.

The intracompany borrowing that we observe on the balance sheet of BHC subsidiaries actually underestimates the true extent of intracompany liquidity support inside a BHC. Typically, banks provide liquidity and funding support to their external clients both via loans (thus reported on balance sheet) *and* with committed lines of credit. Contingent support through credit lines is often larger in overall dollar amount than term lending (see, e.g., Acharya, Cetorelli and Tuckman (2024)). In the case of external counterparties, although the undrawn portion of credit lines are not reported on balance sheets, they are still contractual obligations that are reported as off-balance-sheet line items. In constrast, in the case of affiliated counterparties (i.e. related institutions within a BHC), there are usually no such contractual obligations. However, these subsidiaries may still be operating with the expectation that their affiliates will provide liquidity support during stress periods. We refer to these possible intracompany commitments as *implicit lines of credit*.

To test for the existence and importance of implicit lines of credit internal to a BHC, we look for empirical evidence that intracompany funding intensifies during episodes of unexpected liquidity stress. We exploit differential exposure of commercial banks to the asset-backed commercial paper (ABCP) market prior to 2007. As Acharya, Schnabl and Suarez (2013) illustrate, this market was severely disrupted in August 2007, which led to large liquidity shocks for commercial banks who sponsored ABCP conduits. We find that commercial banks with larger pre-existing exposures to ABCP conduits received greater intracompany funding support in the months after August 2007, conditional on having a larger nonbank footprint. This result provides additional evidence in support of our liquidity synergy theory. If BHCs develop a large nonbank footprint for reasons unrelated to efficient liquidity management, then there should be no reason to expect internal funding flows to respond to liquidity stress experienced by certain subsidiaries.

Related Literature. The literature has recently returned to the fundamental question of what defines a bank. These questions were central in motivating the 2022 Nobel Prize in Economics for contributions in financial intermediation, specifically theories of banking and the existence of bank-like intermediaries providing similar services (The Royal Swedish Academy of Sciences, 2022). Buchak et al. (2024) highlight the "secular decline" of a model of intermediation centered on deposit taking and loan making, emphasizing the emergence of NBFIs as substitutes to banks. Hanson et al. (2024) argue that competition from NBFIs has shifted the business model of banks towards

the holding of long-term securities and away from traditional lending to firms. Acharya, Cetorelli and Tuckman (2024), also motivated by the emergence and growth of NBFIs, posit that the role of banks has transformed from direct lenders in the economy to providers of funding and liquidity to NBFIs. Our paper contributes to this literature by showing that the displacement of banking highlighted by many papers has also been happening *inside* the boundaries of the banking firm.

Our paper also contributes to the long-standing literature on synergies between financial activities conducted by banks. Numerous papers, including KRS, Diamond and Rajan (2001), Gatev and Strahan (2006), and more have explored the reasons why deposit-taking and risky lending might optimally occur under one roof. However, these papers conceptualize banks as institutions that only have deposit-taking and loan-making business lines. This traditional view of banking does not account for banks' expansion into nonbank business lines. Our paper shows that past results about liquidity management synergies between deposit-taking and loan-making can help us understand the organizational choices of the modern banking firm.

Likewise, we contribute to an emerging literature about liquidity management synergies between a variety of financial intermediaries, such as between broker-dealers and banks (Caglio, Copeland and Martin, 2021), mutual funds and banks (Afonso, Cipriani and La Spada, 2022; Jacewitz, Unal and Wu, 2022), mutual funds within the same fund family (Agarwal and Zhao, 2019), and private equity and life insurers (Foley-Fisher, Heinrich and Verani, 2023; Kirti and Sarin, 2023). These papers all explore liquidity management synergies in specific settings. Our paper suggests that these insights may apply more generally. A key aspect of the business model of most financial intermediaries is the provision of liquidity. Any pair of intermediaries that experience relatively uncorrelated liquidity demands can, in principle, engage in efficiency-enhancing transfers that allow them to economize on liquid asset holdings and be more resilient to funding shocks.

Our paper also relates to a broader literature on the importance of internal capital markets for explaining the organizational choices of both financial and nonfinancial firms. Cetorelli and Goldberg (2012*a*,*b*,*c*) show banks' use of internal capital markets on a global scale. Matvos and Seru (2014), Kuppuswamy and Villalonga (2016), Almeida, Kim and Kim (2015), and Matvos, Seru and Silva (2018) argue that the exploitation of internal capital markets is a key driver of the decisions of nonfinancial firms to diversify into conglomerate structures. Thus, our conclusions are consistent with a general ability of integrated firms to experience benefits from making transfers across business lines.

And finally, our paper is also connected to the bulging literature focusing on the rise and

growth of specific NBFI sectors as substitutes of banks in providing liquidity and credit services. Examples the role of investment funds providing liquidity services alternative to bank demand deposits (Pascual, Singh and Surti, 2021), insurance companies as providers of market liquidity (Aramonte and Mano, 2022), or specialty lenders offering credit services alternative to bank loans (e.g., Buchak et al. (2018) on mortgage products, Gopal and Schnabl (2022) on small business lending, Chernenko, Erel and Prilmeier (2022) on corporate lending). Kim, Plosser and Santos (2018) find that after supervisory scrutiny on leveraged lending by banks, nonbanks gained market share in the leveraged lending market using funding provided by banks, which provides an important example of the larger story of interconnections between banks and nonbanks put forward by this paper and Acharya, Cetorelli and Tuckman (2024). Our paper provides a complementary perspective to this literature by emphasizing the equally important growth of NBFIs within the banking sector, thus accentuating the importance of recognizing the tight interconnections and often blurred boundaries between the two sides.

The rest of the paper is organized as follows. In Section 2, we go over specific institutional features of the banking industry that are relevant for our analysis. In Section 3, we present our unique dataset of BHC organizational structure and additional datasets on BHC financials. Section 4 provides a series of stylized facts on the evolution of U.S. banking firms and their nonbank footprint. These stylized facts simultaneously provide novel evidence on the evolution of the nonbank footprint of banks and motivate our subsequent analysis of liquidity synergies. Section 5 presents our theory and empirical evidence concerning the role of liquidity synergies between affiliated commercial banks and NBFIs. Section 6 analyzes how the nonbank footprint of banks, and associated liquidity synergies, have been affected by post-GFC regulation. Section 7 concludes and provides closing remarks on the implications of our results.

2 Institutional Details

In this section, we provide brief overviews on specific institutional features of the banking industry that are instrumental to our analysis.

2.1 The Business of Banking

We first describe the legal and regulatory structure governing the operation of banks in the United States. As is well known, the bank holding company (BHC) is the main legal vehicle in the U.S.

to conduct the business of banking. As we discuss in the next section, most commercial banking institutions do indeed organize themselves as BHCs to conduct their operations.

The common narrative is that the activities of BHCs and banking firms more broadly were heavily limited by the restrictions of the Glass-Steagall Act of 1933, until its partial repeal in 1999 by the Gramm-Leach-Bliley Act. In practice, however, the Bank Holding Company Act of 1956 provided ample discretion to bank regulators to dynamically define the boundaries of the "business of banking" to adapt to a changing environment. Indeed, U.S. bank regulators have often exercised such authority. By the mid 1980s, conditions were considered mature enough for regulators to define the business of banking in the broadest terms possible. For instance, an influential directive of the Office of the Comptroller of the Currency, the regulator of nationally chartered banks, stated that "... the business of banking has changed drastically ... and no one expects banks today to be restricted to [their] practices ...". The directive also stressed the importance of the "... adaptability of the national banking system ..." providing powers to banks "... so as to permit the use of new ways of conducting the very old business of banking", thus effectively opening the doors to turn banks into "financial supermarkets" (Markham, 2010).

Not only was the sentiment of regulators shifting in the 1980s with regard to permissible bank activities, but politicians were changing their views as well. In 1988, the Proxmire Financial Modernization Act proposed repealing Glass-Steagall eleven years before its eventual repeal. The Act passed the Senate with 94 votes in favor, but was not passed by the House of Representatives. This shift in political and regulatory sentiment led to two decades, up to the global financial crisis, of virtually unrestricted choice of business activities for banks.

2.2 Post GFC Regulation: Liquidity Rules and Living Wills

After a period of fairly unencumbered operations during the 1990s and the early 2000s, regulation significantly reverted in the aftermath of the global financial crisis. We focus on two components of post-GFC regulation that are especially relevant to this paper.

The first regulation relevant to liquidity synergies is the liquidity coverage ratio (LCR). This regulation was introduced as a part of Basel III in 2010 and was adopted by the U.S. in 2013. The LCR requires commercial banks and bank holding companies to hold enough high-quality liquid assets (HQLA) to cover liquidity outflows in a 30-day stress scenario. By imposing a rough floor on bank liquid asset holdings, this regulation should naturally reduce the scope for a relationship between the nonbank footprint of a BHC and the size of its liquid asset buffer.

In addition, as part of the Dodd-Frank Act of 2010, bank regulators introduced mandatory resolution planning, colloquially known as "living wills". The objective of living wills is to create the conditions for a rapid and orderly resolution of a BHC in the event of financial distress, which is intended to help credibly address the Too-Big-To-Fail issue associated with the largest banking firms.[5]

Under the regulation, which began in 2012, large bank holding companies have to submit periodic, detailed plans to regulators about how they would separate and resolve their businesses in the event of failure. Note that this regulation does not impose explicit restrictions on activities, nor the requirement to divest of any specific type of affiliates. The regulation, however, explicitly requires disclosing "the interconnections and interdependencies among the covered company [the parent BHC] and its material entities ... that, if disrupted, would materially affect the ... operations of the covered company".[6] This requirement, in the context of demonstrating the ability for a "rapid and orderly resolution", thus places scrutiny on the funding connections between subsidiaries in BHCs. The rationale for this part of the guidance is that such interconnections could make BHCs more difficult to resolve and separate during bankruptcy proceedings.

Hence, we interpret living wills as imposing an exogenous shock to the ability of BHC subsidiaries to borrow from their affiliates, which is a key mechanism for the exploitation of liquidity synergies. We later use the introduction of living wills to show that this restriction on interconnectedness reduced intracompany funding volumes and led BHCs to scale back the size of their nonbank footprints. We are aware that other restrictions, such as the LCR, were introduced for similar banks at a similar time. However, our goal is to highlight the impact of regulation in general, not to evaluate any particular regulatory instrument. If our results were actually driven by the LCR, our conclusions and interpretations are unchanged.

2.3 Regulation W

This paper argues that intracompany funding is a key mechanism for experiencing liquidity synergies. However, Sections 23A and 23B of the Federal Reserve Act, implemented through Regulation

[5]The text of the regulation can be found at the following Federal Register link: https://www.govinfo.gov/content/pkg/FR-2011-11-01/pdf/2011-27377.pdf.

[6]See paragraph 4.g. from the text of the regulation.

W, place certain restrictions on the extent to which commercial bank subsidiaries can engage in intracompany transactions with affiliated entities. Specifically, commercial banks cannot engage in "covered transactions" with a single affiliate that exceed 10% of the bank's capital stock and surplus. Additionally, the bank's covered transactions with all affiliates cannot exceed 20% of its capital stock and surplus. These restrictions are intended to prevent credit losses associated with lending to nonbank affiliates and prevent banks from transferring the benefits of the government safety net (deposit insurance, lender of last resort) to their affiliates. These covered transactions are generally extensions of credit from banks to affiliates. These extensions of credit include traditional lending, as well as similar transactions like asset purchases and securities lending.

We argue that liquidity synergies can be exploited within a BHC, and evidence of them can be found in the data, despite these regulatory restrictions. First, the restrictions only apply to extensions of credit in one direction, *from* commercial banks *to* nonbank affiliates. They do not apply to transactions occurring in the opposite direction. They also do not apply to transactions between holding companies and their subsidiaries nor to transactions between affiliated nonbanks.

Second, permissible bank lending to affiliates can still represent significant amounts of funding for nonbank subsidiaries that are small relative to the commercial bank subsidiaries. For example, suppose 80% of a BHC's assets are in commercial bank subsidiaries and the other 20% are in nonbank subsidiaries. Suppose the bank has a capital ratio of 10%. Based on the Reg W limits, this bank can provide as much as $(0.2 \times 0.1 \times 0.8)/0.2 = 8\%$ of the total funding of its nonbank affiliates.

Third, to the extent that our empirical analysis detects the existence of active intracompany funding dynamics, regulation masks the latent liquidity synergies and thus biases our empirical results towards non-findings. This implies that our estimates provide a lower bound to the full extent BHCs with nonbank footprints can efficiently manage their liquidity needs.

Finally, member banks are able to request Regulation W waivers from the Federal Reserve Board. Historically, such waivers have been often granted. For example, during the global financial crisis, the Board granted waivers to several large financial institutions, including JP Morgan Chase, Wells Fargo, Merrill Lynch, and Wachovia.[7] Legal scholars have debated whether the Section 23A

[7] A full list of waivers granted in 2008 can be found here: https://www.federalreserve.gov/supervisionreg/legalinterpretations/federalreserveact2008.htm.

and 23B restrictions have been effective regulatory tools in limiting intracompany transactions.[8]

3 Data

Database of BHC Organizational Structure. We use a unique database of the organizational structure of all BHCs ever in existence since the 1970s, first presented in Cetorelli and Stern (2015). This database integrates BHC regulatory filings from the FR Y-6 and the FR Y-10 to form a complete, time-consistent panel of BHCs. For each reporting high holder, and at any point in time, we have knowledge of each subsidiary in the organization, the nature of each subsidiary's relationship with its direct parent, and the ownership chain from the subsidiary to the high holder. To our knowledge, this is the only database in existence that contains such wealth of information on BHCs organizational details, in a time-consistent manner and for the entire population.

Most importantly for the purposes of this study, for each subsidiary we know its business activity, reported according to their five-digit NAICS industry code classification. This information helps us distinguish between different types of entities. We group entities into six main categories: commercial banks (NAICS 5221), specialty lenders (NAICS 5222, 5223), securities brokers (NAICS 523), insurers (NAICS 524), investment funds (NAICS 525), and nonfinancials (NAICS not in 52).

BHC-Level Financial Reports. We use four sources of regulatory financial data for BHCs and their subsidiaries. First, we use the well-known FR Y9-C, which provides financial statements at a consolidated level. Second, we use a complement to the Y9-C, the FR Y9-LP, which provides information about the *unconsolidated* financial statements of the BHC's top holder. Because it contains information as reported by just the top holder, this regulatory form has remained highly under-utilized.[9] However, and crucially for us, the Y9-LP provides insights into the extent of nonbank activities within the BHC and the extent of intracompany transactions that are netted out when producing the consolidated Y9-C. This information includes the assets of nonbank subsidiaries, as well as the gross flows of intracompany funding between banks, nonbanks, and holding companies (including intermediate holding companies).

[8] See, e.g., Omarova (2011).

[9] An example of a paper that has used the Y9-LP is Caglio, Copeland and Martin (2021) in their analysis of broker-dealer subsidiaries.

FR Y-11: Subsidiary-Level Financial Reports. In addition, we also make use of another underutilized reporting form: the Y-11, which contains subsidiary-level financial data reported by large, nonbank subsidiaries of BHCs. The Y-11 reports have the advantage of entity-level granularity, but they are a requirement only for a small subset of the universe of nonbank subsidiaries, and with heterogeneous filing frequency (some quarterly, some annually). Hence, we use the Y-11 data to corroborate and complement our main findings based on the utilization of the Y9-LP.

Call Reports. A large portion of this paper concerns the impact of nonbank affiliates on the liquidity and lending decisions of commercial bank subsidiaries. To measure these balance sheet items, we use the financial reports of commercial banks (FFIEC 031/41 - "Call Report"), which are usually subsidiaries of BHCs. In the case of BHCs with more than one commercial bank subsidiary, we aggregate their financials, making use of our database of BHC organizational structure.

Flow of Funds. To measure NBFI activities aggregated across the U.S. over time, we use data from the Federal Reserve Board's Financial Accounts of the United States, also known as Flow of Funds.

4 Evidence on the Expanding Boundaries of the Banking Firm

In this section, we present four stylized facts about the evolution of the boundaries of the banking firm over the last few decades. These facts document that since the 1980s, U.S. banking firms have departed from a traditional model of lending and deposit-taking, instead increasingly resembling over time a conglomerate with involvement in virtually every type of financial intermediation activity. This section provides novel evidence about the nonbank footprint of the banking firm using our unique database of BHC organizational structure and motivates our subsequent analysis into the potential efficiency gains that bank holding companies with a nonbank footprint can generate.

Our descriptive evidence allows for more accurate and granular measurement of the nonbank footprint of banks relative to the existing literature on bank diversification. We use data from the FR Y9-LP, which is the unconsolidated financial report of bank holding companies. This data, rarely used in the banking literature, allows us to directly observe nonbank affiliate assets and decompose those assets into subcategories by merging with other data on nonbank business lines from the FR Y9-C.

Lacking access to this data, the existing literature has used indirect approaches for measuring

the nonbank footprint. One approach compared noninterest income to interest income and loan assets to non-loan assets (Laeven and Levine, 2007). But this approach produces uncertain biases on estimates of the nonbank footprint. Banks earn noninterest income from traditional banking activities (i.e. maintenance fees and transaction fees), while nonbanks earn interest income from loans (finance companies) and securities holdings (broker-dealers and insurers). Additionally, many banks hold securities for liquidity purposes and many nonbanks hold loans (finance companies and insurers) for investment purposes. Another approach has been to simply compare the size of commercial bank assets from the Call Report to the size of BHC assets from the FR Y9-C (Avraham, Selvaggi and Vickery, 2012). While this approach may produce a roughly accurate estimate of aggregate nonbank assets, this approach cannot disaggregate the various underlying nonbank business lines.[10]

Fact 1: BHCs have significantly departed from the traditional banking business model since the late 1980s. As said earlier, the bank holding company has long been the dominant legal vehicle for conducting the business of banking in the United States. Most commercial banks elect to operate as BHCs. In Appendix Figure C.1, we provide a time series of commercial bank assets, broken down between "stand alone" institutions and institutions within BHCs. Commercial bank subsidiaries within BHCs have represented almost the totality of aggregate commercial bank assets for decades.

In Figure 1, we show that over the last five decades, the banking firm has dramatically expanded its boundaries to include a wide variety of nonbank activities. In the top panel, we use data from the FR Y9-LP to plot the industry-wide ratio of total nonbank assets to total consolidated BHC assets, calculated as an asset-weighted average from 1995 to 2022.[11] In the bottom panel, we derive rough but reasonable proxies for the assets of various nonbank business lines. We observe the total assets of broker-dealer and insurance carrier subsidiaries from the FR Y9-C. From the FR Y9-LP, we observe loans held by nonbank subsidiaries, which we interpret as roughly representing the assets of nonbank lender subsidiaries. Finally, from the FR Y9-C, we observe the assets under management

[10] Avraham, Selvaggi and Vickery (2012) do use data from the FR Y-11, which provides financial reports for certain nonbank subsidiaries, to provide some decomposition of nonbank assets. However, as Avraham, Selvaggi and Vickery (2012) note, this data is limited because many nonbank subsidiaries are not required to file the Y-11.

[11] Note that the line items we utilize do not include internal balances with related institutions, which makes our observations of nonbank assets a good proxy for the size of nonbank business lines.

(AUM) of proprietary mutual funds and annuities. While the AUM of proprietary funds are *not* considered to be assets of the BHC itself, we include AUM in this figure to illustrate the large size of this line of business. We begin the bottom panel in 2003 due to the availability of some line items.

We find that nonbank subsidiaries represent very meaningful shares of banking industry assets. From 1995 to 2008, the nonbank asset share more than doubled from 10% to nearly 25%. In the aftermath of the GFC, this share reached upwards of 30%. Note that the large spike in nonbank assets observed during 2009 is explained by the conversion of institutions like Goldman Sachs and Morgan Stanley, among others, into bank holding companies. However, we emphasize that most of the observed increase in nonbank asset shares occurred well before the conversion of these institutions. Starting in 2012 (around the implementation of post-GFC banking regulation), the nonbank asset share declined and then remained flat until 2022, which is a notable break from the clear upward trend we observe before the GFC. In Section 6, we provide direct empirical evidence that post-GFC regulation likely contributed to this decline in nonbank asset shares.

When we decompose the nonbank footprint, we find that mutual funds are by far the largest nonbank business line of BHCs if we consider AUM to be a reasonable proxy for size. In fact, if we include mutual fund AUM, then the total size of all nonbank business lines in BHCs is nearly 50% of consolidated assets. The next largest business line is broker-dealers, which represented about 15% of BHC assets in 2022, a notable increase from less than 10% pre-GFC. Finance companies and insurers hold very small shares of BHC assets in 2022, but had much more meaningful shares in the pre-GFC period.

Note that these reported figures are likely an underestimate of the true amount of nonbank assets within BHCs. This is because these figures do not include the assets of nonbank subsidiaries directly controlled by a commercial bank subsidiary, and therefore consolidated in the commercial bank subsidiary's own balance sheet.[12]

[12] Page PC-B-7 of the instructions for the FR Y9-LP states, "Nonbank subsidiaries exclude all banks ... and their subsidiaries."

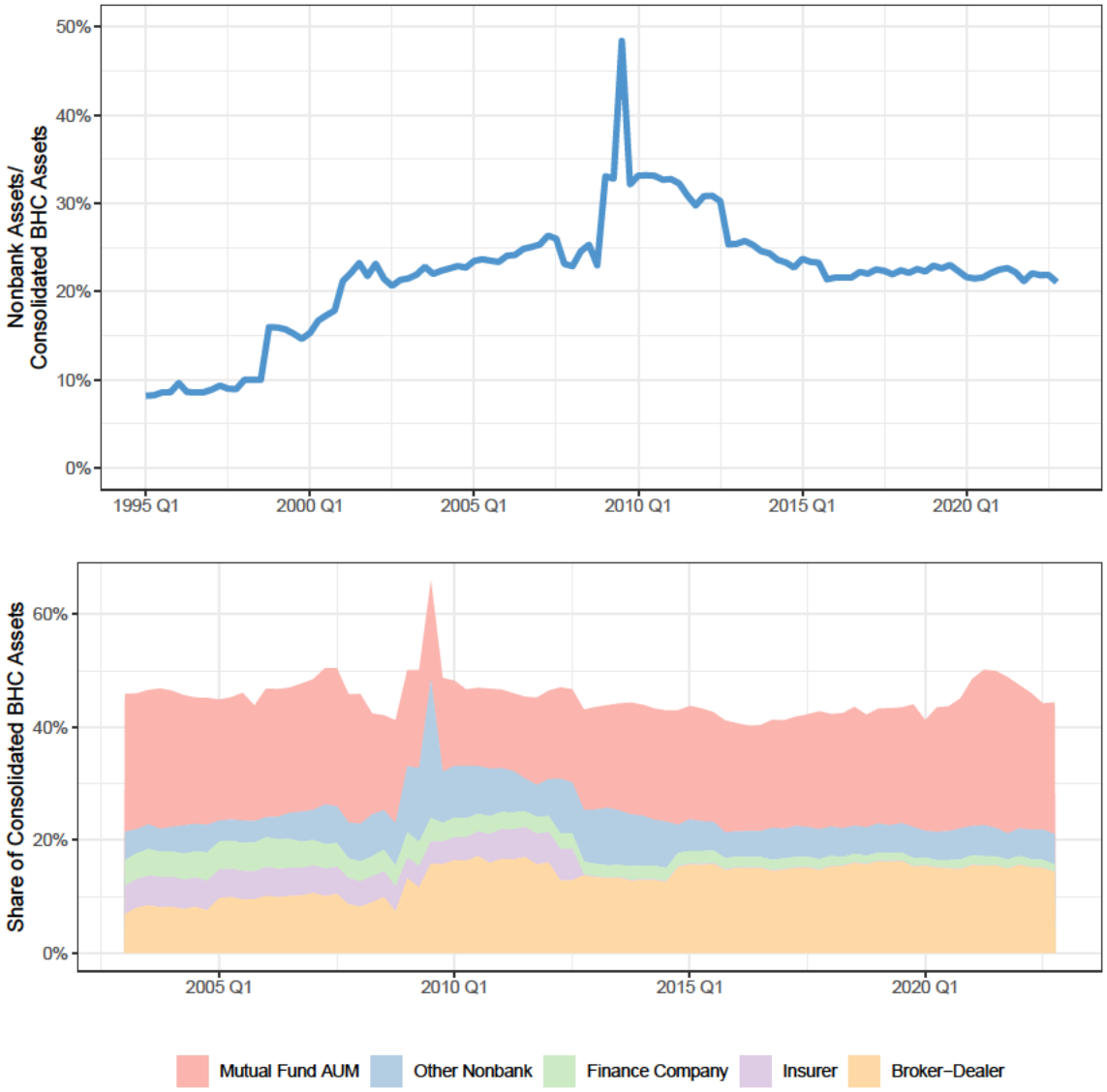

Figure 1: Asset Size of Nonbank Business Lines. This figure expresses the size of various nonbank business lines as a share of consolidated BHC assets. The sample is all BHCs from 2003 to 2022. Data on total assets of nonbank subsidiaries comes from the FR Y9-LP. Data on assets of finance companies comes from the FR Y9-LP's line item of loans and leases of nonbank subsidiaries. Data on assets of broker-dealers, insurers, and consolidated BHCs comes from the FR Y9-C. Assets of "Other Nonbanks" are calculated as the difference between total nonbank assets and the sum of finance company, broker-dealer, and insurer assets. Although mutual fund assets under management are not considered BHC assets, we include AUM of proprietary mutual funds and annuities as a share of BHC consolidated assets for purely illustrative purposes. Data on mutual fund AUM comes from the FR Y9-C.

Fact 2: BHCs exhibit high levels of diversification across nonbank business lines. Although our decomposition of nonbank assets in Figure 1 provides some level of detail about diversification, our data only allows us to identify four broad categories of nonbank activities. In Figure 2, we provide a more granular measure of the scope of the nonbank footprint of BHCs. We plot the asset-weighted average of the number of unique nonbank business lines within BHCs over

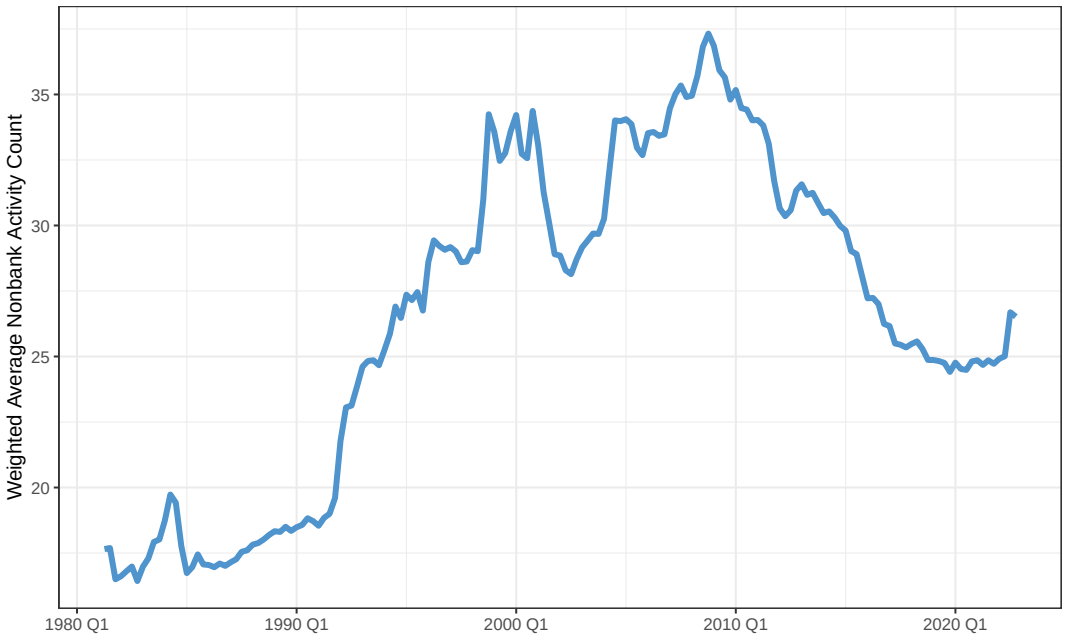

Figure 2: BHC Nonbank Activity Count. This figure depicts the weighted average of unique nonbank activity counts across the BHC industry, where the weights are consolidated BHC assets. The sample period is 1981 to 2022. We measure unique nonbank activity counts as the number of unique five-digit NAICS among nonbank subsidiaries of BHCs.

time, measured as the number of unique five-digit NAICS among their nonbank subsidiaries.

The figure shows the progressive expansion in nonbank scope throughout the 1990s, reaching a peak in 2009, when the typical BHC was engaged in approximately 37 unique nonbank business lines, which is twice as much as the typical BHC in the 1980s. The sheer number of unique nonbank business lines within banking organizations indicates that synergies between banks and nonbanks may not be confined to a particular type of intermediation activity, but may reflect more general complementarities between financial intermediaries. Also, note that both of the previous figures clearly show that the evolution we are describing occurs well before the entry in the BHC population in 2009 of a number of financial institutions (eg, Goldman Sachs, Morgan Stanley, among others) with an already complex organizational structure. In the aftermath of the GFC, BHCs substantially reduced their scope. By 2022, BHC activity counts had returned to pre-1995 levels.

Fact 3: NBFI holdings are not limited to the largest banks. The distribution of nonbank asset holdings across the banking industry is right-tailed, as we show later in Table 3. However, we emphasize that BHC holdings of NBFIs are not limited to the well-known "universal banks", like Citigroup, JP Morgan Chase, and Bank of America. Instead, many medium-sized banks also have

significant holdings of a variety of NBFIs. In Table 1, we show the popularity of each nonbank line of business based on the share of the top 200 BHCs with at least one subsidiary conducting the relevant business line. Using the top 200 BHCs as our sample allows us to capture most industry assets (about 90%) without including too many tiny banks that do not have sufficient scale to invest in NBFIs.[13]

Based on our top 200 sample, we find that nonbank holdings have been widespread across the banking industry for decades. For instance, already in 1990:Q1, 69% of the top 200 BHCs had at least one specialty lender subsidiary, with signficant heterogeneity in sub-categories within specialty lending (eg, 12.5% of BHcs with credit card issuing companies; 41% in sales financing, etc.). In 1990, significant shares of the BHC population also held NBFIs related to securities brokerage and insurance. Over the next few decades, medium-sized banks continued to hold a variety of NBFIs. By 2020 Q1, 64% of BHCs had at least one specialty lender, 69% of BHCs had at least one securities broker, 66% had at least one insurance carrier or broker, and 74% had at least one investment fund.

	1990 Q1	2000 Q1	2010 Q1	2020 Q1
Specialty Lenders (5222, 5223)	0.685	0.710	0.565	0.635
——-Credit Card Issuing (52221)	0.125	0.115	0.055	0.045
——-Sales Financing (52222)	0.410	0.425	0.345	0.300
——-Mortgage and Consumer Lending (52229)	0.570	0.575	0.400	0.420
——-Miscellaneous Lending Activities (5223)	0.285	0.270	0.250	0.310
Securities Brokerage (523)	0.675	0.730	0.660	0.685
——-Investment Banking (5231)	0.520	0.520	0.380	0.365
——-Miscellaneous Brokerage Activities (5232, 5239)	0.550	0.545	0.605	0.635
Insurance (524)	0.615	0.650	0.635	0.655
——-Insurance Carriers (5241)	0.480	0.365	0.275	0.305
——-Insurance Brokers (5242)	0.320	0.555	0.590	0.570
Investment Funds (525)	0.085	0.510	0.855	0.740
——-Employee Benefit Funds (5251)	0.000	0.015	0.015	0.015
——-Open-End Funds (52591)	0.020	0.040	0.080	0.075
——-Other Investment Funds (52599)	0.030	0.490	0.845	0.730

Table 1: Share of Top 200 BHCs Holding Nonbank Business Lines. This table uses the database of BHC subsidiaries described in Section 3 to determine the share of the top 200 BHCs by assets that hold at least one subsidiary within each nonbank business line listed in the table. We identify nonbank business lines using the four or five-digit NAICS code of the subsidiary. The top 200 BHCs are selected within each quarter based on consolidated BHC assets.

[13] In 2000:Q1, the top 200 BHCs represented 87% of all BHC industry assets. In 2020:Q1, the top 200 BHCs represented 96% of all BHC industry assets.

Fact 4: BHC-affiliated NBFIs account for a substantial share of the NBFI industry. Not only do NBFI subsidiaries of BHCs represent a sizeable share of BHC assets, but they constitute a non-negligible share of the U.S. NBFI industry as a whole. We use our derived proxies for the asset size of specific NBFI segments within BHCs, and we compare them to the equivalent segments as reported in the U.S. Financial Accounts (Flow of Funds). As we showed in Fact 2, we have reliable estimates of the assets of broker dealers, nonbank lenders and insurance subsidiaries. In addition, BHCs also have large holdings of proprietary mutual funds and annuities. Although the assets under management of these proprietary funds are not considered to be assets on the balance sheet of the BHCs themselves, the funds' AUM is a good indication of the size of the asset management business of BHCs, and we can compare it to the overall AUM of mutual funds in the United States.

Hence, in Table 2, we report the assets of BHC-affiliated NBFIs as a share of each corresponding, aggregate NBFI industry. We first show these shares aggregating all nonbanks together and then we separate broker-dealers, mutual funds, nonbank lenders, and insurers. The magnitude of these shares confirm that BHC-held NBFIs have been and still are an important structural feature of the financial intermediation industry. The figures for broker-dealer assets are also a good validation of our data, since the post-GFC shift of broker-dealers towards the banking industry has been well-documented.

	All Nonbanks	Broker-Dealers	Mutual Funds	Nonbank Lenders	Insurers
2005 Q1	0.084	0.190	0.234	0.223	0.082
2010 Q1	0.173	0.578	0.192	0.277	0.091
2015 Q1	0.111	0.617	0.189	0.194	0.004
2020 Q1	0.109	0.707	0.195	0.177	0.002

Table 2: BHC-Affiliated NBFI Share of Aggregate NBFI Industry. This table uses data from the FR Y9-LP, FR Y9-C, and Financial Accounts of the United States (Flow of Funds) to find the ratio of assets of BHC-held NBFIs versus all NBFIs in the United States for 2005:Q1, 2010:Q1, 2015:Q1, and 2020:Q1.

5 Liquidity Management Synergies between Banks and NBFIs

The previous section documents that the business model of banking has definitely shifted over the last few decades. The boundaries of the banking firm have expanded to include a variety of nonbank business lines, in addition to the deposit-taking and lending business lines traditionally associated with banking. We argue that the liquidity synergy theory proposed by Kashyap, Rajan and Stein (2002) to explain the coexistence of deposit-taking and lending within commercial banks can be extended to help explain the benefits of integrating commercial bank and nonbank business lines

under BHCs. Institutions that hold both commercial bank and nonbank subsidiaries can spread the costs of their liquid asset holdings across business lines, provided that the different subsidiaries experience liquidity outflows in different states of the world. These subsidiaries should therefore be able to economize on their liquid asset holdings.

We present our empirical evidence in the following progression. First, we show that as the nonbank affiliates of commercial banks expand, the liquid asset shares of commercial banks fall. Second, we show that as commercial banks borrow more from nonbank affiliates, they hold fewer liquid assets, even when we control for the size, diversification, and composition of nonbank affiliates. This relationship also works in reverse: nonbank subsidiaries with a greater reliance on intracompany funding from commercial bank affiliates hold smaller liquid asset buffers. Finally, we study the asset-backed commercial paper freeze of 2007 to show evidence of "implicit lines of credit", where commercial banks can significantly increase their use of intracompany funding during times of unexpected liquidity stress.

5.1 Effects of Nonbank Footprint on Bank Liquid Asset Buffers

One of the basic predictions of our liquidity management synergy theory is that as the nonbank affiliates of commercial banks increase in size, the banks should be able to shrink their liquid asset buffers. Consider a hypothetical BHC operating one or more commercial bank subsidiaries that purchases a broker-dealer or expands the operation of an existing broker-dealer subsidiary. In the absence of any liquidity synergies, the liquidity buffers of the bank and dealer subsidiaries should remain unchanged after the expansion. But if the liquidity outflows experienced by the commercial banks and broker-dealer are relatively uncorrelated, then each institution can rely on intracompany transfers from the other to meet unexpected liquidity outflows. This should allow the bank and dealer to reduce their liquid asset holdings.

Data Construction and Summary Statistics. We restrict our sample to the years 1995 to 2022. We begin our sample in 1995 due to availability of some variables in the regulatory filings that we use. We consider two measures of liquid asset holdings. Our first measure is analogous to the measure used in KRS: the sum of cash (currency, central bank reserves, and balances due from commercial banks), available-for-sale (AFS) securities, and held-to-maturity (HTM) securities. The second, narrower measure is constructed as the sum of cash and "high-quality" securities (HQLA),

Variable	Obs	Mean	SD	25th	Median	75th	90th	95th	99th
All BHCs									
BHC Assets ($B)	112976	11.74	115.27	0.26	0.57	1.43	5.63	15.60	184.21
Bank-Level: (Cash + Securities)/Assets	112973	0.28	0.13	0.19	0.26	0.35	0.44	0.51	0.67
BHC-Level: Nonbank Assets/BHC Assets	112976	0.02	0.08	0.00	0.00	0.00	0.03	0.05	0.36
BHC-Level: Nonbank Subsidiary Count	112976	17.38	147.89	1.00	2.00	5.00	12.00	25.00	303.50
BHC-Level: Unique Nonbank Activities Count	112976	2.99	5.02	1.00	2.00	3.00	7.00	11.00	24.00
Bank-Level: Transaction Dep./Total Dep.	112858	0.22	0.13	0.12	0.22	0.30	0.38	0.43	0.59
Bank-Level: Unused Commit./Assets	112973	0.16	0.61	0.08	0.12	0.18	0.25	0.32	0.62
Nonbank Assets > 0									
BHC Assets ($B)	47543	26.36	176.62	0.41	0.94	3.29	17.94	60.66	589.34
Bank-Level: (Cash + Securities)/Assets	47540	0.27	0.13	0.18	0.25	0.33	0.43	0.50	0.71
BHC-Level: Nonbank Assets/BHC Assets	47543	0.04	0.11	0.00	0.01	0.02	0.06	0.18	0.71
BHC-Level: Nonbank Subsidiary Count	47543	38.56	226.24	2.00	4.00	10.00	29.00	75.00	920.00
BHC-Level: Unique Nonbank Activities Count	47543	5.29	6.85	2.00	3.00	6.00	12.00	17.00	40.00
Bank-Level: Transaction Dep./Total Dep.	47467	0.21	0.13	0.11	0.19	0.28	0.37	0.43	0.62
Bank-Level: Unused Commit./Assets	47540	0.22	0.94	0.10	0.14	0.21	0.30	0.41	1.17

Table 3: Summary Statistics. This table shows summary statistics of selected variables used in our analysis. The sample period is 1995 to 2022. Panel A shows summary statistics for the universe of BHCs. Panel B shows summary statistics for the set of BHCs with positive nonbank assets. BHC Assets ($B) is total consolidated BHC assets in billions of dollars. Bank-Level: (Cash + Securities)/Assets is the ratio of cash and securities to assets for commercial bank subsidiaries of BHCs, excluding securities held for trading purposes. BHC-Level: Nonbank Assets/BHC assets is the ratio of assets of nonbank subsidiaries to total consolidated assets of BHCs. Bank-Level: Transaction Dep./Total Dep. is the ratio of transaction deposits to total deposits for commercial bank subsidiaries of BHCs. Bank-Level: Unused Commit./Assets is the ratio of unused commitments to assets for commercial bank subsidiaries of BHCs.

restricted to treasuries, agency MBS, and agency securities.[14] Our main empirical analysis focuses on the ratio of cash and securities to assets, but we show in the Appendix that all of our results are robust to considering HQLA instead. For both measures, we exclude securities held in trading accounts, consistent with KRS.[15]

In Table 3, we provide summary statistics for these liquid asset variables and nonbank asset shares. We also provide summary stats for transaction deposit shares and unused credit line exposure, which are key control variables in our empirical tests. We note that the distribution of nonbank asset shares is very right-tailed. This is not surprising, reflecting the fact - as shown in the table - that the U.S. banking industry historically displays a very right-tailed distribution for *total* assets, and that expanding scope by acquiring nonbank assets naturally requires sufficient scale in terms of balance sheet size.

[14]We do not calculate HQLA as is used for regulatory purposes, which involves a complex set of weightings for different types of securities. Our measure is meant to be a simple approximation.

[15]KRS exclude securities held for trading because they "may not represent a passive and readily available store of liquidity."

Figure 3: Time Series of HQLA and Nonbank Assets. This figure calculates the weighted average of commercial bank HQLA as a share of assets, BHC HQLA as a share of assets, and nonbank subsidiary assets as a share of BHC assets. The weights are consolidated BHC assets. The sample is a balanced panel of BHCs from 1995 to 2022. HQLA is calculated as the sum of U.S. Treasuries, agency MBS, and agency securities, excluding securities held for trading purposes. Commercial bank data is from the Call Reports, BHC data is from the FR Y9-C, and nonbank subsidiary data is from the FR Y9-LP.

To get a sense of whether the relationships we are investigating are visible in the aggregate, in Figure 3 we plot the time series of commercial bank liquid asset shares and the nonbank asset shares of BHCs. Each observation in each time series is an average across the cross-section of BHCs, weighted by consolidated BHC assets. To eliminate changes in the time series driven by the composition of BHCs, we balance the underlying panel.

These time series aggregates are already highly suggestive of a strong relationship between the nonbank footprint and holdings of liquid assets. From 1995 to 2007, commercial banks sharply reduced their liquid asset shares, going from about 28% in 1995 to about 17% in 2007, approximately at the same time when the ratio of nonbank assets to total consolidated assets of BHCs rose from about 10% to 20%. After the GFC, liquid shares sharply increased to more than 30% by 2013, while the ratio of nonbank assets to total consolidated assets of BHCs fell to about 15%.

Regression Specification. Our first set of empirical tests shows using within-BHC variation that as the size of their nonbank affiliates increases, commercial bank subsidiaries shrink their liquid asset buffers, controlling for a host of balance sheet characteristics. We begin with the following regression specification:

$$\frac{Bank\ (Cash + Securities)_{it}}{Bank\ Assets_{it}} = \alpha_i + \alpha_t + \beta_1 \left(\frac{Nonbank\ Assets_{it}}{BHC\ Assets_{it}} \right) + \beta_2 \left(\frac{Nonbank\ Assets_{it}}{BHC\ Assets_{it}} \right) \times I(Yr \geq 2012) + \boldsymbol{\gamma}^T X_{it} + \epsilon_{it} \tag{1}$$

In this specification, for BHC i at quarter t, $Bank\ (Cash + Securities)_{it}/Bank\ Assets_{it}$ is the ratio of liquid assets to total assets for the commercial bank subsidiaries of the BHC, where liquid assets is either the ratio of cash and securities to assets or the ratio of HQLA to assets. α_t are quarter fixed effects, which allow us to control for macroeconomic trends. α_i are BHC fixed effects, which allow us to control for time-invariant BHC characteristics and isolate within-BHC variation.

$Nonbank\ Assets_{it}/BHC\ Assets_{it}$ is the ratio of nonbank subsidiary assets to total consolidated BHC assets. Due to the extreme right tail of nonbank asset shares we find in Table 3, we trim our dataset at the 99th percentile of nonbank asset share. $I(Yr \geq 2012)$ is a dummy variable corresponding to the years 2012 and later. The interaction of this dummy with the nonbank asset share allows us to test for differential effects of the nonbank footprint before and after the introduction of post-GFC regulation.[16]

In alternate specifications, we also add terms corresponding to other dimensions of the nonbank footprint, namely the number of unique nonbank activities and the number of nonbank subsidiaries within the BHC. These two terms correspond to the diversification of the nonbank footprint of the BHC. Controlling for the nonbank asset share, if a BHC has more unique nonbank activities and subsidiaries, then we can infer that the nonbank assets are spread across a wider array of business lines and entities. These diversified nonbank footprints are therefore less exposed to the idiosyncratic risk associated with any particular nonbank business line or entity. The diversification

[16]We define our post-GFC dummy using 2012 as the threshold because the resolution planning (living wills) provisions of Dodd-Frank, which we extensively discuss later in the paper, were implemented starting in 2012. Other post-GFC regulations were also implemented around 2012, including the liquidity coverage ratio and Dodd-Frank stress testing.

of the nonbank footprint is important because the correlation between outflows experienced by different business lines is an important determinant of the extent to which the conglomerate can economize on liquidity buffers.[17] If nonbank subsidiaries experience liquidity outflows at the same time as commercial banks, then the banks cannot rely on their nonbank counterparts for funding support. Thus, we hypothesize that having a more diversified nonbank footprint - as captured by our diversification measures - should allow BHCs to reduce the correlation between bank and nonbank liquidity outflows, thus allowing the commercial bank to further economize on liquid assets.[18]

X_{it} is a vector of balance sheet controls for both the BHC and the commercial bank subsidiaries. Commercial bank balance sheet controls include log deposits, log assets, ratio of transaction deposits to total deposits, ratio of unused commitments to total credit exposure, ratio of unused commitments to total assets, and ratio of equity to assets. BHC balance sheet controls include log consolidated assets, ratio of unused commitments to consolidated assets, ratio of consolidated equity to consolidated assets, and ratio of unconsolidated cash held by holding companies to consolidated assets. Since our period of study was marked by a rapid expansion of the mortgage origination and securitization businesses of commercial banks, we add additional controls to ensure that our results are not driven by the mortgage line of business. Specifically, we control for the share of securities held in nonagency MBS, the share of securities held in nonagency collateralized mortgage obligations, and the share of loans collateralized by residential real estate.

Regression Results. The results of our regressions are shown in Table 4. In the first three columns, our outcome variable is the ratio of cash and securities to assets of commercial bank subsidiaries. In column (1), we run our base specification from Equation 1. In column (2), we add a term corresponding to the unique nonbank activities of the BHC, which is one of our measures of nonbank footprint diversification. We also add an interaction between unique nonbank activities and the post-2012 dummy. In column (3), we replace unique nonbank activities with nonbank subsidiary count. Across specifications, we find a highly significant negative relationship between nonbank

[17] The correlation between credit line outflows and deposit outflows was the key parameter in the model developed by KRS in the context of commercial banks.

[18] Of course some nonbank activities may have liquidity shocks that can be positively correlated with those of the bank subsidiaries. Besides the fact that, as per KRS, even with a positive correlation liquidity synergies can be exploited - so long as the correlation is not perfectly equal to one, our suite of nonbank footprint metrics intend to precisely allow for the diversification potential from running multiple activities in parallel.

asset share and bank liquid asset share during the pre-GFC period. The magnitude of our estimates are economically large. In column (1), a 1 percentage point increase in the nonbank asset share leads to an approximately 10 basis point decrease in the bank liquid asset share. In column (2), an additional unique nonbank activity leads to a 30 basis point decrease in the bank liquid asset share.

In columns (1) through (3), when we examine the coefficient for the interaction between our nonbank footprint variables and the post-2012 dummy, we find — as expected — that our estimates reverse in the post-GFC period. For example, in column (1), the coefficient on the interaction is 0.30 which cancels out the -0.10 estimate for the pre-GFC period. This is consistent with our hypothesis that post-GFC banking regulation reduced the scope for liquidity synergies within BHCs.

An important corollary of our results is that if commercial banks can economize on their liquid asset buffers, then they should have balance sheet room to expand their investment activity. We directly test this hypothesis in columns (4) through (6) by using the ratio of loans to assets as an alternative outcome variable in our regressions. Column (4) uses the nonbank asset share as the variable of interest, while columns (5) and (6) also add nonbank activities and nonbank subsidiaries as variables of interest. Consistent with our hypothesis, we find a strong relationship between the nonbank footprint and bank lending. The magnitudes of our estimates are very similar in magnitude but opposite in sign as our estimates from columns (1) through (3). This implies that when banks with large nonbank affiliates economize on liquid asset holdings, they reallocate most of their additional balance sheet space towards lending. Thus, these results imply that a large nonbank footprint not only is reflected in more efficient liquidity management, but also naturally translates to more investment activity *by the commercial bank side* of BHCs. Put differently, our evidence provides a unique new setting for confirming the conclusion reached by Acharya, Cetorelli and Tuckman (2024) in reference to the aggregate financial sector: the expansion of banking firms in nonbank segments does *not* necessarily come at the cost of shrinking the more traditional commercial banking activities. In many cases, bank and nonbank activities may be complementary rather than substitutable. As with our results for liquid asset buffers, we find that our estimates for loans-to-assets sharply reverse in the post-GFC period.

In Appendix B, we show that our results are highly robust to a variety of alternative specifications. First, we show robustness to alternative trimmings of the nonbank asset share variable and to taking the log of the nonbank asset share rather than trimming. Second, we show that our results are not sensitive to the inclusion of control variables. Third, we find similar results when we define bank liquid assets using a rough measure of high-quality liquid assets (HQLA), which we calculate as

Dependent Variables:	(Cash + Securities)/Assets			Loans/Assets		
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Nonbank Asset Share	-0.0998***	-0.0712***	-0.0899***	0.0780***	0.0626***	0.0817***
	(0.0211)	(0.0180)	(0.0179)	(0.0217)	(0.0216)	(0.0198)
Nonbank Asset Share × I(Year >= 2012)	0.2997***	0.2324***	0.2177***	-0.1912***	-0.1605***	-0.1882***
	(0.0622)	(0.0350)	(0.0448)	(0.0575)	(0.0312)	(0.0462)
Unique Nonbank Activity Count		-0.0030***			0.0017***	
		(0.0003)			(0.0004)	
Unique Nonbank Activity Count × I(Year >= 2012)		0.0002			7.44×10^{-6}	
		(0.0005)			(0.0006)	
Nonbank Subsidiary Count/100			-0.0008			-0.0023*
			(0.0010)			(0.0013)
Nonbank Subsidiary Count/100 × I(Year >= 2012)			0.0033***			-0.0003
			(0.0013)			(0.0012)
Transaction Deposits/Total Deposits	0.0173**	0.0176***	0.0168**	-0.0331***	-0.0333***	-0.0326***
	(0.0066)	(0.0066)	(0.0067)	(0.0072)	(0.0072)	(0.0072)
Unused Commit/Assets	-0.1317***	-0.1292***	-0.1313***	0.1017***	0.1003***	0.1021***
	(0.0116)	(0.0117)	(0.0115)	(0.0121)	(0.0122)	(0.0121)
Additional Controls	Yes	Yes	Yes	Yes	Yes	Yes
BHC FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	111,387	111,387	111,387	111,387	111,387	111,387
R^2	0.79195	0.79265	0.79208	0.80079	0.80101	0.80089

Table 4: Regressions of Liquidity Buffer vs. Nonbank Affiliate Size for Commercial Bank Subsidiaries. This table shows estimation results from Equation 1. The unit of observation is BHC-quarter. The sample period is 1995 to 2022. In columns (1) through (3), the dependent variable is the ratio of cash and securities to assets for the commercial bank subsidiaries of BHC i. In columns (4) through (6), the dependent variable is the ratio of loans to assets for the commercial bank subsidiaries of BHC i. Nonbank Asset Share is the ratio of nonbank subsidiary assets to total consolidated assets for BHC i. I(Year $\geq$ 2012) is a dummy variable corresponding to the years 2012 and after. Unique Nonbank Activities is the number of unique nonbank NAICS codes among the nonbank subsidiaries of BHC i. Nonbank Subsidiary Count is the number of nonbank subsidiaries of BHC i. Transaction Deposits/Total Deposits is the ratio of transaction deposits to total deposits for the commercial bank subsidiaries of BHC i. Unused Commit/Assets is the ratio of unused commitments to assets for the commercial bank subsidiaries of BHC i. All columns include BHC fixed effects and quarter fixed effects. Controls included in the regressions but omitted from the table include log assets of commercial bank subsidiaries, log BHC assets, log deposits, ratio of equity to assets for commercial banks, ratio of deposits to assets for commercial banks, ratio of unused commitments to assets for BHCs, and equity-to-assets for BHCs. To control for the size of the mortgage line of business, we also control at the commercial bank level for non-agency MBS as a share of securities, non-agency collateralized mortgage obligations as a share of securities, and residential real estate loans as a share of loans. Displayed in parentheses are Driscoll-Kraay standard errors, with a lag of 3 quarters. *** p<0.01, ** p<0.05, * p<0.1.

the sum of Treasury securities, agency securities, and agency mortgage-backed securities, excluding securities held for trading purposes. Finally, we find similar results in the subsample of BHCs with a positive nonbank asset share, which shows that our results are not solely driven by the extensive margin.

Economic Significance. To gauge whether our estimated effects are economically significant, we do a simple back-of-the envelope calculation. Suppose that the largest BHCs were required to

completely separate their commercial banks from their NBFIs, similar to the Glass-Steagall Act of 1933. Suppose a large BHC had a nonbank asset share of 5 percent and 11 unique nonbank activities, which are both pulled from the 95th percentile in the summary stats of Table 4. Our estimates from column (2) of Table 4 imply that if this BHC had to shed its entire nonbank footprint, its commercial bank subsidiaries would increase liquid asset shares by 366 basis points. To put this into perspective, Roberts, Sarkar and Shachar (2023) find that after the implementation of the liquidity coverage ratio, the largest banks increased their liquid asset shares by about 600 basis points relative to pre-regulation levels.[19] Therefore, our estimates imply that in the pre-GFC period, a Glass-Steagall redux would have increased bank liquid asset shares by about 60% of the eventual impact of the LCR.

5.2 Mechanism: Intracompany Transfers

In this section, we sharpen our hypothesis by testing one of the specific channels that should drive liquidity synergies within BHCs: the existence of intracompany funding flows between commercial bank and nonbank subsidiaries. As long as nonbank subsidiaries experience liquidity demands that are uncorrelated with those of commercial banks, then those nonbanks can transfer their "idle" liquidity to meet the unexpected outflows experienced by their commercial bank affiliates. Thus, access to such intracompany funding should allow banks to economize on the size of their precautionary liquid asset buffers. Similarly, nonbank subsidiaries should be able to shrink their own liquid asset pools if they have access to intracompany funding from banks. We find evidence consistent with these hypotheses.

Studying the intracompany funding dynamics inside BHCs is key for understanding the mechanisms that drive liquidity synergies, but also allows us to address potential endogeneity concerns associated with our results on the relationship between nonbank assets and liquidity buffers. Specifically, one could argue that time-varying BHC characteristics, like managerial quality that improves over time with experience, could lead BHCs to simultaneously expand into nonbank segments and reduce their liquid asset holdings. However, if these types of unobservable factors confound our

[19] Specifically, in Table 1 of Roberts, Sarkar and Shachar (2023), banks subject to the full LCR had 14.03% of assets held in HQLA in 2009-2013:Q1 (the pre-LCR period) and 19.72% of assets held in HQLA in 2015-2017. This represents a roughly 600 basis point increase. We assume that the ratio of cash and securities to assets increased by a similar amount.

analysis, then we should not expect to find evidence of large scale intracompany transfers between bank and nonbank subsidiaries, nor should we expect to find evidence of a systematic relationship between intracompany transfers and liquid asset buffers. Thus, the evidence we present in this section provides a more definitive test of our hypothesis.

Time Series for Intracompany Transfers. Our ability to observe intracompany funding flows is relatively unique in the literature on internal capital markets. In the context of internal capital markets within commercial bank divisions, KRS could not explicitly analyze intracompany transfers because such transfers are inherently unobservable for divisions that are integrated under one firm. In contrast, our setting studies flows between distinct legal entities, which are observable using the regulatory data we utilize in this paper.[20]

In Figure 4, we plot intracompany borrowing and lending for commercial bank subsidiaries as a share of assets using a balanced panel of BHCs from 1995 to 2022. We emphasize three main takeaways from this descriptive evidence. First, the sheer volume of intracompany funding is substantial. On average, 5% of commercial bank assets are funded with assets from nonbanks of the BHC, growing to as much as 10% during the global financial crisis.[21] Second, most of the intracompany funding used by banks is directly sourced from nonbank affiliates rather than from holding companies.[22] Third, notwithstanding Regulation W, nonbank subsidiaries are also on the receiving end of substantial transfers from the commercial bank side. Note that the small percentage in terms of commercial bank assets shown in the figure is likely a meaningful contribution for the (typically smaller) aggregate balance sheet of nonbank subsidiaries.

To see the importance of these observations, suppose that nonbank business lines within BHCs were organizationally siloed and were held for purely diversification purposes. Based on this hypothesis, one would expect to find minimal volumes of intracompany transfers. Any observed intracompany transfers would be used to distribute external funding obtained by the parent holding

[20] Examples of existing research work that has also measured actual intracompany funding dynamics in banking is Cetorelli and Goldberg (2012*a*,*b*,*c*), but their focus was on flows between the domestic parent bank and its foreign offices, thus limited to commercial banking operations.

[21] Note that the intracompany funding we are measuring is specifically *debt funding*. In principle, BHC subsidiaries can also receive additional equity funding from affiliates during stress periods, particularly from their parent holding company. Caglio, Copeland and Martin (2021) show that these "equity subsidies" can be large in magnitude.

[22] Note that our measures of intracompany funding balances also include balances between banks and *intermediate* holding companies, rather than only balances between and the top-level holding company.

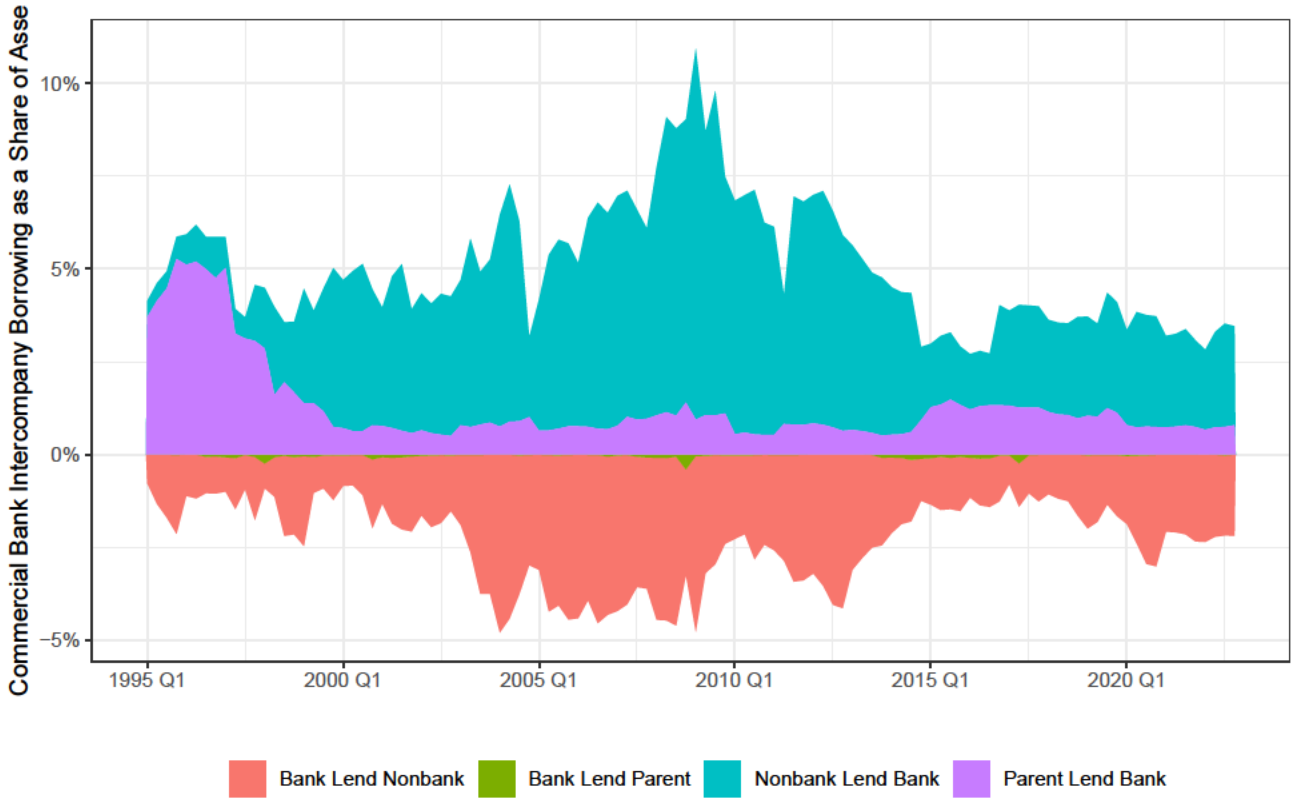

Figure 4: Intracompany Transactions. This figure graphs intracompany transactions engaged in by commercial bank subsidiaries across the bank holding company industry. The sample is a balanced panel of BHCs from 1995 to 2022. In blue, we graph balances due to affiliated nonbanks as a share of bank assets. In purple, we graph balances due to affiliated holding companies as a share of bank assets. In red, we graph balances due from affiliated nonbanks as a share of bank assets. In green, we graph balances due from affiliated holding companies as a share of bank assets.

company rather than to transfer liquidity. Our descriptive evidence suggests that this hypothesis is incorrect. The high transaction volume and the fact that most transactions occur between affiliated banks and nonbanks instead points to active liquidity management between subsidiaries.

Effects of Intracompany Borrowing on Liquidity Buffers: Bank Subsidiaries. We first present results for intracompany borrowing by commercial bank subsidiaries, for which we have the most comprehensive data. We merge bank balance sheet data from the Call Reports with BHC-level aggregate internal funding flows between commercial bank subsidiaries and nonbank affiliates from the FR Y9-LP. We test whether for a given nonbank footprint within a BHC, an *increase* in funding from nonbank subsidiaries to commercial bank subsidiaries leads to a *lower* liquid asset buffer within the banks. Specifically, we estimate the following regression:

$$\frac{Bank\ (Cash + Securities)_{it}}{Bank\ Assets_{it}} = \alpha_i + \alpha_t + \beta_1 \left(\frac{Bank\ Bal\ due\ to\ Nonbanks_{it}}{Bank\ Assets_{it}} \right) + \beta_2 \left(\frac{Bank\ Bal\ due\ to\ Nonbanks_{it}}{Bank\ Assets_{it}} \right) \times I(Yr \geq 2012) + \boldsymbol{\gamma^T X_{it}} + \epsilon_{it} \tag{2}$$

In this specification, our outcome variable, $(Cash+Securities)_{it}/Assets_{it}$, is the ratio of commercial bank liquid assets to total assets. $Balances\ due\ to\ Nonbanks_{it}/Bank\ Assets_{it}$ is our main variable of interest, the balances of commercial bank subsidiaries due to affiliated nonbanks (internal borrowing of the commercial bank subsidiaries from the nonbank affiliates), expressed as a share of bank assets. We trim our dataset at the 99th percentile of $Balances\ due\ to\ Nonbanks_{it}/Bank\ Assets_{it}$.

α_i are BHC fixed effects, which allow us to exploit within-BHC variation and rule out time-invariant confounders specific to each BHC. α_t are time (year-quarter) fixed effects. X_{it} is a suite of balance sheet controls for both the consolidated BHC and its commercial bank subsidiaries, including the controls already presented in Table 4. In all specifications, we control for other intracompany balances, including balances due from nonbanks, balances due to holding companies, and balances due from holding companies. This allows us to isolate variation in intracompany transfers that is specific to banks borrowing from nonbanks and that is separate from the general "openness to trade" within a BHC.

In alternate specifications, X_{it} includes controls for the nonbank asset share of the BHC, number of unique nonbank activities, number of nonbank subsidiaries, and the composition of nonbank subsidiaries. To control for composition, we take our four main nonbank categories from Section 4 (nonbank lenders, brokers, insurers, investment funds) and we find each category's share of the total nonbank subsidiary count of the BHC. For example, we control for the ratio of nonbank lender subsidiaries to total nonbank subsidiaries. This allows us to control for the types of nonbanks that underlie the nonbank asset share. Putting everything together, this specification allows us to test whether two banks with functionally identical nonbank affiliates and liquidity risk profiles experience different outcomes depending on how much they borrow from their nonbank affiliates.

The results are shown in Table 5. In columns (1) through (3), we use the ratio of cash and securities to assets of commercial bank subsidiaries as our outcome. In column (1), we estimate our base specification from Equation 2, excluding controls for the size and composition of the nonbank footprint. In column (2), we add a control for the nonbank asset share and in column (3), we add controls for nonbank footprint diversification and composition. For brevity, we omit the nonbank

footprint composition controls from the table. Across specifications, we find a very consistent negative relationship in the pre-GFC period between intracompany borrowing from nonbanks and bank liquid asset shares, even when we control for the characteristics of the nonbank footprint. The size of our estimates is large: a 1 percentage point increase in borrowing from nonbanks is associated with a 1.8-2.2 percentage point decrease in bank liquid asset shares. For all three specifications, we find that this relationship sharply reversed post-GFC.

In columns (4) through (6) of the table, we repeat the same regressions with the ratio of loans to assets of commercial bank subsidiaries as our outcome in order to test whether banks - after lowering their liquid asset buffers - reallocate their extra balance sheet space towards additional lending. Column (4) does not control for the nonbank footprint, column (5) controls for the nonbank asset share, and column (6) adds controls for nonbank diversification and composition. Across specifications, we find coefficients that are extremely similar in magnitude but opposite in sign as our estimates from columns (1) through (3). This suggests that when banks economize on liquid asset buffers using additional intracompany funding from nonbanks, they use the extra balance sheet space to engage in more lending. Based on the interaction with the post-2012 dummy, we find that these relationships reversed in the post-GFC period. Overall, we interpret these results as providing evidence that intracompany borrowing can lead to additional bank lending, on top of the reduction in liquid asset buffers that we document in columns (1)-(3).

In Appendix B, we show that our results are highly robust to a variety of alternative specifications. First, we show robustness to alternative trimmings of the intracompany balance variable and to taking the log of the intracompany balance rather than trimming. Second, we show that our results are not sensitive to the inclusion of control variables. Third, we find similar results when we define bank liquid assets using a rough measure of high-quality liquid assets (HQLA), which we calculate as the sum of Treasury securities, agency securities, and agency mortgage-backed securities, excluding securities held for trading purposes. Finally, we find similar results in the subsample of BHCs with a positive nonbank asset share and in the subsample of BHCs where commercial bank balances due to nonbank affiliates is positive, which shows that our results are not solely driven by the extensive margin.

Effects of Intracompany Borrowing on Liquidity Buffers: Nonbank Subsidiaries. The previous subsection showed that for commercial bank subsidiaries of BHCs, within-bank increases in borrowing from affiliated nonbanks lead to lower liquid asset shares and more lending. We now show

Dependent Variables:	(Cash + Securities)/Assets			Loans/Assets		
Model:	(1)	(2)	(3)	(4)	(5)	(6)
(Bal. Due To Nonbanks)/Assets	-2.177***	-2.198***	-1.807***	2.035***	2.044***	1.820***
	(0.6265)	(0.6265)	(0.5951)	(0.5763)	(0.5778)	(0.5493)
(Bal. Due To Nonbanks)/Assets × I(Year >= 2012)	4.182***	4.211***	3.419***	-2.504**	-2.517**	-1.989**
	(1.052)	(1.048)	(0.9711)	(0.9556)	(0.9795)	(0.9143)
Nonbank Asset Share		0.0056	0.0192		-0.0024	-0.0091
		(0.0131)	(0.0135)		(0.0141)	(0.0141)
Unique Nonbank Activity Count			-0.0026***			0.0012***
			(0.0003)			(0.0003)
Nonbank Subsidiary Count/100			0.0028***			-0.0031**
			(0.0010)			(0.0015)
Transaction Deposits/Total Deposits	0.0120*	0.0120*	0.0112*	-0.0287***	-0.0287***	-0.0276***
	(0.0069)	(0.0069)	(0.0068)	(0.0072)	(0.0072)	(0.0071)
Unused Commit/Assets	-0.0183	-0.0183	-0.0177	0.0061	0.0061	0.0064
	(0.0175)	(0.0176)	(0.0174)	(0.0161)	(0.0161)	(0.0158)
Additional Controls	Yes	Yes	Yes	Yes	Yes	Yes
BHC FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	111,417	111,417	111,417	111,417	111,417	111,417
R^2	0.78461	0.78461	0.78528	0.79492	0.79492	0.79518

Table 5: Regressions of Liquidity Buffers vs. Intracompany Borrowing for Commercial Bank Subsidiaries. This table shows estimation results from Equation 2. The unit of observation is BHC i and quarter t. The sample period is 1995 to 2022. In columns (1) through (3), the dependent variable is the ratio of cash and securities to assets for the commercial bank subsidiaries of BHC i. In columns (4) through (6), the dependent variable is the ratio of loans to assets for the commercial bank subsidiaries of BHC i. Bal. Due to Nonbanks/Assets is the ratio of balances due to affiliated nonbanks to assets for the commercial bank subsidiaries of BHC i, expressed in logs. I(Year $\geq$ 2012) is a dummy variable corresponding to the years 2012 and after. Nonbank Asset Share is the ratio of nonbank subsidiary assets to consolidated BHC assets for BHC i. Transaction Deposits/Total Deposits is the ratio of transaction deposits to total deposits for the commercial bank subsidiaries of BHC i. Unused Commit/Assets is the ratio of unused commitments to assets for the commercial bank subsidiaries of BHC i. All columns include BHC fixed effects and quarter fixed effects. Controls included in the regressions but omitted from the table include, at the level of the commercial bank subsidiaries of BHC i: log assets, log deposits, ratio of deposits to assets, ratio of equity to assets, and other intracompany balances. At the BHC level, we control for log assets, ratio of unused commitments to assets, and ratio of equity to assets. To control for the size of the mortgage line of business, we control at the commercial bank level for non-agency MBS as a share of securities, non-agency collateralized mortgage obligations as a share of securities, and residential real estate loans as a share of loans. To control for the composition of each BHC's nonbank business, we add controls for the ratio of broker subsidiaries to total subsidiaries, the ratio of insurance subsidiaries to total subsidiaries, the ratio of nonbank lender subsidiaries to total subsidiaries, and the ratio of investment fund subsidiaries to total subsidiaries. Reported in parentheses are Driscoll-Kraay standard errors, with a lag of 3 quarters. *** p<0.01, ** p<0.05, * p<0.1.

that nonbank subsidiaries of BHCs can experience similar benefits. Specifically, in the cross-section of nonbank subsidiaries, those who borrow more from affiliated banks as a share of assets have lower liquid asset shares and engage in more "real" activity, controlling for a range of characteristics.

Our data source is the FR Y-11, which contains subsidiary-level financial data reported by large nonbank subsidiaries of BHCs. We subset our data to include the years 1995 through 2022. Using the NAICS code of the subsidiary, we identify nonbank lenders (NAICS 5222 or 5223) and

broker-dealers (NAICS 5231). Most nonbank subsidiaries do not file the Y-11; only large subsidiaries that meet certain criteria are required to file. Many subsidiaries drop in and out of the sample depending on whether they meet the reporting requirement in a given quarter. The reporting requirements also differ from quarter-to-quarter. Some subsidiaries are only required to file in the fourth quarter of every year, while others are required to file every quarter.

Given these data limitations, within-subsidiary estimation is infeasible. Instead, we must rely on the cross-section of all reporting nonbank subsidiaries across BHCs in each quarter to identify our coefficients. We run the following regression on our Y-11 sample:

$$\begin{aligned}\frac{Nonbank\ (Cash + Securities)_{it}}{Nonbank\ Assets_{it}} &= \alpha_t + \beta_1 \frac{Nonbank\ Balances\ due\ to\ Banks_{it}}{Nonbank\ Assets_{it}} \\ &+ \beta_2 \frac{Nonbank\ Balances\ due\ to\ Banks_{it}}{Nonbank\ Assets_{it}} \times I(Yr \geq 2012) + \boldsymbol{\gamma^T X_{it}} + \epsilon_{it}\end{aligned} \tag{3}$$

In this regression, $(Cash + Securities)_{it}/Assets_{it}$ is the ratio of liquid assets to total assets of nonbank subsidiary i in quarter t. We define liquid assets as the sum of cash and securities. Nonbank Balances due to Banks$_{it}$/Nonbank Assets$_{it}$ is the ratio of intracompany borrowing from affiliated banks to total assets. We trim our dataset at the 99th percentile of this intracompany borrowing variable.[23] $I(Yr >= 2012)$ is a dummy variable for whether the year is greater than or equal to 2012. X_{it} is a set of subsidiary-specific controls at time t, including log subsidiary assets, capital ratio, ratio of unused commitments to assets, ratio of trading liabilities to assets, and other intracompany balances. α_t are time fixed effects.

We provide our results in Table 6. In columns (1) and (2), we subset on nonbank lender subsidiaries. In column (1) our outcome is the liquid asset share and in column (2) our outcome is the loans-to-assets ratio. We find that a 1 percentage point increase in borrowing from affiliated banks is associated with a 0.21 percentage point decline in liquid asset share and a 0.48 percentage point increase in loans-to-assets. In columns (3) and (4), we subset on broker-dealer subsidiaries. In column (3), our outcome is the liquid asset share and in column (4), our outcome is the ratio of trading assets to total assets. We do not find significant effects for liquid asset share but we do

[23] We confirm that our results are robust to a variety of alternative trimmings and robust to taking the log of intracompany borrowing.

	Nonbank Lenders		Broker-Dealers	
	$(\text{Cash+Sec})_{it}/\text{Assets}_{it}$	$\text{Loans}_{it}/\text{Assets}_{it}$	$(\text{Cash+Sec})_{it}/\text{Assets}_{it}$	Trad. $\text{Assets}_{it}/\text{Assets}_{it}$
	(1)	(2)	(3)	(4)
Bal. Due to Affil. Banks/Assets	-0.2115***	0.4818***	-0.1878	0.3462**
	(0.0174)	(0.0430)	(0.1207)	(0.1327)
Bal. Due to Affil. Banks/Assets ×	0.1288***	0.1767***	0.2580	0.0563
I(Year >= 2012)	(0.0168)	(0.0588)	(0.1743)	(0.1573)
Unused Commitments/Assets	-0.0155*	0.0520**	-0.4233*	-0.1006***
	(0.0080)	(0.0237)	(0.2458)	(0.0349)
Additional Controls	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Observations	9,301	9,370	1,487	1,487
R^2	0.08946	0.20424	0.28307	0.45289

Table 6: Regressions of Liquidity Buffers vs. intracompany Borrowing for Nonbank Subsidiaries. This table shows estimation results from Equation 3. The unit of observation is subsidiary i and quarter t. The sample period is 1995 to 2022. The data source is the FR Y-11. Columns (1) and (2) subset on nonbank lenders, which we identify using NAICS code "5222" or "5223". Columns (3) and (4) subset on broker-dealers, which we identify using NAICS code "523". In columns (1) and (3), the dependent variable is the ratio of cash and securities to assets. In column (2), the dependent variable is the ratio of loans to assets. In column (4), the dependent variable is the ratio of trading assets to total assets. Bal. Due to Affil. Banks/Assets is the ratio of balances due to affiliated commercial banks as a share of total assets. I(Year $\geq$ 2012) is a dummy variable corresponding to the years 2012 and after. Unused Commitments/Assets is the ratio of unused commitments to total assets. All regressions include quarter fixed effects. Controls included in the regression but omitted from the table include: ratio of equity to assets, log assets, ratio of trading liabilities to assets, and other nonbank subsidiary intracompany balances as a share of assets. Reported in parentheses are Driscoll-Kraay standard errors, with a lag of 3 quarters. *** p<0.01, ** p<0.05, * p<0.1.

find that a 1 percentage point increase in borrowing from affiliated banks is associated with a 0.34 percentage point increase in the ratio of trading assets to assets.

While we cannot conduct within-subsidiary tests due to aforementioned data limitations, our results strongly suggest that the benefits of access to intracompany funding are bi-directional. Not only can bank subsidiary benefit from access to funding from affiliated nonbanks, but nonbank subsidiaries can benefit from access to funding from affiliated banks.

5.3 Implicit Lines of Credit

We argue that subsidiaries of BHCs have relationships with their affiliates that resemble lines of credit. Not only do commercial bank subsidiaries use intracompany funding from affiliated nonbanks at any given moment, as we document in the previous section, but they also have the discretion to draw upon more intracompany funding if they experience liquidity stress. This access to *contingent* intracompany funding stems not from codified agreements, but rather from implicit obligations of subsidiaries to provide support to their affiliates. We refer to these arrangements as "implicit lines

of credit".

These implicit lines of credit should be the primary channel mediating the effect of nonbank asset shares on commercial bank HQLA. If banks can rely on their nonbank affiliates as a kind of lender of last resort, then they do not need to hold as large of a cash buffer to meet unexpected liquidity outflows.

To find evidence for this channel, we need to show that use of intracompany funding significantly intensifies during periods of unexpected liquidity stress. We focus on a particular episode where financial institutions, particularly large commercial banks, experienced large liquidity outflows: the asset-backed commercial paper (ABCP) funding shock that occurred at the beginning of the global financial crisis. As documented by Acharya, Schnabl and Suarez (2013), ABCP conduits were special purpose vehicles that issued large amounts of commercial paper using credit and liquidity guarantees from commercial bank sponsors, for whom the guarantees represented large off-balance-sheet liabilities. When the ABCP market experienced severe stress beginning in 2007, these conduits were unable to roll over their funding, forcing commercial bank sponsors to assume the assets of the conduits. Thus, the ABCP market stress represented a substantial liquidity shock for exposed commercial banks.

There are two advantages to focusing on this particular episode for testing our hypothesis. First, the funding shock was unexpected, which Cetorelli and Goldberg (2012*a*) exploit in their analysis of internal capital markets within commercial banks. Second, central banks and regulators were slow to respond to the shock, which makes this episode relatively untainted by policy responses. In contrast, other significant liquidity shocks, such as credit line drawdowns during COVID-19, were quickly met with large-scale policy measures.

We exploit differential exposure of commercial banks to the pre-GFC ABCP market to show that banks exposed to liquidity stress were able to draw upon substantial amounts of intracompany funding from affiliated nonbanks. In other words, we show that exposed commercial banks experienced large increases in intracompany borrowing, *conditional on having large nonbank affiliates.*

Regression Specification. We estimate the following regression:

$$\frac{Bal\ Due\ to\ Nonbanks_{it}}{Bank\ Assets_{it}} = \alpha_i + \alpha_t + ABCP\ Exposure_{i,2006} \times \frac{Nonbank\ Assets_{it}}{BHC\ Assets_{it}} \times I(Post_t) + \epsilon_{it} \quad (4)$$

In the estimated regression, we include the main effects and the nested double interactions. In the displayed equation, these terms are omitted for brevity. $Bal\ Due\ to\ Nonbanks_{it}$ is the borrowing of the commercial bank subsidiaries of BHC i in quarter t from (i) affiliated nonbanks or (ii) affiliated holding companies, expressed as a share of commercial bank assets, $Bank\ Assets_{it}$. $ABCPExposure_i$ is the ratio of the assets of ABCP conduits sponsored by the commercial bank subsidiaries of BHC i as a share of bank equity, as of 2006:Q4.[24] $Nonbank\ Assets_{it}/BHC\ Assets_{it}$ is the ratio of nonbank assets to BHC assets. $I(Post_t)$ is a dummy for 2007:Q2 and after, when the ABCP funding shock began. α_i are BHC fixed effects and α_t are quarter fixed effects. We restrict our sample to start in 2005:Q1 and end in 2008:Q4.

In Table 7, we provide our regression results. In the first two columns, we use borrowing from affiliated nonbanks as our outcome and in the second two columns, we use borrowing from affiliated holding companies as our outcome. In column (1), we estimate Equation 4. The insignificant coefficient on the interaction between the nonbank asset share and the post dummy tells us that in general, banks with large nonbank affiliates did not use additional intracompany borrowing. The very large and positive coefficient on the triple interaction between nonbank asset share, ABCP exposure, and the post dummy tells us that banks with large nonbank affiliates used additional intracompany borrowing, *if they had large ABCP exposure*. In other words, we are comparing two banks with similarly sized nonbank affiliates, but with different liquidity stress from ABCP exposure. We find that the bank with more liquidity stress receives more funding, consistent with intracompany funding functioning as a credit line.

Note that these findings are not driven by a mechanical relationship between intracompany borrowing and the size of the nonbank footprint. If our findings were mechanical, then our effects would be concentrated in the coefficient for the interaction between the nonbank asset share and the post dummy. Instead, our findings suggest a relationship between intracompany borrowing and the size of the nonbank footprint, *conditional* on exposure to liquidity stress. Furthermore, a relationship between intracompany borrowing and the size of the nonbank footprint is not necessarily mechanical because BHCs could develop a large nonbank footprint and run those subsidiaries *independently* from its banks. Instead, the findings precisely confirm our hypothesis: intracompany funding from

[24] We use data on bank exposure to ABCP conduits from Acharya, Schnabl and Suarez (2013), available on Phillipp Schnabl's website: https://pages.stern.nyu.edu/~pschnabl/data/data2.htm.

nonbanks can be activated during times of liquidity stress, which functions as an implicit line of credit. In column (2), we find that this result is robust to adding a variety of controls, including bank asset size, liquid asset shares, and other intracompany balances.[25]

Columns (3) and (4) provide further intuition for our results. In column (3), we estimate the same regression as column (1) but with borrowing from affiliated holding companies as our outcome. In column (4), we add the same set of controls as in column (2). For this outcome, we find statistically insignificant results. This implies that the intracompany funding response to the ABCP shock was specifically driven by banks tapping the balance sheets of their nonbank affiliates. Banks did not seem to be relying on funding from the parent holding company or funding raised from external markets channelled through the parent holding company. The specificity of our findings to funding from nonbanks strengthens our argument about the unique liquidity-related relationships between affiliated banks and nonbanks.

Event Study Specification. To show the trajectory of our estimates over time and check pre-trends, we modify our specification to produce an event study:

$$\frac{Bank\ Bal\ Due\ to\ Nonbanks_{it}}{Bank\ Assets_{it}} = \alpha_i + ABCP\ Exposure_{i,2006} \times \frac{Nonbank\ Assets_{it}}{BHC\ Assets_{it}} \times \sum_{\tau=2005:Q1}^{2008:Q4} \beta_\tau I(t=\tau) + \epsilon_{it} \tag{5}$$

In the estimated regression, we include the main effects and the nested double interactions. In the displayed equation, these terms are omitted for brevity. We use 2007:Q1 as the omitted base quarter. In Figure 5, we plot the coefficients associated with ABCP Exposure$_{i,2006}$ $\times$ Nonbank Assets$_{it}$/BHC Assets$_{it}$. We find no evidence of pre-trends based on the insignificant coefficients before 2007. The trajectory of the coefficients in the post period is consistent with our priors. Starting in 2007:Q2, when the ABCP funding shock began, intracompany borrowing from nonbanks sharply rises. The coefficients progressively increase throughout 2007, level off in early 2008 when banks were given access to the Term Auction Facility from the Fed, and sharply increase again in

[25]We confirm that our results are not driven by outliers: our coefficients are robust to taking the logs of the independent and dependent variables.

Dependent Variables:	(Bal. Due To Nonbanks)/Assets		(Bal. Due To Parent)/Assets	
Model:	(1)	(2)	(3)	(4)
Nonbank Asset Share	0.0100	0.0089	0.0163	0.0125
	(0.0069)	(0.0076)	(0.0267)	(0.0253)
ABCP × Nonbank Asset Share	0.0485	-0.0944	-0.0142	-0.0247
	(0.0771)	(0.1414)	(0.0389)	(0.0447)
ABCP × Post	-0.0045***	-0.0060***	0.0002	0.0003
	(0.0005)	(0.0006)	(0.0006)	(0.0005)
Nonbank Asset Share × Post	-0.0049	-0.0051	-0.0015	-0.0014
	(0.0060)	(0.0060)	(0.0032)	(0.0031)
ABCP × Nonbank Asset Share × Post	0.2620***	0.3030***	0.0058	0.0081
	(0.0172)	(0.0157)	(0.0044)	(0.0063)
Controls	No	Yes	No	Yes
BHC FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Observations	13,232	13,200	13,232	13,200
R^2	0.92087	0.95057	0.72324	0.73177

Table 7: Intracompany Borrowing After ABCP Shock. This table shows estimation results from Equation 4. The unit of observation is BHC i and quarter t. The sample period is 2005 to 2008. In columns (1) and (2), the dependent variable is commercial bank balances due to nonbanks as a share of assets. In columns (3) and (4), the dependent variable is commercial bank balances due to holding companies as a share of assets. Post is a dummy variable corresponding to 2007:Q2 and after. ABCP is the ratio of assets of ABCP conduits to equity of the commercial bank subsidiaries of BHC i as of 2006:Q4. Nonbank Asset Share is the ratio of nonbank subsidiary assets to BHC consolidated assets for BHC i. In columns (2) and (4), we control for log BHC assets, log commercial bank assets, log deposits, commercial bank liquid asset share, commercial bank balances due from nonbanks, and commercial bank balances due from holding companies. Reported in parentheses are standard errors clustered by BHC. *** p<0.01, ** p<0.05, * p<0.1.

the aftermath of the Lehman bankruptcy.

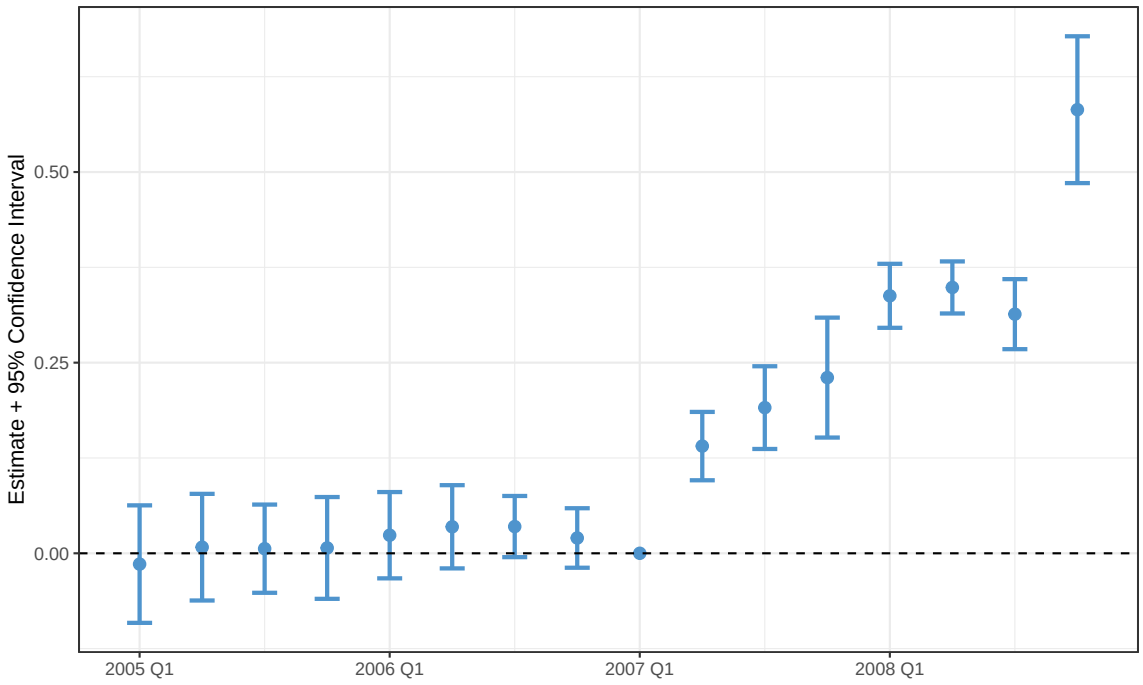

Figure 5: Event Study Coefficients. This table shows estimation results from Equation 5. The dependent variable is commercial bank balances due to affiliated nonbanks as a share of assets. We plot the coefficients associated with the triple interactions between $ABCP\ Exposure_{i,2006}$, $Nonbank\ Assets_{it}/BHC\ Assets_{it}$, and dummy variables corresponding to each quarter. We use 2007:Q1 as the omitted reference quarter. We include 95% confidence intervals using standard errors clustered by BHC.

These results have important implications for our understanding of the role of NBFIs during the GFC. Although the ABCP crisis originated with high commercial bank exposure to nonbank investment vehicles, many other nonbank affiliates of commercial banks appeared to serve as a source of strength and stability and likely allowed large commercial banks to be more resilient to the ABCP funding shock.

6 Effects of Post-GFC Regulation on Liquidity Synergies

In this section, we provide evidence that post-GFC banking regulation disrupted liquidity synergies and that BHCs responded to these disruptions by scaling back their nonbank footprint. This analysis has two main purposes. First, our evidence of the disruption of liquidity synergies provides an explanation for the reversal of our regression estimates from Table 4, Table 5, and Table 6 in the post-GFC period. Second, our evidence that banks scale back their nonbank footprint in response to disruptions of liquidity flows supports our theory that liquidity synergies are an important reason why banks affiliate with nonbanks.

There are two regulations that could have conceivably had an impact on the liquidity synergy. The most obvious regulation was the liquidity coverage ratio (LCR), which required the largest banks to hold a minimum amount of liquid assets against potential liquidity outflows in a stress scenario. By enacting a rough floor on bank liquid asset shares, the LCR could have mechanically zeroed out the correlation between nonbank asset shares and liquid asset shares that existed in the pre-GFC period.

A second, less well-known, regulation that could have also impacted the liquidity synergy was the introduction of resolution planning requirements, also known as "living wills". As we discussed in Section 2, living wills forced bank holding companies to submit periodic, detailed plans to regulators about how they would separate and resolve their businesses in the event of failure. One of the key goals of the regulation was to reduce the interconnections and interdependencies between subsidiaries and business lines in order to facilitate separability during resolution. In the Fed and FDIC's regulation implementing living wills, they specifically require information about the interconnections between bank and nonbank subsidiaries to be a central feature of the living will submissions. Given the importance of intracompany relationships to our theory, living wills may have eliminated much of the liquidity synergy between affiliated banks and nonbanks.

To determine the effects of these regulations on the liquidity synergy, we exploit the natural experiment created by the introduction of living wills. In November 2011, the Federal Reserve and the FDIC jointly released a rule requiring all banks with greater than $50 billion in assets to submit resolution plans.[26] We acknowledge that the LCR was introduced at a similar time for a similar set of banks. We do not take a stand on whether living wills or the LCR drive the results we present below. The purpose of this section is to show the general impact of regulation on the liquidity synergy, not to identify the specific regulation that was most responsible for our estimates.

We analyze the impact of regulation on four main outcomes related to the nonbank footprint of BHCs: nonbank asset share, nonbank activity count, nonbank subsidiary count, and intracompany funding flows between banks and nonbanks. We estimate treatment effects using a traditional difference-in-differences estimator and the synthetic difference-in-differences (SDID) estimator

[26]Treated banks received a different compliance date based on their size. Banks with at least $250 billion in assets were required to submit plans by July 2012. Banks with assets between $100 billion and $250 billion were required to comply by July 2013. Banks with assets between $50 billion and $100 billion were required to comply by December 2013.

from Arkhangelsky et al. (2021). SDID allows us to generate a synthetic control by matching on pre-treatment trends, rather than pre-treatment levels. This allows us to generate credible counterfactuals for outcomes like subsidiary counts, where treated units have substantially higher levels than control units.

We restrict our sample to 2010:Q1 to 2018:Q1. We end our sample period in 2018:Q1 to avoid any influence of the Economic Growth, Regulatory Relief, and Consumer Protection Act of 2018, which modified and tailored the Dodd-Frank Act.[27] We balance our panel and identify 23 banks with assets greater than $50 billion as of 2011:Q4. We drop three banks that exceed the $50 billion asset threshold later in the sample and are thus eventually treated. Our pool of control units are the top 200 BHCs within our sample by 2011:Q4 assets, excluding treated units. We set the treatment to begin in 2011:Q4.

We report our results in Table 8. The first column reports results using traditional difference-in-differences and the second column reports results using synthetic difference-in-differences. First, we find that treated BHCs reduced the size of their nonbank footprint, as measured by the ratio of nonbank assets to BHC assets, by 1.5-2.5 percentage points. The magnitude and significance of our estimates are consistent across both specifications. Second, treated BHCs exit 2-3 nonbank activities and reduce their subsidiary count by 18-19%, indicating a reduction in the scope and diversification of the nonbank footprint. Recall that in Table 4, we find that these measures of scope and diversification are just as important for liquidity synergies as the size of the nonbank footprint. Third, treated BHCs reduce total intracompany funding balances between banks and nonbanks by as much as 40%, which supports our interpretation of living wills as placing restrictions on the interconnections between affiliated banks and nonbanks. Overall, our results confirm that regulation disrupted liquidity synergies within BHCs and that banks responded to this disruption by shrinking their nonbank footprint.

[27]The Economic Growth, Regulatory Relief, and Consumer Protection Act of 2018 modified the Dodd-Frank Act such that only BHCs above $250 billion in assets would be subject to regulations like living wills. In the original iteration of Dodd-Frank, BHCs above $50 billion in assets were subject to living wills.

Dependent Variables	DID (1)	Synthetic DID (2)
Nonbank Asset Share	-0.0252^{**}	-0.0155^{**}
	(0.0102)	(0.0080)
Unique Nonbank Activities Count	-2.7362^{***}	-2.4935^{***}
	(0.6747)	(0.6274)
Log Nonbank Subsidiary Count	-0.1781^{**}	-0.1872^{***}
	(0.0738)	(0.0702)
Log (Sum Intracompany Balances)	-0.3974^{**}	-0.3535^{*}
	(0.1987)	(0.2072)

Table 8: 2011 Living Will Treatment Effects. This table shows the estimated treatment effects of the 2011 introduction of living wills. In the first column, we use a traditional difference-in-differences estimator and in the second column, we use synthetic difference-in-differences (Arkhangelsky et al., 2021). Both estimators are implemented using the "synthdid" R package. In the first row, we use the ratio of nonbank subsidiary assets to consolidated BHC assets as the outcome. In the second row, we use the count of unique nonbank activities for BHCs as the outcome. In the third row, we use the log nonbank subsidiary count for BHCs as the outcome. In the fourth row, we use the log sum of intracompany balances between commercial banks and nonbanks as the outcome, where the sum of intracompany balances is calculated as the sum of commercial bank balances due to nonbanks and balances due from nonbanks. Standard errors, included in parentheses, are calculated by bootstrap using 1000 replications. *** p<0.01, ** p<0.05, * p<0.1.

In Figure 6, we plot the trajectories of our four outcome variables for the treatment group versus the synthetic control group constructed for each outcome. Note that by construction of synthetic difference-in-differences, we have parallel trends between the synthetic control group and the treatment group. To make the parallel trends more apparent, we shift the synthetic control trajectory upwards so that the pre-treatment trajectories of the synthetic control and the treatment are overlaid on top of each other. In reality, the pre-treatment levels for the synthetic control group are much lower than for the treatment group. The vertical line corresponds to 2011:Q3, which is the final pre-treatment period before living wills were announced in 2011:Q4.

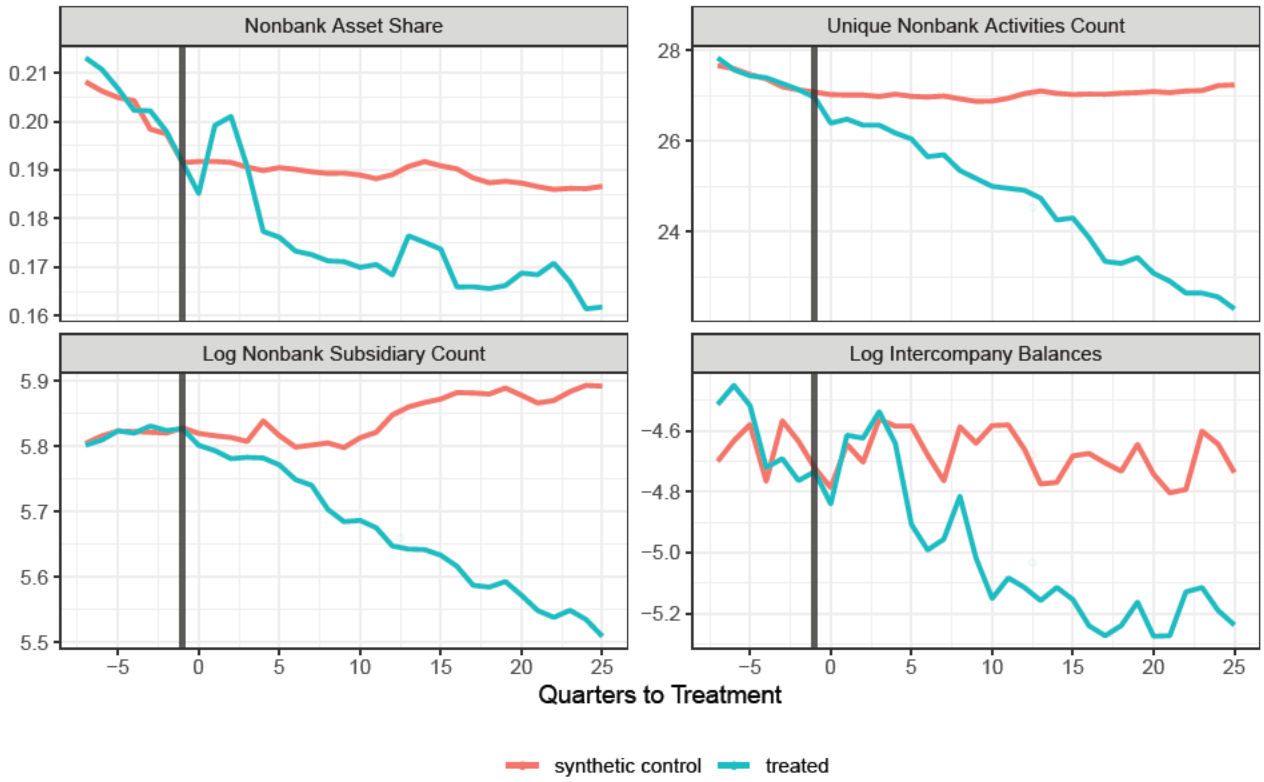

Figure 6: Synthetic Difference-in-Differences Plots. This figure provides the trajectories of our outcome variables for the treatment group and for the synthetic control group associated with each outcome. Plots are generated by the "synthdid" R package. To make parallel trends more apparent, we shift the synthetic control trajectory upwards so that the pre-treatment trajectories of the synthetic control and the treatment are overlaid on top of each other. The vertical line corresponds to 2011:Q3, which is the final pre-treatment period.

One potential concern about our interpretation of our results is that the reduction in intracompany funding and the reduction in the size of the nonbank footprint may not necessarily be related to each other. Both effects may have been independent responses to different parts of the regulation. We think this is unlikely because neither living wills nor the LCR imposed any explicit restrictions on the scope of permissible nonbank activities. Instead, living wills specifically targeted - and discouraged - the funding interconnections between banks and nonbanks inside BHCs - and LCR imposed minimum liquidity buffers. Thus, our results are much more consistent with post-GFC regulation imposing a "tax" on the liquidity synergy and BHCs responding to this tax by scaling back their nonbank footprint.

7 Conclusion

What is a bank? We started the paper by posing this question. On the basis of our documentation and analysis, the general answer appears that a banking firm will typically stretch its boundaries to include any form of financial intermediation consistent with technology and innovation of the time, and as far as regulation will allow.

In this paper, we have studied how the organizational boundaries of U.S. banking firms have expanded over the last five decades to include NBFIs and analyze potential synergies between traditional commercial banking business lines and nonbank business lines.

As we have documented, the years between the mid-1980s and the global financial crisis represent a period during which U.S. bank holding companies were able to operate in a mostly unconstrained regulatory environment with respect to their choice of business activities. We show that during this period, the banking industry added thousands of nonbank subsidiaries spanning virtually every NBFI segment, as they emerged, including specialty lenders, securities firms, insurers, and investment funds. Our evidence thus confirms that the modern U.S. banking firm is *not* the textbook institution defined by deposit taking and loan making operations. Left to themselves, in a relatively unconstrained environment, banking firms will naturally expand their boundaries to include any relevant type of specialized institutions engaging in financial intermediation. Hence, by emphasizing the importance of liquidity management, and the interplay with regulation, we are able to provide a novel angle for studying the evolving boundaries and role of the banking industry. Moreover, our focus on the nonbank footprint of banks also offers a new, complementary perspective to study and understand the rapid growth of NBFIs and their rising role in the financial intermediation landscape.

We leverage the insights in Kashyap, Rajan and Stein (2002) to establish robust evidence that liquidity management synergies are an important benefit of structuring a banking firm to have various nonbank business lines. We show that commercial banks with larger nonbank affiliates tend to have smaller liquid asset buffers. Moreover, we provide evidence of the specific mechanism through which our proposed synergy operates: intracompany funding transactions between affiliated banks and NBFIs. Such internal funding reallocation is especially evident in times of need, evidence consistent with banks operating with *implicit* lines of credit internal to their organizations.

We are also able to establish the role of regulation as a factor mediating the relationship between efficient liquidity management and choices of organizational structure. Regulation, and specifically

regulation designed to increase the cost to interconnections within a bank holding company, does lead BHCs subject to the regulation to a disproportionate reduction in intracompany funding, and to reduction in the scope of their nonbank operations.

We close with a discussion of the implications of our results for the optimal organization of the financial sector. First, our results suggest that interventions that reduce the organizational integration of banks and NBFIs may have some costs. These interventions range in scope from living wills to a "21st Century Glass-Steagall Act" that would reinstate Depression-era restrictions on integrating commercial banking with investment banking. While further separating banks from NBFIs may reduce risk to insured deposits, these risks should be weighed against the efficiency losses of reduced liquidity synergies. Our argument is analogous to the arguments made by KRS with regard to narrow banking proposals, which would separate banks into entities resembling finance companies and money market funds. KRS argue that even if money market funds are a superior savings vehicle for depositors, the benefits of narrow banking may not outweigh the costs of reducing the liquidity synergies that allow banks to be robust providers of credit lines. By extension, our results point at potentially important trade-offs associated with establishing regulatory boundaries, and thus defining what should be on the bank "side" and what should remain "outside".

Second, our study suggests that the results of KRS apply more generally to a wide range of financial intermediaries rather a narrow set of divisions within commercial banks. A key aspect of the business model of most financial intermediaries is the provision of liquidity. Any pair of intermediaries that experience relatively uncorrelated liquidity demands can, in principle, engage in efficiency-enhancing transfers that allow them to economize on liquid asset holdings. These considerations have become more relevant as the industry grapples with new types of hybrid intermediaries (Cetorelli, 2014), like private equity-affiliated life insurers (Kirti and Sarin, 2023).

Finally, the paper makes a deeper point on the importance of liquidity needs and liquidity provision in support of financial intermediation activity: A necessary condition for financial intermediaries - be it a bank or a nonbank - to operate is access to stable funding. Acharya, Cetorelli and Tuckman (2024) builds on this argument and document the existence of strong liquidity interdependences between banks and (unaffiliated) nonbanks. Our study of the joint operations of banks and nonbanks *inside* the organizational boundaries of BHCs provides ideal laboratory conditions to understand the relevance of liquidity synergies in shaping the relationship, and hence the interdependence, between banks and nonbanks. Hence, the paper teases out complementary insights to those in Acharya, Cetorelli and Tuckman (2024), suggesting that in a world where the bank regulatory boundaries are

made narrower, banks and specialized nonbank intermediaries may exist and grow legally separated from one another, but the funding/liquidity interdependence may still remain as an essential input to their operations. Regulation may be effective in drawing *legal* boundaries between banks and nonbanks, but not at all in affecting their *operational* boundaries.

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Appendix

This appendix is structured as follows. Appendix A provides details about the construction of the main variables used in our empirical analysis. Appendix C presents additional figures.

A Data Appendix

Nonbank Asset Variables from FR Y9-LP. These variables are reported only by the parent holding company with respect to their consolidated nonbank subsidiaries. Thus, we only use the Y9-LP report filed by the top-holder.

1. **Total Assets of Nonbank Subsidiaries:** This variable is derived from the FR Y9-LP, specifically line item BHCP 4778. This line item is the dollar value of all assets of nonbank subsidiaries of the parent holding company. This line item defines nonbank subsidiary as any direct or indirect nonbank subsidiary of the parent BHC, excluding commercial banks and subsidiaries of commercial banks.

2. **Loans and Leases of Nonbank Subsidiaries:** This variable is derived from the FR Y9-LP, specifically line item BHCPC427. This line item is the dollar value of total combined loans and leases on the books of nonbank subsidiaries. Past due loans are included. Balances due from related institutions are excluded. Sold or charged-off loans are excluded. Allowances for losses are not deducted.

intracompany Balance Variables from FR Y9-LP. The following line items are reported on the unconsolidated balance sheets of holding companies. Importantly, these line items are reported by both top-tier holding companies and intermediate holding companies. All holding companies, including intermediate holding companies, report intracompany balances between any direct or indirect subsidiary of the top-tier holding company. Thus, these line items include intracompany balances between subsidiaries that are directly held by different holding companies within the same consolidated bank holding company.

1. **Balances held by subsidiary banks due from affiliated nonbanks:** This variable is derived from the FR Y9-LP, specifically line item BHCP6793. This line item is the dollar value of intracompany balances with affiliated nonbanks booked as assets on the balance sheet of subsidiary banks. In other words, this line item is the dollar value of bank lending to nonbank affiliates.

2. **Balances held by subsidiary banks due to affiliated nonbanks:** This variable is derived from the FR Y9-LP, specifically line item BHCP6795. This line item is the dollar value of intracompany balances with affiliated nonbanks booked as liabilities on the balance sheet of

subsidiary banks. In other words, this line item is the dollar value of bank borrowing from nonbank affiliates. This line item includes funds that nonbank subsidiaries hold in deposits at affiliated banks.

3. **Balances held by subsidiary banks due to affiliated holding companies:** This variable is derived from the FR Y9-LP, specifically line item BHCP0533. This line item is the dollar value of intracompany balances with affiliated holding companies booked as liabilities on the balance sheet of subsidiary banks. In other words, this line item is the dollar value of bank borrowing from affiliated holding companies.

4. **Balances held by subsidiary nonbanks due to affiliated holding companies:** This variable is derived from the FR Y9-LP, specifically line item BHCP0537. This line item is the dollar value of intracompany balances with affiliated holding companies booked as liabilities on the balance sheet of subsidiary nonbanks. In other words, this line item is the dollar value of nonbank borrowing from affiliated holding companies.

5. **Balances held by subsidiary banks due from affiliated holding companies:** This variable is derived from the FR Y9-LP, specifically line item BHCP3605. This line item is the dollar value of intracompany balances with affiliated holding companies booked as assets on the balance sheet of subsidiary banks. In other words, this line item is the dollar value of bank lending to affiliated holding companies.

6. **Balances held by subsidiary nonbanks due from affiliated holding companies:** This variable is derived from the FR Y9-LP, specifically line item BHCP3606. This line item is the dollar value of intracompany balances with affiliated holding companies booked as assets on the balance sheet of subsidiary nonbanks. In other words, this line item is the dollar value of nonbank lending to affiliated holding companies.

Nonbank Asset Variables from FR Y9-C.

1. **Net Assets of Broker-Dealer Subsidiaries:** This variable is derived from the FR Y9-C, specifically line item BHCKC252. This line item is the dollar value of assets of broker-dealer subsidiaries of the parent holding companies, excluding balances due from intracompany affiliates.

2. **Assets Under Management in Proprietary Mutual Funds and Annuities:** This variable is derived from the FR Y9-C, specifically line item BHCKB570. This line item is the dollar value of assets under management of mutual funds or annuities for which the reporting holding company or a subsidiary of the holding company acts as investment advisor.

intracompany Balance Variables from FR Y9-C.

1. **Balances held by subsidiary broker-dealers due from affiliated banks:** This variable is derived from the FR Y9-C, specifically line item BHCK4833. This line item is the dollar value of intracompany balances with affiliated banks, and subsidiaries of affiliated banks, booked as assets on the balance sheet of broker-dealer subsidiaries.

2. **Balances held by subsidiary broker-dealers due from affiliated nonbanks:** This variable is derived from the FR Y9-C, specifically line item BHCK4834. This line item is the dollar value of intracompany balances with affiliated nonbanks booked as assets on the balance sheet of broker-dealer subsidiaries.

3. **Balances held by subsidiary broker-dealers due from parent holding company:** This variable is derived from the FR Y9-C, specifically line item BHCK4832. This line item is the dollar value of intracompany balances with the parent company booked as assets on the balance sheet of broker-dealer subsidiaries.

4. **Balances held by subsidiary broker-dealers due to affiliated banks:** This variable is derived from the FR Y9-C, specifically line item BHCK5043. This line item is the dollar value of intracompany balances with affiliated banks, and subsidiaries of affiliated banks, booked as liabilities on the balance sheet of broker-dealer subsidiaries.

5. **Balances held by subsidiary broker-dealers due to affiliated nonbanks:** This variable is derived from the FR Y9-C, specifically line item BHCK5045. This line item is the dollar value of intracompany balances with affiliated nonbanks booked as liabilities on the balance sheet of broker-dealer subsidiaries.

6. **Balances held by subsidiary broker-dealers due to parent holding company:** This variable is derived from the FR Y9-C, specifically line item BHCK5041. This line item is the dollar value of intracompany balances with the parent company booked as liabilities on the balance sheet of broker-dealer subsidiaries.

B Robustness Checks

Bank Liquid Assets vs. Nonbank Affiliate Size. In this section, we show that our results are highly robust to alternative specifications. In Table B.1, we provide robustness checks for the regressions in Table 4, which tests the relationship between bank liquid asset shares and the size of banks' nonbank affiliates. The associated specification is provided below.

$$\frac{Bank\ (Cash + Securities)_{it}}{Bank\ Assets_{it}} = \alpha_i + \alpha_t + \beta_1 \left(\frac{Nonbank\ Assets_{it}}{BHC\ Assets_{it}} \right) + \beta_2 \left(\frac{Nonbank\ Assets_{it}}{BHC\ Assets_{it}} \right) \times I(Yr \geq 2012) + \boldsymbol{\gamma}^T X_{it} + \epsilon_{it}$$

In the first row of Table B.1, we provide our baseline coefficients for β_1, which corresponds to the 1990-2011 period, and our baseline coefficients for β_2, which corresponds to the 2012-2022 period. Our baseline is taken from the first column of Table 4.

In the second and third rows, we show that our estimates are robust to alternative trimmings rather than the 99% trimming used in the baseline. In the fourth row, we take the log of the ratio of nonbank assets to BHC assets as an alternative to trimming.

In the fifth row, we exclude controls to show that our results are not sensitive to the inclusion of any particular control variable. In the sixth row, we define bank liquid assets using a rough measure of high-quality liquid assets (HQLA), which we calculate as the sum of Treasury securities, agency securities, and agency mortgage-backed securities, excluding securities held for trading purposes. In the seventh row, we find similar results when we only include observations where the nonbank asset share is greater than zero.

Specification	β_1	SE	β_2	SE
1. Baseline	-0.0998^{***}	0.0211	0.2997^{***}	0.0622
2. Trim at 99.5%	-0.055^{**}	0.017	0.1293^{**}	0.0584
3. Trim at 98%	-0.1845^{***}	0.0315	0.4137^{***}	0.1010
4. Log, no trimming	-0.0025^{***}	0.0004	0.0052^{***}	0.0009
5. No controls	-0.1111^{***}	0.0230	0.3013^{***}	0.0616
6. HQLA share as outcome	-0.0669^{***}	0.0163	0.3103^{***}	0.0612
7. Nonbank Asset Share > 0	-0.0706^{***}	0.0190	0.3254^{***}	0.0559

Table B.1: Robustness Checks. This table provides robustness checks for Table 4. For each robustness check, we provide the coefficient estimate and standard error for β_1.

Bank Liquid Assets vs. Intracompany Funding. We next provide robustness checks for the regressions in Table 5, which tests the relationship between bank liquid asset shares and the size of intracompany funding balances due to affiliated nonbanks. The associated specification is provided below.

$$\frac{Bank\ (Cash + Securities)_{it}}{Bank\ Assets_{it}} = \alpha_i + \alpha_t + \beta_1 \left(\frac{Bank\ Bal\ due\ to\ Nonbanks_{it}}{Bank\ Assets_{it}} \right) + \beta_2 \left(\frac{Bank\ Bal\ due\ to\ Nonbanks_{it}}{Bank\ Assets_{it}} \right) \times I(Yr \geq 2012) + \boldsymbol{\gamma^T X_{it}} + \epsilon_{it}$$

In the first row of Table B.2, we provide our baseline coefficients for β_1, which corresponds to the 1990-2011 period, and our baseline coefficients for β_2, which corresponds to the 2012-2022 period. Our baseline is taken from the third column of Table 5.

In the second and third rows, we show that our estimates are robust to alternative trimmings rather than the 99% trimming used in the baseline. In the fourth row, we take the log of the ratio of balances due to nonbanks to bank assets as an alternative to trimming.

In the fifth row, we exclude controls to show that our results are not sensitive to the inclusion of any particular control variable. In the sixth row, we define bank liquid assets using a rough measure of high-quality liquid assets (HQLA), which we calculate as the sum of Treasury securities, agency securities, and agency mortgage-backed securities, excluding securities held for trading purposes. In the seventh row and eighth row, we show similar results when we subset on nonbank asset share greater than zero or bank balances due to nonbanks greater than zero.

Specification	β_1	SE	β_2	SE
1. Baseline	-2.1767^{***}	0.6265	4.1816^{***}	1.0523
2. Trim at 99.5%	-0.9013^{***}	0.3247	3.2428^{***}	0.7256
3. Trim at 98%	-2.4260^{***}	0.8712	3.7785^{**}	1.5725
4. Log, no trimming	-0.0022^{***}	0.0006	0.0052^{***}	0.0013
5. No controls	-2.0282^{***}	0.6254	4.0411^{***}	1.1253
6. HQLA share as outcome	-1.6760^{***}	0.6012	5.4551^{***}	1.1196
7. Nonbank Asset Share > 0	-2.3631^{***}	0.5854	4.6290^{**}	0.9475
8. Bal due to Nonbanks > 0	-2.2027^{***}	0.4731	3.7111^{**}	0.8099

Table B.2: Robustness Checks. This table provides robustness checks for Table 5. For each robustness check, we provide the coefficient estimate and standard error for β_1.

C Additional Figures

Figure C.1: Assets of Commercial Banks Held by BHCs vs. Stand-Alone Commercial Banks. This figure calculates the assets of commercial banks that are held within bank holding companies and the assets of "stand-alone" depository institutions that are not held within bank holding companies. Our data source is the Call Reports. We identify depository institutions held by BHCs by merging the Call Reports with our database of BHC organizational structure.