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The Evolution of Banking in the 21st Century: Evidence and Regulatory Implications

ABSTRACT As revealed by the failures of three regional banks in the spring of 2023, bank runs are not a thing of the past. To inform the ongoing discussion of the appropriate regulatory response, we examine trends in the banking industry over the last twenty-five years. On the liability side of bank balance sheets, deposits—and especially uninsured deposits—have grown rapidly. On the asset side, there has been a notable shift away from the information-intensive lending traditionally associated with banks and toward longer-term securities such as mortgage-backed securities and long-term Treasuries. These trends appear to be related, in the sense that banks with the most rapid growth in deposits have seen the biggest declines in loans as a share of assets. Thus, while the banks that failed in early 2023 were arguably extreme cases, they reflect broader trends, especially among larger banks. We construct a simple model to help assess the main regulatory options to reduce the risk of destabilizing bank

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runs—expanding deposit insurance and strengthening liquidity regulation—and argue that the industry trends we document favor the latter option. Using the model, we offer some design considerations for modifying the liquidity coverage ratio so as to require banks to pre-position sufficient collateral—largely in the form of short-term government securities—at the Federal Reserve's discount window to ensure they have enough liquidity to withstand a run on their uninsured deposits. We also comment briefly on some other regulatory implications of our findings, including for interest rate risk regulation and merger policy.

The late winter and early spring of 2023 saw three of the four largest bank failures in US history, those of Silicon Valley Bank (SVB), Signature Bank, and First Republic Bank, on March 10, March 12, and May 1, respectively. This dramatic episode, and the failures in bank regulation that it revealed, naturally led to calls for a variety of regulatory changes. While we believe that this instinct toward reform is well motivated, in this paper we begin by taking several steps back. We try to sketch some of the broader forces that have been shaping the evolution of the banking industry, and of financial intermediation more generally, over the last quarter century. Our premise in doing so is that only by understanding how the economics of the banking industry have evolved can one begin to think sensibly about how regulation might be best adapted.

We organize our analysis around the two fundamental pillars of banks' business model: making information-intensive loans to borrowers who are risky and opaque and providing deposit-taking and transactions services. We then ask how developments in these two areas have affected banks in different size categories: (1) the largest global banks, the so-called global systemically important banks (G-SIBs), which currently have assets over $700 billion; (2) regional banks, which, for the sake of concreteness, we classify as having assets between $100 billion and $700 billion today; and (3) smaller banks, which have assets less than $100 billion today.[1]

1. Eight US bank holding companies currently qualify as G-SIBs: JPMorgan Chase, Bank of America, Citigroup, Wells Fargo, Goldman Sachs, Morgan Stanley, Bank of New York Mellon, and State Street. The first six of these institutions all have assets above $1 trillion. The two custodian banks—Bank of New York Mellon and State Street—have assets below $700 billion but are systemically important because of the central role they play in settling securities transactions. We recognize that there are no sharp dividing lines based on assets that can fully distinguish banks with different business models. So, for example, a number of banks with assets less than $100 billion might have business models similar to those of some banks with assets over $100 billion. See Financial Stability Board, "2023 List of Global Systemically Important Banks (G-SIBs)," press release, November 27, 2023, https://www.fsb.org/2023/11/2023-list-of-global-systemically-important-banks-g-sibs/.

The idea that banks—and financial intermediaries more generally—create value on the asset side of their balance sheets by screening and monitoring borrowers is perhaps the most venerable and widely accepted view in the academic literature. Diamond (1984) is the classic reference for this asset-side view of what makes banks special. However, the view that banks play a unique role in information-intensive lending has come under increasing pressure in recent decades, as nonbank institutions have steadily gained market share in lending to businesses. These nonbank players include securitization vehicles, mutual funds, and insurance companies that finance portions of syndicated loans—and, in more recent years, private credit funds and business development companies (BDCs) that lend to medium-sized firms. Moreover, it appears that the competition from private credit funds and BDCs has been felt most acutely by regional banks. By contrast, community banks, which tend to specialize in lending to much smaller firms, have been less affected by the growth of nonbank intermediaries.[2]

Another branch of the literature, beginning with Gorton and Pennacchi (1990), emphasizes the value that banks create on the liability side of their balance sheets, via their deposit-taking franchises. There are two logically distinct mechanisms at work here. The first is that some agents in the economy prefer holding absolutely safe assets as a store of value and that bank deposits are an especially good vehicle for providing this safety. Moreover, these same agents tend to be inattentive and will often accept below-market rates on their deposits, perhaps partially in exchange for the amenities provided by their bank—for example, friendly and accessible branch offices.[3]

A second source of value from deposits stems from their unique role in the payments system. In addition to being a safe store of value, bank deposits allow firms and households to transfer resources quickly and efficiently. A firm that uses its bank to handle transactions with its employees, suppliers, and customers is an example of this transactional function.

One of the most striking developments that we document over the last quarter century is a dramatic growth in the economy-wide ratio of bank deposits to GDP, with much of this growth coming from large uninsured deposits. Thus, very crudely put, the business of banking seems to be slowly moving away from a Diamond (1984) world and toward a Gorton and Pennacchi (1990) world. We reflect on some of the underlying causes

2. See Erel and Inozemtsev (2024) for an overview of the causes and consequences of the rise in nonbank lending.

3. To the extent that the value of a bank's deposit franchise comes from paying inattentive depositors less than the market rate (and adjusting for the cost of taking deposits), this is a private source of value but not a social benefit.

of this deposit growth in what follows, though to be clear, we do not have a single, encompassing explanation to offer. However, if one posits that the demand for payments services should scale roughly with GDP, the rapid growth in the ratio of deposits to GDP suggests that some of the action is coming from the safe-store-of-value motive, which might scale more naturally with wealth, rather than GDP.

Putting together these two trends—the migration of information-intensive business lending outside of the banking sector and the rapid growth of bank deposits—the inevitable consequence is a shifting of banks' asset portfolios toward categories where there is less of a presumption that they have a unique comparative advantage. Specifically, and this is especially true for the larger banks that have experienced the greatest competition from nonbank lenders, the share of securities in their portfolios has increased significantly in recent decades. These securities consist primarily of US Treasuries and agency mortgage-backed securities (MBS) whose payments are insured by the government-sponsored enterprises. These securities are free of credit risk, so the only risk that banks face in holding them is interest rate risk. In this sense, the larger banks are beginning to look more like long-term bond mutual funds than they did at the beginning of the century, albeit bond funds that have uninsured liabilities that can be withdrawn on demand at par rather than being equity financed. In what follows, we argue that this observation is of particular relevance when considering questions about whether and how regulators should modify deposit insurance coverage and bank liquidity regulation.

Of course, it can be artificial to frame things by simply contrasting theories wherein banks create value either on the asset side of their balance sheet or the liability side. There can be important synergies between the two sides of the balance sheet. For instance, in Diamond and Dybvig (1983) and Hanson and others (2015), banks can finance portfolios of illiquid loans more efficiently than other types of intermediaries so long as they can issue demand deposits that are not prone to destabilizing runs. With some liberties, this theory might be interpreted as warning that a failure to offer sufficiently broad deposit insurance coverage could interfere with the process of credit creation in the economy. This possibility highlights why it is critical to think about exactly what kinds of assets the marginal bank deposit is financing.

Alternatively, a synergy between the two sides of banks' balance sheets can arise if deposit taking, and the resulting need to hold a buffer stock of high-quality liquid assets as well as the associated access to the central bank's lender of last resort (LOLR) function, give banks a balance sheet–based

edge over nonbank intermediaries in offering on-demand lines of credit (Kashyap, Rajan, and Stein 2002). Consistent with this view, we show that the one area of corporate lending where banks have not lost ground to nonbank intermediaries is in providing loan commitments to firms.

In what follows, we explore both time series and cross-sectional aspects of the abovementioned trends in banks' deposit-taking and lending behavior. We then turn to some of the policy implications of these trends. Here we begin by developing—with the aid of a simple model—a normative perspective on the design of bank liquidity regulation.

The bank failures of early 2023 highlighted a dramatic vulnerability with respect to liquidity risk, created by the combination of rapid growth of uninsured deposits and technological and social media innovations, which appear to have made bank runs more rapid and violent than ever before. As one extreme example, 94 percent of SVB's total deposits were uninsured on the eve of its failure, and 25 percent of its deposits were withdrawn in a single day, forcing its closure by regulators. Moreover, had it opened for business the next day, SVB told regulators it expected to see withdrawals of more than twice that amount in the following twenty-four hours (OIG 2023).

This episode lends urgency to the question of how such heightened run risk can best be mitigated. Two broad categories of options are: (1) increasing the scope of deposit insurance so most deposits are insured and hence unlikely to run; or (2) subjecting uninsured deposits to tougher liquidity requirements so the risk of runs poses a smaller threat to financial stability. Although both options are likely to deliver benefits in terms of mitigating run risk, they entail different costs. On the one hand, expanding deposit insurance would likely create additional moral hazard distortions and expose taxpayers to greater losses. On the other hand, tougher liquidity requirements—that is, requiring banks to hold a larger buffer stock of high-quality liquid assets to cover deposit withdrawals—might crowd out valuable information-intensive lending. The observation that, in both the time series and the cross section, the rapid growth in uninsured deposits has largely been used to fund growth in securities—and not in information-intensive lending—suggests that the costs of tougher liquidity requirements are lower, inclining us to this latter option.

Specifically, we propose a regulatory change that would require larger banks to back their uninsured deposits by pre-positioning collateral—largely in the form of short-term government securities—at the Federal Reserve's discount window. As we explain, the federal banking agencies could implement our proposed regulatory change by modifying current liquidity coverage ratio (LCR) requirements.

Of course, to the extent we have correctly identified some of the key underlying trends that are changing the business of banking, there may be reason to adjust other regulatory policies beyond just the pressing case of liquidity requirements. We focus briefly on two of these. One has to do with the treatment of interest rate risk in the regulatory capital regime. Currently, risk-based capital requirements do not account for the ex ante interest rate risk on long-duration securities like Treasury bonds and MBS. Moreover, even ex post, mark-to-market losses on these securities do not flow through to banks' regulatory capital, except for the largest G-SIBs. We argue that in a world where uninsured deposits make up a much larger share of banks' capital structure than in earlier decades, these policies need to be rethought.

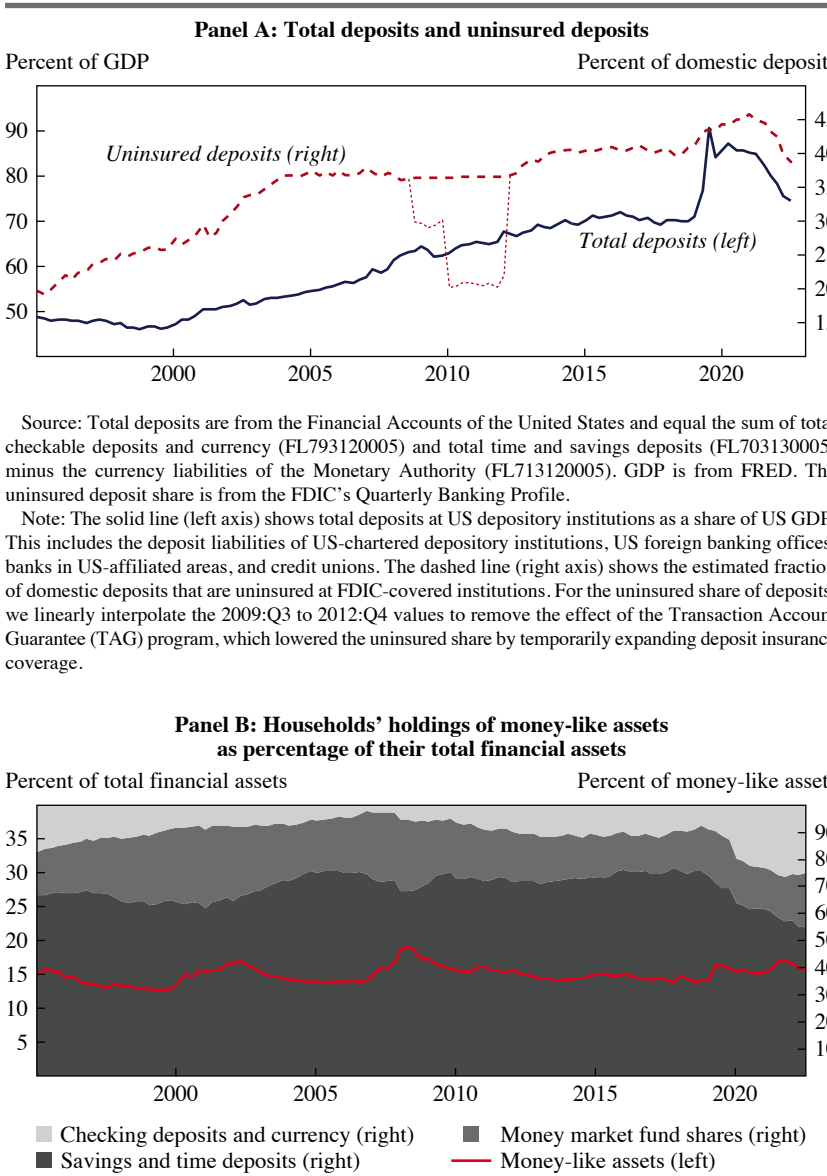
Finally, we turn to merger policy. Our analysis suggests that the business model of regional banks may be particularly vulnerable to the broad forces that are likely to shape the banking industry in the coming years. Unlike the community banks, which focus on relationship lending to the smaller firms in the economy, regionals have lost a good chunk of their core business lending franchise to the nonbank sector. This leaves them disproportionately reliant on their deposit franchises for ongoing viability, at a time when the longer-run durability of these franchises also seems open to question. Moreover, regional banks may not have sufficient economies of scale and scope to compete with the handful of the very largest banks as technological innovation and artificial intelligence become more and more vital to profitability. Mergers within the midsize regional sector might be one helpful mechanism in moving the process of consolidation along, while minimizing harmful medium-term effects on competition and financial stability.

I. The Growth of Bank Deposits

Looking at quarterly data from 1995:Q4 to 2023:Q2, panel A of figure 1 plots the ratio of total deposits in US depository institutions to GDP alongside the ratio of uninsured domestic deposits to total domestic deposits at Federal Deposit Insurance Corporation (FDIC)-insured institutions.[4]

4. To facilitate consistency in this section, our total deposit series in figure 1 comes from the Financial Accounts of the United States and includes US-chartered depository institutions, US foreign banking offices, banks in US-affiliated areas, and credit unions. If we focus on US-chartered depository institutions—a universe that more closely matched the set of FDIC-insured institutions—the ratio of deposits to GDP rises from 41 percent in 1995:Q4 to 63 percent in 2023:Q2.

Figure 1. The Growth of Bank of Deposits



Source: Total deposits are from the Financial Accounts of the United States and equal the sum of total checkable deposits and currency (FL793120005) and total time and savings deposits (FL703130005) minus the currency liabilities of the Monetary Authority (FL713120005). GDP is from FRED. The uninsured deposit share is from the FDIC's Quarterly Banking Profile.

Note: The solid line (left axis) shows total deposits at US depository institutions as a share of US GDP. This includes the deposit liabilities of US-chartered depository institutions, US foreign banking offices, banks in US-affiliated areas, and credit unions. The dashed line (right axis) shows the estimated fraction of domestic deposits that are uninsured at FDIC-covered institutions. For the uninsured share of deposits, we linearly interpolate the 2009:Q3 to 2012:Q4 values to remove the effect of the Transaction Account Guarantee (TAG) program, which lowered the uninsured share by temporarily expanding deposit insurance coverage.

Source: Authors' calculations using data from table B.101 (Balance Sheet of Households and Nonprofit Organizations) from the Financial Accounts of the United States.

Note: The solid line (left axis) shows households' holdings of money-like assets—the sum of checking deposits, savings and time deposits, money market fund shares, and currency in circulation—as a fraction of the households' total financial assets. The right axis shows the fractions of these money-like assets that households hold in the form of checkable deposits and currency, time and savings deposits, and money market fund shares, respectively.

We linearly interpolate the uninsured share of deposits from 2009:Q4 to 2012:Q4 to visually smooth over the effect of the Transaction Account Guarantee (TAG) program, which temporarily lowered the uninsured share by providing unlimited insurance coverage on transaction deposits in the wake of the 2008 global financial crisis.[5] As panel A shows, deposits have grown rapidly relative to GDP over the past thirty years, with much of the growth coming from uninsured deposits. In 1995:Q4, deposits were 49 percent of GDP and the uninsured share was 20 percent. As of 2023:Q2, deposits are 75 percent of GDP and 39 percent of them are uninsured. Simply put, banks are much more deposit rich today than in past decades, but they are also far more exposed to the potential flightiness of uninsured deposits.[6]

This reliance on uninsured deposits is most pronounced for larger banks. As of 2023:Q2, 30 percent of domestic deposits in smaller banks—those with assets under $100 billion—are uninsured. For banks with assets over $100 billion but that are not G-SIBs, the corresponding figure is 39 percent. And for the G-SIBs, it is 51 percent. Indeed, across the latter two categories, 27 percent of banks have an uninsured deposit share than exceeds 50 percent.[7]

To shed some light on the forces driving these trends, figure A1 in the online appendix shows the evolution of a broader measure of money-like assets. Specifically, we decompose deposits into the sum of checkable deposits and savings and time deposits. To arrive at our broader measure of money-like assets, we then add the sum of currency in circulation and money market mutual fund shares. While there are cyclical fluctuations in this broader measure (e.g., money-like assets tend to rise relative to GDP during recessions and market downturns), money-like assets have trended steadily upward in recent decades, rising from 63 percent of GDP

5. The TAG program provided *unlimited* insurance on deposits held in noninterest-bearing transaction accounts for banks that chose to participate. The FDIC created this program in October 2008 using an emergency "systemic risk determination," and it was in effect until the end of 2010. In mid-2010, Congress enacted a similar program for all banks that remained in effect until the end of 2012. See FDIC, "Temporary Liquidity Guarantee Program," https://www.fdic.gov/banker-resource-center/temporary-liquidity-guarantee-program.

6. The uninsured share was also high from the advent of the FDIC in 1934 through the 1970s. However, this was arguably because, adjusted for inflation, insurance limits were much lower in those earlier decades. Thus, what is anomalous is today's combination of a high uninsured share and a generous insurance limit in inflation-adjusted terms.

7. These figures are based on Call Reports data retrieved from Federal Financial Institutions Examination Council (FFIEC), "Central Data Repository's Public Data Distribution," https://cdr.ffiec.gov/public/PWS/DownloadBulkData.aspx. Using these data, we estimate that 41 percent of banks' deposits were uninsured in 2023:Q2. The FDIC estimates that the uninsured share of domestic deposits was 39 percent in 2023:Q2 (figure 1, panel A).

in 1995 to 107 percent of GDP in 2023:Q2. Similarly, even though there are some noticeable cyclical shifts tied to the level of short-term interest rates, the shares of different money-like assets have been fairly stable.[8]

Next, using data from the Financial Accounts of the United States, figure A2 in the online appendix breaks down the holders of money-like assets.[9] Consistent with the well-documented rise in corporate cash holdings (Bates, Kahle, and Stulz 2009; Graham and Leary 2018), the cash holdings of nonfinancial firms and nonbank financial institutions have grown noticeably relative to households' cash holdings. Nonetheless, households still hold the lion's share of money-like assets, accounting for 61 percent as of 2023:Q2 as compared to 27 percent for nonfinancial and financial firms.

Notably, the quantity of deposits and other money-like assets, as well as the uninsured share of deposits, rose sharply following the onset of COVID-19 in 2020. Moreover, checking deposits have grown at record rates since 2020, while the growth in savings and time deposits has languished by comparison. Arguably, some of these recent shifts reflect the heightened precautionary motives associated with the pandemic and the fact that interest rates were at the zero lower bound. In addition, there is also clear evidence from account-level data at JPMorgan Chase that these abnormally large deposit balances are partially due to the outsize fiscal transfers to households during the pandemic (Wheat and Deadman 2023). Finally, Acharya and Rajan (2023) and Acharya and others (2024) have argued that the Federal Reserve's quantitative easing (QE) policies have led to an expansion of uninsured deposit financing, as banks have had to turn to uninsured deposits to fund their much-increased holdings of reserves. Collectively, these factors arguably explain these notable pandemic-era shifts, all of which have begun to reverse in recent quarters. But figure 1, panel A, makes clear that the upward trend in the deposits-to-GDP ratio as well as the uninsured share has been ongoing for decades, predating both the arrival at the zero lower bound and the initiation of QE policies in 2008 as well as the onset of the pandemic in 2020.

8. When the Fed raises its short-term policy rate, the rates that banks pay on checking and savings deposits lag well behind other money market rates (which generally move in lockstep with the Fed's policy rate). Thus, when the Fed raises rates, savers tend to gradually substitute away from lower-yielding checking and savings accounts and toward higher-yielding time deposits and money market fund shares. Conversely, when the policy rate is low, lower-yielding checking and savings deposits tend to grow more rapidly than time deposits. See Drechsler, Savov, and Schnabl (2017).

9. Federal Reserve Board, "Financial Accounts of the United States—Z.1," https://www.federalreserve.gov/releases/z1/.

With respect to the factors that underlie these longer-term trends, we do not have any clear-cut evidence to offer. As noted above, the growth in the ratio of deposits to GDP could reflect a safe-store-of-value motive, which might scale more naturally with wealth, rather than with GDP. Consistent with this view, while total deposits have been growing as a fraction of GDP, panel B of figure 1 shows that households' holdings of deposits and other money-like assets have been quite stable relative to their total financial wealth, suggesting that households' portfolio allocation to money-like assets has been stable over time. Thus, the secular rise in the ratio of deposits to GDP is clearly linked to the secular growth in financial wealth relative to GDP.[10] That said, investors' willingness to hold their safe assets in the form of bank deposits paying less than a market rate—rather than in money market fund accounts, for example—might have been greater, all else being equal, due to the low level of interest rates the United States has experienced in recent decades.

Turning to the upward trend in the uninsured share of deposits, it stands to reason that the secular rise in household wealth inequality and the growth in corporate cash holdings both play some role in driving this trend. However, in the absence of account-level data, it is difficult to say whether or not these are important contributing factors.

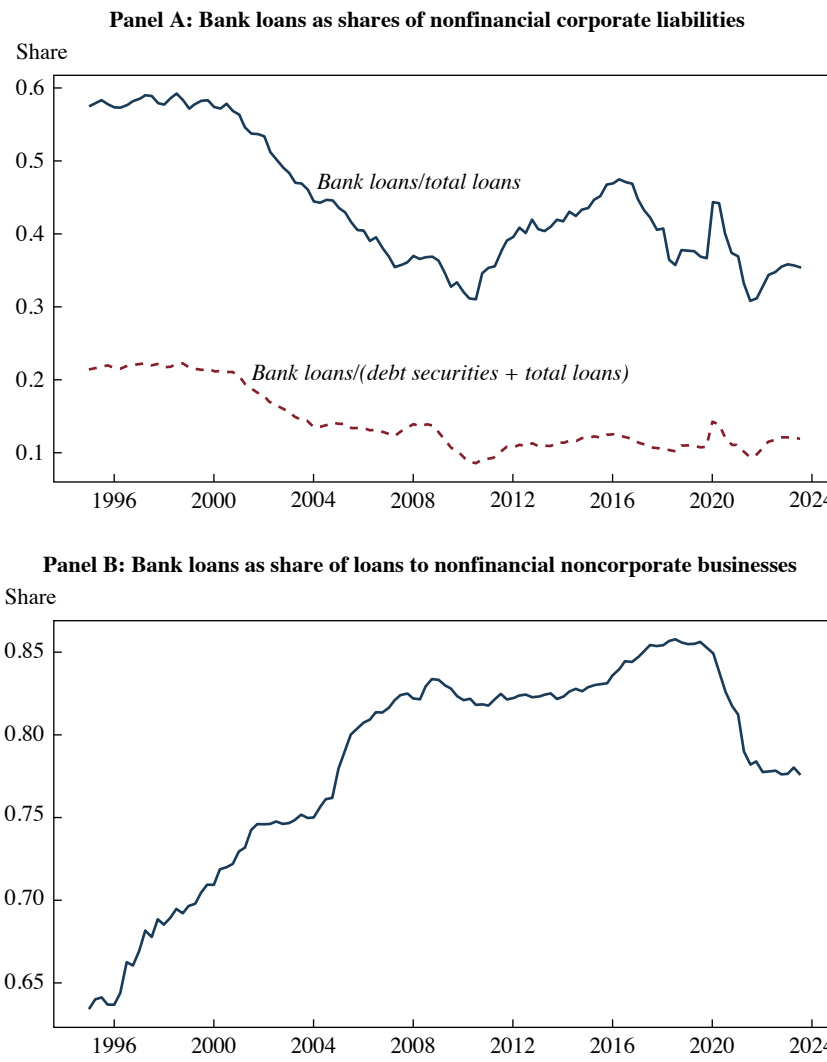
II. The Rise of Nonbank Corporate Lending

Figure 2 presents perspectives on the evolution of bank lending to nonfinancial businesses. Using data from table L.103 of the Financial Accounts of the United States, panel A focuses on nonfinancial corporate businesses. The solid line in the figure shows the ratio of bank loans to nonfinancial corporate businesses divided by total loans to these firms.[11] Importantly, the nonbank component of loans in the Financial Accounts data includes syndicated loans that are held by nonbank investors such as collateralized loan obligations (CLOs), mutual funds, insurance companies, and pension funds, but it *does not include* lending originated by private credit funds

10. Both Lopez-Salido and Vissing-Jorgensen (2023) and Buchak and others (2024) have previously noted that bank deposits have accounted for a stable fraction of household wealth in recent decades.

11. We exclude commercial mortgages from both the numerator and denominator since the Financial Accounts data do not break down commercial mortgages to nonfinancial corporations into those held by banks versus nonbanks.

Figure 2. Bank Lending to Nonfinancial Businesses



Source: These figures are compiled using data from the Federal Reserve Board's Financial Accounts of the United States. Panel A uses series FL103168005.Q (bank loans), FL104123005.Q (loans), FL103165005.Q (mortgages), and FL104122005.Q (debt securities). Panel B uses series FL113168005.Q (bank loans) and FL113169005.Q (other loans and advances).

Note: In panel A, using data from table L.103 (Nonfinancial Corporate Business) from the Financial Accounts of the United States, the solid line shows bank loans (excluding mortgages) as a fraction of total loans (excluding mortgages) to nonfinancial corporate businesses. The dashed line adds corporate bonds to the denominator, plotting bank loans as a fraction of total loans plus corporate bonds. Panel B, using data from table L.104 (Nonfinancial Noncorporate Business) from the Financial Accounts of the United States, the solid line shows bank loans as a fraction of total nonmortgage loans to nonfinancial noncorporate businesses.

and business development companies (BDCs).[12] The dashed line in the figure adds corporate bonds and other debt securities to the denominator, showing bank loans to nonfinancial corporations as a share of all forms of credit (again, excluding loans from private credit funds and BDCs as well as mortgages).

Even before accounting for private credit funds and BDCs, panel A of figure 2 shows that banks currently provide a much smaller share of credit to nonfinancial corporations than they did at the turn of the century. As of 2023:Q3, bank loans account for only 35 percent of total nonmortgage loans and just 13 percent of total nonmortgage credit to nonfinancial corporations, down from 57 percent and 23 percent, respectively, in 2000:Q4. Naturally, banks also account for a similarly small fraction of the total growth in corporate credit over the past decade. From 2013:Q4 to 2023:Q3, bank loans to nonfinancial corporations grew by roughly $700 billion. By contrast, nonbank loans to nonfinancial corporations grew by $1.6 trillion and debt securities grew by almost $3.1 trillion. Thus, bank loans account for 30 percent of the growth in total corporate loans and 13 percent of the growth in all corporate credit over the last decade.

Importantly, the trends seen for nonfinancial corporations do not show up when we look at lending to the noncorporate nonfinancial sector. As shown in panel B of figure 2, this sector, which can be thought of as capturing the smaller, unincorporated businesses in the economy, continues to be highly bank-dependent. The solid line in panel B displays the same construct as the solid line in panel A—bank loans to total nonmortgage loans—but for the unincorporated firms the bank share actually rises in the early part of the sample and has fluctuated between roughly 80 percent and 85 percent over the last twenty years. This divergence suggests that nonbanks are thus far not making meaningful inroads in lending to the smallest firms. This in turn implies that they pose less of a competitive threat to the small banks, whose lending business is largely dependent on relationships with these small firms. Rather, it is the lending model of the larger regional banks that appears to be most exposed to competition from nonbanks.

12. "Private credit" refers to nontraded commercial credit instruments that are originated and funded by nonbank institutions. Historically, private credit was used to finance midsize firms with revenues between $10 million and $1 billion. However, in recent years, private credit has been competing more directly with the syndicated loan market, which caters to larger firms. The biggest recent providers of private debt have been private credit funds and BDCs. Private credit funds are finite-horizon, closed-end funds that primarily invest in private credit instruments. BDCs also invest in private credit but are perpetual, closed-end funds that are financed using public equity and bond issues.

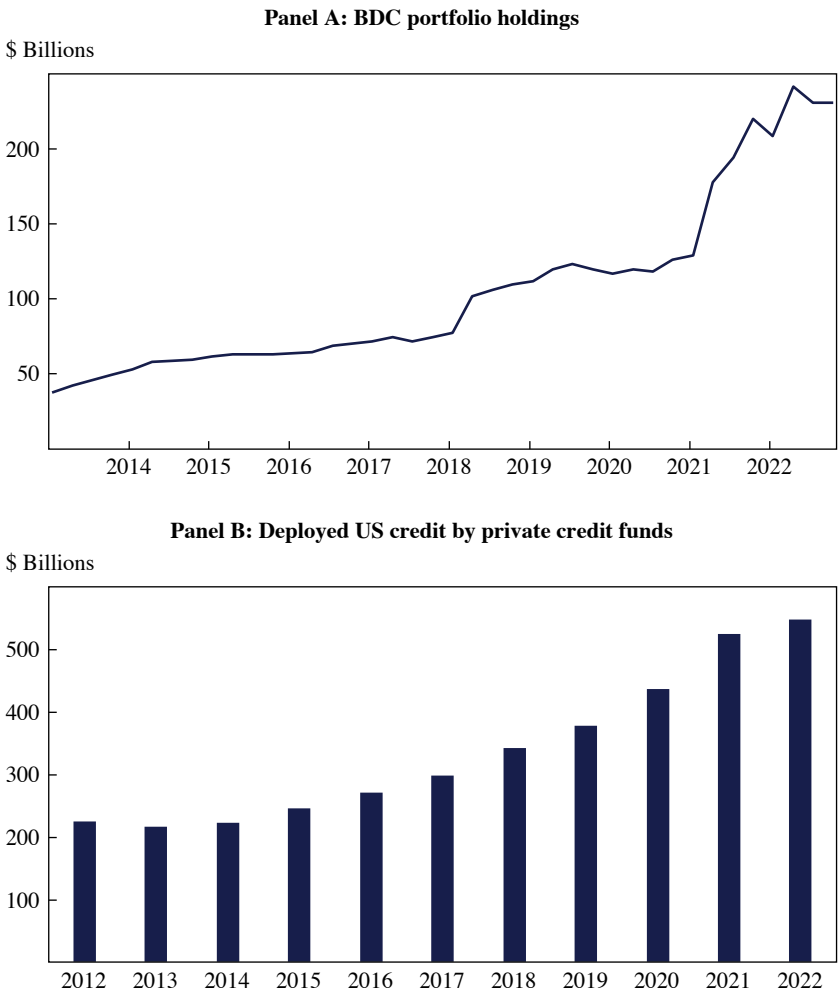
Returning to the corporate nonfinancial firms, the erosion in the bank share of credit to these firms—apparent in the solid line in panel A of figure 2—comes between 2000 and the onset of the global financial crisis in 2008. This is in part due to the rapid growth of nonbank leveraged lending during this period. Figure A3 in the online appendix documents the growth of the leveraged lending market by lender type over the 1996 to 2023 period. The leveraged lending market has always been dominated by nonbank financial institutions, including CLOs, mutual funds, insurance companies, and pension funds. Thus, rapidly growing leveraged lending represents an aggregate substitution away from bank-provided finance. Specifically, participation in the leveraged loan market by nonbank institutions grew from almost nothing in 2000, to about $400 billion on the eve of the global financial crisis and stands at around $1.2 trillion today.

As noted above, panel A of figure 2 presents an incomplete picture of nonbank competition in lending to the corporate sector, because the data underlying the figure do not include private credit funds and BDCs, which grew very rapidly in the post–global financial crisis period. This can be seen in figure 3. Panel A of figure 3 plots loans held by BDCs. Total lending by BDCs has grown from about $40 billion in 2013 to $230 billion today. To benchmark these magnitudes, over the same period, total bank loans to nonfinancial corporations have grown by $700 billion. So, the incremental market share captured by BDCs alone is economically quite significant.

Panel B of figure 3 plots an estimate of the deployed capital of US private credit funds. Since 2013, deployed capital by private funds—a concept broadly analogous to loans on their books—has grown by about $300 billion. Thus, the combined lending to nonfinancial corporations from BDCs and private credit funds has grown by almost $500 billion since 2013. This figure is roughly in the same ballpark as the $700 billion increase in bank loans to nonfinancial corporations over the past decade. So, even excluding all other more established forms of nonbank finance to firms, such as the leveraged loan market and the corporate bond market, these two relatively new sources of nonbank credit alone are now very significant competitors in an important segment of the corporate lending market.

One place where banks have not lost any appreciable ground is when it comes to providing commitment-based revolving loans to corporations. According to Shared National Credit Program data as of 2022:Q2, banks hold over 97 percent of the $1.4 trillion of outstanding syndicated revolving loans (OCC, Federal Reserve Board, and FDIC 2023a). By contrast, banks hold only 26 percent of the $1.5 trillion of outstanding term loans. This implies that almost all the gains in market share that nonbank lenders

Figure 3. The Growth of Nonbank Lending



Source: Panel A is compiled using data from Pitchbook/LCD; panel B is compiled using data from Pitchbook.

Note: Panel A plots total loans held by BDCs. In panel B, US values of private debt assets under management (AUM) are estimated using Pitchbook data on global private debt AUM and applying a rolling five-year average of the US share of global fundraising.

have made in corporate lending have come in the market for installment credit. These findings are consistent with the view in Kashyap, Rajan, and Stein (2002) that deposit taking, and the resulting need to hold a buffer stock of high-quality liquid assets as well as the associated access to the central bank's lender of last resort function, gives banks a particular comparative advantage over nonbanks in supplying on-demand lines of credit.[13]

What explains these trends? At a high level there are two main forces that might explain banks' declining share of credit intermediation. First, the migration away from banks might be driven by advances in informational, contracting, and organizational technologies—for example, the development of securitization or new underwriting techniques by nonbanks. Second, the migration away from banks might be due to changes in financial regulation. Using a structural approach, Buchak and others (2024) find that changes in technology and the deepening of securities markets account for the considerable migration of credit intermediation away from banks that was witnessed from the 1970s to the 1990s. While this migration has continued since 2000—in part due to the heightened regulation of banks since the 2008 global financial crisis—they show that the rate of migration has decelerated. Reviewing the recent literature, Erel and Inozemtsev (2024) survey the evidence that heightened bank regulation has contributed to migration since 2008. At the same time, there is also strong evidence that nonbank lenders have been far more innovative and that these technological shifts have also contributed to migration since 2008 (Lerner and others 2024; Schneider, Strahan, and Yang 2023).

III. Implications for Bank Portfolio Shares

The combination of these two broad trends—rapid deposit growth and strong competition from nonbank providers of corporate credit—has, not surprisingly, left a mark on the composition of bank balance sheets. This is shown in table 1, which documents changes in banks' asset mix from 2000 to 2023. There are three panels in the table. Panel A examines the aggregate

13. The idea is that banks have a balance sheet–driven—as opposed to informational—advantage in extending revolving lines of credit. Since revolving loans can be drawn down on demand by borrowers, they have a similar contingent liquidity profile to demand deposits. Thus, to the extent that loan commitment drawdowns are imperfectly correlated with deposit withdrawals, a financial institution that combines deposit taking with commitment-based lending can economize on its costly buffer stocks of high-quality liquid assets. Empirically, loan commitment drawdowns tend to be strongly negatively correlated with deposit withdrawals in the time series, implying that banks have a significant advantage in making commitment-based loans (Gatev and Strahan 2006; Li, Strahan, and Zhang 2020).

Table 1. Bank Balance Sheet Shares (Percentage of Total Assets)

	(1) *Loans (percent)*	*(2)* *C&I loans (percent)*	*(3)* *Cash & securities (percent)*	*(4)* *Cash & securities < 3yrs (percent)*	*(5)* *Securities > 3yrs (percent)*	*(6)* *Reserves (percent)*
Panel A: All banks						
2000	60	17	27	n/a	n/a	0
2005	57	11	28	15	13	0
2010	53	9	30	18	12	5
2015	51	12	36	22	14	10
2020	52	13	35	21	14	7
2023	50	11	38	22	17	8
Panel B: Banks with less than $100 billion of assets (in $ 2023)						
2000	62	14	32	16	15	1
2005	64	11	29	15	14	0
2010	64	11	28	16	12	6
2015	65	12	29	14	15	5
2020	68	13	24	13	12	5
2023	65	12	28	12	15	5
Panel C: Banks with more than $100 billion of assets (in $ 2023)						
2000	61	20	24	n/a	n/a	0
2005	55	11	27	14	12	0
2010	49	9	33	21	12	5
2015	51	13	35	21	14	10
2020	51	14	36	21	15	8
2023	49	12	39	22	16	9

Source: Authors' compilation using data from FFIEC.
Note: The set of banks with over $100 billion of assets in 2023 dollars is not constant over time; it has grown as many banks have grown faster than inflation.

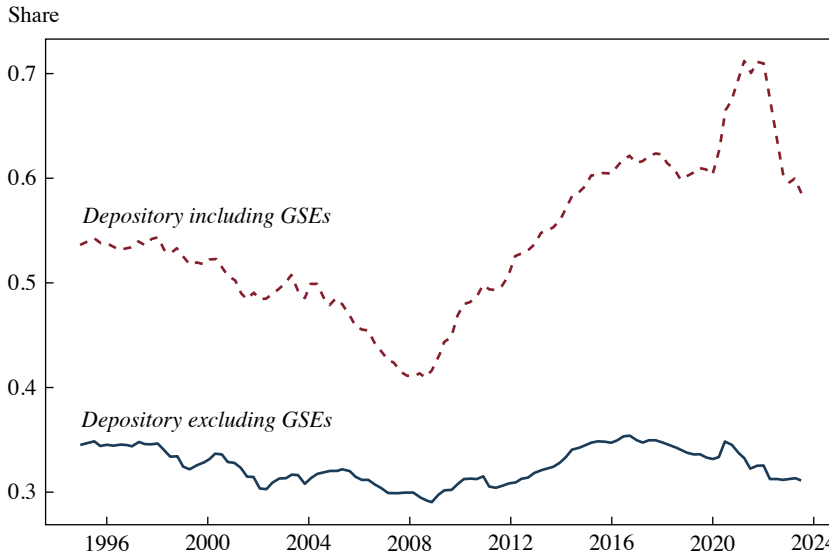
balance sheet of the entire banking sector over time and displays the share of bank assets represented by the following categories: (1) total loans; (2) commercial and industrial (C&I) loans; (3) total cash and securities; (4) cash and securities with a maturity of less than three years; (5) cash and securities with a maturity of greater than three years; and (6) central bank reserves. Panel B repeats the exercise but focuses only on those smaller banks with assets of less than $100 billion in 2023 dollars in each period. Panel C covers the complementary set, those larger banks with assets of greater than $100 billion.

Focusing on the panel C, we see that for larger banks total loans have fallen from 61 percent of assets in 2000 to 49 percent of assets in 2023. Moreover, almost all of this 12 percentage point decline is accounted for by the C&I category, where loans have fallen by 8 percentage points of assets, from 20 percent to 12 percent. Interestingly, however, this share has been roughly flat in the post–global financial crisis era, despite the very strong growth of private credit funds and BDCs, which one might have expected would have driven the bank portfolio share in C&I lending even lower. We suspect that the resolution to this apparent paradox is that overall loan demand, and hence aggregate lending volume, was very strong during this period of generally low interest rates and easy credit conditions. Mechanically, even if banks are losing a considerable share of the market for corporate loans, but at the same time the total size of the market is growing briskly, banks' volume of corporate lending may be holding up better than it otherwise would. Of course, a corollary of this reasoning is that if the growth of aggregate loan demand slows in the current higher interest rate environment and the nonbank providers of credit retain their higher market shares, banks' portfolio shares in C&I lending may decline even further.

The flip side of a reduced share of loans on bank balance sheets is an increased share of cash and securities. For the larger banks in panel C of table 1, we see that cash and securities have gone from 24 percent of assets in 2000 to 39 percent of assets in 2023, representing a quite dramatic reconfiguration of their balance sheets.[14] Furthermore—and this observation will be crucial when we turn to policy implications—even as total securities holdings have gone up, and even as these securities holdings are now increasingly funded with uninsured rather than insured deposits, the share of assets accounted for by securities with maturities over three years has actually increased somewhat, from 12 percent in 2005 to 16 percent today. This is important because, as the Silicon Valley Bank (SVB)

14. This trend is also emphasized by Stulz, Taboada, and van Dijk (2024).

Figure 4. Bank Share of One-to-Four-Family Residential Mortgages, Excluding Fed's Holdings



Source: Figure compiled using data from Flow of Funds (Federal Reserve Board): table L.109 (Monetary Authority), series LM713061705.Q; table L.110 (Private Depository Institutions) series LM703061705.Q; and table L.218 (One-to-Four-Family Residential Mortgages) series FL763065105.Q, FL893065105.Q, FL753065103.Q, FL743065103.Q, and FL473065100.Q. GSE = government-sponsored enterprise.

episode has taught us, an especially combustible mix is the combination of: (1) interest-rate risk coming from long-maturity securities holdings; and (2) a large proportion of runnable uninsured deposits (Drechsler and others 2023). Even if one believes that sticky and effectively long-duration insured deposits are a sensible way to fund long-duration securities, the same cannot be said for more run-prone uninsured deposits.

What are the long-duration securities that have become increasingly important on larger banks' balance sheets? Mortgage-backed securities (MBS) play a leading role. And indeed, the growth of their MBS holdings has helped turn banks into the leading private players in the mortgage market. This is illustrated in figure 4, which plots banks' share of the one-to-four-family residential mortgage market, where the total size of the market is defined excluding the Federal Reserve's holdings via its QE programs. There are two lines in the figure. The lower solid line captures banks' share of the whole loan mortgage market. As can be seen, banks are less prominent in terms of holding whole loans, with a market share that

has fluctuated between roughly 30 percent and 35 percent over the last few decades but that shows no discernible trend.

The story looks very different when we examine the upper dashed line, which presents banks' share of the combined whole loan and agency MBS mortgage markets. Here the bank share soars from about 40 percent in 2008 to over 70 percent in 2021, before retracting somewhat to around 60 percent in 2023. In other words, their growth in MBS holdings is entirely responsible for banks' much increased presence in the overall mortgage market in recent years.

A first reaction to figure 4 might be that the rise in banks' share of the MBS market since 2008 is a mechanical reflection of the Fed's large purchases of MBS. This is not quite right. It is true that the Fed has taken a lot of MBS out of private hands, so that the bank share of the private market would mechanically grow even if bank holdings were not increasing in absolute dollar terms. But this fact still leaves the question why it is other nonbank private holders of MBS, such as bond mutual funds, that have been most willing to cede their MBS to the Fed. Said differently, bank demand for MBS has increased very strongly *relative* to MBS demand from other private investors over the last fifteen or so years. And these other investors are quite capable of intermediating agency MBS. Apparently, the combination of banks' eroding position in the corporate credit market and their large deposit inflows has given them a powerful appetite for MBS.[15]

Going back to table 1, it is instructive to compare the trends in balance sheet composition for the larger banks in panel C to those for the smaller (less than $100 billion in assets) banks in panel B. In sharp contrast to the larger banks, the smaller banks have not seen any noticeable decline in the share of either total loans or C&I loans on their balance sheets. For example,

15. Banks are overweight with MBS relative to a passive US government bond fund that owns Treasuries and agency-backed MBS in proportion to their outstanding market values. Specifically, Treasury and agency securities currently make up roughly 78 percent of banks' securities portfolio. Within this government securities bucket, banks currently hold 70 percent of their assets in agency MBS and the rest in Treasuries. By contrast, a value-weighted government bond fund would hold roughly 32 percent of its assets in agency MBS. (The numbers on bank portfolios are calculated from the Call Reports, and the bond fund figure is the ratio of outstanding agency MBS to outstanding marketable Treasury debt.) Although we cannot offer definitive proof, we suspect that banks' preference for MBS reflects the facts that MBS receive nearly as favorable regulatory treatment but offer higher yields than Treasuries. The analogy is not exact, but agency MBS are similar to callable Treasury bonds and thus offer a meaningful yield spread over Treasuries because MBS holders are short a valuable call option. However, since banks are typically concerned with the reported interest income on their securities—that is, banks care about yield and not simply total returns—they may perceive MBS as being more attractive than Treasuries; see Hanson and Stein (2015).

total loans are 62 percent of small bank assets in 2000 and 65 percent of small bank assets in 2023. Correspondingly, cash and securities are also roughly stable for small banks over the same period, going from 32 percent of assets to 28 percent of assets. This fits closely with the conclusion that we drew from the comparison of lending to nonfinancial corporate firms versus nonfinancial noncorporate firms in panels A and B of figure 2. Given that nonbank lenders have not gained significant market share in lending to the smallest firms in the economy, their growth has not made a discernible impact on the balance sheets of small banks. Instead, it is the larger regional banks whose business has been most disrupted by the increasing importance of nonbank credit providers.

IV. Cross-Sectional Evidence

A simple way to summarize our interpretation of the aggregate time series trends above is to say that, for the banking sector as a whole, deposit growth has outstripped growth in traditional lending opportunities in recent years. This contrasts with a situation where lending opportunities are growing rapidly, and banks must bid aggressively to raise additional deposits to finance an expansion of their lending portfolios. To further bolster our preferred interpretation, it is helpful to look in more detail at the cross section of banks. In table 2, we run the following cross-sectional regression over the 2010–2023 period:

$$\left(\frac{Y}{A}\right)_{i,2023} - \left(\frac{Y}{A}\right)_{i,2010} = \alpha + \beta \cdot \ln\left(\frac{Deposits_{i,2023}}{Deposits_{i,2010}}\right) + \varepsilon_i,$$

where A is total bank assets, and Y refers to a variety of specific asset categories (e.g., total loans, commercial and industrial [C&I] loans, cash, securities, etc.). Thus, we are asking how deposit growth over the 2010 to 2023 period has been correlated with changes in asset composition in the cross section of banks. Panel A of table 2 displays the results for the set of banks with assets over $1 billion in current dollars, and panel B focuses on the smaller set of large banks (twenty-three observations) that currently have over $100 billion in assets.

Looking first at panel B, we see that among the larger banks, more rapid deposit growth is correlated with a decline in the share of total loans to assets, the share of C&I loans to assets, and the share of C&I plus owner-occupied commercial real estate (CRE) loans to assets. Correspondingly, more rapid deposit growth is associated with a sizable increase in the share

Table 2. Regression of Change in Bank Asset Shares on Deposit Growth from 2010 to 2023

	(1) *Total loans*	*(2)* *C&I loans*	*(3)* *C&I & CRE loans*	*(4)* *Cash & securities*
Panel A: All banks				
Change in log deposits	3.572 (1.243)***	0.827 (0.575)	–0.808 (1.002)	–1.757 (1.079)
Observations	814	814	814	814
R^2	0.030	0.006	0.002	0.007
Panel B: Large banks				
Change in log deposits	–8.386 (1.374)***	–4.479 (0.887)***	–0.576 (1.180)	6.709 (2.267)***
Observations	23	23	23	23
R^2	0.259	0.229	0.003	0.194

Source: Call Reports from FFIEC.

Note: "C&I & CRE loans" includes all C&I loans plus loans secured by owner-occupied nonfarm nonresidential properties. Estimated at the regulatory high-holder or standalone bank level. Excludes Goldman Sachs, Capital One, Morgan Stanley, State Street, American Express Bank, and Discover Bank. Standard errors are robust to heteroskedasticity.

of cash and securities to assets. In terms of economic magnitudes, the point estimates imply that a one standard deviation increase in deposit growth is associated with a 4.1 percentage point decline in the ratio of loans to assets, offset by a 3.3 percentage point rise in the ratio of cash and securities to assets. Given the purely descriptive nature of these regressions, we are hesitant to read too much into the coefficient estimates. Nevertheless, they fit qualitatively with the inference we have drawn from the time series, namely that, especially among the larger regional banks, deposit growth has led to a reduced share of loans on the balance sheet and an increased share of cash and securities.

Panel A covers all banks and, importantly, weighs them all equally, so that the results are driven primarily by the smaller banks. Here, the patterns are directionally reversed, and the statistical significance is spotty. Now a one standard deviation increase in deposit growth between 2010 and 2023 is associated with a rise in the ratio of loans to assets of 2.3 percentage points and a decline in the ratio of cash and securities to assets of 1.1 percentage points.

We next turn to the role of uninsured deposits more specifically. It could be the case that uninsured deposits are particularly important for funding lending on the margin—perhaps because banks turn to the uninsured wholesale deposit market when their lending opportunities are too expansive to be funded by their retail deposit bases. This turns out not to be the case.

Table 3. Cross-Sectional Regressions of 2023:Q2 Asset Shares versus Uninsured Deposit Intensity

	(1) *Loans*	*(2)* *Cash & securities*	*(3)* *Cash & securities ≤ 3yrs*	*(4)* *Cash & securities > 3yrs*	*(5)* *Reserves*
Uninsured deposits/ assets	–0.133*** (0.051)	0.131*** (0.050)	0.072* (0.043)	0.059* (0.031)	0.052** (0.021)
Deposits/ assets	0.415*** (0.113)	–0.090 (0.112)	–0.309*** (0.096)	0.220*** (0.036)	–0.267*** (0.076)
Observations	814	814	814	814	814
R^2	0.073	0.018	0.071	0.053	0.141

Source: Call Reports from FFIEC.

Note: The sample includes all banks with assets greater than $1 billion in 2023 dollars. A one-unit increase in the independent variable or dependent variable represents a 1 percentage point increase in the variable as a share of assets. Includes banks with at least $1 billion in assets (in 2023 dollars). Excludes Goldman Sachs, Capital One, Morgan Stanley, State Street, American Express Bank, and Discover Bank. Estimated at the regulatory high-holder or standalone bank level. Standard errors are robust to heteroskedasticity.

To see why, table 3 examines the cross-sectional relationship between balance sheet shares and the composition of deposits. Specifically, for a single cross section in 2023:Q2, and for the sample of the 814 banks with assets over $1 billion, we regress bank asset shares on uninsured deposits as a share of assets, controlling for total deposits as a share of assets. In other words, we are asking how asset composition changes as insured deposits are swapped for uninsured deposits, holding fixed total deposits.

The first column of table 3 shows that while the loans-to-assets ratio is positively correlated with the ratio of total deposits to assets, it is negatively correlated with the ratio of uninsured deposits to assets. A one standard deviation increase in the uninsured deposits-to-assets ratio is associated with a 1.8 percentage point decline in the loans-to-assets ratio. The remaining columns of the table show that this decline in loans is mirrored by a rise in cash and securities, with this increase roughly equally divided between reserves, cash and securities with maturities of three years or less excluding reserves, and securities with maturities greater than three years.

These results are again broadly consistent with the aggregate time trends documented above. In the aggregate, uninsured deposits have grown rapidly even as loans have declined as a fraction of assets. Similarly, in the cross section, high uninsured deposits are associated with less lending, not more. To some extent, this could reflect privately optimal liquidity management

Table 4. Regression of Bank Market-to-Book on Deposit and Loan Characteristics

	(1) *All banks*	*(2)* *Small banks*
Average deposit rate (pp)	–0.343***	–0.320***
	(0.076)	(0.069)
Average loan rate (pp)	0.043	0.051*
	(0.027)	(0.027)
Log deposits	0.581***	0.655***
	(0.120)	(0.121)
Log loans	–0.121	–0.173
	(0.114)	(0.114)
Log branches	–0.096*	–0.115**
	(0.048)	(0.046)
Log noninterest expense	–0.394***	–0.404***
	(0.116)	(0.114)
Log employees	0.017	0.060
	(0.098)	(0.092)
Bank-year observations	3,304	3,137
Within R^2	0.077	0.090

Source: Call Reports (retrieved from FFIEC) and S&P Capital IQ.

Note: This table reports annual panel regressions of a bank's market-to-book ratio on its deposit and loan characteristics. The regressions include year fixed effects and are estimated over the 2010 to 2023 period. All regressions exclude banks with less than $1 billion in assets in 2023 dollars as well as Goldman Sachs, Capital One, Morgan Stanley, BNY Mellon, State Street, American Express Bank, and Discover Bank. All banks owned by the same bank holding company in a particular year are collapsed into a single observation. "Small banks" include banks with $1 to $100 billion of assets in 2023 dollars. Standard errors are clustered by quarter and bank holding company (i.e., regulatory high holder).

in a world with deposit-led growth and modest lending opportunities. Banks flush with more uninsured deposits might be mindful that these deposits are potentially flighty and therefore hold larger liquidity buffers. However, it is worth noting that these liquidity buffers are held largely in the form of longer-maturity securities, and indeed, as uninsured deposits go up the cross section, so too does the share of longer-maturity securities on the balance sheet. As argued by Drechsler and others (2023), if uninsured deposits are vulnerable to run risk, this run risk may actually be exacerbated to the extent that these deposits are funding long-duration securities.

Finally, in table 4 we examine the importance of banks' deposit and lending franchises for bank equity valuations using a simplified version of the empirical strategy from Egan, Lewellen, and Sunderam (2022). The goal is to assess the degree to which each activity contributes to the private value of banks as seen by their shareholders. This private value may not be perfectly aligned with the social value banks create, but it is directly

measurable from equity valuations. Table 4 considers a sample from 2010 to 2023 and estimates panel regressions of the form:

$$\left(\frac{M}{B}\right)_{it} = \alpha_t + \beta_D \cdot r_{it}^{Deposit} + \beta_L \cdot r_{it}^{Loan} + \gamma_D \cdot \ln\left(Deposits_{it}\right) + \gamma_L \cdot \ln\left(Loans_{it}\right) + \boldsymbol{\delta}' \mathbf{x}_{it} + \varepsilon_{it},$$

where $(M/B)_{it}$ is the market-to-book ratio of bank i in year t, $r_{it}^{Deposit}$ is the average net-of-fee rate that bank i pays its depositors, and r_{it}^{Loan} is the average rate that it earns on its loans. The regression asks how much a decrease in deposit rates or an increase in loan rates raises bank equity valuations, holding fixed the scale of deposit taking and lending. We include year fixed effects so that the coefficients are identified from cross-sectional variation across banks in a given year rather than variation over time.

Column 1 of table 4 examines all publicly listed banks with assets over $1 billion in current dollars. The coefficient on deposit rates, β_D, is negative and significant, indicating that, as expected, banks that pay their depositors lower interest rates have higher equity valuations. The coefficient on loan rates, β_L, is positive: banks that earn higher rates on their loans also have higher valuations. However, the coefficient is close to zero in magnitude and is insignificant, suggesting that for all banks, the deposit franchise contributes far more to stock market value than the lending franchise.[16] Column 2 shows that we obtain similar results if we restrict attention to the subset of banks with assets of less than $100 billion.

The difference between the value created by deposits and the value created by the lending business can be better understood by decomposing the market-to-book ratio into the price-to-earnings ratio and the earnings-to-book ratio (return on equity). In untabulated results, we find that lower deposit rates and higher loan rates both increase the earnings-to-book ratio—that is, both increase bank profits. However, lower deposit rates do not affect the price-to-earnings ratio, while higher loan rates are correlated with lower price-to-earnings ratio. In other words, stock market investors treat banks with higher loan rates as riskier and hence penalize their valuations accordingly. But they do not treat banks with lower deposit rates in the same way.

16. Using a more sophisticated empirical approach, Egan, Lewellen, and Sunderam (2022) reach a similar conclusion.

To summarize our empirical findings: over the last twenty-plus years, banks have seen rapid growth in their deposits, with much of this growth coming from uninsured deposits. At the same time, larger banks—those broadly categorized as regional banks—have faced increasing competition on the lending side from a variety of nonbank players, including most recently the fast-growing private credit and business development companies (BDC) sectors. As a result of these two forces, the asset portfolios of the regional banks have shifted significantly away from lending and toward holdings of long-term securities, specifically long-term Treasury bonds and MBS. These time series patterns also have analogs in the cross section, where we find that those banks with the fastest growth of deposits in recent years have seen the biggest declines in lending as a share of assets and the biggest increases in cash and securities as a share of assets.

In what follows, we ask how these observations about the evolution of the banking system should shape one's views toward bank regulation in general, and particularly toward liquidity regulation—that is, regulatory efforts to mitigate the run risks posed by much increased levels of uninsured deposits in the system.

V. Policy Implications

We now turn to policy implications. We discuss three topics: (1) the design of deposit insurance and liquidity regulation—specifically, how best to deal with the run risk created by large amounts of uninsured deposits in the banking system; (2) how capital regulation might be adjusted to deal with interest rate risk on banks' securities holdings; and (3) merger and competition policy. The first of these, deposit insurance and liquidity regulation, involves some subtle trade-offs, and we sketch a simple model to help clarify the issues.

V.A. Deposit Insurance and Liquidity Regulation

As noted above, 39 percent of all domestic deposits currently held in US banks are uninsured, an increase of 19 percentage points from 1995. And for banks with more than $100 billion in assets, 27 percent of banks have uninsured deposits greater than 50 percent of their total domestic deposits. The bank failures of early 2023 highlighted the run risks associated with large amounts of uninsured deposits, and it now seems clear that technology and social media have, in certain circumstances, made these uninsured deposits more vulnerable to extraordinarily rapid and intense

runs (Benmelech, Yang, and Zator 2023; Cookson and others 2023; Koont, Santos, and Zingales 2023).

The question we take up in this section is how best to address the run risk associated with this large volume of uninsured deposits. Our basic premise is that increased equity capital requirements alone, while helpful, are not sufficient for this task. There also needs to be a distinct and robust liquidity-oriented regime to complement capital regulation.

One obvious way to reduce the run risk associated with this high current level of uninsured deposits would be simply to expand the scope of deposit insurance coverage. As recently detailed by the Federal Deposit Insurance Corporation (FDIC), there are various options under this umbrella, from raising the deposit insurance limit somewhat from its current value of $250,000, to fully insuring business payment accounts, all the way to fully insuring all domestic deposits (FDIC 2023). Proponents of more aggressive versions of this approach sometimes argue that because uninsured depositors rarely are subject to losses in bank failures, these deposits are already de facto insured. So, the argument goes, one might as well make this insurance explicit and thereby eliminate run risk. Further, extending insurance to all deposits would entail banks paying higher deposit insurance premia, thereby forcing at least partial internalization by banks of the associated costs.

As a practical matter, it seems unlikely that Congress will expand deposit insurance coverage, at least in the foreseeable future. Thus, a response to run risk will almost surely need to be fashioned under the existing authority of the federal banking agencies. Political constraints aside, though, there are potentially important costs associated with a significant expansion of deposit insurance. Because deposit insurance can never be perfectly risk sensitive, expanding coverage will arguably create some additional moral hazard costs.[17] These costs could arise because deposit insurance distorts banks' ex ante risk-taking decisions in normal times—for example, by encouraging banks to invest in excessively risky assets—or banks' decisions after they have suffered large losses—for example, by allowing zombie banks to either lumber on or, even worse, to gamble for

17. Of course, the FDIC should strive to minimize the extent of moral hazard by making the insurance regime appropriately risk sensitive. However, since asset risk is not observable and since banks will arguably always know more about the risk of their assets than the FDIC, deposit insurance entails moral hazard costs. Thus, policymakers need to solve the second-best problem that involves trading off the run-stopping benefits of deposit insurance against its moral hazard costs in terms of distorting banks' decisions relative to the first best.

resurrection.[18] In its May 2023 review of options for deposit insurance reform, the FDIC also evinced concern about the impact of such a change in policy on the adequacy of the deposit insurance fund and the dynamics of wholesale funding markets (FDIC 2023).

An alternative approach to reducing run risk is to strengthen liquidity regulation by, for example, modifying the liquidity coverage ratio (LCR) to require uninsured deposits to be largely backed with Treasury bills (T-bills) and other short-term Treasuries. The LCR, which currently only applies to very large banks, requires that banks maintain sufficient high-quality liquid assets (HQLA) to cover their anticipated net cash outflows over a thirty-day period of stress.[19]

How one feels about this approach will naturally be colored by how one interprets the evidence we have presented above. At one extreme, if one believes that, at the margin, the banking system is raising uninsured deposits and largely investing them in long-term securities such as mortgage-backed securities (MBS), such an approach would seem relatively attractive. Having banks make investments in long-term securities is arguably a zero net present value (NPV) activity from a social perspective, since the intermediation of long-term securities can be efficiently carried out by bond mutual funds, without creating the severe run risks associated with uninsured deposit funding.[20] At the other extreme, if one has more of a Diamond and Dybvig (1983) view and believes that, even at the margin, wholesale bank

18. Even banks that are deeply insolvent often manage to stay above their regulatory capital minimums—and hence avoid intervention from forbearance-inclined regulators—given the backward-looking nature of accounting-based measure of equity capital. Although it would be a stretch to argue that uninsured depositors exert discipline on banks in the normal course of business, in many cases the event that forces an economically unviable bank to be shut down is a run by uninsured depositors. The savings and loan (S&L) crisis of the 1980s and early 1990s is a useful lesson in this regard, as many highly deposit-insured S&L institutions kept operating for many years in a zombie state, gambling for resurrection while increasing their losses and the ultimate costs to taxpayers.

19. The LCR specifies the eligible HQLA and, as discussed below, projects the anticipated net cash outflows during the thirty-day stress period based on an assumed run-off rate for each type of liability on the bank's balance sheet. At present, only banks with assets greater than $700 billion (or short-term funding greater than $75 billion) are subject to the full LCR, which requires them to hold enough HQLA to cover 100 percent of thirty-day stressed outflows. Depending on their levels of weighted short-term wholesale funding, banks with assets between $100 and $700 billion are subject to either a reduced LCR requirement or no LCR requirement at all.

20. Some have argued that, as in money market funds, investors in bond funds may enjoy a first-mover advantage in redeeming their shares during periods of stress. However, even those who agree with this view have not suggested the run risk is anything like that affecting a bank, which promises redemption at par on a first-come first-served basis.

deposits remain a uniquely efficient way to fund information-intensive credit provision, one is naturally going to be more sympathetic to expanding insurance coverage rather than leaning against the growth of wholesale deposits.

To clarify these issues and formulate a more specific proposal, we develop a simple model of a representative bank that initially funds itself in significant part with uninsured deposits and can invest in three assets: information-intensive loans (i.e., assets that are risky and illiquid), longer-term securities (i.e., assets that are risky but liquid), and short-term T-bills (i.e., assets that are both safe and liquid). The first goal of the model is to weigh the merits of expanded deposit insurance versus a modified LCR in dealing with deposits that are currently uninsured. An obvious proposition is that we should tilt in the direction of a modified LCR if expanding deposit insurance creates significant additional moral hazard or fiscal costs.

A somewhat more subtle proposition—one in the spirit of our empirics—is that an LCR rule is more costly when banks have a lot of positive-NPV lending opportunities, since forcing them to hold liquid assets to comply with the LCR will crowd out more valuable lending. If, as the data suggest, banks now have more uninsured deposits relative to their lending opportunities, an LCR rule looks more attractive compared to expanded deposit insurance.

Another goal of the model is to inform the design of the modified LCR. The model speaks to some of the key questions in adapting the LCR, including whether all uninsured deposits should be fully backed, what assets should qualify as backing for those deposits, and how liquidity regulation should interact with discount window lending.

To the extent that bank lending creates social value that is not equally available outside the banking system, the model suggests that the liquidity coverage requirement on uninsured deposits should be calibrated carefully so as to not overly constrict bank lending. At the same time, the model is quite clear in saying that it is problematic to back uninsured deposits with long-duration securities rather than T-bills and other short-term Treasuries. This is because we assume that long-duration securities can equally well be intermediated outside the banking system with less run risk by, for example, bond mutual funds. We use these implications, along with some considerations not addressed in the model, to put forward a framework for developing a more robust LCR.

MODEL ASSUMPTIONS The version of the model that we sketch here is deliberately kept very simple, with several shortcut assumptions made to minimize the required algebra and keep the focus on the policy implications.

We consider a representative bank—one of many identical banks—that operates at fixed scale and with a fixed capital structure: it has equity of E, small, insured retail deposits from households of D_R, and large wholesale deposits from firms of D_W. By fixing the capital structure in this way, we are implicitly assuming a frictional social cost of using additional equity financing. Otherwise, the problems that we address here could be solved at zero social cost simply by making the bank finance itself with a large quantity of equity. In that case, it could always lend at the first-best level while still holding enough liquid assets to buffer any amount of deposit outflows. So, while it is implicit, the constraint on equity is playing an important role.[21]

On the asset side, the bank can: (1) make loans of L; (2) hold longer-term risky securities in amount S; and (3) hold short-term, very low-risk securities—which we refer to as "T-bills" for simplicity—in amount B. So, the bank's initial balance sheet constraint is that $L + S + B = D_R + D_W + E$. There are three dates: At time zero, the bank chooses its asset mix. At time 1, there is an interim signal about the payoffs on the loans and the securities. With probability p, there is a bad signal. For loans, the bad signal implies that the expected time 2 payoff on the loans has declined to $F_L L < L$, and there is now a nonzero probability of an extremely bad crisis state in which the loans will only pay off some very small amount $0 \leq z_L L < F_L L$. We will begin by considering the limiting case where $z_L = 0$, but we will later ask how things change when $z_L > 0$. Similarly, for securities,

21. Why is bank equity costly? There are many reasons why it is *privately* costly for banks to rely on equity financing. However, many of these private costs do not qualify as social costs: while they affect the division of the economic pie between bank equity holders and other agents, they do not have an impact on the total size of the pie (Admati and others 2013). For example, the tax disadvantages of equity are a private but not a social cost. Of course, since deposit taking is socially valuable, equity capital requirements that limit banks' ability to accommodate the demand for deposits may be socially costly. However, this does not explain why it would be socially costly for banks to issue large amounts of equity to expand their holdings of high-quality liquid assets. In that case, banks could both lend and take deposits at the first-best level while holding enough liquid assets to meet deposit outflows. In this regard, one possible social cost of equity might arise from the agency problem between bank managers and outside investors, with the idea being that debt—particularly short-term debt—helps discipline managers, thereby increasing the size of the pie (Diamond and Rajan 2001). However, even if one believes that the direct social costs of bank equity are small, a substantial increase in bank equity capital requirements might still be costly for society. This is because, in attempting to economize on the private costs of equity, lending activity could flow out of banks and into other more lightly regulated areas, thereby posing threats to financial stability (Hanson, Kashyap, and Stein 2011).

the bad signal implies that the expected payoff has declined to $F_S S < S$, perhaps because interest rates have risen in the bad state. The key distinction between loans and securities is that while both can lose value at time 1, the securities are nonetheless perfectly liquid in that they can be sold for their full expected value at time 1. By contrast, as we explain in more detail shortly, the loans are illiquid at time 1, and selling them involves accepting a fire-sale discount relative to fundamental value. At time 2, all payoffs are realized.

We assume that there is a first-best level of loans L^{FB}. Any amount of lending L up to this level creates social surplus of πL, where $\pi > 0$ is a constant; beyond this point, lending creates no incremental social value. We further assume that $L^{FB} < D_R + D_W + E$, so that even if the bank is doing the first-best level of lending, it will hold some T-bills or securities. Thus, we are focusing on deposit-rich banks—that is, banks whose ability to lend is not constrained by the availability of deposits. This is consistent with the findings from our empirical work. At the same time, we assume that $L^{FB} > D_R + E$. This creates a meaningful tension, since if we require that wholesale deposits be fully backed with liquid T-bills or securities, this will push lending below the first-best level.

THREE SIMPLE POLICY OPTIONS By assumption, the retail deposits of D_R are always insured. We then begin our analysis by contrasting three simple policy options for dealing with the wholesale deposits. To be clear, these three options are effectively polar extremes and are intended to highlight the trade-offs at play in the starkest way.

Option 1: Full expansion of deposit insurance. In this case, the large wholesale deposits of D_W are fully insured. As a result, there are no runs at time 1 and no liquidity-based reason for the bank to forgo lending in order to hold an excess buffer stock of liquid assets. So lending is at the first-best level of L^{FB}, and the only social cost is that the increased deposit insurance leads to some additional moral hazard or fiscal cost, which imposes a social cost of $X > 0$. One interpretation of this cost, which is in the spirit of Diamond and Rajan (2001), is that because there is no run in the bad state at time 1, insolvent banks do not get shut down by regulators and become over-leveraged zombies who make bad lending decisions. So, the cost is only realized at time 1 in the bad state of the world and represents a form of excessive forbearance. Alternatively, a bank that is fully insured may make bad ex ante decisions, that is, take on negative-NPV risky bets at time zero.

Option 2: No expansion of deposit insurance, no liquidity regulation. In this case, the wholesale deposits remain uninsured, and the bank freely

chooses its asset mix without any regulatory constraints. Suppose it picks quantities L^*, S^*, and B^* for loans, securities, and bills, respectively. Here one potential cost is that, because of the risk of insolvency, uninsured depositors necessarily run at time 1 upon observing the bad signal; this is their only way of assuring that they will be paid in full. And these depositors may have to be accommodated by fire-selling some illiquid loans, to the extent that the market value of the liquid securities and bills is not enough to cover all the uninsured deposit outflows. Although the loans of L^* have an expected value of $F_L L^*$, if they are fire-sold at time 1, they fetch only $k_L F_L L^* < F_L L^*$, where $k_L < 1$ is the fire-sale discount. To pay off all the wholesale depositors at time 1, the bank has to sell a fraction Δ_L of its loans such that $\Delta_L k_L F_L L^* + F_S S^* + B^* = D_W$. The private cost to the bank is the expected value of fire-sale losses on its loans: $p\Delta_L(1 - k_L)F_L L^* = p(1/k_L - 1)D_W - B^* - F_S S^*)$. Because the bank internalizes these fire-sale losses, it will seek to mitigate them by holding liquid assets and doing less lending. Thus, even without an LCR, the bank will choose to set $L^* < L^{FB}$. That is, the bank will self-impose some form of liquidity buffer policy.

To see what this self-imposed liquidity buffer looks like, suppose for the moment that the bank sets $S^* = 0$—that is, that the buffer is held entirely in T-bills as opposed to longer-term securities, so the bank's balance sheet constraint implies $(L - D_R - E) = (D_W - B)$. At an interior optimum, where the bank is indifferent between loans and bills, the marginal value of an additional loan must equal the fire sale—preventing benefit of an additional bill, which implies that $\pi = p(1/k_L - 1)$. We assume that $1/k_L$ is determined in equilibrium by the fire sales of all banks and is increasing in the quantity of fire sales $D_W - B$. Letting $h[D_W - B]$ denote the private costs of fire sales, where $h'[D_W - B] = p(1/\mathrm{k_L} - 1) > 0$ and $h''[D_W - B] > 0$, the outcome in the unregulated case where the bank chooses the buffer satisfies $\pi = p(1/k_L^* - 1) = h'[D_W - B^*] = h'[L^* - D_R - E]$, where $k_L^* < 1$ is the equilibrium fire-sale discount and $L^* < L^{FB}$.

The need for a stricter regulatory LCR rule arises to the extent that fire sales of loans create social costs that are not internalized by individual banks. To capture these in a simple way, assume that when the bank liquidates $(D_W - B)$ loans to cover uninsured deposit withdrawals, the expected private costs are $h[D_W - B]$, but the expected social costs are $(1 + \phi)h[D_W - B]$, where $\phi > 0$. In other words, we assume that these fire sales impose some financial stability costs that the bank does not fully internalize (e.g., a negative effect on the balance sheets of other firms holding the affected assets or a negative effect on real investment). This creates a motive for a regulator to require the bank to hold more T-bills and

engage in less lending than the bank would choose if left to its own devices. Specifically, the planner wants the bank to make loans L^{**}, where $\pi = (1 + \phi)p(1/k_L^{**} - 1) = (1 + \phi)h'[L^{**} - D_R - E]$, implying that $D_R + E < L^{**} < L^*$.

Thus, the total social cost of the unregulated market outcome is given by $\pi(L^{FB} - L^*) + (1 + \phi)h[L^* - D_R - E]$ and consists of both the cost in terms of forgone lending and the social fire-sale cost. By definition, this is greater than the social cost that the planner could achieve using optimal LCR regulation, which is $\pi(L^{FB} - L^{**}) + (1 + \phi)h[L^{**} - D_R - E]$.

Option 3: No expansion of deposit insurance, strict liquidity regulation. A simple limit case—though not the global regulatory optimum—is a strict LCR policy that requires that the bank back all its uninsured wholesale deposits with T-bills, so that $B^{Strict} = D_W$ and therefore $L^{Strict} = D_R + E < L^{**} < L^{FB}$. Now there is no moral hazard from expanding deposit insurance, and there are no fire-sale costs (i.e., $h[0] = 0$). The only cost is that with less lending and more bills as assets, the bank forgoes more loans at cost $\pi(L^{FB} - L^{Strict})$.

The basic proposition that follows from this is that if this forgone lending cost is smaller than both the moral hazard cost X and the social costs of the unregulated outcome, then a policy of no deposit insurance for wholesale deposits and a strict T-bill-backed LCR is preferred relative to either the unregulated market outcome or an expansion in deposit insurance. Arguably, our empirical evidence suggests that the costs of forgone lending may be relatively small for most larger banks, specifically that $\pi(L^{FB} - L^{Strict})$ is small.

Of course, the optimally calibrated LCR, which involves lending of $L^{**} > L^{Strict}$ and holding a liquidity buffer of $B^{**} < D_W = B^{Strict}$ T-bills, is always superior to both the unregulated market outcome and the strict LCR. This optimally calibrated LCR will also be superior to a full expansion of deposit insurance if $\pi(L^{FB} - L^{**}) + (1 + \phi)h[L^{**} - D_R - E] < X$.

More generally, one can imagine using various combinations of: (1) more stringent LCR regulation; (2) heightened equity capital requirements; and (3) a partial expansion of deposit insurance to deal with the heightened financial stability risks posed by runs by uninsured wholesale deposits. Indeed, in a richer model, it would arguably make sense to adjust regulatory policy somewhat along all three dimensions—that is, heightened equity capital requirements and a partial expansion of deposit insurance would complement more stringent LCR regulation. Thus, ignoring the political constraints mentioned above, we could envision pairing a more stringent LCR requirement with a modest increase in risk-based equity

capital requirements and a targeted expansion of deposit insurance—for example, raising the insurance limit for business payment accounts, one option recently outlined by the FDIC.

LCR DESIGN CONSIDERATIONS Taken at face value, our simple model suggests that a strict LCR requiring full backing of uninsured deposits with T-bills and other short-term Treasuries is preferable to no LCR at all. This would be a dramatic change in the LCR—tantamount to both increasing the runoff rate for uninsured deposits from the current maximum of 40 percent to 100 percent and disallowing all assets that are currently eligible High Quality Liquid Assets (HQLA) except short-term Treasuries and central bank reserves. But even within the scope of the model itself, the optimal policy is something less strict. Moreover, in its simplicity, the model does not speak to all elements of an appropriate regulatory framework. In this section, we propose some considerations relevant to calibrating the strictness of a modified LCR and to specifying the assets that count as HQLA. We then make some qualifications to the simple liquidity assumptions in the model and discuss the relationship of the LCR to the discount window.

At the outset, we note the importance of applying the full LCR to a broader range of banks. As the events in the spring of 2023 demonstrated, there may be contagion from runs even at a midsize regional bank that can endanger a significant part of the banking system. Thus, we strongly favor requiring full LCR compliance by all banks with more than $100 billion in assets, the current statutory threshold for enhanced prudential regulation by the banking agencies. That said, we believe that there is a strong policy case for further lowering the LCR threshold to $50 billion.

Calibrating a modified LCR. It now seems clear that the current maximum runoff rate of 40 percent for uninsured deposits is woefully inadequate. It also seems quite unlikely that it would be socially optimal to require all uninsured deposits to be 100 percent backed by short-term Treasuries. How should the bank regulatory agencies decide where to set the stringency of the LCR between these two boundaries? Starting from the model's implied 100 percent runoff rate, relaxing the strict LCR regulation envisioned in option 3 above may be warranted because not all uninsured deposits are as highly runnable as is assumed in our simple model (even in light of the experience of March 2023), or the costs of restricting socially valuable lending would exceed the financial stability benefits of fully backing uninsured deposits with T-bills, or some combination of the two.

The first justification for relaxation is not reflected in our simple model, which assumes all uninsured deposits to have identical characteristics.

Were regulators to be convinced that some forms of uninsured deposits—such as those used by businesses to meet payrolls and make routine payments to suppliers—were genuinely less prone to run, then the amounts of uninsured deposits to be backed could be reduced.

As discussed earlier, a second justification for relaxing the strict LCR rule—that is, using the optimally calibrated LCR which involves holding T-bills equal to $B^{**} < B^{Strict} = D_W$—arises due to the marginal social costs $\pi > 0$ of reducing lending below the first-best level of L^{FB}. It is admittedly not clear how to translate this concept from the model into a simple metric that can guide the implementation of regulation. However, one factor that should probably be considered is the elasticity of substitution for the loans in question. For example, if a bank cuts back on making on-balance sheet conforming mortgage loans, the marginal social costs π are unlikely to be very high, as these loans can easily find their way into an MBS pool. By contrast, if the marginal loans are opaque to small businesses, finding an alternative provider of credit may involve more friction and hence greater marginal social cost π.

Finally, a third possible rationale for relaxing the strict LCR rule is the concern that an overly strict LCR could have unintended consequences to the extent that it leads to increased money creation activity in the so-called shadow banking system. Concretely, if a strict LCR makes banks more reluctant to take uninsured deposits, investors seeking safe, short-term alternatives may park their cash in money market funds. Flush with cash from savers and facing a shortage of short-term Treasuries (more of which would be owned by LCR-constrained banks), money market funds might conceivably increase their lending against long-term Treasuries and MBS on a short-term collateralized basis through the repo market. The expanded supply of repo financing might in turn raise the incentive of hedge funds and other levered nonbank institutions to finance their long-term securities by borrowing short term.[22]

While all three of these concerns are legitimate, they essentially suggest that a more stringent LCR must be appropriately calibrated to maximize the net benefits, not that the policy direction itself is ill-advised.

Two other points relevant to calibration are worth noting. First, even as one assesses reasons for relaxing the strict LCR rule implied in option 3,

22. This concern may be somewhat mitigated if, as in our example, the increased repo financing is done only against government-backed collateral such as Treasuries and agency MBS. In this case, the potential damage associated with disorderly fire-sale liquidations would seemingly be relatively modest.

there may be other considerations favoring a relatively more stringent requirement. For example, the more severe the fire-sale externalities ϕ, the more stringent should be the LCR. In other words, an increase in ϕ pushes the T-bill holdings B^{**} in the optimally calibrated LCR up toward $B^{Strict} = D_W$. Second, as regulators balance the considerations identified here, they might formulate a more nuanced rule—for example, one alternative would be to progressively increase the assumed outflow rate on a bank's uninsured deposits as its uninsured deposits rise as a share of its total deposits.

Eligible HQLA. A second important consideration in designing a revised LCR is the definition of HQLA—both the specification of assets that qualify and any limitations or conditions in counting them against runnable liabilities. The same calibrated run rate for uninsured deposits will have quite different impacts upon banks depending on the range of assets that qualify as HQLA. Thus, another way to effectively relax the strict LCR contemplated in option 3 is by allowing the bank to meet some or all of its requirement to back uninsured deposits with all assets that qualify as HQLA under the current LCR, rather than just short-term Treasuries. The most important consideration here is whether there should be any change in the eligibility of long-term securities such as ten-year Treasuries and agency-backed MBS. As we have seen, within their holdings of liquid assets, banks have a very strong preference for longer-duration securities.[23]

At present, longer-duration Treasuries count as unlimited HQLA, based on current market value, while agency-backed MBS may count for up to 40 percent of total HQLA, with a 15 percent haircut off current market value. However, from a social perspective, longer-duration securities are an inefficient way to back uninsured deposits. This is because longer-duration securities, even if they remain completely liquid, may have a lower market value in the bad state. Thus, a bank would have to hold $1/F_S$ units of long-term securities, rather than just one unit of T-bills, to prevent the same

23. Under the current LCR, HQLA are divided into level 1, level 2A, and level 2B assets. Level 1 assets consist of all US Treasuries, reserves, other liquid obligations fully backed by the US government, and liquid obligations of very low-risk foreign sovereigns and international institutions. Level 2A assets consist of agency-backed MBS, other agency-backed debt, and liquid obligations of low-risk foreign sovereigns. Level 2B assets consist of investment-grade nonfinancial corporate bonds, investment grade municipal bonds, and large-cap US public equities. Irrespective of their maturities, level 1 assets are subject to a 0 percent haircut, while level 2A and 2B assets are subject to haircuts of 15 percent and 50 percent, respectively. Furthermore, level 2B assets cannot account for more than 15 percent of a bank's total HQLA; and the sum of level 2A and 2B assets cannot account for more than 40 percent of HQLA.

amount of socially inefficient fire-selling of loans. This in turn would crowd out more valuable lending ex ante, with no social benefit, since society is not obviously better served by having banks hold long-term securities as opposed to T-bills, even if bankers privately prefer the former.[24] Again, an important point here is that, from a social perspective, the intermediation of long-term securities can be more safely done in the bond fund sector, where investors knowingly assume the interest rate risk themselves, than with runnable uninsured bank deposits.

On the other hand, it is unrealistic to think that all banks could back their currently high levels of uninsured deposits with short-term Treasuries and reserves alone. To put this issue in perspective, there is currently about $8.3 trillion of outstanding Treasury debt that matures within the next twelve months (this includes $5.7 trillion of T-bills and $2.6 trillion of short-term notes and bonds), along with about $3.5 trillion of reserves (a figure that is diminishing by about $80 billion a month as the Federal Reserve continues its program of quantitative tightening). There are about $8 trillion of uninsured deposits.[25] So an average assumed runoff rate of 75 percent for uninsured deposits would require using more than half of all reserves and outstanding short-term Treasuries as backing, while an assumed runoff rate of 100 percent would consume about two-thirds of those two asset classes. Thus, as a practical matter, there is reason to allow longer-duration securities that carry essentially no credit risk.

To be clear, this simple calculation ignores equilibrium effects. In particular, imposing a more stringent form of the LCR on uninsured deposits will reduce the quantity of uninsured deposits in the system, which we

24. One reason bankers might have a private preference for long-term securities is that they have a term premium, which generates higher reported income (Hanson and Stein 2015). To the extent that such a term premium is just compensation for risk, long-term securities are not a socially higher-NPV investment than short-term bills, but they may be attractive to managers whose incentives are to maximize reported earnings. Similarly, bankers might have private preference for MBS over like-duration Treasuries because MBS yields contain an extra option premium component that compensates holders for the fact that they are short a call option on interest rates.

25. US Department of Treasury, "Most Recent Quarterly Refunding Documents," quarterly release data, https://home.treasury.gov/policy-issues/financing-the-government/quarterly-refunding/most-recent-quarterly-refunding-documents; Federal Reserve Board, "Liabilities and Capital: Other Factors Draining Reserve Balances: Reserve Balances with Federal Reserve Banks: Week Average," series WRESBAL, retrieved from FRED, https://fred.stlouisfed.org/series/WRESBAL; FDIC, "FDIC Quarterly Banking Profile," balance sheet, https://www.fdic.gov/quarterly-banking-profile.

view as an entirely desirable outcome, especially to the extent that these deposits are funding long-term securities holdings. Moreover, as noted above, even holding fixed the quantity of uninsured deposits, there is a policy case for offsetting to some degree banks' incentive to back them with longer-duration securities. Thus, the banking agencies might want to consider tightening the current LCR limit of 40 percent that applies to agency MBS and imposing some form of limit on the portion of longer-term Treasury securities that can count as HQLA. Alternatively, a similar outcome might be achieved by subjecting eligible longer-term securities to a haircut that steeply increases with the duration of these securities.

Relationship of the modified LCR to the discount window. Our model assumes perfect liquidity for both T-bills and longer-duration securities. However, as observed during both 2008 and 2020, the immediate liquidity of even the safest assets can have limits during periods of serious financial dislocation. Moreover, as was evidenced during the bank panics in the spring of 2023, practical impediments such as the need to move collateral may stymie banks' attempts to access the discount window quickly when other avenues of funding have been closed off. For both these reasons, we believe that any required backing of uninsured deposits under a modified LCR, including T-bills, should be pre-positioned at the discount window.

With or without a requirement for pre-positioning, the question arises whether loans pre-positioned at the discount window should be credited for purposes of satisfying the LCR—both generally and for backing uninsured deposits in the kind of regime we propose. Of course, loans on the books of banks do not qualify as HQLA under the current LCR. But another way for a bank to generate liquidity at time 1—and hence to avoid fire sales of its loans—is to borrow from the discount window using these loans as collateral. In fact, as part of their liquidity management strategies, some banks already pre-position significant portions of their loan portfolios at the discount window. Thus, one might argue that the LCR should give banks credit for this lender of last resort (LOLR) access if they are willing to pre-position the loan collateral at time 0 and allow it to serve, in addition to T-bill holdings, as backing for uninsured deposits. Indeed, a recent report by the Group of Thirty (2024) makes just that recommendation.

To consider this possibility, we assume that the Federal Reserve, as LOLR, is restricted to making loans at time 1 that are fully collateralized, that is, loans that are virtually certain to be fully repaid at time 2. If not, it would be taking nontrivial credit risk, something that it is not legally authorized to do through its discount window lending under section 10B

of the Federal Reserve Act.[26] Accordingly, if a bank pre-positions loans in amount L at the discount window at time zero, it can count on being able to borrow only $z_L L$ at time 1, where again, z_L is the worst-case value of the loans at time 2. Thus far we have assumed that $z_L = 0$, implying that banks cannot use loans to collateralize any discount window borrowing at time 1.

However, the model can be easily extended to cover the case where $z_L > 0$ so that loans can be used to collateralize borrowing from the Fed at time 1. The analysis of option 1 (above) is identical to the case where $z_L = 0$. There is no need for LOLR borrowing at time 1, because all deposits are insured, and hence there are no runs. In option 2, as long as $D_W > z_L L^* + F_S S^* + B^*$, the bank will be unable to fully pay off departing uninsured depositors just by selling its liquid assets and borrowing against its loans at the discount window. Rather, it will now have to liquidate a fraction Δ_L of its loans so that $\Delta_L k_L F_L L^* + (1 - \Delta_L) z_L L^* + F_S S^* + B^* = D_W$. In other words, the LOLR policy reduces the amount of fire-selling (i.e., Δ_L is now smaller all else being equal), because some liquidity is obtained from the LOLR at time 1.

Similarly, in the strict LCR of option 3, the bank does not need to hold as many bills as before in order to completely avoid fire sales. Now we only require that $z_L L + F_S S + B = D_W$. This allows for more lending ex ante and yet still satisfies the requirement that the combination of liquid assets and discount window access be enough to pay off all uninsured depositors in the event of a run at time 1, without having to inefficiently liquidate any loans at this date.

Thus, the model suggests that, subject to appropriate collateral haircuts, it may be sensible to allow loans that are pre-positioned at the discount window to count toward satisfying an LCR for uninsured deposits. Doing so would accord with the aim of ensuring that the LCR does not overly constrain banks' ability to use uninsured deposits to finance positive-NPV loans. Still, it is important to recognize that the issues associated with setting an appropriate haircut on pre-positioned loan collateral in the context of a regulatory requirement would be very different, and considerably thornier, than those that arise in traditional discount window operations.

First is the question of the time horizon. If a bank approaches the discount window ex post, at the moment it needs to borrow, the haircut on

26. Federal Reserve Board, "Federal Reserve Act: Section 10B. Advances to Individual Member Banks," https://www.federalreserve.gov/aboutthefed/section10b.htm. Section 10B requires that any advances to member banks be "secured to the satisfaction" of the Reserve bank making the advance. As reflected in the Federal Reserve's policies on discount window lending, this provision is understood to require sufficient collateralization to virtually guarantee that the Reserve bank will be repaid in full.

collateral is set at the time the loan is extended. If, as is presently the case, a bank chooses to pre-position loans as a precautionary measure, it is doing so as part of its own business strategy. Here, by contrast, we are contemplating a situation where a bank is given ex ante regulatory credit for discount window borrowing that it might undertake at some later date, months or even years into the future. At this longer horizon, there is obviously a greater risk that the collateral will decline in value. In the language of the model, this is tantamount to saying that z_L is likely to be far below 1.

Indeed, it is possible that the prospect of a run is either prompted by concerns about the quality of a bank's loans or, even if a run is set off by other reasons, reveals that its loan book has been opaquely declining in value. In these circumstances, the ordinary response of requiring more collateral to compensate for the decline in value of existing collateral could exacerbate the already deteriorating liquidity situation of the bank. Alternatively, were the Federal Reserve to continue to promise availability at the original value of the loan collateral, it would effectively be taking on credit risk. Thus, haircuts for loans would have to be set more conservatively for LCR purposes.[27]

Second, the logistics of a regime in which allowing pre-positioned loans to meet LCR requirements could be daunting. Precisely because there are no readily identifiable market values for loans, as there are for traded securities, the Federal Reserve's schedule of collateral haircuts has very wide ranges for each category of loan.[28] The actual haircut imposed for any individual loan is determined by a model maintained by the Federal Reserve Bank of New York. Were loans pre-positioned at the discount window to be treated as HQLA, the complexity of this process might have to increase dramatically, with consequent increased risks of mistakes. Regular revaluation of all pre-positioned loan collateral by banks taking advantage of this new form of HQLA would, if taken seriously, be potentially much more burdensome—and imprecise—than repricing securities with observable market values. In this sense, the qualitative argument in favor of a largely T-bill-backed LCR remains similar to that above.

Finally, the inherent imprecision of setting haircuts at such longer horizons, combined with the heightened regulatory stakes at play, suggests that

27. It is important to note that this problem is not fully addressed by the Federal Reserve's current practice of repricing loans pre-positioned at the discount window on a monthly basis, presumably in calm circumstances when a bank could add more collateral. The problem of unknown or hidden losses would remain.

28. For example, the haircut for a commercial real estate loan ranges from 44 percent to 95 percent of its estimated market value.

such a process may give rise to a great deal of lobbying and political pressure around what the appropriate value of the haircuts should be for various types of loans. In short, were the regulatory agencies to go down the road of counting pre-positioned loans as HQLA, we would urge them to proceed cautiously. They might, for example, begin on a relatively small scale—say by creating a new category 2C form of HQLA that would be limited to a small percentage of total HQLA requirements. Over time, if experience with the valuation process gave confidence that a higher limit was prudent, an adjustment could be made.

V.B. Interest Rate Risk and Capital Regulation

In the above discussion, we have taken bank equity capital as exogenously fixed and focused exclusively on liquidity regulation. One conclusion has been that a well-designed LCR should lean against the use of long-duration securities as backing for uninsured deposits. Of course, interest rate risk can also be addressed with capital requirements. The current risk-based capital regime does not do this for the banking book.[29] In fact, the US banking agencies have only partially implemented the framework for supervisory oversight of bank management of interest rate risk originally developed by the Basel Committee on Banking Supervision in 2004 and updated in 2016. Remarkably, the Federal Reserve's stress test scenarios in 2021 and 2022 did not include interest rate increases—something most observers would have identified as an obvious risk to the industry at that time. Even without the broad evolutionary changes to the banking industry that we have highlighted, a more rigorous and complete coverage of interest rate risk in capital requirements would seem warranted. Those changes, though, considerably strengthen the case. As was painfully apparent in March 2023, large portfolios of longer-duration debt securities can meaningfully increase banks' vulnerability to significant changes in market interest rates.

Moreover, interest rate risk on the asset side interacts in an important way with factors that make deposits more likely to either reprice or run. Conventional wisdom has held that interest rate risk in the banking book was to some extent hedged by the stickiness of deposits. That is, although interest rate hikes reduced the present value of a bank's assets, this decline in asset value was offset by an increase in the value of the deposit franchise to the extent that the bank could retain most of its deposits, even if it increased the interest rate it paid on these deposits by only a fraction of the central bank's

29. Interest rate risk is considered in calculating risk-weighted requirements for the trading books of large banks.

target rate increase. But if the deposit beta has increased, pressure on bank earnings and, eventually, capital may build more quickly.[30] See Drechsler and others (2023) for a recent analysis along these lines.

Going further, banks other than the very largest have not even been required to recognize unrealized changes in market value of their securities holdings—for example, due to a rise in interest rates—in their regulatory capital metrics. This is due to hold-to-maturity accounting and the accumulated other comprehensive income (AOCI) opt-out election for securities that are accounted for on an available-for-sale (AFS) basis. The banking agencies have now proposed to eliminate this AOCI opt-out for banks with assets between $100 billion and $700 billion (OCC, Federal Reserve Board, and FDIC 2023b). If this regulatory change is adopted, mark-to-market gains and losses on AFS securities will begin to have an impact on the reported regulatory capital of midsize regional banks. We view this as a useful step in addressing interest rate risk, though it would probably be preferrable to have an explicit capital requirement for duration risk in banking book securities portfolios. Additionally, the regulatory agencies must decide how to treat securities designated as hold-to-maturity. It is unclear to what extent a change in rules applied only to the AFS book might be gamed by banks reclassifying AFS securities as hold-to-maturity.[31]

30. The deposit beta is a measure of the sensitivity of the interest expense on a bank's deposits to changes in short-term money market rates (e.g., the federal funds rate).

31. Banks account for their securities in three different ways under US generally accepted accounting principles (GAAP). Trading account securities are carried on the balance sheet at their current market value, so any mark-to-market gains and losses have an impact on book equity and flow through net income. Securities a bank intends to hold until maturity are recorded in the hold-to-maturity account and are carried at their historical amortized cost. Fluctuations in the market value of hold-to-maturity securities due to changes in level of interest rates do not have an impact on the bank's book equity or its net income. Securities a bank might sell prior to maturity are recorded in the AFS account. AFS securities are carried at their market value and fluctuations in mark-to-market value of AFS securities have an impact on book equity. However, unrealized mark-to-market gains and losses on AFS securities do not affect net income and the retained earnings equity account. Instead, these mark-to-market changes are recorded in a different equity account—the AOCI—and are only recognized in net income if the bank sells the security. While unrealized fluctuations in the mark-to-market value of AFS securities have an impact on accounting book equity, the AOCI opt-out refers to the fact that, since 2013, US bank regulators have allowed banks other than the very largest to ignore mark-to-market changes in the value of AFS when computing their regulatory equity capital. This means that, while they differ for GAAP purposes, there is almost no difference between AFS and hold-to-maturity securities from the standpoint of regulatory capital. The very largest G-SIB banks already must pass through to capital any changes in the market value of their AFS securities. Until the Federal Reserve's 2019 tailoring regulation, *all* banks with over $250 billion were also required to do so.

Finally, unless the Federal Reserve's annual supervisory stress test is again applied to all banks over $50 billion, as was the case before a legislative change in 2018, even a regular stress test scenario focused on interest rate risk would miss many vulnerable banks.[32] Thus, while we are aware of the prevailing view of regulators that a more generally applicable interest rate risk rule is infeasible, we believe that the regulators should try again. If the effort proves unsuccessful, a second-best approach would be a structured supervisory program that regularly assessed the interest rate risk of all banks above a certain size threshold.

V.C. Merger and Competition Policy

Our analysis supports the view that changes in the industry have threatened the business model of many midsize regional banks. As such, our analysis has implications for bank merger policy, as well as prudential regulation.

Midsize banks risk being caught between the scale economies of the largest banks and the relationship-lending capabilities of community banks. Increasing returns to scale have already been achieved in most forms of consumer lending through the standardization of credit analysis. In recent years, scale has also allowed the largest banks to invest substantial amounts in information technologies. As algorithms become more sophisticated and artificial intelligence enters credit decision making, size will likely be further rewarded since there are significant economies of scale in these sorts of IT investments. At the same time, community banks are likely better positioned to take advantage of the remaining opportunities for relationship lending and payoffs to localized knowledge, notably in lending to smaller businesses.

This characterization of the industry is reinforced by the trends we have identified—notably the changes in the portfolios of midsize regional banks, with the decline in C&I lending and the increase in securities holdings. These changes may leave these midsize banks in the uncomfortable position of having to rely very heavily on their deposit franchise—that is, the ability to pay submarket rates to their depositors—for a disproportionate share of their value creation. As was demonstrated in March 2023, the franchise value of this group of banks has likely been further eroded by the increasing ease and speed with which deposits can be moved across banks.

32. Economic Growth, Regulatory Relief, and Consumer Protection Act, Pub. L. 115–174, 132 Stat. 1296 (May 24, 2018), https://www.congress.gov/bill/115th-congress/senate-bill/2155.

If our assessment is on target, the economics of the industry may lead to a significant deterioration in the competitive position of midsize regional banks in the coming years. How this plays out will depend in significant part on the regulatory response. Will the banking agencies allow the capital, liquidity, and earnings positions of a set of increasingly uncompetitive banks to deteriorate? As the savings and loan crisis of the 1980s and early 1990s showed, such forbearance can end up being very costly for the economy and taxpayers. If, instead, the agencies maintain or increase regulatory rigor to prevent these banks from taking excessive risks in a desperate search for profits, then they may just stagnate. In that scenario, the business they lose will probably be captured by larger banks. The result would be a further increase in concentration of the banking industry.

In the face of these possibilities, it may be wise for bank merger policy to acknowledge these competitive dynamics and to look more positively on mergers of midsize regional banks and on acquisitions of smaller banks by regional ones. It is hard to say whether these combinations will be able to achieve the scale economies needed for these banks to thrive over the long run. But at least they would create institutions that are better able to compete with the largest banks. While a strict antitrust policy for the mega-banks is entirely reasonable, a similarly strict policy for the midsize regional banks might—ironically—redound to the benefit of those same mega-banks.

VI. Conclusions

Our review of bank balance sheets over the last quarter century shows that, while uninsured deposits have become a greater share of liabilities, the information-intensive lending that dominates traditional views of banking has declined as a share of assets. While these trends on the deposit side might stall or reverse, the fact that they predated the Federal Reserve's responses to the global financial crisis suggests that the rapid growth in deposits—and the rising share of those deposits that are uninsured—are developments warranting attention from regulators. Similarly, there are good reasons to believe that migration of business lending to nonbank institutions—especially lending to large and medium-size businesses—is likely to continue unabated.

One insight that emerges from the confluence of these two trends is that regulators may be more comfortable tightening liquidity requirements on uninsured deposits, given that the substantial increase in those deposits in recent decades has not been correlated with an increase in

information-intensive lending. On the contrary, the two appear to be negatively correlated. A second conclusion is that the regulation of midsize regional banks may be especially in need of attention. As noted, the business model of these banks looks increasingly vulnerable. At the same time, unlike the G-SIBs and the very largest regional banks, these banks are not currently subject to regulation and supervisory programs that account for the increased runnability of deposits.

Our effort here has been to provide some foundation for fashioning appropriate regulatory responses and some considerations to bear in mind in doing so. More work will obviously need to be done by researchers and regulators to calibrate and build out specific proposals.

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Comments and Discussion

COMMENT BY

ARVIND KRISHNAMURTHY US regional banks experienced financial stress in the spring of 2023. In the case of Silicon Valley Bank (SVB), this stress led to a bank run and ultimate failure. The mix of ingredients that drove stress in SVB are by now well documented: a large fraction of uninsured deposits, investments in long-duration securities that suffered losses as interest rates rose, and poor risk management (Barr 2023; Jiang and others 2023).

As we pass the one-year anniversary of the SVB failure, should we be sanguine about the state of the banking system? The authors make a persuasive case that we should not. The mix of ingredients that drove the banking stresses has been years in the making. The authors take a longer view of the evolution in banking and highlight three key trends.

First, the quantity of deposits relative to GDP has risen across the banking system, and the share of uninsured to total deposits has also risen.

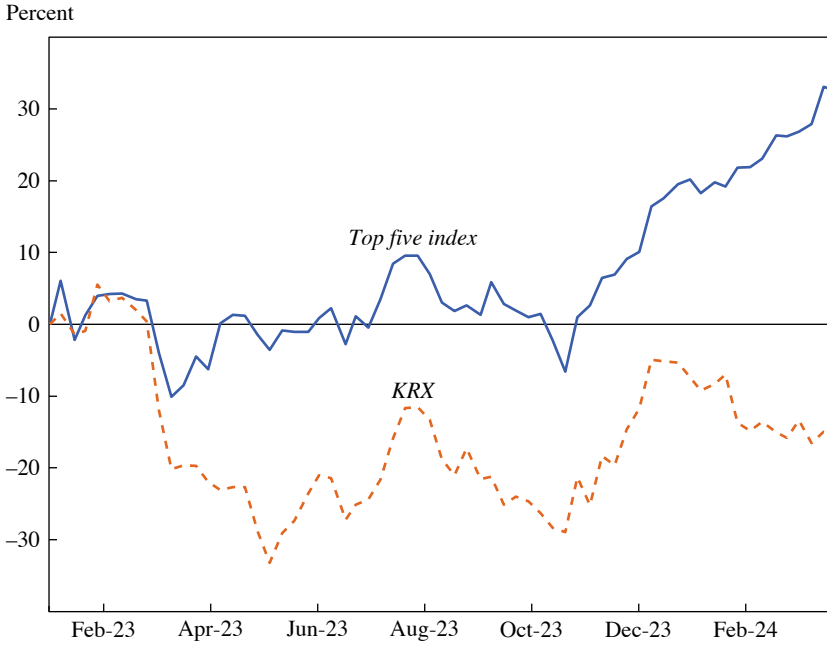
Second, many of the loan-making activities of banks have migrated to nonbanks. These loan-making activities, which require information such as screening or monitoring, are now being performed as effectively, if not more so, by nonbanks. Moreover, this trend has accelerated in the last decade.[1]

Third, in response, the largest banks have shifted toward a liquidity provision model. They offer deposits to customers, holding these deposits in securities such as Treasuries or mortgage-backed securities. They also offer credit lines, a form of contingent liquidity provision, to their corporate customers. These activities are currently not being performed by nonbanks.

1. Buchak and others (2024) document the diminishing role of banks in lending and show that it can have important implications for the monetary transmission mechanism.

Brookings Papers on Economic Activity, Spring 2024: 390–411

Figure 1. Top Five Bank Index versus KBW Regional Bank Index (KRX)



Source: LSEG Data & Analytics.

The regional banks, which previously were active in information-sensitive lending, have had their business eroded. Some, such as SVB, have shifted to providing uninsured deposits to customers and holding securities to back these deposits. But the entry of nonbanks creates risk for their business model.

Figure 1 compares the cumulative stock return on a value-weighted index of the five largest US banks (JPMorgan Chase, Citigroup, Bank of America, Wells Fargo, Goldman Sachs) to that of the KBW Nasdaq Regional Banking Index (KRX). Prior to March 2023, these indexes tracked each other. The banking stresses last spring led to a fall in regional bank stock prices and a rise in the large bank stock prices. By the end of the sample, this divergence has accumulated to a 47.9 percent relative return between the large and midsize banks. The assessment of the authors—that the regional bank model is under stress—is evident in the figure.

The authors then offer three policy proposals to guard against the stresses in the banking system. First, they propose a tightening of the liquidity coverage ratio. Second, they propose that interest rate risk from long-duration securities be subject to risk-based capital requirements and that

Figure 2. Balance Sheet Model of Bank

Assets	Liabilities
Loans (*L*)	Deposits (*D*)
Tradable securities (S)	*(Book) Equity*
Tangible assets (*A*)	Liabilities and equity

Source: Author's illustration.

gains and losses from such security holdings pass through to regulatory measures of bank capital. Finally, they recommend that the government adopt a receptive stance toward bank mergers in the midsize regional banking sector.

In my comments, I will focus on these policy proposals, evaluating them and offering suggestions to strengthen each one. Overall, I strongly endorse the proposals put forward in the paper. I share the authors' view that regional banks are in a financially precarious position that is masked because investors currently assess that their uninsured deposits are effectively backstopped by the government. I also think that action is urgently needed, and that not doing so risks kicking the can down the road.

BALANCE SHEET MODEL OF A BANK Consider the following model of a bank (figure 2). The bank raises funds through deposits and issuing equity. These funds are used to make loans or hold tradable securities. The bank's security purchases, along with its equity issuance, are all market-based transactions with zero net present value at the time of trade.

The bank can create value via its deposit-taking and lending activities. This value is reflected in the interest rate spread the bank offers on deposits and charges on loans, relative to the equivalent market rate. These spreads can exist because of the bank's market power, informational advantages, provision of transaction services, and so on. Define the interest rate spread on deposits and loans, relative to the short-term funding rate, as follows:

$$\text{Deposit rate spread} \equiv r^* - r^D, \text{ Loan rate spread} \equiv r^L - r^*,$$

where r^D is the average rate paid on deposits, r^L is the average rate earned on loans, and r^* is the short-term market interest rate (e.g., the federal funds rate).

Given D as the total amount of deposits, and L as the total amount of loans, the total cash flow generated by these rate spreads is given by:

$$R = D\left(r^* - r^D\right) + L\left(r^L - r^*\right).$$

Suppose that the bank incurs a per period cost of C to operate and earn these spreads. Then the value of the bank franchise is the present value of the net cash flow, $PV(R - C)$.[2]

BANK THRESHOLDS A bank has two important financial thresholds, one governing solvency and the other liquidity. We can compute,

$$Market\ Equity = \Big(L + S - D\Big) + MTM_{L,S} + PV\Big(R - C\Big).$$

The market value of equity is the sum of the assets minus deposits, with an adjustment for any mark-to-market gains or losses on the loans and securities ($MTM_{L,S}$), and the present value of the bank franchise. A bank is *solvent* if this is positive. Capital requirements key off solvency.

A bank is *liquid* if the cash that can be raised from loans and securities covers all of its deposits:

$$\Big[L - hL\Big] + S - D + MTM_{L,S} > 0.$$

Here h is the haircut on loans, and assume there is a zero haircut on securities. The haircut reflects the fire-sale loss that comes from selling assets. Relative to the solvency threshold, liquidity does not include franchise value and includes a haircut on loans.

The liquidity coverage ratio (LCR) is a requirement on the liquidity threshold. Typically, only securities are considered as available liquidity for regulatory purposes and the LCR requirement is:

$$S + MTM_{L,S} - \lambda D > 0,$$

where λ is an assumed runoff rate on deposits. In current bank regulation, this runoff rate is 40 percent on uninsured deposits.

The authors propose three changes to the LCR. First, they propose to increase the runoff rate above 40 percent. Given the speed of the bank run at SVB, a move to increase the runoff rate is warranted. This increase is further justified when considering the broader fact that nonbanks are a substitute for banks in loan making. That is, the social cost of tightening the LCR is that it crowds out lending by banks, but this is less socially costly to the extent that there are good substitutes for bank credit.

2. See DeMarzo, Krishnamurthy, and Nagel (2024) and Drechsler and others (2023) for an analysis of the bank's franchise value.

Third, the authors propose that banks pre-position the securities used to satisfy the LCR at the discount window. I also endorse this proposal, which has been made by others (Duffie 2024; Group of Thirty 2024; Hsu 2024). I see the rationale as primarily operational. In practice, banks turn to the Federal Home Loan Banks (FHLBs) for liquidity during a crisis, rather than the discount window. This appears to happen because FHLBs offer liquidity cheaper than the discount window and because the discount window may create some stigma. In other banking systems, the discount window is the key source of liquidity in a crisis. I see it as low-hanging fruit—no cost and only benefit—if their proposal catalyzes the discount window to operate as intended in a crisis.

DURATION RISK As noted above, the authors propose that the interest rate risk on securities be recognized both in computing capital requirements and for bank accounting. Given the failure of interest rate risk management in the banking crisis, this too is warranted.

Duration considerations also enter in the choice of what set of securities can be used to meet the LCR. The authors propose that reserves and Treasury bills (T-bills) be used, concerned that long-term Treasuries may have low value in a crisis event. But, as the authors note, there are equilibrium issues that arise in this case: "assumed runoff rate of 75 percent for uninsured deposits would require using more than half of all reserves and outstanding short-term Treasuries as backing, while an assumed runoff rate of 100 percent would consume around two-thirds of those two asset classes." In equilibrium, such a proposal would depress T-bill yields and may distort issuance decisions. For example, it would incentivize the US Treasury to shorten issuance maturity, which may increase fiscal risk.

I propose investigating another option, but one which would require the discount window to catch up to modern securities markets. Much interest rate risk is managed using interest rate swaps. These swaps are now plain vanilla, with standardized collateral arrangements. A long-duration Treasury bond plus an interest rate swap to hedge the duration risk is equivalent in risk terms to a short-duration Treasury. Sophisticated banks trade in both securities and interest rate swaps regularly. Thus, I propose that the LCR be satisfied by the combination of a long-term Treasury and swap, and that this package also be pre-positioned at the discount window as collateral.

LIQUIDITY RISK AND BANK CAPITAL An important observation in the SVB episode is that a liquidity problem, even if it is eased by liquidity from the government, can turn into a solvency problem. Consider the case where some uninsured depositors, say corporate business clients, withdraw their deposits from a bank they are nervous about. The bank then turns to the discount

window to source the liquidity to pay these depositors. But in the process, the bank replaces a profitable source of deposits costing r^D with a discount loan at a rate greater than r^*. As a result, the franchise value of the bank $PV(R - C)$ falls. Thus, losing business (the corporate depositor) erodes franchise value and the liquidity problem becomes a solvency problem. Indeed, if the bank is not well capitalized, the financial stress will worsen, and the bank will be forced to close.

Another way of stating my point is to note that the franchise value of a bank, $PV(R - C)$, is a risky bank asset, where the risk arises from liquidity concerns.

An immediate implication is that capital requirements should be *liquidity-based* and not just *risk-based* as in current practice. Thus, I would further propose that capital requirements be strengthened in this manner (DeMarzo, Krishnamurthy, and Nagel 2024; DeMarzo and others 2023).

CONCLUSION The regional bank model is under stress. Uninsured deposits are high in aggregate and in particular pockets. The authors propose a tighter LCR in the face of flighty uninsured deposits, capital charges on interest rate risk, and pre-positioning collateral at the discount window. I strongly endorse these proposals. I would also go further, particularly in terms of tightening capital requirements, linked to liquidity risk.

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COMMENT BY

RAGHURAM RAJAN This is a thoughtful and important paper, consistent with the extraordinary caliber of the coauthors. It tees off the Silicon Valley Bank (SVB) crisis to argue that we need to reexamine bank regulations, especially given that banks themselves have evolved considerably over the last two decades. It suggests three important changes to regulations: (1) recognize that large banks are more like bond mutual funds in that they hold securities and make fewer information sensitive loans; authorities should consider stricter liquidity regulation for them but make access to liquidity easier by allowing pre-positioning of loans at the discount window; (2) require banks to recognize interest rate risk, at least in their "available for sale" securities portfolios if not their "held to maturity" securities portfolio; and (3) allow mergers of midsize banks because they have little franchise value.

I will comment on these proposals later, but first I want to ask three preliminary questions. One rationale for bank regulatory or supervisory intervention ex ante is to avoid externalities imposed by the banks (for instance, fire sales), which in turn might prompt liquidity or solvency bailouts by the authorities. So, first, how large were the externalities in the case of SVB and was a bailout of uninsured depositors once SVB experienced a run really required? Second, to what extent are bank activities a response to previous regulations, supervisory actions, and even monetary policy interventions? Third, is additional regulation necessary, and if so, where?

HOW LARGE ARE THE EXTERNALITIES FROM BANK FAILURE? The financing of loan-making intermediaries with short-term debt or with liabilities with extensive covenants is pervasive—shadow bank structures replicate bank structures in spirit if not in the details.[1] Whether the attraction is the cheap cost of issuing money-like liabilities that offer liquidity to holders or the discipline tough capital structures bring (not because depositors monitor

1. See, for example, Erel and Inozemtsev (2024).

but because they run at the first sign of trouble) or both, as in Diamond and Rajan (2001), does not really matter for the systemic negative externalities they may create down the line. But if discipline is the intent, repeated predictable bailouts privatize the gains from risk taking (the intermediary gains from the returns on the risks it takes) while socializing losses (the public bears the cost of paying off the liabilities the bank contracts at low cost). Before arguing for changing regulations, we must ask first if the problems in SVB were systemic, so much so that the Federal Deposit Insurance Corporation (FDIC) had to bail out its uninsured depositors.

Prima facie, it would seem that SVB management was either greedy or incompetent or both. The bank had around $57 billion in assets in 2018, and it grew to nearly four times that size by 2021, a period when the banking industry grew assets by only 29 percent (Barr 2023). A bank's spectacular growth is often an early warning sign of subsequent problems. The bank had significant investments in long-term securities even as its growth was financed by uninsured demand deposits. Regardless of whether it was searching for yield by investing the inflows in long-term securities, whether it believed its deposits would not reprice as the Federal Reserve raised interest rates (that is, its deposit betas were low), or whether it thought interest rates would stay low, SVB and its supervisors failed Risk Management 101. SVB was insolvent when its holdings were marked to market, a realization that triggered the run.

Clearly, the bailout was too late to stop the run. When SVB was taken over by the FDIC and its parts sold off to other banks, the direct losses as a consequence of the change in management may well have been small. There was no fire sale of individual assets. It is hard to imagine that tech firms did not obtain adequate service from their new bank. So the run seems to have imposed limited costs on the system because of the efficient transfer in ownership, something the FDIC has become adept at. If uninsured depositors had borne the full losses, they would have recovered 80–90 percent of their deposits according to Moody's, a painful lesson for depositing corporate treasurers on what it means to be uninsured but not necessarily debilitating for most.[2]

So why then did SVB's uninsured depositors have to be bailed out? Almost surely, the authorities feared contagion—that other banks were in a

2. Moody's Investors Service, "Moody's Downgrades SVB Financial Group (Senior Unsecured to C from Baa1) and Will Withdraw the Ratings," March 10, 2023, https://www.moodys.com/research/Moodys-downgrades-SVB-Financial-Group-senior-unsecured-to-C-from-Rating-Action--PR_474735.

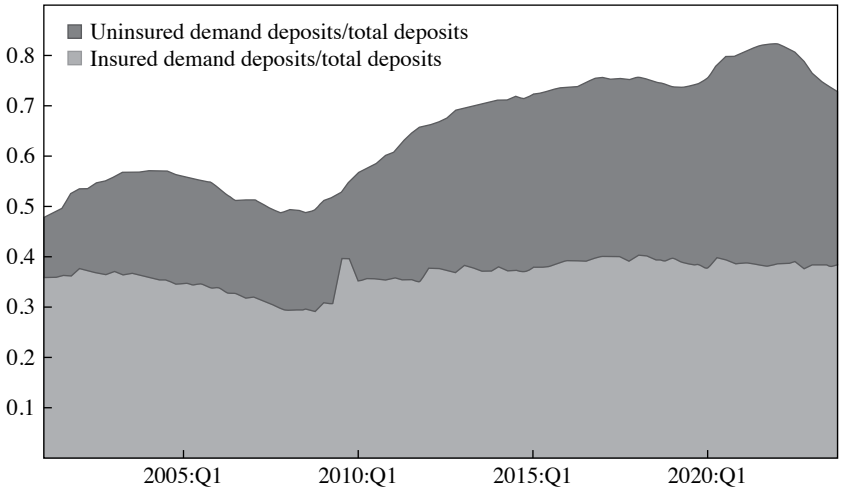
similar position of having long-term asset portfolios financed with uninsured demand deposits, and the losses sustained by the dramatic rise in interest rates made them subject to runs. Indeed, some twenty-two runs were under way (Cipriani, Eisenbach, and Kovner 2024). Jiang and others (2023) estimated that even if only half of uninsured depositors decided to withdraw in March 2023, almost 190 banks with assets of $300 billion were at a potential risk of insolvency. However, when they add going-concern franchise value to the mark-to-market value of assets, DeMarzo, Krishnamurthy, and Nagel (2024) find far fewer insolvent banks.

Nevertheless, the point is that "search for yield" behavior financed by uninsured demand deposits was widespread. Rational runs on the insolvent culprits may have resulted in painful losses for uninsured depositors but would not have been systemic. At the back of the banking authorities' minds, of course, is the worry that if they are not checked, runs may spread from the insolvent to the solvent—a full-fledged panic. Would letting SVB's uninsured depositors bear some losses have led to a full-fledged panic? We will never know because it was not allowed to happen, but it does raise the question of whether the authorities have the appetite for allowing depositor losses at any but the tiniest banks anymore. Undoubtedly, once the Treasury, the Fed, and the FDIC implicitly assured all uninsured depositors that the systemic risk exception invoked to bail out uninsured depositors in SVB and Signature Bank would be applied more widely, further bank runs stopped. At the same time, the authorities may have set a deeply problematic precedent for the future.

DID THE AUTHORITIES CONTRIBUTE TO BANK RISK? No matter how much regulators and supervisors emphasize principles-based regulation, in practice, rules matter because they give the supervisor safe harbor. Moreover, a principles-based supervisor may not have the political clout to highlight, and require remedial action on, vulnerabilities that are not traditional—until it has blown up, how do you know it will? Finally, after a crisis, the rules covering the most recently observed vulnerabilities are strengthened, and compliance is closely monitored—after all, at the very least, regulators and supervisors ought to close the stable door firmly, to show they are cognizant of the horse having bolted (Rajan 2009). Given all this, regulators and supervisors, like generals, tend to fight the last war vigorously.

In 2007–2008, the main issue was the credit risk buried in complex financial assets. There was little of all that in 2023, though there certainly were potential credit defaults in plain vanilla loans to commercial real estate. The biggest cause for concern was interest rate risk in long-term securities and loan portfolios, accentuated by deposit repricing and flight risk on the

Figure 1. The Composition of Domestic Demand Deposits in the United States



Source: Reproduced from Acharya and others (2024).

liability side, again possibly related to interest rates. When the Fed raised interest rates from June 2004, it did so steadily over a two-year period, with a predictable 25 basis point hike every meeting (Federal Reserve Board of Governors 2024). The rate hikes between March 2022 and July 2023 were much more rapid, with four 75 basis point hikes in succession. Moreover, during the period of quantitative easing (QE) preceding the rate hikes, as Acharya and others (2024) document (see figure 1), not only did the share of demand deposits to total domestic deposits go up from 60 percent in 2008 to 88 percent in 2021, the share of uninsured demand deposits to total domestic deposits went up from 24 percent to 47 percent. As a result of the change in deposit structure, which seems to have been little commented on by supervisors (Gopalan and Granja 2023) over the period of successive QEs, deposits became far less attached to the banks than in the past. Alert depositors rather than sleepy depositors dominated now, and deposits became more mobile. SVB was an outlier in this regard, but the phenomenon was more general.

So rapid interest rate hikes were a double whammy for banks. They led to depressed long-term asset values of even safe assets and, simultaneously, to rapid repricing or flight of deposits in ways that banks were hitherto not used to. Supervisors did not anticipate rapid interest rate hikes (as the authors of this paper point out, "remarkably, the Federal Reserve's stress test scenarios in 2021 and 2022 did not include interest rate increases"),

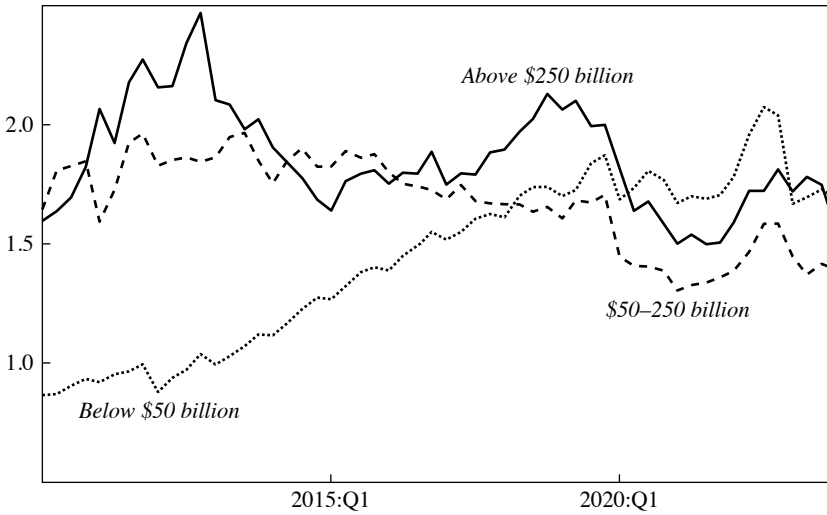
nor did they seem to recognize banks had become more vulnerable to rate hikes.[3] There is some evidence that supervisors noted some of SVB's failings, but they were not sufficiently concerned to press for a rapid response—so much so that SVB was allowed to unwind some of its interest rate hedges just before its demise (Levine 2023). The reason may well be that this was a very different scenario from the run-up to the global financial crisis (recall that with the onset of that crisis, the Fed cut rates, elevating the value of long-term securities). Perhaps supervisors' mindset had not shifted!

Another concern is the distribution of risks across the banking system. The authors show (in table 1 of the paper) that larger bank lending has fallen, and their securities holdings have increased substantially, with cash and short-term securities holdings going up by more than long-term securities holdings. Conversely, smaller banks have maintained their lending at a relative constant fraction of their assets, while their cash plus securities have fallen, especially in the cash plus short-term securities category. Prima facie, it would seem that smaller banks now have greater liquidity risk. Indeed, this is what Acharya and others (2024) show. Figure 2 from their paper suggests the sum of small banks' liquidity exposures (uninsured demand deposits plus lines of credit) to ready sources of liquidity (cash plus reserves plus repo-eligible securities) rose dramatically over the period of quantitative easing, from below 1 to peak at above 2 just before the Fed started raising interest rates. By contrast, for the largest banks, the ratio peaked before the liquidity coverage ratio (LCR) regulation was approved in 2014, and generally drifted down after. It was around 1.7 when the Fed started raising rates. While Acharya and others (2024) define small banks as those with below $50 billion in assets and large banks as those with above $250 billion in assets, table 1 is not inconsistent with their finding—the liquidity risk of smaller banks has gone up substantially in the last decade and a half. They have become more dependent for liquidity on other banks, the Fed, and the Federal Home Loan Banks. Indeed, it bears noting that SVB was one of these smaller banks before 2018.

It would then seem there is interesting specialization emerging within the banking system. The large banks are becoming contingent liquidity

3. DeMarzo, Krishnamurthy, and Nagel (2024) suggest that the excess holding of securities by banks whose franchise value had positive duration risk may have been supervisor-driven, with supervisors believing incorrectly that the securities were offsetting a negative duration franchise value. Gopalan and Granja (2023) show that bank supervisors started downgrading banks with substantial interest rate exposure only after the Fed started raising interest rates. Furthermore, they did not seem to recognize the risk posed by uninsured demand deposits, which Acharya and others (2024) show had spread through the system.

Figure 2. Claims to Potential Liquidity: (Credit Lines + Uninsured Demandable Deposits)/(Reserves + Eligible Assets) across Bank Size



Source: Reproduced from Acharya and others (2024).

Note: This figure plots the distribution across bank holding companies (BHCs) over time of claims to potential liquidity, which is the ratio of the sum of aggregate credit lines and demandable deposits to the sum of reserves and eligible assets between 2010:Q1 and 2023:Q4, with data (field) obtained for each component from Call Reports: Off-balance sheet unused loans or credit lines (RCFDJ457); Uninsured demandable deposits, obtained by subtracting time deposits of more than $250,000 ($100,000 before 2008:Q4) from total uninsured deposits, the latter being estimated from schedule RC-O of the Call Reports. Reserves reflect field RCFD0090, and eligible assets consist of Treasury and agency securities that were eligible for sale to the Fed for reserves in at least one quantitative easing round between 2008:Q4 and 2023:Q1. In particular, bank holdings of Treasury and agency securities are estimated as the sum of the bank's holdings of US Treasuries, obligations of US government agencies, and agency-backed mortgage-backed securities. The value of reserves and credit lines are set to zero if they are missing at the consolidated bank or bank holding company level for a given quarter. The ratio is aggregated by bank size categories. The size buckets are banks with assets above $250 billion, $50–250 billion, and below $50 billion in 2014:O3.

providers (Kashyap, Rajan, and Stein 2002), maintaining suitably liquid balance sheets, including substantial quantities of cash reserves and short-term securities, to do so. Perhaps the more complete application and enforcement of LCR regulation as well as higher capital requirements for systemically important banks forces them to move from holding loans on their balance sheet to using their balance sheet more contingently.[4] Small banks, in contrast, are in the more traditional business of relationship lending, with a significant portion of their assets still relationship loans. It is then particularly

4. Also see Erel and Inozemtsev (2024) on shifts in bank activities as a result of regulatory pressures.

worrying that these banks have increased their reliance on demandable deposits while shrinking their holdings of liquid assets (and even extending their maturity). From a systemic risk perspective, this change is most concerning as it creates a common exposure across many small banks.

The bottom line is that part of the reason small and midsize banks were collectively exposed to the risk of uninsured demandable claims in March 2023 was the prior Fed's balance sheet expansion and contraction. Why these banks did not hold more reserves and short-term securities, and why they instead lengthened the maturity of their securities portfolios (as in table 1) is not obvious. Perhaps it was classic bank search for yield, as Acharya and others (2024) imply. Regardless, the Fed's actions played a role in raising bank risk. Maybe the experience with these actions will lead the Fed to be more circumspect about using its balance sheet as a monetary policy instrument in the future. To the extent, however, that the Fed will continue to use its balance sheet in the future, it will have to consider the effects on the banking system and the potential need for regulations to offset adverse behavior.

MORE REGULATION? The possible adverse behavior engendered by future Fed policy has to be viewed with the additional knowledge that the SVB episode has enhanced the expectation that uninsured depositors in all banks above a (low) size threshold will be bailed out in the future in the event of a run. The authorities will have to worry that banks may have fewer qualms about financing with "cheap" uninsured demand deposits, rendered cheaper because of the anticipation the authorities will intervene. Furthermore, even if they do not run, uninsured depositors are less likely to be attached to the bank than traditional insured depositors and will be quicker to demand repricing. In other words, bank moral hazard and bank risk may increase as a consequence of SVB.

Where then to regulate? Apart from concern about whether supervisors can enforce a holistic mandate on risk taking, there is the important issue of risk migration. To the extent that certain entities are regulated or scrutinized more closely than others, risk migrates away from those entities but often ends up in less-scrutinized entities. So, for example, if liquidity positions are more closely scrutinized at large banks, liquidity risk moves to small banks or into the nonbank sector. Even though the authors emphasize that the costs of additional liquidity regulation may be lower at large banks—which seem more akin to money market bond funds—large banks were not the ones that got into trouble (large bank regulations did not apply to SVB because it was a small-to-midsize bank for much of the time when risks built up). Furthermore, the tighter liquidity regulation on large banks seems to have led them to draw reserves away from small banks. This

would not be a problem if large banks were to lend liquidity freely in times of stress. Unfortunately, as Acharya and others (2024) argue, the residual source of liquidity for stressed banks seems to have been the Fed windows and the Federal Home Loan Banks, and not the large banks. In sum then, more uniform regulation—for instance, extending LCR to smaller banks—seems to them a more desirable first step than more regulations on the large banks. With these caveats, let us move to the specifics of the proposals.

PROPOSAL 1: PRE-POSITIONING LOANS AS COLLATERAL AT LARGE BANKS The SVB crisis suggests stricter liquidity regulation ought to be extended to smaller banks, as this paper commendably suggests. The most novel part of the proposal is to pre-position loans at the discount window, which is what I will focus on. This idea seems very sensible, addressing both the stigma associated with borrowing from Fed facilities (which tends to deter borrowing) as well as the possibility that the bank may have too few high-quality assets to raise secured funding quickly. The authors do a great job in raising concerns and addressing them. A few additional concerns are worth addressing.

First, if indeed large banks are moving to using their balance sheet contingently, offering liquidity to firms in case of need, they will be adding significant loans in times of aggregate liquidity stress. Of course, some of the large banks' liquidity needs could be offset by deposit inflows (Gatev and Strahan 2006). However, to ensure that large banks continue to intermediate liquidity, the central bank should lend against the new loans. These would not have been pre-positioned and may indeed be riskier than the norm—for instance, they will include drawdowns on lines of credit, which could be loans that no bank would make without having entered into a prior commitment. Shouldn't pre-positioning also include such contingent loans?

This leads to a second concern, which at the broadest level applies to all publicly provided insurance: the tendency to underprice it. The central issue in pricing is, of course, the haircut the Fed should apply on the value of these contingent loans to determine the amounts it lends. A related issue is the haircut it imposes on ordinary pre-positioned loans, knowing that the haircut is set in normal times while the Fed's liquidity is drawn upon in times of stress. Haircuts should anticipate such stress, but it will be hard for the central bank to get it right. Should the proposed haircuts be dynamic, increasing if conditions deteriorate more than anticipated? Dynamic haircuts would reduce the value of pre-positioning and may even set off a run if the haircut increases substantially, but it would allow the Fed to set lower haircuts up front given they can be changed.

Taking these considerations into account, perhaps the haircuts should be dynamic but change only after a lag—for instance, the Fed would reexamine

the pre-positioned loans periodically, calculate the liquidity deficiency if the haircut reflected true risk of these loans, get the bank to fill the deficiency from other sources, and announce the new haircut after the next examination. The old haircut would prevail in between examinations, giving the bank the time between examinations to get its liquidity supply in order, while, of course, unavoidably exposing the Fed to more risk.

A final concern is that if the pre-positioning facility is available only to large banks, they may become even more attractive destinations for flight-to-safety money in times of stress. If they do lend the money back out, this is not entirely bad, given our earlier discussion. However, if they hoard it, then a liquidity facility available only to some banks may exacerbate the liquidity shortage in others. More generally, it is worth contemplating a liquidity facility that is widely available rather than one that is available only for some banks.

PROPOSAL 2: INTEREST RATE RISK A second proposal that is hard to argue with is a better treatment of interest rate risk exposures. Of course, a key concern is to get the overall exposure right—if only some part of the exposure is accounted for, the bank forced to recognize it, and the consequent valuation changes made to affect bank regulatory capital, the bank will try and manage down that exposure. If, however, that exposure is a hedge for other, harder-to-measure exposures, such as loan and deposit rate sensitivities, there is a risk that the bank could become overexposed to rate risk. DeMarzo, Krishnamurthy, and Nagel (2024) show how important it is to take all rate exposures into account and conclude that banks overall have positive duration. If so, an expanded securities portfolio can lead to greater interest rate risk, in which case requiring capital against the securities portfolio's interest exposure is a step in the right direction. However, such a conclusion will not be true for every bank.

Should we work toward a supervisory framework that tries to estimate the interest rate exposure of each bank's franchise and, following that, sets a fraction (from zero to 1) for the flow-through of securities portfolio valuation changes into capital? This would add to the complexity of the supervisors' task and expand discretion, with all the attendant previous caveats, but it may be better than mandating 100 percent pass-through. At any rate, I endorse the view that we need better understanding and treatment of bank interest rate exposures.

PROPOSAL 3: ALLOW MERGERS OF SMALL AND MIDSIZE BANKS The proposal to allow some mergers of banks below mega-bank size—so as to allow them to upscale from the midsize level that no longer seems to add value—once again makes sense. The concern is that a lot of small banks merge in

this more liberal environment to become midsize banks—perhaps because small-bank managers have empire-building motives. After all, that is how we got some midsize banks in the first place. One possibility is to make it more attractive for banks to stay small and local. Can they get some of the benefits of scale without scaling up? Other countries have networks of small banks that offer mutual insurance, economies in purchasing technology, and some common resources—for example, the Rabobank network in the Netherlands. Should the impediments to such structures in the United States be identified and removed? Is it too far-fetched to imagine that some midsize banks might break up through management buyouts into such networks of small banks?

SUMMARY This is a great paper and has a number of interesting policy recommendations. Obviously, the analysis is intended to start a debate and will inspire more research. I am sure it will have that effect.

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GENERAL DISCUSSION Donald Kohn questioned what drove the growth of uninsured deposits. He observed that while uninsured deposits as a percentage of domestic deposits seemed to follow a trend in the 1990s and early 2000s, in the following decades, they occasionally stair-stepped and abruptly increased. He theorized that this might be a result of the zero interest rates at those times, which complicated banks' time deposit and demand deposit mix. Banks may have been reluctant to price demand deposits at a negative interest rate because they did not want to lose business. This could make demand deposits more appealing to depositors, meaning that the relative increase in demand deposits might come from the depositor side rather than from the banks seeking demand deposits.

Wendy Edelberg presented an alternative theory of what drove the rising share of deposits held as demand deposits. She asserted that since the US Treasury cannot change the amount of money in the banking system, and since federal borrowing from abroad is modest compared to the overall increase in federal borrowing, the increase in demand deposits might be primarily explained by quantitative easing (QE). Edelberg then suggested that monetary policymakers in the future should account for how QE would affect demand deposits. Even so, she acknowledged that regulators could not practically vary the deposit insurance level every quarter, so they could not simply raise the required deposit insurance level whenever there was higher QE.

Randall Kroszner pointed out that since the United States is currently experiencing quantitative tightening (QT), by the end of 2024, there should be evidence for whether or not QE is driving deposits. If deposits go down very significantly under QT, the hypothesis that QE drives deposits would have more support.

Laura Nicolae contended that QE's role in driving long-term deposit growth was not totally clear. She commented that the Federal Reserve buying

bonds from a bank does not necessarily create deposits—it just switches out reserves for bonds on a bank's balance sheet. Similarly, the Federal Reserve buying bonds from a nonbank might create deposits in the short term but does not guarantee that those deposits will remain where they are. Nicolae instead attributed the long-term growth in deposits to growth in demand for deposits, noting that figure 1 (panel B) in the paper shows that deposits scale with wealth.[1] She also noted that deposits have been growing for decades, through periods of both QE and QT.

Andrew Atkeson reflected on his time at the Federal Reserve Board's Model Validation Council, an advisory body that provides guidance for the models used in bank stress tests. He claimed that the issues of interest rate risk and run risk that led to the collapse of Silicon Valley Bank (SVB) were never considered, despite the purpose of a stress test being to anticipate new and evolving risks. He wondered if there were institutional changes that could be made to allow regulators to address future, otherwise unanticipated, problems.

Laurence Ball echoed the paper's sentiment that stress tests and regulators have made overly optimistic assumptions about the risk presented by uninsured deposits. Referring to one of his own papers, he observed that the current stress test scenario makes additional problematic assumptions.[2] According to Ball, outflow rates for repurchase agreement financing are too low in the current scenario. Furthermore, Ball posited that the scenario's worst error was assuming that banks' outflows are largely offset by inflows, which would come from cutting off financing to customers. Banks might be loath to do this because it would destroy their ability to do business in the future.

Although Ball advocated for stronger liquidity coverage ratio (LCR) regulations, he granted that regulators might conclude that banks ought to hold so much liquidity that there would be none left over for lending. In light of that potentiality, he supported the idea of pre-positioning collateral at the Federal Reserve's discount window. He argued the LCR rule was meant to allow banks to survive crises without borrowing, which might be an unrealistic demand. Future scenarios should make the Federal Reserve's role more explicit and incorporate the option of borrowing.

Burcu Duygan-Bump contemplated the role of liquidity regulations compared to that of the Federal Reserve as the lender of last resort (LOLR).

1. Here refers to figure 1 (panel B) in the conference draft of the paper, available at: https://www.brookings.edu/events/bpea-spring-2024-conference/.

2. Laurence Ball, "Liquidity Risk at Large U.S. Banks," *Journal of Law, Finance, and Accounting* 7, no. 2 (2023): 229–72.

She questioned if a bank's pre-positioned collateral needed to be counted toward its LCR and if that presented any dissonance. She thought not but believed the role of LCR versus LOLR merited further consideration.

Turning now toward the discussion of how to manage interest rate risk and liquidity risk, Kroszner questioned why the United States did not require a capital charge whenever banks take on interest rate risk. This rule had been adopted by many other countries, and Kroszner emphasized that no other country experienced similar issues during the collapse of SVB. He clarified that Credit Suisse's collapse, while contemporaneous, had nothing to do with interest rate risk.

Kohn concurred with the paper's points about penalizing banks that use hold-to-maturity accounting to avoid acknowledging unrealized changes in the market value of their held bonds—called mark-to-market gains and losses. He affirmed that extending the mark-to-market was a vital part of managing interest rate risk and liquidity risk.

Andrew Fieldhouse remarked that conversations with a colleague from regional reserve bank had led him to believe that SVB's collapse was primarily due to duration risk on agency mortgage-backed securities (MBS) rather than interest rate risks on Treasuries. He also recommended that the authors consider the feasibility of hedging refinancing risk on agency MBS in addition to their examination of interest rate risk.

Samuel Hanson compared banks to insurers, saying that insurers marking their assets while not marking their liabilities to market would be economically incoherent. While challenging, Hanson contended that requiring banks to mark both sides of their balance sheet was clearly necessary. He went on to agree with Arvind Krishnamurthy's discussion about creating a capital charge that scaled with the amount of liquidity transformation, since more liquidity transformation meant greater risk of loss of franchise value.

The discussion also touched on why banks seem so hesitant to use the Federal Reserve's discount window. Kroszner expressed concern that the discount window was poorly run and not that user-friendly, and argued that these issues, as well as the stigma associated with using the discount window, must be addressed if the Federal Reserve wanted more banks to use the window more regularly.

Kohn pointed out that banks went to the Federal Home Loan Banks (FHLBs) rather than the discount window because it was cheaper overall. He mentioned that there had been recent discussion of reforming the FHLBs to refocus them on only supporting the mortgage market. Kohn's recommendation to address the stigma around the discount window was for regulators to acknowledge that discount window access can be a part of a

recovery and resolution plan by allowing discount window utilization in stress tests. Additionally, the penalty for using the discount window should be reduced. According to Kohn, the United Kingdom and the eurozone had successfully reduced the stigma by moving to reserve management processes under which banks borrow whenever reserves get sufficiently scarce.

Responding to Jeremy Stein's presentation, Robert Hall drew a sharp distinction between banks and bond mutual funds, noting that it was incorrect to claim banks were becoming mutual funds. Hall said that mutual funds are organized under the Investment Company Act of 1940. This makes them run proof, since someone withdrawing from a fund is paid off immediately at market value. In contrast, banks are immensely at risk of runs, making turning banks into a mutual fund highly desirable.

Stein acknowledged the critique by Hall. He observed that while banks are increasingly resembling MBS bond funds on the asset side, they are much less suited to handle duration risk on the liability side when issuing uninsured deposits. All else being equal, this makes it better for MBS to be held in a bond fund than by a bank that finances the MBS with uninsured deposits. An ideal regulatory framework would level the playing field without encouraging or disadvantaging the bond funds relative to the banks. Unfortunately, bailing out uninsured depositors creates an implicit subsidy, which encourages MBS to be held in banks.

Jón Steinsson discussed the two socially valuable contributions of banks that the paper highlighted: the provision of information-intensive loans and the provision of transaction services. He remarked that the latter service is potentially overlooked. Payment systems work so well today that people forget how crucial they are to a well-functioning economy. He believed this should not be taken for granted, and he pointed out that the debate surrounding which of these two socially valuable contributions to emphasize was often extreme and binary with one side favoring narrow banking and the other side hostile to any increase in capital requirements. He felt that the results of the paper should tilt this debate in the direction of higher capital requirements being optimal.

Steinsson also emphasized another service provided by banks—the creation of liquidity. Steinsson described how banks are traditionally able to make long-term assets very liquid. He worried that the paper's focus on having banks hold short-term assets against uninsured deposits would mean that there would be no institutions left to hold long-term assets.

Adi Sunderam commented that Steinsson—and almost everyone else, including the other authors—seemed to take it as a given that it is always socially valuable to accommodate liquidity demand and safe asset demand.

Sunderam contested this assumption, as accommodating these demands could be negative under some circumstances, such as providing liquidity that facilitated crime.

Kroszner cautioned the authors about being too cavalier about creating regulatory systems that push banks out of information-intensive lending. He argued that just because banks are not doing much information-intensive lending does not mean it is a good idea to push them out entirely—what little they are currently doing might still be very socially valuable. He referred to a recent Bank for International Settlements paper, which found that, following a crisis, lending and investment fell and stayed down at firms that were primarily reliant on nonbanks.[3]

Stein reassured Kroszner, indicating that the authors were being careful not to push banks out of providing loans entirely, as shown by their proposal to allow loans to be pre-positioned at the discount window. Although the authors specifically hoped to lean against banks holding too many long-term MBS, they were careful not to recommend changes that were too extreme because banks only holding short-term securities could create equilibrium issues.

Şebnem Kalemli-Özcan considered whether banks of different sizes should be subject to the same regulations. Kalemli-Özcan inquired why the authors did not apply the LCR to all banks, including banks with assets below $50 billion. She suggested that extending LCR regulations to all banks might trigger desirable endogenous mergers, cutting down on a significant number of banks in the United States. She observed from the Federal Reserve's stress test results (FR Y-14) that small and midsize enterprises in fact borrow mainly from medium-size and large banks.[4] This means that reducing the number of small banks might not cause issues for small businesses.

Anna Paulson brought up the fact that larger and smaller banks have different business models. Consequently, one-size-fits-all regulations create different externalities. For instance, large banks that have fire sales often only part with less information-intensive assets compared to smaller banks. She identified this as a reason why creating blanket regulation was difficult.

Hanson agreed with the discussants and conference participants that applying liquidity regulations to smaller banks was worth considering.

3. Iñaki Aldasoro, Sebastian Doerr, and Haonan Zhou, "Non-bank Lending during Crises," BIS working papers 1074 (Basel: Bank for International Settlements, 2023).

4. Cecilia R. Caglio, R. Matthew Darst, and Şebnem Kalemli-Özcan, "Collateral Heterogeneity and Monetary Policy Transmission: Evidence from Loans to SMEs and Large Firms," working paper 28685 (Cambridge, Mass.: National Bureau of Economic Research, 2024).

He then answered Kalemli-Özcan's question, explaining that the paper anchored at banks with $100 billion in assets because that was where a 2018 law that amended the Dodd-Frank was set. This meant that $100 billion was the lowest level that the Federal Reserve could regulate without requiring further action from Congress. Sunderam added that the paper focuses on midsize banks because of what happened with SVB, but he theorized that the logic of the model should extend.

Internet Appendix for:

The Evolution of Banking in the 21st Century: Evidence and Regulatory Implications

May 2024

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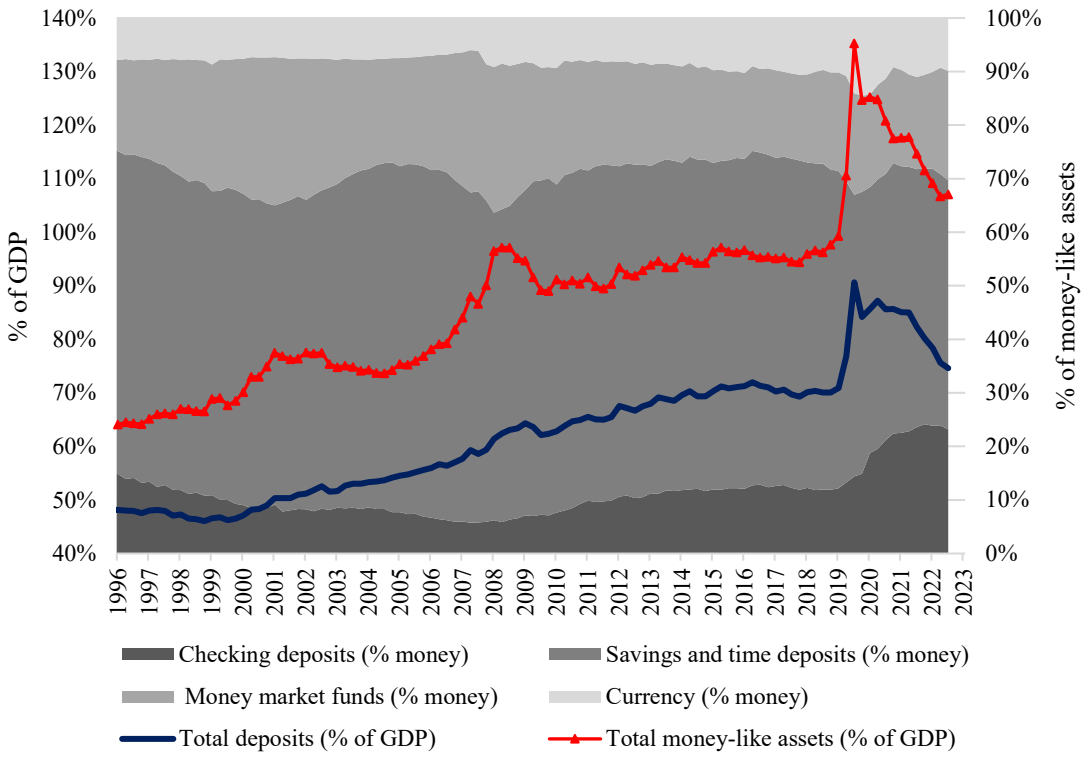
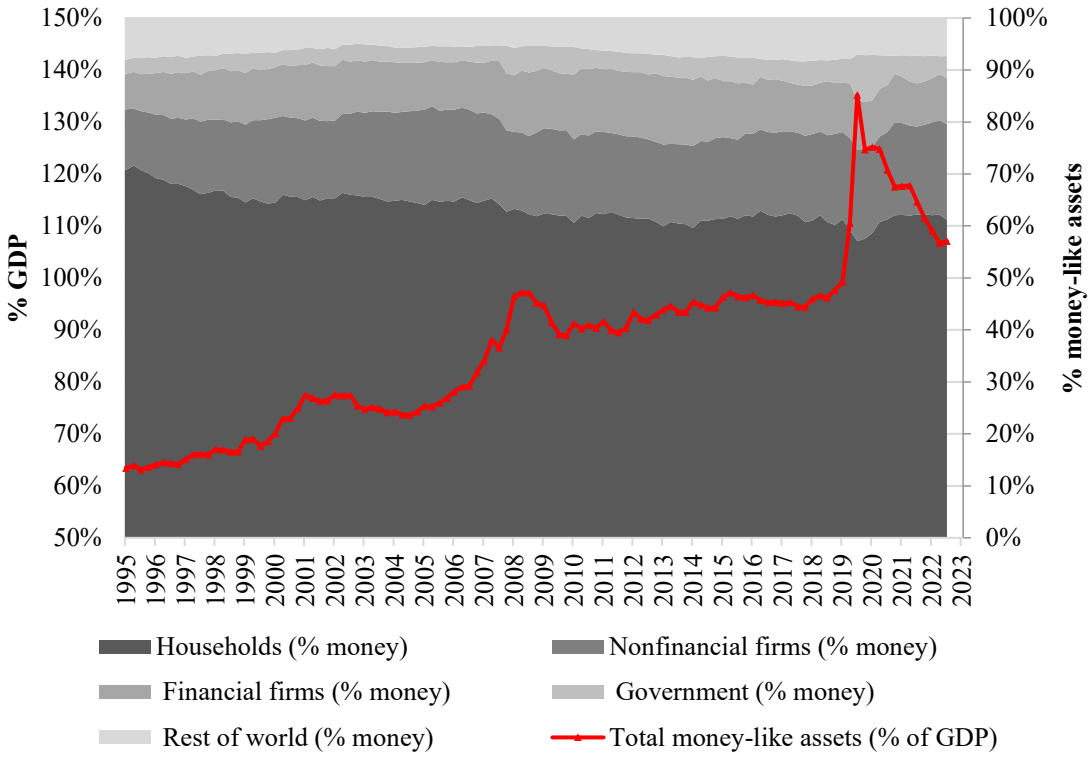
Figure A1: The Growth and Composition of Total Money-like Assets



Notes: The solid line, which is plotted on the left axis, shows total deposits at U.S. depository institutions as a share of U.S. GDP. This includes the deposit liabilities of U.S.-chartered depository institutions, U.S. foreign banking offices, banks in U.S.-affiliated areas, and credit unions. The marked line, also plotted on the left axis, shows how a broader measure of money-like assets—total deposits plus currency in circulation and money market fund shares—has evolved relative to GDP. The right axis shows the shares of these four money-like assets—checking deposits, savings and time deposits, money market funds, and currency—as a fraction of total money-like assets.

Source: Total deposits is from the Financial Accounts of the U.S. and equals the sum of total Checkable Deposits and Currency (FL793120005) and total Time and Savings Deposits (FL703130005) minus the currency liabilities of the Monetary Authority (FL713120005). Total money-like assets adds currency (FL713120005) and money market fund shares (FL634090005). Gross Domestic Product is from FRED.

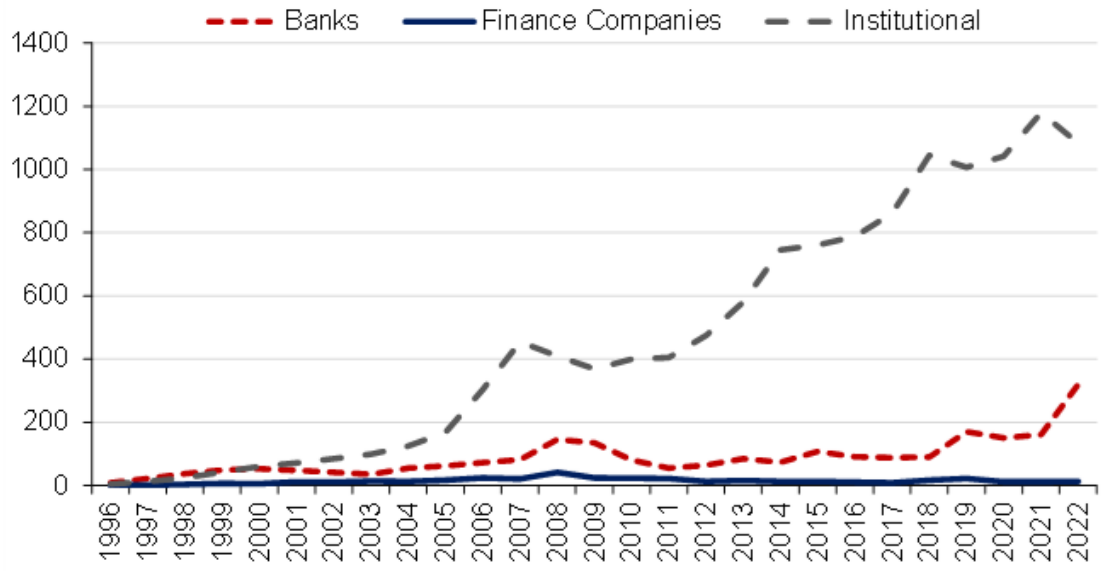
Figure A2: Holders of Money-like Assets



Notes: The marked line, plotted on the left axis, shows a broad measure of money-like assets—the sum of checking deposits, savings and time deposits, money market fund shares, and currency in circulation—has evolved relative to GDP. The right axis shows the fractions of these money-like assets that are held by households, nonfinancial firms, domestic financial firms, federal, state, and local governments, and the rest of the world, respectively.

Source: Authors' calculations using data from Table L.204 (Checkable Deposits and Currency), L.205 (Time and Savings Deposits), and L.206 (Money Market Fund Shares) from the Financial Accounts of the U.S. Gross Domestic Product is from FRED.

Figure A3: Leveraged Loans by Lender Type ($ billion)



Note: This figure plots outstanding U.S. leveraged loans by lender type from 1996 to 2022.

Source: Figure compiled using data from LCD and Pitchbook.