Monetary Policy, Bank Regulation and the Secular Decline of Bank Balance Sheet Lending*

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Abstract

We document the secular decline in bank balance-sheet lending since the 1970s and analyze its implications for monetary policy and financial regulation. The share of private lending on bank balance sheets fell from 55% in the 1970s to 33% in 2023, alongside declines in deposits as a share of savings (21% to 13%) and loans as a share of bank assets (70% to 55%). We develop a model, disciplined by micro and aggregate evidence, that captures the interaction between traditional balance-sheet lending and originate-to-distribute (OTD) intermediation via bank securities holdings. Four forces drive the transformation: (i) borrower demand shifting toward informationally insensitive debt; (ii) saver demand moving away from deposits; (iii) regulatory changes; and (iv) unconventional monetary policy through central bank asset purchases. Borrower demand shifts, reflecting the expansion of debt securities markets, account for most of the decline in balance-sheet lending. Saver reallocation primarily shrinks bank balance sheets. Regulatory changes play a secondary role. Post-2008 quantitative easing (QE) further shifted bank portfolios away from loans and partially crowded out traditional lending. Our framework clarifies monetary transmission in a world where non-bank intermediation is central by separating a conventional interest-rate channel from an unconventional asset-purchase channel that reallocates credit across intermediaries. Simulations show that higher capital requirements reduce banks' footprint with modest effects on aggregate credit, as securities markets absorb the shift, highlighting diminishing regulatory leverage over aggregate lending. Persistent QE reinforces this compositional reallocation toward debt securities markets, reshaping where and how credit is intermediated.

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1. Introduction

Key policies on financial regulations, monetary measures, and bank bailouts are shaped by the traditional view of banks' balance sheets as central to financial intermediation. In this framework, banks connect savers and borrowers by issuing demandable deposits to savers and using the proceeds to make informationally sensitive loans (Diamond and Dybvig 1983; Diamond and Rajan 2001; Kashyap et al. 2023).

This paper starts by documenting two main facts. First, the bank balance sheet model of intermediation has significantly declined over the past half-century. Instead, credit is increasingly intermediated through arms-length transactions, known as the originate-to-distribute (OTD) model, where a lender (whether a bank or non-bank) originates loans and sells them via debt securities (see Keys et al. 2010, 2013; Buchak et al. 2018, 2024). While the shift toward OTD intermediation has been widely studied in the post-Great Financial Crisis context, we show that is a longer-term, secular trend, with significant growth occurring during the 1980s and 1990s, affecting both deposits and various loan segments.

Second, we show that the balance sheet and OTD models are interconnected: Banks hold a significant share of securities produced by the OTD sector. While the traditional bank balance sheet model has declined, the share of securities on bank balance sheets has increased. Additionally, balance sheet bank loans are an important source of financing (often working capital) in the OTD intermediation process.

These facts present a conflicting impression of the importance of the banking sector in the economy. On one hand, banks and non-banks appear to be *substitutes* in providing financial services to borrowers and savers. Under this view, the downsides of bank failures or macroprudential regulation that impede bank activity may be muted by the presence of the OTD sector. On the other hand, banks and non-banks appear to be *complements* in the *production* of financial services. Under this view, although the OTD sector is increasingly the ultimate provider of financial services to the borrower and saver sectors, the provision of these services relies fundamentally on bank balance sheets, including through banks' purchases of debt securities and their loans to nonbank financial intermediaries. In practice, the economy may lie anywhere along the spectrum between these two views.

To study the equilibrium implications of this transformation and to assess where the banking sector lies along this spectrum between substitution and complementarity, we develop a model that captures both forces between bank balance sheets and OTD intermediation. The key feature of our model that distinguishes it from existing work is that we allow banks to hold OTD securities and fund their production with balance sheet loans. A key takeaway from the model is that, in the current economic environment, the size of bank balance sheets is driven more by saver demand for deposits than by borrower demand for loans. Marginal increases in deposits are largely invested in securities that fund informationally insensitive lending, rather than directly supporting bank

loans. A second insight is that the significant decline in bank balance sheet intermediation has altered the trade-offs faced by macroprudential policies and monetary policy. For example, higher capital or liquidity requirements lead to a modest reduction in overall lending, as the contraction in bank balance sheet lending is offset by increased issuance of debt securities. That is, substitution between bank and OTD intermediation appears to dominate the complementarities. Similarly, quantitative easing policies induce a significant reallocation of credit away from bank balance sheets toward debt securities.

We begin by highlighting key trends that illustrate the decline of the traditional bank balance sheet model. First, the share of "informationally sensitive lending" (bank balance sheet lending) peaked at around 55% in the early 1970s but has since nearly halved to 33%. This decline extends beyond loans eligible for securitization by government-sponsored entities (GSEs), affecting loans ineligible for such guarantees, including non-mortgage loans. Second, on the savers' side, the deposit share of household savings has dropped from 21% to roughly 13%, as savers increasingly allocate wealth to alternative savings vehicles such as securitized private credit and Treasury securities. Third, banks have adjusted their business models: in 1970, loans made up 70% of bank assets, but by 2023, this figure had fallen to 55%, with a larger share of bank funding now directed towards purchasing securities created by the OTD sector. Finally, despite these significant shifts in quantities, we observe that price changes have been minimal—spreads on deposits, loans, and credit securities have remained largely stable during this period of dramatic change in volumes.

To interpret these trends and study their implications for monetary policy and financial regulation, we construct a model in which bank balance sheet intermediation interacts with OTD intermediation, introducing two key departures from the existing literature. First, the model is designed to explore the role of intermediation frictions and household preferences in shaping long-term intermediation trends. As a result, we incorporate a rich set of intermediation frictions, at the expense of modeling dynamics, which are more relevant for explaining business cycle fluctuations.

The second departure is that we explicitly model the interconnectedness between bank balance sheets and OTD intermediation through bank securities holdings and direct bank balance sheet lending for working capital purposes. Several existing models study the interaction between the bank balance sheet and shadow banking sectors, focusing on lending, liability creation, or both.[1] Like these models, ours treats the two sectors as *imperfect substitutes*. However, as we document, banks have increasingly invested in informationally insensitive securities as their balance sheet intermediation has declined. They do so because they are more liquid than loans, helping them manage liquidity shocks in the spirit of Diamond and Dybvig (1983). Additionally, when their balance sheets are "too large"—when deposit attraction and rent-earning exceed the optimal level of informationally sensitive lending—banks turn to securities. This interconnectedness suggests

[1] Buchak et al. (2018), Ordonez (2018), Xiao (2020), Corbae and D'Erasmo (2021), Begenau and Landgvoit (2022).

that a contraction in bank balance sheets may reduce OTD intermediation, even though the two sectors provide substitutable saving and borrowing technologies.

The broad outline of our model is as follows: the financial intermediation sector creates borrowing and savings technologies. Intermediaries offer savers two types of financial products—bank deposits and securities, which may include debt securities, equities, or treasuries. These securities are imperfect substitutes for deposits, differing in the transaction services they provide and other characteristics such as diversification benefits for household portfolios. On the borrowing side, firms can choose between informationally sensitive loans or informationally insensitive debt securities, which are also imperfect substitutes. For instance, bank loans and bonds both allow firms to borrow, but they differ in ex ante screening and ex post monitoring, making them imperfect substitutes from the borrowers' perspective. Critically, borrower demand for similarly priced informationally sensitive and insensitive lending, and saver demand for similarly priced deposits and securities, is allowed to fluctuate over time, reflecting implicit shifts in borrower and saver demand.

The intermediation sector consists of two types of intermediaries: "banks" and "OTD" intermediaries.[2] Banks play a central role because they are the only intermediaries that can offer deposits and informationally sensitive loans, whereas the OTD sector can only create informationally insensitive loans and issue securities. As emphasized earlier, banks can invest in securities despite earning the same returns as other savers, meaning deposits are partly invested in securities that investors could own directly. Banks also provide working capital to the OTD sector, with a portion of the OTD sector financed by informationally sensitive bank loans.[3] Intermediation introduces a wedge between (risk adjusted) returns paid by borrowers and those earned by savers. Imperfect substitution gives intermediaries market power, leading to a gap between the rates paid and earned by households and those set by intermediaries.

Finally, we incorporate a monetary authority, funded by currency and reserves, which can affect the long-term inters rates and buy or sell securities (e.g., MBS) at market prices through quantitative easing or tightening policies. Banks hold central bank reserves, treating them as an imperfect substitute for other securities.

We derive equilibrium returns and quantities across saving and borrowing technologies from saver/borrower preferences and the wedges intermediaries face. For instance, the deposit rate relative to T-bills is pinned down by savers' substitution elasticity (which governs markups) and banks' equilibrium funding and lending wedges; because banks have market power, these wedges are only partially passed through to deposit rates. We combine equilibrium price-setting with bank

[2] When applying the model to the institutional setting and data, only banks (depository institutions) can perform what we refer to as "banking" activities. However, a significant portion of OTD intermediation is also conducted by traditional banks (see Buchak et al. 2024). Thus, the definition of the OTD sector is functional rather than strictly institutional.

[3] See Jiang (2023) in the context of residential mortgages.

balance-sheet choices to estimate bank frictions and saver/borrower substitution parameters, using pass-through from risk-free rates to deposit rates, loan rates, and bank equity returns to discipline pricing. To address endogeneity in Treasury rates, we follow Krishnamurthy and Li (2022) and instrument using the total quantity of Treasuries. Remaining preferences and frictions are calibrated to match the time series of prices and quantities.

The estimated model recovers four structural forces that explain the equilibrium outcomes observed in the data: shifts in relative borrower demand for informationally sensitive versus insensitive loans, shifts in saver demand for deposits versus securities; shifts in intermediaries' cost structures, and monetary policy.

We begin by exploring various technological, institutional, and regulatory changes as mechanisms explaining these structural shifts. These mechanisms include the introduction and expansion of the GSEs, and private securitization, the automation and standardization of loan origination, the rise of alternative investment and retirement vehicles, the evolving bank regulatory landscape through the 1980s, 1990s and post-GFC period, and asset purchases undertaken by the central bank.

To show their plausibility, we provide micro-evidence that these mechanisms are at work in explaining our macro trends. First, exploiting variation in GSE mortgage securitization eligibility (following Buchak et al., 2024), we find that securitization expansion and lower OTD frictions reduce informationally sensitive bank balance-sheet lending and shift bank assets from loans toward securities. Second, as balance-sheet lending declines, "shadow money" debt markets absorb a meaningful share of the displaced financing—up to 40% during 1970–1990. We also present micro evidence that pension-fund legislation shifted savings from bank deposits toward non-bank products. Finally, we show that Fed quantitative easing is associated with less informationally sensitive bank lending and with bank portfolios tilting away from loans and debt securities toward reserves.

We next relate these changes quantitatively to the structural parameters we recover from the model. We show that shifts in borrower demand towards informationally insensitive lending are closely associated with the technological, regulatory, and institutional features—particularly the rise of the GSEs—that we highlight above. Interestingly, they do not appear to be driven by changes in the nature of investible projects, such as an increase in intangible assets. [4] Similarly, shifts in saver demand correspond with regulatory and technological changes, as well as the rising wealth share of the richest savers. Finally, changes in bank intermediation costs correspond closely with increased bank regulation, such as capital and liquidity requirements.

[4] These findings connect with the literature in banking that has emphasized the role of "soft information" — i.e., information that is based on interactions between banks and potential borrowers and is difficult to transmit to third party — in lending (e.g., Petersen and Rajan 1994; Stein 2002). It is understood that adoption of information and credit scoring technology over time has helped "harden" part of the soft information, allowing for a greater "distance" between the bank and borrowers (Petersen and Rajan 2002) as well as between originators of risk (i.e., lender) and investors who ultimately hold the risk in the intermediation chain (Rajan et al. 2014).

We then use the model to attribute the aggregate trends to the structurally recovered forces.[5] Our estimates suggest that shifting borrower-side demand for informationally insensitive borrowing explain much of the decline in informationally sensitive lending share. Shifting saver demand towards securities and away from deposits largely affected bank balance sheet size and deposit funding, but had little impact on aggregate lending. Implicit subsidies and costs to bank balance sheet activities, particularly after the global financial crisis, contributed modestly to the declining share of informationally sensitive lending. Finally, Federal Reserve security purchases through programs such as Quantitative Easing boosted aggregate lending while shifting credit away from bank balance-sheet loans and toward informationally insensitive securities.

Next, we use the model to demonstrate that the impact of increased capital or liquidity requirements on aggregate lending is much smaller than their impacts on bank balance sheet lending in particular. We simulate raising capital requirements to 25% and find that while bank balance sheets contract considerably, the effect on aggregate lending is more modest. We observe similar results for liquidity requirements. This indicates that, despite the connection between bank balance sheet and OTD intermediation through securities holdings, the substitution effect found in prior literature still dominates. The reduction in bank lending is partially offset by an increase in lending through debt securities. As a result, higher capital or liquidity requirements lead to only a modest decline in aggregate lending, despite a significant contraction in bank balance sheet lending. More broadly, these counterfactuals suggest that the evolution of the financial sector has made it more resilient to certain regulatory and macroprudential changes—particularly increases in capital requirements—due to changing household preferences and reduced OTD frictions.

Finally, we use the model to clarify how unconventional central-bank policies—especially quantitative easing (QE)—operate in a credit market where non-bank lending and savings are quantitatively important. A key advantage of our framework is that it lets us decompose monetary policy into two distinct components: a *conventional* component that works through interest rates, and an *unconventional* component that works through asset purchases. While in practice these tools are often deployed jointly (e.g., policy-rate cuts alongside QE), we orthogonalize them in counterfactuals to isolate their separate effects on balance sheets, portfolio choices, and the allocation of credit across banks and non-bank intermediaries. In the conventional channel, lower risk-free rates reduce funding and lending rates, draw deposits into banks via imperfect pass-through, and expand both bank and non-bank lending.

We first note that the bulk of the long-run decline in bank balance-sheet lending occurs before QE is introduced, so unconventional policies cannot explain most of that secular shift. Nevertheless, our estimates imply that QE can partly crowd out bank balance-sheet lending by compressing

[5] The model holds the initial capital stock fixed each period and assumes all funds are fully invested or consumed, so longer-run growth effects from relaxed constraints or better project selection lie largely outside the framework. Accordingly, our results should be read as accounting for shifts in the composition of intermediation and balance sheets, not as a full measure of intermediation's contribution to long-run capital accumulation and growth.

yields on purchased debt securities (especially agency MBS) and inducing borrowers to substitute toward cheaper, informationally insensitive, securitized credit. At the same time, because QE is financed by issuing reserves, it primarily recomposes bank assets—swapping securities for reserves—rather than creating new balance-sheet capacity, reinforcing a shift away from loans and debt securities toward reserves. Overall, unconventional purchases modestly raise total lending but tilt its composition away from informationally sensitive bank lending, consistent with the portfolio-balance mechanism and our empirical evidence around large-scale asset purchase episodes. In doing so, QE may weaken banks' screening and monitoring functions.

Our paper contributes to the vast literature on financial intermediation and banking, which we cannot cover comprehensively here. Most closely related to our work is the research by Buchak et al. (2023; 2024), which examines the interaction between bank balance sheet lending and OTD intermediation, highlighting the importance of bank retention and shadow bank substitution margins in financial intermediation pass-through. We take a broader approach by analyzing the entire private credit market to explore the secular decline in balance sheet banking.[6] Our model endogenizes the supply of funds to intermediaries—the savers' side of the economy—and incorporates the fact that banks purchase securities originated by the OTD sector, linking the two. By focusing on the credit market equilibrium across savers, borrowers, and intermediaries, our study also relates to recent models on financial intermediation markets and banking (e.g., He and Krishnamurthy 2013; Brunnermeier and Sannikov 2014; Atkeson et al. 2018; Xiao 2020; Corbae and D'Erasmo 2021; Elenev et al. 2021; Begenau and Landvoigt 2022; Bianchi and Bigio 2022; Davila and Goldstein 2023; Diamond et al. 2024). Within this literature our work emphasizes the secular decline in bank balance sheet lending, its key drivers, the role of bank balance sheets as purchasers of OTD securities, and the equilibrium implications for financial intermediation pass-through, monetary policy, and macroprudential regulation.

2. Aggregate Credit Market Trends and the Secular Decline of Bank Balance Sheet Lending

2.1 The Main Market Segments and Data Sources

We focus primarily on the credit and savings market for US households and non-financial businesses, and the intermediary sector that connects them. We describe these segments here. Appendix A4 details the construction and underlying data series for our measures.

2.1.A. Credit market

Total lending is defined as the outstanding debt of households and non-financial businesses in the United States. Household debt chiefly consists of single-family residential mortgages, and non-mortgage consumer credit such as auto loans and consumer loans. Business debt includes lending to corporate and non-corporate non-financial businesses. Two important exclusions are (1) lending

[6] While we document the secular decline in bank balance sheet lending over the last fifty years, including the period from the 1970s to the 1990s, Hanson et al. (2024) focus on banking trends in the 21st century and discuss their potential implications for regulations preventing uninsured depositor bank runs in the spirt of Jiang et al. (2023).

done directly by the federal government, e.g., federal student loans,[7] and (2) intra-financial sector lending, such as bank loans made to non-bank financial intermediaries. Panel (a) of Figure 1 shows the nominal value of outstanding total lending that rose from approximately $0.45 trillion in 1962 to around $37.8 trillion in 2023.

The vast majority of credit to private borrowers flows through two key segments. The first segment comprises "traditional" loans that depository institutions (chiefly banks) offer to households and non-financial firms and retain on their balance sheets thereafter. We will refer to loans originated by depository institutions and held on their balance sheets as the *informationally sensitive lending* segment. The choice of this terminology stems from potential frictions impacting these loans, which encompass moral hazard issues during their origination and informational asymmetries that render the retention of such loans by their originators a desirable equilibrium outcome. Furthermore, these loans may require additional monitoring and servicing by financial intermediaries, with the implicit assumption that banks are better equipped to fulfill these roles.

The second market segment, *debt securities*, or *informationally insensitive lending*, comprises total credit to the private non-financial sector excluding loans held on depository institutions' balance sheets. It mainly reflects loans not retained by originators but sold to investors via debt securities, though it also includes loans held by non-bank lenders. We treat these loans as less informationally sensitive than traditional bank loans, making secondary-market sale an equilibrium outcome. Examples include asset-backed securities, CLOs, credit card receivables, and mortgage-backed securities. Originators are primarily originate-to-distribute (OTD) lenders, including independent shadow banks (non-depositories) and OTD business lines within traditional banks (see Buchak et al. 2024). Panel (b) of Figure 1 shows the outstanding volume of loans on the balance sheets of depository institutions, referred to as informationally sensitive lending. This lending segment witnessed substantial nominal growth, surging from $0.25 trillion in 1962 to approximately $14.2 trillion by 2023. In robustness checks described below, we supplement our main measures to include private debt funds and undrawn credit lines.[8]

We further disaggregate informationally insensitive lending into *government-affiliated lending* and *private lending*. *Government-affiliated* lending captures Agency/GSE-backed mortgage securities and is measured directly from the Financial Accounts of the United States. *Private lending* is defined as the residual. Panel (c) of Figure 1, shows the total outstanding volume of debt securities (represented by the bold line). The observed growth in outstanding debt securities is striking, escalating from nearly zero ($0.2 trillion) in 1962 to approximately $23.5 trillion by 2023. Approximately 45% of this growth is attributed to government-affiliated debt securities (depicted by the dashed line), which surged from zero in 1962 to about $11 trillion.

[7] Inclusion of such loans do not materially affect our results.
[8] We obtain data on private debt outstanding from Preqin[8], and undrawn credit lines from the FDIC Quarterly Banking Profile.

2.1.B. Savings market

Total saver financial assets are calculated as the total financial assets of the domestic non-financial sectors. This series is taken directly from the Financial Accounts of the United States database. We split these into two main segments: *bank deposits*, defined as the sum of checkable deposits, time deposits, and federal funds and security repurchase agreements of private depository institutions, and *securities*, which includes both government-affiliated and private sector securities.

We note that our measurement approach, by definition, includes international holdings of all relevant assets. That is, non-bank owners of *deposits*, *private debt securities,* and *government-affiliated debt securities* include both the US domestic household sector and foreign owners of these securities. The one exception is total holdings of *other* US financial assets, such as US Treasuries and equity securities, which we do not measure directly but rather as a residual between *total saver financial assets* and the asset holdings we measure directly. While it is not the focus of our paper, our approach will tend to understate the importance of these *other* assets as it excludes foreign holders of these assets.

2.2 Four Facts on the Secular Decline of Balance Sheet Banking

We document four trends, which capture the different aspects of the decline in balance sheet banking in Figure 2 and banks' complementarity in OTD lending.

First, we document a substantial decline in the relative importance of informationally sensitive lending in Figure 2, Panel (a). It plummets from approximately 55% at its peak in the 1960s-1970s to about 33% by 2023, with the majority of this decline occurring between early 1980s and mid-1990s. In other words, lending has substantially shifted towards OTD intermediation. Consistent with the findings of Buchak et al. (2024), we note a reduction in the share of informationally sensitive lending (bank balance sheet lending) during the Great Recession, coinciding with compromised bank balance sheets. However, this decline is relatively modest compared to the enduring decrease in the informationally sensitive lending share observed over several decades. Appendix B confirms the robustness of these trends across different market segments (e.g., mortgages and non-mortgages). It further shows that the secular decline in bank balance sheet lending is not driven by measurement issues related to unused credit lines or the rise of private credit.[9]

Second, we document that households shift their savings away from deposits towards non-deposit savings vehicles: the deposit share of domestic non-financial sector financial wealth declined from a peak of roughly 21% in the mid-1970s down to 9% in 2000, before seeing a minor increase to roughly 13% in 2023 (Figure 2, Panel (b)). While our focus is on the composition of savings and

[9] Accounting for undrawn credit lines mechanically increases measured bank lending capacity in recent years, yet the downward trend remains pronounced. Similarly, incorporating private credit from PE debt funds has only a modest quantitative impact, leaving the overall decline largely unchanged.

lending, as Figure 2 Panel (f) shows, the fall in deposit-to-wealth ratio takes place in a broader context of a dramatically rising financial wealth-to-GDP ratio.

Third, the share of loans to the non-financial sector as a percentage of bank assets has also concurrently fallen from about 65% to 50% (Figure 2, panel (c)). When including loans to non-bank financial intermediaries, i.e., loans made to support non-bank lending, the share, shown with a dotted line, has fallen from 70% to 55%. This trend suggests that the balance sheet and OTD models of financial intermediation have become more interconnected through bank securities holdings over time. Indeed, bank debt securities holdings as a share of bank assets grow from less than 3% at the beginning of our sample to more than 15% (Figure 2, panel d). While banks increasingly own securities, Appendix B shows that total bank balance sheet financing as a share of private lending follows similar trends when including these securities holdings.

Fourth, we note that banks can also indirectly finance debt securities market by providing loans to the non-bank financial sector. To shed light on it Figure 2, panel (e) plots loans from banks to the non-bank financial sector as a share of aggregate informationally insensitive lending. We note that this lending is at the similar level now relative to the beginning of our sample: it began the sample at roughly 8%, fell during the 1980s, before mostly recovering since 2010. This implies that a dollar of OTD lending is associated with about 8 cents in loans from banks to the non-bank financial sector. Combining direct bank holdings of debt securities with bank loans to non-bank intermediaries implies that about 22% of OTD lending is supported by bank balance sheets.

3. Model

As we document in Section 2, financial intermediation has moved away from the traditional bank balance sheet model towards non-bank financing, which is increasingly intermediated through arms-length transactions, such as securitization. At the same time, banks have increased their holdings of informationally insensitive securities rather than shrinking their balance sheet proportionally to the decline of informed lending.

We construct a model of financial intermediation which explores the relationship between the *bank balance sheet model* of intermediation, in which banks intermediate between borrowers and savers by taking deposits from savers and make informationally sensitive loans to borrowers, and the *originate to distribute model* in which borrowers obtain debt funding through informationally insensitive securities which can be sold directly to savers. As emphasized earlier, these models are both *substitutes* in the sense that borrowers and savers can substitute between bank-financed and non-bank financed lending, and deposits and securities, respectively. They are also *complements in production*, in the sense that banks directly lend to non-bank originators and also own some of the debt securities issued by non-banks.

The model has two main objectives. First, it provides a framework for decomposing and interpreting the secular trends documented in Section 2. We allow and identify four forces in the model and map them to institutional changes that occurred since the 1960s:

(i) Forces that shift borrower demand for credit, which we broadly interpret as changes in lending regulations, technologies, and borrower preferences that affecting the relative importance of informationally sensitive versus informationally insensitive credit;

(ii) Forces that shift saver demand, which we broadly interpret as changes in savings or security issuance regulations, technologies, and shifts in borrower preferences or demographics that affect the relative allocation of savings between deposits and non-deposit instruments;

(iii) Forces that alter the cost of balance sheet intermediation, including, e.g., bank capital, liquidity, or supervisory regulations, and implicit costs and subsidies flowing to banks;

(iv) Changes in the monetary policy environment including unconventional tools, influencing demand, credit allocation, and returns across intermediation channels.

The model allows us to quantify the contribution of each force to the observed evolution of credit markets without presuming which mechanisms are most important ex ante. We then project these identified forces onto various developments in line with the above interpretations.

Second, the model provides a laboratory for counterfactual analysis. We will use it to study how the effects of financial regulation and both conventional and unconventional monetary policy depend on the prevailing structure of financial intermediation, and how shifts between balance-sheet banking and originate-to-distribute credit alter the transmission of regulatory and monetary policy to lending and the allocation of credit.

3.1. Model Setup

In order to focus on secular trends (rather than short- or medium-term dynamics), we abstract from dynamics in intermediary capital levels and focus instead on a richer set of intermediation frictions. Thus, our model is static and treats time trends as a series of static snapshots.

The core of our model is the financial intermediary sector. The OTD intermediaries consist of both non-bank intermediaries and the originate-to-distribute business lines of traditional banks, while the banking sector corresponds to traditional bank business models. Banks and OTD intermediaries issue deposits and debt securities, respectively, to the saver sector, and use the proceeds to make informationally sensitive (bank) and informationally insensitive (OTD) loans to the borrower sector. The banking sector also makes informationally sensitive loans directly to the OTD sector, as well as purchases a portion of the debt securities it issues. Finally, the central bank issues reserves to the banking sector, which it uses to purchase non-bank and Treasury securities.

The financial intermediation sector is subject to frictions, which we capture as wedges between the rates paid by borrowers and earned by savers, and those paid and earned by intermediaries. Borrowing and saving technologies are issued at the start of the period and pay off at the end of the period.

Appendix Figure A1 illustrates the flow of funds in the model, which also corresponds closely to our empirical analysis.

3.1.1. Savers

Within each period, there is a "morning" and "evening." The representative saver is endowed with aggregate wealth M_s in the morning, some of which she consumes in the morning, and the remainder of which she invests across different savings technologies, the proceeds of which she "consumes" in the evening. We take evening consumption to represent savings into the next period, but we do not model the across-period savings/consumption decision directly. Saver period utility is a CES aggregator of morning and evening consumption with IES σ and weight $(1-\psi)$ and ψ on morning and evening consumption, respectively:

$$u_s = \left[(1-\psi)(C_m^s)^{\frac{\sigma-1}{\sigma}} + \psi(C_e^s)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \quad \text{(S.1)}$$

Where C_m^s is savers' morning consumption and C_e^s is saver's evening consumption. Savers save for evening consumption by investing in savings technologies, which include bank deposits, and various securities such as equities or government debt that are produced by the intermediary sector. Securities are imperfect substitutes for deposits and for each other as they vary in the transaction services they provide (i.e. how money like they are), as well as in other aspects such as diversification properties they provide to household asset portfolios.

There are *J* savings technologies in the market, which we index by *j*. A unit of savings *j* pays 1 at the end of the period and costs an endogenous price p_j at the start of the period earning a return $r_j = 1/p_j - 1$. There is no risk in the model, and so we interpret the returns as being risk-adjusted. We assume that the utility value of saver evening consumption is given by the following CES aggregator:

$$C_e^s = \left(\sum_j \alpha_j Q_j^{s\,\frac{\sigma_s-1}{\sigma_s}}\right)^{\frac{\sigma_s}{\sigma_s-1}} \quad \text{(S.2)}$$

Q_j^s is the quantity of savings type *j* purchased by the household. α_j is the utility weight on type *j*. For instance, if households require a high volume of deposits to carry out valuable transactions, then the deposit α_j is high. α_j are of central interest in the model because they capture the changes in demand for securities that arise over time. These changes may result from factors such as the Employee Retirement Income Security Act of 1974 or the growing global demand for U.S. debt securities after 1980s.

$\sigma_s > 1$ is the elasticity of substitution. $\sigma_s \to \infty$ means that savings technologies are perfect substitutes, so even small differences in returns across securities or deposits result in large changes in how households save. Conversely, a small σ_s suggests that savings technologies perform

specific roles, for example, it is difficult to substitute the transaction role of deposits with other securities.

Savers engage in morning consumption and invest in technologies in order maximize their utility subject to saving their endowment:

$$\max_{C_m^s, \{Q_j\}} u_s \text{ s.t. } \sum_j p_j Q_j + C_m^s \leq M_s \tag{S.3}$$

The saver's problem (S.3) yields demand for product j as a function of expected return r_j:

$$Q_j^s = \alpha_j \psi \left(\frac{p_j}{P_e^s}\right)^{-\sigma_s} \left(\frac{P_e^s}{P^s}\right)^{-\sigma} \left(\frac{M^s}{P^s}\right) \tag{S.4}$$

where P_e^s is the price index for saver evening consumption and P^s is the overall saver's price index.

$$P_e^s = \left(\sum_j \alpha_j p_j^{1-\sigma_s}\right)^{\frac{1}{1-\sigma_s}} \tag{S.5}$$

$$P^s = \left[(1-\psi)^{1-\sigma} + \psi^{1-\sigma} {P_e^s}^{1-\sigma}\right]^{\frac{1}{1-\sigma}} \tag{S.6}$$

Intuitively, if returns are low, then prices for savings technologies are high, which tightens the budget constraint, reducing overall demand for saving. The demand expression is intuitive. Higher utility, α_j, technologies have higher demand, and a higher substitutability across savings, σ_s, results in demand responding more to returns.

To match the data, we consider the following securities: bank equity, which allows us to endogenize the capital structure of banks; privately intermediated securities (e.g., corporate bonds or CRE securities pools), which substitute for bank loans as we describe below; securities intermediated through government-affiliates (e.g., agency mortgage-backed securities), which captures the fact that some securities have larger government intervention than others; and other assets (e.g., equity or treasury securities).

3.1.2. Borrowers

The representative borrower represents all non-government net borrowers in the economy. They include, for example, household borrowers and non-financial firms. Borrowers receive an evening endowment M_b (representing, e.g., production or income from working) and engage in some borrowing activity in order to smooth consumption over morning and evening. Like savers, borrowers have CES utility over morning and evening consumption:

$$u_b = \left[(1-\psi)(C_m^b)^{\frac{\sigma-1}{\sigma}} + \psi(C_e^b)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \tag{B.1}$$

There are I borrowing technologies in the market, which we index by i. For each unit of credit borrowers receive at the start of the period, they repay the endogenous price p_i at the end of the period. This notational convention ensures consistency between borrowers and savers, such that, like savers, the borrower's demand function is downward sloping. Under this convention, the promised return for a borrowing technology i is thus $r_i = p_i/1 - 1$.[10]

Borrowers can either borrow informationally sensitive loans or informationally incentive loans. Intuitively, informationally sensitive loans are those that cannot be done arm-length. These loans can require soft information, which the lender finds difficult to transmit to an outside investor, such as a local bank manager who knows a small business owner's reliability and business potential through personal interactions even though this informal assessment is difficult to formally verify for outside investors. Alternatively, informationally sensitive loans require intense interaction ex-post, for example, when using a credit line with significant covenants that need to be monitored and potentially renegotiated. Informationally insensitive loans can be seen as arm-length lending. They may also require ex ante information collection as well as ex post, but the frictions that arise are smaller, so that these loans can potentially be traded.

Informatically sensitive and insensitive loans are imperfect substitutes. Some borrowers may have projects that require significant covenant monitoring (informationally sensitive loans), while creditworthiness is easy to transmit for other borrowers (e.g. AAA rated firms). Then lending mostly involves administrative expenses such as collecting payments. On the one hand, money from lending is fungible: a firm may be willing to borrow from either type of funding, depending on the price.

The representative borrower borrows Q_i^b of the quantity of borrowing type. Parallel to savers, their utility from morning consumption from borrowing is given by the following CES aggregator:

$$C_m^b = \left(\sum_j \beta_i Q_i^{b\,\frac{\sigma_b-1}{\sigma_b}}\right)^{\frac{\sigma_b}{\sigma_b-1}} \tag{B.2}$$

where β_i is the utility weight on the borrowing type i. Thus, when borrowers demand a high volume of informationally sensitive loans because many firms are young and opaque, β_i for those loans is high. Alternatively, if there is a significant implicit cost wedge in informationally insensitive lending, such as from inefficient intermediation technology, the β_i for informationally insensitive loans would be low. $\sigma_b > 1$ is the elasticity of substitution. If σ_b is high, then the aggregate amount of debt is a reliable proxy for measuring the overall economic impact of lending.

[10] Broadly "savings" technologies cost "p" today and return 1 tomorrow. "Borrowing" technologies cost 1 today and return p tomorrow.

Conversely, if σ_b is low, he specific composition of lending across different types of loans or borrowers becomes crucially important, as it plays a first-order role in determining outcomes.

Because different types of loans are imperfect substitutes, there are decreasing marginal returns to expanding either informationally sensitive or insensitive loans. One way to interpret these diminishing returns is as follows: As the availability of informationally sensitive loans decreases, only the economic activities that have the highest need for such loans can still obtain funding from the remaining supply. The activities with slightly lower need get crowded out first as the supply tightens. For example, if banks have a larger comparative advantage in credit lines rather than term loans, they will first reduce their term loan lending, and only then decrease their credit lines.

The borrower's problem is as follows:

$$\max_{\{Q_i\}} u_b \text{ s.t. } \sum_i p_i Q_i + C_e^b \leq M_b \tag{B.3}$$

This leads to borrower demand for product i as a function of borrowing returns r_i:

$$Q_i^b = \beta_j (1-\psi) \left(\frac{p_j}{P_m^b}\right)^{-\sigma_b} \left(\frac{P_m^b}{P^b}\right)^{-\sigma} \left(\frac{M^b}{P^b}\right) \tag{B.4}$$

where P_m^b is the price index for borrower morning consumption and P^b is the overall borrower's price index:

$$P_m^b = \left(\sum_j \beta_i p_i^{1-\sigma_b}\right)^{\frac{1}{1-\sigma_b}} \tag{B.5}$$

$$P^b = \left[(1-\psi)^{1-\sigma} {P_m^b}^{1-\sigma} + \psi^{1-\sigma}\right]^{\frac{1}{1-\sigma}} \tag{B.6}$$

To match the data, we consider two types of informationally insensitive loans, private securities, and securities which are issued with the assistance of GSEs.

3.1.3. Financial Intermediaries and Intermediation Frictions

3.1.3.A. Bank Balance Sheet Model

Bank Balance Sheet: At the beginning of the period, banks raise funds from savers through two sources: deposits $D = Q_d p_d$ and equity $E = Q_e p_e$. They then deploy these funds towards two activities: extending informationally sensitive loans to borrowers $L = Q_l$ and investing the balance into a portfolio of securities, $S = D + E - L$. Securities and loans comprise beginning of period assets, $A = L + S$.

Liquid security portfolio. The bank purchases a composite of imperfectly substitutable liquid assets such as treasury securities, agency MBS, corporate bonds, and central bank reserves, with each

asset indexed by j. Individually, each liquid asset has beginning-of-period price p_j and pays 1 at the end of the period.

The bank has end-of-period CES utility over the quantity of each liquid asset it owns with substitution parameter η and utility weight γ_j on each asset:

$$u_s = \left(\sum_j \gamma_j q_j^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}}$$

At the start of the period, the intermediary allocates the total liquid asset allocation,S, among the assets to maximize its end-of-period utility, taking prices p_j as given. The solution to this problem is standard, and is,

$$q_j = \gamma_j \left(\frac{p_j}{P} \right)^{-\eta} \frac{S}{P} \tag{L.1}$$

Where the CES price index is,

$$P_s = \left(\sum_j \gamma_j p_j^{1-\eta} \right)^{\frac{1}{1-\eta}}$$

Additionally, optimized utility, which has the interpretation of an end-of-period payoff, is:

$$U_s^* = S/P_s$$

Frictions: There are frictions present in the process of transforming deposits and equity into loans. These frictions, which can be thought of as costs faced by banks in their intermediation activities, drive a wedge between the interest rates paid to depositors and the rates charged to borrowers. In other words, banks cannot simply pass through the returns from loans and securities one-for-one due to the costs of financial intermediation.

Recall, for each unit of deposits raised from a saver at price p_d, the bank commits to returning the principal amount of 1 unit to the depositor at the end of the deposit term. This costs the bank $1 + p_d\Delta_d$ at the end of term, with $p_d\Delta_d$ representing the deposit wedge. This wedge arises, for example, from the cost of maintaining branches, the costs of regulatory compliance, and the risks associated with deposit withdrawal. Specifically, we assume that the cost of deposit funding is decreasing in bank's holdings of liquid securities:

$$\Delta_d = \delta_d^1 + \delta_d^2 \left(\frac{S - \phi D}{D} \right)^{1/2}$$

Where $\delta_d^2 < 0$. This relation captures the idea that the bank faces the possibility of deposit outflows, for example, between the early and late period in the spirit of Diamond and Dybvig

(1983). It then needs liquid securities (as opposed to loans) to meet this demand. If such shocks are not completely diversifiable, i.e. there are aggregate fluctuations in deposits, then there is a liquidation risk whenever the share of interim deposit outflows exceeds ϕ.

Banks experience a wedge $p_e\Delta_e$ when raising equity, representing, for example, equity issuance costs. We assume these costs are simply proportional issuance costs.

Last, a bank is paid p_l per loan by informationally sensitive borrowers but earns $p_l + \Delta_l$ on repayment, with the wedge representing costs of screening and monitoring these loans. The wedge is a function of bank capitalization:

$$\Delta_l = \delta_l^1 + \delta_l^2 \left(\frac{E - \xi A}{A}\right)^{1/2}$$

With $\delta_l^2 > 0$, a better-capitalized bank receives effectively more repayment per loan, for example, because of better alignment of incentives between equity and proper screening and monitoring of bank lending. One can also interpret this relationship as an effect of capital requirements, in which banks hold a buffer exceeding the minimum regulatory requirement ξ. While the micro foundations for such a capital buffer choice could be derived in a dynamic setting (see Corbae and D'Erasmo 2021), this paper's focus lies elsewhere.

Bank Profits: The bank is operated for the benefit of the bank manager, or equivalently the (unmodeled) inside equity holder (distinct from those in the saver sector who own publicly issued bank equity). The bank manager receives income from lending and securities investment net of financing costs. The banker's profit at the end of the period is as follows:

$$\Pi^{\text{Bank}} = -\underbrace{Q_d(1 + p_d\Delta_d)}_{deposit\ cost} - \underbrace{Q_e(1 + p_e\Delta_e)}_{cost\ of\ equity} + \underbrace{Q_l(p_l + \Delta_{lb})}_{loan\ interest} + \underbrace{S/P_s}_{securities} \tag{I.1a}$$

Observe that at the end of the period, the bank must pay 1 per unit of deposits and equity plus the intermediation wedges, receives p_l plus the intermediation wedge per unit of informationally sensitive loan, and receives 1 per unit of securities purchased. The bank chooses the quantity of deposits, Q_d, and equity to issue to the saver sector, Q_e, the quantity of informationally sensitive loans to issue to the borrower sector, Q_l, and the quantity of securities to purchase at the endogenous securities price p_s.

At the start of the period, the bank's balance sheet must balance, i.e., $D + E = L + S$. Recall that the bank receives $D = Q_d p_d$ from issuing deposits, $E = Q_e p_e$ from issuing equity, pays $L = Q_l$ to make loans, and invests the remainder S in the composite security. Writing $S = Q_{bs}P_s$, where Q_s is the units of the composite security, (I.1) becomes,

$$\Pi^{\text{Bank}} = -\underbrace{Q_d(1 + p_d\Delta_d)}_{deposit\ cost} - \underbrace{Q_e(1 + p_e\Delta_e)}_{cost\ of\ equity} + \underbrace{Q_l(p_l + \Delta_{lb})}_{loan\ interest} + \underbrace{Q_{bs}}_{securities} \tag{I.1b}$$

The bank faces the downward-sloping demand curves for loans Q_l (S.3) and funding (B.3) and takes securities prices as given when making these decisions. The banker's problem is then to maximize the payments to the insider at the end of the period as follows:

$$\max_{Q_d,Q_e,Q_l,Q_{bs}} \Pi^{Bank} \text{ s.t. } D + E = L + S \tag{I.2}$$

3.1.3.B. Originate-to-distribute intermediaries

Originate-to-distribute intermediaries provide informationally insensitive loans to the borrower sector and provide securities to the saver sector. They are pass-through entities in the sense that the loans they issue are sold directly to the saver or bank sector (e.g., through bond issuance or securitization). We interpret the originate-to-distribute sector as encompassing both "independent" shadow banks (e.g., non-depository institutions like Rocket Mortgage) as well as the originate-to-distribute business lines of traditional depository institutions.

The originate-to-distribute intermediary (OTD Lender) originates Q_{AL} informationally insensitive loans (arm's length) at price p_{AL} and obtains funding by issuing Q_s securities at price p_s. We also allow for the possibility that originating loans cannot be done with fully arm's length lending, and that a portion ψ of the loan has to be financed by informationally sensitive lending, i.e., $\psi Q_{AL} \leq Q_{l,OTD}$, which in equilibrium will hold with equality. For example, banks commonly provide credit lines to intermediaries who engage in OTD intermediation (see Jiang et al. 2020; Jiang 2023; Acharya et al. 2025). This nests the idea that, even if all lending were to shift to OTD, some of the funding would still have to be provided by banks. As with banks, the OTD lender's beginning-of-period balance sheet must have assets equal to liabilities:

$$\underbrace{Q_{AL}}_{Assets} = \underbrace{p_s Q_s + Q_{l,OTD}}_{Liabilities}$$

Or, substituting in the bank financing requirement,

$$\underbrace{Q_{AL}}_{Assets} = \underbrace{p_s Q_s + \psi Q_{AL}}_{Liabilities}$$

On repayment of an informationally insensitive loan, an originate-to-distribute intermediary receives p_{AL}. The profit of an OTD intermediary is the difference between the price at which they originate loans minus the cost of funding, where the cost of funding is the weighted average of securities they issue and the information sensitive loans they obtain.

$$\Pi^{\text{OTD Lender}} = Q_{AL}\left(p_{AL} - \left((1-\psi)1/p_s + \psi p_l\right)\right) \tag{I.4}$$

We assume that the OTD intermediation is perfectly competitive. To match the data, there are two originate-to-distribute sub-sectors solving analogous problems, each with its own wedge. The private originate-to-distribute sector that makes informationally insensitive *private* loans and issues privately intermediated securities (e.g., corporate bonds). The government-affiliated

originate-to-distribute sector that makes informationally sensitive *government-affiliated* loans and issues government-sponsored securities (e.g., Agency MBS).

3.1.4. Central bank

The monetary authority is funded with an exogenous amount of currency, and reserves, and buys securities (other assets, MBS, corporate bonds) at market prices, with exogenous weights such that its assets are equal to its liabilities. Banks own the central bank reserves, which pay an exogenous rate, r_r, and the bank treats as an imperfect substitute for other securities, e.g., for treasuries, as described above.

3.1.5. Outside and government sector

There is an outside savings technology is provided perfectly elastically with price and return $p_0 = 1/(1 + r_0)$. This represents, e.g., treasury securities or (risk adjusted) equities.

3.2. Equilibrium

3.2.1. Equilibrium definition

Equilibrium in the model is a set of prices and quantities of savings and borrowing technologies such that:

1. The saver sector maximizes utility (S.3 holds)
2. The borrower sector maximizes utility (B.3 holds)
3. The bank manager optimally firms its liquid securities portfolio and maximizes profits (L.1 and I.2 hold),
4. OTD lenders maximize profits (I.4) and earn zero profits in equilibrium.
5. All markets must clear.
    a. The quantity of bank equity and bank deposits demanded by savers equals the quantity of bank equity and bank deposits issued by banks
    b. The quantity securities issued by the OTD lending sectors must equal the quantity of securities owned by the saver, bank, and central bank sector.
    c. The quantity of informationally sensitive loans demanded by the borrower sector must equal the quantity of informationally sensitive loans provided by the bank sector.
    d. The quantity of reserves issued by the central bank must equal the amount of reserves held by banks.

3.2.2. Deposit Rates and Bank Equity Returns

We can use banks' profit maximization problem to derive the return earned by depositors, and outside bank equity holders. These returns can be expressed as a function of saver preferences and wedges faced by banks at equilibrium bank balance sheet choices. This equilibrium relationship helps us recover intermediation wedges, as well as some borrower and saver preferences when we take the model to the data. The return earned by depositors can be expressed in the following way.

$$r_d = \underbrace{\left(\frac{\sigma_s - 1}{\sigma_s}\right)[1 + r_s] - 1}_{market\ power} - \left(\frac{\sigma_s - 1}{\sigma_s}\right)\underbrace{\left[\delta_d^1 + \delta_d^2\left(\frac{S - \phi D}{D}\right)^{\frac{1}{2}}\right]}_{deposit\ wedge} - \frac{1}{2}\left(\frac{\sigma_s - 1}{\sigma_s}\right)\underbrace{\left[\delta_d^2\left(1 - \frac{S}{D}\right)\left(\frac{S - \phi D}{D}\right)^{-1/2} + \delta_l^2\left(\frac{E}{A}\right)\left(\frac{L}{A}\right)\left(\frac{E - \xi A}{A}\right)^{-1/2}\right]}_{Marginal\ liqudity\ and\ capital\ wedge\ tighthening} \quad \text{(E.1)}$$

Deposits earn less than they would by investing in the liquid security composite, which has (equilibrium) return, r_s. The first term shows the effect of banks market power, which arises because deposits are differentiated, for example, by offering transaction services. The second term illustrates that banks pass the deposit wedge, i.e. the cost of taking deposits, partially to depositors. Banks' market power limits the passthrough of costs to depositors. The last term captures the fact that deposits on the margin tighten both banks' liquidity and capital, which have increasing marginal costs.

The return on bank equity has a similar structure to that of deposits:

$$r_e = \underbrace{\left(\frac{\sigma_s - 1}{\sigma_s}\right)[1 + r_s] - 1}_{market\ power} - \left(\frac{\sigma_s - 1}{\sigma_s}\right)\underbrace{\delta_e^1}_{equity\ wedge} - \left(\frac{\sigma_s - 1}{\sigma_s}\right)\frac{1}{2}\left[\underbrace{\delta_d^2\left(\frac{S - \phi D}{D}\right)^{-1/2} - \delta_l^2\left(\frac{1 - E}{A}\right)\left(\frac{L}{A}\right)\left(\frac{E - \xi A}{A}\right)^{-\frac{1}{2}}}_{Marginal\ liquidity\ and\ capital\ wedge\ loosening}\right] \quad \text{(E.2)}$$

However, unlike deposits, on the margin, equity relaxes the capitalization wedge faced by banks, thus increasing the return on equity—the last term in expression E.2. In other words, consistent with intuition that equity funding is "expensive," banks face a wedge of raising equity δ_e^1. On the other hand, raising equity relaxes capital requirements, and a part of this benefit is passed back to equity holders.

3.2.3. Loan Pricing

Banks offer informationally sensitive lending to borrowers and the OTD sector offers informationally insensitive loans. The bank's first order condition pins down the return on informationally sensitive loans. The return is as follows:

$$r_{bl} = \underbrace{\left(\frac{\sigma_b}{\sigma_b - 1}\right)[1 + r_s] - 1}_{market\ power} - \left(\frac{\sigma_b}{\sigma_b - 1}\right)\underbrace{\left[\delta_l^1 + \delta_l^2\left(\frac{E - \xi A}{A}\right)^{1/2}\right]}_{lending\ wedge} - \left(\frac{\sigma_b}{\sigma_b - 1}\right)\frac{1}{2}\underbrace{\left[\delta_d^2\left(\frac{S - \phi D}{D}\right)^{-1/2}\right]}_{liquidity\ tightening} \quad \text{(E.3)}$$

As above, because banks exercise market power to charge a markup on informationally sensitive lending over and above their marginal cost. Their market power is a function of the borrower's elasticity of substitution, σ_b. The cost of lending is directly impacted by the lending wedge, with constant δ_l^1, which also varies with the bank's excess capitalization. A better capitalized bank is able to charge lower rates to borrowers on balance sheet loans. Finally, banks charge lower rates when the bank is more liquid. Intuitively, banks substitute loans (illiquid) with securities (liquid) on the deposit side, and when the bank is nearer to its liquidity constraint, marginal balance sheet lending is more costly because the alternative---owning securities---relaxes the constraint.

Finally, OTD sector loan rates are pinned down by the sector's being perfectly competitive. In particular, the zero-profit condition implies the following:

$$r_{OTDp} = (1-\psi)r_{sp} + \psi r_l \tag{E.4}$$

$$r_{OTDg} = (1-\psi)r_{sg} + \psi r_l \tag{E.5}$$

3.3. Model Estimation

We estimate saver and borrower preferences, as well as banks' preferences for liquid securities and the frictions that govern financial intermediation in several steps. First, we use the bank's demand function for liquid securities in conjunction with prices to pin down bank preferences for liquid assets. Next, we use intermediary price setting in conjunction with bank balance sheet choices to estimate frictions faced by banks as well as saver and borrower substitution preferences, which give rise to intermediary market power. In the next step we calibrate the remaining saver and borrower preferences and endowments and securitization frictions, which rationalize the time series of price and quantity data.

We use the following data for rates: For r_0, we use the 10-year constant maturity treasury yield. This series is available from 1961, and this constitutes the first year of all estimation procedures. For r_{sp}, we use the Moody's AAA yield. This data series is available for the entire estimation period. For r_{sg} we use Bloomberg's US Mortgage-Backed Securities Index (LUMSSTAT) Yield to Worst. This data is available beginning in 1976. For r_l, we use the average majority prime rate charged by banks on short-term loans to business, quoted on an investment basis. This data is available over the entire estimation window. For r_d, we calculate bank interest expense on deposits divided by total deposits. This series is available beginning in 1984. For r_e, because bank equity is conceptually no different from other outside assets from the point of view of the investor, we set $r_e = r_0$. Bank balance sheet variables are discussed previously and are available over the entire estimation window. We extend our observations for r_d back to 1962 by projecting them on observed treasury and loan rates, and our observations for r_{sg} back to 1962 by projecting them on observed AAA yields.[11]

3.3.2. Bank Liquid Asset Preferences

We begin by estimating bank preferences for liquid assets. From the bank's demand function, we have, $q_j = \gamma_j \left(\frac{p_j}{P}\right)^{-\eta} \frac{S}{P}$. This equation holds with equality at each point in time. We assume that η is fixed and that $\gamma_{jt} = \bar{\gamma}_j \exp \epsilon_{jt}^{\ell}$. Taking logs, we have:

$$\log q_{jt}/S_t = \log \gamma_j - \eta \log p_{jt} + (\eta - 1) \log P_t + \epsilon_{jt}^{\ell}$$

[11] In particular, post-1984 when our deposit rates data begins, we regress $r_{dt} = \beta_0 + \beta_1 r_{0t} + \beta_2 r_{lt} + \epsilon_t$, obtain the estimated $(\hat{\beta}_0, \hat{\beta}_1, \hat{\beta}_2)$, and then for pre-1984 data use $\hat{r}_{dt} = \hat{\beta}_0 + \hat{\beta}_1 r_{0t} + \hat{\beta}_2 r_{lt}$. We run the analogous regression and projection for r_{sgt} using r_{spt}.

Here, $\log q_{jt}/S_t$, $\log p_{jt}$, are directly observable. η and γ_j are parameters to be estimated, and P_t can be calculated as a function of observables and parameters. We make the following moment restrictions on the structural error terms:

$$E_j\left[\epsilon_{jt}^{\ell}\right] = 0 \qquad \text{E(L.1)}$$

$$E[\epsilon_{jt}^{\ell}|z_t] = 0 \qquad \text{E(L.2)}$$

and estimate the model via GMM. As instruments, we use central bank holdings of each asset, with the idea that these holdings are largely orthogonal to bank-level demand shocks, but shift returns through general equilibrium supply effects.

3.3.2. Bank Wedges and Preferences for Substitution

We next utilize time-series returns data and bank balance sheet data, together with equilibrium pricing equations E.1-5, to estimate bank intermediation parameters as well as saver and borrower substitution preferences. Intuitively, we observe a time series of returns on saving and borrowing technologies as well as a time series of bank balance sheet data. We use the passthrough of risk-free rates to deposit rate, loan rates, and returns on bank equity to estimate the parameters governing price setting. Broadly, as banks become more constrained, they pass some of the associated wedges to savers and borrowers. However, the passthrough depends on their market power, i.e., σ_s. The model estimation allows us to account for these forces simultaneously.

We observe a time series of $\{r_0, r_{sp}, r_{sg}, r_l, r_d, r_e, L, S, D, E\}_t$. Given the preferences for liquid security holdings on banks, we are immediately able to calculate the return on the liquid composite security, r_s. Additionally, we impose the following structural assumptions:

$$\delta_{d,t}^1 = \overline{\delta_d^1} - \epsilon_{d,t}$$

$$\delta_{e,t}^1 = \overline{\delta_e^1} - \epsilon_{e,t} \qquad \text{(Est. 1)}$$

$$\delta_{l,t}^1 = \overline{\delta_l^1} + \epsilon_{l,t}$$

$$E\left[\epsilon_{j,t}\middle|Z_t\right] = 0 \qquad \text{(Est. 2)}$$

We interpret these $\left(\epsilon_{d,t}, \epsilon_{e,t}, \epsilon_{l,t}\right)$ as time-varying implicit regulatory costs or subsidies. That is, they are wedges that make issuing deposits, equity, or loans more or less advantageous for the bank than returns alone suggest. Observe that with these definitions, positive values are advantageous to the bank, e.g., $\epsilon_{d,t} > 0$ means that intermediating deposits is relatively less expensive for the bank (and the bank will offer a higher deposit rate to attract more deposits). Intuitively, these epsilons are time-varying wedges that make issuing deposits, equity, or loans more or less advantageous for the bank than returns and the modeled balance sheet costs suggest. Additionally, because we fix the parameters mapping balance sheet variables to intermediation costs, time variation in these epsilons implicitly captures changes in capital or liquidity requirements.

With these assumptions, we aim to identify seven parameters: $\left(\sigma_s, \sigma_b, \overline{\delta_d^1}, \overline{\delta_e^1}, \overline{\delta_l^1}, \delta_d^2, \delta_l^2\right)$. As instruments we use those suggested by ordinary least squares. That is, we use where relevant, $\{r_0, S/D, L/A, D/A, E/A\}$. To account for endogeneity of r_0, we instrument it using the total quantity of treasury securities following Krishnamurthy and Li (2022). Together, this yields 13 moment conditions which we describe in Appendix A5. We implement our estimation as a feasible two-stage GMM estimation on the part of the sample where all data are observable, quarterly, from 1962-2023. As the statutory capital requirement, we use $\xi = 4\%$. We set the lower bound on liquidity at $\phi = 5\%$. This corresponds to the statutory limit on liquidity, is likely more than what the banks would choose privately.

3.3.3. Borrower and saver parameters

Having estimated how substitutable saving and borrowing technologies are (σ_s, σ_b) in the previous stage, we are left to determine saver and borrower preferences for specific technologies (α_j, β_j), and borrower and saver endowments M_s and M_b, and the parameters that govern the borrowing/saving decision, γ, the preference weight between morning and evening "consumption," and σ, the intertemporal elasticity of substitution. First, we set $\sigma = 0.80$, a value suggested by the literature. We set $\gamma = 0.781$ in order to match the empirical ratio of aggregate personal consumption expenditure ("morning consumption") to total household net worth ($M_s + M_b$), which is roughly 12.5%.

To see what drives the calibration, consider the demand for saver technologies in year *t* (S.4). The total size of investable financial wealth at any point of time $M_{s,t}$ is the total invested financial wealth. Given how consumers substitute across savings technologies σ_s, only one set of relative preferences *across* savings products, α_j rationalize their quantities given their returns. We can only estimate relative preferences across products—if all preferences, α_j, increase by the same factor, that leaves demand unchanged. Therefore, the level of α_j is not determined, so we normalize $\alpha_d = 1$. Thus, the saver preference parameters are reported relative to savers demand for deposits. With this normalization, we then exactly identify the time series of saver preferences relative to deposits, $\alpha_j = \left(\alpha_{0,t}, \alpha_{sp,t}, \alpha_{sg,t}, \alpha_{e,t}\right)$.

Borrower preferences: We use an equivalent approach to calibrate preferences of borrowers. As was the case with savers, we (innocuously) normalize $\beta_l = 1$ over the entire sample, so we measure preferences relative to informationally sensitive bank loans. This allows us, in a given period, to exactly determine $\left(\beta_{OTDp,t}, \beta_{OTDg,t}, M_{b,t}\right)$, where $\left(\beta_{OTDp,t}, \beta_{OTDg,t}\right)$ are borrower demand preferences for informationally insensitive private and government-backed OTD lending relative to informationally sensitive lending.

3.3.4. Identification Intuition

Before discussing the results, we briefly provide intuition around our estimation and calibration approach.

The key starting place is bank preferences for liquid assets. The model, particularly equation L.1, describe bank demand for liquid assets as a function of model parameters and returns (equivalently prices). The parameters to identify are η, the price elasticity for liquid assets, together with the preference weights on the four liquid assets, reserves, government-affiliated securities (e.g., MBS), private securities (e.g., corporate bonds), and other securities (e.g., treasuries), given by γ_j. Elasticity of substitution is identified through how differences (and changes) in rates alter portfolio shares. If banks make large adjustments to their holdings in response to rate changes, this suggests that demand is more elastic. In contrast, if they barely adjust their holdings, this suggests that they are relatively inelastic. Identifying this parameter requires rate (price) instruments, as otherwise the empirical relationship between rates and quantities is subject to the typical simultaneous equations bias. We instrument for rates using central bank asset holdings, with the idea that these holdings should be largely orthogonal to idiosyncratic bank demand shocks while impacting prices through general equilibrium effects. The preference weights on the assets are identified by average asset holdings over time, conditional on rates.

The next element is borrower and saver elasticities of substitution. As per equations E.1, E.2, E.3, these are essentially identified through the imperfect passthrough of the outside option rate (here, treasury rates) to lending and deposit rates. If the passthrough is perfect, then the assets are perfect substitutes. To the extent to which rates are not passed through one-to-one disciplines the elasticities of substitution. As interest rates are likely to be endogenous, we instrument using the quantity of treasuries, the idea being that treasury issuance is a supply shifter for r_0. Next, the other parameters of bank supply are obtained by projecting interest rate residuals on bank balance sheet observables such as excess capitalization or excess liquidity.

The parameters mapping bank balance sheet variables to intermediation costs, δ_j^i, as well as the epsilons $(\epsilon_{d,t}, \epsilon_{e,t}, \epsilon_{l,t})$, are also identified with the same time-series variation. The deltas are identified by how returns of debt, equity, and loans vary with balance sheet variables through time. For example, if loan rates increase when bank capitalization is low, we estimate a positive δ_l^2. The ϵ's are residuals, i.e., differences between observed returns and those predicted by markups over the outside option rate and the balance sheet variables. Intuitively, if, for example, required returns on loans are higher than would otherwise be predicted, our model attributes these differences as a negative $\epsilon_{l,t}$, i.e., a regulatory cost.

Once elasticities of substitution are known, we know the slope of saver and borrower demand curves. For savers, since we observe prices (returns) and quantities directly, we can directly calculate the preference parameters that jointly rationalize prices and quantities. For instance, if observed quantities of securities owned by the saver sector increase and prices remain constant, this must reflect a shift outwards in the demand curve, i.e., a preference change. Had prices also decreased, because the slope of the demand curve is known, we would calculate a shift in quantity demanded predicted by the price change and attribute the residual to a shift in the demand curve.

The same intuition holds for borrowers once we observe the slope of the borrowing demand curve and quantities. Thus, for a given price and quantity we can exactly back out the pair $(\beta_{OTDp,t}, \beta_{OTDg,t})$ to match observed quantities and prices and their shifts through time. Specifically, if the return (price) on informationally insensitive loans remains constant across periods while the observed quantity increases, we attribute this change to an outward shift in the borrower demand curve.

It is important to recognize that shifts in saver and borrower demand are independent and can be separately identified. An increase in the quantity of informationally insensitive lending does not directly correspond to a proportional increase in household savings in securities. Borrower demand for informationally insensitive lending and saver demand for securities are connected only through the intermediation sector. For example, suppose there is a significant outward shift in demand for informationally insensitive borrowing. In response, the OTD sector issues more such loans and finances them by issuing additional securities. However, these new securities need not be issued to households—they can be absorbed by the banking sector. In fact, as borrower demand for informationally insensitive loans increases, it is likely accompanied by a relative decline in demand for informationally sensitive bank lending. Consequently, the newly issued securities tend to replace loans on bank balance sheets, leaving the saver sector largely unaffected. The only way savers are impacted is if banks cannot absorb the additional securities. In that case, security returns will rise, prompting savers to shift their portfolios toward securities and away from other assets. Therefore, our model interprets large increases in both informationally insensitive lending and household securities holdings as separate phenomena—one does not necessarily imply the other.

Anticipating our results, we find that the quantity demanded of informationally insensitive loans from the borrower sector increases dramatically. Simultaneously, the quantity demanded of securities from the saver sector increases dramatically. If, counterfactually, this had been accompanied by a large increase in the return offered on securities, our model would say that this was a shift outwards in borrower demand, while savers were merely moving along their demand curve. However, because we observe these quantity changes *without* a dramatic price increase, this implies there must also be a shift in the saver demand curve.

3.3.5. Results

The results of our estimation are shown in Table 1. Panel A shows the results for bank demand for liquid assets. Panel B shows the results for the intermediation parameters. Panel C shows normalizations for the saver and borrower demand estimation. Additionally, Figure 4 show some of our results graphically over time.

3.3.5.A. Bank Preferences for Liquid Assets

We estimate that banks have a very high elasticity of substitution among liquid assets, with η equal to 27.78. As we show below, this is significantly higher than the elasticity we estimate across broad categories of borrowing and savings assets for borrowers and savers. This is consistent with the

notion that from a bank's perspective, liquid assets are mostly interchangeable with the primary concern being the interest rate. Notice, however, that there is not perfect substitution across these assets, which allows a special role for certain assets, e.g., treasuries, as shown in Krishnamurthy and Li (2023). Interest rate variation does not fully explain bank liquid asset holdings, and Figure 4, Panel (c) shows these structural errors, with a positive number indicating that banks hold more than observed returns would predict. Two trends stand out: First, the importance of holding treasury securities relative to private-sector securities declined until the financial crisis, after which point the trend reverses, suggesting that following the financial crisis, treasuries became a more important liquid asset even relative to Agency securities. Second, the structural error for central bank reserves declines until the financial crisis. This secular decline reflects the fact that as market interest rates declined over this period, central bank reserves paid nothing, and to rationalize the fact that reserve holdings stayed roughly constant while the opportunity cost of doing so declined, our model attributes this to a decreasing latent demand. This reverses dramatically when the Federal Reserve began paying interest on reserves.

3.3.5.B. Bank Market Power, Funding, and the Production of Informationally Sensitive Loans

We estimate limited substitution across savings products. Savers' elasticity of substitution across broad asset classes, σ_s, is 4.35. The elasticity estimate for borrowing is broadly in line with Buchak et al. (2024), who estimate a price elasticity of 6.5 for mortgage borrowers, even though the setting, identification procedure, and time period differ significantly.[12] This limited substitution provides significant market power to banks on the funding side, because they are the only sector who can provide deposits. The cost of providing deposits is lower when the bank has a better liquidity position, $\delta_d^2 = -0.07$. Intuitively, when the bank possesses relatively few liquid assets (securities), when paying deposit withdrawals, the bank is forced to liquidate assets that are more expensive to liquidate.

On the lending side, we estimate that banks have market power in providing informationally sensitive loans because borrowers cannot fully substitute informationally sensitive loans for informationally insensitive ones, with the elasticity of substitution of $\sigma_b = 4.05$. Intuitively, if a borrower is a small firm with an opaque project, it will find it difficult to replace a bank credit line with a public bond. Additionally, better capitalized banks experience fewer frictions in providing informationally sensitive loans, with $\delta_l^2 = 0.14$. Quantitatively, a bank moving from a 9% capital ratio relative to the 4% requirement to a 14% capital ratio (excess capitalization increasing from 5% to 10%), the return on informationally sensitive lending increases by approximately 1.3 percentage points.[13] This is consistent with models of capital constraints as well as models in which better-capitalized banks face fewer conflicts of interest. Figure 4, Panel (d) shows how these intermediation epsilons have evolved through time.

[12] One might expect a higher elasticity of substation in Buchak et al. (2024) because it is measured within the same asset class of mortgage products rather than across broad asset classes, which we measure.

[13] $(\sqrt{14\% - 4\%} - \sqrt{9\% - 4\%}) \times 0.14 = 1.3\%$

3.3.5.C Borrower and Saver Demand Shifters

Our structural model produces a time series of saver demand shifters for securities, $(\alpha_{0,t}, \alpha_{sp,t}, \alpha_{sg,t}, \alpha_{e,t})$ and borrower demand shifters for loans, $(\beta_{OTDp,t}, \beta_{OTDg,t})$. We first discuss saver demand shifters for securities. Figure 4, panel (a) shows the time series of our key parameters of interest, $(\alpha_{sp,t}, \alpha_{sg,t})$, the demand shifters for private and government-affiliated securities, in blue and red, respectively. As the figure shows, we find a large secular increase in demand for both private and government securities relative to deposits from mid 1980s. They reach their peak prior to the financial crisis, and fall dramatically thereafter, remaining constant for the rest of the sample period, but still elevated relative to the 1984 base. Preferences for government affiliated securities, demand rose dramatically from 1980s onward before falling somewhat in the run-up to the financial crisis, as savers increasingly held private securities. Demand recovered following the private securitization collapse.

The borrower estimates are shown in Figure 4, Panel (b). Starting with private securitization demand, shown in blue, the parameter remains flat before the 1980s, followed by a modest increase during the 1980s and early 1990s, before stabilizing. We observe some decline in demand for private informationally insensitive lending following the Great Recession, relative to its peak in the early 2000s, although overall demand remains higher in the later period than in the 1970s and 1980s. The government-associated demand parameter, shown in red, rises steadily throughout the sample period until the 2000s.

4. What explains the trends?

The model recovers demand shifters for borrowers and savers, as well as implicit errors on the costs of intermediation. The model does itself does not provide an interpretation of causal identification of what drives these changes over time. This section maps these trends to institutional and technological developments. We first describe these changes and their timing, relating them roughly to the trends depicted above. We next provide identified micro evidence that these forces are at work. Next, we quantitatively connect the model's identified structural parameters to broad proxies of these changes. Finally, we ask how the identified structural parameters individually explain the aggregate shifts we documented above.

4.1. Institutional Developments

We categorize these developments into four main groups: (i) technological and institutional changes around informationally insensitive borrowing, (ii) institutional changes in "savings technologies" and demand for securities, (iii) regulations, subsidies, and implicit costs in bank intermediation, and (iv) and asset purchases by the central bank through unconventional monetary policy.

The purpose of this discussion is to provide historical context for the forces that may have shaped the evolution of financial intermediation, without taking a stand on which developments matter or

how much they contribute to the observed trends. Instead, we use this section to motivate a set of broad forces that enter the structural model as intermediation wedges and are subsequently quantified using the data. These wedges capture changes at an aggregate level and, while they reflect a range of underlying developments, the model is designed to identify their contributions only at the level of broad categories rather than individual mechanisms.

4.1.1 Technological and institutional changes around informationally insensitive borrowing

We begin by reviewing technological and institutional changes that may have facilitated the growth of informationally insensitive lending financed through debt securities. Major developments occurred in government-affiliated securities markets starting in 1968, when Fannie Mae was split into Fannie Mae (retaining GSE status) and Ginnie Mae (fully government-owned). Ginnie Mae issued its first mortgage-backed security (MBS) in 1970, followed by Freddie Mac in 1971 and Fannie Mae in 1981. Following the Global Financial Crisis, increases in conforming loan limits further expanded the range of securitization-eligible loans. Private securities markets developed in parallel. In the late 1970s, private institutions began issuing MBS, followed by the creation of the CMBS market in 1991. [14] Throughout the 1980s and 1990s, securitization expanded to auto loans, credit card receivables, and student debt. CLOs emerged in the late 1980s, ABCP conduits in the mid-1980s, and the corporate bond market diversified with the introduction of high-yield bonds and related instruments.

These institutional changes were accompanied by technological innovations. Advances in computing and data processing facilitated loan standardization and securitization, specialized securitization software was developed, the FICO score was introduced in 1989, and credit rating agencies became increasingly important. Electronic trading platforms improved market liquidity, while post-GFC online origination platforms facilitated non-bank lending.

Most of these developments in both private and government-affiliated securities markets occurred between the late 1970s and mid-1990s, broadly aligning with the decline in the share of informationally sensitive lending observed in Figure 2. The Global Financial Crisis later revealed significant frictions in private securitization markets, including moral hazard in origination (Keys et al., 2010), agency conflicts in servicing and resolution (Piskorski et al., 2010), and misrepresentation of security characteristics (Piskorski et al., 2013). These frictions, together with declining investor trust, may help explain the post-crisis increase in informationally sensitive lending among non-mortgage loans (Appendix B, Figure B1, panel b). This increase did not occur in mortgage lending (Appendix B, Figure B1, panel a), where government-affiliated securities

[14] The savings and loan crisis of the 1980s provided further impetus to the development of securitization markets. In response, the Financial Institutions Reform, Recovery, and Enforcement Act of 1989 established the Resolution Trust Corporation to resolve failed thrift institutions. Together with the Federal Savings and Loan Insurance Corporation (FSLIC), the government resolved the failures of thousands of savings and loan institutions, a process that involved large-scale loan sales in secondary markets, including through mortgage-backed securities. The Federal Deposit Insurance Corporation Improvement Act (FDICIA) of 1991 further encouraged distressed banks to alleviate financial stress by selling loans.

markets remained active, and even among non-mortgage loans the share of informationally sensitive lending remained well below earlier levels, with little recovery in business lending (Appendix B, Figure B1, panel c).

4.1.2 Institutional changes in "savings technologies" and demand for securities

Here we briefly describe several developments that may have influenced "savings technologies" and the demand for debt securities by capital suppliers. First, money market funds emerged in the 1970s, providing deposit-like savings vehicles outside the banking system. Second, regulatory changes facilitated the growth of pension funds through which households can invest in debt securities: the Employee Retirement Income Security Act (ERISA) established guidelines for pension fund management in 1974, and the 1986 Tax Reform Act increased the attractiveness of defined contribution plans. Third, exchange-traded funds (ETFs), introduced in the early 1990s and expanding rapidly thereafter, further broadened access to diversified portfolios of debt securities and other financial instruments. Overall, the timing of these developments broadly aligns with the significant decline in the deposit share of domestic non-financial sector financial wealth observed from the 1980s through the late 1990s (Figure 2, panel b).

4.1.3 Regulations, subsidies, and implicit costs in bank intermediation

In this subsection, we briefly describe regulatory changes that may have affected the relative cost of intermediation on bank balance sheets. Earlier reforms altered both banks' funding conditions and capital requirements. The Depository Institutions Deregulation and Monetary Control Act of 1980 began phasing out interest rate ceilings on deposits and expanded access to Federal Reserve services, increasing competition for deposits and affecting banks' liability structures. The Basel I framework, agreed upon in 1988 and implemented in the United States in the early 1990s, introduced risk-weighted capital requirements, changing incentives for balance-sheet lending and often cited as contributing to the expansion of loan sales and securitization. Subsequent reforms further reshaped bank intermediation. The Riegle–Neal Interstate Banking and Branching Efficiency Act of 1994 facilitated interstate banking, encouraging consolidation and portfolio streamlining, frequently accompanied by increased loan sales. The Gramm–Leach–Bliley Act of 1999 repealed key Glass–Steagall restrictions, enabling affiliations among banks, securities firms, and insurance companies and fostering greater specialization and diversification across financial activities.

More recently, post-GFC regulations increased bank capital and liquidity requirements. The Basel II framework, implemented in the United States beginning in 2008, introduced more risk-sensitive capital requirements, raising the cost of bank balance-sheet lending. Basel III further tightened capital and liquidity standards through higher capital buffers and the introduction of liquidity requirements such as the Liquidity Coverage Ratio and Net Stable Funding Ratio. In parallel, stress-testing regimes and provisions of the Dodd–Frank Wall Street Reform and Consumer Protection Act of 2010 may have influenced banks' portfolio choices and lending strategies. The

post-Global Financial Crisis regulatory environment also contributed to the expansion of non-bank lending reliant on loan sales (Buchak et al., 2018).

4.1.4 Unconventional monetary policy

In response to the Great Recession, the Federal Reserve implemented unconventional monetary policy, launching multiple rounds of quantitative easing (QE) beginning in 2008. These programs expanded the Fed's balance sheet from $900 billion in 2007 to over $8.9 trillion by mid-2022 as shown in Figure 3, panel (a). Over the same period, bank reserve holdings surged from near zero in 2007 to more than $4 trillion by 2021 amounting to almost 20% of bank assets at its peak (Figure 3, panel b). While key shifts in lending trends—such as a notable decline in both the share of bank balance sheet lending and the share of deposits in financial assets documented in Figure 2, began before the first round of QE in 2008, these policies may have nonetheless significantly influenced the quantity and composition of lending in the economy, as well as the structure of bank assets.

4.2 Supporting Micro-evidence

In this section we provide additional empirical evidence on the mechanisms underlying the reallocation documented above.

4.2.1 Expansion of securitization and growth of informationally insensitive lending

We begin with micro-evidence on the expansion of secondary loan markets, showing that it can shift borrowers from informationally sensitive bank lending toward informationally insensitive OTD lending. We exploit the fact that robust secondary markets exist for one loan type but not for a very similar alternative. Building on Buchak et al. (2024), we use variation in GSE securitization eligibility as plausibly exogenous variation in the "ease of securitizing" mortgages. Using HMDA loan-level origination data from 2007–2017, we estimate the following regression:

$$Bank_i = \beta \times Non - conforming_i + \gamma_i + \epsilon_i \quad (1)$$

Here, $Bank_i$ indicates whether the loan is financed on a bank's balance sheet—i.e., originated and retained by a bank, or sold to a bank. $Non\text{-}conforming_i$ indicates the loan amount exceeds the conforming loan limit, making GSE securitization unavailable. We interpret these loans as more informationally sensitive and harder to sell because the financier must underwrite and hold the credit risk. γ_i denotes fixed effects that vary by specification; our strictest specification uses originator fixed effects interacted with loan characteristics, so we compare loans on either side of the cutoff originated by the same lender. Our main results use a ±10% bandwidth around the conforming limit (Panel (a) of Table 3), with robustness using ±25% (in Appendix A6).

Across Table 3's specifications, loans eligible for streamlined securitization are far more likely to be financed off banks' balance sheets. Figure 6's binned scatterplot shows a sharp discontinuity at the conforming loan limit: the share of bank balance sheet lending is about 80% just to the right—where securitization is harder—but falls to roughly 40% just to the left, where securitization is

easier. This links the rise of informationally insensitive lending to secondary-market expansion and reduced OTD frictions (e.g., technological or regulatory).

Next, we assess how these lending-technology shifts affect bank balance sheets. We construct a bank-level *Securitization Exposure* measure from prior-year (t–1) mortgage lending: the share of a bank's volume that becomes newly GSE-eligible when conforming limits rise. Panel (b) of Table 3 shows that higher-exposure banks reduce loan-to-asset ratios (Col. 1) and increase securities-to-assets (Col. 2), with similar patterns within the affected-bank subsample (Cols. 3–4). To address differences in bank characteristics, we apply propensity score matching on capitalization, deposit reliance, mortgage specialization, and headquarters location; results remain similar (Cols. 5–6). Debt securities contribute materially—for example, a 10.3 pp rise in securities-to-assets includes 4.2 pp in debt securities.

Overall, deeper secondary markets increase borrowers' use of informationally insensitive loans, reducing bank-held lending and shifting bank assets from loans toward securities (including debt securities). These micro findings map directly to the *Borrower* channel in Figure 5, which captures how easier securitization drives the decline in informationally sensitive lending, the contraction in bank balance-sheet lending, and the falling loan share of bank assets.

4.2.2. Saver demand for securities, institutional changes, and savings technologies

Next, we explore how technological and institutional changes in "savings technologies" might explain some of the observed trends in saver demand.

Growth of shadow money

Panel (a) of Figure 7 shows that "shadow money" intermediation in nonfinancial-sector (mainly household) financial-asset investment rose from near zero in the 1960s to over 20% recently, coinciding with a decline in deposits' share of total financial assets (Figure 2, panel b). One might attribute this to saving-technology innovations and portfolio shifts toward equities or Treasuries, with limited implications for credit supply. Panel (b) addresses this by focusing on shadow-money holdings of debt securities (e.g., MBS, corporate bonds): their share of total debt to households and firms rises from near zero to above 10%. A back-of-the-envelope calculation implies shadow-money debt financing could explain roughly 40% of the 1970–2000 decline in bank balance-sheet lending by absorbing credit that moved off banks.[15]

Growth of retirement funds: Micro-evidence from-2000s retirement savings reform

[15] During the period from 1970s to early 2000s, the share of bank balance sheet lending in the overall credit to households and firms declined by approximately 20 percentage points (Figure 2, panel b). Concurrently, the share of "shadow money" financing of this credit, which essentially started from zero, grew by about 8 percentage points over the same period (Figure 7, panel b).

In 2001 the Economic Growth and Tax Relief Reconciliation Act increased the contribution limit on defined contribution plans such as 401(k)s and IRAs in 2001,[16] with further increases following (see Mainardi 2025). These reforms expand tax-advantaged savings that households can allocate to bond and equity mutual funds, plausibly shifting savers away from bank deposits toward non-bank instruments. We exploit this change to provide micro-evidence on our saver-side regulatory mechanism using Survey of Consumer Finances data. We expect higher-income savers were more likely to be constrained by the 2000 limit and thus more affected by the 2001 increase. We therefore estimate a difference-in-differences regression in the SCF among employed individuals with positive financial wealth, using all available years from 1989–2011:[17]

$$s_{it}^{j} = \beta HighIncome_i \times Post_t + \gamma_i + \gamma_t + \epsilon_{it}, \tag{2}$$

where s_{it}^{j} is individual i's portfolio share of asset type j at year t, $HighIncome_i$ is an indicator variable for whether the borrower's income is above the median income, $Post_t$ is an indicator for whether the year is 2000 or greater, γ_i are a set of fixed effects around individual characteristics, including income buckets, age, marital status, and whether the individual has children, and γ_t are year fixed effects.

Our primary outcomes of interest are the portfolio share in affected defined contribution plans,[18] and the portfolio share in bank-provided demand accounts.[19] Figure 8 reports a dynamic difference-in-differences analysis (Appendix A7 collapses these effects over the post-reform period). Panel (a) shows that, despite similar pre-trends, the portfolio share in affected retirement accounts rises by about 5% after the law change, while deposit-account shares fall by roughly 3% on impact (Panel b). This aligns with the saver-demand channel in Figure 5 and supports our decomposition: technological and regulatory changes—especially the rise of shadow money and higher tax-advantaged contribution limits—shift portfolios from deposits to non-bank instruments. Consistent with this, the "Saver" component implies a sizable deposit-share decline driven by preferences. The retirement reforms provide micro evidence that households increase retirement holdings while reducing deposits, shrinking bank balance sheets in line with the "Saver" factor in Panel (d) of Figure 5.

4.2.3 Unconventional monetary policy

We close this section by examining how the Federal Reserve's asset purchases under unconventional policy relate to lending trends and bank balance sheets. We focus on QE episodes

[16] In 2001, the limit on 401(k) contributions increased from $30,000 to $35,000, and the limit on IRAs increased from $2,000 to $3,000,

[17] The SCF is available (approximately) every three years starting in 1989. The last year available before the event is 1998, and the next available year is 2001. In robustness analysis, we also define high income to be an individual with income above the 75th percentile. Note that the SCF is a repeated cross-section, not a panel, and so we must use interacted individual characteristics to control for individual differences rather than individual-level fixed effects.

[18] In the SCF, these are grouped as IRA/Keogh accounts and Thrift accounts, which are 401(k)-like plans for government workers and military.

[19] In the SCF, these are checking and savings accounts.

with large, sudden purchases of debt securities that finance private lending, especially mortgage-backed securities (MBS). We study QE1, announced in late November 2008, which included about $1.2 trillion in MBS purchases (Figure 5, panel a). Table 4 compares lending and balance-sheet composition in the year before vs. after QE1. For robustness, Appendix A8 studies QE4, launched in March 2020 in response to COVID-19, which featured large purchases of agency MBS and Treasuries and expanded the Fed's balance sheet by over $4.6 trillion by mid-2022, including $1.2 trillion in MBS (Figure 5, panel b).[20]

Columns (1)–(2) of Panel (a) in Table 4 estimate how QE1 affected whether bank-originated mortgages were retained on bank balance sheets. QE is associated with about a 10% decline in retention, consistent with Buchak et al. (2024), who show QE policies targeting lending markets reduce banks' loan retention. Columns (3)–(4) expand the sample to include both bank and non-bank originations and find a 9–11 percentage point decline in the bank balance-sheet lending share in the segment targeted by the policy. These results are robust to controls for loan amount (and squared), refinancing, conforming status, high-interest-rate loans, and county fixed effects. We next examine how bank balance-sheet composition changes around QE. Panel (b) of Table 7 shows that QE is associated with a decline in both loans and debt securities and an increase in reserves: Loans/Assets falls by 0.29% (Column 2 with controls), Debt Securities/Assets falls by about 0.26% (Column 4), and Reserves/Assets rises by 0.36% (Column 6). These patterns align with Diamond et al. (2024), who show that reserves injected by QE can crowd out bank balance-sheet lending. Appendix A8 finds broadly similar results for QE4.

Overall, these results suggest that unconventional policies can materially shift the composition of lending and bank balance sheets. In particular, quantitative easing—through large-scale debt security purchases—reduces informationally sensitive lending and lowers banks' balance-sheet lending share, while tilting bank assets away from loans and debt securities toward reserves.[21]

4.3 Interpreting the Model

Having discussed and shown evidence that these forces partially explain our secular trends, we next directly link them to our structural parameters. Our approach is to regress the time series of demand shifters and intermediation costs on proxies for the forces discussed above:

$$\alpha_{J,t} = X_t'\beta + \epsilon_t, \tag{3}$$

where $\alpha_{J,t}$ are the borrower and saver demand shifters or the structural intermediation epsilons. X_t' is a vector of time-series covariates, defined as follows:

[20] We note that QE2 did not involve MBS purchases, while QE3 was implemented more gradually than both QE1 and QE2. Unlike earlier programs, QE4 was rapid and largely unexpected.

[21] A large literature emphasizes the role of liquidity regulation and related incentives in shaping banks' balance sheets and holdings of liquid assets (e.g., Sundaresan and Xiao, 2024; Stulz et al. 2024). Our evidence suggests that unconventional monetary policy, particularly quantitative easing, also played an important role in reducing banks' loan-to-asset ratios in the post-GFC period.

Regulation index: We construct a regulation index as an average of several intermediation-related indicators taking a value of 0 before the regulation is implemented and 1 after the regulation is implemented. The index varies between 0 (at the start of the sample) and 1 (at the end of the sample). It includes the key regulations discussed above, namely, FIRRA, GLBA, the date at which Fannie and Freddie were split, the date of the first Ginnie, Fannie, and Freddie MBS issuance, FDICIA, IBBEA, Basel II, and Dodd-Frank.[22]

Technology index: Like the regulation index, the *technology index* is an average of several intermediation-related indicators taking a value of 0 before the technology arrives and 1 afterwards. The index varies between 0 (at the start of the sample) and 1 (at the end of the sample). It includes the technologies discussed above, namely the first private CMBS, the first private CLO, the first money market fund, the first issuance of commercial paper, and the invention of the FICO score.

Additional factors: When explaining savings demand shifters, we include the top 10% wealth share to capture the idea that wealthier households may save a smaller fraction of their wealth in transaction technologies and a larger fraction of their wealth in return-earning products. For government-affiliated lending, we include the real average conforming loan limit, calculated as the loan-weighted conforming loan limit at time *t*, adjusted by the CPI at time *t*. For private-market lending, we include aggregate measures of total firm intangibles-to-assets and R&D expenses-to-assets from Compustat, reflecting the idea that the nature of the projects borrowers seek to finance may change over time.

We present the results of this analysis in Table 2. Panel A Columns (1)-(3) examen saver demand; Columns (4)-(5) borrower demand. Panel B Columns (1)-(4) examine bank liquid asset demand; (5)-(7) intermediation cost epsilons. For government-affiliated securities (Panel A Column 1), we find a strong and statistically significant association between the regulation index and saver demand. In contrast, for private securities (Column 2), the relationship has the opposite sign, supporting the idea that certain regulations—such as the rise of GSEs—crowd out demand for privately issued securities. For other securities (e.g., equities and treasuries), we observe a positive but insignificant relationship. The technology index is positively and significantly associated with the increase in demand for all three types of non-deposit assets, aligning with the notion that improved financial technology has facilitated savers' shift away from traditional deposits toward other savings instruments. Lastly, the wealth share is significantly correlated with all three asset types, consistent with the hypothesis that higher-wealth households hold more return-generating products and fewer transaction-focused products relative to their total wealth.

The results for borrower demand for government-affiliated informationally insensitive lending (i.e., conforming mortgages) in Column 4 show that both the regulation and technology indices

[22] Note that because many of these regulatory developments are contemporaneous, we do not attempt to separately identify which regulation or set of regulations is more or less associated with our measured demand shifters.

are positive and statistically significant, with the regulation index playing a larger role. This aligns with the earlier narrative about the expansion of the GSEs and the introduction of FICO scoring, which streamlined and standardized MBS issuance. Additionally, the real conforming loan limit has a positive coefficient, supporting the idea that as GSEs expand the eligibility criteria for loan guarantees, more homes are financed through government-affiliated, informationally insensitive lending. For private sector informationally insensitive lending, technology plays the largest role in the rise of private securitization. We also observe a modest negative association between R&D expenses-to-assets and private securitization, suggesting that as firms become more R&D-intensive, they rely more on informationally sensitive lending. However, this does not offset the overall growth of informationally insensitive lending; despite the rise of R&D-intensive firms, informationally insensitive lending continues to expand at a faster rate.

We next turn to banks' demand for liquid assets, as shown in Table 2 Panel B columns (1)-(4). Confirming the above intuition, the regression for reserves (Column (1)) interprets the time-series shifts in demand for reserves as being regulation-driven, while the time series shifts in demand for agency and corporate bonds to be mainly technology-driven (Columns (2) and (3)), reflecting the broadening and depending of these markets as information technology made trading less costly. Finally, Column (4) shows that the overall trend away from treasuries is associated with both regulation and technology, essentially the residual of the other securities.

Lastly, we examine the bank funding epsilons. We regress the bank funding epsilons for deposits, equity, and loans on the *Regulation Index* and *Technology Index*. The results, presented in Table 2 Panel B Columns (5)–(7), reveal a consistent pattern. We find a small, negative relationship between regulation and the shift terms for deposits, and equity, and a somewhat larger negative relationship for loans. This is consistent with the narrative that regulation has increased the cost of bank lending. Finally, there is a modest but significant positive relationship between the *Technology Index* and bank lending, indicating that technological advancements have made bank lending more efficient.

Broadly, these results confirm that the regulatory and technological shifts described above are associated with the shifts we observe in borrower demand, saver demand, intermediary demand for liquid assets, and the costs of intermediation.

4.4 Decomposing the structural shifts

Finally, we ask how our structural shifters individually, and together, explain the major trends we observe in the data. To do so, we examine counterfactual outcomes in 2023 under five scenarios. First, we consider the baseline 1963 scenario, where each of these forces are set to their 1963 levels, i.e., borrower preferences, saver preferences, bank costs and subsidies (epsilons), and the size and composition of central bank assets are set to what the model implies in 1963. All other parameters, such as total market sizes, are allowed to vary to their 2023 levels. We then sequentially set our estimated shifts to their 2023 levels, recompute outcomes, and compare them

to the baseline. Finally, we turn on all four forces, which mechanically generates the observed 2023 outcomes.

An important caveat in this analysis is that the aggregate capital stock at the start of each period is exogenously given and all available funds are fully invested or consumed, so changes in intermediation technology do not expand the overall pool of funds deployed except indirectly through within-period consumption–investment decisions. As a result, longer-horizon real effects—operating through relaxed financing constraints, improved project selection, and higher investment quality that would raise future capital and wealth via compounding—are largely outside the framework. The model therefore tends to deliver modest aggregate quantity effects of financial intermediation changes over time, with the main impact showing up as reallocation of a given capital stock across channels and balance sheets. Accordingly, the results should be interpreted primarily as describing how changes in intermediation shifts the *allocation* of a given pool of funds across financing technologies and intermediaries, rather than as a full accounting of intermediation's contribution to long-run capital accumulation and growth.

Figure 5 reports the results. Panel (a) shows total lending as the percent change relative to the 1963-parameter baseline. The 2023 shift in borrower preferences only modestly changes aggregate lending, largely reallocating credit away from bank balance-sheet lending toward OTD lending. A decline in savers' preference for deposits similarly has only a modest effect on total lending, mainly shifting which intermediary holds saver wealth. Changes in banks' subsidies and costs modestly raise total lending: although higher implicit costs of deposits and loans shrink bank balance sheets, migration toward nonbanks more than offsets this. Federal Reserve asset purchases also modestly increase lending through channels we discuss later. Overall, total lending rises by about 0.75% relative to baseline.

This modest aggregate differences mask larger changes in the structure of financial intermediation. Panel (b) shows change in the bank balance sheet lending, revealing a cumulative decrease of nearly 30% relative to the baseline parameters. All four forces contribute to this change, although borrower demand shifts are the primary driver. These shifts naturally draw borrowers towards informationally insensitive financing, contributing approximately 22% to the total decline in bank balance sheet lending. Preferences against saving in deposits reduces bank balance sheet size and informationally sensitive lending along with it by about 3%. Finally, rising implicit costs of making informationally sensitive loans further reduces quantities by about 2%, and Federal Reserve asset purchases have modestly reduced informationally sensitive lending, again by roughly 2%.

Panel (c) of Figure 5 shows how these changes have impacted the composition of lending to borrowers. As a result of our identified forces, informationally sensitive lending in 2023 comprises a much smaller share of overall borrowing (roughly 15% lower) than it would otherwise. As we discussed above, borrower demand shifts are the primary driver in the overall change, although all four forces work against informationally sensitive lending.

Panel (d) examines bank balance sheet size. Shifts in borrower demand away from bank lending have a small, positive impact on bank balance sheet size. While this may seem surprising given that these preferences induced a shift away from bank balance sheet lending, this change is driven by the fact that banks themselves can endogenously shift their business models from making informationally sensitive loans towards owning informationally insensitive securities. Thus, the aggregate size of bank balance sheet lending shares does not dramatically alter bank balance sheet size. Changing saver preferences away from owning deposits, on the other hand, dramatically reduces bank balance sheet size. Our model attributes roughly a 15% decrease in bank balance sheet size to changes in saver preferences.

Next, there is a small decrease in bank balance sheets caused by changes in implicit banks' costs and subsidies versus 1963, particularly on deposits, which cause bank balance sheets to be roughly 4% smaller than they would be otherwise. Finally, the impact of federal reserve asset purchases has close to no effect on bank balance sheet size, as these purchases largely substitute one type of bank asset—securities—for another—central bank reserves. On net, our forces predict that bank balance sheets are 20% smaller than they would have been had technology, preferences, and banks' costs and subsidies been kept at their 1963 level.

In addition to shrinking bank balance sheets, these forces also drive a compositional shift in how banks use their balance sheets. Panel (e) shows that on net, the informationally sensitive share of bank balance sheets declines by roughly 5 percentage points. Shifts in borrower demand lead banks to hold more securities relative to informationally sensitive loans, accounting for roughly a 15 percentage points shift in balance sheet composition. Interestingly, reduced saver preferences for deposits leads to an opposite compositional shift. As savers allocate less wealth towards deposits, bank balance sheets shrink. While balance sheets shrink, informationally sensitive lending opportunities are unaffected, and thus banks' primary margin of adjustment to reduce balance sheet size is to sell securities. This scaling effect accounts for roughly a 9 percentage points increase in the informationally sensitive share of bank balance sheets. Changes in bank subsidies/costs lead to a small increase in the loan share of bank assets, and central bank asset purchases modestly decrease the loan share of bank assets

Finally, turning to saver choices, panel (f) of Figure 5 shows that deposits are a roughly 4 percentage points lower as a share of savings than they would be under the 1963 parameters. These parameters are driven primarily by decreased saver preferences to hold deposits.

In Appendix A2 we examine the impact on bank capitalization. Changes since 1963 have had a largely offsetting impact on overall bank capitalization. Capital ratios rose on net roughly 25 basis points versus the baseline counterfactual where these forces were held fixed at 1963 levels. Borrower demand shifts have reduced bank capital ratios, as they have made the demand for bank lending (and therefore the benefits of banks being well capitalized) smaller. Offsetting this, rising preferences among savers to hold securities relative to deposits cause a reduction in total deposits, which leads banks to be better capitalized.

To summarize, shifts in borrower demand for informationally insensitive versus informationally sensitive lending have led to a large reallocation from bank balance sheet lending to informationally insensitive non-bank lending. We attribute these borrower demand shifts to changes in technology in the case of the private sector and regulations supporting secondary loan markets in the case of the government-affiliated sector. Decreased saver preferences to own deposits have led to large reductions in bank balance sheet size but have had only modest impacts on the quantity and composition of lending. Rising implicit subsidies on equity and rising implicit costs on deposits and loans have further reduced the share of bank balance sheet lending in the economy. Finally, Federal Reserve asset purchases have increased aggregate lending but have crowded out bank balance sheet lending.

5. Counterfactual Analysis: Bank Regulation and Monetary Policy

In this section, we use the model to conduct a set of counterfactual analyses aimed at quantifying the effects of bank regulation and monetary policy on credit allocation and bank balance sheets. We first study counterfactual changes in capital and liquidity regulations to assess their role in shaping banks' size, asset composition, and lending activity. We then turn to monetary policy and decompose its effects into conventional interest rate movements and unconventional balance-sheet policies, focusing on how asset purchases affect credit allocation relative to changes in policy rates. Together, these counterfactuals isolate the distinct channels through which regulation and monetary policy influence intermediation outcomes.

5.1 Counterfactual Capital and Liquidity Requirements

We start by using the model to consider the impact of two major macro-prudential tools, capital, and liquidity requirements. In particular, we consider the counterfactual impact of raising (to 25%) or removing (to 0%) capital and liquidity requirements.[23] We consider the impact of this change given the 2023 parameters. We emphasize that our model is intended to capture the long-term effects of these regulations, rather than the short-term transition dynamics. These results are shown in Figure 9.[24]

We first study the impact of capital and liquidity requirements on total lending in panel (a) of Figure 9. Higher capital or liquidity requirements reduce total lending, and lower capital or liquidity requirements increase lending. In particular, raising capital requirements to 25% reduces lending by roughly 50 basis points. Similarly, raising liquidity requirements to 25% reduces lending by roughly 20 basis points. While we focus on tightening these regulatory ratios, in all cases the impact of *reducing* these ratios is quantitatively small.

Banks react to capital regulations by dramatically reducing their bank balance sheet lending (panel (b)) by nearly 9% in case of higher capital requirements and 6% in case of higher liquidity

[23] We follow Jiang et al. (2020) who show that bank capital requirements of 25% would align bank capital ratios more closely with the capitalization of their non-bank counterparts who engage in similar activities as banks.
[24] In terms of our model, the counterfactuals change ξ, the capital requirement, and ϕ, the liquidity requirement.

requirements. Panel (c) shows that this is accompanied by a dramatic decline in bank balance sheet size. In particular, banks respond to the 25% increase in capital requirements by reducing their balance sheets by roughly 20%. Panel (d) shows that as capital requirements increase, the loan share of bank assets increases. This reflects a compositional shift as banks sell securities, rather than loans, to reduce the size of their balance sheets.

In contrast, panel (c) shows the impact on bank balance sheet size of increased liquidity requirements is negligible. Instead, as panel (d) shows, increased liquidity requirements impact balance sheet lending through a shift in bank business model. The informationally sensitive loan share of bank balance sheets falls by roughly 5%, implying that banks substitute more liquid securities for less liquid loans. This contrasts with how banks' business models respond to increases in capital requirements. In this case, banks shrink their overall balance sheet by selling securities, which leads to an increased loan balance sheet share.

Overall, we observe that both higher bank capital and liquidity requirements have only modest effect on aggregate lending while they have very pronounced adverse effect on bank balance sheet lending share in the economy. This is because these polices lead to simultaneous increase in lending through debt securities that substitute, albeit imperfectly, for informationally sensitive bank balance sheet lending. This result aligns with the findings of Buchak et al. (2024), who present empirical evidence and a structural model of the credit market, demonstrating that increases in capital requirements have relatively modest effects on aggregate lending. This is due to the "bank balance sheet substitution" margin of adjustments, where bank balance sheet lending is replaced by lending financed through loan sales when bank capital requirements increase. In effect, banks possess a comparative advantage in making informationally sensitive loans, so when bank balance sheet capacity becomes more expensive, they reduce activity in the sector where they are at a comparative disadvantage. Finally, while capital requirements also impair banks' abilities to own OTD securities, the saver sector is easily able to absorb them instead.

To summarize, the impact of capital requirements and liquidity requirements on total lending is modest overall, despite a large impact on bank balance sheet lending. This occurs for two reasons. First the impact of higher capital requirements or liquidity requirements on overall lending is relatively modest as debt securities can substitute for informationally sensitive lending, albeit not perfectly. Second, shifts in demand towards informationally insensitive borrowing dramatically increase the number of securities, including on bank balance sheets. When banks face higher capital requirements, they reduce their balance sheet size, which given these shifts, primarily means selling securities. The saver sector can easily absorb these securities. Hence, while capital requirements moderately distort the type of borrowing and savings instruments in the economy, informationally insensitive loans and securities are good enough substitutes for bank loans and bank deposits, respectively, such that aggregate lending is only moderately reduced.

5.2. Conventional and Unconventional Monetary Policy

We next use our model to examine the mechanisms of conventional and unconventional monetary policy in a world where non-bank lending and savings play a major role in how savers save and how borrowers borrow. Our framework allows us to decompose monetary policy into two distinct components: a *conventional* component that operates through interest rates, and an *unconventional* component that operates through asset purchases. When thinking about counterfactuals, it is important to note that in practice monetary policy interventions often involve both dimensions simultaneously—for example, lowering policy rates while engaging in asset purchases. As a result, the interpretation of our results should keep in mind that actual policy actions typically reflect a combination of the two. Our framework, however, allows us to orthogonalize these policy instruments, which helps isolate their individual effects and provides clearer insight into how each tool operates within a modern financial intermediation framework, specifically, through their distinct impacts on balance sheets, portfolio choices, and the allocation of credit and savings across banks and non-bank intermediaries.

5.2.1 Conventional monetary policy

We start by using our model to examine how a stylized version of "conventional monetary policy" impacts lending rates and quantities. We allow the central bank to set the outside security rate, r_0, ("the 10-year treasury rate") as well as the rate on reserves, and examine the impacts of a 1% reduction in both. The results are shown in Figure 10. Panel (a) shows lending quantity changes in \$t, panel (b) shows interest rate changes in percentage points, and panel (c) shows changes in % term in lending quantities. Panel (d) shows bank balance sheet changes in \$t while panel (e) shows % in composition of bank balance sheets. The results of "conventional" monetary policy are shown with the light blue bars.

As panel (a) shows, conventional monetary policy increases total lending by roughly \$100 billion. Of this roughly \$60 billion is bank balance sheet lending and \$40 billion is non-bank informationally insensitive lending. Note that given the structure of our model, these numbers should be interpreted as the net impact on lending, so they do not capture the potentially large effect of monetary policy on the refinancing of existing loans, or general equilibrium effects on the real economy. These lending increases occur because rates fall. As panel (b) shows, rates on deposits fall by roughly 50 basis points, rates on bank loans fall by roughly 85 basis points, MBS rates fall by roughly 80 basis points, and corporate bond yields fall by roughly 75 basis points. This occurs through two channels. First, from both the saver sector's perspective and banks' perspective, MBS and corporate bonds are (imperfect) substitutes for treasuries. As treasury rates fall, the banks and savers (directly) purchase more of these assets, pushing down their rates in a general equilibrium effect. Second, as these rates fall, the bank's cost of funding (and benefit of issuing deposits) declines. This decline is imperfectly passed through to deposit rates and lending rates, as illustrated by the bank's first-order condition. Passthrough is not one-for-one because deposits and bank loans are imperfect substitutes for other savings and borrowing technologies.

Panels (d)-(e) illustrates how this plays out on banks' balance sheets. First, due to the imperfect passthrough to deposit interest rates, in the face of a rate decrease deposits now pay a relatively higher interest rate than other savings technologies, and so deposits (roughly $250 billion) flow into bank balance sheets. In consequence, bank balance sheets grow by approximately the same quantity. As banks reduce loan rates, informationally insensitive lending increases, and the balance of bank asset increases are used to purchase additional securities

Observe that these dynamics are observationally consistent with the patterns of "deposit channel of monetary policy:" Rates on an outside option security fall, and deposit rates fall by less, leading to large deposit inflows. These inflows are partially used to purchase MBS, and MBS rates fall. Importantly, however, as our exercise shows, the observed correlation between deposit inflows and MBS (and therefore mortgage) interest rates is not entirely causal. Rather, it is the equilibrium outcome of savers and banks more broadly reallocating funds into a close substitute for government securities, together with imperfect deposit passthrough leading to deposit inflows into banks.

5.2.2 Unconventional monetary policy (QE/QT)

We next examine the channels of quantitative easing (QE) associated with central bank purchases of debt securities. For that purpose, we counterfactually increase the central bank's holdings of government-sponsored securities (MBS), which are financed by issuing an equal amount of reserves to the banking sector. We roughly replicate the asset purchases associated with 2008 QE episode, which saw a cumulative purchase of roughly $1.2 trillion MBS (Figure 5, panel b). As we discussed before, in interpreting these results, it is important to note that this counterfactual isolates the effects of the Fed's asset purchases. However, the Fed's post-2008 quantitative easing policies also involved conventional interest rate reductions, meaning their overall effects reflect both the "conventional monetary policy" effects quantified above and the asset purchase effects analyzed here.

The results are shown in Figure 10 panels (a)—(e) with dark blue bars. As panel (a) shows, the net effect is to increase total lending by roughly $50 billion. This net effect hides a large reallocation from balance sheet lending to non-bank informationally insensitive lending.

To understand why this reallocation occurs, Panel (b) shows interest rate changes. QE induces a large decrease in the rates on government-sponsored securities of roughly 85 basis points (roughly in line with the numbers observed in Krishnamurthy and Vissing-Jorgensen (2011)). This large effect is due to the fact that the central bank, by purchasing these securities, increases aggregate demand for them, thus increasing their prices and reducing their rates. However, the more muted impact on other rates is driven by the fact banks are mechanically forced to own reserves rather than other assets. That is, purchasing MBS from banks does not create additional bank balance sheet capacity, rather, it swaps one asset for another. This is shown clearly in panel (d) and (e),

which shows that the first-order impact of QE is to increase bank reserve holdings and reduce bank securities holdings, rather than changing the size of bank balance sheets overall.

Finally, as MBS rates fall dramatically, some borrowers who would have borrowed on bank balance sheet instead substitute to borrowing through now-cheaper informationally insensitive loans. Thus, QE partially crowds out bank balance sheet lending through this demand-side relative pricing channel. As panel (c) shows the combined effect of this adjustment is more than 0.1% increase in total lending with a 0.2% decline in bank balance sheet lending.

Overall, our counterfactual analysis indicates that Fed purchases of debt securities lead to a shift away from informationally sensitive lending, reducing the bank balance sheet lending share. Additionally, these policies reallocate bank assets away from loans and debt securities, increasing the share of bank reserves. These effects align with the empirical evidence on changes in lending patterns surrounding large asset purchases, as presented in Section 4.3.3. At the same time the magnitude of these effects suggest that the asset purchases associated with unconventional monetary policy were not large enough to account for most of the decline in bank balance sheet lending share documented in Figure 2. This is also consistent with the fact that most of this decline occurred before the implementation of these policies (i.e., prior to 2008).

Finally, we note that, quantitative tightening (QT) would be expected to generate similar mechanisms in reverse, raising yields on central-bank-sold assets, shifting borrowing back toward bank balance sheets, and undoing the associated reallocation of lending.

6. Conclusion

Our findings suggest a significant transformation in the intermediation sector, with important implications for macroprudential policy and financial regulation. The 2023 bank failures once again highlighted the fundamental vulnerability of banks due to their high financial leverage, a result of safety nets like insured deposit funding and the ability to issue money-like claims (Jiang et al. 2023, 2020). Current regulatory discussions, including the Basel III endgame, aim to address this vulnerability by considering increased capital requirements for banks. Critics argue that such measures could significantly harm aggregate lending and the broader economy. However, our analysis suggests that the role of banks and their balance sheets in credit provision has diminished over time. Our model indicates that raising bank capital requirements would have only modest adverse effects on aggregate lending, as credit would mainly shift from bank balance sheets to debt securities. This aligns with previous studies that emphasize how modern industrial organization of the credit market, which allow intermediaries to sell loans, reduce the impact of capital regulation on lending (Jiang et al. 2020; Buchak et al. 2023, 2024). Our paper shows that this insight holds substantial quantitative importance, applying to the entire lending market, including all loans to households and non-financial businesses, as well as “indirect” lending through banks' debt securities holdings.

Our analysis also highlights the importance of considering lenders' ability to sell their loans and the evolution of the debt securities market when evaluating policies targeting credit markets. Focusing solely on bank balance sheet lending without accounting for these adjustment margins can lead to faulty inferences. For instance, our findings show that the impact of bank capital requirements on aggregate lending is far less severe than suggested by simply examining bank balance sheets, especially when relying solely on bank call report data (see also Buchak et al. 2023, 2024). Therefore, it is crucial for regulatory policy analysis to incorporate lending data beyond what is available from bank balance sheets to provide a more comprehensive view of credit market dynamics.

Our findings have also important implications for the conduct and interpretation of quantitative easing (QE). We demonstrate that Fed purchases of debt securities reduce the share of bank balance sheet lending and increase bank reserves. Specifically, the shift away from informationally sensitive lending implies that QE could weaken the role of banks in screening and monitoring borrowers, potentially affecting credit quality and financial stability. These insights underscore the need to consider how QE affects not just aggregate lending and interest rates, but also the composition of credit and the functioning of financial intermediation.

More fundamentally, our paper addresses the shifting boundaries of the intermediation sector, revealing that banks are becoming less central to credit intermediation and aggregate lending. While banks may still play a key role in loan origination and monitoring, we offer two observations. First, although banks may retain some advantages in these areas, our analysis focuses on the declining significance of bank balance sheet lending. Our findings show that substitutes are increasingly available, diminishing the role banks play in financing loans. This shift carries important policy implications, suggesting a reduced impact of bank deposit funding and related capital regulations on aggregate lending.

Second, non-banks now originate and service a substantial portion of loans in many credit market segments, a trend that has intensified over the past two decades (Buchak et al. 2018, 2024; Seru 2019). This suggests a further erosion of banks' "specialness" in loan origination and servicing. Moreover, the rise of financial innovations, including AI and machine learning, may further reduce the advantages of informationally sensitive bank balance sheet lending. Overall, our analysis suggests that regulatory policy should shift its focus from banks to the debt securities markets and non-bank intermediaries, which now finance a significant portion of lending activities.

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Table 1: Time-Invariant Structural Estimates

This table shows the results of the estimation for the key depository intermediation parameters. Panel A shows the results of the bank liquid asset demand estimation, which uses a feasible two-stage GMM approach based on the model's structural demand model. The weight on other securities is normalized to 1. Panel B shows the results of the estimation of the structural intermediation parameters, which includes saver and borrower elasticities as well as the parameters of the intermediation costs. Panel C shows the normalizations for the borrower and saver demand parameters that are fixed over time.

Panel A: Bank liquidity preferences

Description	Parameter	Value	Std Error
Liquid asset elasticity	η	27.78	(8.16)
Weights on:			
Reserves	γ_{res}	3.52	(0.39)
Gov-affiliated securities	γ_{sg}	1.03	(0.13)
Private securities	γ_{sp}	0.30	(0.04)
Other securities	γ_{s0}	1.00	-

Panel B: Structural intermediation parameters

Description	Parameter	Value	Std Error
Capital requirement	ξ	0.04	-
Liquidity requirement	ϕ	0.10	-
Saver elasticity	σ_s	4.35	(0.20)
Borrower elasticity	σ_b	4.05	(0.49)
Deposit delta (constant)	$\overline{\delta_d^1}$	-0.23	(0.02)
Deposit delta (liquidity coefficient)	δ_d^2	-0.07	(0.01)
Equity delta (constant)	$\overline{\delta_e^1}$	-0.09	(0.03)
Loan delta (constant)	$\overline{\delta_l^1}$	0.26	(0.02)
Loan delta (capital coefficient)	δ_l^2	0.14	(0.02)

Panel C: Persistent structural demand parameters

Description	Parameter	Value
Morning consumption weight	$1-\psi$	0.219 (match PCE/wealth)
IES	σ	0.80 (literature)
Saver deposit preference weight	α_d	1 (normalization)
Borrower deposit preference weight	β_l	1 (normalization)

Table 2: Regulation, Technology, and Other Factors Explaining Demand Shifters

This table presents time-series regressions of the saver demand shifters (Panel A Columns 1 to 3), borrower demand shifters (Panel A Columns 4 to 5), bank liquidity demand epsilons (Panel B Columns (1 to 4)) and intermediary epsilons (Panel B Columns 5 to 7) on time-series covariates. *Regulation index* is an index tracking the implementation of various market and banking regulatory reforms through time. *Technology index* is an index tracking the implementation of various technology changes. *Top 10% wealth share* is the US top-10% wealth share from the WID database. *Real conforming loan limit* is the origination-weighted conforming loan limit divided by the CPI. *Intangibles / assets* is aggregate intangibles divided by aggregate assets, computed from Compustat. *R&D expense / assets* is aggregate R&D expense divided by aggregate assets, computed from Compustat. Standard errors are shown in parentheses.

Panel A: Borrower and Saver Demand Shifters

	Saver			Borrower	
	α_{sg}	α_{sp}	α_0	β_{OTDg}	β_{OTDp}
	(1)	(2)	(3)	(4)	(5)
Regulation index	0.244	-0.267	0.254	0.551	0.221
	(0.045)	(0.127)	(0.662)	(0.063)	(0.236)
Technology index	0.114	0.446	1.417	0.124	0.454
	(0.033)	(0.095)	(0.495)	(0.052)	(0.098)
Top 10% wealth share	0.020	0.063	0.866	-	-
	(0.012)	(0.034)	(0.179)	-	-
Real conforming loan limit	-	-	-	0.050	-
	-	-	-	(0.019)	-
Intangibles / assets	-	-	-	-	-0.019
	-	-	-	-	(0.052)
R&D expenses / assets	-	-	-	-	-0.123
	-	-	-	-	(0.021)
Observations	61	61	61	61	61
R^2	0.940	0.596	0.755	0.966	0.836

Panel B: Intermediation Structural Epsilons

	Bank demand for liquid assets				Return epsilons		
	ϵ^{ℓ}_{rt}	ϵ^{ℓ}_{sgt}	ϵ^{ℓ}_{spt}	ϵ^{ℓ}_{s0t}	ϵ_d	ϵ_e	ϵ_l
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Regulation index	4.455	0.723	-0.030	-0.525	-0.017	-0.017	-0.069
	(0.868)	(0.208)	(0.324)	(0.298)	(0.008)	(0.008)	(0.015)
Technology index	-4.485	1.109	1.340	-0.707	0.013	0.013	0.019
	(0.689)	(0.165)	(0.257)	(0.237)	(0.006)	(0.006)	(0.012)
Observations	61	61	61	61	61	61	61
R^2	0.461	0.934	0.785	0.753	0.082	0.082	0.577

Table 3: Ease of Securitization and Bank Balance Sheet Lending Share and Composition

Panel A of this table examines the relationship between banks' balance-sheet lending share in U.S. residential mortgage origination and the ease of securitizing those loans. Bank balance sheet loan is an indicator equal to one if the loan is financed on a bank's balance sheet (i.e., originated by a bank and retained on balance sheet, or originated by any lender type and subsequently sold to a bank). Non-conforming is an indicator equal to one if the loan exceeds the local conforming loan limit, above which the GSEs will not guarantee the mortgage (i.e., an informationally sensitive loan that is ineligible for GSE securitization). We focus on loans within a bandwidth of ±10% around the local conforming loan limit. Column (1) includes no fixed effects. Column (2) includes loan-characteristic fixed effects (the interaction of origination year, property type, loan purpose, occupancy status, state, county, applicant race, ethnicity, sex, and income). Column (3) includes originator fixed effects. Column (4) includes loan-characteristic-by-lender fixed effects. Panel B examines the relationship between banks' securitization exposure and their balance-sheet composition. Column (1) relates a bank's securitization exposure to its loan-to-asset ratio. Securitization exposure measures the extent to which a bank's mortgage lending volume is affected by changes in conforming loan limits—typically increases in some regions—and is constructed as the share of the bank's prior-year residential mortgage lending that would fall within the newly expanded conforming-loan-limit range following such changes. Column (2) examines the effect of securitization exposure on securities holdings as a share of total assets. Columns (3)-(4) repeat the analysis in the subsample of banks affected by conforming-loan-limit changes (i.e., banks with non-zero securitization exposure). Columns (5)-(6) report results from a matched-sample analysis using propensity score matching, which pairs banks with increased securitization exposure (treatment group) to banks with zero exposure change (control group) based on bank characteristics. Data are from HMDA and bank Call Reports, 2007–2017. Standard errors are in parentheses.

Panel A: Ease of Securitization and Bank Balance Sheet Lending Share

	Bank balance sheet loan			
	(1)	(2)	(3)	(4)
Non-conforming	0.367	0.294	0.267	0.130
	(0.001)	(0.001)	(0.001)	(0.002)
FE	None	Loan	Orig.	Loan x Orig.
N	4,031,790	4,031,790	4,028,149	4,031,790
R^2	0.053	0.687	0.284	0.907

Panel B: Ease of Securitization and Bank Balance Sheet Composition

	All banks		Affected banks		Matched banks	
	Loan/ Asset	Securities/ Asset	Loan/ Asset	Securities/ Asset	Loan/ Asset	Securities/ Asset
	(1)	(2)	(3)	(4)	(5)	(6)
Securitization Exposure	-0.023	0.060	-0.067	0.106	-0.068	0.100
	(0.043)	(0.039)	(0.057)	(0.051)	(0.049)	(0.045)
N	34,877	34,877	2,173	2,173	4,346	4,346
R^2	0.081	0.061	0.140	0.089	0.110	0.070

Table 4: Unconventional Monetary Policy: QE and Bank Balance Sheet Retention, Lending Share, and Asset Composition

Panel A reports results from a linear probability model estimating how the likelihood that a residential mortgage is retained by the originating bank changes after the first round of quantitative easing (QE1), which began in November 2008. The regressions are at the loan level using HMDA data published by the CFPB and FFIEC. The dependent variable is an indicator equal to 1 if the loan was originated by a bank and retained on its balance sheet. The sample in Columns (1)–(2) includes only bank-originated loans in 2008–2009, while Columns (3)–(4) include all originations (banks and non-banks) in 2008–2009. Columns (2) and (4) add controls for loan amount and loan amount squared, a refinance indicator, a conforming-loan indicator, a high-interest-rate indicator, and county fixed effects. Because HMDA reports only the origination year, the QE indicator equals 1 for loans originated in 2009. Panel B reports bank-level regressions estimating changes in the Loans/Assets ratio, the Debt Securities (excluding Treasuries)/Assets ratio, and Federal Reserve Deposits/Assets around QE1. These regressions use quarterly Call Report data from Q4:2007 to Q4:2009 (FFIEC). Columns (4)–(6) include controls for log assets, the equity-to-assets ratio, and state fixed effects. The QE dummy equals 1 for quarters Q4:2008–Q4:2009. Standard errors are reported in parentheses.

Panel A: QE, Bank Mortgage Retention Rate, and Bank Balance Sheet Mortgage Lending Share

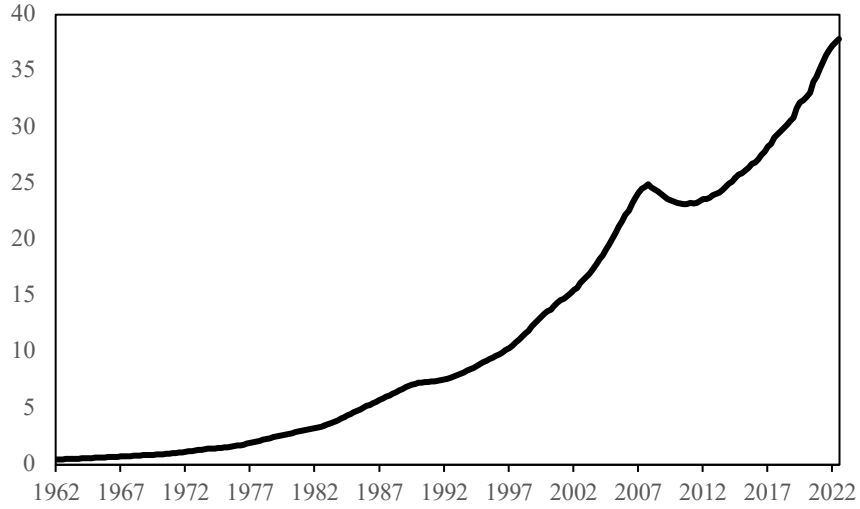
	Bank Originated Mortgages		All Mortgages	
	Retained Share	Retained Share	Bank Balance Sheet Lending Share	Bank Balance Sheet Lending Share
	(1)	(2)	(3)	(4)
QE	-0.120	-0.107	-0.108	-0.101
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Other controls	No	Yes	No	Yes
Observations	12,593,768	12,523,734	16,126,546	15,930,929
R-squared	0.014	0.026	0.013	0.022

Panel B: Quantitative Easing, Bank Mortgage Retention Rate, and Bank Balance Sheet Mortgage Lending Share

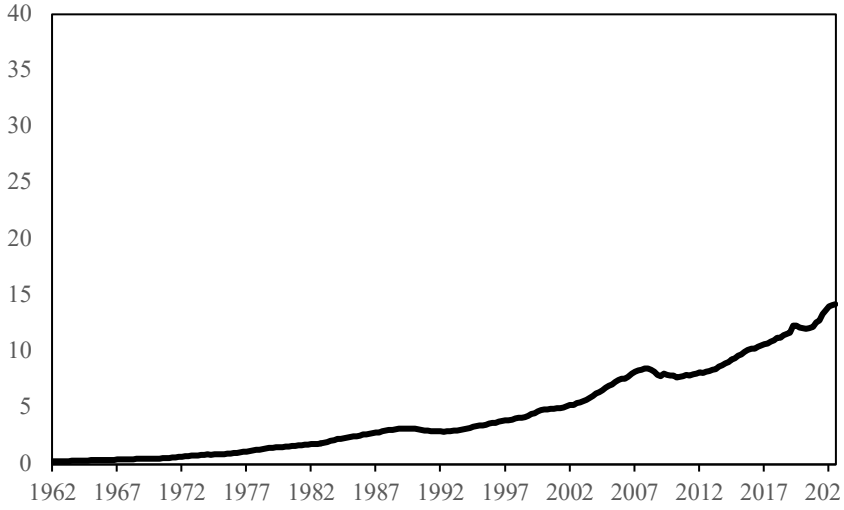
	Loan /Asset	Loan /Asset	Debt Securities /Asset	Debt Securities /Asset	Reserves /Asset	Reserves /Asset
	(1)	(2)	(3)	(4)	(5)	(6)
QE	0.474	-0.292	-0.354	-0.259	0.377	0.361
	(0.146)	(0.120)	(0.120)	(0.114)	(0.0142)	(0.0135)
Other controls	No	Yes	No	Yes	No	Yes
Observations	61,241	61,241	61,241	61,241	61,241	61,241
R-squared	0.000	0.324	0.000	0.099	0.012	0.064

Figure 1: Total Lending to Households and Non-Financial Businesses over Time and its Main Funding Channels

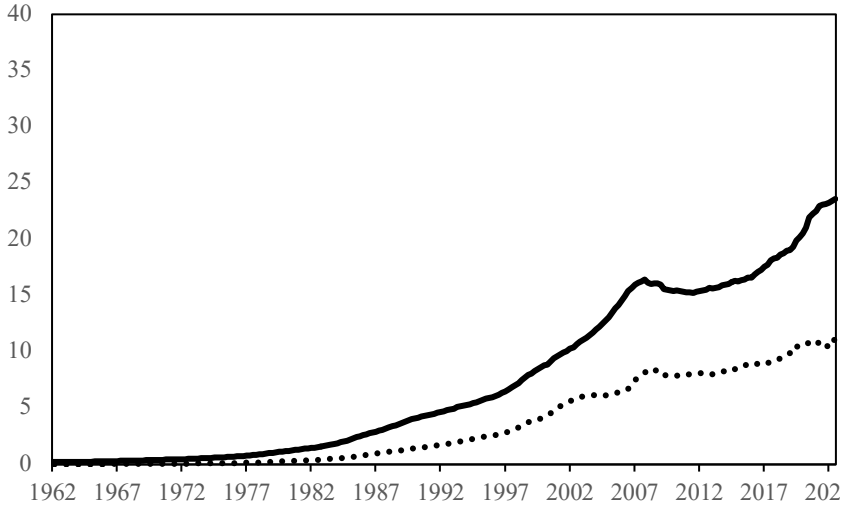
Panel (a) of this figure illustrates the evolution of the outstanding volume of total lending to households and non-financial businesses. Panel (b) and (c) break down the total lending into its two primary funding segments: informationally sensitive loans (bank balance sheet loans) displayed in panel (b) and debt securities depicted by the solid line in panel (c). The dashed line in panel (c) additionally represents the subsegment of debt securities comprising government-affiliated debt securities. All values are presented in $ trillions. *Data Sources:* The Financial Accounts of the United States, the Federal Reserve System.



(a) Total lending



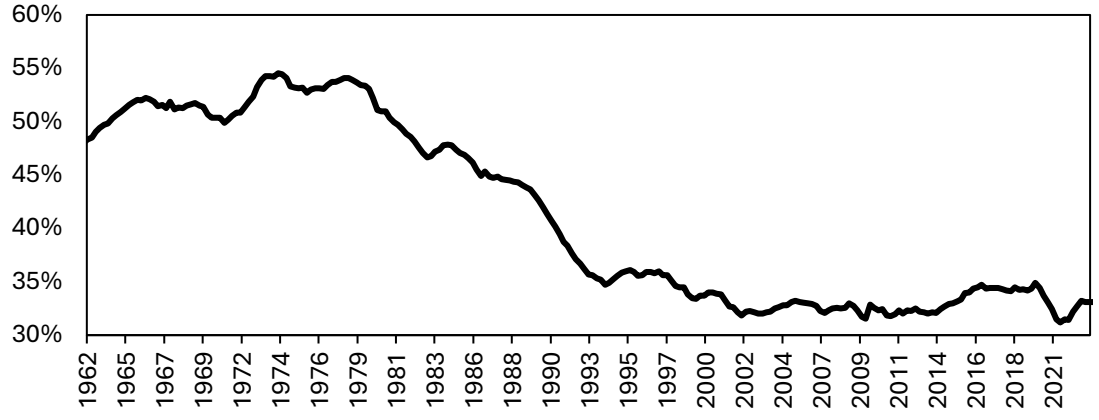
(b) Informationally sensitive lending



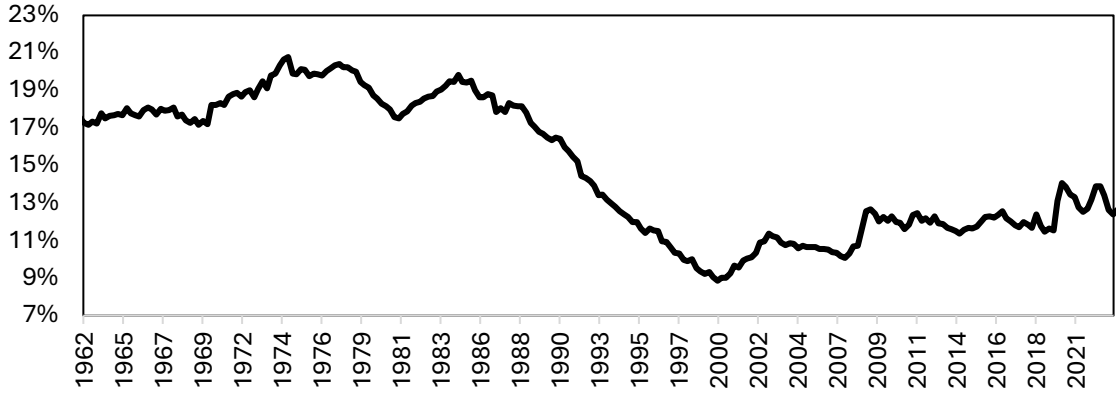
(c) Debt securities

Figure 2: Main Facts on the Secular Decline of Bank Balance Sheet Lending

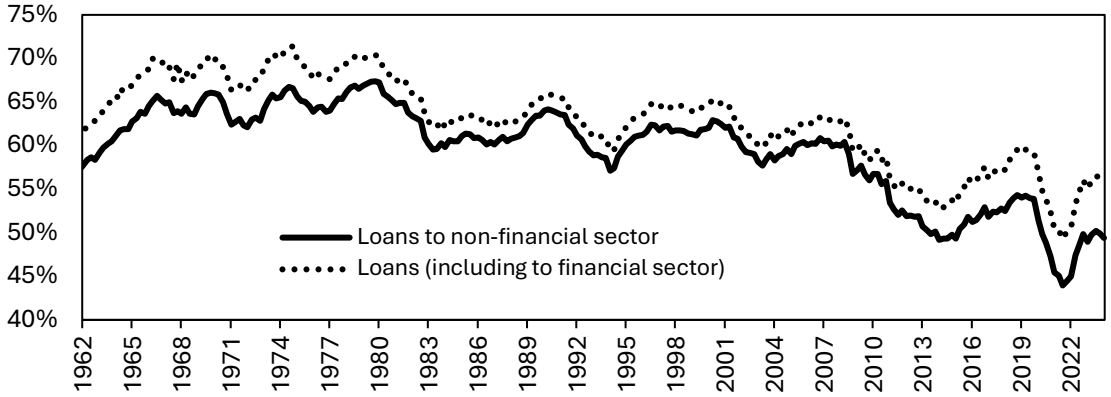
Panel (a) of this figure shows bank balance sheet lending as a percentage of the total outstanding lending volume to households and non-financial businesses. Panel (b) shows the total savings and time deposits own by the domestic non-financial sector relative to the domestic non-financial sector's total financial assets. Panel (c) shows informational sensitive lending (bank loans) as a percentage of bank assets, with the solid line considering only bank loans to the non-financial sector, and the dotted line including loans to the non-depository financial sector. Panel (d) illustrates the evolution of bank debt securities holdings financing households and firms as a share of bank assets. Panel (e) shows the share of non-bank financing funded by bank loans to non-depository financial corporations. Panel (f) shows the domestic non-financial sector's total financial assets as a percentage of GDP. *Data Sources:* The Financial Accounts of the United States, the Federal Reserve System.



(a) Informationally sensitive lending share

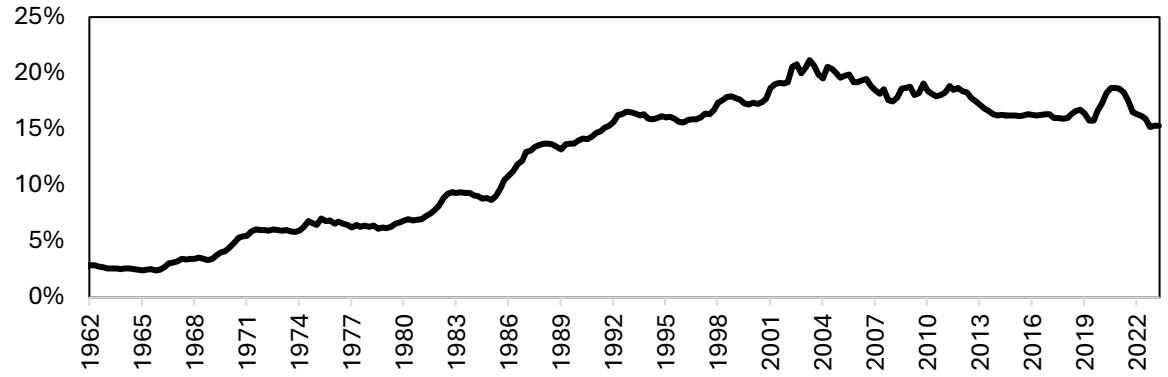


(b) Deposit share of domestic non-financial sector financial assets

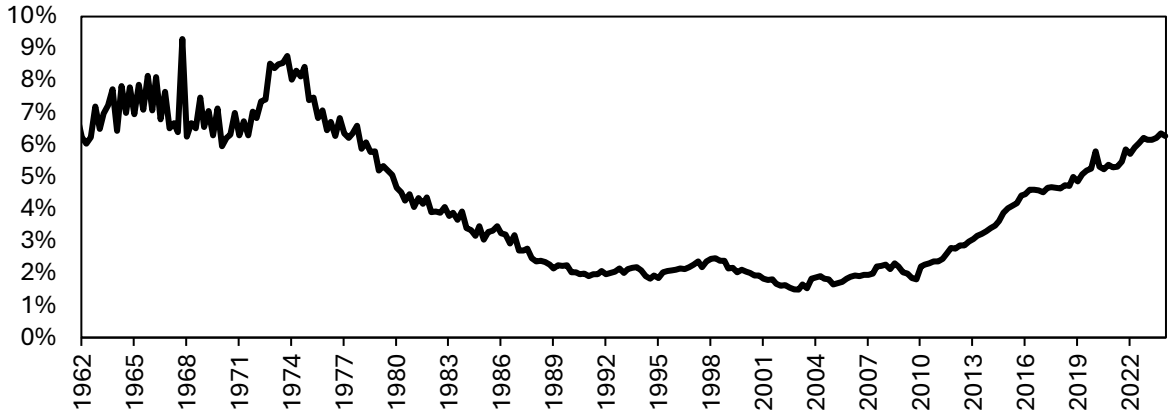


(c) Loan share of bank assets

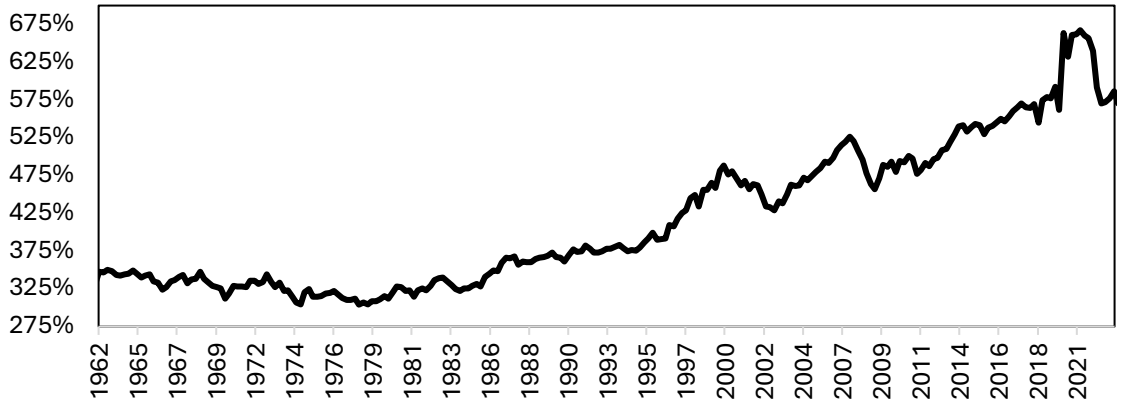
Figure 2: Main Facts on the Secular Decline of Bank Balance Sheet Lending (continued)



(d) Bank debt securities holdings as a share of bank assets



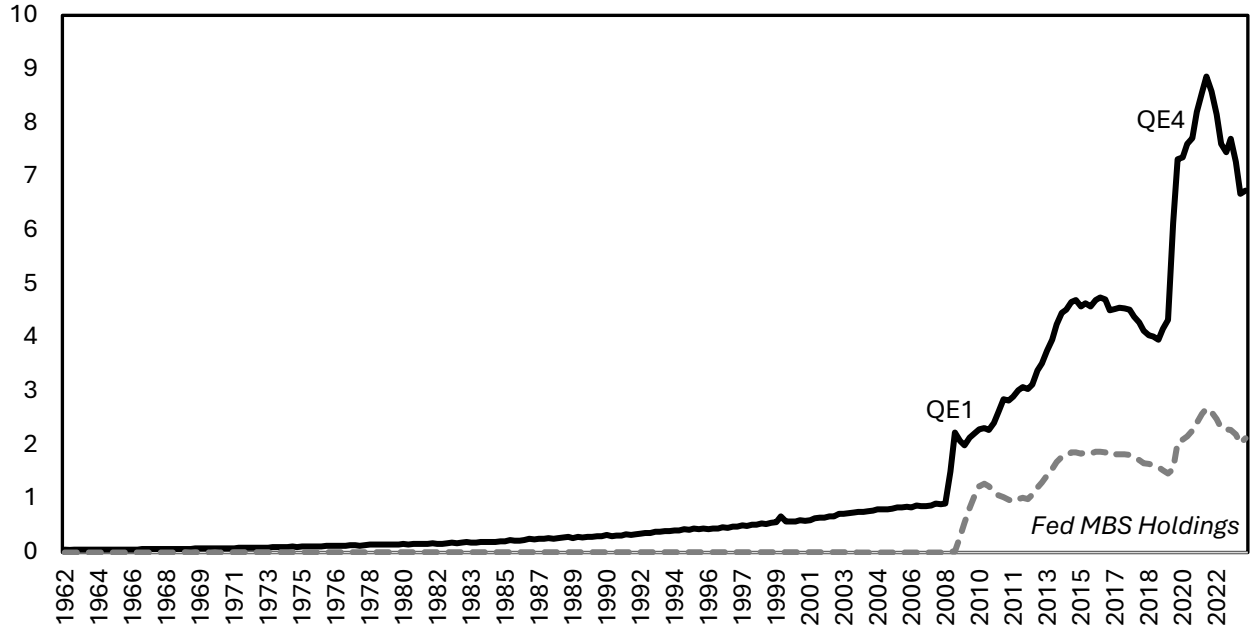
(e) Bank loans to non-bank intermediaries as a share of non-bank lending



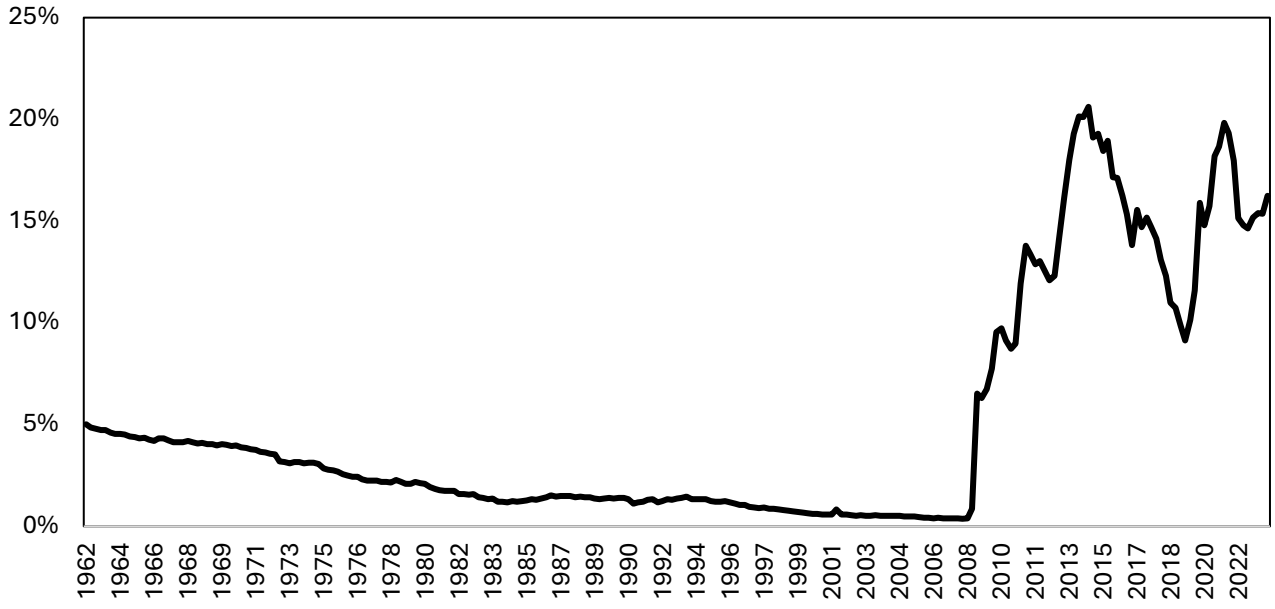
(f) Domestic non-financial sector financial wealth / GDP

Figure 3: Quantitative Easing, Fed Asset Holdings, and Bank Reserves

Panel (a) of this figure shows the financial assets of the Federal Reserve Bank and its mortgage-backed securities holdings (in $tn). Panel (b) shows the bank reserves to asset ratio. Source: Flow of funds.



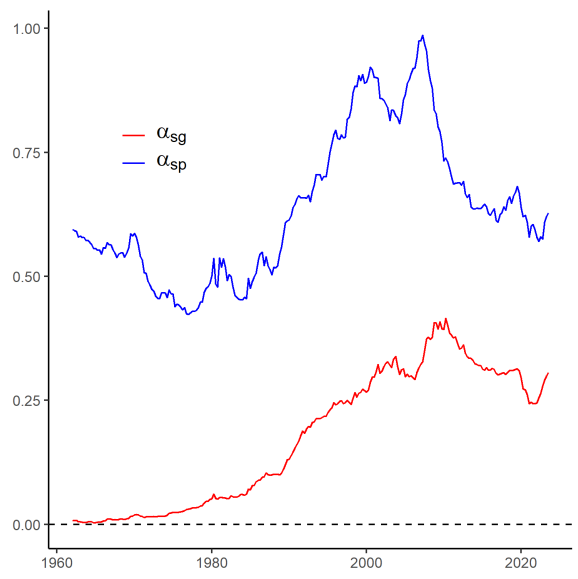
(a) Fed financial assets and Fed MBS holdings (in $tn)



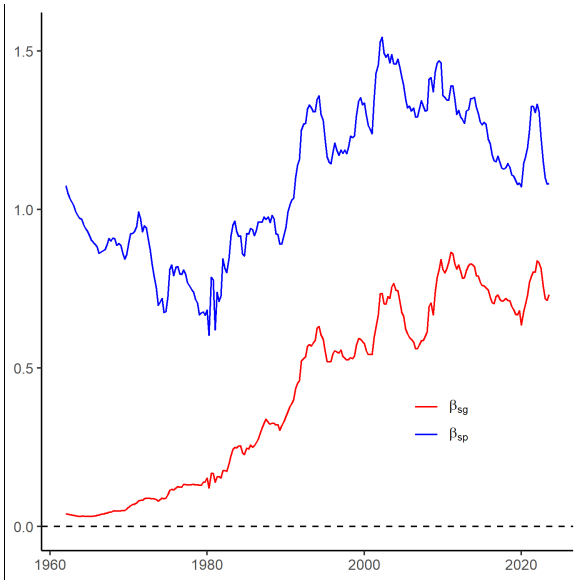
(b) Reserve to asset ratio of depository institutions (in %)

Figure 4: Time-varying Structural Parameters

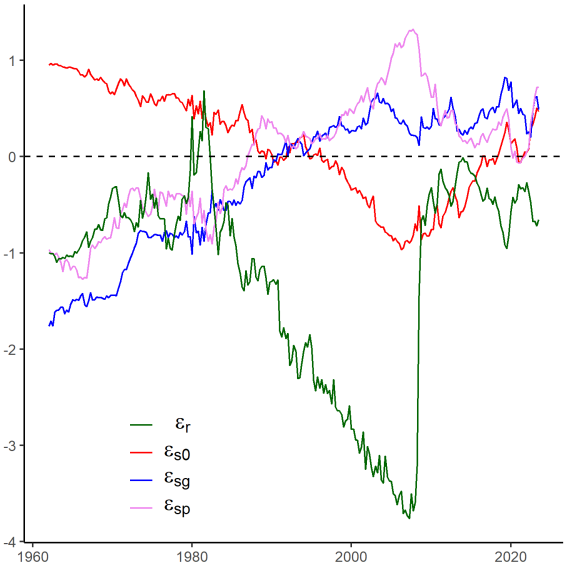
This table shows the time-varying structural parameters. Panel (a) shows savers' demand shifters over government affiliated and private securities relative to deposits. Panel (b) shows the borrower demand shifters for government and private-affiliated informationally insensitive OTD lending, $(\beta_{OTDg,t}, \beta_{OTDp,t})$, relative to informationally sensitive lending. Panel (c) shows the shocks to value for deposits, equity, and the convenience yield for private and government-affiliated securities. Panel (d) shows the shocks to value of bank loans. A positive number is an implicit subsidy, while a negative number is an implicit cost.



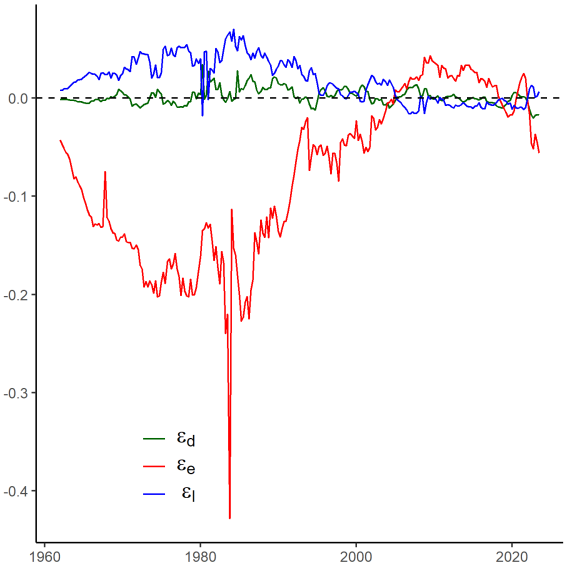
(a) Saver demand shifters



(b) Borrower demand shifters



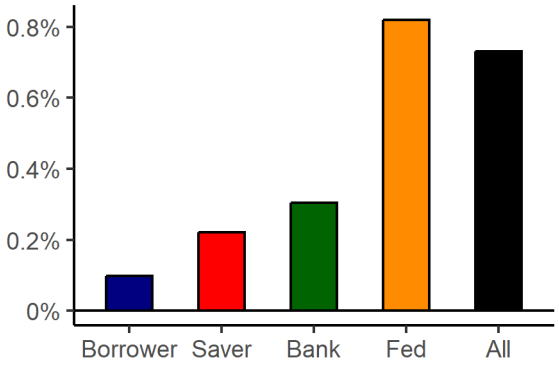
(c) Structural liquidity demand shocks



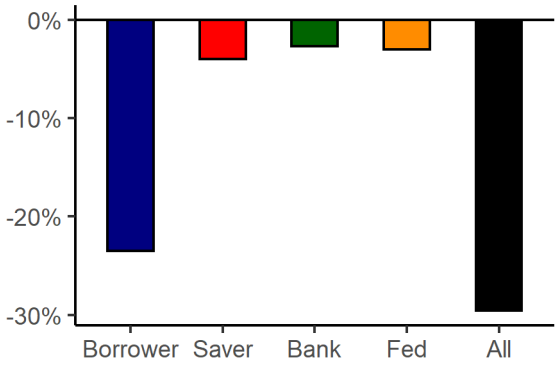
(d) Structural intermediation shocks

Figure 5: Decomposition of Changes in Financial Intermediation

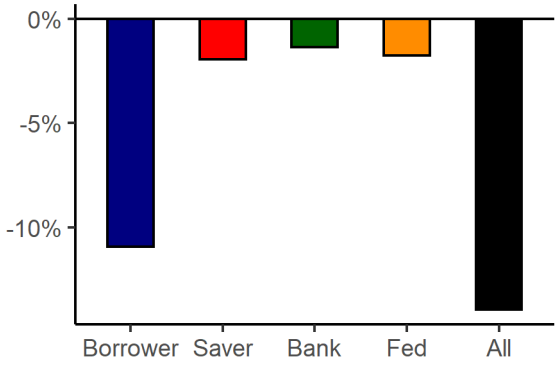
This figure decomposes changes in financial intermediation into changes shifts in borrower demand, shifts in saver demand, central bank asset purchase policies, and implicit subsidies. Each chart shows the change in the relevant measurement versus a baseline scenario in 2023 where borrower demand, saver demand, intermediation wedges ("bank"), and fed balance sheet ("fed"), are set to their 1962 level. "Borrower" (navy) sets the borrower preferences to the 2023 level. "Saver" (red) sets saver preferences to their 2023 level. "Bank" (green) sets unobserved intermediation wedges to their 2023 level. "Fed" (orange) sets the central bank balance sheet equal to its 2023 composition. "All" (black) changes all four and corresponds to the observed equilibrium. Panel (a) shows % changes in total lending. Panel (b) shows % changes in bank balance sheet lending, i.e., changes in the quantity of informationally sensitive lending. Panel (c) shows changes in the share of informationally sensitive lending in total lending. Panel (d) shows % changes in bank assets. Panel (e) shows changes in the loan share of bank assets. Panel (f) shows changes in the deposit share of savings. For example, Panel (c) says the technological changes explain roughly a 10% drop in the informationally sensitive lending share.



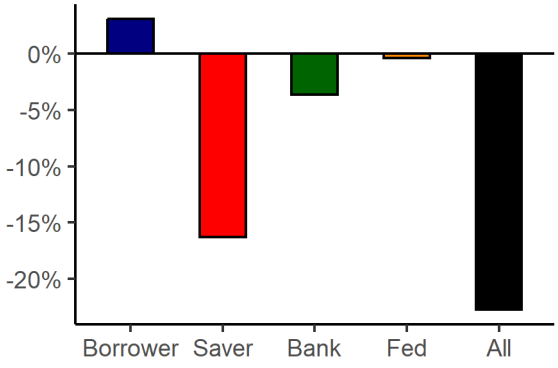
(a) % changes in total lending



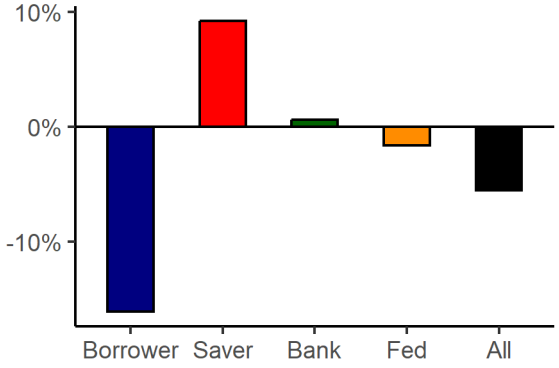
(b) % change in bank balance sheet lending



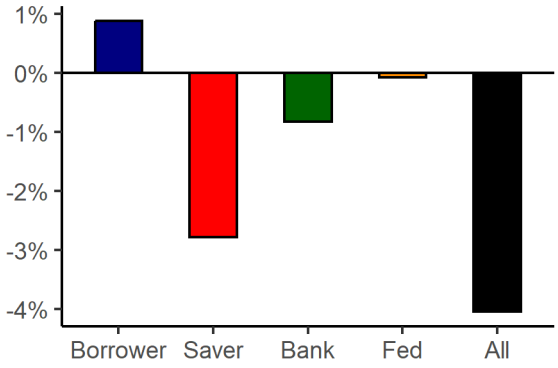
(c) change in info sensitive lending share



(d) % change in bank balance sheet size



(e) change in loan share of bank assets



(f) change in deposit share of savings

Figure 6: Securitization Technology: Bank Balance Sheet Lending and Ease of Securitization

This figure shows bank balance sheet lending using US residential mortgage origination in a binned scatterplot. The x-axis is the loan size relative to the conforming loan limit. Below the limit, GSE guarantees are available (making the loan informationally insensitive and eligible for GSE securitization). Above the limit, GSE guarantees are not available (making the loan informationally sensitive and potentially harder to sell). The y-axis is the fraction of loans in each bin that are financed on bank balance sheets, (i.e., is originated by a bank and retained by the originator, or originated by any lender type and sold to a bank). Data are from HMDA and run from 2007-2017.

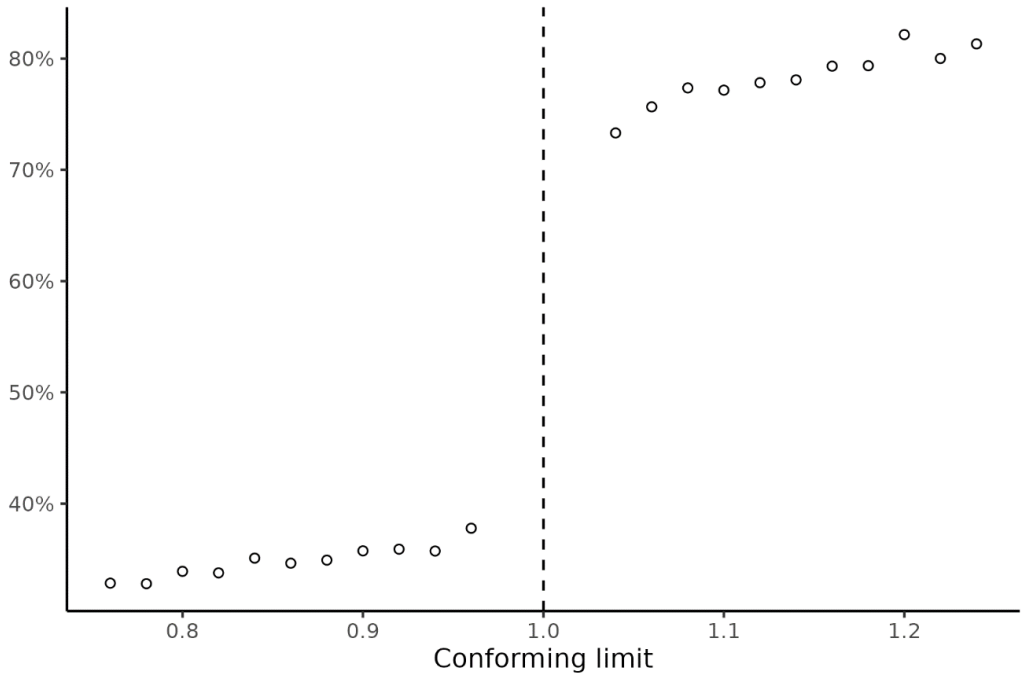
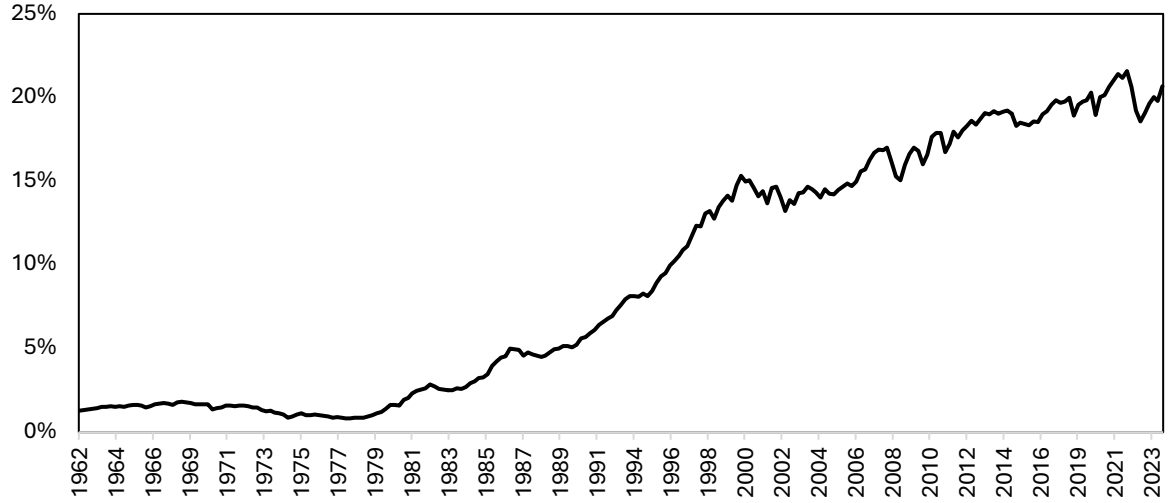
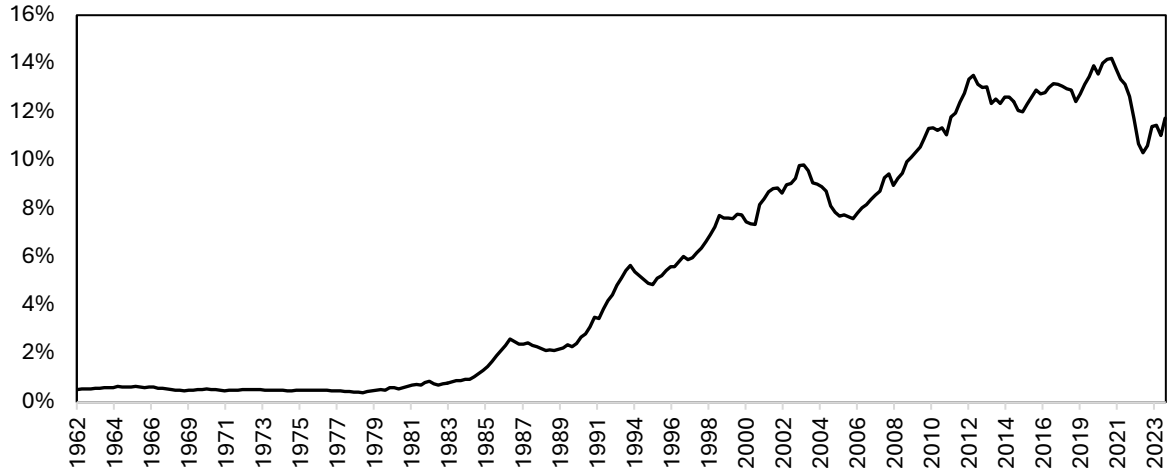


Figure 7: Saver Demand Factors: Growth of Shadow Money

Panel (a) of this figure shows the total shadow money "assets" as a percentage of domestic non-financial sector financial assets. The shadow money assets are defined as total assets of money market funds, closed end funds, ETFs, and mutual funds. Panel (b) shows the percentage of total credit to households and non-financial businesses that is financed with use of debt securities bought through shadow money intermediaries.



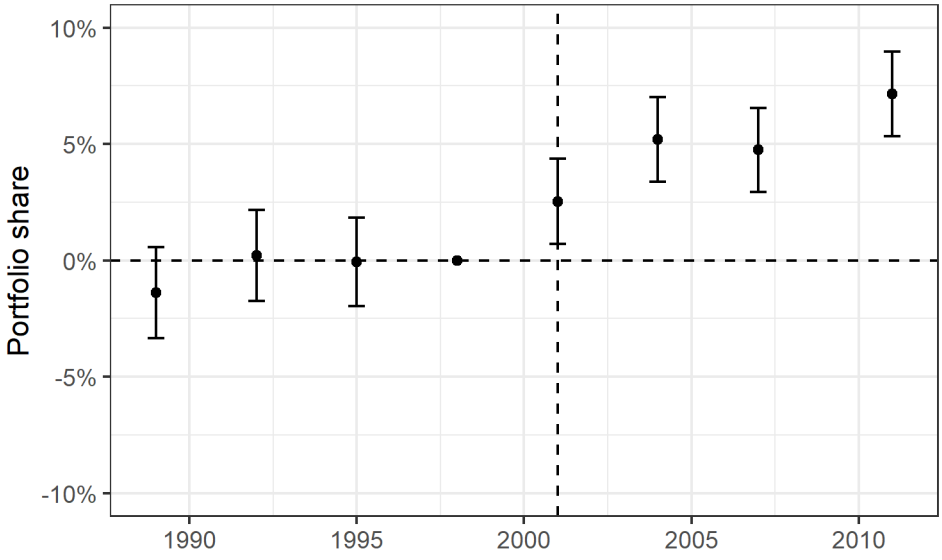
(a) Shadow money share of domestic non-financial sector financial assets



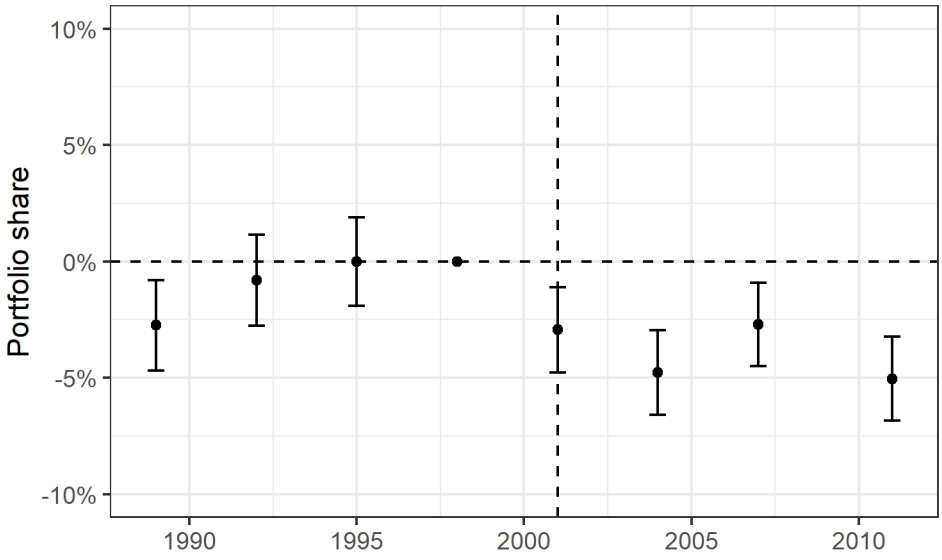
(b) Shadow money share in financing debt securities

Figure 8: Saver Demand Factors: Role of Retirement Funds

This figure shows the impact of the Economic Growth and Tax Relief Reconciliation Act, which increased contribution limits on defined contribution plans starting in 2001, on the portfolio share of non-bank intermediated retirement accounts (panel (a)) and bank-intermediated checking and savings accounts (panel (b)). Each panel shows the coefficient on "high income," which is defined as an individual with income above the overall median income level. Data are from the Survey of Consumer Finances. Bars show 95% confidence intervals. 1998, the last SCF run before the act's passage, is the base year.



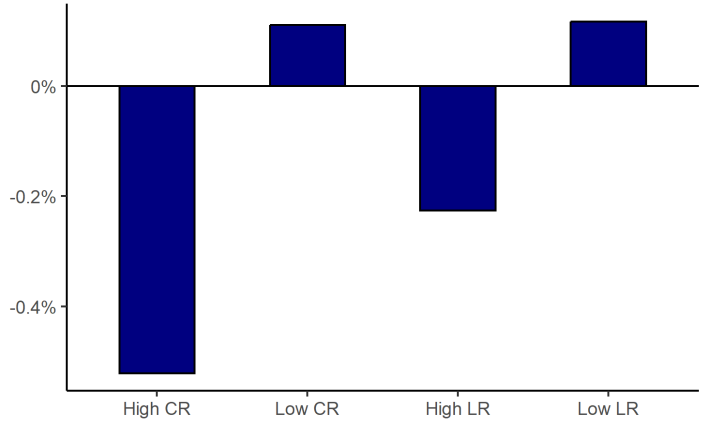
(a) Retirement account portfolio weight



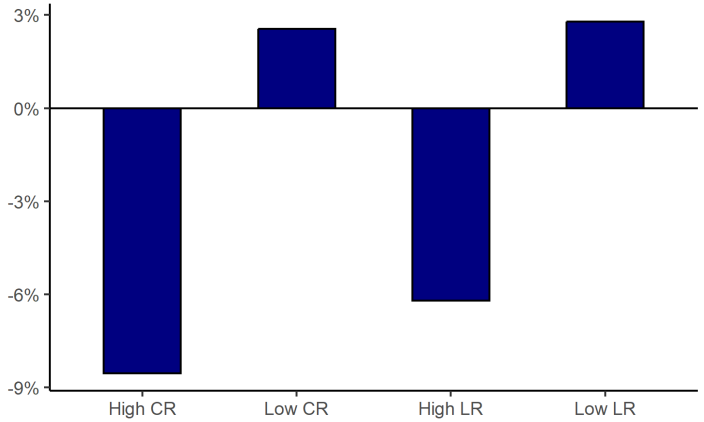
(b) Bank checking or deposit portfolio weight

Figure 9: Counterfactual Capital and Liquidity Requirements

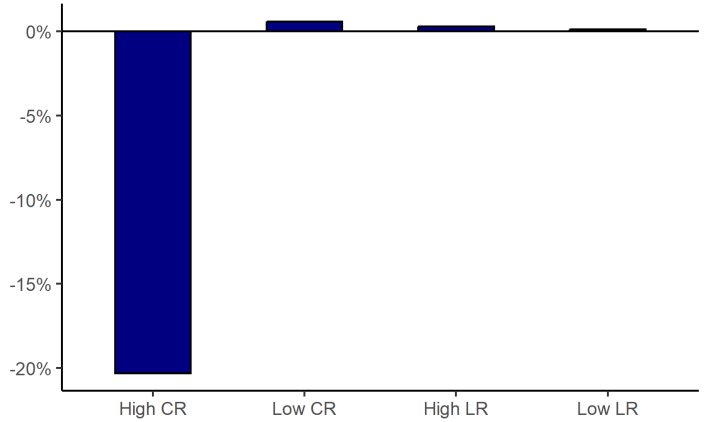
This figure shows the counterfactual impact of high (25%) and low (0%) capital requirements and high (25%) and low (0%) liquidity requirements in the actual (2023, in blue) and historical (1963, in orange) regimes using the calibrated model. Each bar shows changes versus the associated baseline, that is, the 2023 bars show changes versus the 2023 baseline, and the orange bars show changes versus the 1963 baseline. Panel (a) shows the percentage change in total lending. Panel (b) shows the percentage change in bank balance sheet lending. Panel (c) shows the % change in bank assets versus the baseline. Panel (d) shows the change in informationally sensitive loan share of bank balance sheets.



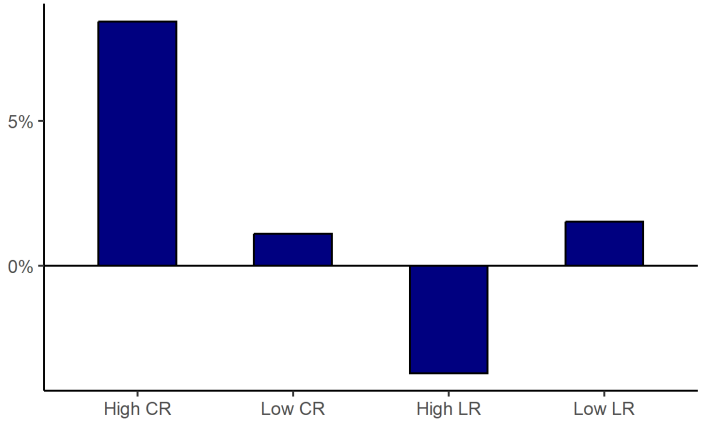
(a) % change in total lending



(b) % change in bank balance sheet lending



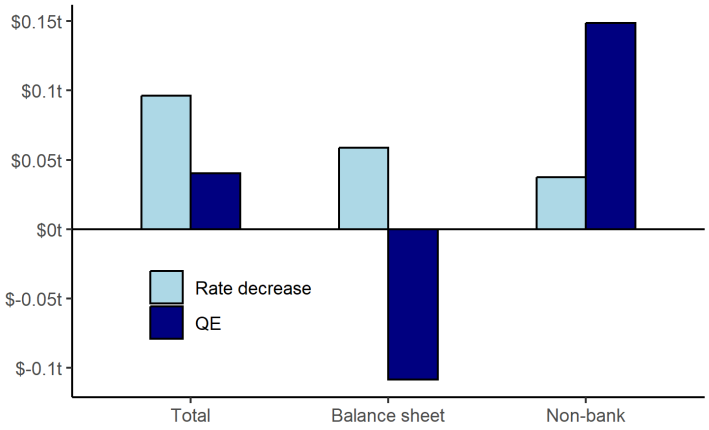
(c) % change in bank assets



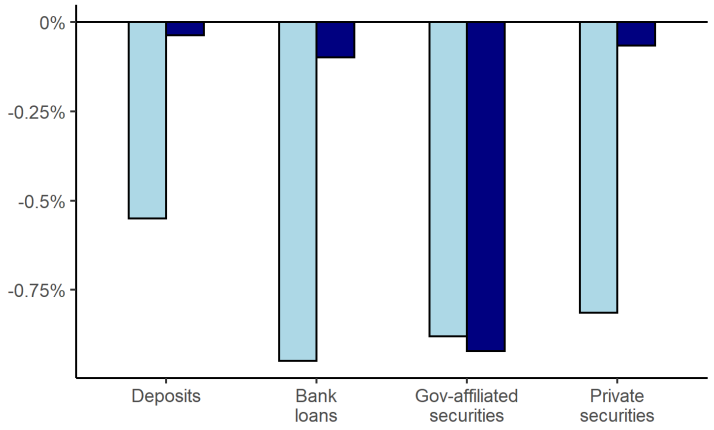
(d) change in loan share of bank assets

Figure 10: Conventional and Unconventional Monetary Policy

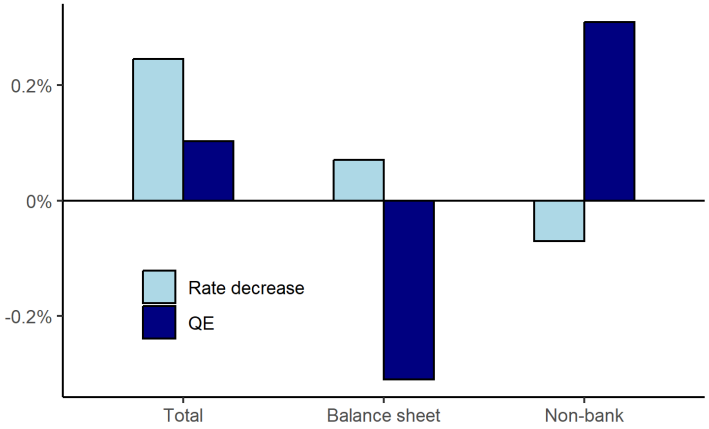
This figure shows the impact of conventional monetary policy (light blue) and unconventional monetary policy (QE, dark blue) on bank lending (changes in $t, panel (a)), interest rates (changes in percentage points, panel (b)), and bank balance sheet quantities (changes in $t, panel (c)), using our estimated model. Conventional monetary policy is a simulated 1% interest rate decrease on the outside option security ("treasuries") and the return on central bank reserves. Unconventional monetary policy is a $1.2 trillion purchase of MBS ("gov-affiliated securities") by the central bank in exchange for bank reserves.



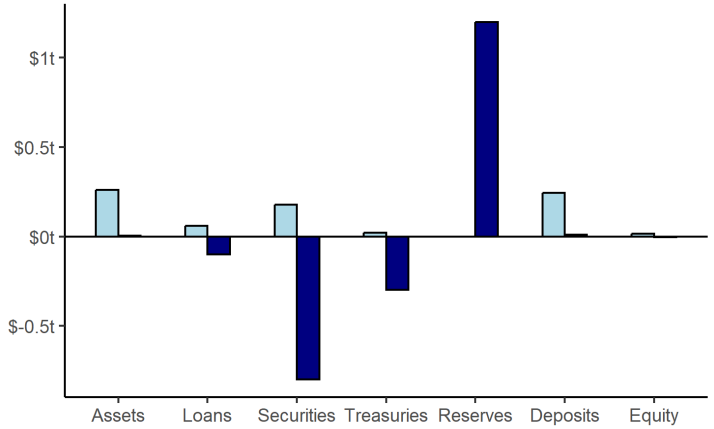
(a) Change in lending quantities



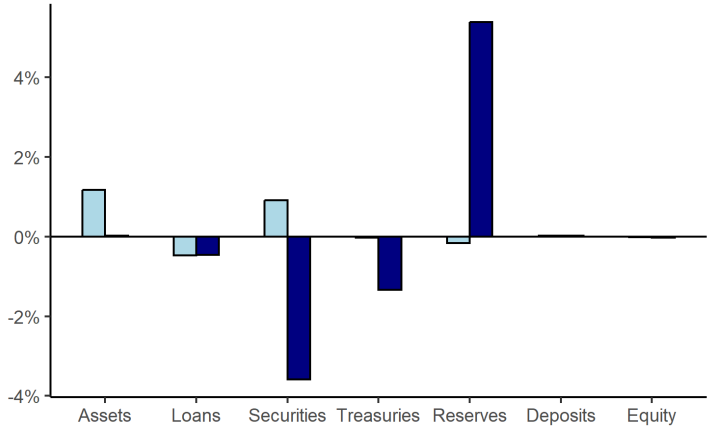
(b) Change in interest rates



(c) Change in total and bank balance sheet lending



(d) Change in balance sheets quantities

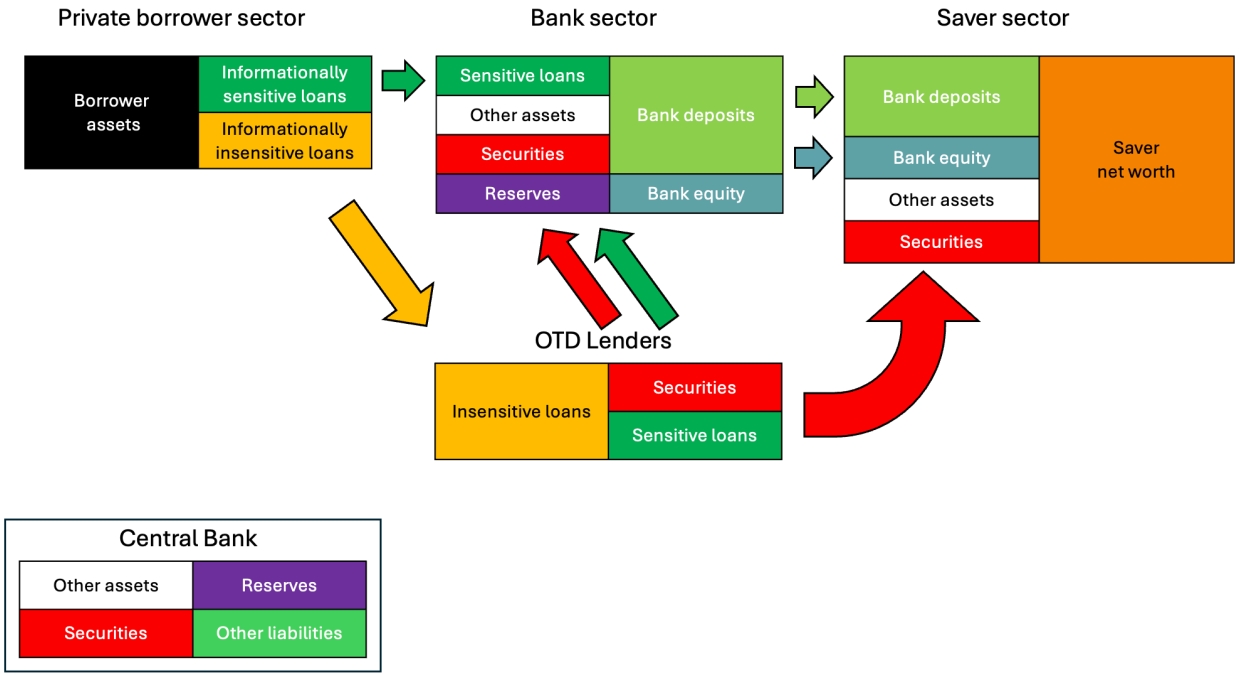


(e) Change in balance sheets composition

Online Appendix

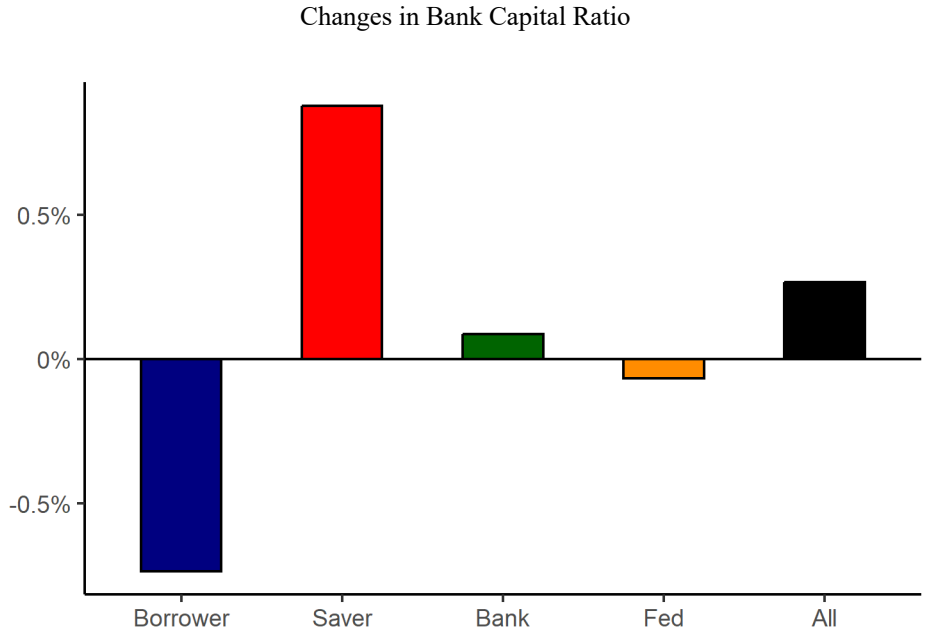
Appendix A1: Model Flow of Funds

This figure shows the flow of funds in our structural model. Left-to-right, the private borrower sector has (unmodeled) assets which it finances with informationally sensitive and informationally insensitive loans. The bank sector issues informationally sensitive loans, bank deposits, and bank equity, and additionally holds securities and other assets. The OTD sector issues informationally insensitive loans and securities, and is additionally partially funded by informationally sensitive loans from the bank sector. Finally, the saver sector saves using bank deposits, bank equity, securities, and other assets.



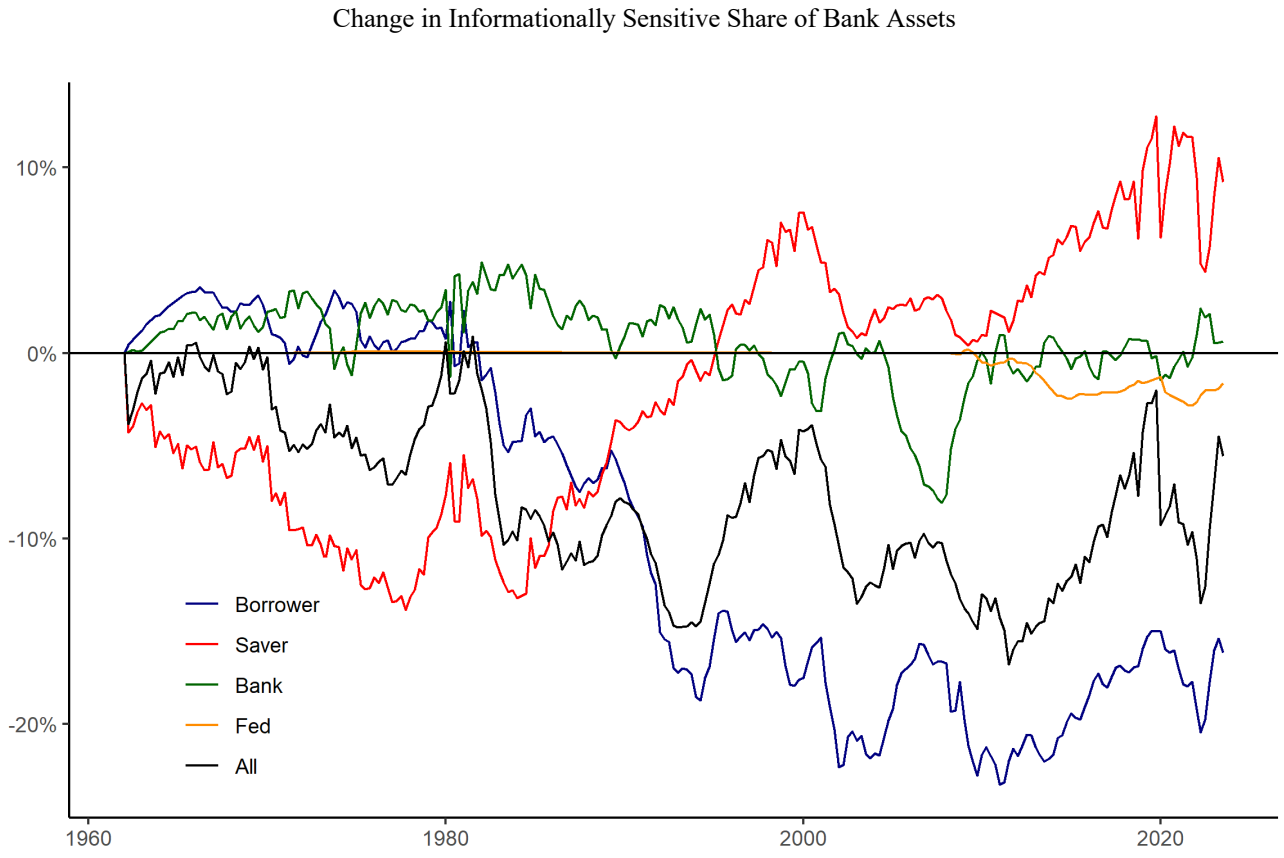
Appendix A2: Bank Capital Ratios

This figure shows the decomposition of changes in bank capital (equity-to-asset) into changes in borrower preferences, saver preferences, implicit subsidies, and central bank asset purchases between 1963 and 2023. Each chart shows the change in the relevant measurement versus a baseline scenario in 2023 where borrower demand, saver demand, intermediation wedges ("bank"), and fed balance sheet ("fed"), are set to their 1962 level. "Borrower" (navy) sets the borrower preferences to the 2023 level. "Saver" (red) sets saver preferences to their 2023 level. "Bank" (green) sets unobserved intermediation wedges to their 2023 level. "Fed" (orange) sets the central bank balance sheet equal to its 2023 composition. "All" (black) changes all four and corresponds to the observed equilibrium.



Appendix A3: Secular Changes to the Informationally Sensitive Share of Bank Assets

This figure shows the decomposition in changes in financial intermediation trends into changes in borrower preferences, saver preferences, implicit subsidies, and central bank asset purchases over time. The chart shows the change in the relevant measurement versus a baseline scenario in which borrower preferences, saver preferences, subsidies, and the central bank balance sheet are held constant at their 1963 level. "Borrower" (navy) allows borrower preferences to change through time. "Saver" (red) allows saver preference parameters to change through time. "Bank" (green) allows implicit bank subsidies and regulatory costs to change through time. "Fed" (orange) allows central bank asset purchases. "All" (black) shows the actual data. The outcome is the informationally sensitive loan share of bank assets.



Appendix A4. Data Federal Reserve Flow of Funds Data Construction

This appendix details our data construction methodology. We obtain the following data series from the fed flow of funds through FRED:

Panel A: Raw Series

Number	Series description	Series name
1	U.S.-chartered depository institutions; other bank loans	BOGZ1FL763068205Q
2	U.S.-Chartered Depository Institutions; Loans for Purchasing or Carrying Securities	BOGZ1FL763067003Q
3	Foreign Banking Offices in the U.S.; Other Bank Loans	BOGZ1FL753068205Q
4	Foreign Banking Offices in the U.S.; Loans for Purchasing or Carrying Securities	BOGZ1FL753067003Q
5	All Sectors; One-to-Four-Family Residential Mortgages	ASHMA
6	U.S.-Chartered Depository Institutions; One-to-Four-Family Residential Mortgages	BOGZ1FL763065105Q
7	Foreign Banking Offices in the U.S.; One-to-Four-Family Residential Mortgages	BOGZ1FL753065103Q
8	Banks in U.S.-Affiliated Areas; One-to-Four-Family Residential Mortgages	BOGZ1FL743065103Q
9	Credit Unions; One-to-Four-Family Residential Mortgages	BOGZ1FL473065100Q
10	Agency-and GSE-Backed Mortgage Pools; One-to-Four-Family Residential Mortgages	BOGZ1FL413065105Q
11	Government-Sponsored Enterprises; One-to-Four-Family Residential Mortgages	BOGZ1FL403065105Q
12	Households and Nonprofit Organizations; Consumer Credit	CCLBSHNO
13	Federal Government; Consumer Credit, Student Loans	FGCCSAQ027S
14	U.S.-Chartered Depository Institutions; Consumer Credit	BOGZ1FL763066000Q
15	Credit Unions; Consumer Credit	BOGZ1FL473066000Q
16	Households and Nonprofit Organizations; Depository Institution Loans N.E.C.	BLNECLBSHNO
17	Households and Nonprofit Organizations; Other Loans and Advances	OLALBSHNO
18	All Sectors; Multifamily Residential Mortgages	ASMRMA
19	All Sectors; Commercial Mortgages	ASCMA
20	All Sectors; Farm Mortgages	ASFMA
21	Agency-and GSE-Backed Mortgage Pools; Multifamily Residential Mortgages	BOGZ1FL413065405Q
22	Government-Sponsored Enterprises; Multifamily Residential Mortgages	BOGZ1FL403065405Q
23	Agency-and GSE-Backed Mortgage Pools; Farm Mortgages	BOGZ1FL413065605Q
24	Government-Sponsored Enterprises; Farm Mortgages	BOGZ1FL403065605Q
25	Agency-and GSE-Backed Mortgage Pools; Commercial Mortgages	BOGZ1FL413065505Q
26	Government-Sponsored Enterprises; Farm Credit System Loans	BOGZ1FL403069345Q
27	U.S.-Chartered Depository Institutions; Multifamily Residential Mortgages	BOGZ1FL763065403Q
28	Foreign Banking Offices in the U.S.; Multifamily Residential Mortgages	BOGZ1FL753065403Q
29	U.S.-Chartered Depository Institutions; Commercial Mortgages	BOGZ1FL763065503Q
30	Foreign Banking Offices in the U.S.; Commercial Mortgages	BOGZ1FL753065503Q
31	Banks in U.S.-Affiliated Areas; Commercial Mortgages	BOGZ1FL743065505Q
32	U.S.-Chartered Depository Institutions; Farm Mortgages	BOGZ1FL763065633Q
33	Foreign Banking Offices in the U.S.; Farm Mortgages	BOGZ1FL753065603Q
34	Nonfinancial Corporate Business; Debt Securities	NCBDBIQ027S
35	Nonfinancial Business; Other Loans and Advances	BOGZ1FL143169005Q
36	Nonfinancial Business; Depository Institution Loans N.E.C.	BOGZ1FL143168005Q
37	Private Depository Institutions; Total Financial Assets	BOGZ1FL704090005Q
38	Private Depository Institutions; Total Liabilities	BOGZ1FL704190005Q
39	Private Depository Institutions; Checkable Deposits	BOGZ1FL703127005Q
40	Private Depository Institutions; Total Time and Savings Deposits	BOGZ1FL703130005Q
41	Private Depository Institutions; Federal Funds and Security Repurchase Agreements	BOGZ1FL702150005Q
42	Private Depository Institutions; Agency- and GSE-Backed Securities	BOGZ1LM703061705Q
43	Private Depository Institutions; Corporate and Foreign Bonds	BOGZ1LM703063005Q
44	Domestic Nonfinancial Sectors; Total Financial Assets	BOGZ1FL384090005Q

Using these raw series, we calculate the following derived series:

Panel B: Derived Series

Series description	Series definition (numbers refer to raw series)
Bank loans to financial intermediaries	1 + 2 + 3 + 4
Home mortgages (depository)	6 + 7+ 8 + 9
Home mortgages (GSEs)	10 + 11
Private consumer credit	12 – 13
Consumer credit (depository)	14 + 15
Other household credit	16 + 17
Commercial mortgages (incl' farm, multifamily)	18 + 19 + 20
Commercial mortgages (depository)	27 + 28 + 29 + 30 + 31 + 32 + 33
Commercial mortgages (GSEs)	21 + 22 + 23 + 24 + 25 + 26
Non-mortgage business debt	34 + 35 + 36
Household debt	5 (1-4 family mortgages) + Private consumer credit + Other household credit
Household debt (depository)	Home mortgages (depository) + Consumer credit (depository) + 16 (other depository)
Business debt	Commercial mortgages + Non-mortgage business debt
Business debt (depository)	Commercial mortgages (depository) + 36 (depository institution business loans)
Total private credit	Household debt + Business debt
Bank loans	Household debt (depository) + Business debt (depository)
Mortgages	5 (1-4 family mortgages) + Commercial mortgages
Mortgages (depository)	Home mortgages (depository) + Commercial mortgages (depository)
Non-mortgage credit	Total private credit – mortgages
Non-mortgage credit (depository)	Bank loans – mortgages (depository)
Bank deposits	39 + 40 + 41
Total bank securities	37 (Total financial assets) – Bank loans
Bank equity	37 (Total financial assets) – 38 (Total liabilities)
Total non-GSE private securities	Total private credit – Bank loans – Home mortgages (GSE) – Commercial mortgages (GSE)
Saver private securities	Total non-GSE private securities – 43 (bank corporate securities)
Saver government securities	Home mortgages (GSE) + Commercial mortgages (GSE) – 42 (bank GSE securities)
Saver other securities	44 (Non-financial sector financial assets) – Bank deposits – Bank equity – Saver private securities – Saver government securities
Borrower info-sensitive loans	Bank loans
Borrower info-insensitive (private)	43 (bank corporate securities) + Saver private securities
Borrower info-insensitive (government)	42 (bank GSE securities) + Saver government securities

Appendix A5. Estimation Moments

This table lists the moments used in the GMM estimation for the intermediation parameters. The exponents on the capital and liquidity ratios correspond to terms that enter the return equations E.1-3. The moments are as follows:

Panel A: Bank Liquidity Moments
$E[\epsilon_r]$
$E[\epsilon_{sg}]$
$E[\epsilon_{sp}]$
$E[\epsilon_{s0}]$
$E[\epsilon_{sg} \times CB_MBSQty]$
$E[\epsilon_{sp} \times CB_BondQty]$
$E[\epsilon_{s0} \times CB_TreasuryQty]$

Panel B: Intermediation Moments
$E[\epsilon_d]$
$E[\epsilon_l]$
$E[\epsilon_e]$
$E[\epsilon_d \times TreasuryQty]$
$E[\epsilon_d \times ExcessLiquidityRatio^{.5}]$
$E[\epsilon_d \times ExcessLiquidityRatio^{-.5}]$
$E[\epsilon_d \times ExcessCapitalRatio^{.5}]$
$E[\epsilon_l \times TreasuryQty]$
$E[\epsilon_l \times ExcessLiquidityRatio^{-.5}]$
$E[\epsilon_l \times ExcessCapitalRatio^{.5}]$
$E[\epsilon_e \times TreasuryQty]$
$E[\epsilon_e \times ExcessLiquidityRatio^{-.5}]$
$E[\epsilon_e \times ExcessCapitalRatio^{-.5}]$

Appendix A6. Ease of Securitization and Bank Balance Sheet Lending Share (Robustness)

This table examines the relationship between banks' balance-sheet lending share in U.S. residential mortgage originations and the ease of securitizing these loans, as in Table 3, using an alternative bandwidth of the local conforming loan limit (+/- 25% of the local conforming loan limit). *Bank balance sheet loan* is an indicator for whether the loan is financed on bank balance sheet (i.e., if it is originated by a bank and retained on balance sheet, or originated by any lender type and sold to a bank). *Non-conforming* is an indicator for whether the loan exceeds the conforming loan limit above which the GSEs will not guarantee the mortgage (i.e., is an informationally sensitive loan that is ineligible for GSE securitization). Column (2) has loan characteristic fixed effects, i.e., the interaction of origination year, property type, loan purpose, occupancy, state, county, applicant race, ethnicity, sex, and income. Column (3) has originator fixed effects. Column (4) has loan characteristic times lender fixed effects. Data are from HMDA and run from 2007-2017. Standard errors are shown in parentheses.

	Bank balance sheet loan			
	(1)	(2)	(3)	(4)
Non-conforming	0.422	0.343	0.312	0.186
	(0.0005)	(0.001)	(0.0004)	(0.001)
FE	None	Loan	Orig.	Loan x Orig.
N	9,183,165	9,183,165	9,174,465	9,183,165
R^2	0.082	0.606	0.303	0.870

Appendix A7. Saver Demand Factors: Access to Retirement Funds and Deposit Share of Savings

This figure shows the impact of the Economic Growth and Tax Relief Reconciliation Act, which increased contribution limits on defined contribution plans starting in 2001, on the portfolio share of non-bank intermediated retirement accounts and bank-intermediated checking and savings accounts. *High income* is an indicator for whether a saver's income is above the indicated cutoff (50% for Columns (1)—(2), and 75% for Columns (3)—(4).) *Post* is an indicator for whether the year is after 2000. All columns include year and income cross age cross kids cross married fixed effects. Columns (1) and (3) examine the retirement account portfolio chare. Columns (2) and (4) examine the checking/savings portfolio share. Data are from the Survey of Consumer Finances from 1998 through 2011. Standard errors are shown in parentheses.

High income cutoff	Retirement	Deposit	Retirement	Deposit
	>50%		>75%	
	(1)	(2)	(3)	(4)
High income x Post	0.052	-0.030	0.025	-0.036
	(0.005)	(0.005)	(0.006)	(0.006)
Observations	84,3742	84,372	84,372	84,372
R^2	0.189	0.277	0.181	0.273
FE	Year, Income x Age x Kids x Married			

Appendix A8. Unconventional Monetary Policy: QE and Bank Balance Sheet Retention, Lending Share, and Asset Composition (Robustness)

This table conducts an analysis analogous to Table 4, but for the fourth round of quantitative easing. Panel A reports results from a linear probability model estimating how the likelihood that a residential mortgage is retained by the originating bank changes after QE4, which began in March 2020. The regressions are at the loan level using HMDA data published by the CFPB and FFIEC. The dependent variable is an indicator equal to 1 if the loan was originated by a bank and retained on its balance sheet. Columns (2) and (4) add controls for loan amount and loan amount squared, a refinance indicator, a conforming-loan indicator, a high-interest-rate indicator, and county fixed effects. The sample in Columns (1)–(2) includes only bank-originated loans in 2019–2020, while Columns (3)–(4) include all originations (banks and non-banks) in 2019–2020. The QE indicator equals 1 for loans originated in 2020. Panel B reports bank-level regressions estimating changes in the Loans/Assets ratio, the Debt Securities (excluding Treasuries)/Assets ratio, and Federal Reserve Deposits/Assets around QE4. These regressions use quarterly Call Report data from Q1:2019 to Q4:2020 (FFIEC). Columns (4)–(6) include controls for log assets, the equity-to-assets ratio, and state fixed effects. The QE dummy equals 1 for quarters Q1:2020–Q4:2020. Standard errors are shown in parentheses.

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Panel A: QE, Bank Mortgage Retention Rate, and Bank Balance Sheet Mortgage Lending Share

	Bank Originated Mortgages		All Mortgages	
	Retained Share	Retained Share	Bank Balance Sheet Lending Share	Bank Balance Sheet Lending Share
	(1)	(2)	(3)	(4)
QE	-0.126	-0.110	-0.112	-0.091
	(0.0002)	(0.0002)	(0.0001)	(0.0001)
Other controls	No	Yes	No	Yes
Observations	10,988,646	10,959,315	23,866,543	23,797,382
R-squared	0.016	0.167	0.015	0.195

Panel B: Quantitative Easing, Bank Mortgage Retention Rate, and Bank Balance Sheet Mortgage Lending Share

	Loan /Asset	Loan /Asset	Debt Securities /Asset	Debt Securities /Asset	Reserves /Asset	Reserves /Asset
	(1)	(2)	(3)	(4)	(5)	(6)
QE	-2.370	-3.000	-0.610	-0.553	0.457	0.344
	(0.175)	(0.148)	(0.144)	(0.139)	(0.038)	(0.034)
Other controls	No	Yes	No	Yes	No	Yes
Observations	41,709	41,709	41,709	41,709	41,709	41,709
R-squared	0.004	0.292	0.000	0.067	0.003	0.168

Appendix B: The Secular Decline of Bank Balance Sheet Lending: Robustness

B.1 Bank Balance Sheet Share across Market Segments

One explanation for the decline in the informationally sensitive lending share is the growth of government-affiliated debt securities, primarily agency mortgage-backed securities. Government credit guarantees could have facilitated the securitization of mortgages that constitute a substantial share of total lending, crowding out financing of these loans through bank balance sheets.

To delve deeper into this, Figure B1 illustrates the informationally sensitive lending share among mortgages (Panel a) and among all loans excluding mortgage loans (Panel b). As observed in Panel (a) of Figure B1, there is a significant decline in the informationally sensitive mortgage lending share from over 60% in the 1970s to 33% by 2023, with the majority of this decline occurring between the early 1980s and mid-1990s. However, Panel (b) of Figure B1 indicates a broadly similar decline in the informationally sensitive lending share among loans that do not include mortgages, and thus were largely ineligible for government guarantees. There is a partial reversal in the trend following the financial crisis but the 2023 level, 33%, is far below the 47% peak. This suggests that the growth of the government-affiliated securities market alone cannot entirely account for the overall decline in the informationally sensitive lending share.

Panel (c) illustrates this further by showing bank balance sheet lending share among non-financial businesses (excluding mortgages). Focusing on loans to firms that are largely ineligible for government guarantees we again see a significant decline in bank balance sheet share from about 42% at its peak in 1970s to 30% in 2023 with essentially no recovery following the Global Financial Crisis.

In summary, there is robust evidence for secular decline in the informationally sensitive lending share. While the growth of the government-backed mortgage-backed securities market may account for a part of this trend, the substantial decline in the bank balance sheet lending share among non-mortgage loans suggests that other factors have also played an important role in this trend. In Section 2.6, we delve into several such factors.

B.2 Role of Unused Bank Credit Lines

Banks have increasingly offered credit lines to households and firms, a trend that has gained momentum over recent decades (Kashyap et al. 2002; Ivashina and Scharfstein, 2008; Acharya et al. 2023). While our data captures credit lines that have been drawn, one could argue that the decline in the bank balance sheet lending share might at least partly reflect a shift in bank lending towards credit lines. This shift may result in undercounting, as a significant portion of this credit may remain unused at any given point in time.

To better understand the scale of this phenomenon, in panel (a) of Figure B2, we incorporate the unused outstanding credit available to households and firms, assuming its maximum potential

utilization based on historical data. Utilization peaks in times of aggregate negative shocks like Covid-19 and Great Recessions (Ivashina and Scharfstein, 2008; Acharya et al. 2023). Accounting for such an adjustment reveals that while this "potential" credit mechanically increases the bank balance sheet share in more recent periods, there is still a notable overall decline in the bank balance sheet share in overall lending. Additionally, because we do not observe undrawn credit lines until the 1990s, this analysis mechanically understates the trend away from bank balance sheet lending, inclusive of credit lines.

B.3 Role of Private Equity Debt Funds

Our calculations based on the flow of funds data may not fully reflect the recent rise in private credit offered by private equity (PE) debt funds. There is a lot of discussion about growth of private credit in the last two decades (Ivashina, Hanson, Sunderam, Stein 2024). To gauge how such private credit might change our inferences we utilize data from Preqin on private debt funds. Focusing on funds managed in the US, we aggregate annual AUM figures, excluding indirect holdings like funds of funds and secondary funds to avoid double counting.

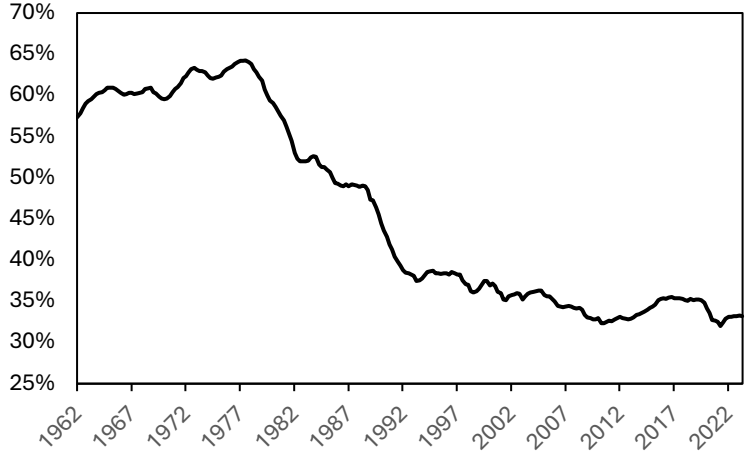
Our analysis reveals substantial growth in private credit debt funds over the past two decades. Their total assets under management (AUM) steadily increased from $37.5 billion in 2000 to about $1.1 trillion in 2023. Notably, private debt funds saw significant expansion since 2019, with AUM rising by over 105% during this period. Despite the substantial growth in private credit debt in recent years, Figure B2, panel (b) illustrates that its overall magnitude is still relatively modest and does not have a pronounced effect on the bank balance sheet share. Indeed, as shown in the figure, accounting for private credit debt only modestly decreases the bank balance sheet lending share in recent years (32% instead of 33% if we ignored private credit provided by PE debt funds).

B.4 Bank security holdings and total bank financing share

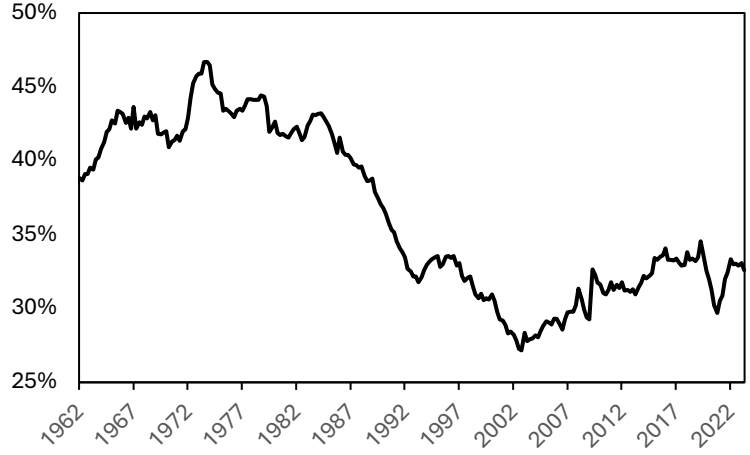
To assess the extent to which bank balance sheets are financing overall lending, both through informationally sensitive loans and debt securities, Panel (c) of Figure B2 shows the bank balance sheet lending share that includes bank debt securities holdings. Although this inclusion increases the bank balance sheet lending share in recent years, we still observe a significant decline: from approximately 60% in the 1970s to slightly above 40% in the recent period. Our modeling framework in Section 3 makes an important distinction between these two forms of credit and examines how substitutable informationally sensitive lending is with debt securities and the importance bank balance sheets play in this regard.

Figure B1: The Secular Decline of Informational Sensitive Lending across Loan Segments

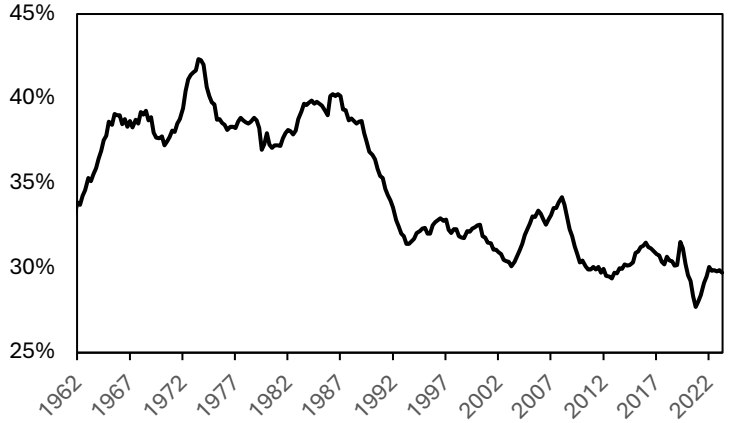
Panel (a) in this figure depicts the evolution of informationally sensitive lending ("bank balance sheet lending") as a percentage of the total outstanding mortgage loans. Panel (b) illustrates the evolution of informationally sensitive lending as a percentage of the total credit, excluding mortgages. Panel (c) shows the evolution of informationally sensitive lending as a percentage of the total outstanding non-financial business loans, excluding mortgages. *Data Sources:* The Financial Accounts of the United States, the Federal Reserve System.



(a) Mortgages



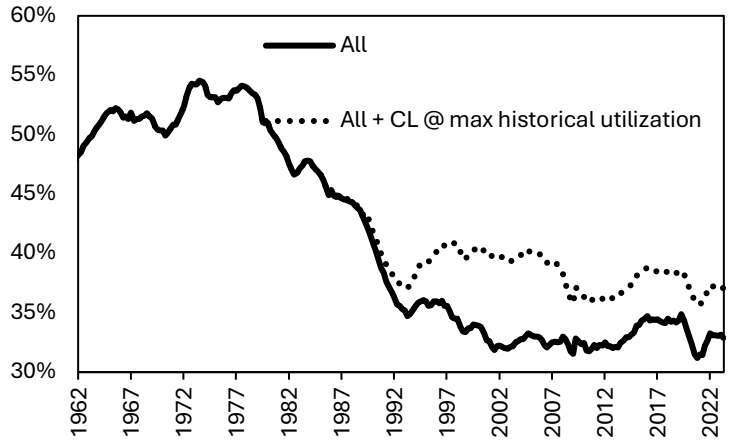
(b) All loans ex mortgages



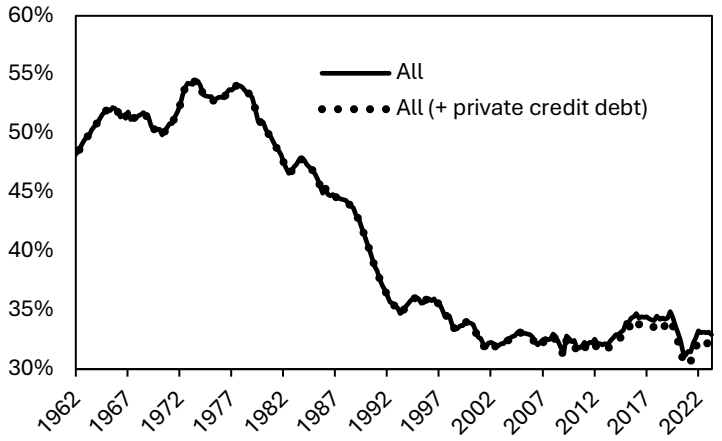
(c) Business loans ex mortgages

Figure B2: The Secular Decline of Informational Sensitive Lending: Impact of Unused Bank Credit Lines & Private Equity Debt Funds

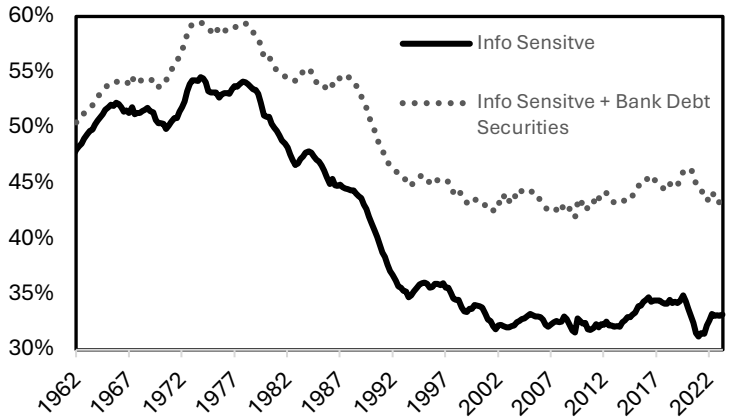
Panel (a) in this figure depicts the evolution of informationally sensitive lending ("bank balance sheet lending share") when in addition we consider an unutilized bank credit lines to households and firms as bank loans (at their peak historical utilization rate). Panel (b) shows the evolution of informationally sensitive lending share where in addition we include non-bank credit debt provided by private equity debt funds. *Data Sources:* The Financial Accounts of the United States, the Federal Reserve System, and Preqin.



(a) Impact of unused credit lines



(b) Impact of private equity debt funds



(c) Bank balance sheet lending share including bank debt securities holdings