Supply of Private Safe Assets:

Interplay of Shadow and Traditional Banks *

Stefan Gissler [†]   Borghan Narajabad [‡]

June 13, 2018

PRELIMINARY AND INCOMPLETE

Abstract

We show that the creation of private safe assets by shadow banks can crowd out traditional banks' supply of safe assets. The 2014-2016 money market fund reform created a large demand shock for government- or government-like safe assets. Shadow banks responded, and in particular, Federal Home Loans Banks (FHLBs) increased their issuance of short-term safe debt. While increasing their balance sheet, FHLBs managed their interest rate risk by mainly increasing their supply of highly interest-rate sensitive loans to their members. As banks differ in their interest rate risk-management, not all could take advantage of increased supply of FHLB loans. We use this differential borrowing in response to the money market reform to study the effect of increased supply of safe assets by FHLBs on banks' balance sheets. We find that banks use FHLB borrowing as a perfect substitute for deposit financing. The substitution of safe debt with FHLB borrowing does not go along with an overall increase in the balance sheet and therefore has no lending effect. This finding has important implications for the transmission of monetary policy as well as broader economic activities. If shadow banks create safe assets at the expense of traditional banks' deposits, then there will be a minimal effect on the total funding available for households and firms from banks and shadow banks.

---

1 Introduction

Private safe assets can come in many forms such as bank deposits, money fund shares, and financial commercial paper. Created by the traditional banking system as well as the shadow banking system, these assets can satisfy the demand for safe assets when there are not enough public safe assets.[1] Yet it is less understood how these different private suppliers of safe assets interact. Do assets by shadow banks simply complement bank deposits, or does an increase in the supply of safe assets by shadow banks alter banks' supply of deposits? It is important to understand such interplay, as it has a direct effect on how much total funding from banks and shadow banks is available for households and firms. This could have implications for the transmission of monetary policy as well as broader economic activities.

In this paper we study how the increased supply of safe assets by part of the shadow banking system affected depository institutions' supply of deposits. We focus on a large demand shock for government or government-sponsored safe assets triggered by the 2014-2016 money fund reform. We study how this shock affected specific private wholesale banks' issuance of safe assets and small banks' supply of deposits. While the money fund reform did not change the size of the money fund industry, it did alter its composition.[2] The money fund industry is mainly comprised by two groups of funds, prime funds and government funds. The total industry remained at about $3 trillion, but over $1.2 trillion flowed out of prime money funds and into government money funds. The investment opportunities for government funds are limited to government or government-sponsored safe assets. As the demand for these assets increased in response to the reform, the supply of short-term debt by the government did not fully accommodate the sudden demand increase, leaving a gap.

The Federal Home Loan Bank (FHLB) system filled this gap. Comprised of 11 privately owned, government-sponsored wholesale banks, the FHLB system is part of the "government-sponsored shadow banking system."[3] FHLBs usually provide loans to depository institutions and insurance companies, which they finance by the issuance of

---

[1]As shown by Holmström & Tirole (1998) and Krishnamurthy & Vissing-Jorgensen (2012), creation of private and public safe assets are negatively correlated, and public debt may crowd out creation of private safe assets (Krishnamurthy & Vissing-Jorgensen 2015).

[2]Among other changes, the reform stopped the use of a net stable value for prime funds, making them less attractive for investors with strict preference for absolute security of their investment.

[3]See Poszar, Adrian, Ashcraft & Boesky (2013).

debt obligations. Their debt is issued jointly, backed by over-collateralized assets, and although it does not have an explicit government guarantee, investors treat it as private safe debt.

The large demand shock from money funds for FHLB debt affected the structure of new FHLB debt issuances. While historically FHLBs financed their assets by a balanced mixture of short- and long-term debt, they shortened their liabilities to cater to their most important investors. The composition of their liabilities changed dramatically and in 2016, over 80 percent of their liabilities had a maturity of less than one year.

FHLBs' increased supply of safe debt went along with an expansion of their balance sheet. However, this growth came not only with compositional changes on the liabilities side, but also on the assets side. To mitigate the increased maturity transformation and heightened interest rate risk, FHLBs shortened the interest-rate structure of their main assets, loans to depository institutions.[4] Newly issued loans still had a longer maturity than FHLBs' liabilities, but now reset their interest rates at a much higher frequency. It is this growth and structural adjustment of both sides of the shadow banks' balance sheets that establishes an interaction between different suppliers of private safe assets. FHLBs are not only suppliers of safe assets to money funds, but also a source of funding for traditional depository institutions. When responding to increased demand for their debt, FHLBs also increased the supply of interest-rate sensitive loans to members.

Identifying a bank's response to this increased supply in short-term FHLB loans provides challenges. A bank's funding choice is endogenous, and increased uptake of FHLB funding around the time of the money reform may stem from a bank's increased demand due to local growth opportunities and not from FHLBs' increased supply. To address this challenge, we use an instrumental variable approach.

Although all depository institutions faced an increased supply in short-repricing FHLB loans, they differed in their ability to take up those loans. While some could cope with the heightened interest rate risk, others could not. These differences are driven by depository institutions' medium- to long-term business models, carefully matching the maturity and interest-rate structure of their assets and liabilities Drechsler, Savov & Schnabl (2017). Depository institutions that historically took out rather short-term debt as part of their wholesale funding strategy could benefit from an increased supply of cheap short-repricing

---

[4]Although FHLBs use interest rate swaps for managing their interest rate risk, their use is limited.

FHLB loans. To capture a depository institution's long-run business model, we use the repricing of its liabilities several years before the money fund reform was announced. This long-run structure influences how a depository institution can respond to decreased funding costs in short-term borrowing from FHLBs and it is exogenous to a depository institution's lending opportunities during our sample period.

To isolate the variation in FHLB advances driven by money funds' increased demand for safe assets, we combine a bank's historical repricing with the time-varying demand for FHLB debt from money funds. We measure this by the ratio of assets in government funds over total money fund assets. Without regulatory changes, this ratio is stable over time. It is only during the run-up to the money fund reform that it changes dramatically. This change captures the heightened demand for FHLBs' safe debt.

Using only the variation in a bank's FHLB borrowing that can be explained by the bank's historical repricing and government funds demand for FHLB debt, our main result is that increased supply of safe assets by FHLBs led to a decreased supply in deposits by banks and credit unions. FHLB borrowing is a perfect substitute for deposit financing; an increase in FHLB borrowing decreases the supply of deposits by the same amount. Further, the composition of deposits changes. While checkable deposits and short-term time deposits decrease, longer-term time deposits take a more prominent role in the funding mix. However, the substitution of safe debt with FHLB borrowing does not go along with an overall increase in the balance sheet and therefore has no lending effect.[5] Looking at prices, we find that when banks increase their borrowing from FHLBs, they decrease their deposit rates. This provides further evidence that we identify the effects of an increased supply in FHLB advances rather a decreased supply for deposits.

Our focus on small banks rules out that these banks could affect the rulemaking process of the money fund reform. Yet even some smaller banks did issue commercial paper potentially held by prime money funds. These banks may increase FHLB borrowing in response to decreased demand for their commercial paper and not because of increased supply of short-term FHLB loans. When we exclude these banks from our sample the results remain the same.

Small banks also have the possibility to get financing from larger banks that issue debt on their behalf. Decreased demand for large banks' debt due to the money reform

---

[5]In particular, large banks increased their use of FHLB loan as a part of their collateral upgrade strategy to meet Leverage Coverage Ratio. See Gissler & Narajabad (2017*b*).

may therefore have a direct effect on some small banks. To address this concern, we turn to another set of depository institutions, credit unions. Unlike small banks, small credit unions never receive any funding from money funds and rarely borrow from banks. The results from the analysis of credit unions' assets and liabilities are in line with our results from small banks, suggesting that the FHLB mechanism is most likely to be the main driver of our findings from the analysis of banks.

These results add to the active field of research on the demand and supply of safe assets summarized by Gorton (2017). Theoretical work by Holmström & Tirole (1998) looks at the interaction between public and private safe debt and shows that public debt can crowed out bank debt. Krishnamurthy & Vissing-Jorgensen (2015) show empirical evidence for a negative interaction between public safe debt and private safe debt. In their study, Treasury supply crowds out bank deposits. Gorton, Lewellen & Metrick (2012) show that while the total share of safe assets in GDP has been stable over time, the shares of private and public safe assets in GDP are negatively correlated. Our study takes a closer look at the components of private safe asset supply. We show that the crowding out of bank deposits is not limited to public debt, but also private debt that investors presume to be backed by the government. Further, while most empirical studies use aggregate data from the Flow of Funds, we add a more disaggregated view using detailed bank-level data combined with a regulatory shock to safe asset demand.

While most early papers mainly focus on public supply of safe assets, the financial crisis of 2007-2009 has sparked interest in the private creation of safe assets. Gorton et al. (2012) relate the growth of the shadow banking system to the decrease in bank deposits since the 1980s. They argue that the shadow banking system stepped in to make up for the decrease in safe asset supply. Sunderam (2014) focuses on the run-up to the last financial crisis and argues that the demand for money-like assets contributed to the growth of the shadow banking system. Our paper adds to this interaction between the shadow banking system and the traditional banking system. We show how regulatory changes in the shadow banking system affect the creation of deposits in the banking sector.

Kacperczyk, Perignon & Vuillemey (2017) find that short-term private securities trade at a premium for their non-pecuniary benefits. In their study, banks react to increased safe-asset demand by issuing debt with shorter maturity. We provide further evidence

that this behavior is not bound to the period around the financial crisis. FHLBs reacted similarly to increased demand from money funds.

2   The 2014-2016 money market fund reform

Money market funds are a type of mutual fund which is redeemable on demand and seek to maintain a stable net asset value (NAV) of typically $1.00. Their dividends reflect prevailing short-term interest rates, making money funds an attractive cash management vehicle for investors. To provide a stable NAV for their investors, money funds in turn need to invest in safe and liquid assets. Money funds are typically categorized according to the type of their primary investment securities, which could be government securities, safe corporate debt securities, or tax-exempt municipal securities. Respectively, these funds are known as government, prime, and tax-exempt money funds. Given the significant size of the money fund industry, about $3 trillion, money funds make up an important source of demand for safe assets. Any substantial inflow, outflow, or change in the type of money funds' primary investment securities could result in a sizable shock to the demand for a particular type of safe assets.

Money funds' demand for safe assets changed significantly because of the Security and Exchange Commission (SEC) 2014 reform of the money fund industry. The SEC reform intended to increase the resilience of money funds and reduce the risk of runs on money funds.[6] The reform made two substantial changes in the regulation of money funds. First, the SEC required prime and tax-exempt money funds who cater to institutional investors to transact at a floating NAV, instead of a $1 stable share price. This change intends to reduce the first mover advantage of early redemption under a stable NAV, because daily share prices of these money market funds fluctuate along with changes in the market-based value of their portfolio securities. Second, the SEC allowed money market funds' boards to impose liquidity fees and temporarily suspend redemptions, known as redemption gates, if their funds' liquid assets fall below the regulatory minimum. The government

---

[6]The run on prime money funds during the 2007-2009 financial crisis culminated in the inability of the Reserve Primary Fund, a large prime fund, to maintain its $1 NAV and thus "breaking the buck" in September 2008. The SEC implemented two rounds of reforms. In the first round, announced and implemented in 2010, the SEC tightened the maturity and credit quality standards, imposed new liquidity requirements, and enhanced disclosure of money funds' investment portfolio. In this paper, we focus on the second round of reforms.

money funds are exempt from the new liquidity fees and redemption gates regulation.[7] Upon enactment of the new regulation in October 2016, investors with a preference for $1 stable NAV who did not want to be subject to any liquidity or redemption gate can only invest in government money funds.[8]

Between the announcement of the SEC's money fund reform in July 2014 and the enactment of the new regulations in October 2016, over 1 trillion dollar in assets moved from prime and tax-exempt money funds into government money funds. The total size of the money fund industry remained stable at around $3 trillion, as shown in Figure 1. Non-government funds' assets declined by over $1.2 trillion, about two-third of their assets, and the size of government funds rose by about the same amount. This large compositional shift in the money fund industry was mainly the result of money fund investors withdrawing from non-government money funds and investing in government funds, and fund sponsors' converting their prime funds into government funds in accordance to their investors' preferences. The $1.2 trillion assets move from non-government funds to government funds increased the money fund industry's demand for government-backed safe assets significantly.

Money funds' heightened demand for government-backed safe assets resulted in a significant rise of money funds' holding of certain debt products. Especially securities from one particular issuer, the FHLB system, experienced a large demand shock (Figure 1). The share of FHLB debt in the total money fund industry's portfolio increased from about 8 percent to about 18 percent. Over time, government funds' portfolio share in FHLB debt converged to its historical average of about 25 percent after some fluctuations (Figure 2, left panel).[9]

---

[7]Government money funds can voluntarily opt into the liquidity fees and redemption gates regulation, if they have previously disclosed it to their investors.

[8]Upon enactment of the reform, government money market funds had to invests at least 99.5 percent, instead of formerly 80 percent, of their assets in cash, government securities and/or repurchase agreements that are collateralized solely by government securities or cash.

[9]Money funds' heightened demand for FHLB debt did not result in a one-to-one increase in the issuance of FHLB debt. The right panel of Figure 2 shows that money funds increased their holding share from about one-third to about half of the outstanding FHLB debt.

3 The FHLB system: Government-sponsored supply of private safe assets

3.1 Institutional background

The Federal Home Loan Bank (FHLB) system was created by the FHLB Act of 1932 to help the mortgage market. Today, the system comprises 11 independent, regional wholesale banks and the national Office of Finance, the system's centralized debt issuance facility. Each FHLB is owned by its member institutions, which have equity stakes in the FHLB and must reside in the FHLB's district. Membership is available to commercial banks, thrifts, credit unions, and insurance companies.

FHLBs provide wholesale funding to their members by extending over-collateralized loans, known as advances. These over-collateralized loans are available in various maturities with either fixed or variable interest rates. Each FHLB independently chooses the interest rates of its advances and the haircuts on its members' collateral. But, all FHLB advances are subject to the statutory super-lien, which means that in the case of the borrower's insolvency, any security interest granted to an FHLB has priority over the claims and rights of any other party. The super-lien on collateral has facilitated FHLBs' ability to lend to a variety of institutions, from subsidiaries of large insurance and bank holding companies to small saving banks and credit unions that might otherwise not have access to funding from investors who cannot secure such protection.

Other than loans to their members, FHLBs invest in mostly mortgage-related securities and hold a fraction of their assets in Federal Funds as their contingent liquidity buffer. The upper panels of Figure 3 show the composition and evolution of the total FHLB system's assets.

The bottom panels provide some more detail about the recipients of FHLBs' largest asset class, their advances. During recent years, the FHLB system expanded. Most of the growth was due to loans to large commercial banks. At the end of 2016, commercial banks with assets over \$50bn accounted for about half of FHLBs' outstanding loans.[10]

---

[10] This is a marked shift from the past: Whereas commercial banks with assets over \$50 billion accounted for less than 2 percent of overall advances in 2000, their share climbed to around 50 percent by the end of last year. The main motivation for the more recent rise in FHLB borrowing by large banks seems to be their incentive to engage in a "collateral upgrade" to help satisfy the requirements of the Liquidity Coverage Ratio (LCR) that banks are now subject to as part of the Basel III. Banks can post less-liquid assets such as whole mortgage loans to FHLBs as collateral against advances and use

In this paper we will not use the growth in advances to large banks and limit ourselves to depository institutions with total assets below 10 billion dollars in 2010.[11]

FHLBs' advances and other assets are mainly funded by consolidated debt obligations. The debt is jointly issued by the Office of Finance, which has two main implications. First, all FHLBs have joint and several liability for the outstanding debt. If one bank is in trouble, the rest of the system has to help. Second, investors do not know which FHLB receives the debt proceeds. Combining the assets side and liabilities side, Figure 4 shows how funding flows from investors in FHLB debt via the Office of Finance to the single FHLBs and their members.[12]

What makes FHLB debt private safe debt? Let us look at this in two steps and start with labelling debt as "safe". Most importantly, investors perceive FHLBs as having an implicit government guarantee due to their status as GSE. Further, FHLB debt is highly information-insensitive as investors do not know the recipient of the proceeds. FHLB debt is not only safe, but also "private" and different from public debt. Other than a \$4 billion guarantee from the Department of Treasury, the government does not explicitly back FHLB debt. FHLBs stress this fact on the first page of their financial statements: "Federal Home Loan Bank obligations are not obligations of the United States and are not guaranteed by either the United States of any government agency".[13] This fact is also stressed by their investors, as for example the prospectus of a government money fund shows: " U.S. government-sponsored entities ("GSEs") ... may be chartered by Acts of Congress, but their securities are neither issued or guaranteed by the U.S. government."[14] Further, FHLBs are privately owned by their members. Taken together, FHLB debt is perceived as safe debt, yet not as public debt, but rather private debt. And given their lack of deposit taking, FHLBs form part of the "government-sponsored shadow banking system" Poszar et al. (2013).

Because of their status as GSEs, the information-insensitiveness, and mostly short-

the proceeds to buy high quality liquid assets (HQLA). As long as FHLB advances have a remaining maturity of longer than 30 days, this strategy will improve the borrowing banks' LCRs. Also, the favorable treatment of FHLB advances in the LCR helps borrowing banks even with advances due within 30 days. Anecdotal evidence suggests that large banks are indeed motivated to borrow from the FHLBs for this reason.

[11]Because of the LCR rule, large banks had an incentive to increase their FHLB borrowing. We will make later clear how this incentive may lead to problems in our estimation strategy.

[12]For a more detailed background on the FHLB system and its current developments, see Gissler & Narajabad (2017a,b,c).

[13]Federal Home Loan Banks Combined Financial Report 2018 Q1

[14]Franklin U.S. Government Money Fund prospectus

term nature of their debt, investors perceive FHLBs' debt as safe. Yet contrary to public safe debt, FHLBs themselves are privately owned institutions and the federal government has no obligation to honor FHLB debt payments apart from a $4bn credit line from the Department of Treasury. For this reason, FHLBs create "government-sponsored private safe assets".

3.2 FHLBs' safe asset creation in response to the money fund reform

Even before the SEC reform, government money funds did invest a constant proportion of their portfolio in short-term FHLB debt. As one trillion dollars flowed out of prime funds and into government funds in response to the SEC reform, government funds' demand for FHLB debt grew rapidly. At the beginning of 2015, money funds held about 30 percent of outstanding FHLB debt. At the end of 2016, this share had risen to over 50 percent. The percentage of FHLB debt in the total money industry's portfolio increased from below 10 percent to 20 percent (Figure 2).

To comply with regulations, money funds need to have a weighted average maturity (WAM) of at most 60 days. A debt issuer catering to this industry will therefore structure its products such that money funds can comply with this regulation. This can either mean issuing debt with a short maturity or with a variable interest rate and a short time between rate resets, the criterion that matters for money funds calculating their WAM. For example, a three-years bond which resets its interest rate monthly will be treated like a one-month debt instrument.

As money funds became the most important holder of FHLB debt, the FHLB system not only grew, but also adjusted its new issuances accordingly. While previously most FHLB debt had a fixed interest rate over the lifetime of the bond, FHLBs started to utilize floating-rate bonds and short-term discount notes. Figure 5 shows how significant FHLBs' move into floating rate debt was in the run-up to the money fund reform. While the weighted average maturity of the money industry's portfolio stayed constant over the last years, the weighted average maturity of FHLB debt held by money funds decreased from 80 days at the end of 2014 to below 40 days at the beginning of 2017.

This significant growth and change in the debt structure had consequences for FHLBs' assets side. Historically, most of their loans to members were medium-to long-term with

fixed interest rates. Given the new liability structure, this would have exposed FHLBs to a large interest rate risk if they would have expanded their assets side according to their historical structure. To mitigate this risk, FHLBs adjusted the structure of their advances to members. In 2011, 64 percent of outstanding advances were fixed-rate and 24 percent variable-rate.[15] This ratio changed first slowly between 2012 and 2014, and later more rapidly. At the end of 2016, 53 percent of advances were variable-rate advances and the proportion of fixed-rate advances had declined to 45 percent.

It is the growth of advances in response to the money reform that links FHLBs, part of the shadow banking system, to the traditional banking system. FHLBs responded to a large demand shock for short-term safe assets by issuing more debt. Yet as any private entity, FHLBs needed to invest the proceeds from the debt sales as well as manage emerging risks. The size and structure not only of their liabilities but also their assets changed–they increased the supply of short-term and variable-rate loans to members. Banks, thrifts, and credit unions felt these changes.

4   Description of the data and sample

Since we look at the entire intermediation chain from money funds via FHLBs to banks, thrifts, and credit unions, the data come from several sources.

Data on money funds mainly come from money funds' N-MFP filings at the SEC. We have detailed portfolio holdings for each money fund from 2011 to mid-2017. We aggregate the data on a quarterly basis and calculate the FHLB debt holdings of the money fund industry in total, and of government money funds in specific.

Bank, thrift, and credit union data come from the quarterly balance sheets and income statements depository institutions have to file. The "Call reports" provide information about an institution's composition of assets and liabilities as well as the maturity or repricing of selected asset and liabilities. For banks and thrifts, repricing information on liabilities is available for small and large time deposits, FHLB advances, and "other borrowing". On the assets side, we have information on the repricing frequency of securities, MBS, mortgages, and loans excluding mortgages. For credit unions, not repricing but the remaining maturity of their liabilities is reported.

---

[15]The remainder of advances were structured in a way that cannot be easily categorized as fixed or variable.

Data on FHLBs come from the quarterly balance sheets published by FHFA and FHLBs' quarterly 10K filings to the SEC.

Table 1 provides the summary statistics for the variables used in our analysis. FHLBs' advances are a stable funding source and the average bank has an advances to asset ratio of around 5 percent. Beteween 2011 and 2017, advances as a funding source have grown on average 124 percent, with two-thirds of this growth taking place after 2014. During our sample period, assets grew on average 26 percent. In our empirical analysis we will focus on the time between the first quarter of 2013 and the second quarter of 2017.

5 FHLB advances and depository institutions' supply of safe assets

This section investigates how banks, thrifts, and credit unions changed their funding mix in response to the increased supply of FHLB advances.

5.1 Banks' FHLB borrowing in response to the money fund reform

FHLB advances are a vital part of depository institutions' funding mix. While large banks have used advances recently mostly for LCR purposes, small and medium sized institutions see advances as a reliable source of funding, often as a substitute for other funding. Did the increased availability of advances affect banks' own supply of safe assets, their deposits?

Table 2 provides the results of the following regression:

$$y_{bt} = \alpha + \beta * FHLB_{bt} + \gamma_t^1 + \gamma_b^2 + \gamma^3 X_{bt} + \epsilon_{bt} \tag{1}$$

y_{bt} are certain liabilities like deposits of bank b at the end of quarter t normalized by the bank's assets in the previous quarter. $FHLB_{bt}$ are outstanding advances from an FHLB to bank b at the end of quarter t, again normalized by lagged assets. The regression includes time fixed effects and bank fixed effects.

The simple OLS regression shows a negative correlation between the uptake of FHLB advances by a bank and a banks' supply of safe assets–their deposits. Column 1 shows

that an increase of FHLB advances over lagged assets from 2 percent to 4 percent is associated with a decrease in total deposits over lagged assets by 0.8 percent. While there is no significant decrease in time deposits, savings deposits and money market deposits are negatively correlated with FHLB advances. While FHLBs increase their production of safe assets, banks substitute part of their deposit funding with advances, producing less safe debt for investors to store their wealth.

Yet these simple OLS regressions do not address the identification challenge inherent when looking at changes on banks' balance sheets. While we are interested in increased use of FHLB advances due to their increased availability (a change in the supply of FHLB advances), banks may increase their borrowing from FHLBs in response to lower demand for their deposits. In such a scenario a decrease in the supply of deposits would not restrict investors' access to safe debt as their total demand has declined. An econometric specification like equation 1 cannot address this problem and the estimates will be biased because of reverse causality.

To address this issue, we use that FHLBs' increased supply of advances affected banks differently depending on their medium-to long-term business model. When FHLBs started to grow in response to the money reform, the newly issued advances came with a shorter repricing of interest rates or a shorter maturity. This helped to manage the increased interest rate risk stemming from FHLBs' rising maturity mismatch. Figure 6 depicts this trend. It shows the average frequency of repricing of FHLB advances borrowed by small and medium sized banks. In 2012, the banking system's FHLB advances matured or reset their interest rate on average every 2 years. In 2017, this time to interest rate reset had declined to slightly more than one year.

Yet not all banks were equally able to take advantage of this increased supply in short-term (or frequent-repricing) loans. Institutions more prone to use shorter-term funding were able to use the increased availability of shorter FHLB funding more than institutions relying more on longer-term funding. This difference in funding structure is part of a banks' longer-term business model. Taking advantage of cheap funding focused on a certain part of the maturity or repricing spectrum is only possible as long as a bank does not run too large of an interest rate or rollover risk given its assets. When FHLB funding with a high repricing frequency became more prevalent, banks that usually relied

on long-term advances faced a disadvantage.[16]

We measure whether a bank's business model relies relatively more on liabilities with a higher interest sensitivity as the average repricing of a bank's liabilities. For all banks we calculate the average repricing of their liabilities between 2010 and 2012. Averaging over this time period serves several purposes. First, we make sure not to pick up short-run quarter-end effects. Second, by starting in 2010 we concentrate at a period outside of the 2007-2009 financial crisis. And third, we focus on a time period where banks could not foresee neither the SEC reform nor its effects, an assumption important for our empirical strategy.

Figure 7 shows that this bank-specific part of our instrument does not pick up an ongoing trend before the money fund reform. The figure shows binscatter plots of cross-sectional regressions of advances growth and the repricing of advances. While repricing is measured in 2010, advances growth is measured between 2013 and 2017 (left panel) and 2011 and 2014. It is only during and after the announcement of the money fund reform that this relationship exhibits a strong negative correlation.

The historical repricing of liabilities allows us to identify cross-sectional variation in the uptake of FHLB funding across banks that is correlated with FHLBs' increased issuance of debt in response to the money reform. Yet a bank's repricing structure may also be a proxy for its riskiness and how it responds to new local growth opportunities. Bank fixed effects control for this time-invariant heterogeneity across banks. To only extract the time-varying component of a bank's FHLB funding driven by the increased demand for safe assets by money funds, we interact a bank's repricing with the money industries' demand for FHLB debt (and other government-like safe assets). We measure this demand by the ratio of the size (in dollars) of government funds over the total size of the money fund industry. This ratio is stable before and after the money fund reform, but changes during the transition period. Changes in this ratio are therefore exogenous to a bank's funding needs and affect each bank only through the SEC's money fund reform.

We employ this reasoning in a two-stage least squares setup. The first stage specification is:

$$FHLB_{bt} = \beta * (MF_t * Reprice_b) + \gamma_b^1 + \gamma_t^2 + \gamma_{dt}^3 + \delta X_{bt} + \epsilon_{bt} \qquad (2)$$

---

[16]Drechsler et al. (2017) show how banks match the interest sensitivity of their assets and liabilities.

$FHLB_{bt}$ is bank b's advances at the end of quarter t in dollars normalized by lagged assets. MF_t is the ratio of AUM by government money funds over total AUM of the money fund industry. This variable is interacted with $Reprice_b$, which is the average repricing in years of bank b's liabilities between 2010 and 2012, which is outside the sample period.

In the second stage, we use the fitted values and estimate the following model:

$$y_{bt} = \beta * \widehat{FHLB}_{bt} + \gamma_b^1 + \gamma_t^2 + \gamma_{dt}^3 + \delta X_{bt} + \epsilon_{bt}. \tag{3}$$

y_{bt} is a balance sheet variable such as total deposits of bank b during quarter t, normalized by lagged assets. $\widehat{FHLB}_{bt}$ is the fitted value from equation 2 of a bank's advances at the end of quarter t divided by lagged assets. Each regression controls for bank fixed effects, time×size fixed effects, time×FHLB district fixed effects, and bank-time varying variables captured in the vector X_{bt}.

Our main concern about the simple OLS estimates are biases that stem from shifts in a bank's demand for advances driven by factors we cannot control for. To satisfy the exclusion restriction, our instrument cannot be correlated with factors such as unobserved growth opportunities for a bank or decreased investor demand for deposits. The first part of our interaction term is clearly exogenous to small and medium sized banks in the US. While it may be possible that the largest bank holding companies had some stake in the rulemaking of the money fund reform, this can be ruled out for smaller banks. Further, time fixed effects will control for the possibility that the money fund reform affected the banking system as a whole. The second part of our interaction term, banks' repricing of their liabilities between 2010 and 2012, is a variable whose volatility at the bank level is low and is pinned down by a bank's medium-to longer term outlook and business model. When deciding on their funding mix before 2013, a bank was not able to either foresee the money fund reform in 2016 (or its announcement in 2014) or the reform's specifics and effects on the money fund industry.

Table 3 provides the results of our instrumental variable approach. Column 1 shows that the money reform affected a bank's outstanding FHLB advances differentially depending on a bank's historical repricing frequency of liabilities.

Columns 2 to 5 show that banks which increased their usage of advances changed their funding mix. An increase in FHLB advances due to increased demand for safe assets by

15

money funds decreases a bank's supply of deposits by the same amount. This can be seen in column 2. While time deposits (column 2) increase, savings deposits and money market deposits decrease significantly. Banks overall decrease their own creation of safe assets when substituting deposits for FHLB advances.

Table 4 sheds light into the change in time deposits. It provides the results of the IV regressions using the composition of time deposits as dependent variables. While overall time deposits increase, the composition of time deposits changes as well. Time deposits with a maturity below 1 year go down as a fraction of total time deposits (column 1) and time deposits with a longer maturity increase with increased usage of advances (column 2).

The results so far have only looked at quantities. To show that banks drove down the supply of deposits, we use data on deposit rates provided by *Ratewatch*. The data are on the bank branch level and we concentrate on branches identified as rate-setters. Table 5 shows the results of the second stage regression of deposit rates on adjusted FHLB borrowing. Rates are for certificates of deposits with different maturities. Consistent with our interpretation of the previous results, banks borrowing more from FHLBs decrease the rates they offer deposits. This decrease can be seen across the maturity spectrum and is a clear sign of a shift in the supply of deposits by banks rather than a shift in deposit demand.

5.2   Credit Unions

One concern is that our analysis is influenced by changes in other wholesale funding markets which we do not observe or control for. The money fund reform affected large banks' use of commercial paper and may as well had an effect on other sources of funding also available to small banks. If such changes happened in short-term products, our results may not only reflect banks' decreased deposit supply due to money funds' demand for safe assets, but also due to the money reform's effect on funding markets in general.

To address this concern, we turn to a different type of depository institutions–credit unions. Credit unions are member owned depository institutions with a relatively simple balance sheet. A typical credit union relies for more than three-quarters of its funding on members' regular *shares*, which are comparable to demand deposits, money market

shares, or certificate of shares.[17] Similar to our main analysis, we limit our data to credit unions with average total assets of less than $ 10 billion between 2010 and 2012. We further restrict the data to credit unions that have borrowed at least once from FHLBs at some point between 2013 and 2017Q2. Unlike small banks, small credit unions never receive any funding from money funds, and rarely borrow from large banks.

Table 9 provides the results of the following regression:

$$y_{ct} = \alpha + \beta * FHLB_{ct} + \gamma_t^1 + \gamma_c^2 + \epsilon_{ct}. \tag{4}$$

y_{ct} are liabilities like regular shares of credit union c at the end of quarter t normalized by the credit union's assets in the previous quarter. $FHLB_{ct}$ are outstanding advances from an FHLB to credit union c at the end of quarter t, again normalized by lagged assets. The regression includes time and credit union fixed effects. Similar to our results for banks, the simple OLS regression shows a negative correlation between a credit union's uptake of FHLB advances and its supply of safe assets. However, as we discussed before, a simple OLS regression cannot address identification problems such as a reverse causality: a lower demand for credit unions safe assets could have forced credit unions to borrow from FHLBs.

To identify the effect of increased safe asset supply by FHLBs on credit unions' deposit supply, we use our instrumental variable approach introduced earlier. The first stage specification combines the inflow of funds into government funds with credit unions' tolerance for interest rate reset:

$$FHLB_{ct} = \beta * (MF_t * Reprice_c) + \gamma_c^1 + \gamma_t^2 + \epsilon_{ct}. \tag{5}$$

$FHLB_{ct}$ is credit union c's advances at the end of quarter t in dollars normalized by lagged assets. MF_t is the ratio of AUM by government money funds over total AUM of the money fund industry. This variable is interacted with $Reprice_c$, which is the average repricing in years of credit union c's liabilities between 2010 and 2012, which is outside the sample period.

---

[17]Table 8 reports the summary statistics for credit union sample we use for our analysis.

In the second stage, we use the fitted values and estimate a model similar to 4:

$$y_{ct} = \beta * \widehat{FHLB}_{ct} + \gamma_c^1 + \gamma_t^2 + \epsilon_{ct}. \tag{6}$$

y_{ct} are liabilities such as money market shares of credit unions c during quarter t, normalized by lagged assets. $\widehat{FHLB}_{ct}$ is the fitted value from equation (5) of a credit union's advances at the end of quarter t divided by lagged assets. Each regression controls for time and credit union fixed effects.

While lending to credit unions allowed FHLBs to increase their production of safe assets, credit unions substituted part of their funding with FHLB advances and cut back on their own direct production of certain types of safe assets for their members. Table 10 provides the results for our two-stage least squares setup. Column 1 shows that the SEC reform affected a credit union's outstanding FHLB advances differentially depending on a bank's historical repricing frequency of liabilities. Columns 3 shows that an increase in FHLB advances due to increased demand for safe assets by money funds decreases a credit union's supply of safe assets in the form of money market shares. An increase in FHLB advances seem to not have a statistically significant effect on a credit union's supply of safe assets to its less interest rate sensitive members in the form of regular shares and certificate of shares or even short-term certificate of shares, as suggested by columns 2, 4, and 5.

6   The real effects of safe asset creation

When private entities create safe assets, they may either simply change their funding mix and keep their size stable or increase their total balance sheet size. While FHLBs mostly chose the latter, it is unclear for banks and credit unions. This section turns to changes in assets at depository institutions in response to increased use of FHLB funding.

Table 6 uses specification 1 to show how FHLB advances are correlated with a bank's total assets and different asset classes. During our sample period, increased usage of FHLB advances is correlated with an increase in assets, driven by increases in several asset classes. Yet, as was the case with banks' liabilities, OLS results may be biased. The coefficients may simply reflect an expanding bank, which as part of its expansion also increases borrowing from FHLBs.

Table 7 shows the results using our 2SLS specification. Column 1 repeats the result of the first stage. Column 2 shows that while banks did change their liabilities in response to cheaper FHLB funding, they do not significantly increase or decrease their total assets. The only asset class that decreases slightly are securities (column 6). Overall, banks' lending does not seem to increase in response to cheaper funding via FHLB advances.

Turning to credit unions, the increased use of FHLB advances due to the SEC reform appear to be uncorrelated with any expansion of their balance sheet, or any type of their main assets. Tables 11 and 12 show results from a simple OLS and a two-stage least square regression with specifications similar to equations(4) and (5)-(6). Columns 1, 2, and 4 of table 11 suggest that there was a positive correlation between a credit union's increased usage of FHLB advances and its increase in assets, particularly driven by fixed mortgages and vehicle lending. However, the results from the instrumental variable approach reported in Table 12 suggest that credit unions did not change their total assets, and in particular did not change mortgage and vehicle lending to their members, in response to cheaper FHLB funding. This results together with the results from the analysis of credit unions' liabilities, suggest that the FHLB mechanism is most likely to be the main driver of our findings from the analysis of banks.

7 Robustness [TO BE COMPLETED]

In this section we explore whether alternative mechanisms might drive our findings or bias our estimates. It is reasonable to assume that smaller banks had no stake in the rulemaking of the money fund reform. However, some small banks use direct funding from prime money funds by issuing certificate of deposits (CDs) to this type of money funds. As we discussed before, the SEC reform resulted in a sizeable flow of funds from prime money funds, which can invest in CDs, into government funds, which cannot invest in CDs. Therefore, the SEC reform could have had a negative effect on some of small banks' direct funding from prime money funds, causing those small banks to increase their borrowing from FHLBs.

We address the concern with a potential bias resulting from a direct effect of the SEC reform on small banks' funding in two steps. First, we exclude all small banks which

have ever issued CDs to money funds. This exclusion reduces our sample of banks by [about 20 ?] and the number of observations by [about 20x18 ?]. Our estimates remain essentially unchanged, suggesting that a direct effect of the SEC reform on small banks' funding is unlikely to contaminate our findings. (TO BE COMPLETED)

8 Conclusion

This paper provides an empirical analysis on how certain private suppliers of safe assets interact. The 2014-2016 SEC money fund reform created a large demand shock for short-term, government-like assets. While public provision of such assets did not change, the FHLB system increased their debt issuances. This creation of government-sponsored private safe assets forced the FHLBs to increase interest-rate sensitive advances to their members. To manage interest rate risk, they decreased the frequency of interest rate resets of their loans to depository institutions. We find that depository institutions that could handle such increased interest rate sensitivity increased their FHLB borrowing at the expense of depository funding. A one dollar increase in FHLB borrowing led to a one dollar decrease in deposits; banks' provision of safe debt decreased.

These results add important lessons to the discussion on the private creation of safe assets. Several academics and policy makers see the rise of the shadow banking system as a response to banks' decreased or stagnating supply of deposits in a world with growing demand for safe assets. Yet we provide evidence that shadow bank debt and traditional bank debt may not only be complements, but also substitutes in certain instances. Understanding this interplay is important when analyzing the changes the financial system has undergone and how the shadow banking system and the traditional banking system are connected.

References

Drechsler, I., Savov, A. & Schnabl, P. (2017), 'Banking on deposits: Maturity transformation without interest rate risk'.

Gissler, S. & Narajabad, B. (2017*a*), 'The increased role of the federal home loan bank system in funding markets, part 1: Background', *FEDS Notes* .

Gissler, S. & Narajabad, B. (2017*b*), 'The increased role of the federal home loan bank system in funding markets, part 2: Recent trends and potential drivers', *FEDS Notes* .

Gissler, S. & Narajabad, B. (2017*c*), 'The increased role of the federal home loan bank system in funding markets, part 3: Implications for financial stability', *FEDS Notes* .

Gorton, G. (2017), 'The history and economics of safe assets', *Annual Review of Economics* **9**(1).

Gorton, G., Lewellen, S. & Metrick, A. (2012), 'The safe-asset share', *The American Economic Review* **102**(3), 101–106.

Holmström, B. & Tirole, J. (1998), 'Private and public supply of liquidity', *Journal of political Economy* **106**(1), 1–40.

Kacperczyk, M. T., Perignon, C. & Vuillemey, G. (2017), 'The private production of safe assets'.

Krishnamurthy, A. & Vissing-Jorgensen, A. (2012), 'The aggregate demand for treasury debt', *Journal of Political Economy* **120**(2), 233–267.

Krishnamurthy, A. & Vissing-Jorgensen, A. (2015), 'The impact of treasury supply on financial sector lending and stability', *Journal of Financial Economics* **118**(3), 571–600.

Poszar, S., Adrian, T., Ashcraft, A. & Boesky, H. (2013), 'Shadow banking', *FRBNY Economic Policy Review* pp. 1–16.

Sunderam, A. (2014), 'Money creation and the shadow banking system', *The Review of Financial Studies* **28**(4), 939–977.

9 Figures and tables

Figure 1: Money funds and FHLB debt. This graph shows the evolution of the money fund industry and its holdings of FHLB debt by fund type.

Money Market Industry Holding of FHLB Debt

Legend:
- Prime, Municipal, and Other Funds
- Government and Treasury Funds
- FHLB Debt
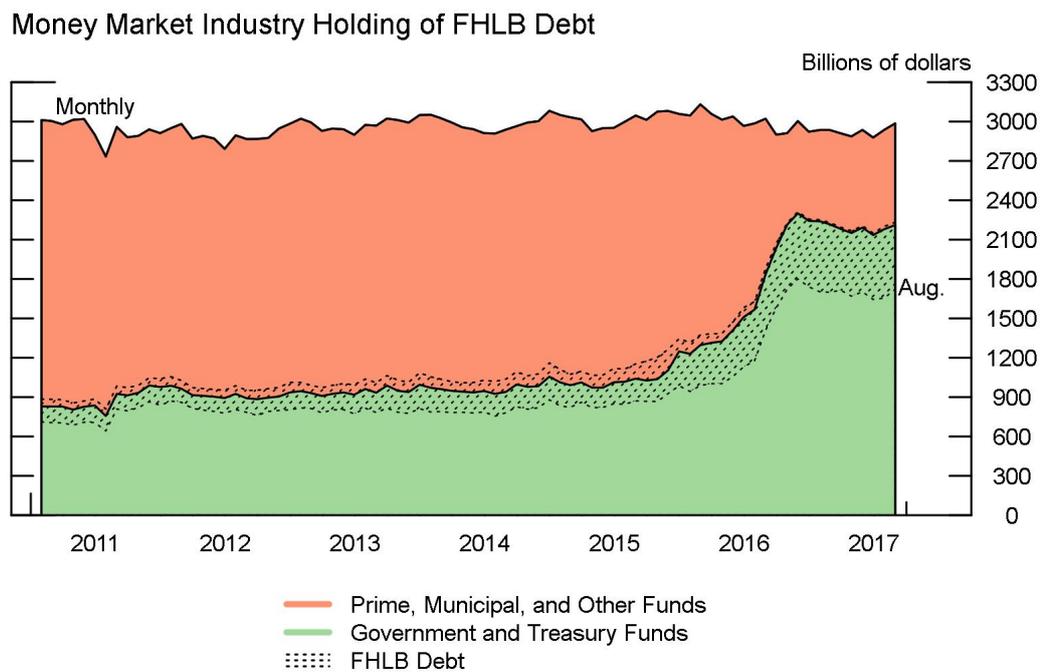
Figure 2: Money funds and FHLB debt. This graph shows the evolution of FHLB debt held by money funds. The left panel shows the percentage of government money funds and the entire money fund industry assets invested in FHLB debt. The right panel shows the percentage of outstanding FHLB debt held by government money funds and the entire money fund industry.
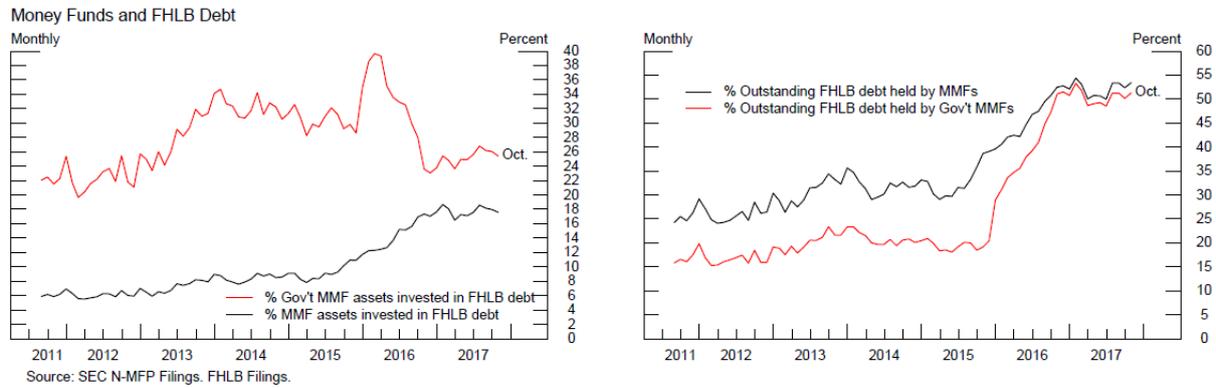
Figure 3: FHLB assets. This figure shows the evolution of FHLBs' assets (upper panel) and outstanding FHLB advances (lower panel) between 2002 and 2017. Assets are broken down by asset type and advances are broken down by member type. In each of the panels, the left figure shows the evolution of assets or advances in $billions, and the right figure shows the evolution per asset type or member type in percent.

Source: FHLB Filings.

Evolution of Advances to Members by Type

Source: FHLB Filings.

Note: CDFI and Housing Assoc. receive neglible advances.
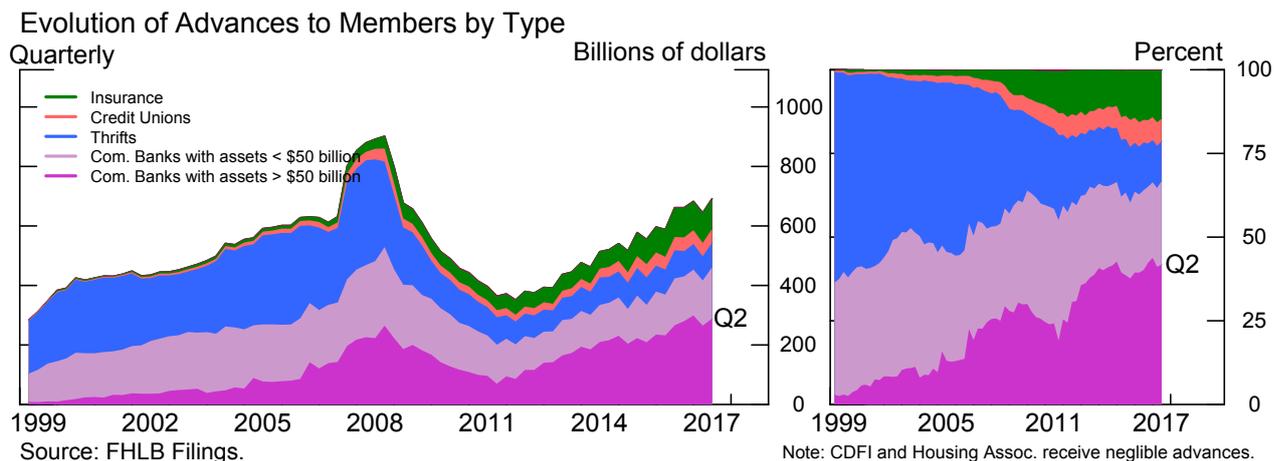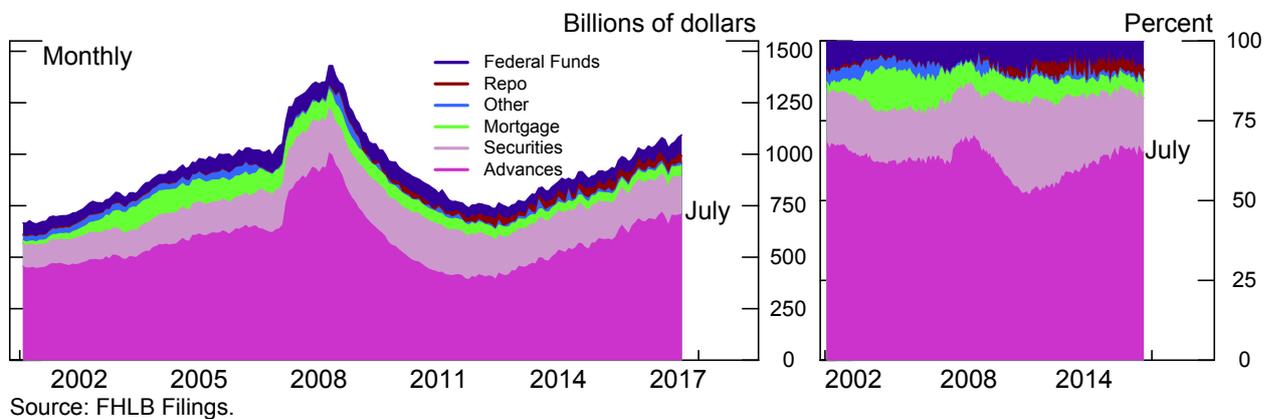
Figure 4: The FHLB system's flow of funding. This graph shows a schematic of the FHLB system's flow of funding from investors in FHLB debt (on the right) to recipients of FHLB advances (on the left). All numbers are in billion dollars and as of June 2017.
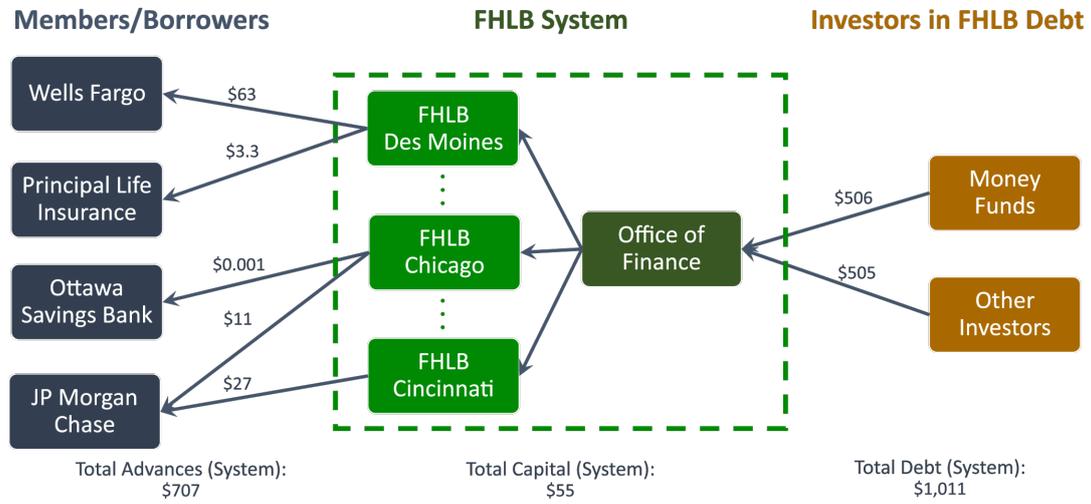
Figure 5: Money funds' weighted average maturity of FHLB debt. This graph shows the evolution of the weighted average maturity of FHLB debt held by money funds and the overall weighted average maturity of all assets held by money funds.
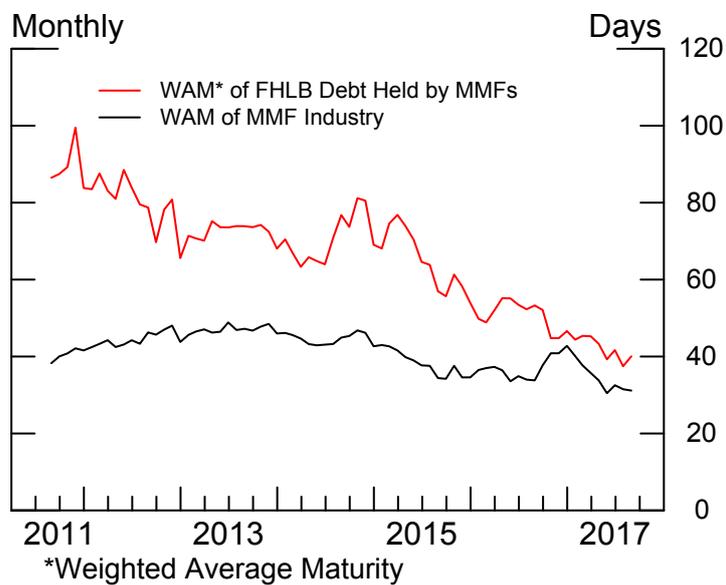
Figure 6: Repricing of advances. This figure shows the evolution of repricing of FHLB advances. Repricing is measured in years and depicted between 2007 and 2017. The figure shows the average for all banks actively borrowing from FHLBs in 2016. All data are quarterly.
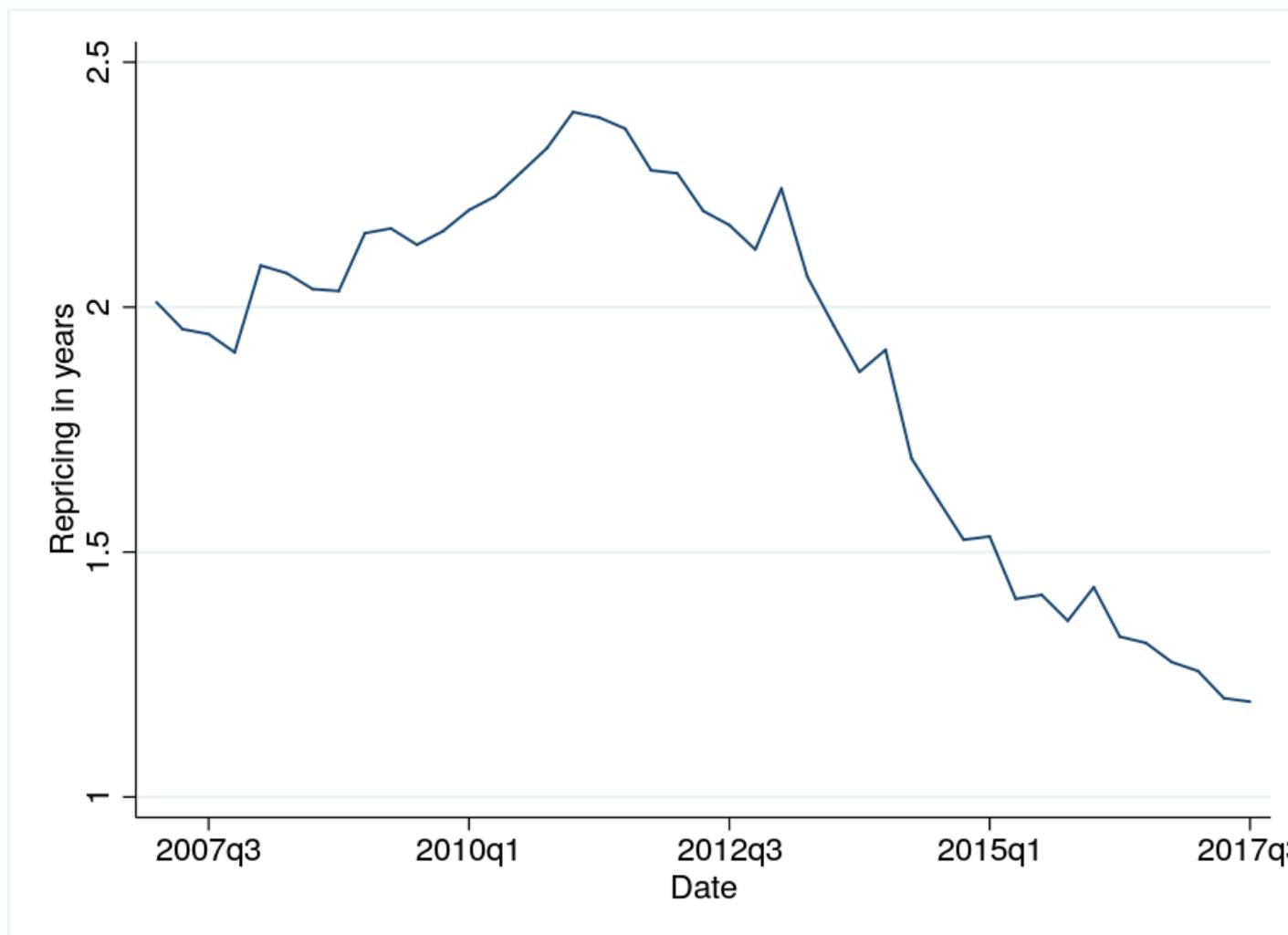
Figure 7: Repricing and advances growth. This figure shows binscatter plots of a regression of advances growth between 2014 and 2017 (left panel) on the repricing of advances in 2010 and of a regression of advances growth between 2011 and 2014 on the repricing of advances in 2010. Observations are grouped into 20 bins according to their repricing. The sample is restricted to banks below $ 2 billion in average assets in 2010.
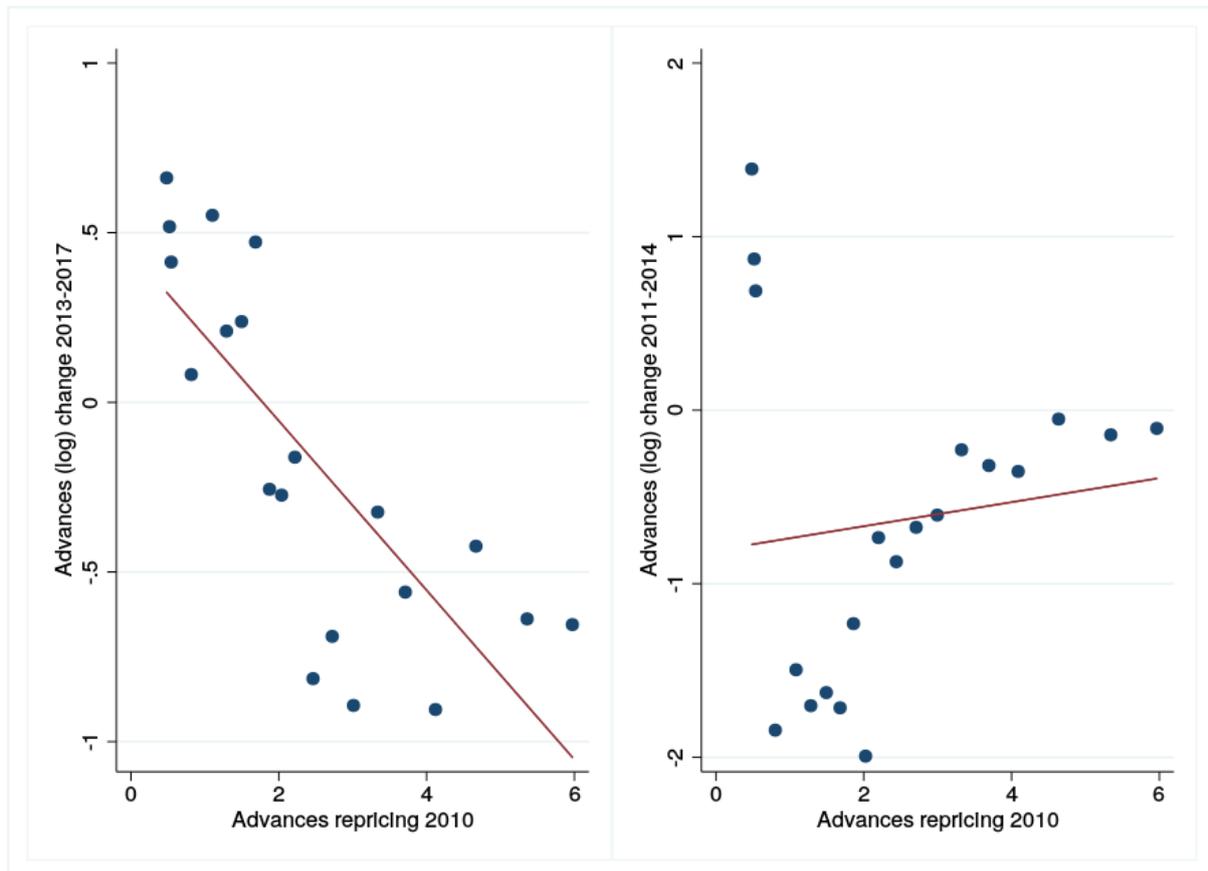
Table 1: Summary statistics of banks and thrifts This table provides the summary statistics for banks and thrifts between 2013Q1 and 2017Q2. All data are taken from banks' and thrifts' quarterly call report filings and SEC's monthly N-MFP data.

|	count	mean	sd	p50	min	max
Assets	81829	579861.1	1303757.5	229844	8515	23887876
FHLB advances	81829	31101.5	102481.7	8000	0	4409000
Mortgages	81829	80947.6	171136.3	30197	0	1577223
Other loans	81829	290925.4	632249.0	108148	0	6216563
Securities	81829	55726.3	100494.4	23628	0	822117
MBS	81829	26922.3	66503.4	7246	0	579476
FHLB/Assets	81829	0.0498	0.0432	0.0381	0.000000257	0.285
Time dep.	81829	133312.8	191299.7	67779	0	1216949
Savings dep.	81829	95676.2	304420.7	16838	0	10643683
MM dep.	81829	139303.1	472144.3	29095	0	14135627
Mortgages/Assets	81829	0.157	0.111	0.132	0.00156	0.741
Other loans/Assets	81829	0.487	0.150	0.492	0.0126	0.834
Securities/Assets	81829	0.128	0.107	0.102	0	0.486
MBS/Assets	81829	0.0486	0.0547	0.0315	0	0.372
Deposits/Assets	81829	0.823	0.0595	0.834	0.315	1.072
Time dep/Assets	81829	0.309	0.119	0.299	0	0.634
Savings dep./Assets	81829	0.129	0.115	0.0910	0	0.472
MM dep./Assets	81829	0.161	0.116	0.138	0	0.530
FHLB reprice	81829	2.410	1.672	2	0.500	6
Liab. reprice	81829	0.329	0.197	0.286	0.00116	1.203
Assets reprice	81829	5.056	1.984	4.770	0.966	13.44
FHLB/MF AUM	81829	0.0872	0.0320	0.0783	0.0552	0.176
Observations	81829					

Table 2: FHLB advances and banks' liabilities This table provides the results for the regression of several banks' balance sheet variables on FHLB advances. All variables are normalized by a bank's assets of the previous quarter. The dependent variables are total deposits (column 1), time deposits (column 2), savings deposits (column 3), and money market deposits (column 4). All regressions include bank and quarter fixed effects. The data are quarterly and the sample is restricted to banks and thrifts with assets below $ 10 billion on average in 2010. The sample period is 2013Q1-2017Q2. Standard errors are clustered at the bank level. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$

	(1)	(2)	(3)	(4)
	Deposits	Time dep	Savings dep.	MM dep.
FHLB	-0.464***	-0.0230	-0.0759***	-0.137***
	(-9.21)	(-0.99)	(-3.39)	(-8.68)
Time FE	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y
Observations	74079	74100	74079	74079
R^2	0.486	0.918	0.949	0.936

Table 3: IV: FHLB advances and banks' liabilities This table provides the results for the first-stage and second-stage regression of several banks' balance sheet variables on adjusted FHLB advances. Adjusted FHLB advances are obtained by first regressing FHLB advances (normalized by lagged assets) on an interaction of AUM by government money funds over AUM by all money funds and the average repricing of a bank's liabilities between 2010 and 2012. First stage results are reported in column 1. All variables are normalized by a bank's assets of the previous quarter. The dependent variables are total deposits (column 2), time deposits (column 3), savings deposits (column 4), and money market deposits (column 5). All regressions include bank and quarter fixed effects. The data are quarterly and the sample is restricted to banks and thrifts with assets below \$ 10 billion on average in 2010. The sample period is 2013Q1-2017Q2. Standard errors are clustered at the bank level. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$

	(1)	(2)	(3)	(4)	(5)
	FHLB	Deposits	Time dep	Savings dep.	MM dep.
GovtMFxLiabreprice	-0.0450***				
	(-8.53)				
FHLB		-1.018***	0.700***	-0.261*	-0.309*
		(-6.86)	(3.03)	(-1.70)	(-1.79)
Time FE	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y	Y
Observations	70536	70513	70534	70513	70513
R^2	0.800	0.466	0.905	0.950	0.937

Table 4: IV: Time deposits composition. This table provides the results for the second-stage regression of banks' composition of time deposits on adjusted FHLB advances. Adjusted FHLB advances are obtained by first regressing FHLB advances (normalized by lagged assets) on an interaction of AUM by government money funds over AUM by all money funds and the average repricing of a bank's liabilities between 2010 and 2012. The dependent variables are time deposits with a maturity below 1 year over total time deposits (column 3), time deposits with a maturity between 1 year and 3 years over total time deposits (column 4), and time deposits with a maturity above 3 years over total time deposits (column 3). All regressions include bank and quarter fixed effects. The data are quarterly and the sample is restricted to banks and thrifts with assets below $ 10 billion on average in 2010. The sample period is 2011q1-2016q4. Standard errors are clustered at the bank level. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$

	(1)	(2)	(3)
	TD<1y	TD 1-3y	TD >3y
FHLB/Assets	-1.423***	1.239***	0.185
	(-4.15)	(4.27)	(0.82)
Time FE	Y	Y	Y
Bank FE	Y	Y	Y
Observations	67846	67846	67846
R^2	0.817	0.673	0.765

Table 5: IV: Deposit rates. This table provides the results for the second-stage regression of banks' deposit rates on adjusted FHLB advances. Adjusted FHLB advances are obtained by first regressing FHLB advances (normalized by lagged assets) on an interaction of AUM by government money funds over AUM by all money funds and the average repricing of a bank's liabilities between 2010 and 2012. The dependent variables are annualized deposit rates at the branch level for certificates of deposits with a maturity of 3 months (column 1), 6 months (column 2), 12 months (column 3), 24 months (column 5), and 60 months (column 6). All regressions include branch and quarter fixed effects. The data are quarterly and the sample is restricted to banks with assets below \$ 10 billion on average in 2010. The sample period is 2011q1-2016q4. Standard errors are clustered at the bank level. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$

	(1)	(2)	(3)	(4)	(5)
	3 months	6 months	12 months	24 months	60 months
FHLB	-0.655	-0.632	-1.278**	-1.406*	-2.282**
	(-1.52)	(-1.39)	(-2.00)	(-1.82)	(-2.16)
Observations	59856	68263	68887	66899	57057
R^2	0.810	0.817	0.803	0.816	0.801

Table 6: FHLB advances and banks' assets This table provides the results for the regression of several banks' balance sheet variables on FHLB advances. All variables are normalized by a bank's assets of the previous quarter. The dependent variables are total assets (column 1), mortgages (column 2), consumer loans (column 3), securities (colum 4), and MBS (column 5). All regressions include bank and quarter fixed effects. The data are quarterly and the sample is restricted to banks and thrifts with assets below $ 10 billion on average in 2010. The sample period is 2013Q1-2017Q2. Standard errors are clustered at the bank level. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$

	(1)	(2)	(3)	(4)	(5)
	Assets	Real Estate Loans	Consumer loans	Securities	MBS
FHLB	0.527***	0.420***	0.00634	0.0211	0.0128
	(8.51)	(13.17)	(1.15)	(1.63)	(1.45)
Time FE	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y	Y
Observations	74079	74079	74079	74103	74103
R^2	0.134	0.851	0.930	0.933	0.877

Table 7: IV: FHLB advances and banks' assets This table provides the results for the second-stage regression of several banks' balance sheet variables on adjusted FHLB advances. Adjusted FHLB advances are obtained by first regressing FHLB advances (normalized by lagged assets) on an interaction of AUM by government money funds over AUM by all money funds and the average repricing of a bank's liabilities between 2010 and 2012. First stage results are reported in column 1. All variables are normalized by a bank's assets of the previous quarter. The dependent variables are total assets (column 2), real estate loans (column 3), consumer loans (column 3), securities (colum 4), and MBS (column 5). All regressions include bank and quarter fixed effects. The data are quarterly and the sample is restricted to banks and thrifts with assets below $ 10 billion on average in 2010. The sample period is 2013Q1-2017Q2. Standard errors are clustered at the bank level. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$

	(1)	(2)	(3)	(4)	(5)	(6)
	FHLB	Assets	Real Estate Loans	Consumer loans	Securities	MBS
GoxtMFxLiabreprice	-0.0401***					
	(-7.73)					
FHLB		-0.212	-0.159	0.0133	-0.488**	0.111
		(-1.51)	(-0.62)	(0.17)	(-2.54)	(0.87)
Time FE	Y	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y	Y	Y
Observations	70529	70513	70513	70513	70536	70536
R^2	0.800	0.090	0.846	0.936	0.927	0.882

35

Table 8: Summary statistics of credit unions This table provides the summary statistics for credit unions between 2013Q1 and 2017Q2. All data are taken from credit unions' quarterly call report filings and SEC's monthly N-MFP data.

	count	mean	sd	p50	min	max
Assets	14,738	775,656.000	1,270,181.000	360,325	14,470	17,593,423
FHLB advances	13,859	33,207.830	115,163.300	4,000.000	0.000	2,069,900.000
Fixed mortgage	14,738	131,881.000	253,954.800	53,319	0	3,928,912
Adjustible mortgage	14,720	20,440.740	50,327.540	3,337.5	0	1,036,605
Vehicle	14,738	184,343.600	365,862.900	67,338	0	5,915,018
FHLB/Assets	13,859	0.032	0.044	0.015	0.000	0.329
Reg. Shares	14,738	300,769.000	502,211.600	148,907	2,259	9,749,432
MM shares	14,735	161,010.900	323,011.500	50,449	0	3,445,907
Share certificate	14,738	131,692.100	240,344.900	56,658	0	3,639,464
Short share certificate	14,738	73,173.270	138,754.200	30,291	0	2,405,327
Fixed mortgage/Assets	14,738	0.163	0.098	0.150	0.000	0.670
Adjustible mortgage/Assets	14,720	0.036	0.070	0.009	0.000	0.724
Vehicle/Assets	14,738	0.230	0.139	0.207	0.000	0.771
Share/Assets	14,738	0.426	0.121	0.420	0.054	0.847
MM share/Assets	14,735	0.172	0.103	0.167	0.000	0.625
Share certificate/Assets	14,738	0.175	0.076	0.168	0.000	0.613
Short share certificates/Assets	14,738	0.099	0.050	0.092	0.000	0.386
Liab. reprice	14,738	1.111	0.337	1.051	0.483	2.593
FHLB/MF AUM	13,859	0.011	0.039	0.001	0.000	0.719
Observations	14,738					

Table 9: FHLB advances and credit unions' liabilities This table provides the results for the regression of several credit unions' balance sheet variables on FHLB advances. All variables are normalized by a credit union's assets of the previous quarter. The dependent variables are deposits and regular shares (column 1), money market shares (column 2), total share certificates (column 3), and share certificate with maturity of less than one year (column 4). All regressions include credit uinion and quarter fixed effects. The data are quarterly and the sample is restricted to credit unions with assets below \$ 10 billion on average in 2010. The sample period is 2013Q1-2017Q2. Standard errors are clustered at the bank level. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$

	(1)	(2)	(3)	(4)
	Shares	MM Shares	Share Certificate	Short Share Certificate
FHLB	-0.339^{***}	-0.144^{***}	-0.114^{***}	-0.095^{***}
	(0.031)	(0.024)	(0.026)	(0.016)
Time FE	Y	Y	Y	Y
CU FE	Y	Y	Y	Y
Observations	13,859	13,856	13,859	13,859
R^2	0.945	0.963	0.935	0.882

Table 10: IV: FHLB advances and credit unions' liabilities This table provides the results for the first-stage and second-stage regression of several credit unions' balance sheet variables on adjusted FHLB advances. Adjusted FHLB advances are obtained by first regressing FHLB advances (normalized by lagged assets) on an interaction of AUM by government money funds over AUM by all money funds and the average repricing of a credit union's liabilities between 2010 and 2012. First stage results are reported in column 1. All variables are normalized by a credit union's assets of the previous quarter. The dependent variables are deposits and regular shares (column 1), money market shares (column 2), total share certificates (column 3), and share certificate with maturity of less than one year (column 4). All regressions include credit union and quarter fixed effects. The data are quarterly and the sample is restricted to credit unions with assets below \$ 10 billion on average in 2010. The sample period is 2013Q1-2017Q2. Standard errors are clustered at the bank level. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$

	(1) FHLB	(2) Shares	(3) MM Shares	(4) Share Certificate	(5) Short Share Certificate
GovtMFxLiabreprice	−0.026**				
	(0.011)				
FHLB		−0.997	−1.091**	0.549	−0.099
		(0.614)	(0.528)	(0.616)	(0.304)
Time FE	Y	Y	Y	Y	Y
CU FE	Y	Y	Y	Y	Y
Observations	13,859	13,859	13,856	13,859	13,859
R²	0.807	0.934	0.931	0.906	0.882

Table 11: FHLB advances and credit unions' assets This table provides the results for the regression of several credit unions' balance sheet variables on FHLB advances. All variables are normalized by a credit union's assets of the previous quarter. The dependent variables are total assets (column 1), fixed mortgages (column 2), adjustable mortgages (column 3), vehicle loans (column 4). All regressions include credit union and quarter fixed effects. The data are quarterly and the sample is restricted to credit unions with assets below $ 10 billion on average in 2010. The sample period is 2013Q1-2017Q2. Standard errors are clustered at the bank level. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$

	(1)	(2)	(3)	(4)
	Assets	Fixed Mortgage	Adjustible Mortgage	Vehicle
FHLB	0.296***	0.065**	0.027	0.108**
	(0.031)	(0.030)	(0.018)	(0.042)
Time FE	Y	Y	Y	
CU FE	Y	Y	Y	
Observations	13,859	13,859	13,841	13,859
R^2	0.190	0.938	0.927	0.947

Table 12: IV: FHLB advances and credit unions' assets This table provides the results for the first-stage and second-stage regression of several credit unions' balance sheet variables on adjusted FHLB advances. Adjusted FHLB advances are obtained by first regressing FHLB advances (normalized by lagged assets) on an interaction of AUM by government money funds over AUM by all money funds and the average repricing of a credit union's liabilities between 2010 and 2012. First stage results are reported in column 1. All variables are normalized by a credit union's assets of the previous quarter. The dependent variables are total assets (column 2), fixed mortgages (column 3), adjustable mortgages (column 4), vehicle loans (column 5). All regressions include credit union and quarter fixed effects. The data are quarterly and the sample is restricted to credit unions with assets below $ 10 billion on average in 2010. The sample period is 2013Q1-2017Q2. Standard errors are clustered at the bank level. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$

	(1)	(2)	(3)	(4)	(5)
	FHLB	Assets	Fixed Mortgage	Adjustible Mortgage	Vehicle
GovtMFxLiabreprice	−0.026**				
	(0.011)				
FHLB		−0.235	0.522	0.533	0.151
		(0.326)	(0.730)	(0.494)	(0.741)
Time FE	Y	Y	Y	Y	
CU FE	Y	Y	Y	Y	
Observations	13,859	13,859	13,859	13,841	13,859
R^2	0.807	0.121	0.930	0.905	0.947