Substitutability of Bank Deposits and Money Market Mutual Funds: Implications for Bank Lending

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Abstract

We examine how U.S. money market mutual fund (MMMF) aggregate flows relate to bank-level deposits. We find a negative relation, indicating product substitutability, with nuances depending on MMMF holdings and deposit types. Government and Treasury MMMFs serve as substitutes for bank deposits, while tax-exempt and prime MMMFs complement them, except for time deposits. Moreover, we observe that the effect of MMMF flows on bank deposits translates into a negative link between MMMF flows and bank lending, depending on MMMF and bank loan types. These findings suggest that MMMF competition could challenge banks' stable funding acquisition, impacting the availability of bank loans.

JEL classifications: G11, G21, G23, E43, E44

Keywords: Bank deposits; Money market deposit accounts; Money market mutual funds; Bank lending

1. Introduction

The recent banking crisis of 2023 brought to light how competitive forces that have existed between the banking sector and money market mutual funds (MMMFs) since their creation can bring banks to an increased risk of bank runs and instability in the financial sector.[1] The availability of MMMFs, which closely resemble bank deposits yet often offering higher interest rates with minimal risks, can amplify the outflow of bank deposits and escalate the risk of bank runs, even though their proliferation may not automatically lead to immediate deposit withdrawals. The preceding decade, characterized by ultralow interest rates, fostered an environment where banks felt relatively secure in retaining deposits (apart from competition with the stock market (Lin, 2020)), despite the presence of MMMFs. However, the recent actions of the Federal Reserve (Fed), particularly its 2022-2023 campaign against inflation, marked a significant shift. This period witnessed an uptick in interest rates, prompting a resurgence of depositors' interest in MMMFs, which offer more competitive rates. This trend has intensified pressure on banks, as depositors gravitate toward MMMFs for higher returns, challenging banks' traditional financial intermediation function.

Money market mutual funds and bank deposits serve as primary short-term cash investment options for both individual and institutional investors due to their liquidity, safety, and accessibility. While both offer minimal-risk returns, there are distinct differences between them. Bank deposits, backed by government insurance and subject to stringent regulations including capital reserves and risk management, generally pose lower risk than MMMFs, provided deposits

[1] In March 2023, Silicon Valley Bank (SVB) and Signature Bank experienced unexpected bank run, failed, and had to be taken over by the FDIC. The panic quickly spread to other banks with significant deposit withdrawals. While some depositors moved their money from small to large banks with the perception of those banks being safe, i.e., "too big to fail", others moved their money en masse to money market mutual funds. A move to money market funds started before the SVB and Signature Bank failures but accelerated after the events. A dominant reason for bank deposits' flight to money market funds is the highest yield since the 2008 financial crisis at the average of 4.12% while banks are slow to increase deposit rates (Demos, 2022; Singh, 2023; Wallerstein and Timiraos, 2023).

are below the Federal Deposit Insurance Corporation (FDIC) cap of $250,000. Consequently, MMMFs must offer higher returns to attract investors, but typically cannot surpass bank deposit yields without assuming greater risks (Kacperczyk and Schnabl, 2013). During the 2008 financial crisis, heightened risk-taking by some MMMFs led to "breaking the buck" events, prompting regulatory reforms in 2014 mandating daily floating net asset values (NAV) for most MMMFs, increasing price volatility and reducing liquidity. However, the 2023 U.S. banking crisis shifted favor towards MMMFs, as they offered more competitive rates compared to banks reluctant or restricted in offering higher rates amidst a rising interest rate environment (Demos, 2022; Singh, 2023; Wallerstein and Timiraos, 2023; Heeb, 2023; Demos, 2023). Thus, while these money market products are similar, they do carry a different level of risk and correspondingly return. If these products are substitutes, even if not perfect alternatives, the relation can have a significant implication on banks' operations, such as lending, as deposits are the main source of funds for banks.

In this study, we empirically investigate the relation between aggregate flows to MMMFs and flows to deposit accounts at the bank level, and their effect on bank lending. Despite the common belief that MMMFs and bank deposits are competing products, offering similar safety and moderate returns, there is a lack of formal research on their interrelation. Previous studies by Hubbard (1983) and Pilloff (1999) have explored the substitutability of MMMFs and bank deposit accounts, finding limited evidence of direct substitution. However, early findings may be influenced by the nascent stage of MMMF development and differing market structures and regulations.[2] Recent discussions in both popular press (Demos, 2022, 2023; Singh, 2023;

[2] While MMMFs were introduced in 1971, it took till 1997 for the MMMFs' assets to reach $1 trillion, with current assets under management at $5.2 trillion as of October 2022. Source: Board of Governors of the Federal Reserve System (US), fred.stlouisfed.org.

Wallerstein and Timiraos, 2023) and academic literature (Li, 2021) suggest potential competition between MMMFs and bank deposits, which has implications for banks' main intermediation functions, particularly in core funding and lending activities.

Using a sample of U.S. commercial banks and money market mutual funds from January 2010 to June 2023, we examine the relation between aggregate net flows to MMMFs and net flows to different types of deposit accounts of individual banks. Furthermore, we test whether the MMMF-bank deposit substitution effect has any implications for bank-level lending activities. We find that aggregate MMMF flows are negatively related to bank total deposit growth, indicating their substitutability. Specifically, a 10% increase in quarterly aggregate MMMF flows is, on average, associated with a 0.76% decrease in bank-level total deposits in the same quarter. Given that the median total deposits in our sample are $172 million, this finding is economically significant as a quarterly increase in MMMF flows corresponds to an outflow of approximately $1.3 million in deposits for a median bank. The result is mainly driven by the substitution effect for money market deposit accounts (MMDA) and other savings deposits, with less substitutability for demand and time deposits. The effect of MMMF flows on bank deposit growth also varies depending on the type of MMMF. Government & Treasury MMMFs act as substitutes, while tax-exempt and prime MMMFs serve as complements for bank deposits. Both retail and institutional MMMF investors treat MMMFs as substitutes for bank deposits, with retail investors being more sensitive to substitution than institutional investors. This relation holds across all types of bank deposits (MMDA, other savings, and demand), except for time deposits, where tax-exempt MMMFs act as substitutes and retail MMMFs as complements. The size of MMMFs appears to matter too, with the largest economic effect of substitution observed for large-size MMMFs compared to small-size MMMFs, with a difference of 165 times. These findings are consistent

across banks of all sizes, with the highest sensitivity of total deposit growth to aggregate MMMF flows observed for small and medium banks, followed by large banks. However, the substitution effect is not observed for demand and time deposits of large banks. In the case of large banks, the substitution effect is primarily driven by Government & Treasury MMMFs, while tax-exempt and prime MMMFs exhibit complementarity with different types of bank deposits, except for demand and time deposits, consistent with results based on the sample of banks of all sizes.

Next, we examine whether the shocks to deposits translate into bank lending. If banks can seamlessly replace deposit funding with alternative sources such as bonds or similar market-based funds, there should be no disruptions to lending. Consequently, the interchangeability between deposits and money market mutual funds will bear little significance in discussions about the impact of MMMF flows on bank deposits. However, we find that substitutability of MMMFs and bank deposits translates into a negative relation between MMMF flows and bank-level lending. Lagged aggregate MMMF flows are negatively associated with the growth of commercial real estate (CRE), residential real estate (RRE) and consumer loans, with economic significance averaging at -4.2%, -4.9% and -2.4% per 100% increase in MMMF inflows, correspondingly.[3] For an average bank, a quarterly increase in MMMF flows by a tenth results in a reduction of 1.18 million in CRE loans, $2.47 million in RRE loans, and $0.55 million in consumer loans. Similar to the MMMF and deposit flow relation, Government & Treasury MMMFs have a negative, while tax-exempt and prime MMMFs have a positive relation with CRE, RRE, and consumer loans, thus confirming the link between MMMF and bank deposit substitutability and its impact on banks' lending ability.

[3] Commercial and Industrial (C&I) loans growth has a very positive relation to MMMF flows over the full sample period. However, no relation exists prior 2020. The significant positive coefficient is driven by the Covid-19 period with the sharp uptick in C&I loans in 2020.

Both retail and institutional MMMF flows show a negative relation with CRE and RRE loans, while only retail MMMF flows have a negative relation with consumer loans. The effect of MMMF and bank deposit substitutability on bank lending (excluding C&I loans) is present only in small and medium banks with less than $2 billion in total assets for the entire MMMF sample. However, when examined by type of MMMF, the negative relation persists between Government & Treasury MMMFs flows and CRE, RRE, and consumer loans growth for bank of all sizes, while the positive relation exists for tax-exempt and prime MMMF flows and CRE, RRE, and consumer loans growth for all bank sizes.

Furthermore, we assess the regulation shift in 2014 that changed institutional non-Treasury MMMFs' NAV reporting from a fixed $1 to a floating NAV, thereby increasing the risk and reducing the liquidity of the product. This regulatory change, fully implemented in 2016, transformed the role of prime and Government & Treasury MMMFs for investors. Prior to the regulation, prime MMMFs served as substitutes, while Government & Treasury MMMFs were complements to bank deposits. However, after 2016, their relation with bank deposits reversed, with prime MMMFs becoming complements and Government & Treasury MMMFs becoming substitutes to bank deposits. The 2016 MMMF NAV regulation had an uneven effect on the relation between MMMF flows and bank lending. While the regulation amplified the negative impact of Government & Treasury MMMF flows on RRE loans, it mitigated the Government & Treasury MMMF flows' negative effect on consumer loans, although it did not affect the relation for CRE loans.

Our study makes several significant contributions to the existing literature. Firstly, it adds to the literature on the substitutability of financial products, such as leasing versus debt financing (Yan, 2006), exchange-traded funds (ETF) versus index mutual funds (Agapova, 2011a), MMMFs

and bank deposits (Hubbard, 1983; Pilloff, 1999), and Treasury supply and bank deposits (Li et al., 2023). Our findings confirm that MMMFs and bank deposits indeed serve as substitutes, albeit not perfect ones.

Secondly, the study emphasizes the vital role of Money Market Mutual Funds in financial stability. Events during the 2008 financial crisis underscored their importance in both banking and broader financial systems (Dwyer and Tkac, 2009; Griffiths et al., 2012; Bengtsson, 2013). Griffiths et al. (2012) and Bengtsson (2013) analyze MMMFs' economic function, especially during crises, while Ma et al. (2022) highlight the significance of both banks and MMMFs in market liquidity provision. Our research shows that although MMMFs serve as imperfect substitutes, they negatively impact bank deposit growth. Consequently, as MMMFs become more attractive in rising rate environments, banks constrained by deposit rate limits may face significant deposit outflows, potentially leading to liquidity shortages, reduced lending, and, in extreme cases, bank failure.

Thirdly, we contribute to the literature on bank competition for deposits. Banks compete for deposits in local markets by offering a variety of deposit products (Drechsler, Savov, and Schnabl, 2017). This competition affects banks' stability, particularly relevant for uninsured depositors (Egan et al., 2017), and hampers the transmission of monetary policy (Drechsler, Savov, and Schnabl, 2017). Moreover, bank deposits compete with Treasury supply, with competitive markets intensifying the crowding-out effect (Krishnamurthy and Vissing-Jorgensen, 2012; Li et al., 2023). This effect is particularly pronounced in wholesale deposit markets due to higher competition than in retail deposit markets (Li et al., 2023). We demonstrate that Money Market Mutual Funds and bank deposits are substitutes, competing for depositors' funds and affecting banks' fragility, as seen in recent banking crises (Demos, 2022, 2023; Singh, 2023; Wallerstein

and Timiraos, 2023; Heeb, 2023). Pricing mechanisms, such as competitive bank deposit rates, are the primary drivers of the competition between MMMFs and bank deposits. However, we also find that Government & Treasury MMMFs are substitutes, while Tax-exempt and Prime MMFs are complements to bank deposits, suggesting limited competition between bank deposits and MMMFs.

Fourthly, our study contributes to the existing literature on bank lending. Several papers study how the availability of bank deposits affects bank lending (Becker, 2007; Gilje, Loutskina, and Strahan, 2016; Plosser, 2014; Parra 2022). The prevailing literature generally agrees that bank deposits have a direct correlation with bank lending (Gatev and Strahan, 2006; Drechsler et al., 2017; Lin, 2020). Most of these studies focus on specific idiosyncratic deposit shocks (Gilje, Loutskina, and Strahan, 2016; Ben-David, Palvia, and Spatt, 2017). Some studies suggest that this connection is attributed to the demand for household deposits (Drechsler et al., 2017; Lin, 2020). A closely related study by Lin (2020) explores the competition for household funds between banks and the stock market. Lin (2020) demonstrates that the demand for retail deposits diminishes during stock market booms, leading to a reduction in bank lending and a decline in real activity among firms reliant on bank financing. While the competition between bank deposits and stock market investments is influenced by market performance cycles and is beyond the control of bank policies, the rivalry between MMMFs and bank deposits persists over time and can be addressed through competitive bank strategies, such as offering competitive deposit rates. This paper extends and complements the findings of Drechsler et al. (2017) and Lin (2020) by showing another mechanism through which macroeconomic shocks could affect bank deposit funding and lending. Our study delves into the more direct competition for household funds between banks and money market mutual funds, as their products serve as more immediate substitutes owing to their design.

This study represents the first formal analysis of the substitutability between money market mutual funds and bank deposit accounts, affirming their competitive relation for investors' funds. Additionally, it is the pioneer investigation to establish a negative correlation between MMMF flows and bank lending, attributable to the substitution effect between MMMFs and bank accounts, which serve as primary sources of bank funding.

The rest of the paper is organized as follows: Section 2 describes the history and design of the products. Section 3 discusses the literature and hypotheses development. Section 4 describes the data and sample. Section 5 presents empirical results, while Section 6 reports the results of the analysis of regulatory changes. Section 7 concludes.

2. Institutional and product design

2.1. Overview of money market mutual funds' and bank deposit accounts' rivalry

Before the 1970s, banks and money market mutual funds operated in separate markets due to existing regulations, particularly Regulation Q from the Glass-Steagall Act, which limited interest rates banks could pay on savings deposits. However, during the 1970s, rising short-term U.S. Treasury rates exceeded the capped rates banks could offer, leading to the emergence of MMMFs. The first MMMF, the Reserve Fund, was established in 1971, followed by several others. According to St. Louis Federal Reserve data, from September 1977 to September 1982, money market mutual funds' total financial assets increased from $3.87 billion to $235.25 billion. Thus, by design, MMMFs were created as a substitute for bank accounts.

In 1982, lobbying efforts by banks led to an amendment of Regulation Q, allowing uncapped rates for money market deposit accounts for customers with over $2,500 balances.[4] This

[4] In December 1982, Garn-St Germain act permitted banks and thrifts to offer Money Market deposit accounts.

change made MMMFs less attractive due to their volatility and no guarantee of principal value, causing a 25% decline in assets by June 1983 as investors returned to FDIC-insured bank accounts. Facing new competition, MMMF managers persuaded the Securities and Exchange Commission (SEC) to adopt new accounting policies, resulting in the "amortized cost" method of valuation, stabilizing net asset value at $1.00.

However, the 2008 financial crisis, triggered by Lehman Brothers' bankruptcy, exposed vulnerabilities in MMMFs. The Reserve Primary Fund "broke the buck", prompting widespread panic and withdrawal requests. The U.S. Treasury intervened to insure MMMFs' NAVs at $1.00 temporarily. Risk-taking by MMMF managers, particularly in institutional prime money market funds, exacerbated the crisis, leading to runs on MMMFs (Kacperczyk and Schnabl, 2013).

In response, in 2014, the SEC adopted and, in 2016, implemented a rule requiring Prime MMMFs to use a daily floating NAV based on the market price of underlying securities, reversing the 1983 amendment aimed at providing pricing stability. The rule aimed to enhance transparency, stability, and liquidity during crises. Consequently, investors now face increased volatility and decreased liquidity in Prime MMMFs compared to money market bank accounts, making these MMMFs less attractive for a given yield.

2.2. Product and institutional design of money market mutual fund and bank deposit accounts

Money market mutual funds are mutual funds regulated under SEC Rule 2a-7, part of the Investment Company Act of 1940. Typically associated with mutual fund families, MMMFs are subject to strict regulations governing their investment choices. Rule 2a-7 limits MMMFs to securities with a remaining maturity not exceeding 397 days and a weighted average maturity (WAM) of 60 days or less (90 days before regulation of 2014). It also mandates portfolio quality

and diversification. MMMFs fall into three main categories: prime, government, and tax-exempt. Prime funds are the riskiest and invest in various short-term instruments such as corporate and government debt. Government funds must invest primarily in government securities or fully collateralized repurchase agreements, or cash. Tax-exempt funds hold municipal bonds. While the SEC mandates risk disclosure for MMMFs, investors are not insured against losses and are subject to market fluctuations and potential investment losses.

Banks derive income from various sources including interest on loans, investment gains, service fees, and off-balance sheet activities. They have the flexibility to redistribute funds across different assets, allowing them to pursue various objectives. In contrast, MMMFs face constraints on investment opportunities and income sources. Their returns are primarily tied to short-term interest rates and gains from securities within their portfolio limitations. Despite this, MMMFs typically offer higher returns than bank deposit accounts due to factors such as lack of reserve requirements and the ability to pass on taxes to shareholders. However, bank accounts benefit from FDIC insurance up to $250,000, reducing risk compared to MMMFs, which must take higher risks to achieve higher returns. Additionally, MMMFs provide less liquidity to investors by imposing minimum withdrawal limits ranging from $100 to $500.

There are also differences in fee structures between bank deposits and MMMFs. Banks inform depositors about individual expenses for each deposit account, while MMMFs offer shareholders reports with aggregated expense data. Under Rule 12b-1, MMMFs can allocate a portion of their assets to cover distribution expenses to brokers and dealers. Christoffersen (2001) demonstrates that MMMF managers often waive management fees when the fund's performance does not cover expenses, likely to retain investors and prevent them from moving to alternatives with better performance or lower fees.

The performance of MMMFs is closely tied to interest rates set by the Federal Reserve. In a low-rate environment, MMMFs may not outperform bank deposits after accounting for fund expenses. However, in a high-interest rate environment, MMMFs offer more competitive risk-adjusted returns than banks, as banks are typically slower to increase rates on their deposit accounts (Demos, 2022, 2023; Singh, 2023; Wallerstein and Timiraos, 2023; Heeb, 2023).[5]

3. Related literature and hypotheses development

3.1. Substitutability of MMMFs and bank deposits

Previous studies directly comparing the substitutability of MMMFs and bank deposits are scarce. While numerous studies have examined various aspects of MMMFs (see, e.g., Domian, 1992; DeGennaro and Domian, 1996) and bank deposits (e.g., Kashyap et al., 2002) separately, there is a notable gap in the literature regarding their direct comparison as substitutes for investors' funds. To the best of our knowledge, there are only a few exceptions that directly examine this substitution effect but all of them are based on the early period of the U.S. banking sector's de-regulation. Hubbard (1983) investigates the impact of MMMFs on the money supply and monetary control and argues that MMMFs provide an alternative to traditional bank deposits. The author's findings suggest that this substitution effect may potentially affect the Fed's ability to control the money supply through traditional monetary policy tools. Furthermore, Pilloff (1999) investigates whether MMMFs can be considered as close substitutes for accounts at insured depository institutions. Using data from the early 1990s, the study assesses the similarities between MMMFs and bank deposits of different types in terms of risk, return, liquidity, and convenience. The

[5] While all bank deposits may serve as substitutes for Money Market Mutual Funds, Money Market Deposit Accounts are the closest substitutes, offering benefits like limited check writing, higher interest rates, and FDIC insurance up to $250,000. Both MMMFs and MMDAs function as on-demand cash accounts but differ structurally, with MMMFs carrying investment risk while offering higher yields.

findings suggest that while there are differences between MMMFs and bank deposits in terms of risk and return, MMMFs can indeed be considered as close substitutes to some types of bank deposits, especially MMDAs.

Another relevant study also suggests that MMMFs can serve as a less costly alternative banking product for taxpayers, with minimal risk of value loss, as they offer similar transaction services as regular bank accounts without federal deposit insurance burdens (Scott, 1998). Nonetheless, MMMFs entail some risk, exemplified by past instances such as the 1993 failure of the Community Bankers US Government Fund due to derivatives losses and the 2008 breakdown of the Reserve Primary Fund, which sparked a money market and banking crisis.

As indicated by the existing literature, money market mutual funds could potentially serve as substitutes for bank deposit accounts, providing an alternative monetary asset within the financial system. Although this assertion may seem extreme, there exists a significant overlap in the services offered by these two types of financial intermediaries. The pivotal question to explore is whether MMMFs and bank deposit accounts truly act as substitutes or complements.

In addition, banks' competition for deposits occurs across various products and dimensions (e.g., Egan et al., 2017). Drechsler, Savov, and Schnabl (2017) reveal that in concentrated markets, monetary policy affects deposit channels most significantly, leading to increased deposit spreads and outflows with a rise in the Fed funds rate. However, banks also face competition from other money market instruments. Li et al. (2023) illustrate that an increase in Treasury supply displaces bank deposits, particularly in competitive deposit markets. The authors do not attribute this result to monetary policy or banks' investment opportunities and rationalize it with a model of imperfect deposit competition.

We base our argument on the substitutability of MMMFs and bank deposits on the theoretical model proposed by Drechsler et al. (2017). In their model, households exhibit a preference for liquidity, which they obtain from cash and bank deposits. Cash offers high liquidity but no interest, while bank deposits offer partial liquidity and pay an interest rate determined by banks with market power in local deposit markets. Additionally, households can invest in bonds, which offer no special liquidity and pay a competitive open-market rate set by the central bank, the Fed funds rate. In our framework, we posit that MMMFs serve as a superior alternative to bonds, providing rates tied to the Fed funds rate that are higher than deposit rates, while maintaining liquidity comparable to bank deposits. Consequently, when the central bank increases the Fed funds rate, the cost of holding cash rises, enabling banks to raise deposit spreads without losing deposits to cash. This leads households to reduce their deposit holdings, causing deposits to flow out of the banking system and into bonds in Drechsler et al. (2017) model, and into MMMFs in our context.

The focus of this study is on bank competition for deposits with money market mutual funds. Banks and mutual funds, while providing somewhat different but overlapping functions in financial markets, are expected to exhibit different performance and risk in money market instruments they offer, as discussed above. Despite their differences, bank deposits and MMMFs are expected to be substitutes due to the similarity of the products (Hubbard, 1983; Pilloff, 1999). However, they may cater to different clienteles or changing risk preferences of the same investors as market conditions evolve. Thus, it is an empirical question whether flows into MMMFs and bank deposits are related and whether they serve as substitutes or complements. Our first set of hypotheses is therefore as follows:

H1null: Net flows to MMMFs and bank deposit accounts are unrelated as investors use them independently.

H1a1: Net flows to MMMFs and bank deposit accounts are negatively related as investors use them as substitutes.

H1a2: Net flows to MMMFs and bank deposit accounts are positively related as investors use them as complements.

Due to market frictions, we anticipate that even if these products serve as substitutes, they are not perfect substitutes and may, in some cases, act as complements. These frictions arise from differences in product designs and existing regulations. For instance, banks typically offer less volatile yields on their deposits compared to MMMFs, resulting in lower returns. Additionally, some MMMFs may enhance returns by investing in riskier money market products (Kacperczyk and Schnabl, 2013), introducing a risk factor absent for traditional insured bank deposits. Banks can also redistribute returns among deposit accounts, whereas MMMFs lack this option, affecting the overall attractiveness of the investment. While MMMFs may exhibit higher price elasticity with upward rate changes, posing significant competition for bank deposits and potentially leading to withdrawals from bank accounts in favor of MMMFs, the riskier nature and potentially higher expenses of MMMFs could mitigate this competitive pressure on bank accounts.

3.2. MMMFs flows and bank lending

Numerous studies explore how the availability of bank deposits impacts bank lending (see, e.g., Becker, 2007; Gilje, Loutskina, and Strahan, 2016; Plosser, 2014; Parra, 2022). The prevailing literature generally agrees that there is a direct correlation between bank deposits and bank lending (Gatev and Strahan, 2006; Drechsler et al., 2017; Lin, 2020). While some studies focus on specific

idiosyncratic deposit shocks (Gilje, Loutskina, and Strahan, 2016; Ben-David, Palvia, and Spatt, 2017), others suggest that this connection is attributed to the demand for household deposits (Drechsler et al., 2017; Lin, 2020).

Drechsler, Savov, and Schnabl (2017), for instance, demonstrate theoretically and empirically that when the Fed funds rate rises, banks widen the interest spreads they charge on deposits, leading to outflows of deposits from the banking system. Since banks heavily rely on deposits for funding, these outflows result in a contraction in lending. Hence, an increase in the Fed funds rate leads to a decrease in bank deposits and a significant contraction in lending, securities, and total assets. Lin (2020) similarly observes this trend in the context of stock market participation, where an increase in stock market return and participation are associated with deposits' outflow and a decrease in bank lending. This contraction is driven by banks' inability to seamlessly replace deposits with wholesale (non-deposit) funding. The assumption that deposits are special, prevalent in banking literature, can be attributed to their unique stability and dependability (Hanson et al., 2015), or to an increasing marginal cost of wholesale funding (Stein, 1998).

The theoretical framework of Drechsler et al. (2017) applies in our context as well, where MMMFs serve as substitutes for bank deposits, leading to a reduction in deposits when the Fed funds rate increases and yields generated by MMMFs become more attractive. However, whether flows into MMMFs and bank lending are related empirically depends on the type of MMMFs and bank deposits, as they may act as substitutes or complements. Therefore, our second hypothesis is stated in a null form as follows:

H2null: Net flows to MMMFs and bank lending are unrelated as investors use MMMFs and bank deposits independently.

H2a1: Net flows to MMMFs and bank lending are negatively related as investors use MMMFs and bank deposits as substitutes.

H2a2: Net flows to MMMFs and bank lending are positively related as investors use MMMFs and bank deposits as complements.

4. Data and sample

The primary data in this study are quarterly growth in bank deposit accounts, loans, and money market mutual funds from January 2010 to June 2023. The data on U.S. commercial banks come from the Wharton Research Data Services (WRDS) Bank Regulatory database of the Federal Reserve Bank Call Reports. We include all commercial U.S. banks regulated by the Federal Reserve System, Federal Deposit Insurance Corporation, and Comptroller of Currency. We exclude banks with no deposits and zero or negative equity capital and trim all continuous variables at 1% and 99%. Our final sample consists of over 290,158 bank-quarter observations on 7,573 individual banks.

We collect information about deposits and loans at the bank level. The main dependent variables, quarterly bank deposits' and loans' growth rates, are calculated as the natural logarithm of the ratio of the dollar amount of deposits (loans) in quarter t to the dollar amount of deposits (loans) in quarter t-1, $Ln(Deposits_t/Deposits_{t-1})$ ($Ln(Loans_t/Loans_{t-1})$). We calculate the growth of total bank deposits and all types of bank deposits, specifically, money market deposit accounts, other savings deposit accounts, demand deposit accounts, and time deposit accounts. We calculate the growth of bank loans by type: Commercial and industrial loans (C&I), Commercial real estate loans (CRE), Residential real estate loans (RRE), and Consumer loans. The Appendix provides the full description of the variables.

Since deposit flows are a function of several bank- or product-specific factors, we extract numerous other bank-level variables. First, the interest rate is arguably one of the most important determinants of deposit flows. We account for this factor by constructing an implicit deposit rate, calculated by dividing interest expenses on deposits by total deposits. In the case of MMDAs and other savings deposits, Call Reports do not contain information about interest expenses on these accounts separately but report them as an aggregate number. To address this issue, we construct an implied measure of interest rates by dividing the weighted interest expenses on MMDAs and savings deposits by the amount of each of those deposits, correspondingly. The weights, in turn, are defined by the proportion of MMDAs and savings deposits in the total sum of MMDAs and savings deposits in each bank. The implicit deposit rate on demand and time deposits is obtained by dividing interest expenses on transaction accounts or interest expenses on time deposits on the corresponding amounts of total demand deposits or total time deposits.

Second, deposit flows may be driven by bank-specific characteristics such as size, asset quality and riskiness. To account for other bank-level characteristics, we include bank size (measured as the natural logarithm of total assets), capital ratio (calculated as bank total equity to total assets), total loans to assets and total deposits to assets ratios, loan loss reserves ratio (allowance for loan losses scaled to total loans) and return on assets (net income to total assets). To account for the bank's demand for core deposits, we also control for the amount of other deposits by including the ratio of large time deposits (over $250,000) to total deposits.

The data on U.S. money market mutual funds come from CRSP Mutual Fund database. We identify MMMFs using CRSP objective identifier CRSP_OBJ_CD being equal IM ('IM' is fixed income (I) money market (M)). We classify MMMFs as tax-exempt if LIPPER_OBJ_CD is within (ITE, MAM, MIM, NJM, NYM, OHM, OTM, PAM, TEM) or LIPPER_TAX_CD is N; as

Government & Treasury if LIPPER_OBJ_CD is ITM, IUS, USS, UST; and Prime if LIPPER_OBJ_CD is IMM or MM. Fund characteristics, such as investment objective, expense ratio, fees, and loads come from CRSP Mutual Funds – Summary file. Monthly returns and TNA come from CRSP Mutual Funds – Monthly Returns and Net Asset Values file. We calculated quarterly returns by cumulating monthly returns.

Figure 1 depicts the cumulative total net assets of all MMMFs and by the type of portfolio holdings over the sample period. While the level of TNA was relatively stable over the first two-thirds of the sample period, 2010-2018, all MMMF TNA experienced significant growth over the last one-third of the sample period, 2019-2023. This specific trend in MMMF TNA is related to changes in MMMF returns depicted in Figure 2. As MMMF net returns, linked to the Fed funds rate, increased after 2017, the MMMF TNA also increased. The growth was mainly driven by the Government & Treasury MMMFs, while Prime MMMFs experienced significant decline in TNA after the 2016 MMMF regulation affecting Prime MMMFs NAV volatility.

<Insert Figure 1 here>

<Insert Figure 2 here>

At the same time, the bank deposit rates, as shown in Figure 2, were stickier over the sample period even when the money market rates increased. As expected, due to pricing competition of non-perfect competitors in the face of MMMFs and bank deposits, when the deposit rates were above MMMF returns, bank deposits were larger in size than MMMF TNAs, as for the period of 2010-2018 (Figure 3). This inverse relation between the amount of investment in MMMFs and bank deposits is the most noticeable for MMDAs. After 2019, when money market rate increased while bank deposits' rates stagnated, MMDA cumulative deposits substantially decreased, while MMMF TNA increased, with the two products reaching the same size of about $5 billion in 2023.

<Insert Figure 3 here>

Figure 4 presents the trend in bank loans by type, C&I, CRE, RRE, and Consumer loans relative to the MMMF total net asset trend over the sample period. There is some indication of inverse relation between MMMF TNA and cumulative amount of RRE and CRE loans. An interesting observation is that there is a jump in C&I loans in second quarter of 2020, which reserved over about one year period. This jump is probably attributable to Covid-19 period government measures to support businesses.

<Insert Figure 4 here>

The main explanatory variable, aggregate quarterly MMMF flows (*MMMF flow*), is calculated in the following way. First, we calculate the flows at the fund level. Following Sirri and Tufano (1998), we define *fund_flow* in millions of dollars for fund *i* in quarter *t* as:

$$fund\_flow_{i,t} = TNA_{i,t} - \left(1 + r_{i,t}\right) * TNA_{i,t-1} \qquad (1)$$

where $TNA_{i,t}$ is fund *i*'s Total Net Assets (TNA) at the end of quarter *t*, $r_{i,t}$ is fund *i*'s cumulative return in quarter *t*. Then, we aggregate *fund_flow* across all MMMFs as a sum of all fund flow observations in quarter *t.* Finally, we scale aggregated fund flows to cumulative total net assets of MMMFs, creating variable *MMMF flow*.

To check for the sensitivity of flows to different MMMF characteristics, we calculate flows for different types of MMMFs separately. Specifically, we differentiate between MMMFs flows based on fund portfolio holdings (Tax-exempt/Government & Treasury/Prime), investors characteristics (institutional/retail), and fund size.

We also include two macroeconomic measures to account for changes in aggregate demand for deposits. Following Drechsler et al. (2017), Lin (2020), and Chen et al. (2022), we use lagged

fed funds rates and value-weighted quarterly market returns to control for opportunity costs of holding bank deposits.

To control for the demand of loans in the economy, we use the loan demand variable constructed from the Federal Reserve quarterly survey of banks' senior loan officers on their assessment of the demand for loans.[6] Change in loan demand is the net percentage of respondents, reporting stronger demand, i.e. (substantially stronger + moderately stronger) – (moderately weaker + substantially weaker). We use questions related to demand for different types of loans. These questions read (e.g., for C&I loans): "Apart from normal seasonal variation, how has demand for C&I loans changed over the past three months? (Please consider only funds actually disbursed as opposed to requests for new or increased lines of credit.)" There are 5 options to answer: substantially stronger, moderately stronger, about the same, moderately weaker, substantially weaker. We capture the changes in demand by calculating the net percentage of respondents reporting stronger demand. The value is positive if more banks are reporting stronger demand and negative if more banks are reporting weaker demand.

Table 1 provides summary statistics of the dependent, main explanatory and control variables. Table 2 reports the distribution of bank deposits, loans, and MMMF flows.

<Insert Table 1 here>

Our main dependent variable, Log difference of total deposits $Ln(Deposits_t/Deposits_{t-1})$, varies from -0.117 to 0.225, implying that in extreme cases banks experience a relatively sizeable quarterly decline or increase in total bank deposits that correspond to -11% and 25% of deposit quarterly growth rate. Nevertheless, the average change corresponds to a positive 1.3% of deposit quarterly growth rate (Table 1). While there is substantial cross-sectional variation in banks'

[6] The link to the survey: https://www.federalreserve.gov/data/sloos.htm

deposit composition, on average, Time Deposits represent the largest share of the bank deposits at 32.8% (with 27.4% of that number being FDIC-insured), followed by Demand deposits and MMDAs at about 19%, on average, finishing with Other Savings deposits at 17%, on average (Table 2). The sample banks are on average well-capitalized with a capital ratio of 11.3% and profitable with a quarterly return on assets of 0.2%.

Bank loans on average constitute about 63% of total assets, while 84.1% of the total assets are funded by deposits. About 5% of deposits consist of large (>$250,000) time deposits. The loan portfolios of the sample banks are of relatively good quality as the loan loss reserve ratios are on average 1.5% that vary from 0.3% to 5.5%. As Table 2 reports, CRE and RRE loans on average represent the majority of total bank loans at 44% and 42.6% respectively. C&I loans on average represent 13.8 % of total loans and consumer loans on average are only 5.4% of total loans.

Our main explanatory variable, *MMMF flow*, varies from -6.2% to 19.9%, with a mean of 1.1% of the aggregate net assets of money market mutual funds, indicating significant quarterly variation in outflows and inflows of funds in these products. Notably, as Table 2 presents, about 86% of dollar amount flows occur at retail MMMFs, while institutional MMMFs account for the remaining 14%. Most of the flows take place within taxable, Prime (mean of 246.9%) and Government & Treasury (mean of -153.1%), MMMFs rather than tax-exempt MMMFs (mean of 6.2%). Expectedly, MMMFs of larger size account for most of the flows.

<Insert Table 2 here>

5. Empirical analysis

5.1. Substitutability of Money market mutual fund and bank deposits

To test our first hypothesis on the substitutability of MMMF and bank deposits, we estimate the following baseline empirical model using ordinary least square (OLS) regression on panel data:

$$Ln(Deposit_{i,t}/Deposit_{i,t-1}) = \alpha + \beta_1 MMMFflow_t + \theta X_{i,t-1} + \delta Z_{t-1} + \varphi_i + \gamma_t + \varepsilon_{i,j,t}, \quad (2)$$

where dependent variable $Ln(Deposit_{i,t}/Deposit_{i,t-1})$ is a quarterly growth in deposit accounts of bank *i* in quarter *t*. The main explanatory variable is aggregate net flows to MMMFs, $MMMFflow_t$, in quarter *t*. $X_{i,t-1}$ are the bank-level characteristics, such as bank deposit implied rate, bank size, capital ratio, return on assets (*ROA*), loans-to-asset ratio, total deposits-to-assets ratio, large uninsured time deposits relative to total deposits (*Time deposits>$250k/Total deposits*), and loan loss reserves ratio (LLR). Z_{t-1} are market indicators, such as *FedFundsRate* and *MarketRet*. φ_i are bank fixed effects, and γ_t are quarter-year effects. In all regressions, the robust standard errors ($\varepsilon_{i,j,t}$) are clustered by bank. If MMMFs and bank deposits are substitutes, we expect β_1 to be negative, and, if they are complements, we expect β_1 to be positive.

Table 3 presents our main results of the test of substitution versus complementary effect between the flows to MMMF and bank deposits. We begin the analysis by considering growth of total deposits at a bank level. As shown in column (1), the aggregate MMMF flows have a strong negative effect on the growth of total deposits with a 7.6% decrease in total deposits per 100% increase in aggregate MMMF flows at less than 1% significance level. In columns (2) through (7), we analyze the MMMF flows' relation to types of bank deposits: MMDAs, Other Savings, Demand Deposits, Time Deposits, and Time Deposits categorized by FDIC-insured and FDIC-uninsured. We observe a robust negative relation with aggregate MMMF flows across all types of

bank deposits, with a marginally higher sensitivity of Other Savings (-14.2%) and MMDA (-10.4%) compared to Demand (-6.2%) and Time (-3.3%) deposits.

<Insert Table 3 here>

Regarding the control variables, not surprisingly, we observe that interest rates offered on bank deposits are the most important determinant of deposit flows. The coefficient on the implied deposit rate is positive and highly economically and statistically significant across all types of bank deposits, except Time Deposits, which is negative and highly significant. This inverse relation is consistent with the view that depositors may interpret a very high deposit rate as an indication of unobservable bank-level risk, which results in a backward bending supply curve for deposits at very high deposit rates (see, e.g., Karas et al., 2013). We also find that bank capitalization, profitability, loans-to-assets ratio, and the fraction of large time deposits in total deposits are in general positively related to the growth of bank deposits. In contrast, bank size, total deposits-to-assets ratio, and loan loss reserves ratio are negatively associated with the growth of total and all types of bank deposits. Finally, Fed funds rate and market returns have a negative relation with total deposits and different types of deposits, implying that depositors are aware of the opportunity costs of holding funds at a bank and tend to withdraw funds when these costs are higher. The only exception is Time Deposits, where depositors are constrained by a fixed time frame and are unable to promptly adjust to opportunity costs without forfeiting a portion of the return on these deposits.

Since MMMFs differ by their portfolio holdings and characteristics, we also examine the relation between MMMFs and bank deposits by type of MMMF. As discussed in section 2, there are three types of MMMFs based on their portfolio holdings: Tax-exempt, Prime and Government & Treasury. There are also two types of MMMFs based on investors' profile: Retail and Institutional. Table 4 presents the estimation results where we consider the flows to these types of

MMMFs separately. As can be seen in columns (1) and (2) of Table 4, both Retail and Institutional MMMFs appear to act as substitutes for total bank deposits and most of deposit types, with a greater sensitivity observed for Retail MMMFs. The only exception is growth of Time Deposits, which has a positive relation with Retail MMMFs' flows, suggesting that they may act as complements in this specific context. Furthermore, the observed substitution effect of all MMMFs and bank total deposits reported in Table 3 is primarily driven by the effect of Government & Treasury MMMFs, which have a positive relation with total deposits and all types of bank deposits, as reported in column (5) of Table 4. However, the flows to Tax-exempt (column (3)) and Prime MMMFs (column (4)) show a positive relation with the growth of total deposits and the growth of MMDAs, Other Savings, and Demand deposits at less than 1% significance level, indicating that they are complements, contrary to Government & Treasury MMMF effect. Time deposit relation with MMMF types is an exception again. While Time Deposits have the same relation with Prime and Government & Treasury MMMFs as other types of bank deposits, positive and negative, respectively, Tax-exempt MMMFs appear to act as substitutes for Time Deposits.

<Insert Table 4 here>

5.1.2. Estimations by MMMF and bank size

Our sample of money market mutual funds consists of about 1,000 funds of different sizes. Hence, it is reasonable to examine the sensitivity of MMMF and bank deposit substitution effect to the size of MMMFs. We categorize our sample of MMMFs into three groups: small, medium, and large funds, where size is defined by funds' total net assets distribution quartiles. Small funds are the funds in the bottom quartile with net assets less than $24 million, while large funds are in the top quartile with net assets exceeding $1 billion. Medium-sized funds encompass the remaining

funds with assets ranging between $24 million and $1 billion. We then calculate the flows in each of these size categories separately and normalize them by the aggregate net assets in each size group. Table 5 reports the results of these estimations. We find that across all sizes of MMMFs – small, medium, and large, the relation remains negative for total deposits. In column (4) of Table 5, we include the flows of small and large funds in the same model (excluding medium-sized funds) and find that the growth in bank deposits is most sensitive to the flows of large MMMFs, while flows of small MMMFs, although still negative, albeit marginal effect on deposit growth. We conduct the same analysis by type of bank deposits: MMDA, Other Savings, Demand and Time Deposits, columns (5), (6), (7) and (8), respectively. We observe the same relations as for total deposits' growth in the cases of MMDAs and Other Savings deposits. However, the growth in Demand Deposits shows a positive relation with large MMMFs' flows, implying that there may be different dynamics for this type of deposits and large MMMFs, given their flexibility and relatively low interest rates. The growth in Time Deposits displays a positive relation with small MMMFs' flows but the magnitude of this effect is extremely small.

<Insert Table 5 here>

The relation between MMMF flows and deposit growth may also depend on bank size as smaller banks are expected to be more constrained in funding sources and be more deposits dependent. Hence, we further assess the sensitivity of our results to the role of different bank sizes. In Table 6, we re-estimate our baseline model from Table 3 for three distinct groups of banks: small, medium, and large. Medium banks are defined as those with total assets ranging between $0.5 billion and $2 billion, while small and large banks are defined as those with less than $0.5 billion and over $2 billion in assets, respectively. The negative relation between MMMF flows and the growth in total deposits is evident across banks of all sizes: small (column (1)), medium

(column (2), and large (column (3)) and significant at less than 1% level. Medium banks appear to be the most sensitive to this relation, followed by small and large banks.

Larger banks typically have access to alternative funding sources besides deposits and may be more inclined to forgo certain types of deposits if they can be replaced with other funding sources. Therefore, we further analyze the sample of large banks by type of deposits. Columns (4) and (5) of Table 6 show that large banks' MMDAs and Other Savings deposits exhibit substitutability with aggregate MMMF flows. However, column (6) indicates that the growth of Demand Deposits in large banks has a positive relation with MMMF flows, while column (7) reveals that the growth of Time Deposits in large banks shows no significant relation with flows to MMMFs.

<Insert Table 6 here>

We also dissect the MMMF – bank deposit relation by bank size and by type of MMMFs in Table 7. The results reported in Table 6 persist for Retail MMMFs (Panel A) and Institutional MMMFs (Panel B) within a sample of small, medium, and large banks' total deposits, as well as the large banks' MMDAs and Other Savings deposits. Notably, there is a higher sensitivity to Retail MMMFs' flows compared to Institutional ones. Large banks' Demand Deposits appear to act as complements to Institutional MMMFs but remain independent to Retail MMMFs. Conversely, large banks Time Deposits act as substitutes to Institutional MMMFs but as complements to Retail MMMFs. The results by bank size are influenced by the type of MMMF portfolio holdings. For Government & Treasury MMMFs (Panel E), they are substitutes to total deposits across banks of all sizes and for large banks MMDAs, Other Savings, and Time Deposits. However, they function as complements to large banks Demand Deposits. Conversely, the findings for Tax-exempt MMMFs (Panel C) and Prime MMMFs (Panel D) show the opposite effect to

Government & Treasury MMMFs. Both Tax-exempt and Prime MMMFs act as complements to total deposits for banks of all sizes and to large banks MMDA, Savings, and Demand Deposits. However, while Tax-exempt MMMFs are substitutes, Prime MMMFs are complements to large banks Time Deposits.

<Insert Table 7 here>

5.2. MMMF flows and bank lending

To test our second hypothesis on the effect of substitutability of MMMF and bank deposits on bank lending, we estimate the following baseline empirical model using ordinary least square (OLS) regression on panel data:

$$Ln(Loan_{i,t}/Loan_{i,t-1}) = \alpha + \beta_1 MMMFflow_{t-1} + \theta X_{i,t-1} + \delta Z_{t-1} + \varphi_i + \gamma_t + \varepsilon_{i,j,t}, \quad (3)$$

where dependent variable $Ln(Loan_{i,t}/Loan_{i,t-1})$ is a quarterly growth in loan accounts of bank *i* in quarter *t*. The main explanatory variable is the lagged aggregate net flows to MMMFs, $MMMFflow_{t-1}$, in quarter *t-1*. $X_{i,t-1}$ are the bank-level characteristics, such as bank size, capital ratio, return on assets (*ROA*), loans-to-asset ratio, total deposits-to-assets ratio, large uninsured time deposits relative to total deposits (*Time deposits>$250k/Total deposits*), and loan loss reserves ratio (LLR). Z_{t-1} are market indicators, such as *FedFundsRate* and *MarketRet*, and change in loan demand.[7] φ_i are bank fixed effects, and γ_t are quarter-year effects. In all regressions, the robust standard errors ($\varepsilon_{i,j,t}$) are clustered by bank. If MMMFs and bank deposits are substitutes, we expect β_1 to be negative as reduction in deposits due to positive MMMF flows correlates with reduction in loans, and if MMMFs and bank deposits are complements, we expect

[7] Change in loan demand is the net percentage of respondents to the quarterly Federal Reserve survey, reporting stronger demand, i.e. (substantially stronger + moderately stronger) – (moderately weaker + substantially weaker).

β_1 to be positive, as increase in deposits due to positive MMMF flows correlates with increase in loans through the demand channel described and modeled by Drechsler et al. (2017).

Table 8 presents the main model results. The lagged aggregate MMMF flows are negatively related to the growth of Commercial Real Estate, Residential Real Estate and Consumer loans. The finding is consistent with the deposit channel mechanism described by the theoretical model of Drechsler et al. (2017), supporting our argument that the MMMFs and bank deposits act as substitutes, resulting in inverse effect of MMMF flows on bank lending. These results are both economically and statistically significant. The economic effect is in the range from 2.4% to 4.9% decrease in loans per 100% increase in aggregate MMMF flows. The exception to this trend is the positive and significant results for Commercial and Industrial loans. However, this result seems to be driven by Covid-19 period, during which state-imposed polices (such as Paycheck Protection Program (PPP)) boosted C&I lending by commercial loans. In unreported robustness test, we observe no significant relation between MMMF flows and growth of C&I loans in the sample period prior to 2020.

<Insert Table 8 here>

Continuing our analysis of the MMMF – bank lending relation, we investigate the effect of MMMF characteristics on this dynamic, considering investors' types and portfolio holdings (Table 9), as well as by bank size (Tables 10 and 11). Consistent with the findings reported in section 5.1., we observe that the relation between MMMF flows and bank loan growth depends on whether MMMFs and bank deposits act as substitutes or complements. Specifically, the lagged flows of Government & Treasury MMMFs have a negative relation with CRE, RRE, and Consumer loans due to their substitutability with bank deposits, as seen in column (5) of Table 9. In contrast, the lagged flows of Prime (column (4)) and Tax-exempt (column (5)) MMMFs show

a positive relation with these loans reflecting their complementarity with bank deposits. Further differentiation based on investor type reveals that the lagged flows of Retail MMMFs demonstrate a negative relation with CRE, RRE, and Consumer loans' growth, while those of Institutional MMMFs have a negative relation with CRE and RRE loans' growth but a positive relation with Consumer loans' growth. Similar to finding in Table 8, C&I loans once again present an exception (Panel A), showing a contrary relation with MMMF flows, which differs from all other loan types, potentially influenced by Covid-19 lending policies, such as the Paycheck Protection Program (PPP) loans.

<Insert Table 9 here>

Table 10 reports the results of the analyses of lagged aggregate MMMF flows and bank loans by bank size: small & medium (odd columns) and large (even columns). The findings suggest that only loans of small and medium banks are affected by the impact of MMMFs flows on bank deposits. While loans of large banks have a negative relation with lagged MMMF flows, this relation is statistically insignificant. The C&I loans are an exception, as in the findings above, and exhibit a positive relation with the lagged MMMF flows across all bank sizes.

<Insert Table 10 here>

Additionally, akin to our analysis of bank deposits, we refine our sample by categorizing MMMFs based on investors (Retail and Institutional) and portfolio holdings (Tax-exempt, Prime, and Government & Treasury), as well as by bank size (small & medium versus large). These results, presented in Table 11, reveal significant heterogeneity in the relation between MMMFs and bank loans across these dimensions. Focusing on CRE, RRE, and Consumer loans, we find that Government & Treasury MMMFs, which drive the substitution relation with bank deposits as discussed in section 5.1, pose a primary threat to bank funding, resulting in reduced lending across

banks of all sizes. This effect is more pronounced for CRE and RRE loans of small and medium banks in comparison to large banks, whereas the opposite magnitude effect is observed for Consumer loans, indicating that Consumer loans of large banks are more sensitive to the availability of bank deposits than those of small and medium banks. The magnitude of the positive relation between Tax-exempt and Prime MMMFs and CRE and RRE loans is greater for large banks than for small and medium banks. The opposite is observed for Consumer loans. Moreover, large banks' CRE and RRE loans are less sensitive, or insensitive, to the lagged Retail and Institutional MMMF flows compared to those of small and medium banks. Additionally, large banks' Consumer loans are more sensitive to the negative effect of lagged flows of Retail MMMFs and the positive effect of lagged flows of Institutional MMMFs than those of small and medium banks.

<Insert Table 11 here>

6. Regulatory changes and additional tests

6.1. Money market mutual fund and bank deposit/loans and regulations

Prior to October 2008, investors viewed MMMFs as low-risk, short-term, highly liquid investments similar to bank deposits, despite lacking explicit government guarantees or insurance. The fallout from the MMMF run in September 2008, however, prompted intervention by the Treasury Department and the Federal Reserve aimed at halting the runs. The SEC regulation fully implemented in 2016 required Prime MMMFs to use a daily floating NAV based on the market price of underlying securities, departing from the prior amortization method and $1 NAV reporting. The rule aimed to enhance transparency, stability, and liquidity during crises. Consequently, investors now face increased volatility and decreased liquidity in Prime MMMFs

compared to money market bank accounts, making these MMMFs less attractive for a given yield. We examine the effect of the MMMF regulation of 2014 and its implementation in 2016, which targeted NAV reporting for Prime MMMF and show that the regulation has changed the role of Prime and Government & Treasury MMMFs for investors. As depicted in Figure 1, the total net assets size has switched between Prime and Government & Treasury MMMFs in 2016, the time of the regulation implementation. Investors withdraw their money from Prime MMMFs and put them into Government & Treasury MMMFs as the former ones became more volatile due to new NAV accounting for the funds being based on fair market value of holdings instead of being amortized and being steady at $1 before the regulation. We, therefore, re-estimate the main models specified in equations (2) and (3) by sub-periods, before and after 2016. We also perform the analysis using the following modified baseline empirical models of eq. (2) and (3) by adding dummy variables for the regulation announcement in 2014 and regulation implementation in 2016 and their interaction terms with these dummies, using ordinary least square (OLS) regression on panel data:

$$Ln(Deposit_{i,t}/Deposit_{i,t-1}) = \alpha + \beta_1 MMMFflow_t + \beta_2 2016 + \beta_3 2016 \times MMMFflow_t + \theta X_{i,t-1} + \delta Z_{t-1} + \varphi_i + \gamma_t + \varepsilon_{i,j,t}, \quad (5)$$

$$Ln(Loan_{i,t}/Loan_{i,t-1}) = \alpha + \beta_1 MMMFflow_{t-1} + \beta_2 2016 + \beta_3 2016 \times MMMFflow_{t-1} + \theta X_{i,t-1} + \delta Z_{t-1} + \varphi_i + \gamma_t + \varepsilon_{i,j,t}, \quad (6)$$

where dependent variables are $Ln(Deposit_{i,t}/Deposit_{i,t-1})$ and $Ln(Loan_{i,t}/Loan_{i,t-1})$, which are a quarterly growth in deposits and loan accounts of bank *i* in quarter *t,* correspondingly. The main explanatory variable is aggregate net flows to MMMFs, $MMMFflow_t$, in quarter *t* in eq (5) and lagged aggregate net flows to MMMFs, $MMMFflow_{t-1}$, in quarter *t-1* in eq (6). $X_{i,t-1}$ are the bank-level characteristics, such as bank deposit implied rate (in case of deposits growth

regressions), bank size, capital ratio, return on assets (*ROA*), loans-to-asset ratio, total deposits-to-assets ratio, large uninsured time deposits relative to total deposits (*Time deposits>$250k/Total deposits*), and loan loss reserves ratio (LLR). Z_{t-1} are market indicators, such as *FedFundsRate* and *MarketRet*, and change in loan demand (eq (6) only). φ_i are bank fixed effects, and γ_t are quarter-year effects. In all regressions, the robust standard errors ($\varepsilon_{i,j,t}$) are clustered by bank.

Tables 12 and 13 report the findings of this analysis. Table 12 illustrates that, before 2016, Prime MMMFs were substitutes to bank deposits and Government & Treasury MMMFs were complements to bank deposits (columns (1) and (2)). This relation has flipped after the regime shift post 2016 (columns (3) and (4)). The announcement of the regulation in 2014 did not influence the relation of Prime MMMFs and bank deposits but increased the substitutability of Government & Treasury MMMFs and bank deposits (columns (5) and (6)). The implementation of the regulation in 2016 increased flows to bank deposits in general but made Government & Treasury MMMFs more substitutes, while Prime MMMFs more complements to bank deposits (columns (7) and (8)).

<Insert Table 12 here>

Table 13 report the results of the effect of MMMF regulation on the link between MMMF flows and bank loans. The implementation of the regulation increased the positive relation of Prime MMMF lagged flows and CRE and RRE loans, through enhanced complementarity of Prime MMFMs with bank deposits. Conversely, the regulation's implementation intensified the negative relation between Government & Treasury MMMF flow and RRE loans, through enhanced substitutability of Government & Treasury MMMF and bank deposits. The opposite effect from regulation change is observed for Consumer and C&I loans, which have more negative relation

with Prime MMMFs' flows and more positive relation with Government & Treasury MMMFs' flows after the regulatory shift.

<Insert Table 13 here>

7. Conclusion

Introduced in 1971, money market mutual funds emerged as an alternative to traditional bank savings accounts, which were constrained by interest rate regulations at the time. This competition prompted a relaxation of bank regulations on interest rates and the inception of money market bank deposit accounts in 1983. While both products cater to investors seeking low-risk, cash-like investments, they differ significantly in risk and corresponding returns. Bank deposits are typically considered risk-free up to FDIC insurance limits, whereas MMMFs can fluctuate in value. Historically, both banks and MMMFs have faced deposit runs, but the equity structure of MMMFs, particularly with the 2016 floating NAV rule, mitigates the speed of potential runs compared to banks (Ma et al., 2022). Whether investors perceive these products as substitutes is a matter for empirical investigation.

Analyzing a dataset of 7,573 U.S. commercial banks, we investigate how aggregate flows into MMMFs affect the growth of individual banks' deposits. Our findings reveal a negative relation between MMMF flows and the growth of total bank deposits, including various types such as MMDAs, Other Savings, Demand, and Time Deposits (both FDIC-insured and uninsured), indicating their substitutability. However, this substitution is not uniform across all MMMFs; certain types exhibit strong substitution effects with specific bank deposit accounts, while others appear to complement them. Particularly, Government & Treasury MMMFs drive the negative relation with bank deposits' growth, while Tax-exempt and Prime MMMFs show a positive

correlation, suggesting complementarity. Furthermore, this relation remains consistent across all sizes of MMMFs, with larger MMMFs exerting the most significant impact. Bank size also plays a role, with larger banks' deposits being less sensitive to the substitution effect of MMMF flows.

We further investigate whether the effect of MMMF flows on deposits translates into bank lending activities. If banks can easily replace deposit funding with alternative sources, lending activities may remain unaffected. However, we find that the substitutability of MMMFs for deposits results in a negative relation between MMMF flows and bank lending. Lagged aggregate MMMF flows negatively correlate with the growth of commercial real estate, residential real estate, and consumer loans. Aligned with the impact on bank deposits, different MMMF types have varying effects on bank lending. Specifically, Government & Treasury MMMFs show negative relations, while tax-exempt and prime MMMFs show positive ones with CRE, RRE, and consumer loans. Retail and institutional MMMF flows negatively affect CRE and RRE loans, while only retail flows negatively impact consumer loans. This effect on bank lending is predominantly observed in small and medium banks (< $2 billion in total assets). Nevertheless, the negative relation with Government & Treasury MMMF flows and the positive relation with tax-exempt and prime MMMF flows exist across all bank sizes.

Our analysis indicates that the MMMF regulation of 2014, enforced in 2016 with floating NAV requirements for Prime MMMFs, has intensified the substitution effect between non-prime MMMFs and bank deposits, and deepened a negative relation between non-prime MMMF flow and bank loans. This regulatory change has also reshaped the dynamics between Prime and Government & Treasury MMMFs.

Overall, these findings carry significant implications for bank operations. The bank run of 2023 demonstrated that investors swiftly respond to perceived or actual risks of bank failure by

withdrawing deposits. Unlike past runs, which often involved cash movement to the largest and safest banks, recent runs have taken the form of cross-product shifts to competing financial instruments like money market mutual funds. The degree of sensitivity of bank deposits to MMMF flows emerges as a crucial factor in determining bank capital requirements and systemic risk, warranting further investigation in subsequent studies.

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Appendix A Variable Definition

Variable Name	*Description*
Bank deposits	
Total Deposits' growth rate	Log of the ratio of total deposits in quarter t to total deposits in quarter t-1
MMDA growth rate	Log of the ratio of MMDA in quarter t to MMDA in quarter t-1
Savings deposits' growth rate	Log of the ratio of Savings deposits in quarter t to Savings deposits in quarter t-1
Demand deposits' growth rate	Log of the ratio of Demand deposits in quarter t to Demand deposits in quarter t-1
Time deposits' growth rate	Log of the ratio of Time deposits in quarter t to Time deposits in quarter t-1
Bank loans characteristics:	
Bank loan growth rate	Log of the ratio of bank loans in quarter t to bank loans in quarter t-1(by loan type)
Total loans ('000 USD)	Total loans held for investment and for sale
C&I loans ('000 USD)	Commercial and industrial loans
CRE loans ('000 USD)	Commercial real estate loans (includes: 1–4 family residential construction loans; Other construction loans and all land development and other land loans; Loans secured by owner-occupied nonfarm nonresidential properties; Loans secured by other nonfarm nonresidential properties; loans secured by farmland; Secured by multifamily (5 or more) residential properties)
RRE loans ('000 USD)	Residential real estate loans (includes: Revolving, open-end loans secured by 1–4 family residential properties and extended under lines of credit; Closed-end loans secured by 1–4 family residential properties secured by first liens and by junior liens)
Consumer loans ('000 USD)	Consumer loans are loans to individuals for household, family, and other personal expenditures (includes: credit cards; other revolving credit plans; automobile loans; and other consumer loans)
MMMF	
MMMF total flow	Aggregate of fund flow ($TNA_{i,t} - (1 + r_{i,t}) * TNA_{i,t-1}$), scaled by cumulative TNA_t of all MMMFs
Tax-Exempt MMMF flow	Scaled aggregate fund flow of all tax-exempt MMMFs
Prime MMMF flow	Scaled aggregate fund flow of all prime MMMFs
Govt&Treasury MMMF flow	Scaled aggregate fund flow of all government & Treasury MMMFs
Retail MMMF flow	Scaled aggregate fund flow of all retail MMMFs
Institutional MMMF flow	Scaled aggregate fund flow of all institutional MMMFs
Bank-level controls:	
Implicit total deposit rate	Interest expenses on deposits/Total deposits
Implicit MMDA rate	(Interest expenses on total savings deposits*MMDA/total savings deposits)/MMDA
Implicit savings dep rate	(Interest expenses on total savings deposits*Other savings deposits/total savings deposits)/Other savings deposits
Implicit demand dep rate	Interest expenses on transaction accounts/Total demand deposits
Implicit time dep rate	Interest expenses on time deposits/Total time deposits
Capital ratio	Total bank equity capital/Total assets
ROA	Net income/Total assets
Loans/Assets	Total loans/Total assets
Total deposits/Assets	Total deposits/Total assets
Time deposits>$250k/Total deposits	Time deposits >$250k/Total deposits
LLR ratio	Allowance for loan losses/Total loans
Macroeconomic controls:	
Loan Demand	change in loan demand as net percentage of respondents reporting stronger demand, i.e. (substantially stronger + moderately stronger) – (moderately weaker + substantially weaker).
FedFunds rate	Quarterly average of monthly Federal funds effective rate
Market return	Quarterly average of monthly S&P500 index return

Figure 1. Money Market Mutual Funds Net Assets

The figure presents cumulative MMMF total net assets by type of MMMF: Tax-exempt, Prime and Government & Treasury.

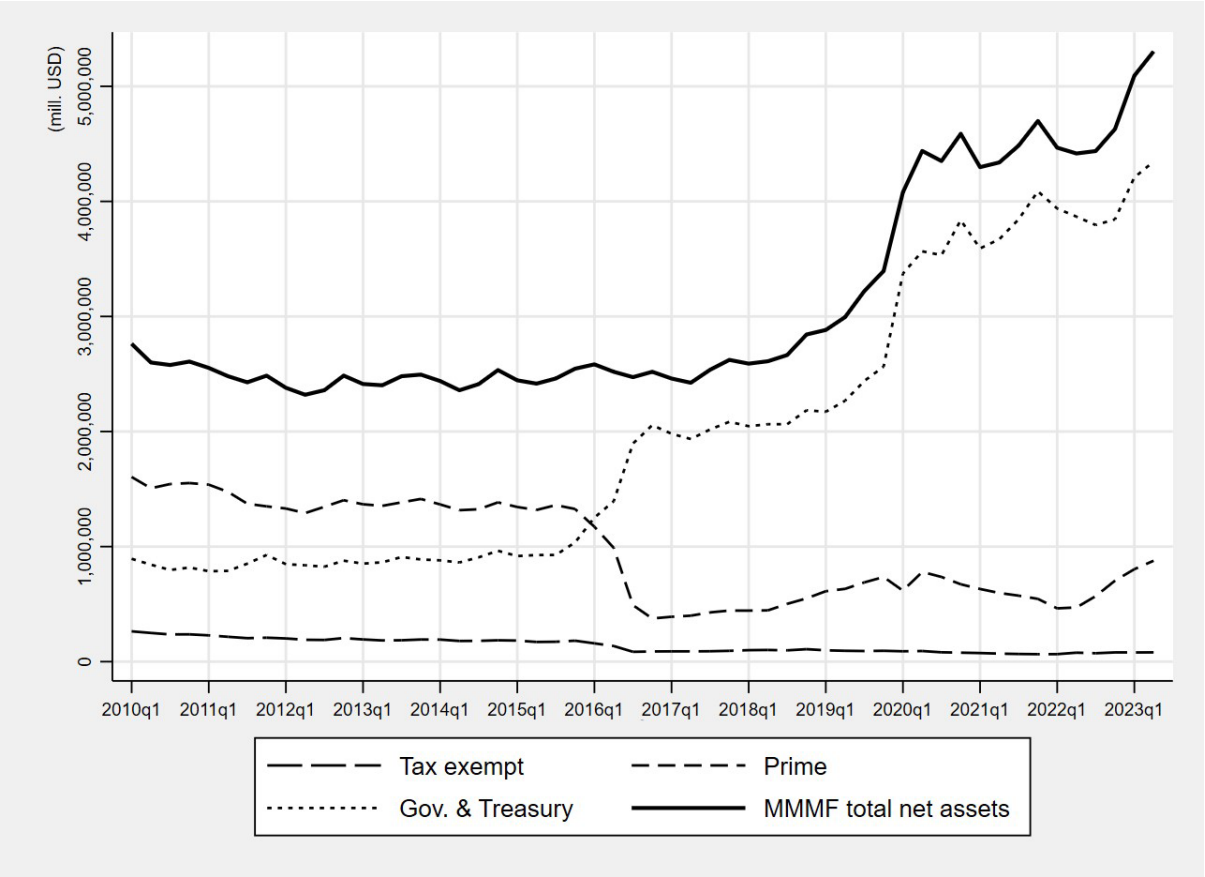

Figure 2. Average deposit rates and MMMF net return

The figure presents annualized implied deposit rates and MMMF net return.

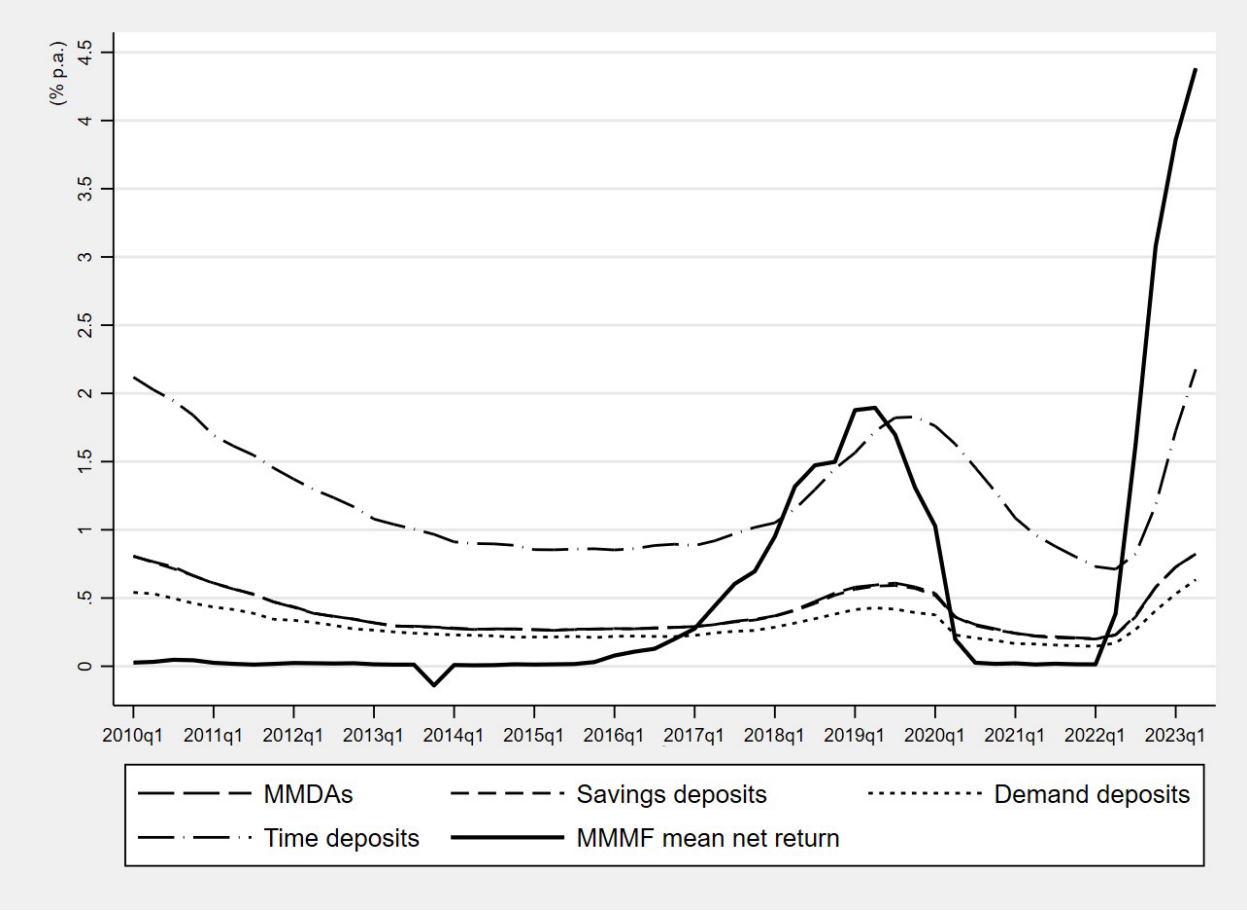

Figure 3. Bank deposits and MMMF total net assets
The figure presents cumulative bank deposits by type and MMMF total net assets in our sample.

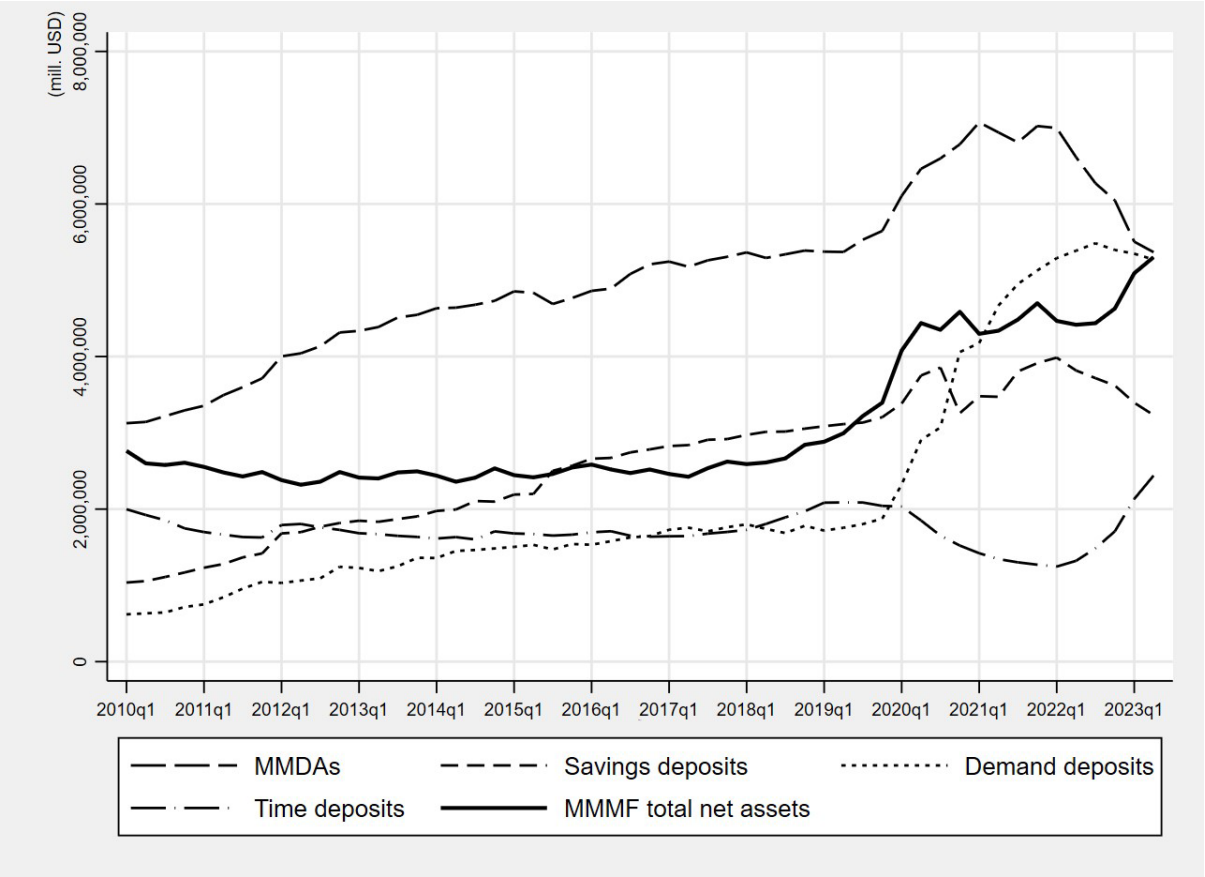

Figure 4. Bank loans and MMMF total net assets

The figure presents cumulative bank loans by type and MMMF total net assets in our sample.

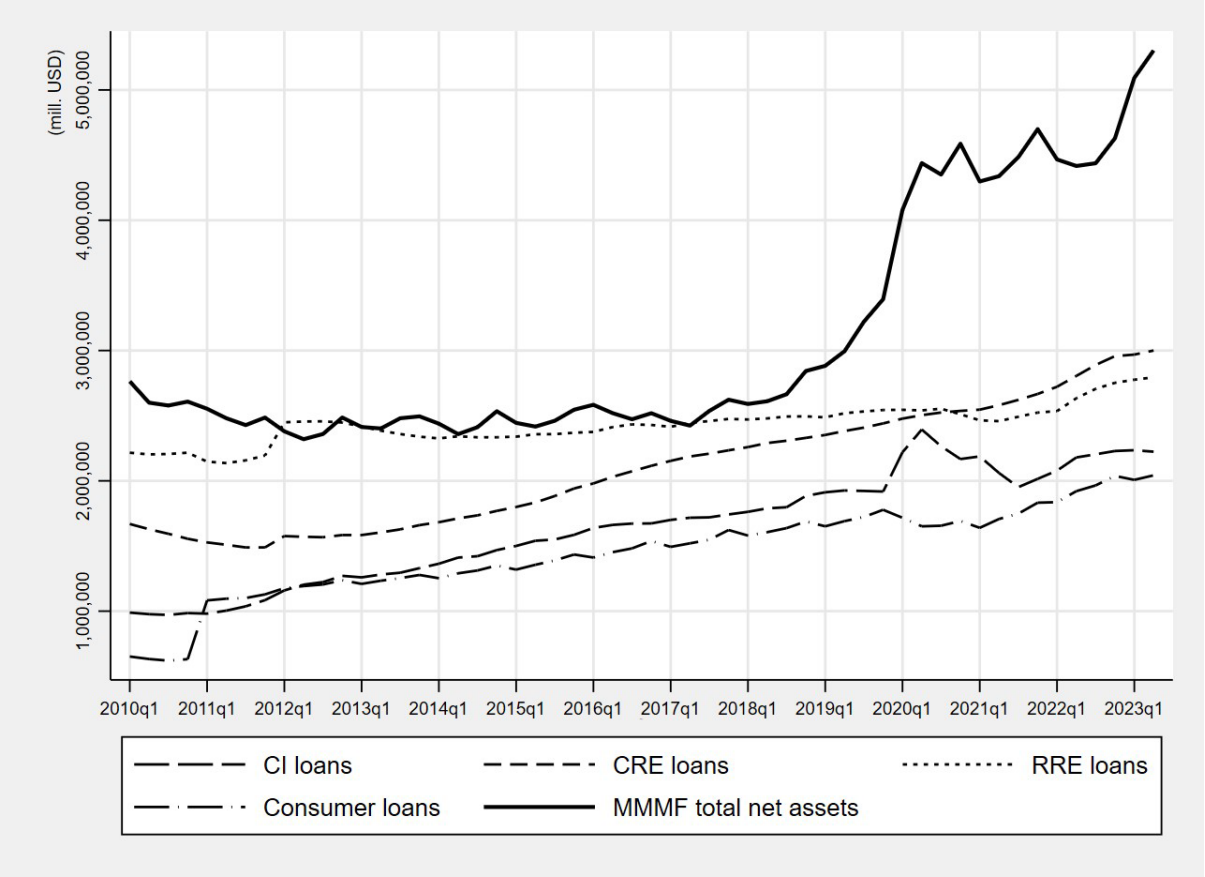

Table 1. Summary statistics

The table reports descriptive statistics of the dependent variables measuring bank deposit and loans: total deposits, money market deposit accounts (MMDA) flow, other savings deposit flow, time deposit flow with less than 100 thousand, between 100 and 250 thousand, and more than 250 thousand dollars, all scaled by bank total assets (TA); main explanatory variable – MMMF flow; bank level characteristics: MMDA implied rate, savings deposits implied rate, time deposits rate, bank size (Ln(total assets)), capital ratio (equity/assets), return on assets (ROA), loans to assets ratio, total deposits to assets ratio, time deposits above $250K to total deposits, and loan loss reserve ratio (LLR); and macroeconomic variables: Fed fund rate and Market return.

	N	Mean	SD	Min	p25	p50	p75	Max
Bank deposits:								
Log difference of total deposits	290,158	0.013	0.045	-0.117	-0.013	0.009	0.035	0.225
Log difference of demand deposits	283,699	0.028	0.132	-0.532	-0.040	0.021	0.087	0.723
Log difference of MMDAs	273,150	0.017	0.111	-0.423	-0.038	0.011	0.066	0.545
Log difference of other savings deposits	281,587	0.022	0.075	-0.307	-0.016	0.016	0.053	0.473
Log difference of time deposits	287,046	-0.001	0.071	-0.210	-0.033	-0.010	0.016	0.673
Log difference of time deposits <$250k	286,578	-0.006	0.066	-0.219	-0.034	-0.013	0.010	0.565
Log difference of time deposits>$250k	272,136	0.012	0.178	-0.736	-0.047	0.002	0.061	0.874
Bank loans:								
Log difference of CI loans	273,425	0.010	0.130	-0.479	-0.051	0.004	0.064	0.660
Log difference of CRE loans	281,759	0.013	0.072	-0.260	-0.022	0.006	0.042	0.398
Log difference of RRE loans	283,871	0.012	0.054	-0.173	-0.016	0.007	0.035	0.288
Log difference of consumer loans	273,237	0.014	0.182	-0.562	-0.047	-0.005	0.040	2.194
MMMF flows:								
MMMF flow/TNA	290,158	0.011	0.042	-0.062	-0.019	0.009	0.035	0.199
Retail MMMF flow/TNA	290,158	0.011	0.042	-0.102	-0.020	0.006	0.034	0.132
Institutional MMMF flow/TNA	290,158	0.011	0.048	-0.071	-0.022	0.007	0.041	0.233
Tax-exempt MMMF flow/TNA	290,158	-0.016	0.062	-0.234	-0.054	-0.015	0.016	0.190
Prime MMMF flow/TNA	290,158	0.0003	0.096	-0.424	-0.032	-0.004	0.044	0.229
Gov. & Treasury MMMF flow/TNA	290,158	0.026	0.072	-0.085	-0.019	0.017	0.055	0.313
Bank-level controls:								
Implicit total deposit rate	290,158	0.002	0.001	0.000	0.001	0.001	0.002	0.005
Implicit MMDA rate	270,396	0.001	0.001	0.000	0.000	0.001	0.001	0.005
Implicit savings dep rate	278,958	0.001	0.001	0.000	0.000	0.001	0.001	0.005
Implicit demand dep rate	282,996	0.001	0.001	0.000	0.000	0.000	0.001	0.010
Implicit time dep rate	287,317	0.003	0.001	0.000	0.002	0.003	0.004	0.007
Ln (Total assets)	290,158	12.379	1.396	8.004	11.470	12.212	13.069	21.969
Capital ratio	290,158	0.113	0.035	0.041	0.092	0.105	0.124	0.764
ROA	290,158	0.002	0.002	-0.010	0.001	0.002	0.003	0.017
Loans/Assets	290,158	0.626	0.156	0.006	0.529	0.649	0.745	0.904
Total deposits/Assets	290,158	0.841	0.063	0.001	0.813	0.855	0.885	0.939
Time deposits>$250k/Total deposits	290,158	0.054	0.050	0.000	0.021	0.041	0.072	1.000
LLR ratio	290,158	0.015	0.007	0.003	0.010	0.013	0.018	0.055
Macroeconomic controls:								
FedFunds rate	54	0.008	0.011	0.001	0.001	0.002	0.012	0.050
Market return	54	0.009	0.026	-0.070	0.001	0.014	0.027	0.064
Demand for CI loans	54	0.001	0.176	-0.556	-0.111	0.007	0.139	0.310
Demand for CRE loans	54	0.038	0.265	-0.712	-0.079	0.055	0.225	0.479
Demand for RRE loans	54	-0.014	0.296	-0.879	-0.177	-0.019	0.220	0.525
Demand for consumer loans	54	0.011	0.139	-0.523	-0.056	0.045	0.101	0.231

Table 2. Distribution of bank deposits, loans, and MMMF flows

The table reports descriptive statistics of the dependent variables measuring bank deposit and loans and main explanatory variables of MMMF.

	N	Mean	SD	Min	p25	p50	p75	Max
Bank deposits characteristics:								
Total deposits (mill USD)	290,158	1,996	33,100	2	82	172	403	2,200,000
Demand deposits (mill USD)	290,158	367	8,581	0	13	27	61	990,000
MMDAs (mill USD)	290,158	838	14,300	0	7	24	76	1,020,000
Other savings deposits (mill USD)	290,158	447	11,000	0	7	18	60	1,160,000
Time deposits (mill USD)	290,158	267	2,514	0	25	51	116	205,000
Time deposits <$250k (mill USD)	290,158	189	1,581	0	20	42	93	119,000
Time deposits >$250k (mill USD)	290,158	79	1,249	0	3	8	21	104,000
Demand dep/Total deposits	290,158	0.189	0.123	0.000	0.098	0.173	0.254	1.000
MMDA/Total deposits	290,158	0.186	0.154	0.000	0.076	0.153	0.253	1.000
Other savings dep/Total deposits	290,158	0.170	0.146	0.000	0.072	0.128	0.221	1.000
Time dep/Total deposits	290,158	0.328	0.160	0.000	0.209	0.314	0.431	1.000
Time dep <$250k/Total deposits	290,158	0.274	0.147	0.000	0.164	0.258	0.367	1.000
Time dep >$250k/Total deposits	290,158	0.054	0.050	0.000	0.021	0.041	0.072	1.000
Bank loans characteristics:								
Total loans (mill USD)	290,158	1,441	20,500	0.208	55	127	317	1,190,000
C&I loans (mill USD)	273,425	94	817	0.001	5	14	38	115,000
CRE loans (mill USD)	281,759	282	2,253	0.002	10	36	117	125,000
RRE loans (mill USD)	283,871	505	7,697	0.003	23	53	128	390,000
Consumer loans (mill USD)	273,237	228	4,197	0.001	1	3	9	255,000
C&I loans/Total loans	276,797	0.138	0.099	0.000	0.072	0.117	0.179	0.999
CRE loans/Total loans	283,270	0.426	0.173	0.000	0.309	0.428	0.543	1.000
RRE loans/Total loans	282,392	0.440	0.192	0.000	0.306	0.421	0.551	1.000
Consumer loans/Total loans	273,237	0.054	0.082	0.000	0.011	0.030	0.066	1.000
MMMF characteristics:								
Retail MF flow/Total flow	290,158	0.859	6.115	-3.161	0.049	0.252	0.416	51.089
Institutional MF flow/Total flow	290,158	0.141	6.115	-50.089	0.584	0.748	0.951	4.161
Tax-exempt MF flow/Total flow	290,158	0.062	0.752	-4.361	-0.007	0.047	0.123	1.988
Prime MF flow/Total flow	290,158	2.469	10.721	-2.513	0.139	0.416	0.864	84.823
Gov. & Treasury flow/Total flow	290,158	-1.531	10.332	-79.462	-0.042	0.465	0.783	3.434
Small MF flow/Total flow	290,158	0.011	0.194	-0.648	-0.007	0.000	0.012	0.891
Medium MF flow/Total flow	290,158	-0.146	2.085	-16.062	-0.046	0.028	0.119	4.523
Large MF flow/Total flow	290,158	1.136	2.206	-3.984	0.853	0.978	1.049	17.640

Tabel 3 MMMF flows and bank deposits

The table reports the results of fixed-effects OLS regressions of bank deposits' growth on aggregate MMMF flow scaled by TNA. The dependent variable: Total Deposits, TD ($Ln(TD_t/TD_{t-1})$ (1), Money Markert Deposit Account, MMDA ($Ln(MMDA_t/ MMDA_{t-1})$ (2), Savings Deposits, SavingsD $Ln(SavingsD_t/ SavingsD_{t-1})$ (3), Demand Deposits, DemandD $Ln(DemandD_t/ DemandD_{t-1})$ (4) Time Deposits, TimeD $Ln(TimeD_t/TimeD_{t-1})$ (5), and FDIC insured and uninsured Time Deposits, TimeD<$250k $Ln(TimeD<250k_t/ TimeD<250k_{t-1})$ and TimeD>$250k $Ln(TimeD>250k_t/TimeD>250k_{t-1})$, (6) and (7), correspondingly. Other control variables are as specified in section 4. The OLS models control for quarter, year, and bank fixed effects; robust standard errors are clustered by bank and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable:	$Ln(TD_t/D_{t-1})$	$Ln(MMDA_t/ MMDA_{t-1})$	$Ln(SavingsD_t/ SavingsD_{t-1})$	$Ln(DemandD_t/ DemandD_{t-1})$	$Ln(TimeD_t/ TimeD_{t-1})$	$Ln(TimeD<250k_t/ TimeD<250k_{t-1})$	$Ln(TimeD>250k_t/ TimeD>250k_{t-1})$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MMMF flow	-0.076***	-0.104***	-0.142***	-0.062***	-0.033***	-0.025***	-0.052***
	(0.003)	(0.009)	(0.005)	(0.009)	(0.006)	(0.005)	(0.013)
Implicit dep rate	4.272***	6.058***	2.834***	11.455***	-4.711***	-4.519***	-3.572***
	(0.305)	(0.578)	(0.413)	(0.439)	(0.326)	(0.308)	(0.662)
Bank size	-0.020***	-0.015***	-0.013***	-0.032***	-0.005***	-0.006***	-0.021***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Capital ratio	0.151***	0.115***	0.027**	0.219***	-0.027	-0.010	-0.085**
	(0.014)	(0.020)	(0.014)	(0.024)	(0.018)	(0.016)	(0.033)
ROA	0.327***	0.119	0.003	0.013	0.264**	0.082	0.733***
	(0.076)	(0.175)	(0.112)	(0.186)	(0.119)	(0.113)	(0.269)
Loans/Assets	0.084***	0.065***	0.016***	0.112***	0.089***	0.074***	0.113***
	(0.002)	(0.004)	(0.003)	(0.005)	(0.003)	(0.003)	(0.007)
TD/Assets	-0.187***	-0.172***	-0.051***	-0.205***	-0.195***	-0.156***	-0.241***
	(0.005)	(0.010)	(0.007)	(0.010)	(0.008)	(0.008)	(0.016)
TimeD>$250k/TD	-0.002	0.130***	0.061***	0.146***	-0.197***	0.089***	-1.044***
	(0.005)	(0.010)	(0.007)	(0.011)	(0.009)	(0.008)	(0.029)
LLR ratio	-0.616***	-0.491***	-0.369***	-0.171***	-0.905***	-0.842***	-1.141***
	(0.030)	(0.057)	(0.040)	(0.057)	(0.045)	(0.044)	(0.102)
FedFunds Rate	-0.251***	-1.079***	-0.786***	-0.873***	2.175***	1.651***	3.305***
	(0.033)	(0.092)	(0.053)	(0.088)	(0.077)	(0.068)	(0.155)
Market Return	-0.191***	-0.113***	-0.179***	-0.431***	-0.005	0.003	-0.025*
	(0.003)	(0.009)	(0.006)	(0.011)	(0.005)	(0.005)	(0.015)
Constant	0.341***	0.302***	0.239***	0.467***	0.219***	0.183***	0.494***
	(0.013)	(0.020)	(0.015)	(0.023)	(0.018)	(0.017)	(0.036)
Adj. R-squared	0.122	0.038	0.096	0.047	0.117	0.089	0.051
N. of obs.	290,158	270,396	278,958	282,996	287,317	286,849	272,377
N. of banks	7,573	7,336	7,474	7,532	7,577	7,571	7,455
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 4. Types of MMMF flows and bank deposits

The table reports the results of fixed-effects OLS regressions of bank deposits' growth: total deposits (*Ln(Total deposits$_t$/Total deposits$_{t-1}$)* (Panel A), Money Markert Deposit Account, MMDA (Ln(MMDA$_t$/ MMDA$_{t-1}$) (Panel B), Savings Deposits, SavingsD Ln(SavingsD$_t$/ SavingsD$_{t-1}$) (Panel C), Demand Deposits, DemandD Ln(DemandD$_t$/ DemandD$_{t-1}$) (Panel D) Time Deposits, TimeD Ln(TimeD$_t$/TimeD$_{t-1}$) (Panel E), on aggregate MMMF flow scaled by lagged TNA. The model is run with five specifications of the main explanatory variable: retail MMMF flow (1), institutional MMMF flow (2), tax-exempt MMMF flow (3) Prime MMMF flow (4), and Government & Treasury MMMF flow (5). Other control variables are as specified in section 4. The OLS models control for quarter, year and bank fixed effects; robust standard errors are clustered by bank and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Dependent variable:	**Growth of Total Deposits**				
	Retail	Institutional	Tax-exempt	Prime	Gov. & Treasury
	(1)	(2)	(3)	(4)	(5)
MMMF flow	-0.086***	-0.051***	0.068***	0.028***	-0.033***
	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)
Adj. R-squared	0.122	0.121	0.124	0.122	0.121
N. of obs.	290,158	290,158	290,158	290,158	290,158
N. of banks	7,573	7,573	7,573	7,573	7,573
Panel B: Dependent variable:	**Growth of MMDAs**				
	(1)	(2)	(3)	(4)	(5)
MMMF flow	-0.107***	-0.074***	0.084***	0.012***	-0.050***
	(0.008)	(0.007)	(0.005)	(0.003)	(0.004)
Adj. R-squared	0.038	0.038	0.039	0.038	0.038
N. of obs.	270,396	270,396	270,396	270,396	270,396
N. of banks	7,336	7,336	7,336	7,336	7,336
Panel C: Dependent variable:	**Growth of Other Savings Deposits**				
	(1)	(2)	(3)	(4)	(5)
MMMF flow	-0.178***	-0.091***	0.090***	0.033***	-0.069***
	(0.005)	(0.004)	(0.003)	(0.002)	(0.003)
Adj. R-squared	0.097	0.095	0.096	0.094	0.095
N. of obs.	278,958	278,958	278,958	278,958	278,958
N. of banks	7,474	7,474	7,474	7,474	7,474
Panel D: Dependent variable:	**Growth of Demand Deposits**				
	(1)	(2)	(3)	(4)	(5)
MMMF flow	-0.151***	-0.018***	0.180***	0.050***	-0.010***
	(0.010)	(0.008)	(0.006)	(0.004)	(0.005)
Adj. R-squared	0.048	0.047	0.050	0.048	0.047
N. of obs.	282,996	282,996	282,996	282,996	282,996
N. of banks	7,532	7,532	7,532	7,532	7,532
Panel E: Dependent variable:	**Growth of Time Deposits**				
	(1)	(2)	(3)	(4)	(5)
MMMF flow	0.024***	-0.041***	-0.045***	0.026***	-0.019***
	(0.005)	(0.005)	(0.003)	(0.002)	(0.003)
Adj. R-squared	0.117	0.118	0.118	0.118	0.118
N. of obs.	287,317	287,317	287,317	287,317	287,317
N. of banks	7,577	7,577	7,577	7,577	7,577
Panels A-E:	(1)	(2)	(3)	(4)	(5)
Constant	Yes	Yes	Yes	Yes	Yes
Bank-level controls	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Quarter Effects	Yes	Yes	Yes	Yes	Yes

Table 5. MMMF size and bank deposits

The table reports the results of fixed-effects OLS regressions of bank deposits' growth on aggregate MMMF flow scaled by lagged TNA grouped by fund size: small, medium, and large MFs. Small and large MF flows are defined as flows to funds in the bottom and top 25% of TNA distribution in each quarter. Mid-size category contains flows to funds in the remaining part of the TNA distribution. Columns 1-4 estimate models for total deposits growth as the main dependent variable. Columns 5-8 estimate models for different types of deposits: MMDAs (Column 5), Other savings deposits (Column 6), Demand deposits (Column 7), and Time deposits (Column 8). Other control variables are as specified in section 4. The OLS models control for quarter, year, and bank fixed effects; robust standard errors are clustered by bank and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable:	$Ln(TD_t/TD_{t-1})$				$Ln(MMDA_t/MMDA_{t-1})$	$Ln(SavingsD_t/SavingsD_{t-1})$	$Ln(DemandD_t/DemandD_{t-1})$	$Ln(TimeD_t/TimeD_{t-1})$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Flow to small MMMFs	-0.0002***			-0.0002***	-0.0001***	-0.0003***	-0.001***	0.00002***
	(0.000)			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Flow to mid-size MMMFs		-0.014***						
		(0.0004)						
Flows to large MMMFs			-0.033***	-0.046***	-0.093***	-0.117***	0.032***	-0.045***
			(0.003)	(0.003)	(0.009)	(0.005)	(0.010)	(0.006)
Implicit dep rate	4.102***	4.179***	4.388***	4.043***	6.038***	2.797***	11.375***	-4.641***
	(0.304)	(0.304)	(0.305)	(0.304)	(0.577)	(0.413)	(0.438)	(0.327)
Bank size	-0.020***	-0.020***	-0.020***	-0.020***	-0.015***	-0.013***	-0.032***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Capital ratio	0.142***	0.142***	0.147***	0.147***	0.114***	0.024*	0.206***	-0.025
	(0.014)	(0.014)	(0.014)	(0.014)	(0.020)	(0.014)	(0.023)	(0.018)
ROA	0.334***	0.334***	0.320***	0.337***	0.124	0.020	0.075	0.262**
	(0.076)	(0.076)	(0.076)	(0.076)	(0.175)	(0.112)	(0.186)	(0.119)
Loans/Assets	0.083***	0.083***	0.084***	0.082***	0.064***	0.014***	0.107***	0.089***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.003)	(0.005)	(0.003)
TD/Assets	-0.186***	-0.186***	-0.188***	-0.185***	-0.172***	-0.050***	-0.201***	-0.195***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.010)	(0.007)	(0.010)	(0.008)
TimeD>$250k/TD	-0.003	-0.003	-0.002	-0.003	0.130***	0.060***	0.141***	-0.196***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.010)	(0.007)	(0.010)	(0.009)
LLR ratio	-0.615***	-0.616***	-0.613***	-0.617***	-0.491***	-0.370***	-0.176***	-0.905***
	(0.030)	(0.030)	(0.030)	(0.030)	(0.057)	(0.040)	(0.057)	(0.046)
FedFunds Rate	-0.582***	-0.433***	-0.456***	-0.386***	-1.152***	-0.931***	-1.279***	2.214***
	(0.029)	(0.029)	(0.032)	(0.033)	(0.092)	(0.052)	(0.088)	(0.077)
Market Return	-0.190***	-0.188***	-0.185***	-0.196***	-0.116***	-0.186***	-0.447***	-0.005
	(0.003)	(0.003)	(0.003)	(0.003)	(0.009)	(0.006)	(0.011)	(0.005)
Constant	0.341***	0.341***	0.344***	0.338***	0.301***	0.237***	0.460***	0.219***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.020)	(0.015)	(0.023)	(0.018)
Adj. R-squared	0.124	0.124	0.120	0.124	0.038	0.096	0.051	0.118
N. of obs.	290,158	290,158	290,158	290,158	270,396	278,958	282,996	287,317
N. of banks	7,573	7,573	7,573	7,573	7,336	7,474	7,532	7,577
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 6. MMMF flows, bank size, and deposits flows

The table reports the results of fixed-effects OLS regressions of bank deposits' growth on aggregate MMMF flow scaled by lagged TNA. The dependent variable: Total Deposits, TD ($Ln(TD_t/TD_{t-1})$ (1)-(3), Money Markert Deposit Accounts, MMDA ($Ln(MMDA_t/ MMDA_{t-1})$ (4), Savings Deposits, SavingsD $Ln(SavingsD_t/ SavingsD_{t-1})$ (5), Demand deposits, DemandD $Ln(DemandD_t/ DemandD_{t-1})$, and Time Deposits, TimeD $Ln(TimeD_t/TimeD_{t-1})$ (7). The Total Deposits models are run with three specifications of the dependent variable deposit growth rate by size of the banks: small banks, banks with total assets <0.5 bill USD (1), medium bank, = >0.5<2 bill USD in total assets (2), and large bank, >2 bill in total assets (3). Other control variables are as specified in section 4. The OLS models control for quarter, year and bank fixed effects; robust standard errors are clustered by bank and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent variables:	$Ln(TD_t/TD_{t-1})$			$Ln(MMDA_t/MMDA_{t-1})$	$Ln(SavingsD_t/SavingsD_{t-1})$	$Ln(DemandD_t/DemandD_{t-1})$	$Ln(TimeD_t/TimeD_{t-1})$
	Small banks	Medium banks	Large banks	Large banks	Large banks	Large banks	Large banks
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MMMF flow	-0.076***	-0.081***	-0.041***	-0.094***	-0.119***	0.097**	-0.034
	(0.003)	(0.006)	(0.011)	(0.021)	(0.016)	(0.041)	(0.026)
Implicit dep rate	5.316***	5.133***	1.090	1.916	5.985***	10.881***	-13.377***
	(0.370)	(0.738)	(1.108)	(1.875)	(1.815)	(1.432)	(1.551)
Bank size	-0.028***	-0.045***	-0.026***	-0.023***	-0.015***	-0.030***	-0.021***
	(0.001)	(0.002)	(0.003)	(0.004)	(0.003)	(0.006)	(0.005)
Capital ratio	0.147***	0.148***	0.058	0.048	0.027	-0.026	-0.329***
	(0.017)	(0.026)	(0.036)	(0.058)	(0.045)	(0.100)	(0.067)
ROA	0.354***	0.268	0.157	1.127	0.043	0.687	1.604**
	(0.085)	(0.167)	(0.391)	(0.685)	(0.527)	(0.821)	(0.766)
Loans/Assets	0.086***	0.107***	0.071***	0.061***	0.009	0.090***	0.102***
	(0.003)	(0.006)	(0.010)	(0.016)	(0.015)	(0.024)	(0.020)
TD/Assets	-0.210***	-0.215***	-0.189***	-0.180***	-0.080***	-0.143***	-0.265***
	(0.007)	(0.011)	(0.017)	(0.024)	(0.021)	(0.037)	(0.028)
TimeD>$250k/TD	0.006	0.006	0.030	0.177***	0.049	0.161***	-0.226***
	(0.006)	(0.014)	(0.023)	(0.034)	(0.032)	(0.056)	(0.049)
LLR ratio	-0.566***	-0.514***	-0.408***	-0.467**	-0.261	0.375	-0.941***
	(0.035)	(0.088)	(0.123)	(0.185)	(0.175)	(0.287)	(0.220)
FedFunds Rate	-0.314***	-0.386***	-0.072	-0.438**	-0.942***	-2.337***	4.140***
	(0.041)	(0.070)	(0.113)	(0.218)	(0.176)	(0.326)	(0.318)
Market Return	-0.164***	-0.269***	-0.246***	-0.212***	-0.288***	-0.348***	-0.066**
	(0.004)	(0.008)	(0.014)	(0.025)	(0.021)	(0.056)	(0.028)
Constant	0.434***	0.700***	0.505***	0.478***	0.321***	0.505***	0.569***
	(0.019)	(0.035)	(0.045)	(0.072)	(0.059)	(0.102)	(0.085)
Adj. R-squared	0.127	0.159	0.130	0.072	0.125	0.049	0.225
N. of obs.	220,055	50,687	19,416	18,489	18,247	18,365	18,919
N. of banks	6,356	2,179	767	753	748	761	765
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 7. Types of MMMF flows and bank deposits by bank size

The table reports the results of fixed-effects OLS regressions of bank deposits' growth on aggregate MMMF flow scaled by lagged TNA. The model is run with five specifications of the main explanatory variable: retail MMMF flow (Panel A), institutional MMMF flow (Panel B), tax-exempt MMMF flow (Panel C) Prime MMMF flow (Panel D), and Government & Treasury MMMF flow (Panel E). The dependent variable: Total Deposits, TD ($Ln(TD_t/TD_{t-1})$ (1)-(3), Money Markert Deposit Accounts, MMDA ($Ln(MMDA_t/ MMDA_{t-1})$ (4), Savings Deposits, SavingsD $Ln(SavingsD_t/ SavingsD_{t-1})$ (5), Demand deposits, DemandD $Ln(DemandD_t/ DemandD_{t-1})$, and Time Deposits, TimeD $Ln(TimeD_t/TimeD_{t-1})$ (7). The Total Deposits models are run with three specifications of the dependent variable deposit growth rate by size of the banks: small banks, banks with total assets <0.5 bill USD (1), medium bank, = >0.5<2 bill USD in total assets (2), and large bank, >2 bill in total assets (3). Other control variables are as specified in section 4. The OLS models control for quarter, year and bank fixed effects; robust standard errors are clustered by bank and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent variables:	$Ln(TD_t/TD_{t-1})$			$Ln(MMDA_t/ MMDA_{t-1})$	$Ln(Savings D_t/ Savings D_{t-1})$	$Ln(Demand D_t/ Demand D_{t-1})$	$Ln(Time D_t/ Time D_{t-1})$
	Small banks	Medium banks	Large banks	Large banks	Large banks	Large banks	Large banks
Panel A:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Retail MMMF flow	-0.080***	-0.098***	-0.063***	-0.096***	-0.164***	0.046	0.045*
	(0.004)	(0.006)	(0.012)	(0.022)	(0.018)	(0.043)	(0.025)
Adj. R-squared	0.127	0.160	0.131	0.072	0.127	0.049	0.225
Panel B:							
Institutional MMMF flow	-0.052***	-0.055***	-0.024***	-0.070***	-0.077***	0.087**	-0.050**
	(0.003)	(0.005)	(0.009)	(0.018)	(0.014)	(0.036)	(0.022)
Adj. R-squared	0.126	0.158	0.130	0.072	0.124	0.049	0.225
Panel C:							
Tax-exempt MMMF flow	0.069***	0.060***	0.067***	0.065***	0.132***	0.109***	-0.086***
	(0.002)	(0.004)	(0.007)	(0.013)	(0.012)	(0.025)	(0.016)
Adj. R-squared	0.129	0.160	0.134	0.072	0.129	0.050	0.226
Panel D:							
Prime MMMF flow	0.024***	0.034***	0.035***	0.029***	0.037***	0.044**	0.085***
	(0.001)	(0.003)	(0.005)	(0.010)	(0.008)	(0.019)	(0.010)
Adj. R-squared	0.126	0.159	0.132	0.072	0.124	0.049	0.227
Panel E:							
Gov. & Treasury MMMF flow	-0.032***	-0.036***	-0.020***	-0.045***	-0.065***	0.067***	-0.036***
	(0.002)	(0.003)	(0.006)	(0.012)	(0.009)	(0.024)	(0.013)
Adj. R-squared	0.126	0.159	0.130	0.072	0.125	0.049	0.225
Panels A-E:							
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	220,055	50,687	19,416	18,489	18,247	18,365	18,919
N. of banks	6,356	2,179	767	753	748	761	765

Table 8. MMMF flows and bank loans

The table reports the results of fixed-effects OLS regressions of bank loans' growth on aggregate MMMF flow scaled by lagged TNA. The dependent variable is growth in: Commercial and industrial loans, C&I (Ln(C&I $Loans_t$/C&I $Loans_{t-1}$) (1), Commercial real estate loans, CRE (Ln(CRE $Loans_t$/CRE $Loans_{t-1}$) (2), Residential real estate loans, RRE Ln(RRE $Loans_t$/RRE $Loans_{t-1}$) (3), Consumer loans, Ln(Consumer $Loans_t$/Consumer $Loans_{t-1}$) (4). Other control variables are as specified in section 4. The OLS models control for quarter, year and bank fixed effects; robust standard errors are clustered by bank and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

*C&I loans growth is very positive in full sample. No relationship prior 2020 and significant positive coef. is driven by Covid-19 period (look at aggregate C&I loans graph - sharp uptick in 2020)

Dependent variables:	Ln(C&I $Loans_t$/C&I $Loans_{t-1}$)	Ln(CRE $Loans_t$/CRE $Loans_{t-1}$)	Ln(RRE $Loans_t$/RRE $Loans_{t-1}$)	Ln(Consumer $Loans_t$/Consumer $Loans_{t-1}$)
	(1)	(2)	(3)	(4)
MMMF flow $_{t-1}$	0.827***	-0.042***	-0.049***	-0.024**
	(0.012)	(0.004)	(0.004)	(0.011)
Bank size	-0.027***	-0.009***	-0.010***	-0.029***
	(0.002)	(0.001)	(0.001)	(0.003)
Capital ratio	0.229***	0.103***	-0.001	-0.068*
	(0.026)	(0.015)	(0.014)	(0.037)
ROA	-0.194	0.412***	-0.119	-1.444***
	(0.199)	(0.100)	(0.105)	(0.339)
Loans/Assets	-0.088***	-0.055***	-0.017***	-0.024***
	(0.006)	(0.003)	(0.003)	(0.008)
TD/Assets	-0.006	-0.002	-0.001	-0.064***
	(0.011)	(0.005)	(0.006)	(0.017)
TimeD>$250k/TD	0.033***	-0.013*	-0.015**	0.023
	(0.012)	(0.007)	(0.007)	(0.019)
LLR ratio	-1.165***	-1.214***	-0.830***	-0.802***
	(0.077)	(0.041)	(0.045)	(0.120)
FedFunds Rate	2.413***	-0.033	0.322***	1.456***
	(0.080)	(0.036)	(0.035)	(0.114)
Market Return	-0.439***	-0.026***	-0.038***	0.502***
	(0.011)	(0.005)	(0.004)	(0.019)
Loans demand	-0.006*	0.007***	0.002*	0.037***
	(0.003)	(0.001)	(0.001)	(0.004)
Constant	0.399***	0.150***	0.135***	0.467***
	(0.028)	(0.018)	(0.018)	(0.042)
Adj. R-squared	0.082	0.027	0.030	0.020
N. of obs.	276,797	283,270	282,392	273,237
N. of banks	7,396	7,501	7,497	7,393
Bank Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Quarter Effects	Yes	Yes	Yes	Yes

Table 9. Types of MMMF flows and bank loans

The table reports the results of fixed-effects OLS regressions of bank loans' growth on aggregate MMMF flow scaled by lagged TNA. The dependent variable is growth in: Commercial and industrial loans, C&I ($\text{Ln}(\text{C\&I Loans}_t/\text{C\&I Loans}_{t-1})$) (Panel A), Commercial real estate loans, CRE ($\text{Ln}(\text{CRE Loans}_t/\text{CRE Loans}_{t-1})$ (Panel B), Residential real estate loans, RRE $\text{Ln}(\text{RRE Loans}_t/\text{RRE Loans}_{t-1})$ (Panel C), Consumer loans, $\text{Ln}(\text{Consumer Loans}_t/\text{Consumer Loans}_{t-1})$ (Panel D). The model is run with five specifications of the main explanatory variable: retail MMMF flow (1), institutional MMMF flow (2), tax-exempt MMMF flow (3) Prime MMMF flow (4), and Government & Treasury MMMF flow (5). Other control variables are as specified in section 4. The OLS models control for quarter, year and bank fixed effects; robust standard errors are clustered by bank and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Dependent variable:	**Change in C&I Loans**				
	Retail	Institutional	Tax-exempt	Prime	Gov.&Treasury
	(1)	(2)	(3)	(4)	(5)
MMMF flow $_{t-1}$	1.020***	0.587***	-0.022***	-0.050***	0.396***
	(0.014)	(0.010)	(0.005)	(0.003)	(0.007)
Adj. R-squared	0.086	0.075	0.054	0.055	0.074
N. of obs.	276,797	276,797	276,797	276,797	276,797
N. of banks	7,396	7,396	7,396	7,396	7,396
Panel B: Dependent variable:	**Change in CRE Loans**				
	Retail	Institutional	Tax-exempt	Prime	Gov.&Treasury
	(1)	(2)	(3)	(4)	(5)
MMMF flow $_{t-1}$	-0.037***	-0.033***	0.016***	0.009***	-0.026***
	(0.005)	(0.003)	(0.003)	(0.002)	(0.002)
Adj. R-squared	0.027	0.027	0.027	0.027	0.027
N. of obs.	283,270	283,270	283,270	283,270	283,270
N. of banks	7,501	7,501	7,501	7,501	7,501
Panel C: Dependent variable:	**Change in RRE Loans**				
	Retail	Institutional	Tax-exempt	Prime	Gov.&Treasury
	(1)	(2)	(3)	(4)	(5)
MMMF flow $_{t-1}$	-0.032***	-0.040***	0.029***	0.016***	-0.032***
	(0.005)	(0.003)	(0.003)	(0.001)	(0.002)
Adj. R-squared	0.029	0.030	0.029	0.029	0.030
N. of obs.	282,392	282,392	282,392	282,392	282,392
N. of banks	7,497	7,497	7,497	7,497	7,497
Panel D: Dependent variable:	**Change in Consumer Loans**				
	Retail	Institutional	Tax-exempt	Prime	Gov.&Treasury
	(1)	(2)	(3)	(4)	(5)
MMMF flow $_{t-1}$	-0.407***	0.060***	0.169***	0.020***	-0.059***
	(0.016)	(0.009)	(0.008)	(0.004)	(0.006)
Adj. R-squared	0.023	0.020	0.021	0.020	0.020
N. of obs.	273,237	273,237	273,237	273,237	273,237
N. of banks	7,393	7,393	7,393	7,393	7,393
Panels A-D:	(1)	(2)	(3)	(4)	(5)
Constant	Yes	Yes	Yes	Yes	Yes
Bank-level controls	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Quarter Effects	Yes	Yes	Yes	Yes	Yes

Table 10. MMMF flows and loans by bank size

The table reports the results of fixed-effects OLS regressions of bank loans' growth on aggregate MMMF flow. The dependent variable is growth in: Commercial and industrial loans, ($Ln(C\&I\ Loans_t/C\&I\ Loans_{t-1})$) (1)-(2), Commercial real estate loans, ($Ln(CRE\ Loans_t/CRE\ Loans_{t-1})$) (3)-(4), Residential real estate loans, ($Ln(RRE\ Loans_t/RRE\ Loans_{t-1})$) (5)-(6), Consumer loans, ($Ln(C\ Loans_t/CLoans_{t-1})$) (7)-(8). The models are run with two specifications of the dependent variable loan growth rate by size of the banks: small & medium banks, with total assets <2 bill USD in total assets, odd columns, and large bank, >2 bill in total assets, even columns. Other control variables are as specified in section 4. The OLS models control for year, quarter, and bank fixed effects; robust standard errors are clustered by bank and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent variables:	$Ln(CI\ Loans_t/CI\ Loans_{t-1})$		$Ln(CRE\ Loans_t/CRE\ Loans_{t-1})$		$Ln(RRE\ Loans_t/RRE\ Loans_{t-1})$		$Ln(C\ Loans_t/\ C\ Loans_{t-1})$	
	Small & Medium	Large	Small & Medium	Large	Small & Medium	Large	Small & Medium	Large
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MMMF flow $_{t-1}$	0.841***	0.707***	-0.046***	-0.001	-0.053***	-0.013	-0.023**	-0.032
	(0.013)	(0.036)	(0.004)	(0.009)	(0.004)	(0.011)	(0.012)	(0.040)
Bank size	-0.026***	-0.053***	-0.008***	-0.025***	-0.008***	-0.017***	-0.028***	-0.060***
	(0.002)	(0.006)	(0.002)	(0.004)	(0.002)	(0.004)	(0.003)	(0.011)
Capital ratio	0.240***	0.162**	0.120***	-0.050	0.014	-0.050	-0.076**	0.111
	(0.029)	(0.063)	(0.016)	(0.043)	(0.015)	(0.041)	(0.039)	(0.145)
ROA	-0.255	0.939	0.382***	1.057***	-0.170	0.341	-1.372***	-4.658***
	(0.207)	(0.711)	(0.103)	(0.342)	(0.108)	(0.407)	(0.351)	(1.389)
Loans/Assets	-0.090***	-0.054***	-0.057***	-0.049***	-0.016***	-0.047***	-0.023***	-0.072**
	(0.006)	(0.020)	(0.003)	(0.013)	(0.003)	(0.014)	(0.008)	(0.036)
TD/Assets	0.000	-0.071**	0.001	-0.027*	0.004	-0.008	-0.063***	-0.060
	(0.012)	(0.028)	(0.006)	(0.014)	(0.006)	(0.017)	(0.018)	(0.063)
TimeD>$250k/TD	0.035***	0.021	-0.010	-0.012	-0.015**	-0.053*	0.025	-0.070
	(0.012)	(0.037)	(0.007)	(0.020)	(0.007)	(0.030)	(0.019)	(0.067)
LLR ratio	-1.143***	-1.144***	-1.201***	-1.114***	-0.874***	-0.236	-0.839***	-1.199***
	(0.082)	(0.247)	(0.044)	(0.150)	(0.048)	(0.147)	(0.127)	(0.463)
FedFunds Rate	2.441***	2.090***	-0.022	-0.172**	0.301***	0.586***	1.536***	0.531
	(0.086)	(0.194)	(0.038)	(0.086)	(0.037)	(0.106)	(0.121)	(0.341)
Market Return	-0.429***	-0.525***	-0.026***	-0.024*	-0.036***	-0.059***	0.507***	0.429***
	(0.012)	(0.034)	(0.005)	(0.014)	(0.005)	(0.015)	(0.019)	(0.065)
Loans demand	-0.012***	0.053***	0.007***	0.009***	0.001***	0.015***	0.035***	0.058***
	(0.003)	(0.009)	(0.001)	(0.003)	(0.001)	(0.004)	(0.035)	(0.058)
Constant	0.373***	0.920***	0.128***	0.450***	0.111***	0.312***	0.446***	1.069***
	(0.034)	(0.092)	(0.021)	(0.060)	(0.020)	(0.073)	(0.048)	(0.192)
Adj. R-squared	0.077	0.181	0.026	0.069	0.029	0.056	0.019	0.036
N. of obs.	257,635	19,162	264,157	19,113	263,349	19,043	254,079	19,158
N. of banks	7,088	751	7,193	753	7,188	752	7,080	752
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 11. Types of MMMF flows and bank loans by bank size

The table reports the results of fixed-effects OLS regressions of bank loans' growth on aggregate MMMF flow scaled by lagged TNA. The model is run with the main explanatory variable: retail MMMF flow (Panel A), institutional MMMF flow (Panel B), tax-exempt MMMF flow (Panel C) Prime MMMF flow (Panel D), and Government & Treasury MMMF flow (Panel E). The dependent variable is growth in: Commercial and industrial loans, C&I ($\text{Ln}(\text{C\&I Loans}_t/\text{C\&I Loans}_{t-1})$), Commercial real estate loans, CRE ($\text{Ln}(\text{CRE Loans}_t/\text{CRE Loans}_{t-1})$), Residential real estate loans, RRE $\text{Ln}(\text{RRE Loans}_t/\text{RRE Loans}_{t-1})$, Consumer loans, $\text{Ln}(\text{Consumer Loans}_t/\text{Consumer Loans}_{t-1})$. Other control variables are as specified in section 5. The models control for quarter, year and bank fixed effects; robust standard errors are clustered by bank and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent variables:	$\text{Ln}(\text{C\&I Loans}_t/\text{C\&I Loans}_{t-1})$		$\text{Ln}(\text{CRE Loans}_t/\text{CRE Loans}_{t-1})$		$\text{Ln}(\text{RRE Loans}_t/\text{RRE Loans}_{t-1})$		$\text{Ln}(\text{Consumer Loans}_t/\text{Consumer Loans}_{t-1})$	
MMMF flow_{t-1}	Small & Medium	Large	Small & Medium	Large	Small & Medium	Large	Small & Medium	Large
Panel A:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Retail	1.024***	0.986***	-0.041***	0.004	-0.036***	0.024*	-0.402***	-0.440***
	(0.015)	(0.039)	(0.005)	(0.010)	(0.005)	(0.014)	(0.017)	(0.054)
Adj. R-squared	0.081	0.199	0.026	0.069	0.028	0.056	0.022	0.039
Panel B:								
Institutional	0.599***	0.491***	-0.035***	-0.002	-0.043***	-0.017*	0.059***	0.061*
	(0.010)	(0.029)	(0.003)	(0.008)	(0.003)	(0.009)	(0.010)	(0.034)
Adj. R-squared	0.071	0.169	0.026	0.069	0.029	0.056	0.020	0.036
Panel C:								
Tax-exempt	-0.020***	-0.042***	0.015***	0.028***	0.027***	0.051***	0.162***	0.240***
	(0.006)	(0.014)	(0.003)	(0.007)	(0.003)	(0.008)	(0.008)	(0.031)
Adj. R-squared	0.050	0.142	0.026	0.070	0.028	0.058	0.021	0.039
Panel D:								
Prime	-0.052***	-0.021**	0.009***	0.016***	0.015***	0.035***	0.018***	0.046***
	(0.003)	(0.009)	(0.002)	(0.004)	(0.001)	(0.005)	(0.004)	(0.017)
Adj. R-squared	0.051	0.142	0.026	0.070	0.028	0.058	0.020	0.036
Panel E:								
Gov.&Treasury	0.403***	0.329***	-0.027***	-0.014**	-0.033***	-0.029***	-0.057***	-0.072***
	(0.007)	(0.021)	(0.002)	(0.006)	(0.002)	(0.007)	(0.006)	(0.021)
Adj. R-squared	0.069	0.166	0.026	0.070	0.029	0.057	0.020	0.036
Panels A-E:								
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	257,635	19,162	264,157	19,113	263,349	19,043	254,079	19,158
N. of banks	7,088	751	7,193	753	7,188	752	7,080	752

Table 12. Regulatory changes, MMMF flows and bank deposits

The table reports the results of fixed-effects OLS regressions of total bank deposits' growth on aggregate MMMF flow scaled by lagged TNA controlling for MMMF regulation of 2014 and its implementation in 2016. The model specifications are: subsample before 2016 regime shift (2010Q1-2016Q3) – columns (1) and (2), subsample after 2016 regime shift (2016Q4-2023Q2) (3) and (4), Regulation 2014 dummy variable and its interaction with MMMF flow (5) and (6), Regime shift 2016 dummy variable and its interaction with MMMF flow (7) and (8). Other control variables are as specified in section 4. The OLS models control for quarter-year and bank fixed effects; robust standard errors are clustered by bank and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Ln(Total deposits$_t$/Total deposits$_{t-1}$)							
Dependent variable:	Prime	Gov. & Treasury	Prime	Gov. & Treasury	Prime	Gov. & Treasury	Prime	Gov. & Treasury
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MMMF flow	-0.055***	0.050***	0.082***	-0.053***	0.022***	0.004	0.044***	0.020***
	(0.004)	(0.005)	(0.002)	(0.002)	(0.004)	(0.003)	(0.004)	(0.003)
Regulations announced 2014					-0.003***	-0.0002		
					(0.001)	(0.001)		
Ra 2014×MMMF flow					0.007	-0.046***		
					(0.005)	(0.004)		
Regulations implementation 2016							0.035***	0.022***
							(0.001)	(0.001)
Ri 2016×MMMF flow							0.041***	-0.085***
							(0.004)	(0.004)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.134	0.134	0.179	0.175	0.122	0.122	0.127	0.124
N. of obs.	154,289	154,289	135,869	135,869	290,158	290,158	290,158	290,158
N. of banks	7,511	7,511	5,919	5,919	7,573	7,573	7,573	7,573
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 13. Regulatory changes, MMMF flows and bank loans

The table reports the results of fixed-effects OLS regressions of bank loans' growth on aggregate MMMF flow scaled by lagged TNA controlling for MMMF regulation of 2014 and its implementation in 2016. The dependent variable is growth in: Commercial and industrial loans, C&I (Ln(C&I Loans$_t$/C&I Loans$_{t-1}$), Commercial real estate loans, CRE (Ln(CRE Loans$_t$/CRE Loans$_{t-1}$), Residential real estate loans, RRE Ln(RRE Loans$_t$/RRE Loans$_{t-1}$), Consumer loans, Ln(Consumer Loans$_t$/Consumer Loans$_{t-1}$). The main explanatory variables are MMMF flow, Regulation implementation 2016 dummy variable and its interaction with MMMF flow, Ri 2016xMMMF flow. Other control variables are as specified in section 5. The models control for quarter, year and bank fixed effects; robust standard errors are clustered by bank and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent variables:	Ln(CI Loans$_t$/ CI Loans$_{t-1}$)		Ln(CRE Loans$_t$/ CRE Loans$_{t-1}$)		Ln(RRE Loans$_t$/ RRE Loans$_{t-1}$)		Ln(Consumer Loans$_t$/ Consumer Loans$_{t-1}$)	
	Prime	Gov. & Treasury	Prime	Gov. & Treasury	Prime	Gov. & Treasury	Prime	Gov. & Treasury
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MMMF flow$_{t-1}$	0.159***	0.178***	-0.007	-0.027***	-0.033***	-0.013***	0.373***	-0.165***
	(0.014)	(0.011)	(0.006)	(0.005)	(0.006)	(0.004)	(0.020)	(0.012)
Regulations implementation 2016	-0.014***	-0.086***	0.000	0.001	0.002*	0.002***	0.011***	0.009***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)
Ri 2016×MMMF flow	-0.244***	0.357***	0.018***	-0.001	0.054***	-0.024***	-0.359***	0.101***
	(0.015)	(0.011)	(0.006)	(0.005)	(0.006)	(0.005)	(0.021)	(0.013)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.056	0.079	0.027	0.027	0.030	0.030	0.021	0.021
N. of obs.	276,797	276,797	283,270	283,270	282,392	282,392	273,237	273,237
N. of banks	7,396	7,396	7,501	7,501	7,497	7,497	7,393	7,393
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes