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The Heterogeneous Effects of U.S. Monetary Policy on Non-Bank Finance

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ABSTRACT: Using flow of funds and high frequency data from the Investment Company Institute, we study the effects of monetary policy shocks on the size of non-bank assets as well as on flows into long-term mutual funds and returns on their assets. Consolidating chains of non-bank intermediation to avoid double counting, we find that contractionary monetary policy shocks shrink the assets of non-banks reliant on long-term funding, while increasing those of nonbanks reliant on short-term funding. Contractionary shocks also cause sustained outflows from long-term mutual funds and reduce their returns. Using a Markov-Switching VAR, we find these effects to be more prevalent after the Global Financial Crisis, and show that monetary policy shocks had the opposite effects in some earlier periods. Policymakers will thus have to contend with a complex and heterogeneous transmission of monetary policy to financial and macroeconomic outcomes through the non-banks.

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WORKING PAPERS

The Heterogeneous Effects of U.S. Monetary Policy on Non-Bank Finance

Prepared by Andrew Hodge and Anke Weber[1]

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1 Introduction

The structure of the U.S. financial system has changed dramatically over recent decades. The non-bank sector has grown relative to traditional banks, while regulatory changes have affected the relative costs and risks of intermediation by these institutions. Non-banks have already been associated with periods of financial instability, including the sudden re-pricing of risk associated with residential mortgage-backed securities that preceded the Global Financial Crisis (GFC) and runs on money market and other mutual funds in early 2020 that were accompanied by liquidity shortages in the U.S. Treasuries market.

This paper explores how monetary policy shocks influence the size of the non-bank sector in the U.S. and how their impact on the sector has changed over time, thereby extending the existing literature that does not allow for a time-varying relationship. Our analysis consists of three parts. We first estimate the size of the non-bank sector, using quarterly flow of funds data and two alternative approaches to measurement: An 'institutional approach' that sums up the inflation-adjusted real assets of non-banks; and a 'functional approach' that consolidates chains of intermediation, based on Gallin (2015). Second, we examine the impact of monetary policy shocks on the overall size of the non-bank sector, distinguishing between non-banks reliant on short-term funding and subject to run-risk, and those that have more stable, longer-term funding. Finally, we study flows into non-banks and returns on their assets by focusing on long-term mutual funds, due to data availability constraints. We use monthly data from the Investment Company Institute, distinguishing between different types of bond and equity funds.

Our empirical analysis relies on a range of techniques. We use local projections (LP) to investigate the impact of monetary policy shocks on our measures of non-bank assets, but vector autoregressions (VAR) in the context of long-term mutual fund flows and returns, given their potential co-movement. For both the LP and VAR, we focus on high-frequency changes in financial conditions around Federal Open Market Committee (FOMC) meetings, following Jarociński and Karadi (2020), which allow us to identify monetary policy shocks separately from shocks to financial conditions arising from surprises about the current or future state of the economy. To study the time-varying nature of the relationship between monetary policy and non-banks, we complement these analyses with a Markov-Switching VAR (MS-VAR). This allows for the impact of monetary policy to differ across several discrete regimes, each of which may reflect fundamentally different macroeconomic relationships, potentially because of regulatory changes over time. Sign restrictions are used to identify monetary policy shocks in the context of the MS-VAR, which allows us to study regime changes over a longer sample period than would be possible if shocks were identified by the Jarociński and Karadi (2020) approach. A parsimonious specification is chosen for the MS-VAR, which allows three regimes for the coefficients of the VAR and three regimes for the variance-covariance matrix.

Our estimates of the size of the non-bank sector using the 'institutional' and 'functional' approaches behave in a similar way around the GFC, but have diverged modestly during the pandemic. Measures based on both approaches show the non-bank sector reliant on short-term funding growing rapidly leading up to the GFC, before declining. The role of private asset-backed securities (ABS) issuers in non-bank intermediation rises before the GFC, reflecting the role of higher-risk securitized lending in the crisis, but has declined subsequently, without ever fully recovering. The non-bank sector reliant on short-term funding began to grow again around 2014 and accelerated in advance of the pandemic, with Government Sponsored Enterprises (GSEs) playing an increasingly important role in non-bank intermediation. Since the pandemic began, the institutional and functional measures diverge somewhat. The institutional measures of non-banks reliant on short-term funding continue to grow while the functional measure declines. This suggests that the cross-holdings between financial institutions, netted out by the functional approach, drove the growth of non-banks during the pandemic to some extent, rather than an expansion of credit from these institutions to the non-finanical sector of the economy. Both approaches show that the size of non-banks reliant on long-term funding has grown since the GFC and continued to grow during the pandemic, although there is some evidence that growth has levelled off more recently.

Using our preferred 'functional' approach to measuring the size of the non-bank sector, we find that contractionary monetary shocks shrink the total size of non-banks reliant on long-term funding, but increase the size of the sector reliant on short-term funding subject to run-risk. Contractionary monetary shocks also cause sustained outflows from long-term bond mutual funds and a decline in their returns. The impact on long-term equity mutual funds is similar but less pronounced. Overall, this constitutes some evidence of a 'dislocation' effect whereby tighter monetary policy displaces intermediation into the non-bank sector reliant on short-term funding. The 'dislocation' effect may reflect the incentive to fund lending outside the traditional banking system by securitizing assets, when the cost of traditional deposit funding for banks is higher, as argued by Loutskina and Strahan (2009) and Loutskina (2011). There may also be substitution from non-banks reliant on long-term funding to those with short-term funding.

Moreover the impact of monetary policy on non-banks has changed over time, as shown using a MS-VAR. The impact of contractionary monetary policy shocks on long-term bond mutual fund outflows is found to have strengthened over time. A similar result is found for the 'functional' measure of the size of non-banks reliant on long-term funding, which is found to shrink following a contractionary monetary policy shock during the past decade, but not in some earlier periods such as prior to the mid-1980's. In contrast, the 'functional' measure of non-banks reliant on short-term funding is found to increase following a monetary policy shock, after the early 2000s, revealing the 'dislocation' effect, but not in all earlier periods.

Literature. Our paper relates to the literature that tracks the evolution of the non-bank sector over time. Adrian and Shin (2008), Adrian and Shin (2010) and Pozsar et al. (2010) provide a comprehensive mapping of the U.S. non bank sector, although without recent updates. These papers define measures of the size of non-banks reliant on short-term funding, following an 'institutional' approach, conceptually similar to the Federal Reserve's measure of 'runnable' assets in the financial system (see Bao et al. (2015)), as well as the 'narrow' FSB measure of the size of non-banks (see FSB (2019)). Gallin (2015) provides an important methodology to net out intermediate steps in long chains of intermediation, following the 'functional approach,' to provide a measure of non-bank credit to the real economy that avoids double counting, although this has also not been recently updated. One of the contributions of this paper is thus to update and compare estimates of the size of the non-bank sector, using alternative approaches, tracking developments after the GFC and during the pandemic.

Our paper most closely relates to the macro-financial literature that studies the impact of monetary policy shocks on non-bank financial intermediation. Nelson et al. (2017) study the pre-GFC period in the U.S. and find that contractionary monetary policy shocks increased the growth of the non-bank sector, potentially due to the pursuit of cheaper funding costs outside the traditional banking sector. Den Haan and Sterk (2011) and Drechsler and Schnabl (2022) find a similar effect, focusing on mortgages and consumer credit, as does Xiao (2020), who focuses on money market funds, as well as Peydró et al. (2021), who use micro data on certain types of non-bank lending products. In a recent paper focused on Europe, Hodula (2019) finds evidence of non-linearity in the relationship, with the European non-bank sector expanding in response to contractionary monetary policy shocks before the GFC, but continuing to expand following expansionary shocks in the prolonged period of loose monetary policy after the crisis, potentially because investors sought higher returns outside the traditional banking sector. Other relevant papers include Holm-Hadulla et al. (2022) who show that contractionary monetary policy shocks decrease the assets of investment funds in the euro area. We contribute to the understanding the relationship between U.S. monetary policy and the non-bank sector by studying its impact on the different measures of non-bank size, distinguishing pure monetary shocks from central bank information shocks. We also illustrate how the relationship has changed over time.

There is a growing literature focusing on flows into particular non-banks in response to monetary policy shocks. Banegas et al. (2022) find that there have been inflows to U.S. bond funds and outflows from equity funds after unexpected monetary tightening by the Fed. Daniel et al. (2021) provide evidence for the U.S. that following an interest rate decrease, investors rebalance their portfolios towards assets that yield higher income, such as high yield bonds. Hau and Lai (2016) and Giuzio et al. (2021) have similar findings in the Euro Area, while Kaufmann (2020) studies international flows and finds an increase in flows to investment funds globally after a loosening of U.S. monetary policy. We contribute to the understanding of the impact of U.S. monetary policy by considering both flows and returns of different types of mutual funds and also investigating changes in the impact of monetary policy over time.

The remainder of the paper is structured as follows. Section 2 first explains how the regulation and supervision of non-banks has changed over time and then presents some stylized facts and our measures of the size of the non-bank sector, using institutional and functional approaches.

Section 3 presents our preferred measure of monetary policy shocks. Section 4 analyzes the impact of monetary policy shocks on the size of the non-bank sector, while section 5 illustrates the impact on flows and returns of long-term mutual funds. Section 6 presents the MS-VAR analysis to show how the impact of monetary policy on non-banks has evolved over time. Finally, section 7 concludes.

2 Stylized Facts: Non-Bank Finance in the U.S.

2.1 Supervision and regulation of the non-bank sector

In the U.S., there have been substantial changes to supervision and regulation of the non-bank sector since the GFC, which may be underlying some of the structural changes in the non-bank sector that have occurred, which we will describe further below. Non-bank financial intermediation is regulated in part by the Securities and Exchange Commission, the Commodity Futures Trading Commission and the Financial Stability Oversight Council (FSOC). The latter was established as part of the 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act, and designed to monitor and address risks to the financial system.[1] The FSOC has several statutory responsibilities and tools, including the authority to subject a systemically risky non-bank financial institution to consolidated supervision and enhanced regulatory safeguards. When a non-bank financial institution is designated as a systemically important financial institution by the FSOC, it is subjected to stronger consolidated federal oversight by the Fed and enhanced financial stability rules, including capital requirements, liquidity rules and stress tests. Dodd-Frank also created new registration requirements for hedge funds and private equity firms, established a federal office to monitor the insurance industry and to negotiate international insurance agreements, created executive compensation restrictions for financial firms, and granted regulators the authority to wind down systemically important nonbanks in an orderly fashion. Moreover, under Dodd-Frank, the Consumer Financial Protection Bureau has authority to use traditional law enforcement to stop non-banks from engaging in conduct that pose risks to consumers.

Non-banks still remain subject to generally less stringent regulation and supervision than traditional banks. The Dodd-Frank Act made profound changes to traditional banking sector oversight and regulation, which included tighter than Basel III capital and liquidity requirements, heightened prudential standards for the largest banking firms, and regular stress tests.[2] Heightened prudential standards require the largest and most interconnected banks to meet capital surcharges and stricter risk-management standards than other banks. Regular stress tests evaluate banks' ability to remain solvent and liquid when under severe macroeconomic stress. The Volcker Rule—one of the centerpieces of the Dodd-Frank Act—imposes broad prohibitions

[1] https://www.cftc.gov/sites/default/files/idc/groups/public/@swaps/documents/file/hr4173_enrolledbill.pdf

[2] https://www.federalreserve.gov/newsevents/speech/fischer20150327a.htm

and restrictions on proprietary trading and investing in hedge funds or private equity funds by banking organizations and their affiliates. There is some evidence that increased regulation of banks may have pushed intermediation into less regulated financial institutions, such as non-banks, with some studies providing empirical evidence of the positive relationship between bank capital requirements and the size of non-bank finance (e.g., Irani et al. (2021)).

Several work-streams are currently ongoing to address the shortcomings in non-bank financial intermediation revealed during the market dislocations of March 2020. In 2021, the FSOC made it a priority to evaluate and address the risks to U.S. financial stability posed by three types of non-bank financial institutions: hedge funds, open-end funds, and money market funds (MMFs).[3] For the latter, potential reform options have been outlined in a report by the President's Working Group on Financial Markets in December 2020 while work on hedge funds and open-ended funds is ongoing.[4]

2.2 Measuring the non-bank sector

We define non-banks reliant on short-term funding as institutions that perform bank-like intermediation - in the form of credit, liquidity and maturity transformation - but are funded on a short-term basis and lack access to the credit and liquidity backstops that traditional banks have through deposit insurance and Federal Reserve liquidity facilities. These non-banks are subject to run-risk. Non-banks reliant on long-term funding perform similar bank-like activities, but have access to more stable funding that is less subject to run risk.

Given these general definitions, we follow two alternative approaches to measuring the quantitative size of these institutions:

Institutional. This involves summing the inflation-adjusted, real assets of particular types of institutions or particular real liabilities of a short-term nature within the financial system. For a measure of non-banks reliant on short-term funding, we follow Pozsar et al. (2010) in summing the liabilities of total outstanding open market paper, total repo liabilities, net securities loaned by broaker-dealers, total GSE (Government Sponsored Enterprises) liabilities and agency and GSE mortgage pool securities and total liabilities of ABS issuers, as well as total shares outstanding of money market mutual funds. [5] We consider an alternative measure of Adrian et al. (2010) which comprises the assets of agency and GSE backed mortgage pools, ABS issuers, finance companies and funding corporations. All data are from the Federal Reserve's quarterly 'Financial Accounts of the United States (Z.1)' (flow of funds), up to 2022 Q1. These measures are conceptually similar to the Federal Reserve's measure of 'runnable' assets in the financial system (see Bao et al. (2015)), as well as the 'narrow' FSB measure of the size of non-banks (see FSB (2019)). An analogous measure of the size of the traditional banking system is obtained from real assets

[3] https://home.treasury.gov/news/press-releases/jy0587

[4] https://home.treasury.gov/system/files/136/PWG-MMF-report-final-Dec-2020.pdf

[5] The assets of GSEs, agency and GSE backed mortgage pools and money market mutual funds are used to net out cross holdings between these institutions.

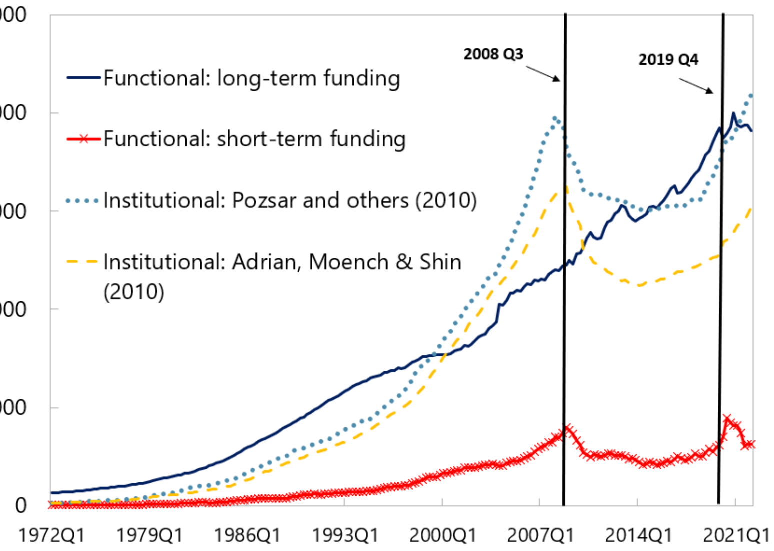
of commercial banks, credit unions and savings institutions, using data from the flow of funds.

Functional. This approach seeks to consolidate chains of intermediation, to avoid double counting. Following the methodology developed by Gallin (2015), we measure the size of non-banks reliant on short-term funding by approximately consolidating chains of intermediation that begin with short-term funders and end with non-financial sector borrowers. Short-term funders are defined to include money market mutual funds (money funds), unregistered liquidity funds, local government investment pools, and cash- collateral reinvestment pools from securities lending programs. The approximate consolidation is done by exploiting the asset and liability structure of these short-term funders and other institutions– referred to as intermediate funders–that play an intermediate role in the chain of consolidation. Intermediate funders are defined as broker-dealers, GSEs, finance companies and private ABS issuers. The size of non-banks reliant on long-term funding can be computed analogously, substituting short-term funders for long-term funders, which are defined as mutual funds (other than money market funds), pension funds and insurance companies. Furthermore, the size of the bank sector is computed by substituting banks and credit unions in the place of short or long term funders. Each of these functional measures for non-banks (reliant on short and long-term funding) and banks is deflated by the GDP deflator, to adjust for inflation, in the same way as the institutional measures.

The institutional and functional measures of non-banks reliant on short-term funding evolve in a similar way but the functional measures have a lower level, since they avoid double counting (see Figure 1). They show the non-bank sector growing rapidly ahead of the GFC, but then declining. The share of private ABS issuers in intermediate funding rises before the GFC and declines, reflecting the role of higher-risk securitized lending in the crisis (see Figure 2). The non-bank sector reliant on short-term funding began to grow again around 2014 and accelerated in advance of the pandemic, with GSEs accounting for a rising share of intermediate funding. Since the pandemic began, the institutional and functional measures diverge. The institutional measures of non-banks reliant on short-term funding continue to grow while the functional measure declines. This suggests that the cross-holdings between financial institutions, netted out by the functional approach, drove the growth of non-banks during the pandemic, rather than an expansion of credit from these institutions to the non-finanical sector of the economy. The functional approach shows that the size of non-banks reliant on long-term funding has grown since the GFC and continued during the pandemic, although it has begun to decline more recently.

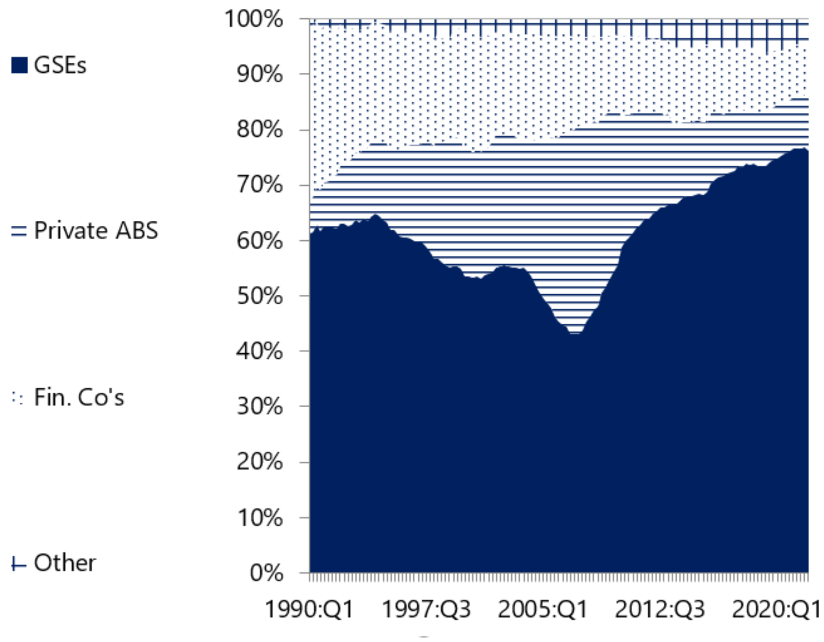
The overall size of non-banks can be affected by both flows into these institutions, as well as by valuation effects, through growth of their assets. A simple decomposition of asset growth into changes in flows and a residual, assumed to comprise valuation effects, suggests that these valuation effects have been significant during the pandemic, particularly for mutual funds (see Figure 3). This illustrates the importance of considering flows and returns of non-banks. We do this using monthly data from the Investment Company Institute (ICI) on long-term mutual funds. We focus on monthly data for U.S. domiciled open-ended mutual funds investing in

Figure 1: The Size of U.S. Non-Banks: Institutional and Functional Measures ($US bns)



Sources: Federal Reserve, Adrian et al. (2010), Pozsar et al. (2010), Gallin (2015) and authors' calculations.

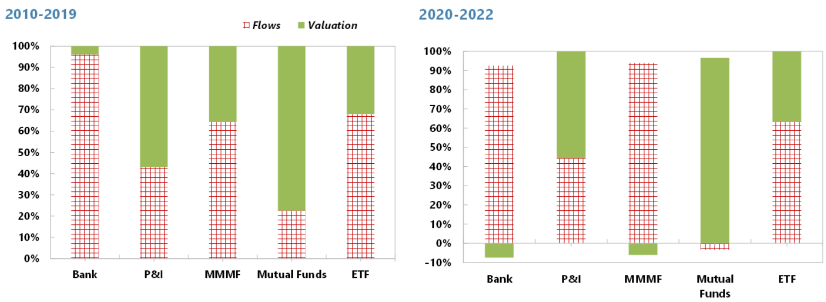
Figure 2: Non-Bank Intermediation by Intermediate Funder (percent of total)



Sources: Federal Reserve, Gallin (2015) and authors' calculations.

both domestic and international markets between 2000 and 2021. This approach abstracts from valuation issues. It also allows for a higher degree of disaggregation between different types of mutual funds (e.g., identifying those with higher risk assets). We have data on flows and net assets on equity mutual funds, both domestic and international, with the latter being funds investing primarily in stocks of foreign companies. We also have data on flows and net assets of investment grade, high yield (funds seeking current income by investing two-thirds or more of their portfolios in lower-rated corporate bonds), world (investing in the debt securities of foreign companies and governments), government (investing in taxable bonds issued, or backed, by the US government), multisector (a combination of domestic fixed-income securities including MBS), municipal and hybrid bond mutual funds (investing in a mix of debt and equity).

Figure 3: Decomposition of Asset Growth into Flows and Valuation Effects (percent of total)



Pension and Insurance (P&I); Money Market Funds (MMMF); Exchange Traded Funds (ETF); Sources: Federal Reserve and authors' calculations.

ICI data on net assets of long-term mutual funds confirm what we see in the Federal Reserve's flow-of-funds data (Table A.1). Two observations stand out: first, the remarkable growth of the sector, quadrupling over the last twenty years, to what is now a 22 trillion industry and second, the fact that equity mutual funds make up more than half of total net assets. While not shown in Table A.1, the ICI website reports that individual investors hold about 90 percent of open-ended mutual fund assets, with institutional investors playing a much smaller role. Bond mutual funds show continued inflows during the pandemic while equity funds have experienced persistent outflows (Figures A.2 and A.3).

3 Identifying Monetary Policy Shocks

The main measure of monetary policy shocks we use is that developed in Jarociński and Karadi (2020). They focus on interest rate surprises in the three-month fed funds future, which exchanges a constant interest rate for the average federal funds rate over the course of the third calendar month in the contract. As regular FOMC meetings are six weeks apart from each other, the three-month future reflects the shift in the expected federal funds rate after the following policy meeting, not the immediate next meeting. These shocks do not capture surprises to the balance sheet, implicitly assuming that such changes are orthogonal to surprises to the policy rate (and that balance sheet measures would not affect 3-month futures). These shocks can be aggregated to either monthly or quarterly frequency.

Jarociński and Karadi (2020) separate pure monetary policy shocks from signaling shocks related to the state of the economy — so called "Fed information" shocks. The latter capture the fact that economic agents take Fed actions as a signal about the state of the economy and adjust their expectations accordingly. For instance, a surprise monetary loosening can be taken as a sign that the economy is performing poorly. The effect of Fed information shocks, therefore, goes in the opposite direction to that of monetary policy, and mixing the two together can significantly bias the results and confound channels. Fed information shocks are distinguished from monetary shocks by assuming that the correlation between changes in interest rates and stock prices following an information shock is positive, while the correlation following a monetary policy shock is negative.

Figure A.1 presents the time-series of the Jarociński and Karadi (2020) shocks, including both monetary policy and Fed information shocks. Monetary policy shocks exhibit both significant tightening and loosening periods over our sample period.

4 The Impact of Monetary Policy on the Size of the Non-Bank Sector

In order to quantify the impact of monetary shocks on the size of the non-bank sector, we estimate local projections following Jorda (2005), for each of the following outcome variables y_t at quarterly frequency. We first consider the functional measures based on our preferred approach by Gallin (2015) for both short- and longer-term non-bank funding, as outlined in Section 2. We also provide results from regressions using institutional measures for the outcome variables. These are the institutional measures of Pozsar et al. (2010) and Adrian et al. (2010) for non-banks reliant on short-term funding, while for the size of non-banks reliant on longer-term funding, we consider real mutual funds assets (excluding money market funds) from the flow of funds, as an institutional measure. We also consider as outcome variables the corresponding functional and institutional measures of traditional banks.

For each outcome variable, the following regression is estimated with OLS using Newey and West (1987)[6] standard errors:

$$y_{t+h} - y_t = \alpha^h + \beta^h \epsilon_t + \gamma^h y_{t-1} + u_t^h \tag{1}$$

for each quarter $h = 1, 2, ..., 12$, where $\epsilon_t = \epsilon_t^{MP}$ is the monetary policy shock or $\epsilon_t = \epsilon_t^{Info}$ is the Fed information shock identified according to the methodology of Jarociński and Karadi (2020). The sample covers 1990 Q1 through 2019 Q2, limited by the availability of the identified shocks. The estimated β^h can be interpreted as the percentage point change of the outcome variable after quarter h in response to a 100 basis point contractionary monetary policy shock or a 100

[6] Since we are working with time series data, we use the Newey-West autocorrelation consistent covariance estimator to account for the possibility of serial correlation in the error term of the econometric model.

basis point positive Fed information shock.

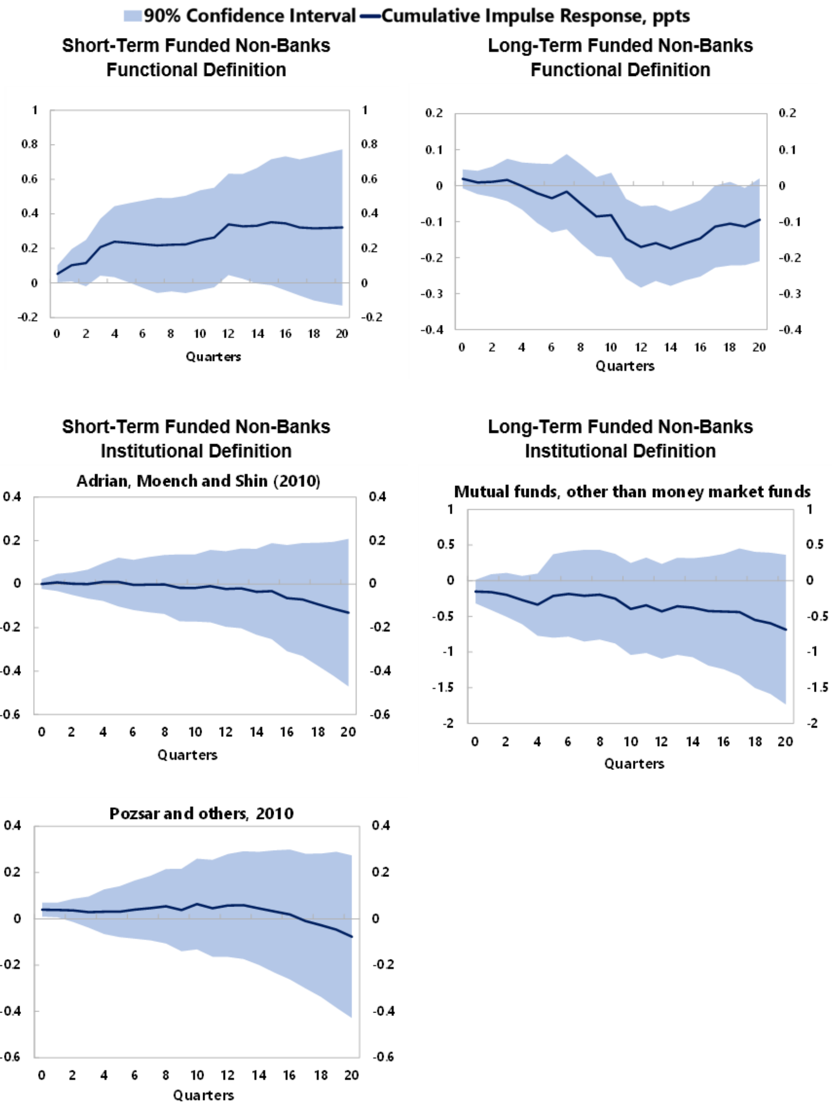
We find evidence of a 'dislocation' effect, whereby monetary tightening boosts the short-term non-bank sector, although shrinking the longer-term sector (see Figure 4). A contractionary 100 basis point monetary policy shock is found to cause an expansion in the size of the non-bank sector reliant on short-term funding, measured according to the functional methodology of Gallin (2015). Inflation-adjusted non-bank assets of this type are around 1/4 percentage point larger after five quarters, with the impact statistically significant at the 10 percent level. The impact on bank assets is not found to be statistically significant. By contrast, a similar shock is found to reduce the inflation-adjusted size of the non-bank sector reliant on long-term funding, also measured by the functional approach, by 1/4 percentage point after 12 quarters, after an initial increase in size. This effect is also statistically significant at the 10 percent level.

We find contractionary monetary policy not to have a statistically significant impact on institutional measures of the size of the non-bank sector over our more recent sample, based on our method of shock identification. The contractionary shock is found to reduce the size of mutual funds (excluding money market funds), although this is not necessarily robust to adding covariates.

Figure A.5 shows that the finding of contractionary monetary policy boosting the size of the short-term non-bank sector (when measured according to our preferred functional methodology) is robust to including lags of the shocks and a vector of control variables X_t, including year-over-year real GDP growth, the Federal Funds Rate (midpoint of target range at end of quarter), as well as a set of financial variables including the spread between the yield on ten-year and three month US treasuries (term spread), the year-over-year change in the S&P 500 index, the year-over-year change in the CoreLogic Case-Shiller house price index, and the year-over-year change in the real assets of broker dealers, all of which are relevant to the size of bank and non-bank balance sheets (see Nelson et al. (2017)). The impact of contractionary monetary policy on the size of the non-bank sector reliant on long-term funding loses statistical signficance when all controls are included.

Overall, the evidence we find of a 'dislocation' effect of contractionary monetary policy is qualitatively similar to the findings of Nelson et al. (2017), who focus on the period before the GFC, Den Haan and Sterk (2011) and Drechsler and Schnabl (2022), who focus on mortgages and consumer credit, Xiao (2020), who focuses on money market funds, as well as Peydró et al. (2021), who use micro data on certain types of non-bank lending products. These papers all find some shift of intermediation from banks to non-banks, or an expansion of non-banks, following contractionary monetary policy. One potential explanation for a 'dislocation effect' is that banks have a greater incentive to securitize mortgages outside the perimeter of the traditional banking system, rather than make loans funded by deposits, when the cost of funding from deposits increases following monetary policy tightening: see Loutskina and Strahan (2009) and Loutskina (2011) who present evidence of this mechanism using micro-data. There may also be substitution

Figure 4: Impact of 100 bps Monetary Shock on Non-Banks Assets (ppts)

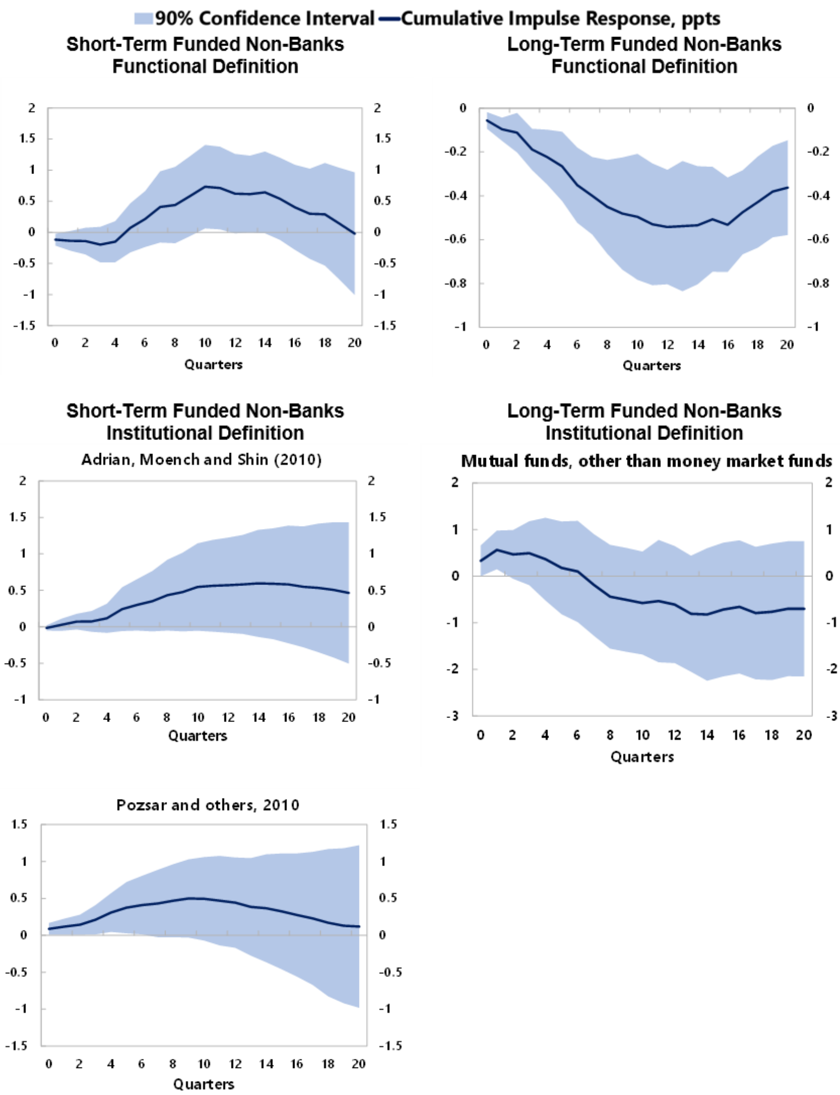


Source: Authors' calculations.

from non-banks reliant on long-term funding to those with short-term funding.

The magnitude of the effects we find on non-bank size is smaller than in earlier research, such as Nelson et al. (2017) who find that a 100 basis point contractionary monetary policy shock increased the inflation-adjusted size of the U.S. non-bank sector by a peak of 1.5 percent, after one year, although this paper is based on a much longer pre-GFC sample spanning 1966-2007 and uses an institutional measure of non-bank size, similar to Adrian and Shin (2010), while monetary shocks are identified based on a Cholesky decomposition and sign restrictions. Den Haan and Sterk (2011) also find a relatively large impact of a 100 basis point contractionary policy shock on the inflation-adjusted size of non-bank mortgages and consumer credit, increasing them by 1 and 1.5 percent respectively after 18 and 36 months, again using a pre-GFC sample of 1984-2008 and institutional measures of non-banks, with shocks identified by a Cholesky decomposition. The larger impact found in these papers may reflect a combination of differences in sample period, methods of shock identification and measures of non-banks' size. Nelson et al. (2017) also find that a 100 basis point contractionary monetary shock causes a 1 percent reduction in the inflation-adjusted size of commercial bank assets, while Den Haan and Sterk (2011) find a similar impact on bank mortgages and consumer credit, after 18-24 months.

Figure 5: Impact of 100 bps Fed Information Shock on Non-Banks Assets (ppts)



Source: Authors' calculations.

We find that a contractionary monetary policy shock does not have a statistically significant impact on the 'functional' measure of traditional bank size, for most of the horizon: (see Figure

A.7, which presents results from equation 1 without control variables). Surprisingly, the monetary shock is found to have a small positive impact on the 'institutional' measure of bank size. Given our more recent sample, these results raise the possibility that bank balance sheets have become less sensitive to the cost of deposit funding, as influenced by monetary policy, potentially consistent with the mechanism outlined in Loutskina and Strahan (2009) and Loutskina (2011). It is also noteworthy that Den Haan and Sterk (2011) find the impact of monetary policy on real bank mortgages and real bank consumer credit to be smaller in the two most recent decades preceding the GFC, compared with during the 1950's-1970's. On the other hand, Nelson et al. (2017) find that contractionary monetary shocks reduce the overall size of the banking sector, while Angeloni et al. (2015) find it reduces various measures of bank risk. We explore the potential for a time-varying impact of monetary policy on bank size in Section 6.

For the measures of non-banks based on the functional approach, a positive Fed information shock unambiguously reduces the size of the non-bank sector reliant on long-term funding, while also initially reducing the size of the sector reliant on short-term funding. These results are contrary to those found using institutional measures of non-bank size (see Figure 5) and suggest that double counting along chains of intermediation within the non-bank sector can account for some of the expansion of institutional non-bank measures following a Fed information shock. A positive information shock reduces the inflation-adjusted size of non-banks reliant on long-term funding by around $1/2$ percentage points after 12 quarters, when measured according to Gallin (2015). The impact is initially negative on non-banks reliant on short-term funding, by around $1/4$ percentage points after five quarters, but eventually turns positive. Similar results are found when including lags of the shocks and control variables in the regression: see Figure A.6. The impact of these shocks on the size of traditional banking is found to be not statistically significant A.8.

5 The Impact of Monetary Policy on Flows and Returns of Long-Term Mutual Funds

Given the impact of valuation effects on the size of non-banks, we study the impact of monetary policy on flows into non-banks (different types of long-term mutual funds), using higher frequency data. We are interested in the impact of monetary policy on both flows and returns, and since the two are related, this calls for an econometric technique that can incorporate those interlinkages. Following the methodology in Banegas et al. (2022), and using monthly data from the Investment Company Institute (ICI) during 2000-2019, we estimate a VAR where flows into long-term mutual funds and their returns are endogenous variables. Within this framework, and while controlling for other determinants, we compute the dynamic impulse responses of long-term mutual funds' net flows and returns as the monetary policy shocks propagate through the system.

We follow the ICI in defining net flows and returns. Net new cash flows into fund category i, are the sum of total sales minus monthly redemptions, net exchanges and reinvested dividends. Net exchanges are the dollar amount of net shareholder switches into or out of funds in the same complex during month t. We exclude reinvested dividends here as investors are not consciously making a decision to buy more shares in the fund. Hence, flows for each investment category are calculated as:

$$c_{i,t} = s_{i,t} - re_{i,t} - e_{i,t} - d_{i,t} \tag{2}$$

where $c_{i,t}$ denote net new cash flows into fund category, i, during month, t, $s_{i,t}$ are total sales, $re_{i,t}$ account for monthly redemptions, $e_{i,t}$ are net exchanges, and $d_{i,t}$ are reinvested dividends.

We calculate monthly price returns as the change in total net assets at the end of the month minus total net flows (which in this case include distributions) divided by assets in the previous period:

$$r_{i,t} = \frac{a_{i,t} - (c_{i,t} + d_{i,t}) - a_{i,t-1}}{a_{i,t-1}} \tag{3}$$

where $r_{i,t}$ are monthly price returns and $a_{i,t}$ are total net assets at the end of the month, t.

To study the interlinkages between flows and returns, we follow Banegas et al. (2022) and estimate a two variable VAR. The endogenous variables are the ratio of net flows to total net assets for fund type i and the return for fund category i. We also include our measure of the monetary policy surprise shocks and a vector of exogenous explanatory variables including financial and macro indicators, such as inflation, business conditions, corporate treasury spreads, the term spread and a measure of risk aversion, namely the VIX. We also include the real effective exchange rates as a robustness check since some funds invest in non-domestic assets. We use two lags based on the Akaike criterion.

The specification can be written as follows:

$$f_{i,t} = \alpha_{i,f0} + \sum_{j=1}^{p}(a_{i,pff} f_{i,t-j} + a_{i,pfr} r_{i,t-j}) + \beta_{i,f} mp_t + \psi_{i,f'} \mathbf{X}_t + u_{i,t} \tag{4}$$

$$r_{i,t} = \alpha_{i,r0} + \sum_{j=1}^{p}(a_{i,prf} f_{i,t-j} + a_{i,prr} r_{i,t-j}) + \beta_{i,r} mp_t + \psi_{i,r'} \mathbf{X}_t + v_{i,t} \tag{5}$$

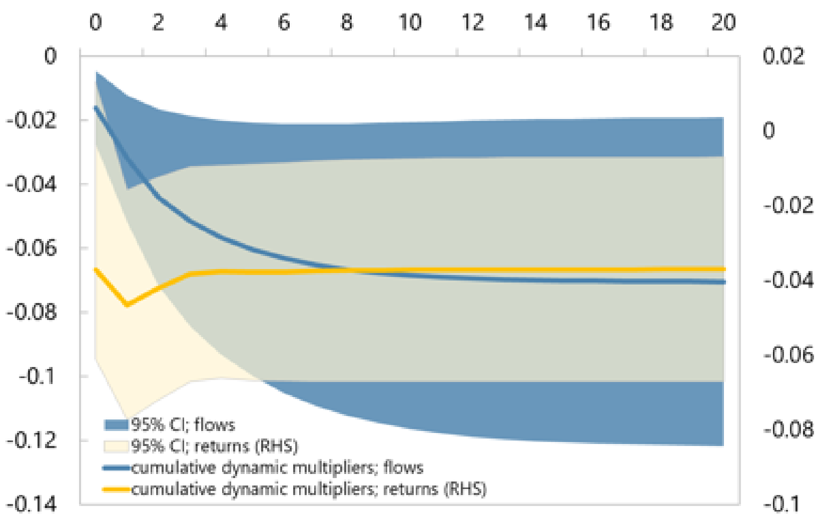
where $f_{i,t} = \frac{c_{i,t}}{a_{i,t-1}}$, i stands for type of mutual fund, $\boldsymbol{X}$ is a vector of control variables including financial and macro indicators (core PCE, ADS business conditions index, BBB corporate-Treasury spreads, term spread, VIX), and $(u_{i,t}, v_{i,t})$ are mutual fund specific innovations.

The coefficients that we are most interested in are $\beta_{i,f}$ and $\beta_{i,r}$, as they measure the impact of the monetary policy surprise shocks on fund flows and returns. Because the monetary policy surprises are exogenous, we will not be computing standard impulse response functions, which would typically suppose that there are underlying structural shocks, which are (by definition) uncorrelated, and that these shocks are related to the reduced-form shocks. This methodology would then necessitate imposing an ordering on the variables through, for example, a Choleksy decomposition. Instead, we will be computing dynamic impact multipliers that measure the impact of a unit increase in the exogenous variable, in our case the monetary policy surprise shock, on the endogenous variables over time.

For our monthly mutual fund flows and returns, we generally find that contractionary monetary policy causes outflows and depresses returns. This is consistent with the results of the previous section, where we found that contractionary monetary policy reduced the size of non-banks reliant on long-term funding, such as mutual funds. There is evidence of heterogeneity across types of funds, with a greater impact of monetary policy on high yield bond funds, relative to other bond funds, and international equity funds relative to domestic equity funds.

We first estimate the vector autoregression for aggregate bond and equity mutual fund investment strategies for the whole sample period starting in 2000. Figure 6 shows the impact of our preferred measure of exogenous contractionary monetary policy shocks on bond mutual fund flows and returns. The lines are the cumulative dynamic multipliers and the shaded areas are the confidence intervals. The figure shows that the impact of the shocks on flows and returns is significant at the 5 percent level throughout the time period of 20 months that we look at. In terms of magnitudes, a 100 basis points contractionary monetary policy surprise shock translates into a 2 percent fall in bond mutual fund net flows and a 4 percent fall in returns.

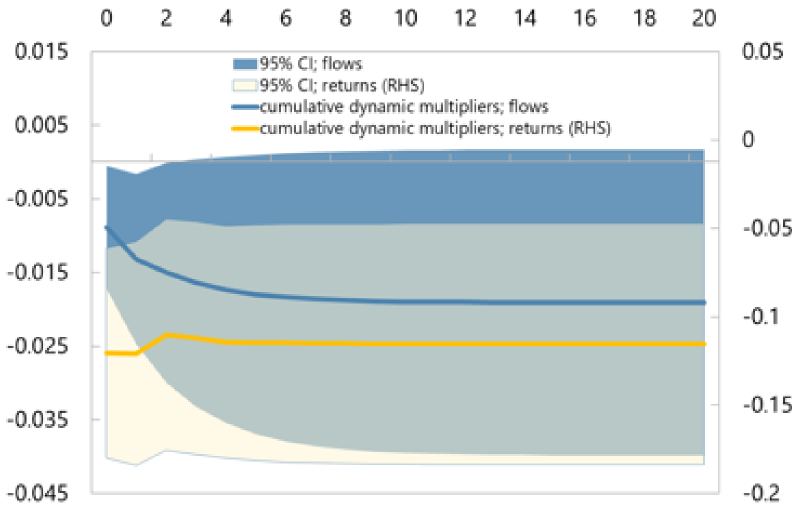
Figure 6: Total Bond Mutual Fund Flows and Returns in Response to a MP Shock



Sources: ICI, Jarociński and Karadi (2020), authors' calculations.

We also estimate the same VAR for aggregate equity mutual funds. The results show a smaller initial impact of the monetary policy surprise shocks on net flows, with a 100bps contractionary shock resulting in a decline of net flows by about 1 percentage point, but a larger impact on returns than in the case of bond mutual funds (about 12 percentage points for a 100 basis point monetary policy shock on impact). To test whether the pure monetary policy shocks have a different effect than the information shocks, we run the same VAR with the Jarociński and Karadi (2020) information shocks. As expected, positive information shocks translate into into inflows and higher returns (see Figure A.4). This highlights the importance of differentiating between those two effects.

Figure 7: Total Equity Mutual Fund Flows and Returns in Response to a MP Shock



Sources: ICI, Jarociński and Karadi (2020), authors' calculations.

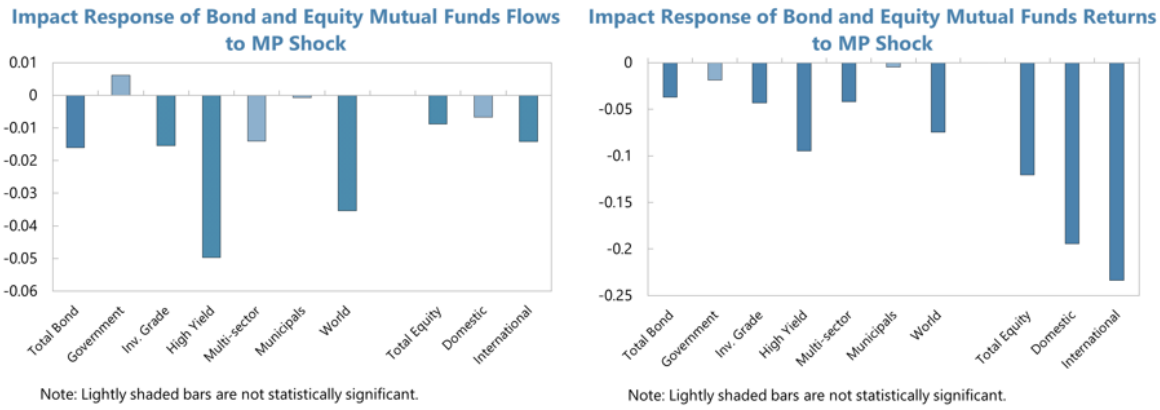
Disaggregating flows and returns by type of bond and equity mutual fund reveals some differences in terms of the impact of monetary policy shocks. Figure 8 shows the impact response of a monetary policy shock on mutual fund flows and returns. For both flows and returns, there is some heterogeneity among different types of mutual funds, albeit more in magnitude than direction. Over the whole sample period monetary policy shocks had particularly strong effects for high yield bonds and world bond mutual funds, potentially pointing to the risk-taking channel of monetary policy.

The results are generally robust to using different sets of monetary policy shocks (e.g., those by Nakamura and Steinsson (2018)) as well as the inclusion of additional explanatory variables (e.g., the exchange rate, see Tables A.2 and A.3 for overall bond and equity flows). [7]

We also test the impact of monetary policy on pre and post-GFC samples. Using the monthly ICI data, we generally find a stronger impact of monetary policy post-GFC. As shown in Figure 9, while we find the overall response to be broadly similar pre and post GFC, the sensitivity to monetary policy surprises of some types of mutual funds has increased, notably for government investment grade and world bond and equity mutual funds. The impact of monetary policy

[7] Results for disaggregated bond and equity flows and returns are available from the authors upon request.

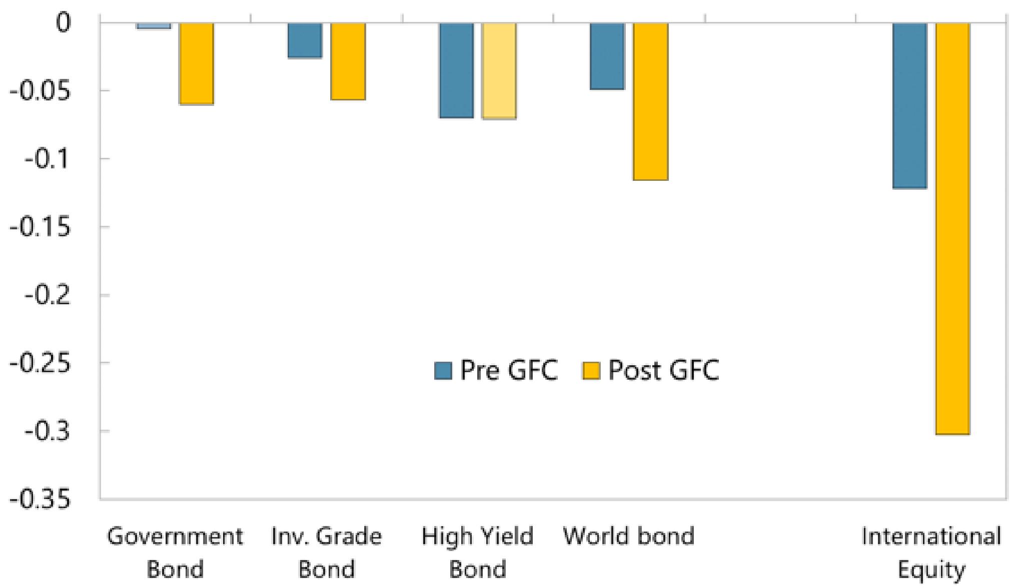
Figure 8: Responses to MP Shock by Different Types of Fund



Sources: ICI, Jarociński and Karadi (2020), authors' calculations.

surprise shocks on high yield funds is no longer significant in the post-GFC period. This could indeed point to the importance of regulatory changes in becoming a key driver of flows for the riskier mutual fund segments.

Figure 9: Impact Response of Bond and Mutual Equity Funds Returns to MP Shock Pre and Post GFC



Sources: ICI, Jarociński and Karadi (2020), authors' calculations.
Notes: Lightly shaded bars are not statistically significant.

6 The Changing Impact of Monetary Policy over Time

In order to formally assess whether the impact of monetary policy on the size of non-banks, as well as on flows into non-banks, has changed over time, we estimate a Markov Switching VAR (MS-VAR). First, we focus on monthly ICI data on flows into mutual funds and their returns, using them as endogenous variables in the VAR. We also add the monthly unemployment rate, core PCE inflation (month over month) and the Fed Funds Rate (midpoint of target range at end of month) as observable, endogenous variables. This small set of endogenous variables is chosen for parsimony and because of potential co-movement with mutual fund flows and returns, as well as its availability at monthly frequency. We assume these five endogenous variables evolve according to a VAR with two lags. We allow for three regimes for the constant terms and autoregressive coefficients of the VAR equations, as well as three regimes for the variance-covariance matrix, all of which are assumed to be independent. These assumptions and the parsimony of the VAR (with a small set of endogenous variables) minimize the computational challenges associated with the proliferation of parameters in an MS-VAR.

The MS-VAR takes the form:

$$Y_t = c_{\theta_t} + A_{1,\theta_t} Y_{t-1} + A_{2,\theta_t} Y_{t-2} + \xi_{\delta_t}^{1/2} w_t \tag{6}$$

$$w_t \sim \mathcal{N}(0, I) \tag{7}$$

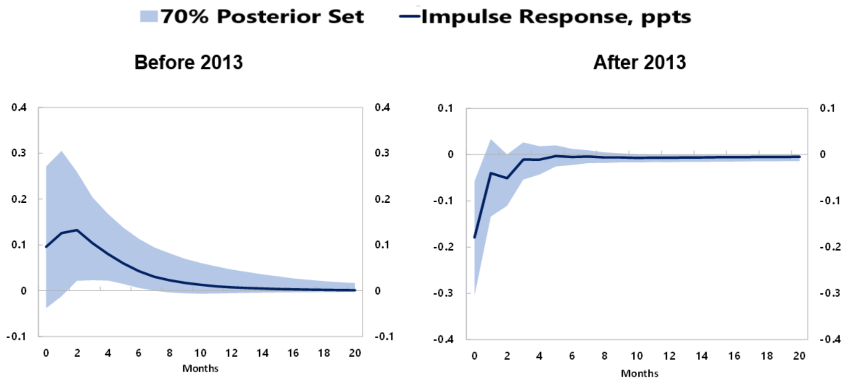
where Y_t is an $(nx1)$ vector of data on the five observable, endogenous variables. The unobserved state variables that determine the regimes in place for the VAR coefficients (constant and autoregressive coefficients) and the variance-covariance matrix are θ_t and δ_t respectively. Each of these state variables takes one of three possible finite vales, each corresponding to one of the three regimes. The state variables follow two independent Markov chains, with $(3x3)$ transition matrices G^θ and G^δ such that the probabilities $p[\theta_t = i|\theta_{t-1} = j] = g_{i,j}^\theta$ and $p[\delta_t = i|\delta_{t-1} = j] = g_{i,j}^\delta$.

Following Bianchi and Melosi (2017), the MS-VAR is esimated using Bayesian techniques with flat priors, so as not to impose any restrictions on the nature of each regime. For each observation in the sample, we compute the probability that each regime is in place, both for the VAR coefficients and variance-covariance matrix, using the posterior mode. This reveals which regimes were most likely to be in place during particular periods of history.

We identify monetary policy shocks using sign restrictions, imposing that the impulse response of core PCE inflation must be negative for five months following a contractionary monetary policy shock, while the impulse response for the Fed Funds Rate and the unemployment rate must be positive for five months. Using sign restrictions allows us to consider longer samples later in this section, which would not be possible if shocks were identified using the methodology of Jarociński and Karadi (2020).

We estimate a MS-VAR with monthly ICI data on flows and returns of long-term bond mutual

Figure 10: Time-Varying Impact of 1 Std. Dev. Monetary Shock on Bond Mutual Fund Flows (ppts)



Source: Authors' calculations.

funds over 2000-2019. We estimated the probability of being in each regime at each point during the sample, which reveals that each of the three regimes for VAR coefficients are associated with three distinct time periods (see Figure A.10). The first regime is estimated to have been in place prior to 2007, when a contractionary monetary shock caused flows into bond funds. The impact of the shock is similar during the period in which the second regime is estimated to have been in place: 2007-12 (see Figure 10). After 2013, when the third regime was in pace, there is a statistically significant reduction in flows by almost -0.2 percentage points on impact, although the effect of the shock on returns and equity flows is ambiguous.[8] It should be noted that the results of the Markov-Switching model exercise are not directly comparable to the previous section, where we use different shocks and explanatory variables and find that contractionary monetary policy still reduced flows to bond mutual funds prior to the GFC. Nonetheless, the exercise confirms and formalizes our results in the previous section that monetary transmission has changed over time, with contractionary monetary policy reducing flows to mutual funds more recently.

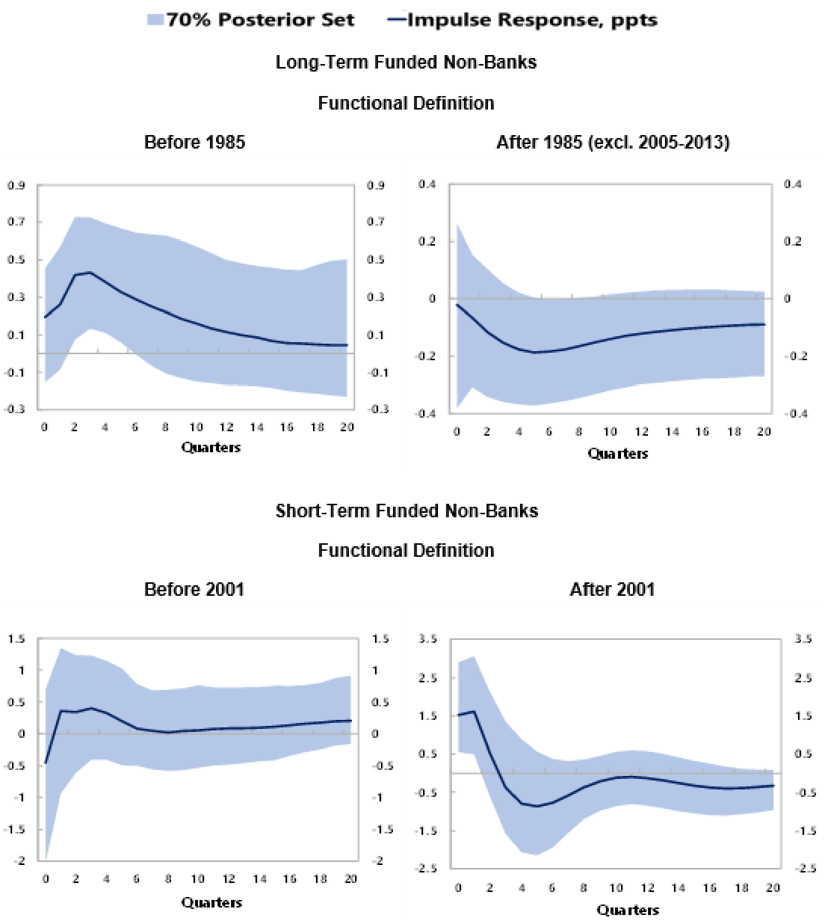
We also estimate a MS-VAR with monthly data on flows and returns of equity mutual funds, over the same sample period. We find that contractionary monetary policy does reduce flows to equity mutual funds during a regime in place before 2007, but the results are not statistically significant in a regime prevailing more recently. The impulse response functions are shown in Figure A.9, while the estimated probability of being in each regime at each point during the sample is shown in Figure A.11.

Next, we estimate MS-VARs using quarterly data on the size of banks and non-bank sectors, measured using either the functional or institutional approaches. In addition to these measures of bank and non-bank size, the endogenous variables in the VAR include the Fed Funds Rate (midpoint of target range at end of quarter), year-over-year real GDP growth and year-over-year

[8] Detailed estimates are available from the authors upon request.

growth in the GDP deflator. As with the MS-VAR using data on mutual fund flows, we chose a small set of endogenous variables for parsimony and because of their potential co-movement with the size of the bank and non-bank sectors. The sample covers 1973 Q3 through 2019 Q4, since monetary shocks are identified using sign restrictions and the sample is no longer limited by the monetary shocks identified using Jarociński and Karadi (2020). The sign restrictions impose that a monetary policy shock increases the Fed Funds Rate for the first five quarters from impact, while it reduces the growth rate of real GDP and the GDP deflator for five quarters. The estimated probability of being in each regime over the sample is presented in Figure A.12 through Figure A.15.

Figure 11: Time-Varying Impact of 1 Std. Dev. Monetary Shock on Non-Bank Assets: Functional Defn. (ppts)



Source: Authors' calculations.

MS-VARs using the functional measures of non-banks reliant or short-term or long-term funding both indicate that a regime for VAR coefficients prevailed prior to the mid 1980's, while another regime prevailed for much of the 2000s. A contractionary monetary policy shock is found

Figure 12: Time-Varying Impact of 1 Std. Dev. Monetary Shock on Non-Bank Assets: Institutional Defn (ppts)

Source: Authors' calculations.

to expand the non-bank sector reliant on long-term funding prior to the 1980's, but shrink it by up to 0.2 percentage points during the 2000's (see Figure 11). In contrast, the model using the functional measures for the size of non-banks reliant on short-term funding show a strong 'dislocation' effect after 2001, so that contractionary policy shocks boost the size of the sector.

In MS-VARs using the institutional measures of the size of the non-bank sector, there are regimes estimated to be in place prior to the mid 1980's and also after the early 2000's. Contractionary monetary shocks are found to shrink the size of mutual funds (excluding money market funds) beyond the early 2000's, consistent with what is found using the functional measure of non-banks reliant on long-term funding (see Figure 12). The results are less clear for the institutional measures of non-banks reliant on short-term funding. Using the measure of Adrian et al. (2010), contractionary policy shocks cause the non-bank sector to shrink after the early 2000's, but a 'dislocation' effect is found in the pre-2001 regime. Results using the Pozsar et al.

(2010) measure of the size of non-banks are similar. This is contrary to the findings using the functional measures of non-banks reliant on short-term funding, which showed the 'dislocation' effect in more recent times.

Overall, contractionary monetary policy appears to have reduced the size of the non-bank sector reliant on long-term funding since the early 2000's, replacing a 'dislocation' effect that prevailed during earlier regimes. Contractionary policy also appears to cause flows out of bond mutual funds after 2013. The 'dislocation' effect appears to still arise for non-banks reliant on short-term funding, but this is only found using the functional measures of the size of that sector, rather than the institutional ones.

Finally, when estimating the MS-VARs with quarterly data, we found evidence that contractionary monetary policy caused a reduction in the size of the traditional banking sector more recently. In the MS-VAR using the functional definition of banks and long-term funded non-banks, a contractionary monetary shock causes a reduction in the size of the bank sector, after an initial expansion, for the regime in place most recently (see Figure A.16). The impact is statistically insignificant in an earlier regime prior to the mid-1980's, although the contractionary shock also causes an expansion of the banking sector on impact. A similar result is found in the MS-VAR using the functional definition of banks and short-term funded non-banks. The evidence was more mixed in the MS-VARs using the institutional measures of size (see Figure A.17). In the MS-VAR using the institutional definition of banks and long-term funded non-banks (i.e. mutual funds, other than money market funds), the impact on banks after 2003 is initially positive and then not statistically significant. However, in the MS-VAR using the institutional definitions of banks and short-term funded non-banks, based on Adrian and Shin (2010), contractionary monetary policy causes a small reduction in the size of the banking sector after 2001 that is statistically significant. Overall, when we allow for a time-varying relationship using an MS-VAR, we find some evidence that contractionary monetary policy reduces the size of the banking sector more recently, whereas in Section 4, our analysis using a different methodology in a non-time varying model was inconclusive regarding the banking sector and did not show the sector contracting after a monetary shock.

7 Conclusion

In this paper, we take a multi-pronged approach to shed light on the role of monetary policy shocks in shaping the size of the non-bank sector in the U.S. over time. We show that monetary policy has a significant impact on the size of the non-bank sector, as well as flows into the sector and returns. Overall, we find that contractionary monetary policy significantly reduces the balance sheet of non-banks reliant on long term funding, while also leading to significant outflows from long-term mutual funds. Higher risk bond funds and international equity funds seem most impacted by monetary policy, consistent with the risk-taking channel. We also find evidence that the impact of monetary policy on the size of the non-bank sector has changed over time. For non-banks reliant on longer-term funding, the contractionary impact of surprise monetary tightening shocks has generally strengthened in recent years. For non-banks reliant on short-term funding, the opposite is found, with contractionary policy increasing their size, especially in more recent years, pointing to a potential 'dislocation' effect of monetary policy.

This analysis suggests that the ongoing tightening of monetary policy by the Federal Reserve may induce flows out of the mutual funds sector, with a drop in returns, as the overall size of the sector shrinks. While shrinking the size of the non-bank sector reliant on longer-term funding, which makes up the vast majority of non-bank assets in the U.S., our results also suggest that contractionary policy could increase the size of non-banks reliant on short-term funding and hence more susceptible to run risks.

These findings have important implications for policy and point to avenues for further research. The conduct of monetary policy will need to continue to adapt to changes in the transmission mechanism as nonbank financial intermediation grows. As the relative importance of the risk-taking channel has increased for non-banks reliant on long-term funding, the effects of monetary policy changes on the real economy may have become more marked. Monetary policy actions are also likely to have stronger consequences for financial soundness because they increasingly affect the risk-taking behavior of financial intermediaries, calling for greater vigilance by prudential and regulatory authorities. Further research could explore the underlying drivers of changes in monetary policy transmission to the non-banks and their consequences for monetary policy transmission to the real economy.

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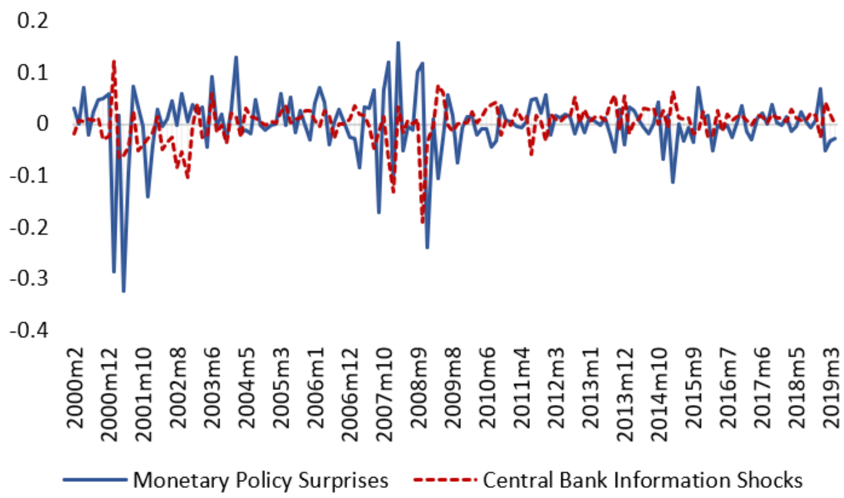
A Additional Tables and Figures

Figure A.1: Monetary Policy Shocks (JK 2020)



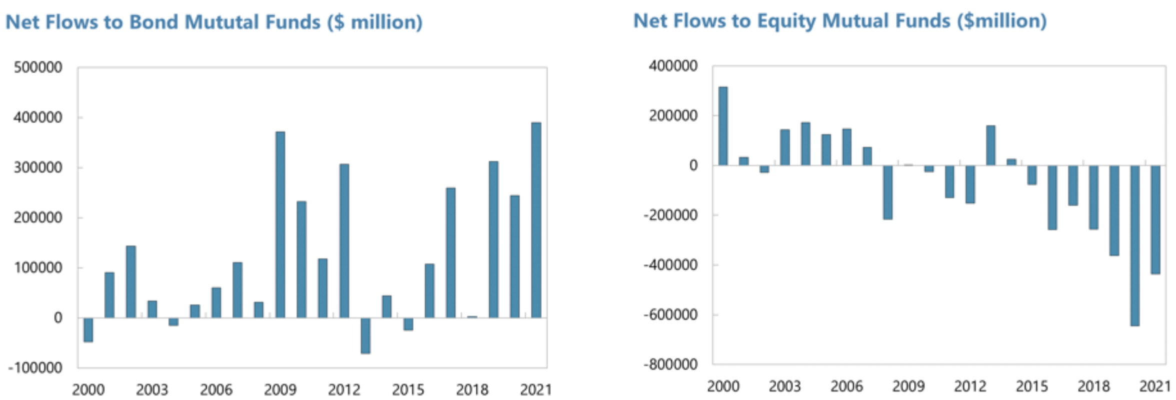
Sources: Jarociński and Karadi (2020).

Table A.1: Long-term Mutual Fund Assets Over Time

Total net assets (billions of US$, year-end)	2000	2005	2010	2015	2021
Equity Funds	3933	4885	5590	8140	14715
Domestic	3369	3929	4053	6042	11257
International	564	956	1537	2098	3458
Bond funds	817	1356	2589	3412	5625
Investment grade	246	573	1242	1510	2643
High yield	103	157	242	325	396
World	33	60	246	432	579
Government	125	167	225	266	411
Multisector	32	59	160	286	618
Muni	278	339	474	593	977
Hybrid funds	361	621	842	1341	1869
Total long-term mutual funds	5111	6862	9021	12893	22209

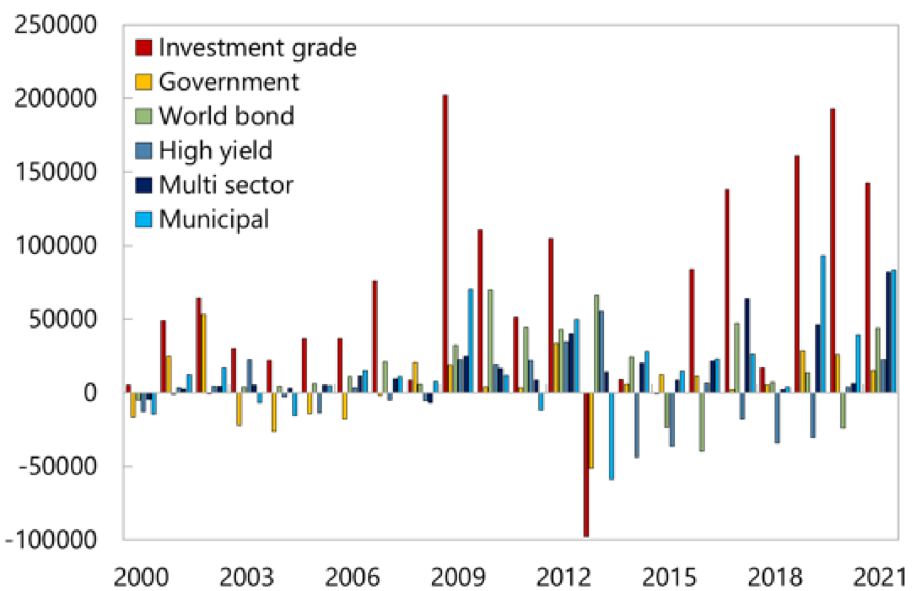
Notes: This table summarizes net assets of various mutual fund classes based on ICI data. *Sources*: ICI and authors' calculations.

Figure A.2: Bond and Equity Mutual Funds Net Flows



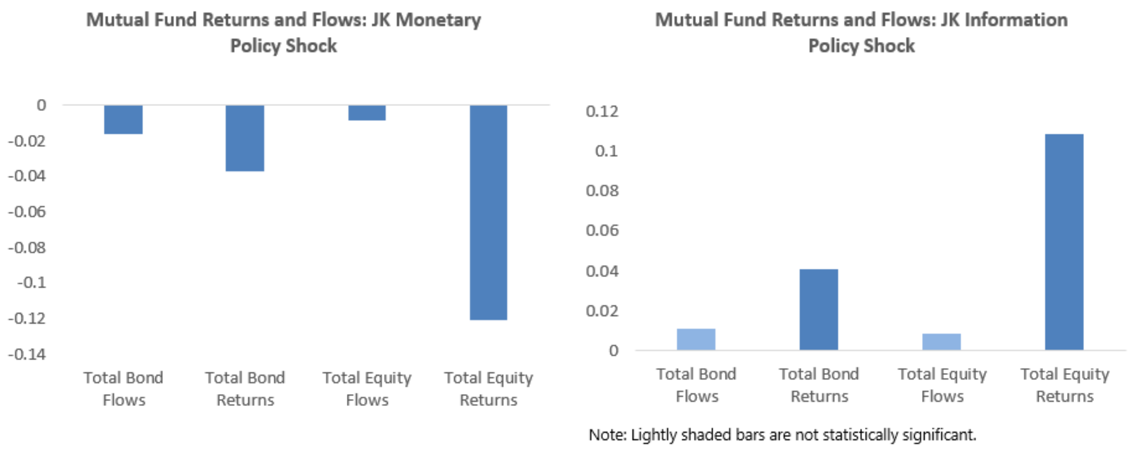
Sources: ICI, authors' calculations.

Figure A.3: Bond Mutual Fund Flows by Different Type of Fund ($ million)



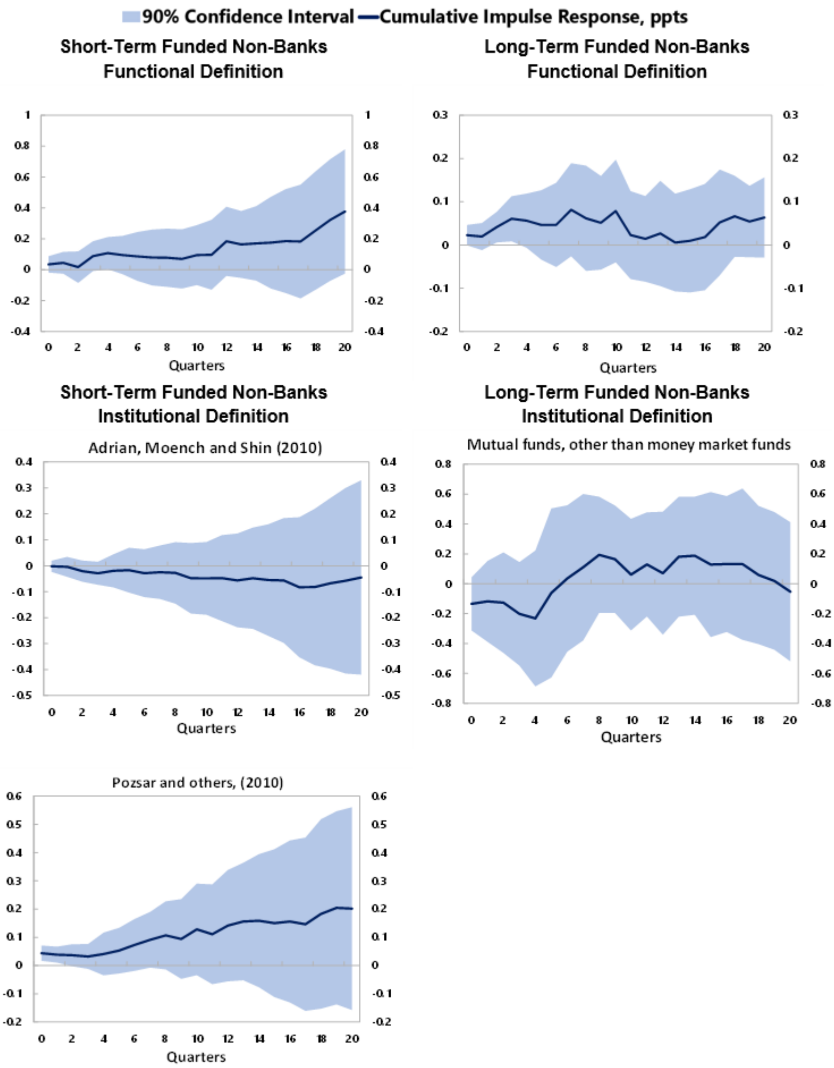
Sources: ICI, authors' calculations.

Figure A.4: Monetary Policy Shocks Versus Information Shocks



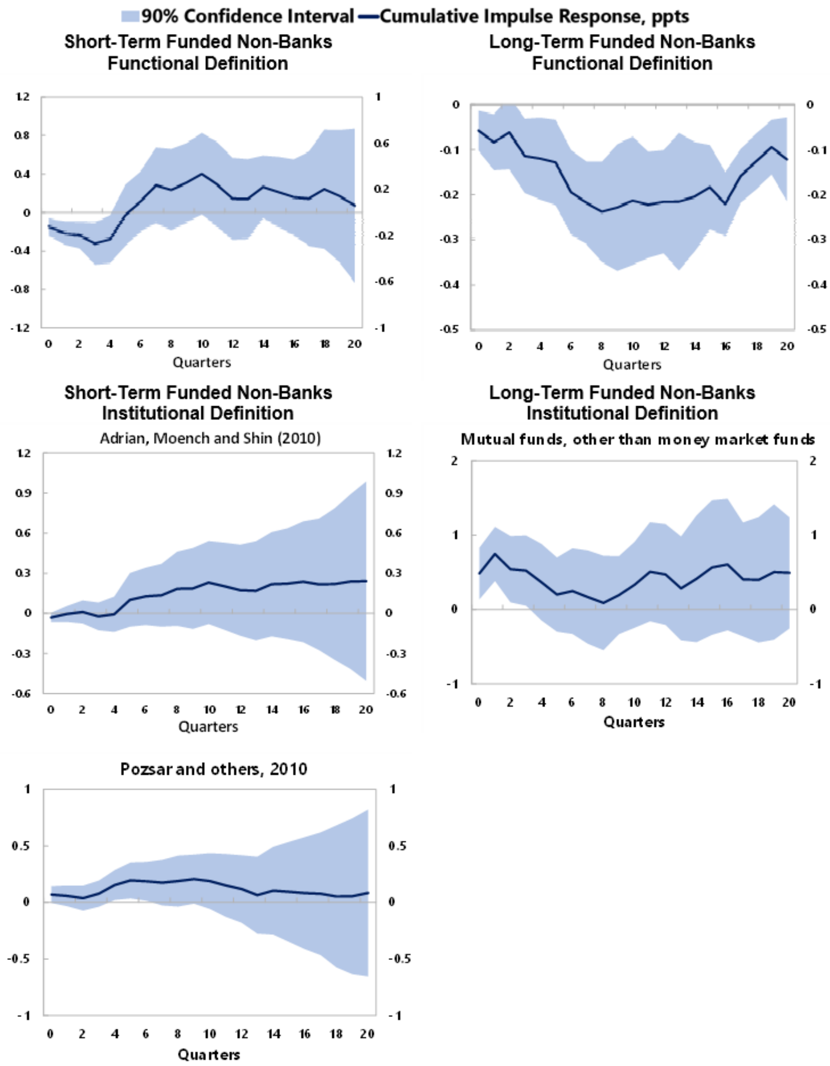
Sources: ICI, Jarociński and Karadi (2020), authors' calculations.

Figure A.5: Impact of 100 bps Monetary Shock on Non-Banks Assets (ppts)



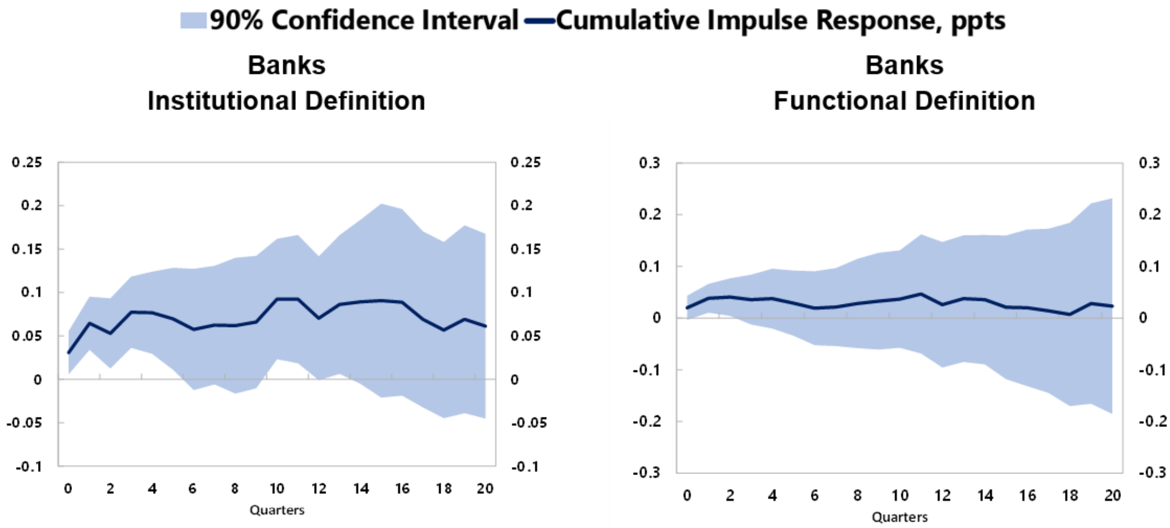
Notes: These local projections are based on regressions including the contemporaneous value and first lag of the shocks, as well as the first lag of the following set of controls: year-over-year real GDP growth, the Federal Funds Rate (midpoint of target range at end of quarter), the spread between the yield on ten-year and three month US treasuries (term spread), the year-over-year change in the S&P 500 index, the year-over-year change in the CoreLogic Case-Shiller house price index, and the year-over-year change in the real assets of broker dealers.
Source: Authors' calculations.

Figure A.6: Impact of 100 bps Fed Information Shock on Non-Banks Assets (ppts)



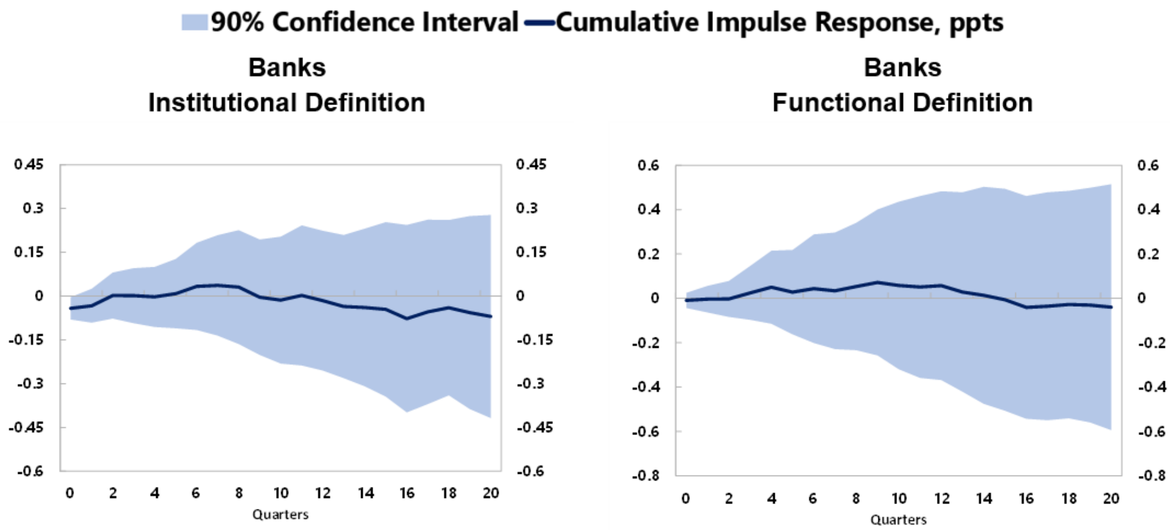
Motes: These local projections are based on regressions including the contemporaneous value and first lag of the shocks, as well as the first lag of the following set of controls: year-over-year real GDP growth, the Federal Funds Rate (midpoint of target range at end of quarter), the spread between the yield on ten-year and three month US treasuries (term spread), the year-over-year change in the S&P 500 index, the year-over-year change in the CoreLogic Case-Shiller house price index, and the year-over-year change in the real assets of broker dealers.
Source: Authors' calculations.

Figure A.7: Impact of 100 bps Monetary Shock on Bank Assets (ppts)



Notes: The 'institutional' measure comprises real assets of commercial banks, credit unions and savings institutions, from the flow of funds. The 'functional' measure is based on chains of intermediation beginning with commercial banks, credit unions and thrifts that reside in the U.S.
Sources: Federal Reserve and authors' calculations.

Figure A.8: Impact of 100 bps Fed Information Shock on Bank Assets (ppts)



Notes: The 'institutional' measure comprises real assets of commercial banks, credit unions and savings institutions, from the flow of funds. The 'functional' measure is based on chains of intermediation beginning with commercial banks, credit unions and thrifts that reside in the U.S.
Sources: Federal Reserve and authors' calculations.

Table A.2: Total Bond Flows and Returns Vector-Autoregression

VARIABLES	*Flows* Baseline	*Returns* Baseline	*Flows* Add. Var	*Returns* Add. Var	*Flows* NSS shock	*Returns* NSS shock
L.BOND	0.244***	-0.156	0.243***	-0.163	0.307***	-0.137
	(0.0932)	(0.192)	(0.0932)	(0.191)	(0.0961)	(0.175)
L2.BOND	0.365***	0.0741	0.365***	0.0731	0.275***	0.00558
	(0.0915)	(0.188)	(0.0915)	(0.187)	(0.0927)	(0.169)
L.bond_f	0.318***	0.321***	0.319***	0.325***	0.262***	0.177*
	(0.0446)	(0.0917)	(0.0446)	(0.0913)	(0.0519)	(0.0944)
L2.bond_f	-0.0103	-0.168*	-0.00829	-0.155*	0.0162	-0.0668
	(0.0447)	(0.0919)	(0.0449)	(0.0920)	(0.0493)	(0.0896)
SHOCK	-0.0161***	-0.0371***	-0.0159***	-0.0357***		
	(0.00593)	(0.0122)	(0.00595)	(0.0122)		
ADS	-0.000267	0.00595***	-0.000247	0.00608***	-0.000591	0.00460**
	(0.000776)	(0.00160)	(0.000777)	(0.00159)	(0.00109)	(0.00198)
DcorePCE	0.00732*	0.0125	0.00742*	0.0131	0.00467	0.00649
	(0.00418)	(0.00860)	(0.00419)	(0.00857)	(0.00426)	(0.00776)
TermSpread	-0.000402	-0.00170**	-0.000377	-0.00154**	-0.000316	-0.00111
	(0.000364)	(0.000749)	(0.000369)	(0.000756)	(0.000372)	(0.000677)
Corporate	0.00159*	0.00712***	0.00166*	0.00755***	0.000672	0.00358*
	(0.000963)	(0.00198)	(0.000977)	(0.00200)	(0.00105)	(0.00191)
VIX	-7.93e-05	-0.000222	-8.47e-05	-0.000256	6.10e-06	6.98e-05
	(7.69e-05)	(0.000158)	(7.80e-05)	(0.000160)	(8.17e-05)	(0.000149)
lREER			0.00168	0.0106	0.000986	0.00738
			(0.00417)	(0.00854)	(0.00434)	(0.00789)
nsshock					-0.0208*	-0.0376*
					(0.0106)	(0.0194)
Constant	-0.00262	-0.00802**	-0.0106	-0.0587	-0.00598	-0.0391
	(0.00190)	(0.00391)	(0.0200)	(0.0409)	(0.0208)	(0.0378)
Observations	154	154	154	154	146	146

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table summarizes VARs with different sets of explanatory variables.
Sources: ICI and authors' calculations.

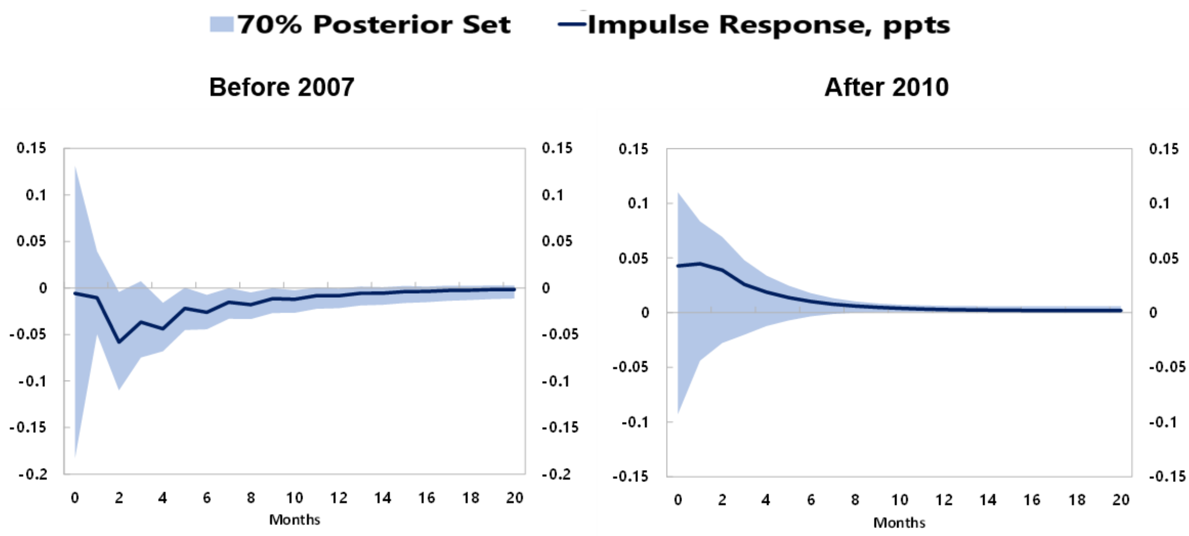
Table A.3: Total Equity Flows and Returns Vector-Autoregression

VARIABLES	*Flows* Baseline	*Returns* Baseline	*Flows* Add. Var	*Returns* Add. Var	*Flows* NSS Shock	*Returns* NSS Shock
L.EQUITY	0.270***	-0.376	0.243***	-0.446	0.264***	-0.407
	(0.0945)	(0.672)	(0.0938)	(0.678)	(0.0912)	(0.656)
L2.EQUITY	0.242***	0.691	0.225***	0.647	0.236***	0.388
	(0.0829)	(0.590)	(0.0819)	(0.593)	(0.0804)	(0.578)
L.equity_f	0.0159	0.0309	0.0181	0.0369	0.000975	-0.00641
	(0.0115)	(0.0815)	(0.0113)	(0.0819)	(0.0115)	(0.0826)
L2.equity_f	-0.0119	-0.126	-0.00742	-0.114	-0.00567	-0.0502
	(0.0108)	(0.0771)	(0.0108)	(0.0784)	(0.0109)	(0.0787)
SHOCK	-0.00886**	-0.120***	-0.00813*	-0.119***		
	(0.00426)	(0.0303)	(0.00421)	(0.0304)		
ADS	-0.000437	0.00548	-0.000381	0.00563	-0.000565	0.00331
	(0.000533)	(0.00379)	(0.000526)	(0.00380)	(0.000688)	(0.00495)
DcorePCE	0.00780***	0.0272	0.00818***	0.0282	0.00657**	0.00818
	(0.00290)	(0.0207)	(0.00287)	(0.0207)	(0.00274)	(0.0197)
TermSpread	0.000451*	0.000525	0.000554**	0.000796	0.000652***	0.00183
	(0.000259)	(0.00184)	(0.000259)	(0.00187)	(0.000241)	(0.00173)
Corporate	-0.000570	0.0164***	-0.000378	0.0169***	-0.000925	0.00653
	(0.000700)	(0.00498)	(0.000694)	(0.00502)	(0.000694)	(0.00499)
VIX	-6.88e-05	-0.00247***	-8.83e-05*	-0.00252***	-3.84e-05	-0.00209***
	(5.31e-05)	(0.000378)	(5.30e-05)	(0.000383)	(5.08e-05)	(0.000366)
lREER			0.00679**	0.0178	0.00518*	0.00689
			(0.00293)	(0.0212)	(0.00281)	(0.0202)
nsshock					-0.00122	-0.120**
					(0.00691)	(0.0497)
Constant	0.000893	0.00773	-0.0314**	-0.0770	-0.0232*	-0.00717
	(0.00143)	(0.0102)	(0.0140)	(0.101)	(0.0134)	(0.0966)
Observations	154	154	154	154	146	146

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

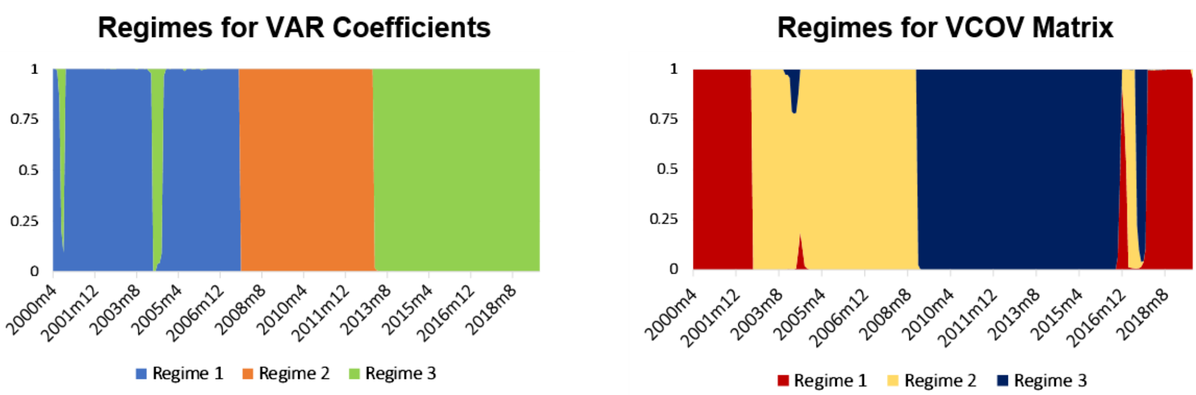
Notes: This table summarizes VARs with different sets of explanatory variables.
Sources: ICI and authors' calculations.

Figure A.9: Time-Varying Impact of 1 Std. Dev. Monetary Shock on Equity Mutual Fund Flows (ppts)



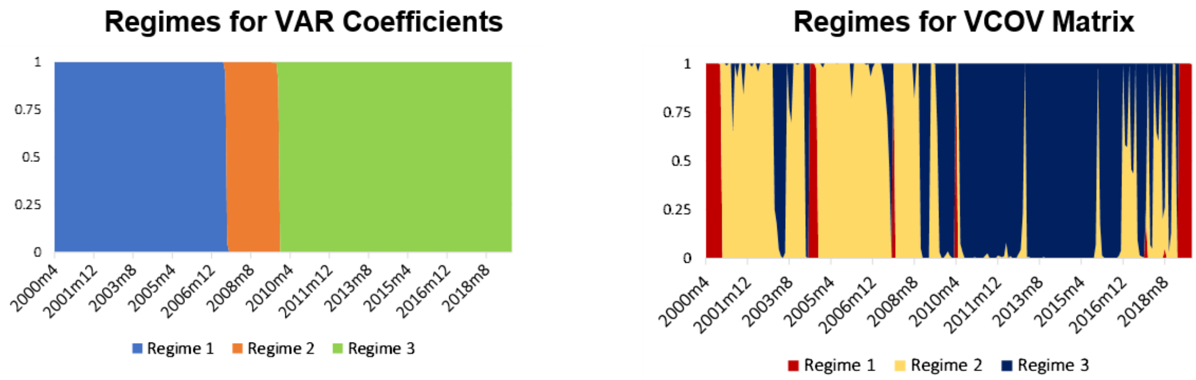
Sources: ICI and authors' calculations.

Figure A.10: Probability of Regimes Within-Sample for MS-VAR with Bond Mutual Fund Flows



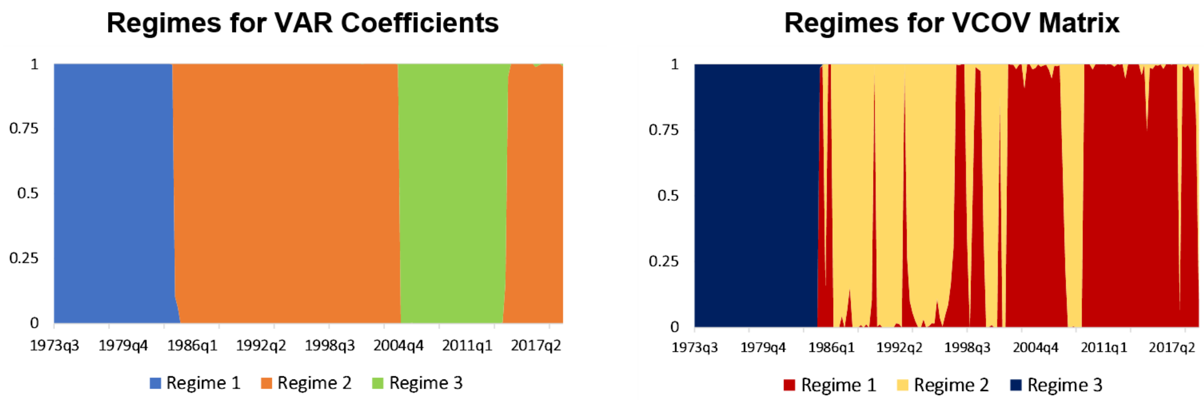
Notes: The probabilities are evaluated at the posterior mode. The three possible regimes allowed for VAR coefficients and the three possible regimes allowed for the Variance-Covariance Matrix (VCOV) are assumed to be independent.
Sources: ICI and authors' calculations.

Figure A.11: Probability of Regimes Within-Sample for MS-VAR with Equity Mutual Fund Flows



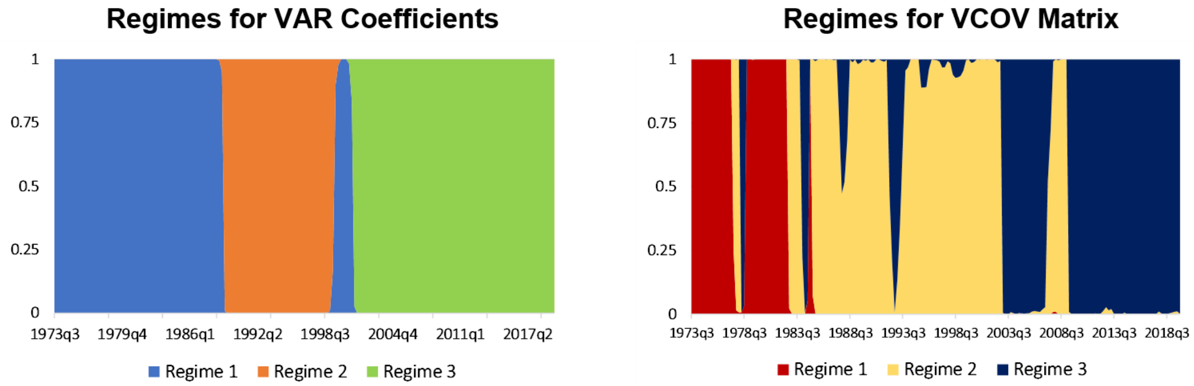
Notes: The probabilities are evaluated at the posterior mode. The three possible regimes allowed for VAR coefficients and the three possible regimes allowed for the Variance-Covariance Matrix (VCOV) are assumed to be independent.
Sources: ICI and authors' calculations.

Figure A.12: Probability of Regimes Within-Sample for MS-VAR with Assets of Long-Term Funded Non-Banks (Functional Definition)



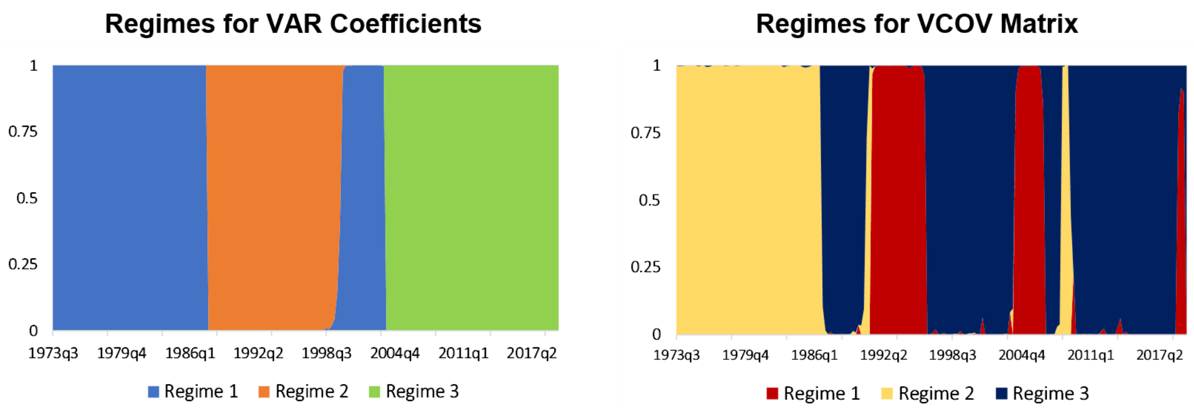
Notes: The probabilities are evaluated at the posterior mode. The three possible regimes allowed for VAR coefficients and the three possible regimes allowed for the Variance-Covariance Matrix (VCOV) are assumed to be independent.
Sources: Federal Reserve and authors' calculations.

Figure A.13: Probability of Regimes Within-Sample for MS-VAR with Assets of Short-Term Funded Non-Banks (Functional Definition)



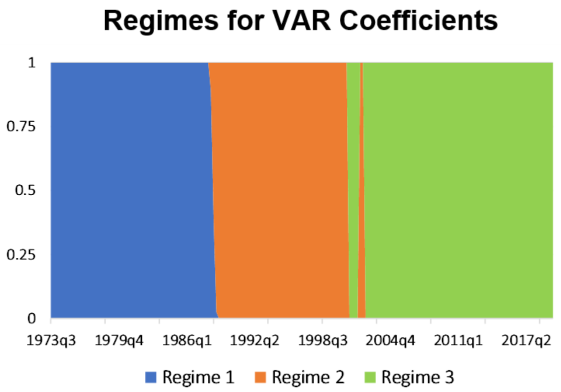
Notes: The probabilities are evaluated at the posterior mode. The three possible regimes allowed for VAR coefficients and the three possible regimes allowed for the Variance-Covariance Matrix (VCOV) are assumed to be independent.
Sources: Federal Reserve and authors' calculations.

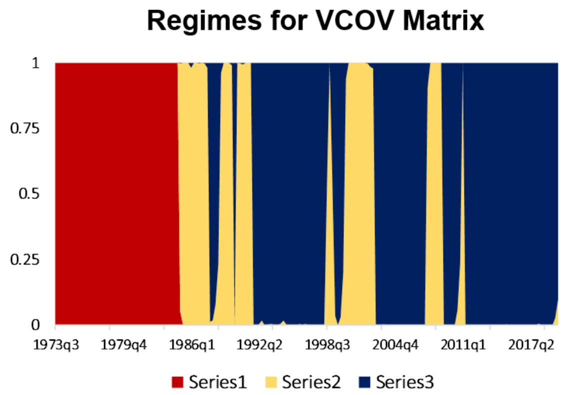
Figure A.14: Probability of Regimes Within-Sample for MS-VAR with Assets of Long-Term Funded Non-Banks (Institutional Definition)



Notes: The institutional definition of the size of long-term funded non-banks comprises real mutual funds assets (excluding money market funds) from the flow of funds. The regime probabilities are evaluated at the posterior mode. The three possible regimes allowed for VAR coefficients and the three possible regimes allowed for the Variance-Covariance Matrix (VCOV) are assumed to be independent.
Sources: Federal Reserve and authors' calculations.

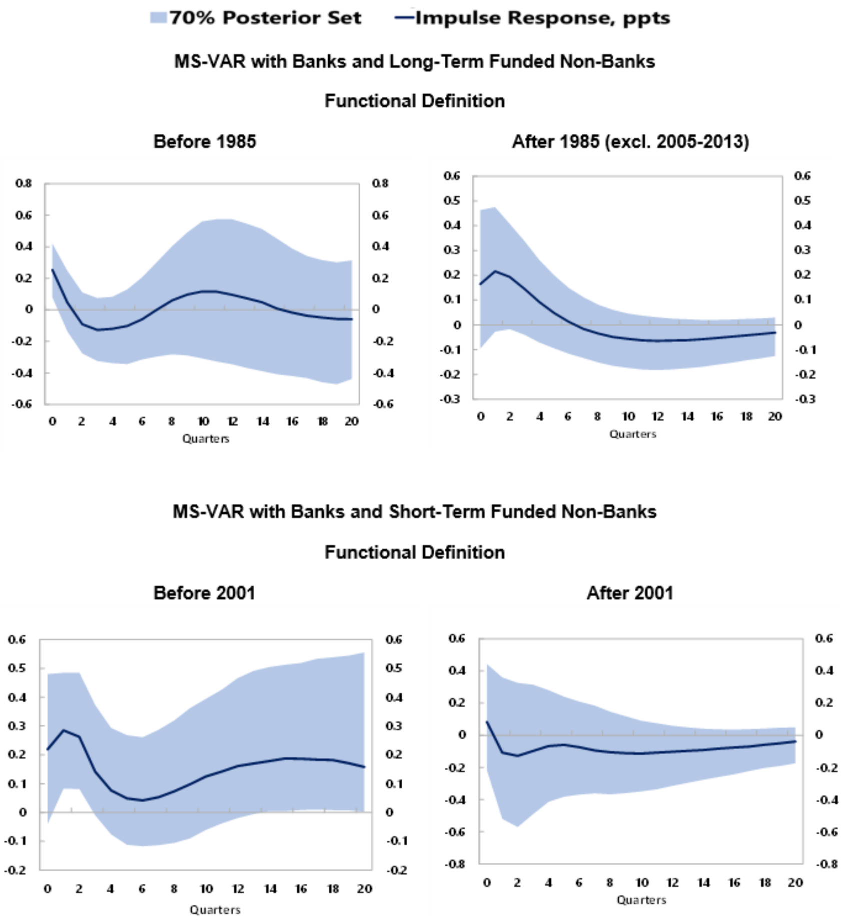
Figure A.15: Probability of Regimes Within-Sample for MS-VAR with Assets of Short-Term Funded Non-Banks (Institutional Definition)





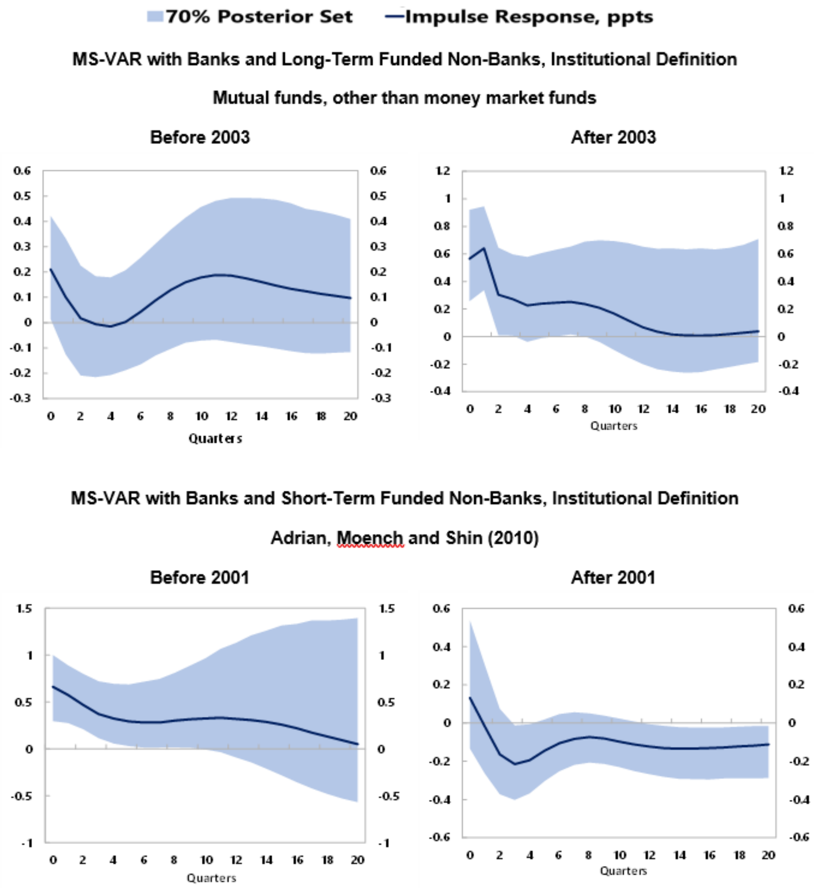
Notes: The institutional definition of the size of short-term funded non-banks is based on Adrian et al. (2010). The regime probabilities are evaluated at the posterior mode. The three possible regimes allowed for VAR coefficients and the three possible regimes allowed for the Variance-Covariance Matrix (VCOV) are assumed to be independent.
Sources: Federal Reserve and authors' calculations.

Figure A.16: Time-Varying Impact of 1 Std. Dev. Monetary Shock on Bank Assets: Functional Defn. (ppts)



Source: Authors' calculations.

Figure A.17: Time-Varying Impact of 1 Std. Dev. Monetary Shock on Bank Assets: Institutional Defn. (ppts)



Source: Authors' calculations.

PUBLICATIONS

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