Equity Flows Induced by Monetary Policy: The Roles of Financial Intermediation and Investor Performance Sensitivity

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Abstract

We develop a theory and provide measurement of equity flows across heterogeneous financial intermediaries due to monetary policy. We build an analytical intermediary-based asset pricing model where a household delegates wealth between a bank and mutual fund. The model demonstrates that in response to contractionary monetary policy, mutual funds should experience equity outflows which are absorbed by bank balance sheets. We provide empirical evidence for this claim and show that mutual funds sell significant amounts of equity quantities after a contractionary shock. To clear asset markets, we find that banks market-make and purchase equity. We confirm that the outflows mutual funds experience are net worth declines by verifying that mutual funds do not rebalance assets across alternative asset classes in response to monetary policy. We emphasize the role of investor sensitivity to recent performance of their mutual funds as a mechanism which amplifies equity redistribution due to monetary policy. We find that performance-sensitive mutual funds experience additional outflows while such a channel does not exist for banks.

JEL Codes: E44, E52, G11, G12, G21, G23, G40.
Keywords: Monetary Policy, Financial Intermediation, Portfolio Allocation, Equity Markets, Risk Premia.

[1]For comments, we thank Nicholas Barberis, Christopher Clayton, Eduardo Dávila, Carlos Garriga, Stefano Giglio, Joel Flynn, Christopher Neely, and Alp Simsek. All errors are our own. Kindly do not circulate without prior permission.

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1 Introduction

The transmission of monetary policy to financial markets is a key channel through which monetary policy affects the economy. Understanding the mechanisms behind how and why asset prices change in response to monetary policy is important for quantifying its impact and designing optimal policy. Traditionally, a large academic literature has studied the transmission of monetary policy to financial markets and measured the response of asset prices to monetary policy surprises, noting that across many asset classes monetary policy has a large instantaneous impact along with a considerably persistent effect.[1]

However, almost all studies of the financial transmission of monetary policy have focused on asset price changes when considering the impact of rate changes on financial markets. Price changes are an aggregate outcome which conceal granular changes the quantities of assets held across investors. In this study, we identify how quantities of equity securities flow across heterogeneous agents participating in financial markets to shed new light on the transmission of monetary policy to financial markets.

The key insight motivating this paper is simple: asset market transactions are predominantly initiated by financial intermediaries which have heterogeneous business models. We highlight the business models of two types of intermediaries due to their predominant market share in managing equity shares: banks and mutual funds. We provide institutional details which demonstrate that mutual funds represent buy-and-hold investors and that they return their trading profits to investors via shares of mutual funds which are liquid and redeemable at any moment. On the other hand, banks participate in equity markets to clear the market or to provide liquidity for other institutional investors. Any profits banks make through market making activities or proprietary trading does not necessarily have to be rebated to bank depositors through changes in deposit rates or dividend distribution.

Critically, banks and mutual funds have fundamentally different functions in financial markets and yet interact daily in clearing asset markets. Because of their different business models, we demonstrate both theoretically and empirically that these classes of financial intermediaries respond heterogeneously to changes in monetary policy. Such insight regarding the relative positions and roles of financial intermediaries within asset markets may contribute substantially towards explaining what are often regarded as puzzlingly large asset market movements to very small monetary shocks.

Our first contribution in this paper is to write an analytical model which establishes how equity quantities flow between heterogeneous financial intermediaries due to monetary policy shocks. Our environment is purposefully stylized to yield conjectures testable in the data. We model two

[1] See, for example, Bernanke and Kuttner (2005), Gürkaynak et al. (2005b), Cieslak and Pang (2021), Kashyap and Stein (2023).

periods where the supply-side of the economy is a standard New Keynesian framework, and a representative household chooses to consume and allocate savings under a set of beliefs. Rather than a traditional portfolio choice between stocks and risk-free bonds, the household instead chooses to delegate wealth between classes of financial intermediaries as in intermediary asset pricing models (He and Krishnamurthy, 2013; Brunnermeier and Sannikov, 2014). Our theory introduces heterogeneity on the intermediary block of the model: there is a mutual fund and a bank, both of which operate with different preferences and functions. As in reality, the two intermediaries offer different types of returns to the household. Banks offer risk-free returns to households which one can think of as savings or time deposits. Mutual funds instead offer a risky-return which depends on the underlying returns of the financial market. The main theoretical result of the model demonstrates that a monetary policy contraction in the economy causes the household to lower its wealth weight on the mutual fund, inducing equity flows away from mutual funds towards banks.

A consequence of our theory is an alternative mechanism for how monetary policy affects risk premia in the economy. Earlier theoretical work has emphasized the role of leveraged agents deleveraging due to a change in monetary policy (Drechsler et al., 2018; Caballero and Simsek, 2020; Kekre and Lenel, 2022), where explanations for ex ante leverage consist of heterogeneity in risk tolerance or beliefs among market participants. We provide a theory where the household has beliefs over future returns and financial intermediaries feature different risk tolerances. In many respects our model features similar features to preexisting theories, but notably, our model does not require a deleveraging mechanism due to the combination of household beliefs and heterogeneous financial intermediaries. We conclude our theoretical section by demonstrating that the model generates changes in risk premia due to monetary policy which is consistent with the prior theoretical literature.

The second contribution of this paper is to empirically identify how equity quantities flow across intermediaries due to a monetary shock. We employ standard data and methods from the macro-finance literature to make this contribution. To identify monetary shocks, we employ a high-frequency approach using the methods pioneered by Gertler and Karadi (2015), Nakamura and Steinsson (2018) and Bauer and Swanson (2023). For identification, we must assume that the monetary policy identified surprise is orthogonal to alternative aggregate time-varying factors which simultaneously are correlated with investor portfolio decisions. By the construction of the monetary surprise measure, this orthogonality condition is satisfied. In order to measure changes in equity holdings across financial intermediaries, we use the S34 database of quarterly institutional investment manager equity holdings. Our primary variable of interest is a measure of the change in equity quantities independent of price effects in a given quarter, which is constructed following the literature on portfolio rebalancing (Calvet et al., 2009; Chien et al., 2012).

Our main empirical exercise is grounded in the theoretical conclusions of the model. First, we test whether mutual fund holdings decline as a result of a contractionary monetary surprise. We find that a one standard deviation monetary contraction reduces mutual fund flows by 26% of their typical equity flow amount. This decline in equity purchases is highly significant both statistically and for asset prices as mutual funds and similar investment advisors comprise 74.6% of the AUM within the S34 database on average. The result that mutual funds engage in selling behavior due to monetary contractions implies that household expectations regarding equity returns play a prominent role in determining equity flows. Through the lens of the model, this empirical result suggests that the household believes that a monetary contraction which lowers asset prices contemporaneously is likely to persist, inducing equity flows away from the mutual fund. How sensitive households are to return performance is an empirical channel we test for empirically.

Due to our novel approach of studying changes in equity quantities across intermediaries, we identify that the previous studies which documented large equity price declines due to contractionary monetary shocks are caused by mutual fund selling pressures. Who then takes the opposite position in these transactions to clear the equity market? Our methodology uncovers that banks increase their buying of equities to market make for mutual funds during monetary policy events. Banks increase their purchases of equities by 40.5% of their typical quarterly flow due to a one standard deviation contractionary shock to absorb selling pressure from mutual funds. This result demonstrates that financial intermediary heterogeneity is critical to explain aggregate price movements, a point touched upon in Koijen and Yogo (2019) as they estimate starkly different latent demands for equities across classes of intermediaries. We micro-found that banks exhibit different latent demands and trading behaviors around monetary policy surprises because of their business model which is to provide liquidity to other intermediaries such as mutual funds.

The model and baseline empirical exercise suggests that household sensitivity to mutual fund returns is a key channel in explaining equity flows around monetary shocks. We test for whether mutual funds relying on more performance-sensitive investors for funding are subject to greater outflows after a contractionary monetary policy shock to validate the mechanism. Investor sensitivity to performance can be considered as an intermediary-specific factor that drives the equity flows we identify. In the model, there is a parameter that governs how sensitive the household should be to mutual fund returns when making their financial delegation decisions. While it is challenging to characterize the comparative statics of this parameter theoretically, we test for the role of its close empirical proxy within the data. Empirically, we estimate how sensitive household investors are to returns by constructing a measure of institutional investor flow sensitivity by estimating regressing manager flows on past recent performance to construct an idiosyncratic measure. This sensitivity is interpreted as a measure for how much manager assets change because of performance- if this measure is high it implies that manager receives large inflows due to positive performance.

We then interact manager sensitivity with the monetary policy surprise to see how manager-specific frictions interplay with monetary transmission to financial markets. We find that while banks are statistically insensitive to performance[2], mutual fund AUM is highly responsive to recent performance. When there is a monetary contraction which lowers equity prices, mutual funds that are more sensitive experience greater declines in equity holdings. Our results suggest that a mutual fund whose investors are one standard deviation more sensitive to performance relative to the average mutual fund experiences an additional 34% more equity outflows relative to their usual amount due to a monetary contraction.

A potential limitation of our baseline analysis with the S34 is that we only observe the equity holdings of institutional investors. This implies that the equity flows we measure cannot separately identify AUM outflows from the intermediary with changes in portfolio rebalancing. We construct a dataset linking S34 managers to mutual fund holdings that contain information on holdings of other asset classes. Using this dataset, we test whether mutual fund responses to monetary policy are driven by changes in portfolio weights or changes in total net assets. We find zero statistical evidence that mutual funds rebalance towards different asset classes in response to a monetary shock at the manager level. In contrast, we find that a one standard deviation contractionary shock lowers total net assets at mutual fund managers by 0.6% of their net assets- a highly significant amount. Because our baseline results with the S34 remove price effects by construction, this result confirms that mutual funds experience net outflows due to contractionary policy.

The final empirical contribution of the paper is to provide dynamics of the effects estimated. We extend our baseline regression to a dynamic local linear projection as in Jorda (2005), to demonstrate the dynamic impacts of monetary policy on manager equity flows. As is well known, monetary surprises are small and mean-reverting, thus we would expect that if mutual fund depositors are sensitive to fund returns, then there will be mean reversion in equity flows due to a contractionary shock. This conjecture is confirmed in the data where we measure that contractionary shocks redistribute equity from mutual funds to banks on impact but then subsequently reverse direction for the following period when the monetary shock mean-reverts. Finally, we estimate from rolling regressions that while the dichotomy of mutual funds and banks taking opposite sides of trades around monetary policy exists for our entire sample, it has strengthened since the financial crisis. The dynamics of the strength of intermediary responses throughout our sample represent a potential avenue for future research.

Related Literature.

This paper contributes to several strands of literature on asset pricing and monetary transmission to financial markets both theoretically and empirically. We contribute to the literature regarding

[2]Banks in general can make large trading profits in their market-making and liquidity provision business. However, unlike mutual funds, any profits they make are not necessarily distributed to their depositors and can be retained. This can be thought of as due to the different business model of a bank versus a mutual fund. The way a bank offers returns to depositors is generally through fixed interest rates on illiquid accounts like time deposits or certificates of deposit.

theoretical intermediary asset pricing as in He and Krishnamurthy (2013), Brunnermeier and Sannikov (2014), and He et al. (2017). In canonical models in this literature, a household interacts with an intermediary where the intermediary is not a veil, but instead the marginal investor in pricing assets. Our model follows this insight, but further introduces heterogeneous financial intermediaries to explain the patterns of flows across different intermediary classes.

Our work also contributes to the large theoretical literature on the interaction of monetary policy and asset pricing (Bianchi et al., 2022; Caballero and Simsek, 2023), where monetary policy moves risk premia. Theories of monetary policy changing risk premia have traditionally ascribed such changes to deleveraging forces caused by heterogeneity in risk tolerance (Drechsler et al., 2018; Kekre and Lenel, 2022) or heterogeneity in investor beliefs (Caballero and Simsek, 2020; Caballero and Simsek, 2022). Our model and empirical evidence propose a distinct mechanism that features both of these forces: financial intermediaries with heterogeneous risk-tolerance and a household with potentially misspecified beliefs on asset returns. Notably, our theoretical results do not require that some agents be leveraged, a fact consistent with intermediary balance sheets as we show in Section 2. That we model the household as having return sensitivity is consistent with prior empirical[3] and theoretical[4] work in behavioral finance.

Empirically, our work contributes to the literature of studies which measure the financial transmission of monetary policy. This literature includes early work by Bernanke and Kuttner (2005) and Gürkaynak et al. (2005b) which demonstrated large equity price effects caused by monetary policy. This result has continued to hold in recent times (Paul, 2019; Ozdagli and Velikov, 2020; Swanson, 2021a; Miranda-Agrippino and Ricco, 2021) and has been explained with a wide array of mechanisms. To identify a novel mechanism for financial transmission, we remove price effects of such monetary policy surprises and identify how equity quantities are redistributed following a shock. Relative to the previous studies of monetary transmission to financial markets, our approach allows us to observe redistribution of quantities of equity holdings which allows new insight not observable using aggregate asset price data.

Finally, although we do not use the same methodology, our focus on changes in quantities of asset holdings due to aggregate shocks bears resemblance to the recent demand system asset pricing literature developed in Koijen and Yogo (2019) and Gabaix and Koijen (2021). Lu and Wu (2023) is recent, related paper which studies how investors rebalance within and across asset classes due to monetary policy shocks using a similar high-frequency identification. They use their methodology to estimate what impact rebalancing has on aggregate asset prices. Rather than estimate demand price elasticities, our study instead seeks to unveil the two sides of equity market

[3]Household extrapolation of previous financial performance is a robust empirical finding. Empirical work which has documented this phenomenon includes Vissing-Jorgensen (2003), Greenwood and Shleifer (2014), Kuchler and Zafar (2019), and Cassella and Gulen (2018).

[4]Theoretical models of investor extrapolation include Barberis and Shleifer (2003), Barberis et al. (2018), and Bastianello and Fontanier (2023).

transactions occurring around monetary policy events. Our approach allows us to uncover the role of mutual fund selling pressures and bank market making activities induced by monetary policy as distinct channels which can explain asset price movements around monetary policy because we ultimately measure the redistribution in quantity and not its effect on price.

2 Institutional details

In traditional models of intermediary-based asset pricing, financial intermediaries are majority claimants of risky assets, with households have little-to-none direct equity holdings. Financial institutions take up high leverage from households to invest in a portfolio of equity and debt instruments. Investors hold fixed claims on financial intermediaries, and have limited direct control on their investment portfolios. Hence, most intermediation occurs for the purpose of proprietary trading (intermediaries trading for their own profit rather than on behalf of customers), with little role for investor involvement in portfolio allocations. In order to study the impact of monetary policy on aggregate equity portfolio reallocation, it is essential to understand its impact on the business model of financial intermediaries that are the majority claimants of equities.

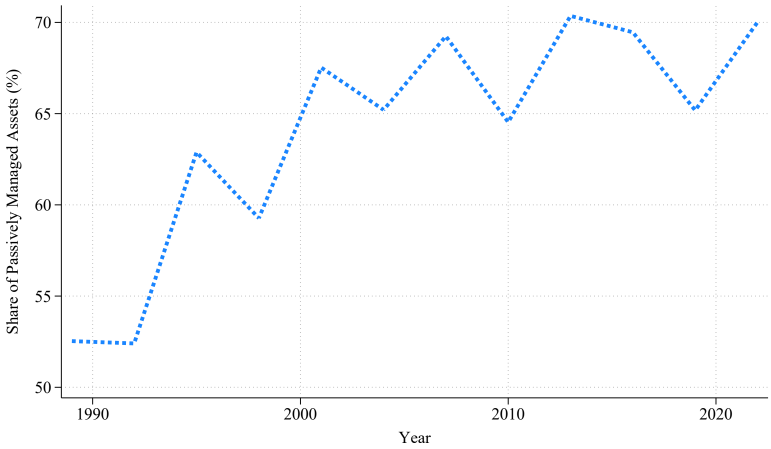
In this section, we the discuss the business models of the two largest financial intermediaries present in the U.S. equity markets: mutual funds and banks. Together, these institutions hold over two thirds of the aggregate U.S. stock market. However, these two classes of intermediaries are far from monolithic as assumed in traditional models. Their business models and reasons for holding equities differ drastically. Lastly, technological development in financial trading over the past three decades has drastically changed the landscape of portfolio reallocation: indexation has made passive investment increasingly accessible, while online trading platforms have given retail investors much greater control over portfolio rebalancing decisions. Furthermore, as discussed in Wurgler (2011), index funds generally have lower expenses and costs than actively managed funds, allowing for easy liquidation and reallocation of equities for investors.

We intend to discuss these details in this section, as we build towards a richer model of intermediary-based asset pricing that rationalizes the evidence we provide on the impact of monetary policy on aggregate equity portfolio reallocation in the U.S. over the past three decades.

2.1 Passive Management by U.S. Households

The theory and data to follow emphasizes household delegation of wealth management to financial intermediaries and the study of how these intermediaries portfolios change due to monetary policy. We argue that financial intermediaries are the relevant agent to study for financial management because of the high incidence of passive management of financial assets for U.S. households. We plot data from the Survey of Consumer Finances (SCF) in Figure 1 which demonstrates that passively managed assets as a share of total financial assets has risen sharply over recent decades. In recent years approximately 70% of household financial assets are delegated to outside managers. This share has trended up and is even more prevalent for middle income households, whereas the plotted series gives large weights to wealthy households.

Figure 1: Share of Passively Managed Financial Assets



Data from Survey of Consumer Finances Table 6 (SCF). Passive share of wealth managed is calculated as the average median wealth within an asset class across net-worth bins, weighted by total financial assets. Active management includes holdings in stocks, bonds, savings bonds, CDs, and brokerage accounts. Passive categories are retirement ccounts, investment funds, life insurance, and other managed assets.

2.2 Mutual Funds as Intermediaries

As per a U.S. Securities and Exchange Commission (SEC) report for mutual fund investors, a mutual fund is an open-end investment company registered with the SEC that pools money from many investors to invest in stocks, bonds, short-term money-market instruments, and other securities. The combined securities and assets the mutual fund owns are known as its portfolio, which is managed by an SEC-registered investment adviser. Each mutual fund share represents an investor's proportionate ownership of the mutual fund's portfolio and the returns the portfolio generates. Investors in mutual funds buy their shares from, and sell/ redeem their shares to, the mutual funds themselves. Mutual fund shares are typically purchased from the fund directly or through investment professionals, often brokers. The price, the per-share value of the mutual fund's assets minus its liabilities, is called the NAV or net asset value. Mutual funds must sell and redeem their shares at the NAV.

Table 1: Balance sheet for mutual funds

Assets		**Liabilities**	
Corporate equities	11138.9	Investor shares	16694.5
Debt securities	5081.0		
Other assets	474.6		
	16694.5		16694.5

Note:

This table is constructed using table L.122 from the Financial Accounts of the United States. The data is as of the end of 2019 Q4. Other assets include security repurchase agreements, syndicated loans to nonfinancial corporate businesses and unidentified miscellaneous assets. Values are in billions of dollars.

In Table 1 we report key line items of the aggregate balance sheet of mutual funds from the Financial Accounts of the United States collected by the Federal Reserve Board. What is notable about the aggregate mutual fund balance sheet is that their assets and liabilities are largely of the same maturity. Their liabilities, investor shares, are redeemable at any point in time, and their assets are predominantly corporate equities or debt securities which trade in liquid markets. If investors redeem their shares, there will be selling pressure on mutual funds to reduce their holdings in liquid markets such as the market for corporate equities.

In this paper, we ask how equity holdings are reallocated across the entire U.S. stock market due to monetary policy shocks. Central to our question is the study of how those shocks affect investors of the largest equity-holding financial intermediary, namely mutual funds. Two previously established facts are worth highlighting. First, retail investors are sensitive to or extrapolative of past financial returns[5]. Second, monetary policy affects stock market returns through an expectations channel.[6] Table 1 suggests a potential mechanism: investor return expectations plays an increasingly prominent role in financial markets when a majority of the aggregate equities are held by mutual funds. Combining these facts with the nature of mutual fund balance sheets, we anticipate a tight link between equity flows from mutual funds and monetary policy.

[5]See, for example, Vissing-Jorgensen (2003), Greenwood and Shleifer (2014), Cassella and Gulen (2018), and Kuchler and Zafar (2019).

[6]The seminal work on this topic is Bernanke and Kuttner (2005), but has been demonstrated times including recent work such as Ozdagli and Velikov (2020) and Miranda-Agrippino and Ricco, 2021.

2.3 Banks as Intermediaries

The most traditional type of financial intermediary explored in the academic literature is the bank. Traditionally, banks offer a return to their investors in the form of interest payed on deposited accounts, such as time deposits or certificates of deposit. Banks earn returns on assets that comprise of loans and investments in securities. While banks can invest for proprietary trading, a majority of their equity and fixed-income portfolio holdings are for market-making. While academia has explored the deposit-taking and lending roles of traditional commercial banks, a potentially under-emphasized role of the investment segment of banks in academic literature is their business in market-making.[7] As a result of this business, banks buy and trade significant amounts of equities.

Banks often separate their commercial and investment banking activities. For example, deposits taken in by the commercial banking arm are generally used to fund loans and other traditional banking activities. The investment banking arm engages in trading and securities activities, typically funded through capital markets and not directly from customer deposits. However, investment banks may use deposits to fund various activities, including trading assets, but this is regulated and limited by several rules to ensure the stability and soundness of the financial system. Regulations such as the Volcker Rule (part of the Dodd-Frank Act) restrict banks from engaging in proprietary trading with depositor funds. However, there are exceptions, such as market-making, underwriting, and risk-mitigating hedging activities.

Table 2 presents the consolidated financial statements reported by chartered depository institutions in the U.S.. We see that a majority banking assets are loans and debt security investments. On the liability side, we see that their business model differs significant from that of mutual funds in Table 1 since they rely significantly on leverage through deposits.

However, this is not the entire picture. From an accounting perspective, investment banks typically classify equities under "trading assets" or "securities available for sale" rather than directly under "equity". These classifications allow for frequent buying and selling, aligning with their business models which focus on liquidity and market-making activities. As a result, these equities are reported in categories that encompass various types of financial instruments, not just stocks. Investment banks may also engage in off-balance sheet activities, such as derivatives trading and special purpose vehicles (SPVs), where equity investments are not directly shown on the balance sheet. These activities can obscure the direct visibility of equity holdings in standard financial reports.

[7] The market-making function of banks provides liquidity to a variety of financial markets. This role that banks play often composes an important part of their profitability (Bank Trading Profits), and th eir importance to the functioning and pricing of financial markets is well understood by regulators and central banks (BIS, 2014).

Table 2: Balance sheet for banks

Assets		Liabilities	
Corporate equities	133.9	Deposits	12743.7
Mutual fund shares	58.0	Uninsured deposits	5325.1
Debt securities	4058.4	Other liabilities	5142.8
Loans	9665.5		
Other assets	2207	Equities	1821.7
	16064.8		16064.8

Note:

This table is constructed using table L.111 from the Financial Accounts of the United States. The data is as of the end of 2019 Q4. All units are reported as billions of dollars. Other assets include cash, reserves, security repurchase agreements, life insurance reserves, receivables and unidentified miscellaneous assets. Other liabilities include security repurchase agreements, payables and miscellaneous liabilities. Values are in billions of dollars.

To highlight the importance of trading for banks, we present in Table 3 a breakdown of assets and liabilities across all business segments (Commercial, Corporate & Investment) for the largest bank in the U.S., JP Morgan Chase & Co. The table is reported in the Management's Discussion and Analysis (MD&A) in the Form 10-Q quarterly report pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934. Due to the commercial banking segment, a significant portion of the balance sheet is dominated by loans and deposits, emphasizing stability and liquidity. However, we now see that the investment banking segment features significantly in the balance sheet through the large volume of trading assets and investment in securities. This highlights the banks' focus on market activities and short-term profitability.

Table 3: Form 10-Q for JPMorgan Chase & Co.

Assets		Liabilities	
Trading assets	495.9	Deposits	1525.3
Investment securities	394.3	Long-term debt	296.5
Loans	945.2	Other debt	678.5
Other assets	929.3	Total stockholders' equities	264.4
	2764.7		2764.7

Note:

This table is constructed using consolidated financial highlights (unaudited) reported in the Form 10-Q quarterly report pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934. The data is as of the end of 2019 Q4. All units are reported as billions of dollars.

In the next section, we build on these institutional details of the U.S. equity market to inform a heterogeneous model of intermediary asset pricing, featuring investors (households) with passive holdings of equities through mutual funds and banks that facilitate market-making for profits. We evaluate equity flows induced by a monetary policy shock in this context, which yields predictions which we then bring to data in sections 4 and 5.

3 Model

In this section we develop an analytically tractable, two-period model to demonstrate how equity flows across classes of financial intermediaries are affected by monetary policy. The model is written in the class of risk-centric macroeconomics developed in Caballero and Simsek (2020) and Caballero and Simsek (2023), where the real economy (output) is influenced by asset prices and monetary policy. Relative to similar models in this class, such as Kekre and Lenel (2022), we introduce financial intermediaries with heterogeneous business models and study the implications of household interactions with different types of intermediaries.

3.1 Production Environment

The model is set to be in two periods, $t \in \{0, 1\}$. Throughout this section, lowercase variables indicate the log of the variable. The supply side of the model features monopolistically competitive intermediate goods firms and a competitive final goods producer as in the classical New Keynesian model.

We derive the supply-side of the model in detail in Appendix A.1 and here offer a summary. There is a representative hand-to-mouth (HTM) household which supplies labor to the economy, which is the only factor of production. We ensure transfers in the economy are such that the HTM household receives a constant share of output produced

$$C_t^{HTM} = (1-\alpha)Y_t. \tag{1}$$

To clarify the analysis, we make the assumption that there are nominal rigidities in the form of perfectly sticky prices. Additionally, we assume that output will be at its potential in $t = 1$, but that output can be below potential to focus on its endogenous determination in $t = 0$. In $t = 1$, potential output is given

$$y_1 = y_1^* = y_0^* + z_1, \quad z_1 \sim N(\mu_z, \sigma_z^2), \tag{2}$$

such that y_0^* refers to potential output in $t = 0$ and z_1 is a permanent productivity shock. We assume that $\mu_z > 0$ so that there is economic growth in period 1.

3.2 Financial Markets

In this economy, there are two financial assets.

The first asset is the *market asset* which we refer to as the equity market. This financial asset gives a claim on the share of output accrued to firms which we show in Appendix A.1 to be αY_t. We denote that the measure of the market asset in this economy is given by S which we normalize to unity for simplicity.

The market asset pays dividends in the form of intermediate firm profits as well as capital gains. Therefore, gross returns in each period are defined as

$$R_0 = \frac{\alpha Y_0 + P_0}{P_-}, \quad \text{and} \tag{3}$$

$$R_1 = \frac{\alpha Y_1}{P_0}, \tag{4}$$

where P_t denotes the price of the asset portfolio in a given period.

We also assume that there is a risk-free bond in this economy with return R^f which is in net-zero supply. The return on the risk-free bond is set by the Central Bank, using a Taylor Rule which we will define in a subsequent subsection.

3.3 Household Environment

There is a representative household lives for two periods. The household is endowed with some level of initial wealth A_{-} and consumes out of this and chooses to invest wealth A_0.

Instead of the typical portfolio choice problem, we do not allow for the household to hold financial assets directly but instead the household delegates its wealth management to two financial intermediaries: a mutual fund (superscript M) and a bank (superscript B). Each financial intermediary offers the household a return. We assume that the return on a mutual fund is risky and the bank offers a certain return[8]. For analytical tractability, we equip the household with Epstein-Zin preferences over consumption with unitary EIS, risk aversion given by parameter γ, and that it discounts the future at rate $\exp(-\rho)$. Therefore the household maximizes utility according to

$$\max_{C_0, A_0, \omega_0^M} \log C_0 + \exp(-\rho) \log \left(\mathbb{E} \left[C_1^{1-\gamma} \right] \right)^{\frac{1}{1-\gamma}} \tag{5}$$

$$\text{subject to} \quad C_0 + A_0 = A_{-} \left(\omega_{-}^M \left(R_0^M - R^B \right) + R^B \right), \tag{6}$$

$$C_1 = A_0 \left(\omega_0^M \left(R_1^M - R^B \right) + R^B \right), \tag{7}$$

$$\omega_0^M \geq 0,$$

where R_t^M denotes the return on the mutual fund in a given period, and ω_t^M gives the household wealth weight on the financial intermediary at the end of the period. The return on the bank R^B does not change between periods. Also note that we impose a short-selling constraint to remove the unlikely scenario that a household borrows money to invest into a bank holdings.

Optimization for this problem is standard. We solve for period 0 consumption as

$$C_0 = \frac{1}{1 + \exp(-\rho)} A_{-} \left(\omega_{-}^M \left(R_0^M - R^B \right) + R^B \right) \tag{8}$$

We follow Campbell and Viceira (2002) and assume that the household portfolio return is approximately log-normal to derive that the portfolio weight is approximately given by

$$\omega_0^M \approx \max \left(\frac{1}{\gamma} \frac{\mathbb{E}[r_1^M] - r^B + \frac{1}{2}\sigma_M^2}{\sigma_M^2}, 0 \right), \tag{9}$$

where lower case variables indicate log returns. The household portfolio allocation to the mutual fund is standard and given by a Sharpe ratio scaled by risk-aversion and mutual fund volatility, but the short-selling constraint imposes that it must be weakly positive. Regarding beliefs of mutual fund returns, the household is not a sophisticated investor and has misspecified beliefs over the data generating process of period 1 returns. The household believes that the mutual fund returns

[8] We think of holdings at a bank to represent a one-period certificate of deposit or savings account.

follow the process

$$
\begin{aligned}
R_1^M &= \left(R_0^M \exp(\varepsilon)\right)^{\varphi} (R_1^*)^{1-\varphi} \\
r_1^M &= \varphi r_0 + (1-\varphi) r_1^* + \varphi \varepsilon,
\end{aligned} \tag{10}
$$

where $\varepsilon \sim N(0, \sigma_\varepsilon^2)$ and $\varepsilon \perp\!\!\!\perp z_1$. Therefore, the household believes the mutual fund return is distributed as

$$
r_1^M \sim N\left(\varphi r_0 + (1-\varphi)(y_0^* + \mu_z - p_0), (1-\varphi)^2 \sigma_z^2 + \varphi^2 \sigma_\varepsilon^2\right). \tag{11}
$$

The household beliefs over mutual fund returns weight two cases that are interesting from a theoretical perspective. The parameter φ is a sensitivity parameter that determines the relative weight that the household assigns to previous mutual fund returns. When $\varphi = 1$, the household is completely extrapolative regarding mutual fund returns. The belief parametrization also places some weight, $(1-\varphi)$, on the correct data generating process for returns based on output. We parameterize household beliefs to contain an extrapolative component due to the wide empirical literature on belief extrapolation previously cited. Other theoretical work has considered household belief extrapolation as a model prior[9].

3.4 Financial Intermediaries

Our model features two financial intermediaries who return value to the household and earn profits heterogeneously by investing in financial assets on behalf of the household.

Mutual Funds

Mutual funds are allocated a share of household wealth in period zero $A_0 \omega_0^M$, and invest in financial profits. Mutual funds operate in a perfectly competitive market and therefore earn zero profits. Furthermore, mutual funds maximize wealth respecting household preferences, so that if a household were to allocate all of its wealth on the mutual fund, our household problem would collapse to the well known two-period portfolio choice problem.

Mutual funds maximize household wealth according to

$$
\max_{\theta} \left(\mathbb{E}\left[\left(\omega_0^M A_0 \left(\theta\left(R_1 - R^R\right) + R^F\right)^{1-\gamma}\right)\right]\right), \tag{12}
$$

where θ is the portfolio weight that the mutual fund places on the market asset. Financial intermediaries have correctly specified beliefs about market asset returns due to their financial sophis-

[9] Some example of this literature include Barberis and Shleifer (2003), Barberis et al. (2018), and Bastianello and Fontanier (2023). Our model features a similar mechanism as Jin and Sui (2022) who also consider return extrapolation.

tication. Therefore, optimization and approximation of the mutual fund portfolio weight is given by

$$\theta \approx \frac{1}{\gamma} \frac{\mathbb{E}_z[r_1] - r^f + \frac{1}{2}\sigma_z^2}{\sigma_z^2}. \tag{13}$$

Due to the competitive nature of the market for mutual funds, the representative mutual fund will return $A_0\omega_0^M\left(\theta\left(R_1 - R^f\right) + R^f\right)$vto households.

Banks

Banks differ from mutual funds in two critical respects within the model: they can earn profit and they offer a fixed return to the household. Banks receive $\left(1 - \omega_0^M\right) A_0$ of household wealth in period 0. Banks maximize their wealth according to

$$\max_{\theta^B} \left(\mathbb{E}\left[\left((1-\omega_0^M)A_0\left(\theta^B\left(R_1 - R^R\right) + R^F\right)^{1-\gamma^B}\right)\right]\right), \tag{14}$$

where γ^B refers to the bank's relative risk aversion and θ^B is the bank's portfolio weight on the market asset. In each period the bank must pay out $A_{t-1}\left(1 - \omega_{t-1}^M\right) R^B$ to the household, and thus earns profits which they consume,

$$C_t^B = \left(\theta^B\left(R_1 - R^R\right) + R^F - R^B\right)\left(1 - \omega_{t-1}^M\right) A_{t-1}.$$

We again approximate the bank portfolio weight on the market asset as

$$\theta^B \approx \frac{1}{\gamma^B} \frac{\mathbb{E}_z[r_1] - r^f + \frac{1}{2}\sigma_z^2}{\sigma_z^2}. \tag{15}$$

Market Clearing Conditions

Given the description of financial assets, the household, and financial intermediaries, we can define the market asset clearing condition by

$$A_t\left(\omega_t^M\theta_t + \left(1 - \omega_t^M\right)\theta_t^B\right) = P_t. \tag{16}$$

As shown in Appendix A.1, financial markets receive a claim on output of αY_t each period. Given household and bank consumption, the goods market equilibrium is defined as

$$\alpha Y_t = C_t + C_t^B. \tag{17}$$

3.5 An Equilibrium Characterization

To provide clarity on the main mechanisms and implications of the model, we make a number of clarifying assumptions and characterize an equilibrium.

Asset Pricing

First, we choose the initial condition that coming into $t = 0$, the household has its entire wealth invested in mutual funds, $\omega_{-}^{M} = 1$. This simplifies analysis of period 0 as the bank then consumes zero profits initially. Using (17) with this condition implies

$$\alpha Y_0 = C_0^H.$$

We then use the goods market equilibrium condition in period 0 and combine it with the optimal consumption policy (8), which gives an output-asset pricing equation in logs

$$y_0 = p_0 + \rho - \log \alpha. \tag{18}$$

Using the consumption policy we can also derive the log return in period 0 as

$$r_0 = \kappa + p_0 - p_{-}, \tag{19}$$

where $\kappa = \log(\alpha \exp(\rho) + 1)$.

Because the market asset is a unitary measure and bonds are in net zero supply, we note that $A_0 = P_0$. Using asset market clearing in period 0, (16), and combining with the household portfolio optimization (9), and the intermediary portfolio weights (13, 15) we derive an aggregate risk balance equation,

$$\frac{y_0^* + \mu_z + \log \alpha - p_0 + \frac{1}{2}\sigma_z^2 - r^f}{\sigma_z} = \gamma(\omega_0^M)\sigma_z, \tag{20}$$

$$\text{where} \quad \gamma(\omega_0^M) = \left(\frac{\omega_0^M}{\gamma} + \frac{1 - \omega_0^M}{\gamma^B}\right)^{-1}.$$

The term $\gamma(\omega_0^M)$ is the inverse of the aggregate effective risk-aversion in the economy which is weighted by the household wealth shares on each intermediary. This function implicitly prices the market asset.

The Central Bank and Monetary Policy

At this point it is convenient to define the objective and role of the central bank in the economy. The central bank has an objective to set $y_0 = y_0^*$. In order to achieve this policy objective, the output-asset price equation (18) implies that there is a p_0 such that $y_0 = y_0^*$. In light of the aggregate risk balance condition, (20), there is an $r^{f,*}$ that satisfies the condition[10] $y_0 = y_0^*$ through the role of $r^{f,*}$ on p_0. The central bank attempts to set $r^{f,*}$, but instead sets

$$r^f = r^{f,*} + \eta, \quad \eta \sim N(0, \sigma_\eta^2), \tag{21}$$

where η is a monetary policy shock and σ_η^2 is the variance of the shock which is small.

Implications of a Monetary Policy Shock

To complete characterization of the equilibrium and to generate novel, testable predictions to bring to data, we make the following parametric assumption,

Assumption 1. $\gamma^B = \gamma + \nu$*, where* $\nu > 0$ *and* ν *is small.*

Our first assumption dictates that banks are the relatively more risk averse financial intermediary[11] but not dramatically more so.

Assumption 2. $\varphi \geq \frac{1}{2}$,

we also assume that the household is sufficiently sensitive to period 0 returns. This assumption will determine the sign of the comparative statics to follow and is validated in the empirical analysis.

Using the environment and assumptions defined, we are able to generate predictions capable of being tested in empirical work. The main theoretical result we derive is given

Proposition 1. *A contractionary monetary policy shock* ($\eta > 0$) *reduces the household weight on mutual funds:* $\frac{\partial \omega_0^M}{\partial \eta} \leq 0$*. The outflows are absorbed by the bank intermediary.*

Proof. See Appendix A.4. □

Proposition (1) establishes that if the household is sensitive enough to period 0 returns, then it will redistribute its wealth from its mutual fund to a bank when there is a contractionary monetary policy shock. We will test for this prediction directly in the data subsequently.

The effect of the sensitivity to the previous returns, φ, on both portfolio weights and the change in portfolio weights due to a contractionary shock would be interesting to sign. However, to do so theoretically would require strong assumptions on the magnitude of various parameters. To keep the theoretical analysis robust, we do not provide these conditions to sign the comparative statics with respect to φ, and instead will allow the empirical analysis to shed light on the role of sensitivity to past returns in determining equity flows generated by monetary policy.

[10]See Appendix A.3 for a derivation of this target rate.

[11]See Section 2.3 for discussion of bank business activities. One can think of this assumption as capturing that banking regulations such as Basel III makes market-making a costly activity for banks.

Corollary 1. *A monetary policy contraction ($\eta > 0$) increases the risk premium in the economy.*

Proof. See Appendix A.4. □

A consequence of Assumption 1 is that contractionary policy shocks increase the risk premium in the economy[12]. As our empirical study does not focus on reactions of risk premia to monetary policy shocks, we wished to highlight it. Empirical studies that have inferred the effects of monetary policy on various risk or term premia in the economy include Bernanke and Kuttner (2005), Bekaert et al. (2019), and Gertler and Karadi (2015).

Our theory proposes a distinct channel for monetary policy to affect risk premia compared to the existing literature. In this model, the main mechanism for changing risk premia are household wealth distributions across heterogeneous financial intermediaries. Compared to the existing theoretical literature, an interesting implication is that monetary policy can affect risk premia even when the agents in the model are not leveraged, a fact more consistent with real intermediary balance sheets[13].

4 Data Description

In this section, we begin by outlining the data sources we use for equity holdings at institutional managers. We then describe our off-the-shelf measure of monetary policy surprises. Finally, we provide summary statistics for the key data sources used in the study.

4.1 Institutional Asset Holdings Data

We make use of several data sources for our analysis. To observe the equity holdings of institutional investors at the fund manager $\times$ equity $\times$ quarterly date level we use the Thomson Reuters Institutional Holdings Database (S34 file), which are compiled from the quarterly filings of Securities and Exchange Commission Form 13F. All institutional fund managers with equity investment accounts exceeding \$100 million in total market value are required by the SEC to file Form 13F, which implies that the S34 covers a large share of the entire equity market.

The detailed nature of the S34 permits us to merge data on equity characteristics for each stock $\times$ quarterly date using data from the Center for Research in Security Prices (CRSP). Notably, because we are interested in studying equity quantity flows less valuation gains/losses, merging data from CRSP permits indexing prices to the previous quarter to remove contemporaneous price

[12] Note that Proposition 1 holds if $\gamma^B < \gamma$, what Assumption 1 buys is that the risk-premium simultaneously increases. This is a choice on parameters to demonstrate that our model can replicate findings in other theoretical works including: Drechsler et al. (2018), Caballero and Simsek (2020), Caballero and Simsek (2021), and Kekre and Lenel (2022).

[13] Note that mutual funds do not exhibit net leverage to purchase equities as seen in their balance sheets, as demonstrated in Table 1.

effects of monetary surprises, and instead study changes in quantities within and across investors. The CRSP dataset on stocks further allows us to control for stock splits and dividend payouts for each stock in every fund manager's portfolio every time period.

Within the S34 file, fund managers are grouped into six classes: mutual funds, independent investment advisors, banks, pension funds, life insurance funds, endowments (universities and foundations). We rely on classifications by Thomson Reuters prior to 1998 since classifications after 1998 are poorly recorded, and rely on Koijen and Yogo (2019) and work by Brian Bushee for updating classifications after 1998. Finally, we hand clean and categorize the top 100 fund managers to ensure the accuracy of our approach. All non-identified managers are categorized as others.[14]

A limitation of the S34 dataset is the absence of non-13F securities, such as cash and bond positions. We utilize fund $\times$ quarterly date level data provided by the CRSP Mutual Funds Database (MFDB) to study holdings of bonds, cash and other securities for funds. This dataset crucially provides data on returns, net asset value (NAV), total net assets (TNA), expense ratios, loads, and other fees for funds. The CRSP MFDB dataset reports fund characteristics from 1961 onward, and holdings data from 2003 onward.

In order to link manager level holdings of the S34 to the fund-level data of the MFDB, we make use of the S12 database. The S12 database is the compilation of SEC N-30D filings to the SEC from mutual fund companies. This data provides equity holdings of mutual fund companies at the fund-level and Wharton Research Data Services (WRDS) provides a manager crosswalk from the S34 to the S12. We merge the S12 data with the S34 managers at the fund $\times$ quarterly date level, then further merge this data to the CRSP using the MFLinks linking tables provided by WRDS. Finally, we aggregate the data to the fund manager level using the the share of each fund's assets-under-management (AUM) as a weight.

4.2 Monetary Policy Surprises

The goal of this study is to identify equity flows across financial intermediaries caused by monetary policy. Our preferred measure for a monetary policy surprise is the one proposed by Bauer and Swanson (2023), that accommodates interest rate surprise identified in earlier work[15] for innovations in economic news and professional forecast revisions between Fed announcements. Their measure employs high-frequency identification of a monetary policy surprise. Specifically, their measure condenses the monetary policy surprise into a single dimension by taking the first principal component of rate changes in short-maturity federal funds futures contracts and two- to four-quarter-ahead Eurodollar futures contracts in a narrow, 30-minute window surrounding

[14] Appendix table B.1 provides a list of the ten largest fund managers by assets-under-management in our dataset.

[15] Notable examples of high frequency identification of monetary policy shocks and the identification arguments for them include Gürkaynak et al. (2005a), Gertler and Karadi (2015), and Nakamura and Steinsson (2018).

each FOMC announcement. The resultant time series is a reflection of monetary surprise at both the short-horizon and along the longer-maturity yield curve. These monetary surprises are then purged of any remaining explainable time-variation by orthogonalizing the surprises on a vector of economic news to create a series of monetary policy surprises which are orthogonal to any news besides the policy announcements. Utilizing such a high-frequency approach for identification of monetary shock transmission is increasingly common in the empirical literate.[16] We will subsequently describe our assumptions for identification when discussing our empirical specifications.

One difficulty arises because high-frequency monetary policy surprises are by nature constructed to represent a short-window where the monetary policy stance has been altered by policy makers. Our data on institutional holdings are quarterly, a lower frequency. To measure the MPS of a quarter our baseline is to aggregate all MPS events in a given quarter as has been performed in a variety of empirical applications measuring the effects of monetary policy at the quarterly frequency including Ottonello and Winberry (2020) and Altavilla et al. (2019).

We aggregate the MPS events in a given quarter by weighting each event by the time from the beginning of the quarter to the event, implying that later monetary events receive a larger weight. Our rationale for this weighting scheme is that traditional models of portfolio choice (Merton, 1971) emphasize instantaneous portfolio rebalancing by investors, and even recent work on mutual fund flows has demonstrated that mutual funds actively rebalance at least at the quarterly frequency (Parker et al., 2023). Therefore, we give larger weight to monetary policy events that occur closer to the report date[17].

Our series for monetary surprises begins in 1989, whereas the institutional investor holdings data begins in an earlier period. Therefore, results throughout the paper are calculated for the years 1989-2019 to begin the sample as early as possible, while avoiding the period encompassing COVID-19.

4.3 Summary Statistics

Table 4 presents summary statistics of key variables by financial intermediary class: number of institutions within class, % of market held within the S-34, AUM, equity flows, fund manager return, and investor performance-sensitivity. Construction of equity flows and investor performance-sensitivity is discussed in the following section. Equity flows capture the proportion of a fund manager's equity portfolio that gets sold or bought quarter-on-quarter.[18] For a sense of magni-

[16]See, for example, Ottonello and Winberry (2020), Swanson (2021b), Ma and Zimmermann (2023), and Kroen et al. (2023).

[17]We check for robustness for all results in Section 5 using an alternative MPS variable where the shocks in a quarter are simply summed with equal weights and confirm that our empirical results do not depend on this particular construction of monetary policy surprises.

[18]We present its absolute value to eliminate opposing signs for buy and sell side activity, and present a measure that captures the extent of churn in a fund manager's equity holdings. The flow measure is purged of any valuation

tude, a value of equity flows of 0.129 implies 12.9% of the portfolio experiences churn. Investor performance-sensitivity is a measure of flows induced by a fund manager's α, with a positive value indicating high inflows in response to a high α.

We report that mutual funds and investment advisors capture around two-thirds of the market in the two decades 1990-2010, and around four-fifths of the market since 2010. Investment banks market around a fifth of the market in the first two decades, and fourteen percent in the last decade. Together, these two segments capture above ninety percent of the market.

Next, while the median mutual fund and investor advisor was of a similar size as the typical bank by AUM in the earlier part of the sample, banks greatly outpaced the growth of other intermediaries over time. This growth occurred as the number of banks fell, implying bank consolidation. The opposite is true for mutual fund and investor advisors. Both intermediary classes experiences similar churn in equity portfolios, in the mean and in the right tail. However, mutual funds and investment advisors have higher performance-sensitivity, particularly excluding the 2000-2009 decade. Interestingly, banks are the only large financial intermediary to have negative performance-sensitivity, with a particularly high magnitude in the recent decade. A negative relationship implies inflows (outflows) after a recent poor (good) return of the equity portfolio. We discuss this further in the subsequent section, and argue that it is a representation of the insensitivity of banks' trading behavior to their performance due to their market-making function.

We also report the summary statistics for the quarterly monetary policy surprises provided by Bauer and Swanson (2023) in Table B.2. Our baseline MPS measure on average features a shock of 0 basis points in a quarter and the distribution of surprises is symmetric. The standard deviation of our baseline measure is 7 basis points.

effects and hence represents pure quantity changes.

Table 4: Summary statistics by financial intermediary class

Period	**Number of Institutions**	**% of market held**	**AUM ($ million)**		**Equity flows** ($(\|\Delta\, \omega\|)$)		**Fund manager return**		**Performance-sensitivity** ((α))	
			Median	90th percentile	Mean	90th percentile	Mean	90th percentile	Mean	90th percentile
Mutual funds & Investment advisors										
1990-1999	1820	64.6	168	2134	0.129	0.275	0.881	1.090	-0.707	1.328
2000-2009	3689	66.4	214	3066	0.132	0.292	0.860	1.091	1.125	3.759
2010-2019	6188	78.7	292	4125	0.111	0.233	0.918	1.084	3.529	19.573
Banks										
1990-1999	376	22	172	2963	0.129	0.257	0.934	1.086	-1.171	0.928
2000-2009	279	23.6	247	10279	0.122	0.241	0.892	1.079	1.647	6.080
2010-2019	283	14	463	16436	0.102	0.206	0.959	1.089	-2.622	14.053
Pension & Life insurance funds										
1990-1999	173	12.8	313	4166	0.142	0.307	0.904	1.086	-0.905	1.126
2000-2009	156	9.4	959	17966	0.123	0.280	0.883	1.102	1.150	6.738
2010-2019	155	5.9	2171	30931	0.102	0.226	0.931	1.093	15.379	76.836
Other fund managers										
1990-1999	50	0.9	83	920	0.072	0.211	0.812	1.095	-0.136	0.599
2000-2009	152	0.8	100	1374	0.097	0.260	0.824	1.105	-0.093	1.553
2010-2019	207	1.4	127	3798	0.048	0.134	0.833	1.145	-5.932	18.789

5 Equity Market Responses to Monetary Policy

In this section we conduct empirical tests to identify how monetary policy redistributes equity across financial intermediaries through trading. Our empirical analysis is motivated by the theory of Section 3. We test whether mutual funds experience outflows due to contractionary shocks, whether banks absorb these outflows, and sign whether these flows are stronger if their investors are more performance sensitive. Because our measure of equity flows cannot separately identify a rebalancing channel from an AUM channel, we use our mutual fund data sources to examine which of these channels is dominant in explaining the baseline results. Finally, we extend our baseline exercise to a dynamic environment and study the long-run impact of monetary shocks on equity flows.

5.1 On-impact Equity Flows Responses

We are interested in documenting equity flows induced by a monetary surprise for the universe of financial intermediaries discussed in Section 2. As proposed in Section 3, we would like to test whether equity flows are explainable by distinct business models for heterogeneous financial intermediaries.

In order to study equity flows, we must first build a measure which captures changes in equity holding quantities within financial managers. We construct a fund manager $\times$ quarterly date measure of equity flows that control for valuation gains/losses, to study the purely quantity-based effects of monetary policy. We inform the measure from work on portfolio rebalancing by Calvet et al. (2009). Specifically, we measure

$$\omega_{m,t} = \sum_s \omega_{m,s,t} = \sum_s \frac{P_{s,t-1} \times \Delta S_{m,s,t}}{H_{m,t-1}}$$

with fund manager holdings, $H = \sum_s (P_{s,t-1} \times S_{m,s,t-1})$, and quarterly changes in fund manager stock holdings, $\Delta S_{m,s,t} = S_{m,s,t} - S_{m,s,t-1}$. We refer to $\omega_{m,t}$ as equity flows and it captures the change in equity holdings as a share of previous equity portfolio value, independently of any price changes. We regress flow changes against monetary surprise as,

$$\Delta\omega_{m,t} = \gamma \cdot \text{MPS}_t + \alpha_m + \varepsilon_{m,t} \tag{22}$$

where the explanatory variable is scaled by average flows for that manager class, and MPS is scaled by its standard deviation to aid in interpretation of the coefficients. The identification of (22) requires MPS_t to be orthogonal to any common time-varying factors that could simultaneously affect fund manager flows. By construction, the shocks satisfy such an orthogonality property as Bauer and Swanson (2023) orthogonalize their measure of monetary policy surprises on a large set of time-varying aggregate factors which could move equity markets. We include fund manager specific fixed effects to control for any level differences in flows between managers due to unobservable covariates which are idiosyncratic. Finally, our regressions are weighted by lagged holding levels for each manager, which implies that are coefficients give us aggregate effects à la Amiti and Weinstein (2018).

We specifically test whether variation in business models of financial intermediaries create economically significant differences in flows, in both segmented panel regressions and a pooled regression of (22) for each manager class. The pooled regression is as follows,

$$\Delta\omega_{m,t} = \sum_{k\in\{\text{MF\&IA, Banks, P\&LI}\}} \gamma^k \cdot (\text{MPS}_t \times \mathbb{1}_k) + \alpha_m + \varepsilon_{m,t}. \tag{23}$$

Table 5 present results for (22) for the segmented panels. The first column estimates the flows for the entire economy, and columns two to six separate the effect by intermediary class. On aggregate, a one standard deviation contractionary monetary surprise does not create equity flows across all traders, implying that within the S-34 sample of fund managers, traders net out and there is no outflow out of S-34 fund managers into direct holdings by households or by the rest of the world.[19] The notable result of Table 5 is that the dynamics of flows are vary considerably: mutual funds & investment advisors actively reduce their holdings of equity, whereas banks sharply increase their quantities of equity. These two classes of institutions (columns two and three) capture most of the equity market, with their combined AUM comprising 91.7% of the total AUM for all S34 institutions. The third largest category of traders, pension and life insurance funds, do not respond to a temporary shock in the form of the MPS. Together, these three traders capture 98.2% of all S-34 holdings. Table 6 estimates a pooled regression of the same equation. We arrive at a similar conclusion regarding buying and selling behavior. These findings are all robust to an unweighted measure of MPS and are reported in table B.4.

[19] In Appendix table B.3, we verify that, if at all, non-S34 managers experience a small inflow of equity holdings.

Table 5: Equity flow response to a monetary surprise

	Dependent variable: $\Delta\omega_{m,t}$					
	Full sample	Mutual funds & Investment advisors	Banks	Pension & Insurance funds	University & foundation endowments	Other funds
	(1)	(2)	(3)	(4)	(5)	(6)
MPS	-0.098	-0.259***	0.405**	0.250	0.360	-0.787**
	(0.077)	(0.064)	(0.202)	(0.170)	(0.370)	(0.330)
Manager FE	Y	Y	Y	Y	Y	Y
Observations	284005	241783	23152	13581	994	4495
Adjusted R^2	0.161	0.196	0.040	0.035	0.093	-0.020
$\mathbb{E}$(Y)	0.9%	0.7%	1.4%	1.3%	2.7%	1.2%
AUM share	100%	74.6%	17.1%	7.1%	0.1%	1.1%

Note:

Coefficients are scaled by the mean of the dependent variable. Explanatory variables are scaled to one standard deviation. Heteroskedasticity-robust standard errors clustered by fund managers are in parentheses. *p<0.1; **p<0.05; ***p<0.01

As alluded to in Section 2, the flows of banks are driven principally by their market-making function. This would imply their response is systemically inverse to the aggregate response of all other participants to ensure equity market-clearing, a hypothesis which we confirm. Equity outflows out of mutual funds after a temporary monetary contraction, where the outflows are absorbed by banks is as predicted in Proposition 1 .

In practice, as seen in Table 1, mutual funds rely on an equity-driven (no leverage) business model: Mutual fund flows are completely subject to demand-side (investor) flows to the extent that investors are sensitive to aggregate shocks and fund performance. Hence, our candidate explanation for the sell side behaviour is that of investor sensitivity to fund performance. If, after a contractionary monetary surprise, contemporaneous return on equities temporarily declines, investor response is predicated on their ex-ante sensitivity to market performance of their fund managers. While the model in Section 3 is unable to theoretically sign how investor sensitivity to returns interacts with equity flows caused by monetary policy, we now demonstrate the empirical relevance of investor sensitivity to returns.

Table 6: Equity flow response to a monetary surprise

	Dependent variable: $\Delta\omega_{m,t}$
	Aggregate economy
	(1)
MPS × MF & IA	-0.259***
	(0.064)
MPS × Banks	0.405**
	(0.202)
MPS × PF & LI	0.250
	(0.170)
Manager FE	Y
Observations	284005
Adjusted R^2	0.162
$\mathbb{E}$(Y)	0.7%

Note:
Explanatory variables are scaled to one standard deviation. Heteroskedasticity-robust standard errors clustered by fund managers are in parentheses. AUM share of Mutual Funds & Investment Advisors is 74.6%, of Banks is 17.1%, and of Pension and Insurance Funds is 7.1%.
*p<0.1; **p<0.05; ***p<0.01

To formally test this channel, we first define a fund manager × quarterly date measure of sensitivity. Building on earlier work[20], we specify the sensitivity (τ) measure as follows,

$$\text{Flows}_{m,t} = \tau_t \cdot \text{Performance}_{m,t-1} + \alpha_m + \alpha_t + \varepsilon_{m,t} \;\; \forall\, t \in \{s, ..., s-12\} \tag{24}$$

where

$$\text{Flows}_{m,t} = AUM_{m,t} - AUM_{m,t-1} \cdot (1 + R_{m,t})$$

and $\text{Performance}_{m,t-1}$ is the fund manager-α from 12 quarter rolling regressions on the Fama-French 5-factors and the momentum factor from Carhart (1997). In our estimations, we impose that a fund manager have at least 40 quarters of data to be included in our sample.

Table 7 report the sensitivities. Past fund performance significantly impacts flows for mutual funds & investment advisors, consistent with prior findings: higher (lower) performance relative to the 6-factor benchmark raises (lowers) flows into the fund. Interestingly, such a relationship is

[20] See, for example, Chevalier and Ellison (1997), Berk and Green (2004), Huang et al. (2007), Agarwal et al. (2013), and Shive and Yun (2013).

not significant for banks. The full sample is convex combination of all fund classes, with mutual funds and banks receiving a large share of the aggregation weights, 75.1% and 16.9% respectively. Results for other classes are reported in Appendix table B.5, and we find a null result similar to banks for these classes. As robustness, we estimate the same relationship using quarterly returns as a coarser (and possibly endogenous) measure of fund performance. Results are qualitatively unchanged and reported in Appendix table B.6.

Table 7: Flow-performance sensitivity

	Dependent variable: $\text{Flows}_{m,t}$		
	Full sample	Mutual funds & Investment advisors	Banks
	(1)	(2)	(3)
Performance (α)	0.821***	0.981***	0.871
	(0.214)	(0.241)	(0.691)
Manager FE	Y	Y	Y
Time FE	Y	Y	Y
Observations	260,944	217,568	24,587
Adjusted R^2	0.158	0.166	0.148
$\mathbb{E}$(Y)	\$93M	\$91M	\$103M
AUM share	100%	75.1%	16.9%

Note:
Coefficients are scaled by the mean of the dependent variable. Explanatory variables are scaled to one standard deviation. Heteroskedasticity-robust standard errors are in parentheses.
*p<0.1; **p<0.05; ***p<0.01

Armed with a time-varying measure of sensitivity for each fund manager from (24), we estimate the following:

$$\Delta\omega_{m,t} = \sum_{k\in\{\text{MF\&IA, Banks, P\&LI}\}} \left[\gamma_1^k \cdot (\text{MPS}_t \times \text{Sensitivity}_{m,t-1} \times \mathbb{1}_k) + \gamma_2^k \cdot (\text{MPS}_t \times \mathbb{1}_k) \right] + \alpha_m + \varepsilon_{m,t} \tag{25}$$

In line with our theoretical predictions, we would expect that mutual funds & investment advisors should experience even greater outflows as their exposure to performance-sensitive investors increases. Accordingly, both γ_1 and γ_2 should be negative for this class of intermediaries. In contrast, banks and pension & life insurance funds are not exposed to such performance-sensitivity.

We would expect γ_1 be null for these classes. Finally, owing to their market-making role, we would expect γ_2 be positive for banks.

Table 8: Equity flow response to a monetary surprise

	Dependent variable: $\Delta\omega_{m,t}$
	Aggregate economy
	(1)
MPS × Sensitivity × MF & IA	-0.340***
	(0.083)
MPS × MF & IA	-0.208***
	(0.080)
MPS × Sensitivity × Banks	0.021
	(0.051)
MPS × Banks	0.748**
	(0.333)
MPS × Sensitivity × PF & LI	-0.003
	(0.132)
MPS × PF & LI	0.034
	(0.134)
Manager FE	Y
Observations	134636
Adjusted R^2	0.183
$\mathbb{E}$(Y)	0.7%

Note:
Explanatory variables are scaled to one standard deviation. Heteroskedasticity-robust standard errors clustered by fund managers are in parentheses. AUM share of Mutual Funds & Investment Advisors is 74.6%, of Banks is 17.1%, and of Pension and Insurance Funds is 7.1%.
*p<0.1; **p<0.05; ***p<0.01

Table 8 reports our findings. For the average mutual fund, a standard deviation contractionary monetary shock increases outflows by 34% more for every standard deviation increase in sensitivity of a fund manager's investors. By contrast, the insignificance of flow sensitivity to a bank's business model shown in Table 7 implies an insignificant value of γ_1 for banks, in line with expectations. Although banks as a whole have insensitive flows to performance, banks increase their market-making business induced by monetary policy shocks as documented by a positive γ_2. These findings are all robust to an unweighted measure of MPS and are reported in table B.7.

As a visual representation of our mechanism, Figure 2 plots the cross-sectional relationship between investor sensitivity and equity flows across fund managers in our sample. We find a negative correlation: more sensitive investors cause higher outflows for fund managers after poor returns. Investor sensitivity, combined with heterogeneity in business models across financial intermediaries, amplifies equity flows in response to a monetary policy surprise.

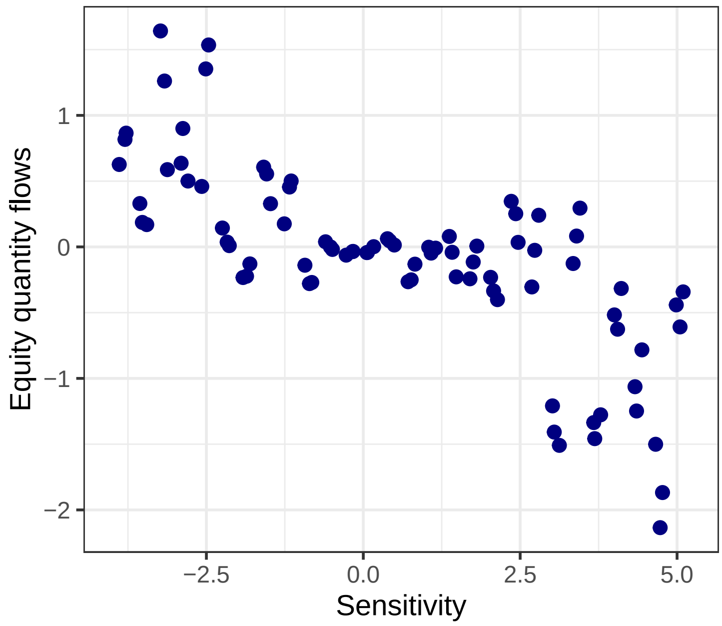


Figure 2: Correlation between equity flows and sensitivity

Note:

This figure plots the cross-sectional relationship between investor sensitivity and equity flows across fund managers in our sample. The scatterplot is equally-spaced binned such that each point captures a similar number of managers in our entire sample. The x-axis is a measure of sensitivity estimated as τ in (24) at the manager-level. The y-axis is a measure of equity flow response estimated through rolling regression of (22) at the manager-level. We find a negative correlation, i.e., more sensitive investors cause higher outflows for fund managers after poor returns.

5.2 Rebalancing response versus net worth shocks

In a single asset economy, equity outflows by performance-sensitive investors would result in a decline in the total net worth of their fund managers. However, if fund managers hold several assets on their investment portfolio, flows out of equities may not necessarily be driven by flows out of the fund manager by investors. Another candidate explanation is rebalancing across asset classes by fund managers. Switching out of equities and into bonds, cash or other securities would imply negative equity flows and positive flows into other asset classes, whereas our theory in Section 3 predicts that such equity outflows are genuine redistribution of household wealth out of mutual funds. Results from section 5.1 cannot rule out such a within-fund manager rebalancing narrative.

We formally conduct a horse-race between our explanation of exit from mutual funds versus a mutual fund rebalancing explanation. If performance-sensitive investors are liquidating equity positions in their fund managers, we should see a decline in the net worth of fund managers without any change in their portfolio weights across asset classes. Such a finding would invalidate the latter explanation in favor of the former, convincing us that the equity outflows for mutual funds are a result of investor liquidation and not a fund manager-level rebalancing, and thus consistent with Proposition 1. We use the panel of mutual funds merged between Thomson Reuters S34 and CRSP MFDB for our analysis, since the latter provides us with detailed portfolio holdings across several asset classes for mutual funds, as well as their total net assets (TNA) as a measure of net worth.

Specifically, we estimate (22) on this panel, exchanging the dependent variable for one of the following: change in portfolio weights for equities (Δ Equity Share), for bonds (Δ Bond Share), or for other securities (Δ Other Share) for each fund manager, as well as a change in their net worth (Δ TNA). Table 9 reports our findings. There are three key findings. First, as shown in columns one to three, we find no evidence of rebalancing across asset classes by fund managers. These finding rules out the candidate alternate explanation. Second, column four reports that a one standard deviation contractionary monetary surprise results in a 0.8% net worth decline for the typical mutual fund manager with high statistical significance. This result validates our explanation for equity flows induced by monetary policy. Third, and perhaps the most strikingly, we find that the magnitude of the net worth decline (0.8%) is roughly similar to the magnitude of equity outflows report in table 8 (1.2%). This provides very strong evidence for our mechanism, particularly since estimations for Tables 6 and 9 were run on two different ownership datasets for mutual funds.

These findings are all robust to an unweighted measure of MPS and are reported in Table B.8.

Table 9: Portfolio rebalancing and outflows for mutual funds

	(1)	(2)	(3)	(4)
	Δ Equity Share (%)	Δ Bond Share (%)	Δ Other Share (%)	Δ TNA (%)
MPS	0.055	0.010	-0.025	-0.008***
	(0.036)	(0.019)	(0.035)	(0.001)
Manager FE	Y	Y	Y	Y
Observations	23853	23853	23853	30788
Adjusted R^2	-0.006	-0.007	-0.008	0.031

Heteroskedasticity-robust standard errors clustered by fund managers are in parentheses.

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

Next, we explicitly test our mechanism as in (25): are net worth declines larger for fund managers whose business models rely more on investors with higher performance-sensitivity? Results reported in Table 10 confirm earlier findings of a net worth shock due to investor outflows, instead of a within-fund manager rebalancing. Net worth declines more for fund managers with more performance-sensitive investors. A one standard deviation contractionary shock creates an additional net worth decline of 0.6% above the average net worth decline in response to a contractionary MPS. As before, these findings are all robust to an unweighted measure of MPS and are reported in Table B.9.

Table 10: Portfolio rebalancing and outflows for mutual funds

	(1)	(2)	(3)	(4)
	Δ Equity Share (%)	Δ Bond Share (%)	Δ Other Share (%)	Δ TNA (%)
MPS × Sensitivity	0.059	-0.031	-0.031	-0.006*
	(0.073)	(0.047)	(0.091)	(0.003)
MPS	0.131*	-0.010	-0.091	-0.006***
	(0.074)	(0.036)	(0.067)	(0.002)
Manager FE	Y	Y	Y	Y
Observations	9294	9294	9294	11654
Adjusted R^2	-0.009	-0.020	-0.008	0.003

Heteroskedasticity-robust standard errors clustered by fund managers are in parentheses.

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

In Appendix Tables B.10 and B.11, we test our mechanism at the fund-level instead of the fund manager-level. Both tables run the same estimation as in (25), and differ in the variation of MPS employed. Results are roughly equivalent, indicating that the equity flows and net worth responses are roughly symmetric across all funds within a fund manager and not a feature of some very large funds of a few managers in our sample. Furthermore, the estimates are very close to those reported in earlier tables, bolstering the consistency of our findings at a much greater level of granularity[21], and alleviating concerns that funds unable to be merged between the CRSP MFDB and the S34 are not subject to notable selection bias.

5.3 Dynamics of Equity Flows due to Monetary Policy

So far, we have studied the on-impact response of financial intermediaries to a surprise contraction. With a temporary monetary surprise, negative returns on-impact would reverse in subsequent periods. In this case, an extended multi-period model in Section 3 would likely imply that mutual fund investors would oscillate from selling to buying equity funds due sensitivity to return extrapolation. The role of banks would market-make and occupy the opposite side of the trade, and earning profits as they buy when asset markets are depressed and sell when equity prices are high. This paper studies quantities, and flows must offset each other due to asset markets clearing. Thus, if mutual fund investors sell upon impact of a contractionary shock, and the shock mean-reverts, then we would expect mutual funds to re-purchase equity upon the mean-reversion in subsequent periods.

We trace the evolution of equity flows over four quarters since the MPS through a local projection of (23) à la Jorda (2005),

$$\Delta\omega_{m,t+h} = \sum_{k\in\{\text{MF\&IA, Banks}\}} \gamma_k^h \cdot (\text{MPS}_t \times \mathbb{1}_k) + \alpha_m + \varepsilon_{m,t+h} \quad \forall h \in \{0, ..., 3\} \tag{26}$$

We present the evolution coefficients in Figure 3. To compare flows across classes, we scale equity flows by their within-class mean values and then by the average market share of the class. Each coefficient captures the average flows in terms of the overall equity market resulting from a financial intermediary class. We see that, on impact of one standard deviation contractionary shock, mutual funds sell while banks buy, as demonstrated in preceding sections. Dynamically, both classes of intermediaries oscillate with their equity flows next quarter, and stabilize their trading towards zero thereafter. In the fourth quarter, net flows into both intermediaries are zero, suggesting that equity flows caused by monetary policy peter out within one year. The counterpart to this figure under the unweighted MPS is shown in Figure B.1.

[21] Since we compute sensitivity at the fund manager-level, for our analysis at the fund-level, we proxy for sensitivity using the expense ratio incurred by investors. The former measure is a demand-side characteristic, whereas expense ratio is a supply-side one. The latter acts a friction against liquidation for investors, and must be inversely related to sensitivity. All results follow similar logic.

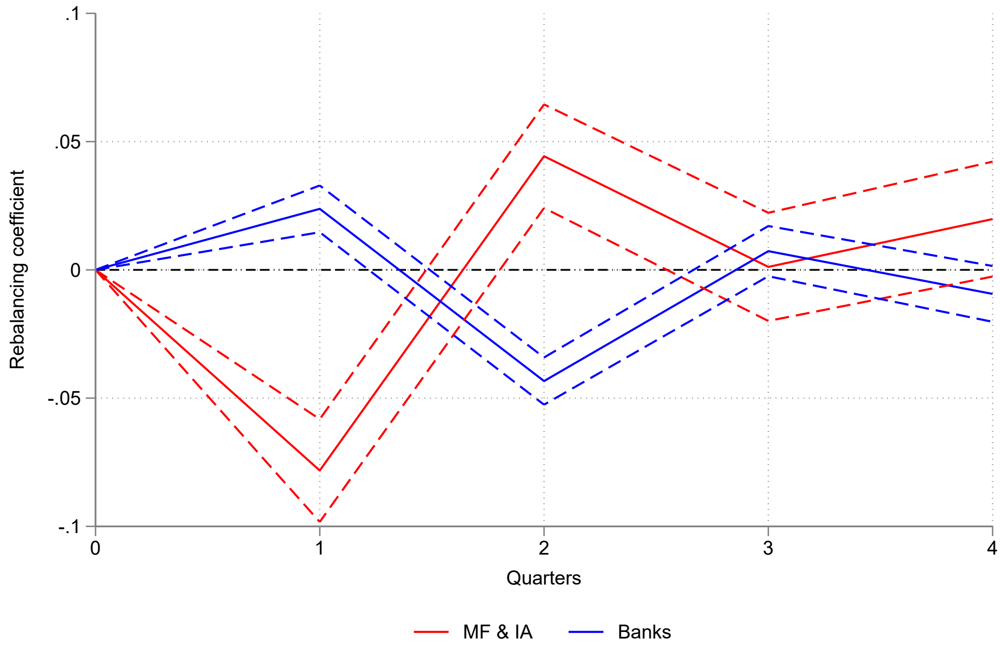


Figure 3: Local projection of equity flows

Note: This figure plots coefficients from (26) that capture the four-quarter equity flows induced by a contractionary monetary policy surprise for mutual funds and banks. The figure plots confidence intervals at 95%.

Finally, we capture time variation in the response to a contractionary monetary surprise over the past three decades for both classes of intermediaries. We estimate rolling regression of (24) over 5-year windows and report the combined coefficient in response to a one standard deviation shock for a one standard deviation increase in investor sensitivity. We report a plot of the coefficients in Figure 4 and find three interesting trends. First, banks' flow response to monetary policy contraction is negatively correlated to that of mutual funds as suggested in the baseline results. However, while mutual funds oscillate between buying and selling in the first two decades between 1990-2010, banks never sell after a contraction. Second, prior to the global financial crisis, there was less selling pressure for mutual funds. Around the crisis, mutual funds experience a sharp decline in equity flows due to monetary policy (increased selling pressure). Around the crisis, banks witness a large buy-side response, possibly driven by sell-offs in several sectors (mutual funds, households, and the rest of the world).

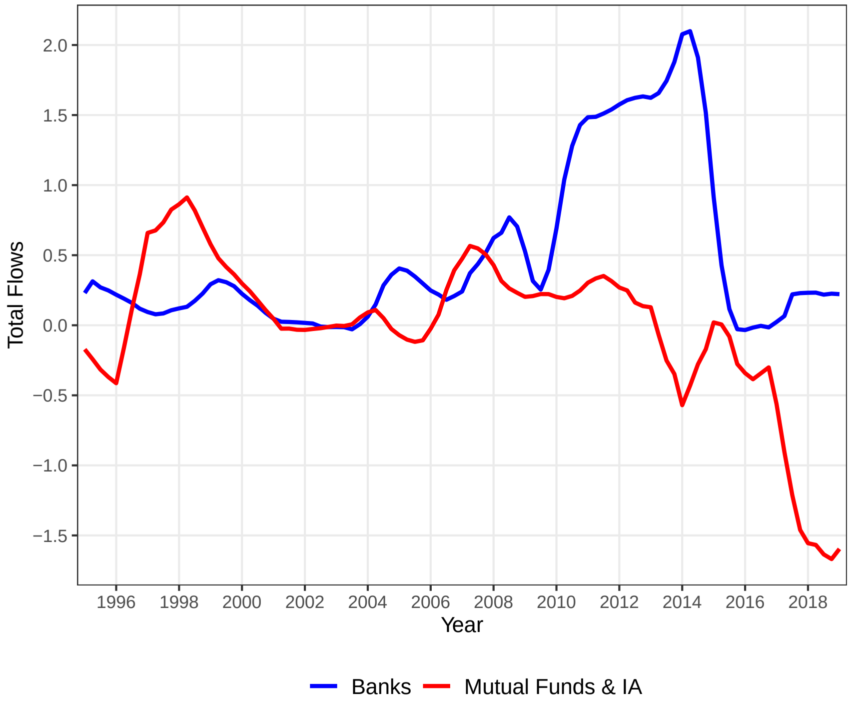


Figure 4: Time variation in equity flows

Note: This figure plots rolling coefficients for mutual funds and banks from (24). The y-axis depicts the combined coefficient in response to a one standard deviation shock for a one standard deviation increase in investor sensitivity ($\gamma_1 + \gamma_2$). This regression uses unweighted monetary policy shocks.

Finally, since the past decade and a half, the trend has largely been negative for mutual funds: Their investors are responding with higher selling after a surprise contraction in monetary policy, despite the contraction being temporary and mean-reverting. This is evidence of growing performance-sensitivity for investors that delegate their financial portfolios to mutual funds & investment advisors, which creates larger flows in response to shocks.

6 Conclusion

In this paper, we develop a novel approach towards understanding equity market responses to monetary policy. At the heart of both the theory and the data is the observation that households delegate their wealth management between heterogeneous financial intermediaries. While previous work has focused on changes in aggregate prices, we identify how quantities of equity shares are redistributed across classes of financial intermediaries, giving rise to the aggregate price fluctuation studied in other papers. We explain equity redistribution as a function of differences in the business models of intermediaries. These differences are salient. Mutual funds offer households easy access to equity markets, but these funds are also subject to large net worth shocks and resultant equity flows due to overreaction to recent performance by investors. In contrast, banks and pension & life insurance funds rely on longer maturity debt and are not exposed to performance-sensitive investors. Banks can thus carry out market-clearing and liquidity provisioning roles in the equity market.

We build an analytical intermediary-asset pricing model to demonstrate how equity flows are induced by monetary policy. The model generates the prediction that contractionary monetary shocks will reduce equity holdings at mutual funds which will be absorbed by banks. Empirically, we test our model predictions and provide further evidence on what mechanisms amplify this result. We identify that mutual funds experience large equity outflows due to a monetary contraction, and further find that mutual funds whose investor flows are more sensitive to recent performance are especially vulnerable to selling after contractionary shocks. To confirm that our results are not driven by rebalancing away from equities within a fund, but instead by losses in net worth incurred by mutual funds that create equity outflows. We demonstrate that because the monetary shock tends to mean revert within a year and that the trades by banks and mutual funds flip behavior in subsequent quarters, indicating an overreaction to a temporary shock that amplifies trading and price volatility due to performance sensitive investors. We further find evidence of bank market-making activity around monetary policy events.

Finally, we investigate time series variation in selling pressure on mutual funds due to investor sensitivity. The rapid rise in indexation over the past two decades must surely lower transaction costs from liquidation of equity portfolios for investors and must increase outflows in response to adverse shocks when investors extrapolate fund returns from recent performance. We offer support that the since the past decade and a half, the trend has largely been negative for mutual funds: Their investors are responding with higher selling after a surprise contraction in monetary policy, despite the contraction being temporary and mean-reverting. This is evidence of growing performance-sensitivity for investors that delegate their financial portfolios to mutual funds & investment advisors, which creates larger equity flows in response to shocks and implies higher price volatility in recent decades. Such a trend suggests links between a rise in investor trading costs through indexation, investor sensitivity to fund performance, and observed rises in trading and price volatility. How these developments in financial markets affect the role of monetary policy and aggregate outcomes remains a topic for future research.

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A Theoretical Appendix

In this appendix we provide any derivations or proofs omitted from the main text.

A.1 Supply-Side of the Model

In this section we derive in full detail the supply-side of the model. As briefly described in Section 3, there is a continuum of intermediate goods producers indexed by $j \in [0, 1]$. A perfectly competitive, final good producer aggregates inputs to create the final good with technology

$$Y_t = \left(\int_0^1 Y_t(j)^{\frac{\theta-1}{\theta}} \right)^{\frac{\theta}{\theta-1}}, \quad \theta > 1, \tag{A.1}$$

where θ is the elasticity of substitution, $Q_t(j)$ is an intermediate firm's price, and Q_t is the aggregate price index. All output is generated using labor as the input of production. To provide this labor, we assume there is a representative hand-to-mouth (HTM) household which supplies labor according to per-period utility maximization

$$\max_{L_t} \log C_t^{HTM} - \chi \frac{L_t^{1+\xi}}{1+\xi} \tag{A.2}$$

$$\text{subject to} \quad Q_t C_t^{HTM} = W_t L_t + T_t, \tag{A.3}$$

where we assume that the HTM household dislikes work and consumes out of labor earnings and government transfers. We will make an assumption on household transfers subsequently for tractability. Optimizing (A.2) implies a labor supply curve given by

$$\frac{W_t}{Q_t} = \chi L_t^{\xi} C_t^{HTM}. \tag{A.4}$$

Intermediate firms produce with technology

$$Y_t(j) = A_t L_t(j)^{1-\alpha} \tag{A.5}$$

where $L_t(j)$ is the labor hired by the intermediate producer, and A_t is an aggregate productivity parameter. These intermediates solve a cost-minimization problem to determine their price

$$Q_t Y_t = \min_{y_t(j) \in [0,1]} \int_0^1 Q_t(j) Y_t(j) dj \tag{A.6}$$

$$\text{subject to} \quad Y_t = \left(\int_0^1 Y_t(j)^{\frac{\theta-1}{\theta}} \right)^{\frac{\theta}{\theta-1}}.$$

Standard optimization implies that intermediate firm demand is given by

$$y_t(j) \leq \left(\frac{Q_t(j)}{Q_t}\right)^{-\theta} Y_t. \tag{A.7}$$

We derive the standard aggregate price index to be

$$Q_t = \left(\int_0^1 Q_t^{1-\theta} dj\right)^{\frac{1}{1-\theta}}. \tag{A.8}$$

The labor market clearing condition is

$$\int_0^1 L_t(j) dj = L_t. \tag{A.9}$$

We make a simplifying assumption on the nature of lump-sum transfers to be given by

$$T_t = (1-\alpha) Q_t Y_t - W_t L_t, \tag{A.10}$$

which combined with the budget constraint of the HTM household implies that HTM consumption is simplified to be a constant share of output:

$$C_t^{HTM} = (1-\alpha) Y_t \tag{A.11}$$

Finally, note that if HTM consumption is given by (A.11), it must be the case that the share of output which intermediate firms accrue is αY_t.

A.1.1 Flexible Price Benchmark

Even with perfectly rigid prices, it is useful to define what the flexible-price benchmarks are to determine potential output. Without nominal rigidities the intermediate goods producing firm maximizes profit. We omit time subscripts for notation, and as every decision it within-period. This profit maximization is given by

$$\Pi(j) = \max_{Q(j), L(j)} Q(j) Y(j) - W_t L(j) - T_t \tag{A.12}$$

$$\text{subject to} \quad Y(j) = A L(j)^{1-\alpha} = \left(\frac{Q(j)}{Q}\right)^{-\theta} Y.$$

We can then derive the optimal flexible intermediate price as

$$Q(j) = \frac{\theta}{\theta - 1} \frac{W}{(1-\alpha) Y} L(j)^{\alpha}. \tag{A.13}$$

An intermediate firm in a flexible-price economy will take aggregate output prices, wages, and output as given and thus set $Q(j) = Q$ and $Y(j) = Y$. Therefore, in the flexible price benchmark, we can combine intermediate demand (A.13) with labor supply (A.4) to generate an equilibrium labor equation of

$$\frac{W_t}{Q_t} = \frac{\theta - 1}{\theta}(1 - \alpha)A_t L_t^{-\alpha}. \tag{A.14}$$

This can be further combined with HTM consumption (A.11) to solve for potential equilibrium labor and output as

$$L_t^* = \left(\frac{\theta - 1}{\theta}\frac{1}{\chi}\right)^{\frac{1}{1+\xi}}, \tag{A.15}$$

$$Y_t^* = A_t\left(\frac{\theta - 1}{\theta}\frac{1}{\chi}\right)^{\frac{1-\alpha}{1+\xi}}. \tag{A.16}$$

Going forward we refer to $\log Y_t^* = y_t^*$, and make the following assumption over y_1^*

$$y_1^* = y_0^* + z_1, \quad z_1 \sim N(\mu_z, \sigma_z^2), \tag{A.17}$$

where we assume that there is a permanent productivity shock to y_0^* in $t = 1$.

A.1.2 Perfect Price Rigidity

We simplify our analysis in the main text with the assumption that prices are fully sticky. This implies that $Q_t(j) = Q^*$, and therefore that $Q_t = Q^*$. This assumption transforms the intermediate goods producer profit maximization problem to be

$$\max_{L(j)} Q^* A_t L(j)^{1-\alpha} - W_t L_t(j) - T_t \tag{A.18}$$
$$\text{subject to} \quad A_t L_t^{1-\alpha} \leq Y_t,$$

because these firms are homogeneous, this implies $L_t(j) = L_t$ and $Y_t(j) = Y_t$. Under the assumption that any monetary policy shocks we use in the model are small, firms will optimally meet demand for goods. Therefore, with sticky prices labor and output are determined by

$$L_t = \left(\frac{Q^*(1-\alpha)A_t}{W_t}\right)^{\frac{1}{\alpha}} \tag{A.19}$$

$$Y_t = A_t\left(\frac{Q^*(1-\alpha)A_t}{W_t}\right)^{\frac{1-\alpha}{\alpha}}. \tag{A.20}$$

A.2 Derivation of Period 0 Return

We write log returns in period 0 as

$$\log R_0 = r_0 = \log\left(\frac{\alpha Y_0 + P_0}{P_-}\right)$$
$$= \log\left(\frac{\alpha Y_0}{P_0} + 1\right) + \log\left(\frac{P_0}{P_-}\right)$$

Define $X = \frac{\alpha Y_0}{P_0}$. Then we can rewrite $r_0 = \log(X+1) + p_0 - p_-$. In $t = 0$, when the household owns all of the market asset due to market clearing, and using the household consumption policy (8) we derive

$$\frac{\alpha Y_0}{P_0} = \exp(\rho).$$

Therefore, we can substitute $\exp(\rho)$ for $\frac{\alpha Y_0}{P_0}$ above which yields

$$r_0 = \log(1 + \exp(\rho)) + p_0 - p_-,$$

we define $\kappa = \log(1 + \exp(\rho))$, which gives (19).

A.3 Derivation of Central Bank Target

In this subsection we derive the target rate the central bank attempts to set to ensure that $y_0 = y_0^*$. We begin by noting that from (18), $p_0^* = y_0^* + \log\alpha - \rho$. We then can approximate the optimal period 0 return as

$$r_0^* \approx \kappa^{'} + y_0^* - p_- \tag{A.21}$$
$$\text{where} \quad \kappa^{'} = \log(1 + \exp(\rho)) + \log\alpha - \frac{1}{1 + \exp(\rho)}\left(\rho + \rho\exp(\rho)\right),$$

using the Campbell-Shiller approximation to period 0 returns. We then use the approximation to r_0^* and the identity for p_0^* in the aggregate risk-balance equation (20) to derive

$$\sigma_z = \left(\frac{\omega_0^M}{\gamma} + \frac{1 - \omega_0^M}{\gamma^B}\right)\frac{\mu_z + \rho + \frac{1}{2}\sigma_z^2 - r^{f,*}}{\sigma_z}$$
$$\implies \sigma_z^2\left(\left(\frac{1}{\gamma^2} - \frac{1}{\gamma\gamma^B}\right)\frac{\mathbb{E}[r_1^M] - r^B + \frac{1}{2}\sigma_M^2}{\sigma_M^2}\right) = \mu_z + \rho + \frac{1}{2}\sigma_z^2 - r^{f,*}$$
$$\implies \underbrace{\sigma_z^2\left(\left(\frac{1}{\gamma^2} - \frac{1}{\gamma\gamma^B}\right)\frac{\varphi(\kappa' + y_0^* - p_-) + (1-\varphi)(y_0^* + \mu_z - p_0) - r^B + \frac{1}{2}\sigma_M^2}{\sigma_M^2}\right)}_{\text{A}} = \mu_z + \rho + \frac{1}{2}\sigma_z^2 - r^{f,*},$$

which finally implies that the optimal risk-free rate is given

$$r^{f,*} = \mu_z + \rho + \frac{1}{2}\sigma_z^2 - A\sigma_z^2. \tag{A.22}$$

The central bank attempts to set this rate to ensure $y_0 = y_0^*$.

A.4 Proofs

Proposition 1. *A contractionary monetary policy shock ($\eta > 0$) reduces the household weight on mutual funds: $\frac{\partial \omega_0^M}{\partial \eta} \leq 0$. The outflows are absorbed by the bank intermediary.*

Proof. In the first part of the proof, we demonstrate that $\frac{\partial \omega^M}{\partial \eta} < 0$. Recall that the aggregate risk balance equation (20) is given

$$\frac{y_0^* + \mu_z + \log\alpha - p_0 + \frac{1}{2}\sigma_z^2 - r^{f,*} - \eta}{\sigma_z} = \gamma(\omega_0^M)\sigma_z,$$
$$\text{where} \quad \gamma(\omega_0^M) = \left(\frac{\omega_0^M}{\gamma} + \frac{1-\omega_0^M}{\gamma^B}\right)^{-1},$$

and that the household portfolio weight is optimally given by (9)

$$\omega_0^M \approx \max\left(\frac{1}{\gamma}\frac{\mathbb{E}[r_1^M] - r^B + \frac{1}{2}\sigma_M^2}{\sigma_M^2}, 0\right).$$

We insert household beliefs and use (19) to rewrite the household portfolio weight as

$$\omega_0^M \approx \max\left(\frac{1}{\gamma}\frac{\varphi(\kappa + p_0 - p_-) + (1-\varphi)(y_0^* + \mu_z - p_0) - r^B + \frac{1}{2}\sigma_M^2}{\sigma_M^2}, 0\right), \tag{A.23}$$
$$\sigma_M^2 = (1-\varphi)^2\sigma_z^2 + \varphi^2\sigma_\varepsilon^2.$$

Note that within ω_0^M the only endogenous term is p_0. To sign $\frac{\partial \omega_0^M}{\partial \eta}$, it is sufficient to sign $\frac{\partial p_0}{\partial \eta}$. Note that $\frac{\partial \omega_0^M}{\partial p_0} > 0$ under the condition that $\varphi > \frac{1}{2}$, which is guaranteed under Assumption 2. Therefore, to prove $\frac{\partial \omega_0^M}{\partial \eta} < 0$, we have to show that $\frac{\partial p_0}{\partial \eta} < 0$.

Using the portfolio weight we can construct the implicit function

$$G(p_0, \eta, \omega_0^M) = \frac{y_0^* + \mu_z + \log\alpha - p_0 + \frac{1}{2}\sigma_z^2 - r^f}{\sigma_z}\left(\frac{\omega_0^M}{\gamma} + \frac{1-\omega_0^M}{\gamma^B}\right) - \sigma_z. \tag{A.24}$$

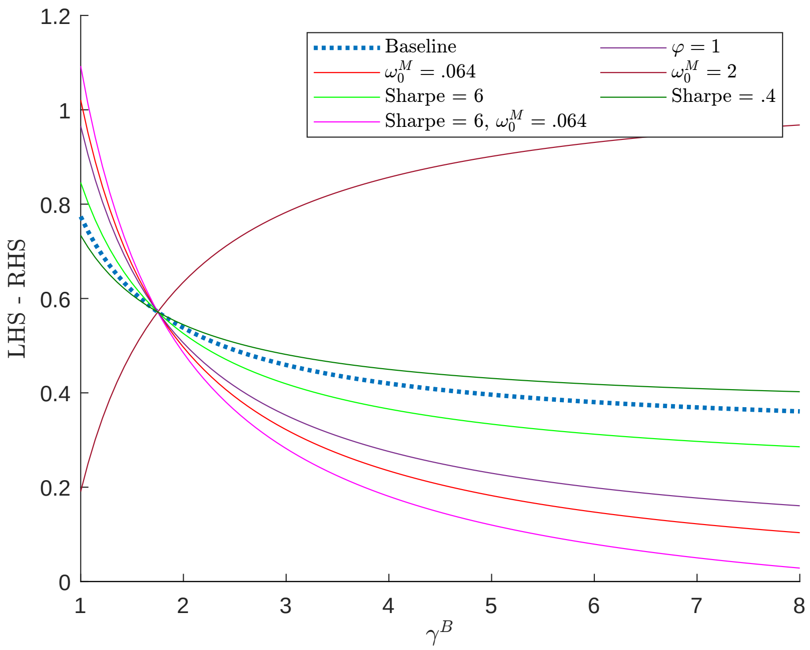
We then use the implicit function theorem to derive $\frac{\partial p_0}{\partial \eta}$. In the case with $\omega_0^M = 0$ because the short-sale constraint is binding, this derivative is immediately 0. When ω_0^M is unconstrained

$$\frac{\partial p_0}{\partial \eta} = \frac{\frac{1}{\sigma_z^2}\left(\frac{1-\omega_0^M}{\gamma^B} + \frac{\omega_0^M}{\gamma}\right)}{-\frac{1}{\sigma_z^2}\left(\frac{1-\omega_0^M}{\gamma^B} + \frac{\omega_0^M}{\gamma}\right) + \frac{1}{\sigma_z^2}\left(y_0^* + \mu_z - p_0 + \log\alpha + \frac{1}{2}\sigma_z^2 - r^{f,*} - \eta\right)\left(\frac{1}{\gamma^2}\frac{2\varphi-1}{\sigma_M^2} - \frac{1}{\gamma^B\gamma}\frac{2\varphi-1}{\sigma_M^2}\right)}. \tag{A.25}$$

Because of the short-selling constraint on ω_0^M, the numerator is positive. For the denominator to be negative, the following condition must hold

$$\frac{\omega_0^M}{\gamma} + \frac{1-\omega_0^M}{\gamma^B} > \left(\frac{1}{\gamma^2} - \frac{1}{\gamma^B\gamma}\right)(2\varphi - 1)\frac{y_0^* + \mu_z - p_0 + \log\alpha + \frac{1}{2}\sigma_z^2 - r^f}{\sigma_M^2}. \tag{A.26}$$

The left-hand side of (A.26) is strictly positive. Under the assumption that $\gamma^B = \gamma + \nu$, with ν small, this condition holds. We verify that this condition holds numerically under a series of both realistic and unrealistic calibrations of the parameters featured in A.26). We plot these calibrations in Figure A.1, where we plot the left-hand side less the right-hand side of (A.26).



We parameterize $\gamma = 1.75$ to be in line with the literature. Our baseline has $\omega_0^M = 0.64$, a Sharpe Ratio of 2.47, and $\rho = .6$.

Figure A.1: Confirmation of (A.26)

Any calibration of (A.26) holds when γ^B is in the neighborhood of γ, as demonstrated in Figure A.1. In fact, even outside a local neighborhood of $\gamma^B \in (\gamma - \nu, \gamma + \nu)$, this condition holds even as we set very unreasonable calibrations of the parameters such as a Sharpe ratio of the stock market at 6 along with the household putting only 6.4% of its wealth in a mutual fund.

Therefore, we conclude that $\frac{p_0}{\partial \eta} < 0$, which in turn implies $\frac{\partial \omega_0^M}{\partial \eta} < 0$. This comparative static combined with $\frac{\partial \omega_0^M}{\partial \eta} = 0$ when ω_0^M is constrained verifies the first claim of the proposition.

We then show the bank intermediary in the model necessarily absorbs the equity outflows. By the household portfolio choice, if $\frac{\partial \omega_0^M}{\partial \eta} < 0$, then the household wealth weight on banks $(1 - \omega_0^M)$ must increase. To demonstrate that the bank absorbs equity outflows from mutual funds, it is enough to verify that the bank weight on the market asset does not decline when combined with bank AUM increasing.

It is simple to verify that $\frac{\partial \theta^B}{\partial \eta} > 0$. Using (15),

$$\frac{\partial \theta^B}{\partial \eta} = \frac{\partial}{\partial \eta}\left(\frac{1}{\gamma^B}\frac{y_0^* + \mu_z + \log\alpha - p_0 - r^{f,*} - \eta}{\sigma_z^2}\right),$$

this comparative static is positive when $-\frac{\partial p_0}{\partial \eta} > 1$. This condition holds when

$$\frac{1-\omega_0^M}{\gamma^B} + \frac{\omega_0^M}{\gamma} > \frac{1-\omega_0^M}{\gamma^B} + \frac{\omega_0^M}{\gamma} - \left(y_0^* + \mu_z - p_0 + \log\alpha + \frac{1}{2}\sigma_z^2 - r^{f,*} - \eta\right)\left(\frac{1}{\gamma^2}\frac{2\varphi - 1}{\sigma_M^2} - \frac{1}{\gamma^B\gamma}\frac{2\varphi-1}{\sigma_M^2}\right),$$

which is true with $\mu_z > 0$ and Assumption 2 as the right hand side of the expression above is the same as the left hand side less a positive expression.

This completes the proof. □

Corollary 1. *A monetary policy contraction ($\eta > 0$) increases the risk premium in the economy.*

Proof. The aggregate risk balance equation (20) must hold in any equilibrium. As established in Proposition 1, a contractionary monetary policy shock decreases ω_0^M. Examining (20),

$$\frac{y_0^* + \mu_z + \log\alpha - p_0 + \frac{1}{2}\sigma_z^2 - r^f}{\sigma_z} = \gamma(\omega_0^M)\sigma_z,$$
$$\text{where} \quad \gamma(\omega_0^M) = \left(\frac{\omega_0^M}{\gamma} + \frac{1-\omega_0^M}{\gamma^B}\right)^{-1},$$

if η causes ω_0^M to decrease, then the right hand side of (20) must increase. This occurs because the contractionary shock places more weight on $1 - \omega_0^M$, which is scaled by $\gamma^B > \gamma$. If the RHS of (20) increases, then the LHS increases as well to balance the risk in the economy. The LHS of (20) is the risk-premium scaled by the volatility of the productivity shock which is exogenous, so the risk-premium in the economy must increase due to a contractionary shock.

□

B Empirical Appendix

B.1 List of fund managers

Table B.1: List of largest fund managers

Banks	Mutual funds	Investment advisors	Life insurance funds	Pension funds	University & Foundation endowments
STATE STREET BANK	THE VANGUARD GROUP	CAPITAL WORLD INVESTORS	AXA FINANCIALS	CALIFORNIA PUBLIC EMPLOYEES	BILL & MELINDA GATES FOUNDATION
NY MELLON BANK	FIDELITY MANAGEMENT & RESEARCH	CAPITAL RESEARCH & MANAGEMENT	EQUITABLE LIFE	NEW YORK STATE COMMON RETIREMENT	HARVARD UNIVERSITY
J P CHASE BANK	BLACKROCK FINANCIAL MANAGEMENT	AE WEALTH MANAGEMENT	CITIGROUP LIFE INSURANCE	LEGAL AND GENERAL GROUP	UNIVERSITY OF CALIFORNIA
BANK OF AMERICA	J P CHASE INVESTMENT MANAGEMENT	GEODE CAPITAL MANAGEMENT	TRAVELERS INC	CANADA PENSION	FORD FOUNDATION
MORGAN STANLEY BANK	WELLINGTON MANAGEMENT	NBIM	PRINCIPAL FINANCIAL	NEW YORK STATE TEACHERS	HOWARD HUGHES MEDICAL INSTITUTE
BARCLAYS BANK	PRICE T ROWE ASSOCIATES	CAMBRIDGE ASSOCIATES	STATE FARM	FLORIDA STATE BOARD	CHARLES STEWART MOTT FOUNDATION
NORTHERN TRUST BANK	GOLDMAN SACHS ASSET MANAGEMENT	BERKSHIRE HATHAWAY	PRUDENTIAL	CALIFORNIA STATE TEACHERS	TEXAS A&M UNIVERSITY
CITIBANK	MORGAN STANLEY ASSET MANAGEMENT	BLACKROCK ADVISORS	NORTHWESTERN MUTUAL	TEXAS TEACHERS	PRINCETON UNIVERSITY
DEUTSCHE BANK	FRANKLIN RESOURCES	CLEARBRIDGE ADVISORS	METLIFE	WISCONSIN INVESTMENT BOARD	YALE UNIVERSITY
PNC BANK	JANUS CAPITAL	ADAGE CAPITAL MANAGEMENT	MASSMUTUAL	NATIONAL PENSION SERVICE (SOUTH KOREA)	UPENN

B.2 MPS Measure

We report statistics on two measures of quarterly monetary policy surprises (MPS) in Table B.2. These surprises are interpreted to be in units of basis points and are aggregated from Bauer and Swanson (2023). Our baseline measure simply aggregates all orthogonal MPS's in a quarter as defined in Bauer and Swanson (2023). We also perform robustness exercises using "MPS Weighted" which weights each MPS event by the length of time that event was the most recent shock within a quarter.

Table B.2: Summary Statistics for MPS (1988-2019)

	Mean	Standard Deviation	10th Percentile	Median	90th Percentile
MPS	-0.00	0.07	-0.09	0.00	0.08
MPS Weighted	0.00	0.07	-0.07	-0.00	0.10

Note:
Quarterly aggregated MPS shocks from (Bauer and Swanson, 2023). The row "MPS" refers to a simple aggregated measure of MPS that occur in a quarter. The "MPS Weighted" row refers to an aggregated measure where surprises are weighted by the length of time a shock was from the start of quarter.

B.3 Active management by non-S34 sectors

We classify non-S34 holdings for each stock as the difference between the total market capitalization for each stock less the market capitalization managed by S34 managers. In 2019, S-34 managers collectively manage around 70% of the US stock market, with the remaining 30% attributed to non-S34 sectors. Koijen and Yogo (2019) present these sectors as household holdings, but we can generalize this to other smaller managers, RoW, and households.

Indexing for valuation effects for every stock and collapsing by the past quarter weight of the stock in the overall market, we create a measure of aggregate flow for the non-S34 sectors, Active_t. We regress Active_t against MPS_t to test for the aggregate flow response by all other sectors outside the S-34. We find that, after a contractionary monetary surprise, equity flows into S-34 managers by around 3.8%.

Table B.3: Non-S34 share of equities in response to a monetary surprise

	Dependent variable: Active_t
	Aggregate economy
	(1)
MPS	-0.038*
	(0.021)
Observations	128
Adjusted R^2	0.017
$\mathbb{E}$(Y)	51.71%
$\mathbb{E}$(Y, post-GFC)	25.01%

Note:

Explanatory variables are scaled to one standard deviation. Heteroskedasticity-robust standard errors are in parentheses.

*p<0.1; **p<0.05; ***p<0.01

B.4 Equity flows for unweighted MPS

Table B.4: Equity flow response to a monetary surprise

	Dependent variable: $\Delta\omega_{m,t}$
	Aggregate economy
	(1)
MPS × MF & IA	-0.255***
	(0.064)
MPS × Banks	0.235*
	(0.126)
MPS × PF & LI	0.104
	(0.201)
Manager FE	Y
Observations	284005
Adjusted R^2	0.162
$\mathbb{E}$(Y)	0.7%

Note:

Explanatory variables are scaled to one standard deviation. Heteroskedasticity-robust standard errors clustered by fund managers are in parentheses. AUM share of Mutual Funds & Investment Advisors is 74.6%, of Banks is 17.1%, and of Pension and Insurance Funds is 7.1%.

*p<0.1; **p<0.05; ***p<0.01

B.5 Flow performance sensitivity for other classes

Table B.5: Flow-performance sensitivity

	Dependent variable: $\text{Flows}_{m,t}$		
	Pension & Insurance funds	University & foundation endowments	Other funds
	(1)	(2)	(3)
Performance (α)	-0.664	-3.788	1.831
	(0.668)	(4.410)	(3.034)
Manager FE	Y	Y	Y
Time FE	Y	Y	Y
Observations	14,615	1,131	3,043
Adjusted R^2	0.175	0.107	0.066
$\mathbb{E}$(Y)	\$117M	\$29M	\$61M
AUM share	6.8%	0.1%	1.1%

Note:

Coefficients are scaled by the mean of the dependent variable. Explanatory variables are scaled to one standard deviation. Heteroskedasticity-robust standard errors are in parentheses.

*p$<$0.1; **p$<$0.05; ***p$<$0.01

B.6 Flow performance sensitivity by raw returns

Table B.6: Flow-performance sensitivity

	Dependent variable: $\text{Flows}_{m,t}$					
	Full sample	Mutual funds & Investment advisors	Banks	Pension & Insurance funds	University & foundation endowments	Other funds
	(1)	(2)	(3)	(4)	(5)	(6)
Performance (R)	0.050***	0.053***	0.011	0.060	-0.320	0.031
	(0.001)	(0.015)	(0.103)	(0.073)	(0.590)	(0.827)
Manager FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Observations	344,847	290,923	30,298	17,400	1,322	4,904
Adjusted R^2	0.145	0.152	0.168	0.100	0.054	0.034
$\mathbb{E}$(Y)	$79M	$78M	$86M	$103M	$30M	$48M
AUM share	100%	75.4%	16.6%	6.8%	0.1%	1.2%

Note:

Coefficients are scaled by the mean of the dependent variable. Explanatory variables are scaled to one standard deviation. Heteroskedasticity-robust standard errors are in parentheses.

*p<0.1; **p<0.05; ***p<0.01

B.7 Equity flows and investor sensitivity for unweighted MPS

Table B.7: Equity flow response to a monetary surprise

	Dependent variable: $\Delta\omega_{m,t}$
	Aggregate economy
	(1)
MPS × Sensitivity × MF & IA	-0.428***
	(0.092)
MPS × MF & IA	-0.187**
	(0.088)
MPS × Sensitivity × Banks	0.028
	(0.028)
MPS × Banks	0.364*
	(0.218)
MPS × Sensitivity × PF & LI	-0.255
	(0.230)
MPS × PF & LI	-0.065
	(0.208)
Manager FE	Y
Observations	134636
Adjusted R^2	0.182
$\mathbb{E}$(Y)	0.7%

Note:
Explanatory variables are scaled to one standard deviation. Heteroskedasticity-robust standard errors clustered by fund managers are in parentheses. AUM share of Mutual Funds & Investment Advisors is 74.6%, of Banks is 17.1%, and of Pension and Insurance Funds is 7.1%.
*p<0.1; **p<0.05; ***p<0.01

B.8 Portfolio rebalancing versus net worth shock for unweighted MPS

Table B.8: Portfolio rebalancing and outflows for mutual funds

	(1) Δ Equity Share (%)	(2) Δ Bond Share (%)	(3) Δ Other Share (%)	(4) Δ TNA (%)
MPS	0.018	0.064	0.027	-0.016***
	(0.042)	(0.044)	(0.063)	(0.002)
Manager FE	Y	Y	Y	Y
Observations	23853	23853	23853	30788
Adjusted R^2	-0.006	-0.006	-0.008	0.044

Heteroskedasticity-robust standard errors clustered by fund managers are in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.9: Portfolio rebalancing and outflows for mutual funds

	(1)	(2)	(3)	(4)
	Δ Equity Share (%)	Δ Bond Share (%)	Δ Other Share (%)	Δ TNA (%)
MPS × Sensitivity	0.059	-0.035	-0.054	-0.006**
	(0.081)	(0.052)	(0.109)	(0.003)
MPS	0.106	0.002	-0.097	-0.013***
	(0.070)	(0.061)	(0.095)	(0.003)
Manager FE	Y	Y	Y	Y
Observations	9294	9294	9294	11654
Adjusted R^2	-0.010	-0.020	-0.008	0.012

Heteroskedasticity-robust standard errors clustered by fund managers are in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

B.9 Portfolio rebalancing versus net worth shock at the fund level

Table B.10: Portfolio rebalancing and outflows for mutual funds

	(1)	(2)	(3)	(4)	(5)	(6)
	Δ Equity Share (%)	Δ Other Share (%)	Δ TNA (%)	Δ Equity Share (%)	Δ Other Share (%)	Δ TNA (%)
MPS $\times$ Expense Ratio				-0.002	0.008	0.005***
				(0.014)	(0.014)	(0.001)
MPS	0.012	-0.015	-0.012***	0.015	-0.017*	-0.010***
	(0.010)	(0.010)	(0.000)	(0.010)	(0.010)	(0.001)
Fund FE	Y	Y	Y	Y	Y	Y
Observations	1351581	1351581	1591364	1120852	1120852	1331181
Adjusted R^2	-0.023	-0.023	0.048	-0.021	-0.021	0.045

Heteroskedasticity-robust standard errors clustered by funds are in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

B.10 Portfolio rebalancing versus net worth shock at the fund level for unweighted MPS

Table B.11: Portfolio rebalancing and outflows for mutual funds

	(1)	(2)	(3)	(4)	(5)	(6)
	Δ Equity Share (%)	Δ Other Share (%)	Δ TNA (%)	Δ Equity Share (%)	Δ Other Share (%)	Δ TNA (%)
MPS $\times$ Expense Ratio				-0.015	0.022	0.003***
				(0.014)	(0.014)	(0.001)
MPS	-0.007	0.004	-0.018***	-0.008	0.006	-0.016***
	(0.012)	(0.012)	(0.001)	(0.012)	(0.012)	(0.001)
Fund FE	Y	Y	Y	Y	Y	Y
Observations	1351581	1351581	1591364	1120852	1120852	1331181
Adjusted R^2	-0.023	-0.023	0.054	-0.021	-0.021	0.051

Heteroskedasticity-robust standard errors clustered by funds are in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

B.11 Local projection for unweighted MPS

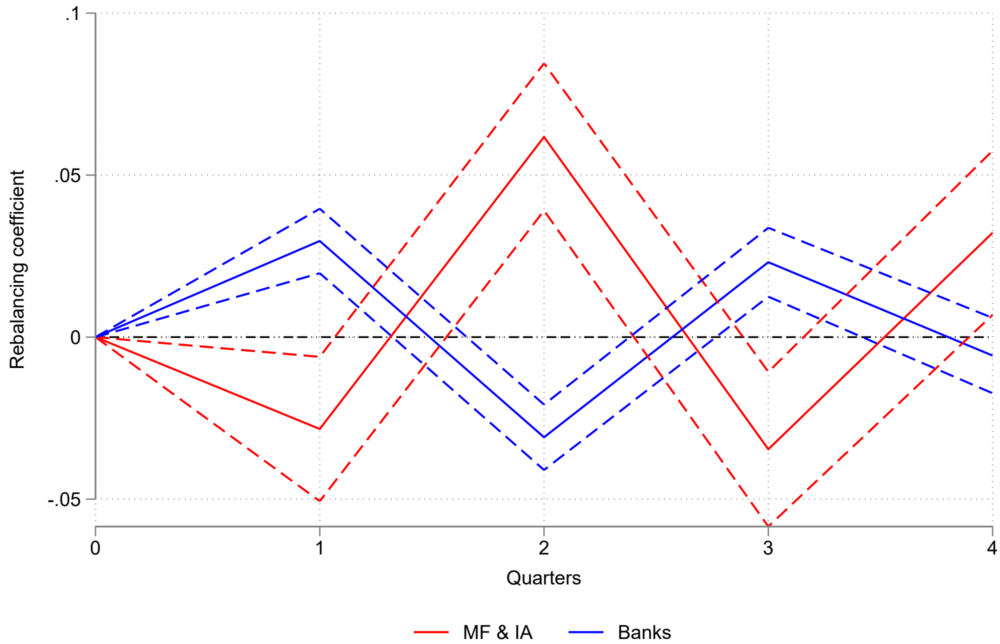


Figure B.1: Local projection of equity flows

Note: This figure plots coefficients from (26) that capture the four-quarter equity flows induced by a contractionary monetary policy surprise for mutual funds and banks. The figure plots confidence intervals at 95%.