Monetary Transmission in Equity Markets: Evidence from Financial Intermediaries*

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We show that heterogeneous equity flows across financial intermediaries amplify monetary policy transmission to asset prices. We find that mutual funds with performance-sensitive retail investors experience outflows after contractionary monetary shocks, triggering forced equity sales. Banks have funding that is insensitive to recent performance and therefore absorb these sales and provide liquidity. This intermediary-level heterogeneity aggregates meaningfully: stocks held by more performance-sensitive investors exhibit larger price declines following monetary tightening. To explain these patterns, we develop an intermediary asset pricing model where heterogeneous intermediaries manage portfolios for investors with performance-sensitive flows, highlighting a novel mechanism of monetary transmission to equities.

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1. Introduction

The transmission of monetary policy to financial markets is a critical mechanism through which central banks influence the broader economy. A robust empirical regularity is that even small monetary policy surprises cause large movements in asset prices.[1] A natural candidate to rationalize these large responses is capital flows across investors triggered by monetary policy.[2] To date, there is little systematic evidence on the scale of equity flows caused by monetary policy, or on the identity of the buyers and sellers in such trades. Identifying the magnitudes of and providing the microfoundations behind these flows is essential for tracing how monetary policy moves asset markets. This paper provides both.

Existing explanations for flow-induced price movements following monetary shocks rely on institutional details such as fixed mandates, rebalancing rules, or preferred habitat mechanisms. While useful, these explanations largely treat the underlying equity flows as exogenous. In this paper, we offer a novel mechanism that endogenizes heterogeneous flows across intermediary classes: the flow responsiveness of an intermediary's investor base to recent performance. By focusing on the endogenous response of investor flows to recently realized returns, we provide a microfoundation for flow heterogeneity that connects investor belief formation to institutional trading patterns.

Using three decades of institutional portfolio holdings data, we document that mutual funds are financed by investors whose flows are highly sensitive to recent performance, while banks face funding conditions that are far less reactive to short-term returns. These differences are closely linked to institutional structure: mutual funds are open-ended, equity-financed intermediaries that offer investors near-instantaneous redemption, while banks finance themselves through more stable, longer-term liabilities. When contractionary policy depresses asset prices, mutual funds face redemptions that force them to liquidate equity holdings. Banks act as liquidity providers around these events and absorb the sales at discounted prices. These equity flows across intermediaries generate the asset price amplification that has characterized monetary transmission to equity markets, and highlight the role of both flow-performance sensitivity and intermediary heterogeneity.

[1]Seminal early work includes Bernanke and Kuttner (2005) and Gürkaynak et al. (2005b), and these findings have held in recent times, e.g., Cieslak and Pang (2021) and Kashyap and Stein (2023).

[2]Recent work in demand-based asset pricing, such as Koijen and Yogo (2019) and Gabaix and Koijen (2021), highlights how small investor flows, whether from institutions or households, can generate large price effects.

Empirics. We use micro portfolio holdings data to provide a comprehensive picture of how equity holdings shift across institutional investors in response to monetary policy. We measure changes in equity holdings across financial intermediaries using the Thomson Reuters Institutional Holdings (S34) database of quarterly institutional investment holdings, and identify monetary shocks using the high-frequency approach of Bauer and Swanson (2023). The S34 represents all institutional investors managing over $100 million in assets. In 2019, S34 managers collectively held around 70% of the U.S. stock market. Our central finding is that a one standard deviation monetary contraction that translates to a 7 basis points hike in the Federal Funds Rate (FFR) increases equity outflows at mutual fund by 26% of their typical quarter flow. This constitutes an economically large selloff: mutual funds account for 74.6% of assets under management in the S34 database. To absorb this selling pressure, banks increase their equity purchases by 40.5% of their typical quarterly flow.

Differences in asset allocation behavior across financial intermediaries are a well-established feature of portfolio-level data. We build on this insight by proposing and testing a microfoundation for why mutual funds act as net sellers following contractionary monetary shocks.[3] We show that mutual fund outflows can be explained by the performance sensitivity of their underlying investors: when monetary tightening lowers asset returns, performance-sensitive investors withdraw capital, forcing mutual funds to liquidate equity positions due to their open-ended, equity-financed structure and the near-instantaneous redeemability of their shares.[4]

To measure differences in investor flow-performance sensitivity, we construct a time-varying, intermediary-specific measure under rolling regressions. Following seminal work including Chevalier and Ellison (1997) and Berk and Green (2004), we regress realized fund flows on recent returns and, alternatively, on fund alphas, capturing how responsive a fund's assets under management are to recent returns/performance. A higher sensitivity measure indicates higher inflows (outflows) following positive (negative) returns.

We then test whether funds with higher flow-performance sensitivity experience stronger outflows and greater selling pressure after contractionary monetary policy shocks. First, in the cross-section

[3] This mechanism is most salient for mutual funds and similar intermediaries. Related intermediary types in our classification include ETFs, which are grouped with mutual funds in the S34, and investment advisors.

[4] In this context, "equity-financed" indicates that these intermediaries are generally unlevered and invest primarily out of their net asset base.

of institutional managers, we report that mutual fund flows are highly responsive to recent returns, while bank flows exhibit no statistically significant performance sensitivity.[5] Following contractionary monetary shocks, mutual funds with more performance-sensitive investors reduce their equity holdings more aggressively: a mutual fund whose investors are one standard deviation more sensitive to past performance than the average fund experiences 34% larger equity outflows. To absorb these flows, performance-insensitive banks step in as market makers, purchasing depressed shares and profiting from price recovery in subsequent periods, where we document a subsequent reversal in flows between banks and mutual funds. That major banks in the U.S. and the E.U. reported record equity trading profits after the 2022–23 monetary tightening is consistent with our framework.[6]

An alternative mechanism to flow-performance sensitivity is conventional portfolio rebalancing across asset classes within an investor group. To test the salience of this force relative to the flow-performance sensitivity channel, we link institutional managers in the S34 dataset to mutual fund characteristics in the CRSP Mutual Fund Database (MFDB), which provides information on portfolio allocations across asset classes. We find no evidence that mutual fund managers rebalance across asset classes (bonds, equities, cash, and other assets) in response to monetary shocks. At the fund level, portfolio weights remain stable across asset classes. Instead, a one standard deviation contractionary shock reduces total net assets under management by 0.82%. This decline is highly significant and concentrated among funds with more performance-sensitive investors. These findings support the interpretation that monetary policy shocks generate real capital withdrawals from mutual funds, not endogenous rebalancing across asset classes.

A central insight of this paper is that equity market transactions between heterogeneous financial intermediaries aggregate into systematic movements in asset prices. Empirically, this paper identifies a novel *flow-sensitivity channel* of monetary policy transmission in the US equity market. In our third set of empirical exercises, we examine how the performance sensitivity of investors amplifies monetary transmission at the level of individual stocks.

[5] Although banks can earn substantial trading profits through market-making and liquidity provision, these profits are typically retained rather than passed through to depositors – reflecting the fundamental difference in business models between banks and mutual funds.

[6] Reported by Bloomberg (July 16, 2024; October 15, 2024) and the Financial Times (April 25, 2024; July 24, 2024).

For each stock, we compute the AUM-weighted average performance-flow sensitivity of its institutional owners. This measure captures how responsive the ownership base of a given stock is to recent performance, and we interpret it as a forward-looking indicator of how likely a stock is to be sold in response to a monetary shock. Stocks with a one standard deviation higher exposure to performance-sensitive investors experience an additional 44.8 basis point decline in returns following a 7 bps contractionary shock to the FFR. This effect remains robust after controlling for a rich set of time-varying stock characteristics, including standard asset pricing factor loadings at the stock-time level.

Theory. Our second contribution is an analytical model that rationalizes our empirical findings on how equity flows between heterogeneous financial intermediaries in response to monetary policy. The model is purposefully stylized to yield testable predictions that we verify in our empirical exercises.

We consider a two-period economy where the supply side follows a standard New Keynesian framework and a representative household chooses consumption and savings allocations based on its beliefs about financial returns. Rather than making a traditional portfolio choice between stocks and risk-free bonds, the household delegates its wealth across financial intermediaries, extending an intermediary asset pricing framework.[7] For parsimony, we model two classes of intermediaries: a mutual fund and a bank. Each offers distinct financial returns. Banks provide risk-free returns, characterized as savings or time deposit rates. Mutual funds offer risky returns that depend on the performance of the underlying assets.

The model's primary theoretical results characterize household wealth allocation and asset price dynamics following a monetary policy contraction, and the role of performance sensitivity in amplifying these dynamics. An increase in the risk-free rate induces the household to reduce its wealth allocation to mutual funds, leading to equity outflows from these funds. Banks act as market makers, absorbing these outflows. This reallocation occurs because the household forms expectations about future risky returns based on past mutual fund performance, and heightened sensitivity to

[7] This assumption departs from traditional models where the household is directly invested in financial assets and actively manages its portfolio. As discussed in Section 2, over three-fourths of U.S. households hold financial assets passively through various financial intermediaries.

these returns reduces portfolio weights on mutual funds. In the model, households hold extrapolative beliefs regarding financial returns. Since bank returns are fixed and not performance-sensitive, banks use household deposits to provide liquidity in equity markets at a premium. We further characterize how greater investor sensitivity to past performance amplifies both asset price changes and equity flows in response to changes in the risk-free rate.

Our model connects to a broad literature on how monetary policy affects risk premia.[8] Our framework generates changes in risk premia through the interaction of two forces: household belief sensitivity to financial returns and heterogeneous financial intermediaries. Households form expectations about risky returns based on past performance. When risk-free rates rise, households liquidate mutual fund holdings and asset prices decline as banks value equity less than households do.

Related literature. This paper contributes to several strands of literature on monetary transmission, intermediary asset pricing, and behavioral macro.

Empirically, our work contributes to the literature measuring the financial transmission of monetary policy. Early work by Bernanke and Kuttner (2005) and Gürkaynak et al. (2005b) demonstrates large equity price effects of monetary policy. The asset price impact of monetary policy has continued to hold in recent studies and across a variety of contexts.[9] We provide a novel interpretation by shifting the focus from aggregate price data to the granular portfolio flows of equities across intermediaries. This approach connects to the demand-system asset pricing framework of Koijen and Yogo (2019) and Gabaix and Koijen (2021). Recent work by Lu and Wu (2023) studies how intermediaries rebalance in response to monetary policy shocks driven by portfolio holding mandates. We differ by treating these flows as a primary outcome driven by a specific microfounded mechanism – performance-sensitivity – rather than as a means to estimate aggregate price elasticities.

Our work also parallels studies of bond market rebalancing during quantitative easing (Selgrad, 2023; Fang and Xiao, 2025). However, instead of the segmented markets framework used in fixed income environments (Vayanos and Vila, 2021), we propose a quantity-based approach in equity

[8]Models where risk premia move with monetary policy include Drechsler et al. (2018), Caballero and Simsek (2021), Kekre and Lenel (2022), and Caballero and Simsek (2023).

[9]See, for instance, Nakamura and Steinsson, 2018; Ozdagli and Velikov, 2020; Swanson, 2021a; Miranda-Agrippino and Ricco, 2021; Nagel and Xu, 2024.

markets centered on agents with heterogeneous beliefs.

We extend the literature on intermediary asset pricing by documenting how the heterogeneity of intermediary business models dictates the transmission of shocks. Prior empirical work highlights that risk-averse intermediaries act as marginal pricers (Adrian et al., 2014; Adrian et al., 2021; Haddad and Muir, 2025), and theoretical models often treat intermediaries as non-trivial marginal investors (He and Krishnamurthy, 2013; Brunnermeier and Sannikov, 2014). We add to this literature by incorporating heterogeneity into their framework, showing that the distinct funding structures of mutual funds and banks create the very flows that move prices. This supports the hypothesis that lower transaction costs in open-ended funds amplify the incorporation of investor beliefs into aggregate prices (Dávila and Parlatore, 2021).

A growing theoretical literature suggests that monetary policy influences asset prices by changing risk premia (Caballero and Simsek, 2021; Bianchi et al., 2022; Caballero and Simsek, 2023). Traditional models attribute these shifts to deleveraging forces driven by heterogeneous risk tolerance (Caballero and Simsek, 2021; Drechsler et al., 2018; Kekre and Lenel, 2022) or differing beliefs (Caballero and Simsek, 2020). Our model and empirical evidence propose distinct but related mechanisms: financial intermediaries with heterogeneous business models, and a household with performance-driven beliefs about risky asset returns.

Finally, our model builds on the literature framing investor expectations as extrapolative (Barberis and Shleifer, 2003; Barberis et al., 2015; Barberis et al., 2018; Jin and Sui, 2022), a view consistent with extensive evidence on household behavior (Chevalier and Ellison, 1997; Vissing-Jorgensen, 2003; Berk and Green, 2004; Greenwood and Shleifer, 2014; Kuchler and Zafar, 2019; Cassella and Gulen, 2018). Our framework is most closely related to Barberis et al. (2015), but we introduce a non-trivial intermediation problem where rational intermediaries must manage the flows of extrapolative households. While we use extrapolation for tractability, our empirical findings are consistent with other microfoundations that link beliefs to prior returns, such as mislearning (Bastianello and Fontanier, 2023) or internal rationality (Adam and Marcet, 2011; Adam et al., 2017).

The remainder of the paper is organized as follows. Section 2 discusses institutional details of heterogeneous financial intermediaries in US equities. Sections 3 and 4 present our data and empirical findings on equity flows. Section 5 documents how equity flows driven by investor performance sensitivity aggregate into asset price impacts. Section 6 rationalizes our empirical evidence in a general equilibrium model. Section 7 concludes.

2. Details of Equity Market Intermediation

Over the 2010-2020 decade, the U.S. equity market represented 45% of the $112 trillion global equity market cap, or $50.8 trillion in value (SIFMA Report, 2021). The impact of monetary policy announcements by the Federal Reserve are of first-order importance to not only the U.S. financial markets, but the global financial economy. In this section, we briefly present the institutional details on U.S. equity ownership and the business models of key intermediaries in this market. Doing so is a prerequisite to understanding the flows underlying aggregate equity price impact of Fed policy.

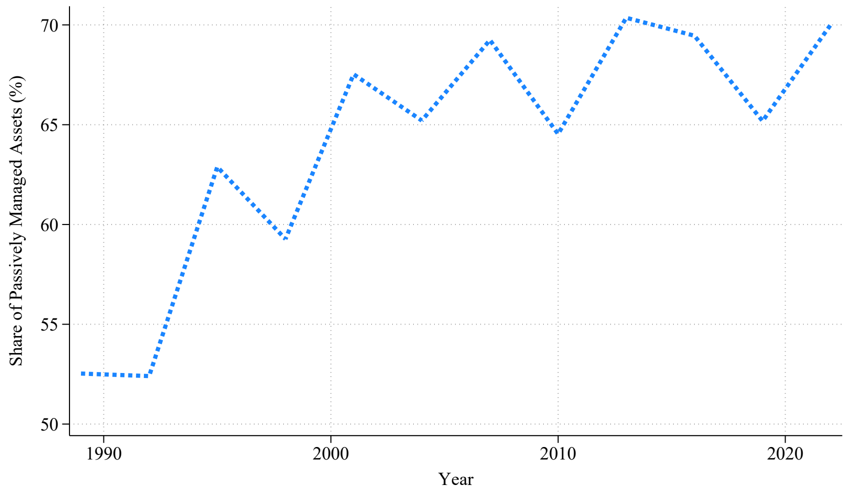
Over recent decades, U.S. households have increasingly delegated equity investments to passive financial intermediaries rather than actively managing portfolios. Figure 1 highlights the growing role of financial intermediaries (mutual funds, banks, pension funds, life insurance funds, hedge funds, etc.) in management of household portfolios. Mutual funds and ETFs have emerged as dominant vehicles, driven by innovations in financial products, reduced trading costs, and instant liquidity. By 2019, approximately two-thirds of U.S. household financial wealth was managed through these entities.

As we describe in the data section, two classes of institutions are primary intermediaries in the US equity market: mutual funds and banks. Together, these institutions control over four-fifths of US equity holdings in our institutional data but differ substantially in their funding structures, investor bases, and trading behavior. We present the salient differences here, and discuss their business models in depth in Appendix A.

Mutual funds and related entities are predominantly equity-financed, open-ended investment vehicles whose shares are instantly redeemable at net asset value. Their investors, primarily retail, can enter or exit positions with minimal frictions, often at low or negligible costs. This structure renders these intermediaries highly sensitive to short-term fluctuations in investor sentiment. As a consequence, underlying investor belief changes rapidly translate into equity flows of mutual funds and asset price movements.

Figure 1: Share of Passively Managed Financial Assets

This figure plots the share of U.S. household financial wealth managed through passive financial intermediaries from 1989 to 2022. Data are drawn from the Survey of Consumer Finances (SCF). Active management includes direct holdings in stocks, bonds, savings bonds and CDs. Passive categories include investment funds, life insurance, retirement accounts, and other managed assets.



Banks, in contrast, finance themselves predominantly through stable deposits and longer-maturity liabilities (Drechsler et al., 2017; Drechsler et al., 2021). Bank liabilities, such as demand deposits and certificates of deposits, have either contractual returns or are illiquid. Banks' trading activities are thus structurally insulated from rapid investor redemptions. Moreover, banks are regulated (e.g., via the Volcker Rule) to limit proprietary trading using depositor funds but can actively engage in market-making and liquidity provision as brokers. Due to these institutional features, banks are ex ante different than mutual funds within equity markets, acting as stabilizing forces by absorbing liquidity shocks. The interaction between mutual funds and banks in U.S. equity markets facilitates over \$ 2.5 billion in daily trading volume. The stark contrast in their business models between mutual funds/ETFs and banks underlies significant differences in their responses to monetary policy shocks.

3. Data Description

3.1 Institutional Equity Holdings Data

Our primary data on intermediary flows come from the Thomson Reuters Institutional Holdings (S34) database, which aggregates quarterly SEC Form 13F filings. All institutional fund managers with equity investment accounts exceeding $100 million in total market value are required by the SEC to file Form 13F. The data are at the fund manager-stock-quarter level. As of 2019, this sample captures approximately 70% of the U.S. equity market by assets under management (AUM).

Fund managers are uniquely identified by an identification number and equities are uniquely identified by their CUSIP. Fund managers are grouped into six classes: mutual funds, independent investment advisors, banks, pension funds, life insurance funds, and endowments (universities and foundations). Following Koijen and Yogo (2019) and Bushee (2001), we use a refined classification scheme to correct for reporting inconsistencies after 1998, and manually verify the top 100 managers to ensure accuracy. All non-identified managers are categorized as others, and compose less than 1% of our sample by AUM.[10]

We merge institutional equity holdings with equity-level characteristics using data from the Center for Research in Security Prices (CRSP). We use security prices to index stock prices to the prior quarter to remove valuation effects of capital gains and losses[11], which provides more direct identification of the quantity of equity flows.

3.2 Portfolio Composition and Funding Structure

While 13F filings provide granular equity data, they omit non-equity positions such as cash and bonds. We supplement the S34 data with the CRSP Mutual Funds Database (MFDB) to capture a complete view of fund balance sheets, including returns, NAV, and total net assets (TNA). The CRSP MFDB dataset reports fund characteristics from 1961 onward, and holdings data from 2003 onward.

[10] Appendix table C.1 provides a list of the ten largest fund managers by AUM in our dataset.

[11] The CRSP data for equities further allows us to measure and control for stock splits and dividend payouts for each stock in every fund manager's portfolio over time.

We link fund manager-level holdings of the S34 with individual fund-level data of the MFDB through the S12 database and WRDS *MFLinks*, aggregating individual fund-level characteristics to the manager level using AUM-weighted averages. [12] This combined dataset allows us to observe how equity rebalancing interacts with changes in cash cushions and investor flows.

3.3 Monetary Policy Surprise Measure

We identify exogenous shifts in the monetary policy stance using the high-frequency measure developed by Bauer and Swanson (2023). This series captures the first principal component of changes in federal funds futures and Eurodollar contracts within a 30-minute window of FOMC announcements. The measure is further orthogonalized against a vector of economic news and professional forecast revisions between Fed announcements to ensure the shocks are purged of endogenous information effects.

One difficulty arises because high-frequency monetary policy surprises are, by nature, constructed to capture a short-window where the monetary policy stance has been altered by policy makers. To align these high-frequency shocks with our quarterly holdings data, we aggregate all policy events within a quarter. Our baseline specification uses a time-weighting scheme that assigns greater weight to shocks occurring later in the quarter, closer to the report date. This weighting reflects the empirical reality that intermediaries actively rebalance at high frequencies (Parker et al., 2023) and captures the state of the portfolio at the time of the 13F filing. Our results are robust to a simple unweighted sum of shocks (see Appendix C.4). Similar aggregation of high-frequency monetary policy shocks in a given quarter as has been performed in a variety of empirical applications.[13]

Our sample spans 1989 to 2019, balancing the availability of the MPS series with a desire to avoid the structural breaks of the COVID-19 pandemic. Appendix C.2 provides summary statistics for the key variables employed in this paper.

[12] The S12 database is the compilation of SEC N-30D filings to the SEC from individual mutual fund companies. The basic relationship between the S34 and S12 sets comes from the fact that almost every fund in the S12 set has a manager in the S34 set, and the latter provides aggregated totals for the holdings of all funds under the manger's control (i.e. a fund family). For example, in S34, Fidelity (MGRNO=27800) reports as a single entity and aggregates the holdings of all funds and trusts that it manages into its quarterly 13F filings. At the same time, in S12, Fidelity reports holdings of individual funds such as Magellan (FUNDNO=21858), its largest equity fund, both in fund prospectuses and official SEC filings.

[13] See, for example, Altavilla et al. (2019), Ottonello and Winberry (2020), Swanson (2021b), Ma and Zimmermann (2023), and Kroen et al. (2023).

4. Monetary Policy Induced Equity Flows

In this section we perform empirical analysis on the equity flows around monetary events. We document that contractionary monetary policy causes equity to flow from mutual funds and related intermediaries to banks. We propose a mechanism which drives this relationship: underlying investor sensitivity to prior returns. We demonstrate that these equity flows are not portfolio rebalancing to other asset classes within mutual funds but instead result from a loss of capital at intermediary driven by underlying investor withdrawals. Finally, show that this intermediary-level heterogeneity aggregates meaningfully at the stock-level.

4.1 On-Impact Equity Flows

In order to identify equity flows across financial intermediaries, 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 effects of capital gains, to study the purely quantity-based effects of monetary policy (Calvet et al., 2009),

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

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 label $\Delta Q_{m,t}$ as equity flows and this captures the change in equity holdings as a share of a fund's previous period equity portfolio value, independent of portfolio price changes. It is analogous to the portfolio turnover ratio that is commonly used by practitioners.

Our empirical strategy throughout this section is to regress measured equity flows on the identified monetary policy shock aggregated from Bauer and Swanson (2023). Identification in this framework hinges on the assumed orthogonality of the aggregate monetary shock measure to other aggregate, time-varying factors. We interpret the coefficients of the monetary shock measure as the causal effect of monetary policy on equity flows. We estimate the following equation,

$$\Delta Q_{m,t} = \gamma \cdot \text{MPS}_t + \alpha_m + \varepsilon_{m,t} \tag{1}$$

where the outcome variable is scaled by average flows for that manager class, and MPS_t is scaled by its standard deviation to aid in interpretation of the coefficients. We include fund manager specific fixed effects to control for any level differences in flows between managers due to unobservable covariates that are idiosyncratic. Finally, our regressions are weighted by lagged holding levels for each manager, which implies that our coefficients aggregate to economy-wide equity flows following the strategy of Amiti and Weinstein (2018).

Table 1 estimates (1) for each class of intermediary we consider. γ in equation (1) captures manager-class net flows scaled by average volume, where $\gamma > 0$ indicates inflows and $\gamma < 0$ indicates outflows. For example, $\gamma = -0.5$ means a contractionary shock triggers net outflows equal to 50% of the manager's average flow activity. 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, equity flows 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.[14]

Table 1 reveals significant flow heterogeneity across institution classes in response to a one standard deviation MPS, which translates into a 7 basis point surprise hike in the Fed Funds Rate (Refer Table C.4). Three notable manager classes stand out, that collectively capture 98.2% of S-34 holdings. Mutual funds and investment advisors (74.6% of overall S-34 AUM) reduce equity holdings by 0.18% ($= 0.259 \times 0.7\%$), driving a 0.13% sample-wide selloff. In contrast, banks increase holdings by 0.57% (a 0.10% sample-wide purchase), while pension and life insurance funds also buy equities, absorbing the remaining -0.03% selloff gap.

The divergent response of bank equity flows suggests a market-making role discussed in Section 2. As shown in Table 1, banks absorb the selling pressure from mutual funds following contractionary shocks, acting as the primary providers of liquidity. While the MPS coefficient for banks is larger in magnitude, this reflects their smaller aggregate equity share: to clear the market, banks must proportionally increase their flows more than the larger, selling intermediaries.

In contrast to banks and pension and life insurance funds that rely on stable funding, mutual fund flows are driven by the demand of their underlying investors. Because mutual funds are equity-

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

Table 1: Equity flow response to a monetary surprise

This table reports estimates of equation (1), which regresses intermediary-level equity flows ($\Delta Q_{m,t}$) on the quarterly monetary policy surprise (MPS) from Bauer and Swanson (2023). Column (1) estimates the regression for the full sample of S34 institutional managers. Columns (2)–(6) estimate the regression separately by intermediary class: mutual funds & investment advisors, banks, pension & insurance funds, university & foundation endowments, and other funds. Equity flows are constructed as the change in equity holdings valued at prior-quarter prices, scaled by lagged portfolio value. Coefficients are scaled by the within-class mean of the dependent variable, and the MPS is scaled to one standard deviation. All regressions include fund manager fixed effects and are weighted by lagged holdings. The row E(Y) reports the mean of the dependent variable for each class, and AUM share reports the average share of total S34 assets under management. Heteroskedasticity-robust standard errors clustered by fund manager and year are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Dependent variable: $\Delta Q_{m,t}$					
	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
	(0.068)	(0.065)	(0.226)	(0.145)	(0.280)	(1.055)
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%

financed and provide daily redemption at NAV, their flows directly pass-through investor beliefs regarding future performance.[15] We posit that this selling behavior is rooted in performance-sensitivity. Since monetary tightening generates immediate negative equity returns (Bernanke and Kuttner, 2005), it can trigger outflows if investors use realized returns to update their beliefs about future performance or fund quality.[16] Contractionary shocks have the ability to cause equity outflows from mutual funds to the extent that mutual fund investors update their beliefs of fund ability or the distribution of returns using recent, realized returns.

To test this mechanism, we exploit cross-sectional heterogeneity in flow-performance sensitivity

[15]The S34 data cannot separately identify investor liquidations of funds from manager rebalancing reactions because the data only covers held equities. We return to this point in Section 4.2 to test directly whether these flows are rebalancing or investor withdrawals.

[16]Mutual fund investors' sensitivity to performance is well-documented in the literature, notably by Chevalier and Ellison (1997), Berk and Green (2004), Huang et al. (2007), Agarwal et al. (2013), and Shive and Yun (2013).

across fund managers, constructing a novel manager by time-level measure to identify whether performance-driven flows explain the aggregate transmission of monetary shocks,informed by prior literature (Chevalier and Ellison, 1997; Shive and Yun, 2013). Specifically, we measure time-varying investor return-sensitivity for each manager ($\tilde{\varphi}_{m,t}$) as follows,

$$\text{Flows}_{m,t} = \tilde{\varphi}_{m,t} \cdot \text{Performance}_{m,t-1} + \alpha_m + \alpha_t + \varepsilon_{m,t}, \qquad \forall\, t \in \{s, ..., s-12\},\ \ \forall\, s,\ \ \forall\, m \tag{2}$$

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 by time-level α from 12 quarter rolling regressions on the five factor model proposed by Fama and French (2015) and the momentum factor from Carhart (1997). This creates a time-varying measure of returns innovation above-and-beyond the market factors for each manager every time period, which we use as the "returns surprise" for investors at that manager. We then test whether investor flows in-to or out-of the manager respond to the past returns performance, for each manager every time period in rolling regressions. In our estimations, we impose that a fund manager have at least 40 quarters of data to be included in our sample. Our measure $\tilde{\varphi}_{m,t}$ captures the magnitude of how recently realized returns affect fund AUM in equities for each manager m in every time period t.

Table 2 reports these flow-performance sensitivities by fund manager class. 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. Consistent with the market-making business model which is not equity driven that we have documented, such a relationship is 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 C.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 C.6.

Table 2: Flow-performance sensitivity

This table reports estimates of equation (2), which regresses fund-level dollar flows on lagged fund manager performance (alpha from rolling 12-quarter regressions on the Fama-French five-factor plus momentum model). Column (1) estimates the regression for the full sample. Columns (2) and (3) estimate the regression separately for mutual funds & investment advisors and banks, respectively. Dollar flows are defined as $AUM_{m,t} - AUM_{m,t-1} \cdot (1 + R_{m,t})$. Coefficients are scaled by the within-class mean of the dependent variable, and explanatory variables are scaled to one standard deviation. All regressions include fund manager and time fixed effects. Fund managers are required to have at least 40 quarters of data. The row E(Y) reports the mean of the dependent variable in dollar terms, and AUM share reports the average share of total S34 assets under management. Heteroskedasticity-robust standard errors clustered by fund manager are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	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%

Armed with the time-varying measure of flow-performance sensitivity for each fund manager from (2), we test the relevance of this channel for equity flows caused by monetary policy by estimating the following regression,

$$\Delta Q_{m,t} = \sum_{k \in \{\text{MF\&IA, Banks, P\&LI}\}} \left[\gamma_1^k \cdot (\text{MPS}_t \times \tilde{\varphi}_{m,t-1} \times \mathbb{1}_k) + \gamma_2^k \cdot (\text{MPS}_t \times \mathbb{1}_k) \right] + \gamma_3 \cdot \tilde{\varphi}_{m,t-1} + \alpha_m + \alpha_t + \varepsilon_{m,t}. \quad (3)$$

In line with the intuition we have provided,[17] we would expect that mutual funds & investment

[17] Section 6 provides a micro-foundation in a general equilibrium model which explicitly generates these comparative statistics.

advisors should experience greater outflows if they are exposed to more performance-sensitive investors. Accordingly, γ_1 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 3: Equity flow response to a monetary surprise

This table reports estimates of equation (3), which regresses intermediary-level equity flows ($\Delta Q_{m,t}$) on the interaction of the quarterly monetary policy shock (Bauer and Swanson, 2023) with lagged flow-performance sensitivity ($\tilde{\varphi}_{m,t-1}$), separately by intermediary class (mutual funds & investment advisors, banks, and pension & life insurance funds). Column (1) includes fund manager fixed effects only. Column (2) adds time fixed effects. The flow-performance sensitivity measure $\tilde{\varphi}$ is estimated from equation (2) using rolling windows. Explanatory variables are scaled to one standard deviation. Regressions are weighted by lagged holdings. Heteroskedasticity-robust standard errors clustered by fund manager and year are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Dependent variable: $\Delta Q_{m,t}$	
	Aggregate economy	Aggregate economy
	(1)	(2)
MPS × $\tilde{\varphi}$ × MF & IA	-0.335***	-0.276***
	(0.105)	(0.097)
MPS × MF & IA	-0.211**	1.588
	(0.083)	(1.086)
MPS × $\tilde{\varphi}$ × Banks	0.013	-0.008
	(0.061)	(0.063)
MPS × Banks	0.749**	2.544**
	(0.371)	(1.128)
MPS × $\tilde{\varphi}$ × PF & LI	-0.031	-0.008
	(0.136)	(0.137)
MPS × PF & LI	0.026	1.846*
	(0.131)	(1.092)
Manager FE	Y	Y
Time FE	N	Y
Observations	134,636	134,636
Adjusted R^2	0.183	0.232
$\mathbb{E}$(Y)	0.7%	0.7%

Table 3 reports our findings from estimating (3) on the pooled sample of intermediaries. For the average mutual fund, a one standard deviation increase in investor sensitivity amplifies outflows by 33.5% following a 7 basis points surprise FFR hike. When controlling for time effects to account for aggregate trends in equity flows, the outflow is attenuated to 27.6%, though it remains large and highly significant. By contrast, bank flows exhibit no significant sensitivity to portfolio performance, as shown in Table 2, leading to an insignificant estimate of γ_1.

This finding suggests that heterogeneity in bank flow-performance relationships does not influence monetary transmission to these intermediaries in equity markets. However, while banks as a whole are insensitive to performance-driven flows, they increase their equity purchases in response to a contractionary monetary shock, as reflected in a positive and significant γ_2. Pension and life insurance funds respond in a manner similar to banks, supporting the internal consistency of our mechanism in Table 1.

These results indicate that intermediaries most exposed to investors with high flow-performance sensitivity, primarily mutual funds, are the source equity outflows following contractionary monetary policy. In contrast, intermediaries with no significant flow-performance relationships, notably banks, act as liquidity providers, absorbing mutual fund outflows and clearing asset markets.

Our findings remain robust when using an unweighted measure of MPS, as reported in Table C.7, reinforcing the role of investor sensitivity in shaping monetary transmission via equity flows.

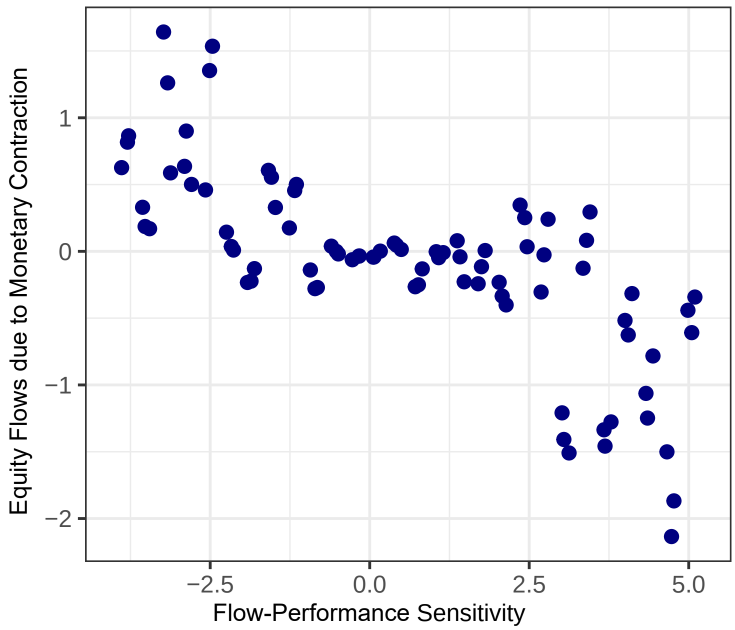
As a visual representation of the mechanism, Figure 2 plots the cross-sectional relationship between investor flow-performance sensitivity on the x-axis and the estimated $\Delta Q_{m,t}$ caused by a one standard deviation monetary contraction on the y-axis. There is a clear negative correlation: more performance sensitive investors create higher outflows for managers following lower returns implied by a surprise monetary contraction.

4.1.1 Robustness to General Stock Market Returns

To conclude our analysis of on-impact equity flows, we estimate the elasticity of equity flows for institutional fund managers in our data to aggregate stock market returns and report the results in Appendices C.8-C.10. This analysis establishes that the equity flow responses we have estimated in Tables 1 and 3 in the context of monetary policy shocks hold more generally and are related to

Figure 2: Correlation between equity flows and sensitivity

This figure plots the cross-sectional relationship between intermediary flow-performance sensitivity and equity flows induced by monetary policy across fund managers. The x-axis measures flow-performance sensitivity ($\tilde{\varphi}$) estimated from equation (2) at the manager level. The y-axis measures the equity flow response (γ) estimated through rolling regressions of equation (1) at the manager level. The scatterplot is equally spaced-binned such that each point captures a similar number of managers in the sample. We find a negative correlation, i.e., more sensitive investors cause higher outflows for fund managers after poor returns.



aggregate stock market returns.

We first engineer shocks to stock market returns using monetary policy shocks as instruments in table C.8. In line with prior literature, there is a negative impact of a contemporaneous contractionary monetary policy shock on stock returns, and this effect is short-lived. Constructing price shocks implied from the first stage in Table C.8, we then estimate the equity flow elasticities to aggregate stock returns across intermediary classes.

Tables C.9 and C.10 report our findings in a stock-time panel. We find that following a positive return due to a monetary policy shock, mutual funds buy equities, and that mutual funds reliant on more flow-performance sensitive investors more equities. Banks continue to act as the counterparty to these trades in response to an aggregate stock market shock. Although not the primary focus of this study, this robustness exercise reveals that the equity flow patterns we have documented in this section may apply to other contexts and could be analyzed in future work.

4.2 Portfolio Rebalancing or Performance-Sensitive Outflows?

In a single asset economy, equity outflows by investors would reduce the total net worth of their fund managers. However, if fund managers hold diversified portfolios across multiple asset classes, equity outflows may not necessarily be driven by investor withdrawals. A candidate alternative explanation to our findings is that fund managers rebalance across asset classes, selling equities to purchase bonds, cash or other securities. In this case, negative equity flows would be offset by positive inflows into other asset classes, resulting in no loss of manager net worth. Therefore, it is critical to disentangle these two forces to understand the mechanism driving the equity flows across intermediaries.

Our results in section 4.1 cannot directly rule out a within-fund manager rebalancing narrative because the S34 only covers intermediary equity holdings. In this section, we show that mutual fund portfolios do not significantly rebalance in response to monetary policy. Instead, we find they experience net worth losses. This indicates that the observed equity outflows are primarily investor withdrawals rather than portfolio adjustments.

We formally test whether the observed negative equity outflows for mutual funds occur because of investor redemptions or fund manager rebalancing. To implement these tests, we use a panel of mutual funds that can be linked between the previously described S34 and CRSP MFDB datasets. The CRSP MFDB provides detailed portfolio holdings across asset classes and total net assets (TNA), which we use as a measure of fund net worth. To do so, we estimate Equation (1) on this merged panel, replacing the dependent variable with one of the following measures: the change in portfolio weights for equities (Δ Equity Share), bonds (Δ Bond Share), or other securities (Δ Other Share) for each fund manager, as well as the change in their net worth (Δ TNA).

Table 4 presents the estimation results, revealing two key findings.[18] First, as shown in columns (1) to (3), we find no significant changes in portfolio weights across asset class, indicating a lack of rebalancing by fund managers. In fact, although statistically insignificant, we find evidence that mutual fund managers insignificantly *increase* their portfolio share in equities, which should suggest

[18]These findings are all robust to an unweighted measure of MPS and are reported in Table C.11.

Table 4: Portfolio rebalancing and outflows for mutual funds

This table reports estimates of equation (1) for the merged S34–CRSP Mutual Fund Database (MFDB) sample, replacing the dependent variable with measures of portfolio composition and net worth. Columns (1)–(3) use the quarterly change in portfolio weight allocated to equities, bonds, and other securities, respectively. Column (4) uses the percentage change in total net assets (TNA) as the dependent variable. The MPS is the weighted quarterly aggregate from Bauer and Swanson (2023), scaled to one standard deviation. All regressions include fund manager fixed effects. Heteroskedasticity-robust standard errors clustered by fund manager and year are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	(1) Δ Equity Share (%)	(2) Δ Bond Share (%)	(3) Δ Other Share (%)	(4) Δ TNA (%)
MPS	5.520	0.983	-2.454	-0.822***
	(10.265)	(6.525)	(6.698)	(0.283)
Manager FE	Y	Y	Y	Y
Observations	23,853	23,853	23,853	30,788
Adjusted R^2	-0.006	-0.007	-0.008	0.031

a positive equity flow for these intermediaries. These results make investor-driven withdrawals the far more likely explanation for observed equity outflows caused by monetary policy.

Our second finding is that that a one standard deviation contractionary monetary surprise results in a 0.82% net worth decline for a mutual fund manager (Table C.11, Column 4). This result validates that negative equity flows are caused by investor withdrawals. Interestingly, these outflows are similar in economic and statistical magnitude to the outflows documented across all mutual funds in table 1, which we measured to be approximately 1.8% (0.259×0.7).

To examine whether mutual fund net worth declines are driven by the flow-performance mechanism, we estimate (3) with the updated dependent variables. We report results in Table 5. Column (4) corroborates our earlier findings, showing that mutual fund net worth declines as a result of investor outflows. A one standard deviation contractionary shock reduces mutual fund net worth by 0.66%, a sizable effect given typical net worth fluctuations. Critically for our candidate mechanism, we find that a mutual fund with one standard deviation higher flow-performance sensitivity ($\tilde{\varphi}_{m,t}$), net worth declines by an additional 0.61%.[19] This result demonstrates that the aggregate selling behavior observed of mutual funds in equities is both i) driven by investor capital withdrawals and ii) associated with mutual funds who have more performance-sensitive investor bases.

[19] As before, these findings remain robust to an unweighted measure of MPS, as reported in Table C.12.

Consistent with our previous findings, we find little evidence that fund managers rebalance their portfolios in response to the monetary shock. Even after accounting for heterogeneity in investor flow-performance sensitivity, mutual funds do not shift their portfolios into bonds or other asset classes. Mutual funds in the merged sample weakly increase their equity portfolio share, suggesting that in the absence of investor withdrawals, contractionary monetary policy would lead to positive equity flows[20]. The significant decline in TNA, along with the findings in Section 4.1, confirms that investor withdrawals, not fund manager rebalancing, drive the equity outflows following a contractionary monetary shock.

Table 5: Portfolio rebalancing and outflows for mutual funds

This table reports estimates of equation (3) for the merged S34–CRSP MFDB sample, replacing the dependent variable with measures of portfolio composition and net worth. Columns (1)–(3) use the quarterly change in portfolio weight allocated to equities, bonds, and other securities, respectively. Column (4) uses the percentage change in total net assets (TNA). Regressions include the interaction of the monetary policy shock (Bauer and Swanson, 2023) with lagged flow-performance sensitivity ($\tilde{\varphi}_{m,t-1}$), and the MPS alone. All regressions include fund manager fixed effects. Heteroskedasticity-robust standard errors clustered by fund manager and year are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	(1) Δ Equity Share (%)	(2) Δ Bond Share (%)	(3) Δ Other Share (%)	(4) Δ TNA (%)
MPS $\times$ $\tilde{\varphi}$	6.490	-3.365	-3.623	-0.610*
	(7.960)	(6.085)	(8.917)	(0.349)
MPS	13.309*	-1.154	-9.340	-0.660**
	(7.259)	(4.310)	(6.441)	(0.334)
Manager FE	Y	Y	Y	Y
Observations	9,164	9,164	9,164	11,505
Adjusted R^2	-0.008	-0.019	-0.007	0.005

For robustness, we extend our analysis to the fund level by using the entire CRSP MF database, not just the sample which can be merged to the S34. We report our findings in Appendix Tables C.13 and C.14. Because flow-performance sensitivity is estimated at the fund manager-level, for our analysis at the fund-level, we proxy for investor return sensitivity by using the expense ratio for investors to the fund. The manager flow-performance sensitivity is an investor demand characteristic, whereas expense ratio is a fund characteristic. The latter acts a friction *against* liquidation for investors,

[20] As a large number of studies have argued, risk premia rises with contractionary policy. All else equal, this should increase Sharpe ratios and increase portfolio weights in equities. We find this holds weakly with more performance-sensitive managers. That equity flows are significantly negative (Section 4.1) further demonstrates that investor capital withdrawals dominate a rebalancing channel in equity flows around monetary events.

and should be inversely related to flow-performance sensitivity as it makes investor transactions more costly. Both Appendix tables estimate our specification (3) at the fund-level, and differ in the measure of the MPS employed (weighted vs. unweighted average). The fund-level results are similar to manager-level results, 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 the tables within this subsection, supporting our findings at a finer level granularity, and alleviating concerns that funds able to be merged between the CRSP MFDB and the S34 are not subject to notable selection bias.

4.3 Dynamics of Equity Flows

Thus far, our analysis has focused on the immediate response of financial intermediaries to a surprise monetary contraction. However, understanding the persistence of these effects is crucial for assessing the full impact of monetary policy on equity markets. If monetary surprises are uncorrelated over time, the initial negative return impact should revert in subsequent periods due to mean-reversion in asset prices. Under this mean-reversion dynamic, return-sensitive mutual fund investors should alternate between selling and buying equity funds over time, consistent with our earlier findings on investor flow-performance sensitivity. In this setting, banks should act as market makers, absorbing selling pressure when markets are depressed and unwinding positions when equity prices recover. By doing so, they should earn profits from intertemporal arbitrage while ensuring market clearing.

To uncover these hypothesized dynamics, we estimate the response of equity flows over four quarters from the MPS through a local projection of a pooled estimation of (1) following Jorda (2005),

$$\Delta Q_{m,t+h} = \sum_{k \in \{\text{MF\&IA, Banks}\}} \gamma_k^h \cdot (\text{MPS}_t \times \mathbb{1}_k) + \alpha_m + \varepsilon_{m,t+h} \quad \forall h \in \{0, ..., 3\} \tag{4}$$

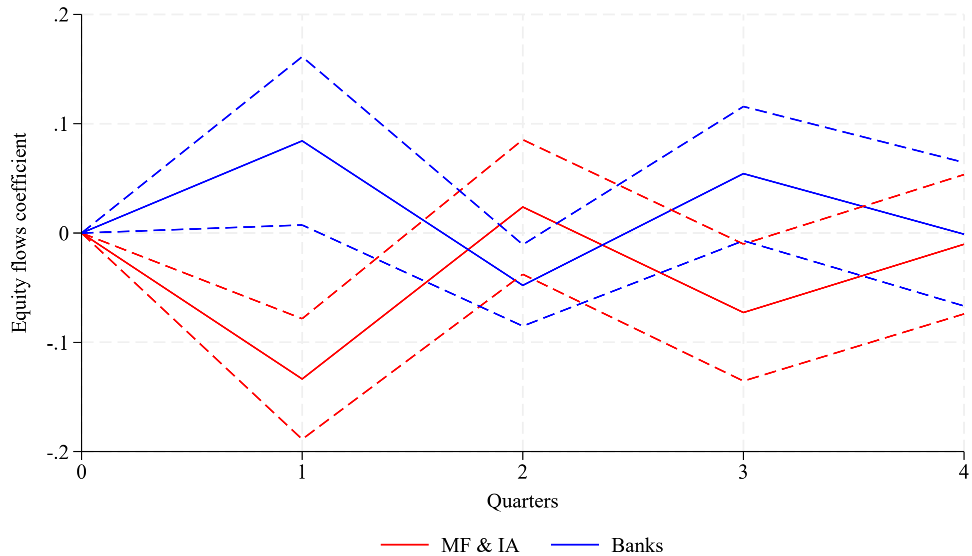
The dependent variable is the cumulative change between periods $t + h$ and $t - 1$. We present the dynamic coefficients from (4) in Figure 3.[21] Confidence intervals are plotted at 90% and generated

[21]The counterpart to this figure under the unweighted MPS is shown in Figure C.1.

using heteroskedasticity-robust standard errors clustered by fund manager and time. 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.

Figure 3: Local projection of equity flows

This figure plots impulse response coefficients from the local projection in equation (4), tracing the cumulative equity flow response over four quarters following a one standard deviation contractionary monetary policy surprise. Separate responses are shown for mutual funds & investment advisors and banks. Equity flows are scaled by their within-class mean values and then by the average market share of each class, so that coefficients capture flows as a share of the overall equity market. Confidence intervals are plotted at the 90% level using heteroskedasticity-robust standard errors clustered by fund manager and year.



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 decay within one year. After impact, the dynamics of equity flows and monetary policy indicate an overshooting and reversal in trading patterns. Banks weakly sell equities in the quarter after the monetary shock while mutual funds buy equities. However, that there is not much statistical significance after impact suggests that monetary impact on equity flows is short-lived.

5. Equity Price Impacts due to Monetary Policy

Thus far, our analysis has documented how financial intermediaries' equity flows respond to monetary policy shocks. We argue that understanding the underlying mechanisms of granular equity flows provides deeper insight into asset price transmission of monetary policy. This section examines whether our proposed mechanism of investor flow-performance sensitivity can explain a quantitatively significant share of equity price variation caused by monetary policy. Specifically, we investigate whether aggregating the flow-performance sensitivity across managers and time affects the price elasticity of equity prices to monetary shocks.

The flow-performance sensitivity mechanism predicts that a security held by intermediaries with more performance-sensitive investors will face greater selling pressure because of underlying investor withdrawals. To test whether greater flow-performance sensitivity amplifies price elasticities in response to monetary policy, we exploit heterogeneity in stock-level exposure to flow-performance sensitive institutional owners (intermediaries). We define a stock-specific, time-varying measure of exposure to flow-performance sensitivity based on the characteristics of its intermediary owners. Specifically, for each stock s, we compute the weighted average of intermediary flow-performance sensitivity $\tilde{\varphi}_{m,t}$. We construct:

$$\tilde{\varphi}_{s,t} = \sum_{\mathcal{M}} \frac{AUM_{m,s,t} \times \tilde{\varphi}_{m,t}}{AUM_{s,t}}. \tag{5}$$

In (5), for each stock, s, we take the weighted average of intermediary flow-performance sensitivity, $\varphi_{m,t}$, estimated from (2) at a time t. The weights for a given intermediary are the size of holdings in stock s. This measure will be used as to capture stock-level exposure to the flow-performance mechanism.

Using this measure of stock-level exposure to the flow-performance sensitivity of its institutional owners, we estimate the following regression:

$$r_{s,t,t+1} = \alpha_s + \alpha_t + \beta_1 \cdot (\text{MPS} \times \tilde{\varphi}_{s,t-1}) + \beta_2 \cdot \tilde{\varphi}_{s,t-1} + \varepsilon_{s,t}, \tag{6}$$

where $r_{s,t,t+1}$ is the log return for stock s between periods t and $t+1$, and $\tilde{\varphi}_{s,t-1}$ is the lagged stock's exposure to the flow-performance sensitivity of institutional fund managers. We include stock and time fixed effects to robustly control for differences in returns across stocks and time. The key coefficient of interest β_1, captures whether stocks more exposed to performance-sensitive intermediaries experience larger return effects following a monetary shock. We also control directly for any direct impact of intermediary flow-performance sensitivity on stock returns, independently of monetary shocks.

Results from the estimation of (6) are presented in Table 6, where the second column adds time effects.[22] Column (1) shows that stocks with a one standard deviation higher exposure to flow-performance sensitivity experience a 44.8 basis point decline in returns following a 7 basis points of a surprise hike in Fed Funds rate. This estimate is robust to the inclusion of manager and time fixed effects with an estimate of a 11.4 basis points decline. Given these results, we conclude that flow-performance sensitivity is a factor which has considerable explanatory power in both generating and amplifying the significantly negative returns caused by contractionary monetary policy shocks.

Our use of exposure to intermediary flow-performance sensitivity in these asset pricing regressions bears some comparison to traditional asset pricing models. Unlike traditional factor betas (FF5 and momentum) which reflect static stock characteristics, our flow-performance sensitivity measure captures an institutional, dynamic characteristic. If underlying investors to intermediaries generate beliefs over future returns using realized returns, the exposure measure to intermediary flow-performance is an important factor in predicting how investor beliefs transmit to asset prices. We microfound and formalize this argument theoretically in Section 6.

To assess the economic significance of our proposed channel for monetary transmission, we augment our previous results by including time-varying stock-level betas into our analysis. Specifically, we estimate betas from the six-factor model (FF5 + momentum) for all CUSIPs in our sample. We extend our baseline regression (6) by incorporating these well-established asset pricing factors, leading to the following augmented specification,

$$r_{s,t,t+1} = \alpha_s + \alpha_t + \beta_1 \cdot (\text{MPS} \times \tilde{\varphi}_{s,t-1}) + \beta_2 \cdot \tilde{\varphi}_{s,t-1} + \Gamma'(MPS_t \times \text{F}_{s,t-1}) + \varepsilon_{s,t}, \qquad (7)$$

[22] We report similar findings for the unweighted monetary policy shock in table C.15.

Table 6: Price elasticity to monetary policy shocks

This table reports estimates of equation (6), which regresses quarterly stock-level log returns ($r_{s,t,t+1}$) on the interaction of the monetary policy shock (Bauer and Swanson, 2023) with the stock's exposure to intermediary flow-performance sensitivity ($\tilde{\varphi}_{s,t}$), constructed as the AUM-weighted average of manager-level $\tilde{\varphi}_{m,t}$ from equation (5). Column (1) includes stock fixed effects only; column (2) adds time fixed effects. Heteroskedasticity-robust standard errors clustered by stock CUSIP and year are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	(1) Return$_{t+1}$	(2) Return$_{t+1}$
MPS $\times$ $\tilde{\varphi}$	-0.448***	-0.114***
	(0.032)	(0.032)
Stock FE	Y	Y
Time FE	N	Y
Observations	650,422	650,422
Adjusted R^2	0.025	0.169

where $F_{s,t-1}$ is the vector of the six stock-specific time-varying factor loadings of the Fama-French five factors plus momentum. These capture variation in stock characteristics that could potentially explain stock-level returns in our sample. We report β_1 as the influence of our specific mechanism while controlling for these standard factor loadings.

Table 7 reports our results including stock by time-level loadings for traditional asset pricing factors from estimating (7). In column (1), we find that the effect of flow-performance sensitivity exposure is more than twice as large in magnitude to the effect of monetary policy on the market beta factor loading. Moreover, the flow-performance sensitivity exposure measure remains highly significant and exhibits a larger magnitude than all traditional asset pricing factor loadings, highlighting its considerable explanatory power. A second notable finding is that the momentum loading – despite being a stock-level characteristic that could plausibly relate to flow-performance sensitivity exposure – shows no significant economic or statistical effect upon controlling for our measure. The significance of these findings continues to hold with the inclusion of time fixed effects in column (2), and when using an unweighted measure of monetary policy, as reported in Table C.16.

The large and significant coefficient on the sensitivity exposure measure highlights the critical role of financial intermediary flows in amplifying monetary transmission. These findings validate our novel approach of analyzing equity flows between heterogeneous intermediaries as a key channel through which monetary policy affects asset markets. Empirically, this demonstrates that factor built on characteristics of the institutional owners is a powerful predictor of asset price returns.

Table 7: Price elasticity to monetary policy shocks (with FF6)

This table reports estimates of equation (7), which augments the baseline stock-level return regression by including interactions of the monetary policy shock (Bauer and Swanson, 2023) with time-varying stock-level betas from the six-factor model (Fama-French five factors plus momentum). The key variable is the interaction of the MPS with our stock-level exposure to intermediary flow-performance sensitivity ($\tilde{\varphi}_{s,t}$). Column (1) includes stock fixed effects only; column (2) adds time fixed effects. Heteroskedasticity-robust standard errors clustered by stock CUSIP and year are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	(1) Return_{t+1}	(2) Return_{t+1}
MPS $\times\ \tilde{\varphi}$	-0.477***	-0.142***
	(0.036)	(0.036)
MPS $\times \beta^{\text{MKT}}$	0.234***	0.082*
	(0.050)	(0.047)
MPS $\times \beta^{\text{SMB}}$	0.427***	0.164***
	(0.055)	(0.050)
MPS $\times \beta^{\text{HML}}$	0.427***	0.222***
	(0.062)	(0.058)
MPS $\times \beta^{\text{RWM}}$	0.000	0.017
	(0.049)	(0.045)
MPS $\times \beta^{\text{CMA}}$	0.393***	0.147**
	(0.064)	(0.059)
MPS $\times \beta^{\text{MOM}}$	-0.088	-0.057
	(0.054)	(0.051)
Stock FE	Y	Y
Time FE	N	Y
Observations	475,799	475,799
Adjusted R^2	0.020	0.177

6. Model

In this section, we develop a two-period model that analytically characterizes how monetary policy affects equity flows across different classes of financial intermediaries and the resulting asset price dynamics. In the model, monetary policy shocks reallocate wealth across heterogeneous financial intermediaries, generating the observed patterns in equity flows of the previous sections. These flows influence asset prices through shifts in risk premia. The theoretical conclusions of this framework yield testable predictions that we validated empirically in prior sections.

The model has two primary objectives. First, we examine how equity flows differ across financial intermediaries, extending beyond traditional intermediary asset pricing models where trading occurs between households and a representative intermediary. Unlike standard intermediary asset pricing frameworks (e.g., He and Krishnamurthy, 2013; Brunnermeier and Sannikov, 2014), our model explicitly incorporates heterogeneity across financial intermediaries. Them model yields comparative statics on how equity flows respond to monetary policy shocks.

The second objective is to study how flow-performance sensitivity – the key mechanism identified in our empirical findings – shapes equity flows and amplifies asset price dynamics in response to monetary shocks. The key agent in the model is a representative household that delegates a portion of its wealth to a mutual fund. The household forms expectations about future mutual fund returns based on past performance, which generates the equity flow and price dynamics observed in the data. We find that both the household belief formation process and the presence of heterogeneous financial intermediaries are crucial to explaining the documented equity flow patterns and price dynamics.

Our model builds on the risk-centric macroeconomic framework developed in Caballero and Simsek (2020), in which asset prices and monetary policy influence real economic output. We extend this framework by incorporating heterogeneous financial intermediaries and a household belief formation process based on past performance.

6.1 Model Environment

The model is set in two periods, $t \in \{0, 1\}$. In period 0, a representative household allocates wealth between consumption today and investment in heterogeneous financial intermediaries (mutual funds or banks) which offer the household different returns. Financial intermediaries then invest household wealth in equity and bond markets. The central bank sets its policy rate, which is the return of a risk-free bond which endogenously affects asset prices and output in the economy. In period 1, the household consumes its savings and accrued financial returns from the investment decision.

Production in the Economy

We derive the supply-side of the model in detail in Appendix B.1 and here offer a brief summary. There is a representative hand-to-mouth (HTM) household which supplies labor to the economy, which is the only factor of production. There is a continuum of monopolistically competitive intermediate goods firms and a competitive final goods producer as in the canonical New Keynesian model. Prices are perfectly sticky in this stylized framework to highlight the role of central bank transmission to asset prices.

We assume that output will be at its potential in $t = 1$, and focus on its endogenous determination in $t = 0$ to characterize the relevant comparative statics. In $t = 1$, log potential output[23] is given

$$y_1^* = y_0^* + z_1, \quad z_1 \sim N(\mu_z, \sigma_z^2), \tag{8}$$

such that y_0^* refers to potential output in $t = 0$ and z_1 is a permanent productivity shock.

Financial Markets

In this economy, there are two financial assets[24]. The first asset is the *market asset* which we refer to as the equity market. This asset represents a claim on the share of output accrued to firms, which we show in Appendix B.1, to be a constant share of output: αY_t. Its gross return is denoted R_t. The second asset is a *risk-free bond*, which yields a return of R^f and is in net-zero supply.

A representative household generates demand in the economy and is endowed with initial wealth A_-. The household allocates its wealth between current consumption and investment, setting aside A_0 for consumption in $t = 1$.

Rather than holding financial assets directly, the household delegates investment decisions to two financial intermediaries: a mutual fund (M) and a bank (B). Each intermediary offers a log-return on investment: mutual fund shares yield mutual fund shares return r^M, which is risky, while the bank returns r^B, which is certain.[25] The household has Epstein-Zin preferences over consumption with unitary EIS, risk aversion γ, and discounts the future at rate $\exp(-\rho)$. Appendix B.3 provides

[23] Throughout the remainder of Section 6, lower-case variables denote log variables.

[24] See Appendix B.2 for a full description of financial markets and derivation of return processes.

[25] The bank offers a product similar to a one-period certificate of deposit or savings account to the household in this economy.

a formal derivation of the household's optimization problem and its optimality conditions.

The true distribution of mutual fund returns is not in the information set of the household. The household forms beliefs about future returns by forecasting that mutual fund returns follow an AR(1) process:

$$r_1^M = \varphi r_0^M + \varepsilon, \quad \varphi > 0, \tag{9}$$

where $\varepsilon \sim N(0, \sigma_\varepsilon^2)$ is a shock to the household's return forecast which is believed to be normally distributed.

Given the household's belief about mutual fund returns, its optimal portfolio allocation follows from standard expected utility maximization. Following Campbell and Viceira (2002), the household's portfolio choice for the mutual fund is approximately given by

$$\omega_0^M \approx \max\left(\frac{1}{\gamma}\frac{\varphi r_0^M - r^B + \frac{1}{2}\sigma_\varepsilon^2}{\sigma_\varepsilon^2}, 0\right), \tag{10}$$

where lower case variables indicate log returns. The household's portfolio share allocated to the mutual fund is proportional to the perceived Sharpe ratio, adjusted for risk aversion and scaled by perceived return volatility. A short-selling constraint ensures that the household's mutual fund allocation is non-negative.

Financial Intermediaries

Financial intermediaries receive household investments and allocate them across financial assets. Mutual funds allocate investments between the market asset and the risk-free bond, maintaining a fixed portfolio weight $\lambda > 1$ on the market asset. This simplification is motivated by the fact that many mutual funds follow a fixed investment mandate, and that we do not find mutual fund portfolio shares to be responsive to monetary shocks in Section 4.2.[26]

Unlike mutual funds, the bank guarantees a fixed return to the household while earning profits from investing its wealth from household deposits in financial assets. The bank optimizes its portfolio allocation to maximize expected utility, choosing a portfolio weight θ^B on the market asset based

[26]Our theoretical results hold with endogenous portfolio choice of the mutual fund.

on its relative risk aversion γ^B. A full derivation of the bank's optimization problem is provided in Appendix B.4.

The key general equilibrium condition is given by market clearing. This requires that total household investment in the market asset through both intermediaries equals the asset's valuation:

$$A_t \left(\omega_t^M \lambda + \left(1 - \omega_t^M\right) \theta_t^B\right) = P_t, \tag{11}$$

where total household wealth, A_t, invested in the market asset through the mutual fund and bank must be worth the valuation of the market asset, P_t.

6.2 The Effect of a Monetary Contraction

Asset Pricing

In the model, asset prices influence real economic activity by shaping household consumption and investment decisions, as in other risk-centric macroeconomic models such as Caballero and Simsek (2021) and Kekre and Lenel (2022). We formally derive this linkage in Appendix B.5. The connection between output and financial markets is captured by the output-asset pricing equation:

$$y_0 = p_0 + \rho - \log \alpha. \tag{12}$$

This equation captures the fundamental link between asset valuations and economic output, incorporating risk-adjusted returns and equilibrium conditions.

The output-asset pricing equation relies on several key components: the production of real output as dividend claims for the risky asset, household and intermediary portfolio allocations, returns on financial assets, and the central bank's policy rule for the risk-free rate. Appendix B.6 derives the return processes for the market asset and mutual fund. We assume that the central bank targets a rate $r^{f,*}$ which causes output to equal its potential, we formally derive the policy rule in Appendix B.7. We assume that the central bank sets $r^f = r^{f,*} + \eta$, where $\eta \sim N(0, \sigma_\eta^2)$ is a small monetary shock that we will subsequently study.

Since the risky asset is assumed to have a unitary supply and bonds are in net-zero supply, total household wealth satisfies $A_0 = P_0$. Combining the asset market clearing condition (11) with the household's portfolio choice (10) and the intermediary portfolio weights (λ, θ^B), we derive the *aggregate risk-balance* equation:

$$\frac{y_0^* + \mu_z + \log \alpha - p_0 + \frac{1}{2}\sigma_z^2 - r^f}{\sigma_z} = \gamma(\omega_0^M)\sigma_z, \tag{13}$$

$$\text{where} \quad \gamma(\omega_0^M) = \gamma^B \frac{1 - \lambda\omega_0^M}{1 - \omega_0^M}. \tag{14}$$

The term $\gamma(\omega_0^M)$ represents the inverse of the economy's aggregate effective risk aversion, weighted by the household's allocation across financial intermediaries. This term implicitly determines the price of the market asset.[27]

Implications of a Monetary Policy Shock

To link the empirical findings of the previous sections to our micro-founded general equilibrium model, we provide comparative statics under sufficient conditions of equity flows across intermediaries and asset prices. Throughout this section we refer to comparative statics with respect to η, the monetary shock affecting the yield of the risk-free bond.

Proposition 1. *Consider a local monetary perturbation, η. For $r_0^* < \zeta$*

1. $\frac{\partial \omega_0^M}{\partial \eta} \leq 0$*, the household reduces its wealth weight on the mutual fund as a result of a contractionary shock and,*

2. $\frac{\partial (1-\omega_0^M)\theta^B}{\partial \eta} \geq 0$*, the bank absorbs the outflows of the market asset.*

Where r_0^* is a function of model primitives and $\zeta = \frac{\gamma\sigma_\varepsilon^2\left(1-\left(\varphi\lambda(\lambda-1)\frac{\gamma^B\sigma_z^2}{\gamma\sigma_\varepsilon^2}\right)^{\frac{1}{2}}\right)+r^B-\frac{1}{2}\sigma_\varepsilon^2}{\varphi}$.

Proof. See Appendix B.8. □

Proposition (1) establishes that contractionary shocks will redistribute wealth managed from mutual

[27]The risk-balance equation (13) expresses the economy's equilibrium Sharpe ratio as a function of effective risk aversion. Importantly, while household beliefs feature extrapolation from current mutual fund returns, they do not directly impact the Sharpe ratio, as the household delegates investment decisions to sophisticated financial intermediaries who fully understand the economy's data-generating process. Instead, household beliefs influence equilibrium asset prices indirectly by shifting the allocation of wealth across intermediaries, which alters the aggregate risk tolerance $\gamma(\omega_0^M)$ and, in turn, affects equilibrium asset pricing conditions.

funds to the bank intermediary. This implies that contractionary shocks will cause equity flows where the mutual fund sells shares of the market asset to the bank, as we demonstrated empirically in Section 4.1. We provide Corollary 1 in Appendix B.8 to demonstrate that these results are driven by monetary shocks shifting risk premia. Our model provides an alternative explanation for how monetary policy affects risk premia through shifting household beliefs over future returns and the interaction of heterogeneous financial intermediaries within equity markets.

Next, we decompose the role of the household's sensitivity to prior returns for monetary transmission. We model household sensitivity to prior-returns (φ) as a micro-foundation for the flow-performance relationship observed for mutual funds in the data.

Proposition 2. *Consider a local monetary perturbation, η. For $r_0^* \in (0, \zeta)$,*

1. $\frac{\partial^2 p_0}{\partial \eta \partial \varphi} \leq 0$*, a more return-sensitive household amplifies price declines in the market asset due to monetary contraction and,*
2. $\frac{\partial^2 \omega_0^M}{\partial \eta \partial \varphi} \leq 0$*, equity flows from the mutual fund are amplified.*

Proof. See Appendix B.8. □

The model predicts that asset price declines caused by monetary policy will be amplified by a more return-sensitive household (higher φ). Furthermore, these price declines will result in a larger outflow of wealth from mutual funds to banks due to a monetary contraction. This result demonstrates that our analytically tractable model is capable of generating the price and equity flow dynamics we observed that were caused by mutual fund performance-flow sensitivity in the data.

Numerical Example of Monetary Dynamics

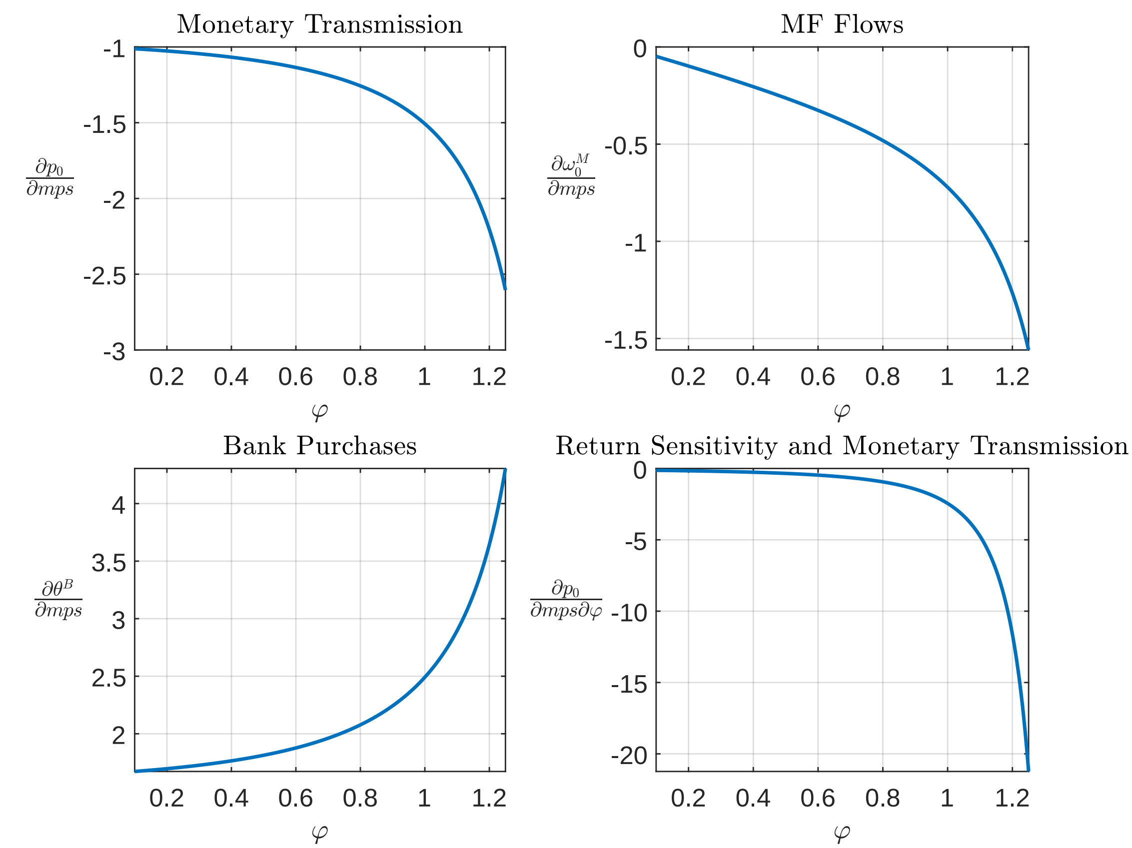
Figure 4 plots a numerical example of the dynamics of the model.[28] The calibration is meant to be illustrative to demonstrate the nonlinear, but potentially monotonic, dynamics that our model is capable of generating. To generate these dynamics, we solve the model for $r^f = r^{f,*}$ and perturb the equilibrium an infinitesimal monetary shock $\eta > 0$ at $t = 0$. We then study numerically how the equilibrium would change with different levels of investor performance-sensitivity, φ.

[28] We provide the set of illustrative calibration parameters in Table B.1.

The dynamics of Figure 4 demonstrate that, regardless of the household return-sensitivity parameter φ, monetary contractions cause asset prices to decline and equity flows from the mutual fund. During a contraction, the bank provides liquidity to equilibrate this redistribution in the market asset. The numerical example demonstrates that as φ increases, sensitivity amplifies asset price changes and equity flows.

Figure 4: Theoretical Monetary Dynamics

This figure plots the comparative statics of the model with respect to the household return-sensitivity parameter φ. The four panels show: (top-left) the derivative of the log asset price with respect to the monetary shock ($\partial p_0/\partial$mps); (top-right) the derivative of the household mutual fund wealth weight ($\partial \omega_0^M/\partial$mps); (bottom-left) the derivative of the bank's equity purchases ($\partial \theta^B/\partial$mps); and (bottom-right) the cross-partial of the asset price with respect to the monetary shock and φ ($\partial^2 p_0/\partial$mps$\partial\varphi$). The model is solved at the central bank's target rate $r^{f,*}$ and perturbed by an infinitesimal contractionary shock $\eta > 0$, which corresponds to mps above. Calibration parameters are reported in Table B.1. See Figure B.1 for the levels of prices and portfolio allocations.



This numerical example is illustrative that if households generate beliefs which lead to flow-performance sensitivity for mutual funds, monetary transmission to asset markets naturally has a large price elasticity ($\left|\frac{\partial p_0}{\partial mps}\right| > 1$, where mps is η within the model). This amplification of asset price declines due to monetary policy is a notable contribution of the model. The literature on monetary transmission often suggests that the empirical estimates of asset price elasticities to small monetary perturbations is puzzlingly large (Bernanke and Kuttner, 2005; Lu and Wu, 2023). Both the empirical evidence we have compiled in our empirics and the model developed in this section are capable of generating large price elasticities through equity redistribution between heterogeneous financial intermediaries.

7. Conclusion

This paper offers a new perspective on how monetary policy transmits to equity markets through the structure and behavior of financial intermediaries. At the core of our approach is the observation that households delegate portfolio decisions to intermediaries that differ systematically in how their funding responds to performance.

Empirically, we show that mutual funds – financed by performance-sensitive investors – experience significant outflows following contractionary monetary shocks, triggering equity sales. In contrast, banks – funded through longer-term, performance-insensitive liabilities – act as liquidity providers by absorbing these flows. These effects are driven by investor redemptions, not by within-fund rebalancing across asset classes. Importantly, we demonstrate that variation in flow-performance sensitivity across intermediaries meaningfully amplifies the impact of monetary shocks on asset prices.

We formalize these findings in an intermediary asset pricing model in which households allocate capital across intermediaries based on recent returns. The model highlights how investor behavior and intermediary heterogeneity jointly shape asset price dynamics. Although we focus on monetary policy, we argue that the underlying mechanism is broader. We believe our results should generalize to the amplification of other macroeconomic shocks and invite future work on how investor performance sensitivity interacts with intermediary structure to shape financial market outcomes.

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Online Appendix

Monetary Transmission in Equity Markets: Evidence from Financial Intermediaries

Matthew Famiglietti, Pranav Garg

A. Institutional Background

Traditional intermediary asset pricing models typically assume that financial institutions act as the primary claimants of risky assets, while households hold only fixed claims. In this framework, intermediaries employ high leverage to engage in proprietary trading, leaving little room for investor-driven portfolio shifts.

However, the rise of indexation and online trading over the past three decades has fundamentally shifted this landscape. Modern investors exert significant control over their portfolio allocations, often utilizing low-cost index funds that facilitate rapid liquidation and reallocation (Wurgler, 2011). To understand how monetary policy affects aggregate equity prices today, one must account for how these evolving business models alter the transmission of shocks through different types of intermediaries.

This appendix details the distinct business models of mutual funds and banks, which together hold over two-thirds of the U.S. equity market. We show that these institutions differ in their funding structures and hold equities for fundamentally different purposes, thereby providing the institutional foundation for our model of monetary transmission.

A.1 Mutual Funds and ETFs as Intermediaries

As per U.S. Securities and Exchange Commission's (SEC) guide for investors (SEC Pub. 182), 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.

Mutual funds are managed by SEC-registered advisers, with each share representing a proportionate claim on the underlying portfolio. A defining feature of this structure is that funds must issue and redeem shares at their daily net asset value (NAV). Consequently, the aggregate mutual fund balance sheet exhibits a high degree of maturity matching: liabilities consist of investor shares redeemable on demand, while assets are primarily liquid corporate equities and debt. We can see this in Table A.1. This liquidity structure implies that investor redemptions translate directly into immediate selling pressure on the underlying securities.

Table A.1: Balance sheet for mutual funds

This table reports the aggregate balance sheet of mutual funds in the United States as of 2019 Q4, constructed from Table L.122 of the Financial Accounts of the United States (Federal Reserve Board). Assets include corporate equities, debt securities, and other assets (security repurchase agreements, syndicated loans to nonfinancial corporate businesses, and unidentified miscellaneous assets). The sole liability category is investor shares. All values are in billions of dollars.

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

We investigate how monetary policy shocks drive the reallocation of equity holdings across the U.S. financial system. Our analysis focuses on how these shocks propagate through mutual funds – the largest equity-holding intermediaries. Our mechanism builds on two established empirical regularities. First, retail investor beliefs are typically extrapolative, meaning flows respond strongly to past returns [1].

Second, monetary policy significantly shifts stock market returns via an expectations channel [2]. Together, these facts suggest that monetary tightening can trigger a self-reinforcing cycle of price

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

[2] The seminal work on this topic is Bernanke and Kuttner (2005) which argues that monetary policy affects expectations of future dividends, but has been demonstrated times including recent work such as Ozdagli and Velikov (2020) and Miranda-Agrippino and Ricco, 2021.

declines and performance-induced outflows.

Table A.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 because of the open-ended and redeemable nature of their balance sheets.

A.2 Banks as Intermediaries

The most traditional class 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.[3] 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 A.2 presents the consolidated financial statements reported by chartered depository institutions in the U.S.. The majority of banking assets are loans and debt security investments. On the liability side, their aggregate business model differs significant from that of mutual funds in Table A.1 because they rely significantly on leverage through deposits.

[3] 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, and their importance to the functioning and pricing of financial markets is well understood by regulators and central banks (BIS, 2014).

However, this aggregate balance sheet 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.

Table A.2: Balance sheet for banks

This table reports the aggregate balance sheet of chartered depository institutions in the United States as of 2019 Q4, constructed from Table L.111 of the Financial Accounts of the United States (Federal Reserve Board). Assets include corporate equities, mutual fund shares, debt securities, loans, and other assets (cash, reserves, security repurchase agreements, life insurance reserves, receivables, and unidentified miscellaneous assets). Liabilities include deposits, uninsured deposits, and other liabilities (security repurchase agreements, payables, and miscellaneous liabilities). All values are in billions of dollars.

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

To highlight the importance of trading for banks, we present in Table A.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 for potential short-term profitability.

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

This table reports consolidated financial highlights from JPMorgan Chase & Co.'s Form 10-Q quarterly report pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934, as of 2019 Q4. The table aggregates across all business segments (Commercial, Corporate, and Investment Banking). All values are in billions of dollars.

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

B. Theoretical Appendix

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

B.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 6, 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

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

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

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

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

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 (B.2) implies a labor supply curve given by

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

Intermediate firms produce with technology

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

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

$$Q_t Y_t = \min_{y_t(j)\in[0,1]} \int_0^1 Q_t(j) Y_t(j) dj \tag{B.6}$$
$$\text{subject to} \quad Y_t = \left(\int_0^1 Y_t(j)^{\frac{\theta-1}{\theta}} \right)^{\frac{\theta}{\theta-1}}.$$

Standard optimization implies that intermediate firm demand is given by

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

We derive the standard aggregate price index to be

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

The labor market clearing condition is

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

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

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

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

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

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

B.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

$$\Pi(j) = \max_{Q(j),L(j)} Q(j)Y(j) - W_t L(j) - T_t \tag{B.12}$$
$$\text{subject to} \quad Y(j) = AL(j)^{1-\alpha} = \left(\frac{Q(j)}{Q}\right)^{-\theta} Y.$$

We can then derive the optimal flexible intermediate price as

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

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 (B.13) with labor supply (B.4) to generate an equilibrium labor equation of

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

This can be further combined with HTM consumption (B.11) to solve for potential equilibrium labor and output as curve (B.4) and substitute for hand-to-mouth consumption (B.2) to obtain the equilibrium labor curve implicitly as,

$$\chi(\underbrace{L^*}_{\text{Labor Supply}})^{\zeta}\underbrace{(1-\alpha)Y^*}_{\text{HTM Consumption}} = \frac{\theta-1}{\theta}(1-\alpha)A_t(\underbrace{L_t^*}_{\text{Labor Demand}})^{-\alpha}. \tag{B.15}$$

In equilibrium, output is given $Y_t^* = A_t(L_t^*)^{1-\alpha}$, therefore (B.15 simplifies to

$$\chi(L^*)^{\zeta} = \frac{\theta-1}{\theta}. \tag{B.16}$$

We refer to L^* as potential labor supply and Y^* as potential output. Going forward we refer to $\log Y_t^* = y_t^*$, and make the following assumption over y_1^*

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

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

B.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

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

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.

Because prices are perfectly rigid in our model, shocks will affect aggregate output. Firms will choose to meet demand, $Y_t = AL^{1-\alpha} = C_t^{HTM} + Ct^H$. Recall, as per (B.2), we can determine aggregate output as,

$$Y_t = \frac{C_t^H}{\alpha} \tag{B.19}$$

B.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 B.1, to be αY_t. We denote the measure of the market asset in this economy is given by S which we normalize to be in unitary supply.

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

$$R_0 = \frac{\alpha Y_0 + P_0}{P_-}, \quad \text{and} \tag{B.20}$$

$$R_1 = \frac{\alpha Y_1}{P_0}, \tag{B.21}$$

where P_t denotes the price of the asset portfolio in a given period[4].

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 subsequently.

B.3 Household Environment

There is a representative household which is endowed with some level of initial wealth A_-. The household consumes out wealth 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[5]. 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

[4]Therefore P_- is the price of the asset in the period prior to $t = 0$, which pins down the return in $t = 0$.

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

the future at rate $\exp(-\rho)$. Therefore the household maximizes utility according to

$$\max_{C_0, A_0, \omega_0^M} \log C_0 + \exp(-\rho) \log \left(\mathbb{E}\left[C_1^{1-\gamma} \right] \right)^{\frac{1}{1-\gamma}} \tag{B.22}$$

$$\text{subject to} \quad C_0 + A_0 = A_- \left(\omega_-^M \left(R_0^M - R^B \right) + R^B \right), \tag{B.23}$$

$$C_1 = A_0 \left(\omega_0^M \left(R_1^M - R^B \right) + R^B \right), \tag{B.24}$$

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

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 for simplicity. Also note that we impose a short-selling constraint to remove eliminate the improbable scenario that a household borrows money to invest into bank holdings.

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

$$C_0 = \frac{1}{1 + \exp(-\rho)} A_- \left(\omega_-^M \left(R_0^M - R^B \right) + R^B \right) \tag{B.25}$$

B.4 Financial Intermediary Environment

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 invest in the market asset and the risk-free bond on behalf of the household, and do so using a fixed portfolio weight, $\lambda > 1$, on the market asset. That $\lambda > 1$ ensures that the mutual fund likes the market asset relatively more than the bank, and is a stand-in for differences in risk-tolerance or regulation between intermediary types.

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

$$\max_{\theta^B}\left(\mathbb{E}\left[\left((1-\omega_0^M)A_0\left(\theta^B\left(R_1-R^F\right)+R^F\right)^{1-\gamma^B}\right)\right]\right), \tag{B.26}$$

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[6],

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

Following Campbell and Viceira (2002), we approximate the bank portfolio weight on the market asset as

$$\theta^B\approx\frac{1}{\gamma^B}\frac{\mathbb{E}_z[r_1]-r^f+\frac{1}{2}\sigma_z^2}{\sigma_z^2}. \tag{B.27}$$

B.5 Equilibrium Asset Pricing

As shown in Appendix B.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

$$\alpha Y_t=C_t+C_t^B. \tag{B.28}$$

To provide clarity on the main mechanisms and implications of the model, we make a number of clarifying assumptions and characterize an equilibrium. 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 (B.28) with

[6]Because the bank payouts per unit of wealth invested are linear in R^B, which is an exogenous return, including it in the wealth maximization condition would change the bank's level of utility, but not the portfolio weight derived below.

this condition implies the goods market equilibrium condition in $t = 0$ as

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

Next, we use this goods market equilibrium condition in $t = 0$ and combine it with the optimal consumption policy (B.25) and the asset market clearing condition (11), to derive the *output-asset pricing* equation (in log terms),

$$y_0 = p_0 + \rho - \log \alpha.$$

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

$$r_0 = \kappa + p_0 - p_-, \tag{B.29}$$

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

Because the market asset is a unitary measure and bonds are in net zero supply, the identity $A_0 = P_0$ holds. Using asset market clearing in $t = 0$, (11), and combining with the household portfolio optimization (10), and the bank portfolio weight (B.27) we derive an aggregate *risk-balance equation*, equation (13) in the main text:

$$\frac{y_0^* + \mu_z + \log \alpha - p_0 + \frac{1}{2}\sigma_z^2 - r^f}{\sigma_z} = \gamma(\omega_0^M)\sigma_z, \tag{B.30}$$

$$\text{where} \quad \gamma(\omega_0^M) = \gamma^B \frac{1 - \lambda\omega_0^M}{1 - \omega_0^M}. \tag{B.31}$$

The term $\gamma(\omega_0^M)$ is the effective risk-aversion in the economy which depends on the weight the household places on the banking intermediary relative to its wealth weight in the mutual fund. This risk-balance condition prices the market asset.

B.6 Approximation of Period 0 Mutual Fund Returns

We write log returns of the market asset in $t = 0$ 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 (B.25) 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 (B.29).

To allow for analytical tractability we take a second order Taylor approximation of the mutual fund return in $t = 0$, following Campbell and Viceira (2002). The mutual fund return is approximately log-normal as it is a convex combination of a log-normal variable (the market asset), and a constant (risk-free bond). We define $R_0^M = \lambda R_0 + (1-\lambda)R^f$. We perform the following approximation

$$\frac{R_0^M}{R^f} = 1 + \lambda\left(\frac{R_0}{R^f} - 1\right)$$
$$\log\left(\frac{R_0^M}{R^F}\right) := r_0^M - r^F$$
$$= \log(1 + \lambda\left(\exp(r_0 - r^f) - 1\right))$$

We then take a 2^{nd} order Taylor approximation of $r_0 - r^f \approx 0$ of the above expression. This yields

$$r_0^M - r^f \approx \lambda\left(r_0 - r^f\right) + \frac{1}{2}\lambda(1-\lambda)\sigma_z^2, \tag{B.32}$$

an approximation we will use throughout the analytical analysis of the model including in the derivation of the household wealth weights as the expectation of (B.32) is log-normal.

B.7 Derivation of Central Bank Target

In this subsection we derive the target rate the central bank attempts to set to ensure that $y_0 = y_0^*$. First, we characterize the risk-free rate the central bank would set to have output equal its potential.

We begin by noting that from (12), $p_0^* = y_0^* + \log\alpha - \rho$. We then can write the optimal period 0 return as

$$r_0^* = \kappa + y_0^* + \log\alpha - \rho - p_- \tag{B.33}$$
$$\text{where} \quad \kappa = \log(1+\exp(\rho)),$$

Therefore, the optimal mutual fund return in $t = 0$ is approximately

$$r_0^{M,*} \approx \lambda\left(\kappa + y_0^* + \log\alpha - \rho - p_- - r^{f,*}\right) + r^{f,*} + \frac{1}{2}\lambda(1-\lambda)\sigma_z^2 \tag{B.34}$$

We then use these identities for r_0^*, $r_0^{M,*}$ and the identity for p_0^* in the aggregate risk-balance equation (13) to derive

$$\mu_z + \rho + \frac{1}{2}\sigma_z^2 - r^{f,*} = \sigma_z^2 \underbrace{\frac{1-\lambda\omega_0^{M,*}}{1-\omega_0^{M,*}}}_{\Phi},$$

$$\text{where } \Phi = \frac{1-\lambda\omega_0^{M,*}}{1-\omega_0^{M,*}} = \frac{\gamma^B\left(1 - \frac{\lambda}{\gamma}\frac{\varphi\left[\lambda(\kappa+y_0^*-p_--r^{f,*})+r^{f,*}+\frac{1}{2}\lambda(1-\lambda)\sigma_z^2\right]-r^B+\frac{1}{2}\sigma_{\varepsilon}2}{\sigma_\varepsilon^2}\right)}{1-\ \frac{1}{\gamma}\frac{\varphi\left[\lambda(\kappa+y_0^*-p_--r^{f,*})+r^{f,*}+\frac{1}{2}\lambda(1-\lambda)\sigma_z^2\right]-r^B+\frac{1}{2}\sigma_{\varepsilon}2}{\sigma_\varepsilon^2}}$$

which finally implies that the optimal risk-free rate is defined by the fixed point,

$$r^{f,*} = \mu_z + \rho + \frac{1}{2}\sigma_z^2 - \Phi\sigma_z^2. \tag{B.35}$$

The term y_0^* appears in $\sigma_z^2\Phi$, potential output is given by (**??**). The central bank' objective is to set this rate to target $y_0 = y_0^*$. However, it does so with some error such that the policy rate is given,

$$r^f = r^{f,*} + \eta, \quad \eta \sim \mathrm{N}(0, \sigma_\eta^2) \tag{B.36}$$

B.8 Proofs

Proposition 1. *Consider a local monetary perturbation, η. For $r_0^* < \zeta$*

1. $\frac{\partial \omega_0^M}{\partial \eta} \leq 0$*, the household reduces its wealth weight on the mutual fund as a result of a contractionary shock and,*
2. $\frac{\partial (1-\omega_0^M)\theta^B}{\partial \eta} \geq 0$*, the bank absorbs the outflows of the market asset.*

Where $\zeta = \frac{\gamma\sigma_\varepsilon^2\left(1-\left(\varphi\lambda(\lambda-1)\frac{\gamma^B\sigma_z^2}{\gamma\sigma_\varepsilon^2}\right)^{\frac{1}{2}}\right)+r^B-\frac{1}{2}\sigma_\varepsilon^2}{\varphi}$.

Proof. We start with characterizing the comparative statics of the bank's portfolio weight on the market asset with respect to the monetary shock,

$$\frac{\partial \theta^B}{\partial \eta} = \frac{1}{\gamma^B \sigma_z^2}\left(-\frac{\partial p_0}{\partial \eta} - 1\right),$$

and the change in the household's wealth weight on the mutual fund when not facing the short-selling constraint,

$$\frac{\partial \omega_0^M}{\partial \eta} = \frac{1}{\gamma \sigma_\varepsilon^2}\left[\varphi\left(\lambda\left(\frac{\partial p_0}{\partial \eta} - 1\right) + 1\right)\right].$$

It is clear that a sufficient condition for $\frac{\partial \theta^B}{\partial \eta} > 0$ and $\frac{\partial \omega_0^M}{\partial \eta} < 0$ is $\frac{\partial p_0}{\partial \eta} < -1$. We now show that with $\lambda > 1$ this condition holds, proving Proposition 1 in the unconstrained case.

We rewrite the risk-balance condition (13) as

$$H : y_0^* + \mu_z + \log \alpha - p_0 + \frac{1}{2}\sigma_z^2 - r^{f*} - \eta - \sigma_z^2 \gamma^B \frac{1 - \lambda \omega_0^M}{1 - \omega_0^M} = 0, \tag{B.37}$$

and use the implicit function theorem to derive

$$\frac{\partial p_0}{\partial \eta} = -\frac{\partial H/\partial \eta}{\partial H/\partial p_0}$$

$$= \frac{\overbrace{1 + \sigma_z^2 \gamma^B \left(\frac{-\lambda \frac{\widetilde{\partial \omega_0^M}}{\partial \eta}(1-\omega_0^M) + \frac{\widetilde{\partial \omega_0^M}}{\partial \eta}(1-\lambda\omega_0^M)}{(1-\omega_0^M)^2} \right)}^{F}}{\underbrace{-1 - \sigma_z^2 \gamma^B \left(\frac{-\lambda \frac{\widetilde{\partial \omega_0^M}}{\partial p_0}(1-\omega_0^M) + \frac{\widetilde{\partial \omega_0^M}}{\partial p_0}(1-\lambda\omega_0^M)}{(1-\omega_0^M)^2} \right)}_{G}}, \tag{B.38}$$

where $\frac{\widetilde{\partial \omega_0^M}}{\partial \eta} = \frac{\varphi(1-\lambda)}{\gamma \sigma_{\varepsilon^2}}$ and $\frac{\widetilde{\partial \omega_0^M}}{\partial p_0} = \frac{\varphi \lambda}{\gamma \sigma_{\varepsilon^2}}$, are partial derivatives of ω_0^M ignoring the GE effects of price changes. For Proposition 1, we must show $\frac{p_0}{\partial \eta} < -1$. The numerator, F, is strictly positive. For the proposition to hold we must have $G < 0$. It is straightforward to verify if

$$r_0^* < \frac{\overbrace{\gamma \sigma_\varepsilon^2 \left(1 - \left(\varphi \lambda (\lambda - 1) \frac{\gamma^B \sigma_z^2}{\gamma \sigma_\varepsilon^2}\right)^{\frac{1}{2}}\right) + r^B - \frac{1}{2}\sigma_\varepsilon^2}^{\zeta}}{\varphi}$$

$$\text{where} \quad r_0^* = \lambda(\kappa + p_0^* - p_- - r^{f,*}) + r^{f,*} + \frac{1}{2}\lambda(1-\lambda)\sigma_z^2,$$

then $G < 0$. With $G < 0$, it suffices to show $F > -G$ This simplifies to the condition

$$1 - \lambda < \lambda,$$

which is always true with $\lambda > 1$. This verifies the claim of Proposition 1 when $\omega_0^M > 0$.

When $\omega_0^M = 0$ due to the short-selling constraint, the proposition holds weakly as $\frac{\partial \omega_0^M}{\partial \eta} = 0$ and $\frac{\partial p_0}{\partial \eta} = -1$.

□

Proposition 2. *Consider a local monetary perturbation, η. For $r_0^* \in (0, \zeta)$,*

1. $\frac{\partial^2 p_0}{\partial \eta \partial \varphi} \leq 0$*, a more return-sensitive household amplifies price declines in the market asset due*

to monetary contraction and,

2. $\frac{\partial^2 \omega_0^M}{\partial \eta \partial \varphi} \leq 0$.

Proof. We extend the proof method of Proposition 1. First, consider the constrained region where $\omega_0^M = 0$. In this case, it is straightforward to verify $\frac{\partial p_0}{\partial \eta \partial \varphi} = 0$.

When unconstrained,

$$\frac{\partial^2 \omega_0^M}{\partial \eta \partial \varphi} = \frac{1}{\gamma \sigma_\varepsilon^2} \left[\lambda \frac{\partial p_0}{\partial \eta} - 1 + \varphi \lambda \frac{\partial^2 p_0}{\partial \eta \partial \varphi} \right],$$

therefore conditions under which $\frac{\partial^2 p_0}{\partial \eta \partial \varphi} < 0$ completes the proof. Applying the implicit function theorem twice to (B.37) yields,

$$\frac{\partial^2 p_0}{\partial \eta \partial \varphi} = \frac{H_{\eta \phi} H_{p_0} - H_\eta H_{p_0 \phi}}{H_{p_0}^2}.$$

We use the result and condition in Proposition 1 and conclude this is equivalent to $\frac{\partial p_0}{\partial \eta} H_{p_0 \varphi} < -H_{\eta \varphi}$. The derivations for $H_{p_0 \varphi}$ and $H_{\eta \varphi}$ are as follows,

$$H_{p_0 \varphi} = (1 - \omega_0^M)^{-2} \lambda (\lambda - 1) \frac{\sigma_z^2 \gamma^B}{\sigma_\varepsilon^2 \gamma} \left(1 + \frac{2\varphi}{1 - \omega_0^M} \frac{\partial \omega_0^M}{\partial \varphi} \right),$$
$$H_{\eta \varphi} = -(1 - \omega_0^M)^{-2} (\lambda - 1)^2 \frac{\sigma_z^2 \gamma^B}{\sigma_\varepsilon^2 \gamma} \left(1 + \frac{2\varphi}{1 - \omega_0^M} \frac{\partial \omega_0^M}{\partial \varphi} \right),$$

then we show

$$\begin{aligned} & \frac{\partial p_0}{\partial \eta} H_{p_0 \varphi} < -H_{\eta \varphi} \\ \implies & \frac{\partial p_0}{\partial \eta} \left((1 - \omega_0^M)^{-2} \lambda (\lambda - 1) \frac{\sigma_z^2 \gamma^B}{\sigma_\varepsilon^2 \gamma} \left(1 + \frac{2\varphi}{1 - \omega_0^M} \frac{\partial \omega_0^M}{\partial \varphi} \right) \right) < \\ & (1 - \omega_0^M)^{-2} (\lambda - 1)^2 \frac{\sigma_z^2 \gamma^B}{\sigma_\varepsilon^2 \gamma} \left(1 + \frac{2\varphi}{1 - \omega_0^M} \frac{\partial \omega_0^M}{\partial \varphi} \right), \end{aligned}$$

which after dividing by $(1-\lambda)\frac{\sigma_z^2\gamma^B}{\sigma_\varepsilon^2\gamma}(1-\omega_0)^{-2}<0$, simplifies to

$$(1-\lambda)\left(1+\frac{2\varphi}{1-\omega_0^M}\frac{\partial\omega_0^M}{\partial\varphi}\right)<-\lambda\frac{\partial p_0}{\partial\eta}\left(1+\frac{2\varphi}{1-\omega_0^M}\frac{\partial\omega_0^M}{\partial\varphi}\right).$$

Now, under $r_0^*<\zeta$, it must be the case that $\omega_0^M<1$. Therefore, if $\frac{\partial\omega_0^M}{\partial\varphi}>0$, the proof is complete as $-\lambda\frac{\partial p_0}{\partial\eta}>0>1-\lambda$. We derive,

$$\frac{\partial\omega_0^M}{\partial\varphi}=\frac{r_0^*}{\gamma\sigma_\varepsilon^2},$$

which is positive as long as $r_0^*>0$. Thus, with $r_0^*\in(0,\zeta)$ the proof is complete. □

Discussion

Note that Propositions 1 and 2 were proven under local perturbations arguments around the optimal period 0 prices targeted by the central bank. The equilibrium asset price is a quadratic function, and we can derive similar conditions for global versions of Propositions 1 and 2 which are available upon request.

Corollary 1. *A monetary contraction increases the risk premium in the economy.*

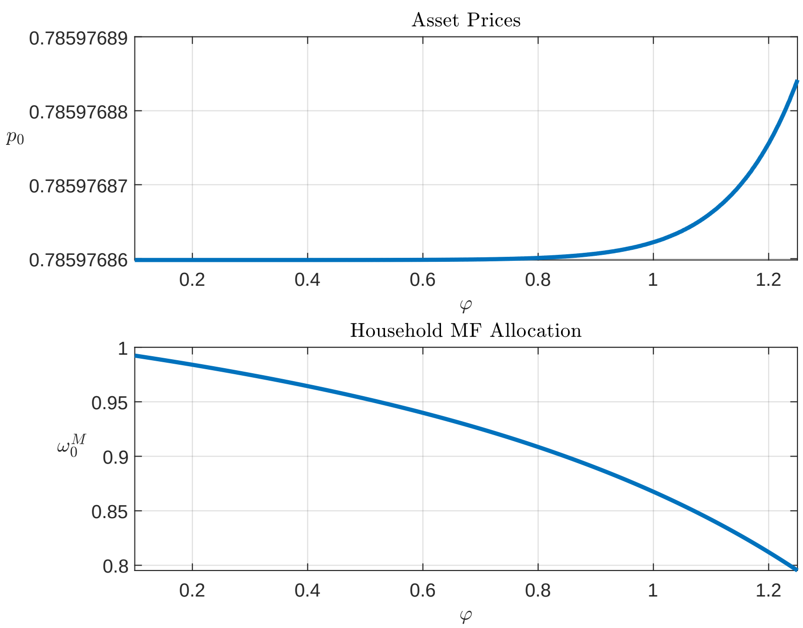
Proof. The aggregate risk balance equation (13) must hold in any equilibrium. As established in Proposition 1, a contractionary monetary shock causes ω_0^M to decline. Examining (13), if ω_0^M declines, then the right hand side of the risk balance condition must increase as $\lambda>1$. To equilibrate this shift in portfolio holdings, the LHS of (13), which is the risk-premium of the economy scaled by the volatility of output[7], increases. □

Table B.1: Numerical Example Calibration Values

Parameter	**Value**
y_0^*	2
α	0.3
μ_z	0.2
σ_z^2	0.22
σ_ε^2	1.11
r^b	0.05
γ	2.25
γ^B	2.75
κ	0.698
λ	1.2

B.9 Numerical Example Details

Figure B.1: Model Values in Levels



[7] This is the Sharpe ratio of the market asset.

C. Empirical Appendix

C.1 List of Fund Managers

Table C.1: List of the 10 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

C.2 Summary Statistics

Table C.2 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 main text. Equity flows capture the proportion of a fund manager's equity portfolio that gets sold or bought quarter-on-quarter.[8] For a sense of magnitude, 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 in Table C.2 that mutual funds and investment advisors captured around two-thirds of the market in the two decades 1990-2010, and around four-fifths of the market since 2010. Investment banks represent 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 institutional equity market.

We find that 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.

[8] 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 effects and hence represents pure quantity changes.

Table C.2: Summary statistics by financial intermediary class

Period	Number of Institutions	% of market held	AUM ($ million)		Equity flows ($\|\Delta Q\|$)		Fund manager return		Performance-sensitivity ($\tilde{\varphi}$)	
			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

C.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 C.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

C.4 MPS Measure

We report statistics on two measures of quarterly monetary policy surprises (MPS) in Table C.4. These surprises are interpreted to be in units of basis points and are aggregated from Bauer and Swanson (2023). As reported in the main text, our baseline measure is “MPS Weighted” which weights each MPS event in a quarter by the length of time from the beginning of the quarter to the event. This causes events occurring towards the end of quarter to have the most weight. We also compare all results against “MPS”, which is an unweighted aggregation of all high frequency monetary events in a quarter.

We report summary statistics for our MPS measures in Table C.4. 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. This standard deviation is used as the size of monetary shock with which we calculate our results throughout the text.

Table C.4: 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.

C.5 Flow performance sensitivity for other classes

Table C.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 clustered by fund manager are in parentheses.
*p<0.1; **p<0.05; ***p<0.01

C.6 Flow performance sensitivity by raw returns

Table C.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 clustered by fund manager are in parentheses. *p<0.1; **p<0.05; ***p<0.01

C.7 Equity flows and investor sensitivity for unweighted MPS

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

	Dependent variable: $\Delta Q_{m,t}$	
	Aggregate economy	Aggregate economy
	(1)	(2)
MPS × $\tilde{\varphi}$ × MF & IA	-0.418***	-0.365***
	(0.120)	(0.113)
MPS × MF & IA	-0.189**	2.308
	(0.093)	(1.614)
MPS × $\tilde{\varphi}$ × Banks	0.028	0.016
	(0.058)	(0.060)
MPS × Banks	0.365	2.921*
	(0.290)	(1.633)
MPS × $\tilde{\varphi}$ × PF & LI	-0.211	-0.207
	(0.207)	(0.200)
MPS × PF & LI	-0.075	2.508
	(0.209)	(1.623)
Manager FE	Y	Y
Time FE	N	Y
Observations	134,636	134,636
Adjusted R^2	0.182	0.231
$\mathbb{E}$(Y)	0.7%	0.7%

Note:

Explanatory variables are scaled to one standard deviation. Heteroskedasticity-robust standard errors clustered by fund manager-by-year 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

C.8 Equity flows in response to equity market shocks

Table C.8: Aggregate transmission of monetary policy shocks to equity markets

	Dependent variable: R_t			
	(1)	(2)	(3)	(4)
	All stocks index	S& P 500 index	Funds sample	Funds with $\tilde{\varphi}$
MPS_t	-0.212**	-0.199**	-0.180*	-0.178*
	(0.101)	(0.096)	(0.105)	(0.105)
MPS_{t-1}	0.011	0.002	0.031	0.030
	(0.099)	(0.094)	(0.102)	(0.103)
MPS_{t-2}	-0.002	-0.015	0.037	0.039
	(0.100)	(0.095)	(0.103)	(0.103)
MPS_{t-3}	-0.046	-0.050	-0.003	-0.002
	(0.098)	(0.094)	(0.102)	(0.102)
MPS_{t-4}	-0.151	-0.146	-0.125	-0.125
	(0.101)	(0.096)	(0.104)	(0.105)
Observations	124	124	124	124
Adjusted R^2	0.006	0.006	-0.007	-0.008

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

Table C.9: Flow elasticity to price shocks

	Dependent variable: $\Delta\omega_{m,t}$			
	(1)	(2)	(3)	(4)
	All stocks index	S& P 500 index	Funds sample	Funds with $\tilde{\varphi}$
$\widehat{R}\times$ MF & IA	0.223***	0.227***	0.196***	0.194***
	(0.061)	(0.062)	(0.058)	(0.058)
$\widehat{R}\times$ Banks	-0.351	-0.353	-0.340	-0.334
	(0.238)	(0.242)	(0.226)	(0.224)
$\widehat{R}\times$ PF & LI	-0.172	-0.159	-0.217*	-0.218*
	(0.142)	(0.146)	(0.131)	(0.131)
Manager FE	Y	Y	Y	Y
Observations	267,574	267,574	267,574	267,574
Adjusted R^2	0.162	0.162	0.161	0.161

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

Heteroskedasticity-robust standard errors clustered by fund manager and year are in parentheses.

Table C.10: Flow elasticity to price shocks

	Dependent variable: $\Delta\omega_{m,t}$			
	(1)	(2)	(3)	(4)
	All stocks index	S& P 500 index	Funds sample	Funds with $\tilde{\varphi}$
$\widehat{R}\times\ \tilde{\varphi}\times$ MF & IA	0.257***	0.255***	0.234***	0.234***
	(0.074)	(0.075)	(0.071)	(0.071)
$\widehat{R}\times$ MF & IA	0.157**	0.163**	0.127*	0.125*
	(0.072)	(0.074)	(0.068)	(0.068)
$\widehat{R}\times\ \tilde{\varphi}\times$ Banks	0.032	0.032	0.028	0.029
	(0.052)	(0.051)	(0.060)	(0.059)
$\widehat{R}\times$ Banks	-0.637	-0.644	-0.600	-0.589
	(0.401)	(0.407)	(0.380)	(0.378)
$\widehat{R}\times\ \tilde{\varphi}\times$ PF & LI	0.021	0.030	-0.008	-0.007
	(0.113)	(0.114)	(0.110)	(0.110)
$\widehat{R}\times$ PF & LI	0.052	0.070	-0.028	-0.032
	(0.137)	(0.139)	(0.144)	(0.145)
Manager FE	Y	Y	Y	Y
Observations	128,418	128,418	128,418	128,418
Adjusted R^2	0.186	0.186	0.185	0.185

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

Heteroskedasticity-robust standard errors clustered by fund manager and year are in parentheses.

C.9 Portfolio rebalancing versus net worth shock for unweighted MPS

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

	(1)	(2)	(3)	(4)
	Δ Equity Share (%)	Δ Bond Share (%)	Δ Other Share (%)	Δ TNA (%)
MPS	1.843	6.974	2.401	-1.665***
	(11.287)	(7.662)	(9.677)	(0.390)
Manager FE	Y	Y	Y	Y
Observations	23,853	23,853	23,853	30,044
Adjusted R^2	-0.006	-0.005	-0.007	0.048

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

Heteroskedasticity-robust standard errors clustered by fund manager and year are in parentheses.

Table C.12: Portfolio rebalancing and outflows for mutual funds

	(1)	(2)	(3)	(4)
	Δ Equity Share (%)	Δ Bond Share (%)	Δ Other Share (%)	Δ TNA (%)
MPS × $\tilde{\varphi}$	6.591	-3.835	-6.141	-0.661*
	(9.115)	(6.831)	(10.179)	(0.356)
MPS	10.884	0.026	-9.956	-1.326***
	(9.354)	(5.104)	(8.354)	(0.449)
Manager FE	Y	Y	Y	Y
Observations	9,164	9,164	9,164	11,505
Adjusted R^2	-0.009	-0.019	-0.007	0.014

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

Heteroskedasticity-robust standard errors clustered by fund manager and year are in parentheses.

C.10 Portfolio rebalancing versus net worth shock at the fund level

Table C.13: 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 × Expense Ratio				-0.152	0.803	0.530***
				(1.459)	(1.482)	(0.063)
MPS	1.156	-1.527	-1.188***	1.509	-1.713*	-1.031***
	(1.030)	(1.037)	(0.050)	(0.975)	(0.979)	(0.058)
Fund FE	Y	Y	Y	Y	Y	Y
Observations	1,351,581	1,351,581	1,591,364	1,120,852	1,120,852	1,331,181
Adjusted R^2	-0.023	-0.023	0.048	-0.021	-0.021	0.045

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

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

C.11 Portfolio rebalancing versus net worth shock at the fund level for unweighted MPS

Table C.14: 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 × Expense Ratio				-1.514	2.176	0.347***
				(1.512)	(1.533)	(0.064)
MPS	-0.749	0.360	-1.773***	-0.808	0.569	-1.627***
	(1.126)	(1.132)	(0.057)	(1.114)	(1.116)	(0.064)
Fund FE	Y	Y	Y	Y	Y	Y
Observations	1,351,581	1,351,581	1,591,364	1,120,852	1,120,852	1,331,181
Adjusted R^2	-0.023	-0.023	0.054	-0.021	-0.021	0.051

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

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

C.12 Local projection for unweighted MPS

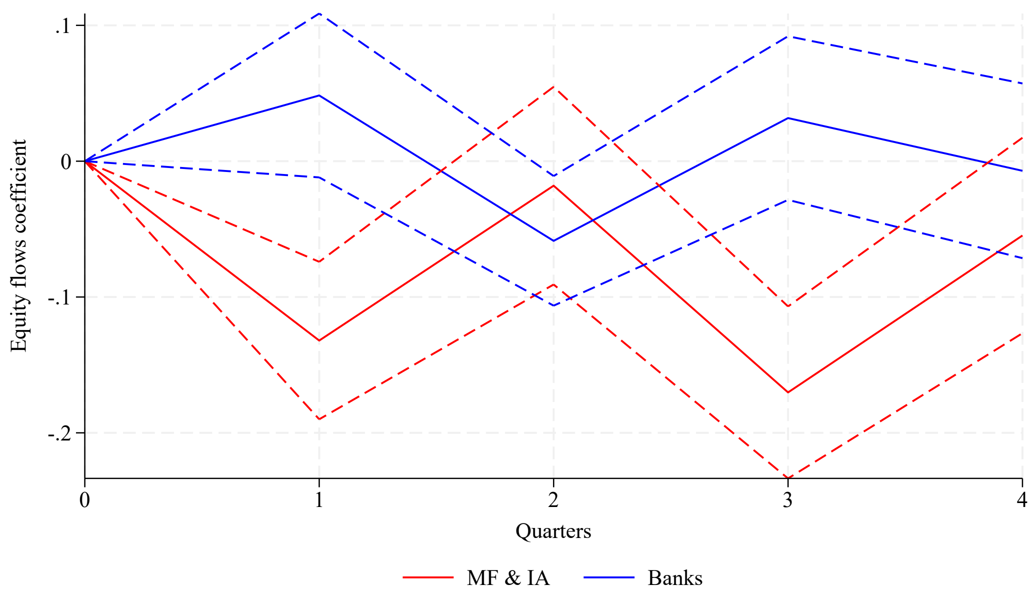


Figure C.1: Local projection of equity flows

Note: This figure plots coefficients from (4) that capture the four-quarter equity flows induced by a contractionary monetary policy surprise for mutual funds and banks.

C.13 Price response to unweighted MPS

Table C.15: Price elasticity to monetary policy shocks

	(1)	(2)
	Return_{t+1}	Return_{t+1}
MPS $\times\ \tilde{\varphi}$	-0.163***	-0.157***
	(0.038)	(0.038)
Stock FE	Y	Y
Time FE	N	Y
Observations	650,422	650,422
Adjusted R^2	0.025	0.169

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

Heteroskedasticity-robust standard errors clustered by stock CUSIP and year are in parentheses.

Table C.16: Price elasticity to monetary policy shocks (with FF6)

	(1)	(2)
	Return$_{t+1}$	Return$_{t+1}$
MPS $\times\ \tilde{\varphi}$	-0.165***	-0.182***
	(0.043)	(0.044)
MPS $\times \beta^{\text{MKT}}$	0.025	-0.088*
	(0.053)	(0.051)
MPS $\times \beta^{\text{SMB}}$	-0.005	-0.236***
	(0.057)	(0.054)
MPS $\times \beta^{\text{HML}}$	0.049	0.056
	(0.064)	(0.061)
MPS $\times \beta^{\text{RWM}}$	0.245***	0.285***
	(0.050)	(0.047)
MPS $\times \beta^{\text{CMA}}$	0.175***	0.122**
	(0.064)	(0.062)
MPS $\times \beta^{\text{MOM}}$	0.198***	0.164***
	(0.053)	(0.051)
Stock FE	Y	Y
Time FE	N	Y
Observations	475,799	475,799
Adjusted R^2	0.020	0.177

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

Heteroskedasticity-robust standard errors clustered by stock CUSIP and year are in parentheses.