The Execution Gap of Trading Mutual Funds

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ABSTRACT

We investigate the intraday price pressure patterns of mutual fund flows. Consistent with the demand to track Net Asset Values (NAV) priced at market close, daily fund flows are associated with abnormal returns in the net portfolio of stocks from equity funds at the US stock market's closing auction. However, 97% of the flow driven abnormal daily stock returns occur during prior market hours, with 74% occurring before the final half hour of market operations. These pre-execution stock and NAV returns partially revert over the next several trading days and impose significant execution costs in trading mutual fund shares. We calculate an implicit annual cost of roughly half a basis point on the $13.7 trillion domestic equity mutual fund portfolio for investors, adding up to $0.8 billion dollars per annum.

JEL Classification: G10, G12, G14, G23

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I. Introduction

Open-ended mutual funds have been the primary delegated asset management vehicle of choice for long-term investors. Investors purchase and redeem shares of mutual funds at their Net Asset Values (NAV) at the closing of US market operations, and fund managers allocate and liquidate stocks to meet such orders. The once-a-day trading mechanism for fund shares stands in direct contrast to the dynamic equity market, where trade orders are executed continuously and microseconds of execution priority could evolve into substantial informational advantages (Foucault, Hombert, and Rosu, 2016; Hu, Pan, and Wang, 2017; and Chordia, Green, and Kottimukkalur, 2018).

The net trading of mutual fund shares is economically substantial- a large finance literature finds robust price impact from such trades on the underlying assets at low frequencies (Coval and Stafford, 2007; Lou, 2012; Koijen and Yogo, 2019) and in aggregate (Edelen and Warner, 2001; Ben-Rephael, Kandel, and Wohl, 2011). However, such prior analyses do not distinguish the timing of this price impact- whether it occurs before, at, or after the closing of the equity market. In our analysis of this intraday timing, we will show that the dynamic evolution of stocks prices to flows substantially affects the NAV prices paid by mutual fund investors.

In stocks, bonds, and options, large net dollar volume of trade orders is known to generate implicit costs due to their execution dynamics (Glosten and Milgrom 1985; Kyle, 1985; Chan and Lakonishok, 1995; Mayhew, 2002; Bessembinder, Maxwell, and Venkataraman, 2006; Frazzini, Israel, and Moskowitz, 2018). Prices tend to move away from large institutional orders, as soon as market participants realize such orders' existence.[1] These pre-execution returns on order-flows add to the prices paid by the investors.

[1] Asset prices tend to increase (decrease) when other market participants realize the existence of large institutional buys (sell) orders, which makes these orders even more costly.

Yet, in mutual funds, whose execution delays can be substantial- up to 24 hours from the time a trade order for fund shares is entered- such dynamic costs have not been estimated or as far as we know, even analyzed. In this paper, we offer the first examination of the implicit costs of trading fund shares within the intraday frequency- beyond fees (Tufano and Sevick, 1997), expenses (Carhart, 1997; Barber, Odean, and Zheng, 2005; Gil-Bazo and Ruiz-Verdú, 2009), and liquidity management (Edelen, 1999; Aragon, 2007).

To conduct this analysis, we match daily fund flows (the net daily purchase and redemption of investor dollars) for a large set of individual domestic US equity funds to intraday stock returns. Consistent with prior literature that uses monthly and quarterly mutual fund holdings (Coval and Stafford, 2007; Lou, 2012; Koijen and Yogo, 2019; Wardlaw, 2020), daily net fund flows, aggregated to individual stocks, are positively related to the stocks' daily returns. The novelty of our results is that we show that such price increase (reduction) occurs prior to the actual arrival of the investors inflow (outflow) to equity funds; adding a costly implicit component to the prices paid by mutual fund investors. We outline and explore several explanations for this pre-execution return on the underlying stocks.

In our intraday analysis, 97% of price adjustments to net daily fund flows occur before the actual execution of the trade for mutual fund shares at the end of day equity auction prices; with over 74% of price adjustments occurring even before the final half hour of stock market operations. This return pattern partially reverses over the next several trading days, consistent with ex-post non-fundamental price pressure. To address potential reverse causality, we use 1) flows to retirement share classes, which largely follow payroll and redemption schedules set in advance and are unlikely to respond to same-day returns, and 2) vector autoregressions that allow flows and returns to affect each other over time. We estimate that the delay costs 0.26 to 0.6 basis points of equity fund assets per

year, or $0.36 to $0.8 billion on the $13.7 trillion of domestic equity assets in 2025 (Investment Company Institute, 2026).[2]

In the cross-section of individual mutual funds, we decompose flows to individual mutual funds into a systematic component, which captures the impact of net flows across all visible mutual funds, and a residual idiosyncratic component. Although net flows to individual mutual funds have limited association with their daily returns, the net systematic flow component is positively associated with contemporaneous daily returns and predicts negative daily returns over the next several trading days. Therefore, mutual funds that hold more (less) of the stocks most exposed to aggregate flow pressure have NAVs that increase (decrease) before their share-trade executions, and decrease (increase) in the subsequent trading days. Within the intraday horizon, we show that 68% of this flow-to-return relationship occurs in the replicating portfolio between 9:30 a.m. and 3:30 p.m.

Trading mutual fund shares is costly because such trades are structured to execute only at the closing auction prices; whereas the underlying stock returns adjust throughout the market hours. Beyond our estimate of these implicit costs, our analysis of daily fund flows extends the institutional demand asset pricing literature from its analysis of the monthly and quarterly price patterns to the intraday interval domain.

By legal mandate, the purchase and sale of mutual funds are executed at the Net Asset Values (NAV) of their asset portfolio at a prespecified time.[3] For domestic US equity funds, such NAVs are marked to the forward trading day closing prices of the stocks that constitute equity portfolios, and the orders of fund shares are accordingly executed at the same closing time. For instance, while an investor may submit to redeem his Vanguard 500 Fund shares through his brokerage account at 5:00

[2] See Investment Company Institute (2026) for the estimate of total us domestic equity mutual fund size.

PM EST, the execution of this order will only occur and be marked to the closing market prices at 4:00 PM EST on the following trade day. This gap between the order and the execution of trades for mutual fund shares represents a substantial delay in the financial markets, where even a microsecond of trading priority could generate significant informational advantage and profit (Foucault, Hombert, and Roşu, 2016; Hu, Pan, and Wang, 2017; and Chordia, Green, and Kottimukkalur, 2018).

How such a widespread delay matters to stock prices and to investors' trading costs has been an uninvestigated, but potentially first order, phenomenon in asset management research. As investors face a choice between mutual funds and alternative managed structures, and as speed becomes more relevant to asset prices, our analysis of this trading gap is important for the mechanism design of the modern financial market.

Consistent with demand from mutual fund companies to track their portfolio Net Asset Values (NAV) priced at the closing auction, we find that daily fund flows are associated with abnormal intraday returns specifically at the market close. One percentage point of proportionally aggregated daily flows to purchase a stock is associated with 0.131% ($t = 6.033$) of daily stock returns. However, 97% of the flow driven abnormal daily stock returns occur outside of the market closing auction, with 74% occurring even before the final half hour of the market operation. The returns associated with this net price pressure revert over the next several trading days, consistent with non-fundamental demand.

These underlying return patterns impose significant costs for investing in mutual fund shares. We calculate an annual implicit expense of one bps from using mutual funds as investment vehicle due to net investor flows. Furthermore, we also provide alternative estimates using 401k dollars, where the required purchases can be precisely foreseen by the investor, the pension sponsor, and the funds themselves. We estimate that such an implicit cost due to the execution gap adds up to $0.8 billion in 2025.

Our analysis contributes to several strands of finance literature. Foremost, we estimate the cost of the structural execution delays in the orders for mutual fund shares. As far as we know, there has not been any prior analysis of this kind for mutual funds, despite this delay being such a substantial market structure faced by investors. This implicit cost of trading in open-ended mutual fund shares, which does not exist for other delegated asset management structures such as ETFs, close-ended mutual funds, and investment trusts, adds to the debate on the desired and allowable asset classes in pensions and long-term savings accounts (Helmke, 2023), as well as to the debate on swing trading proposals (Jin, Kacperczyk, Kahraman, and Suntheim, 2022; Ma, Xiao, and Zeng, 2025). Additionally, prior debate on marking to closing time NAV revolved around the legal violations of the Rule 22c-1 on backdating mutual fund orders for preferred clients (Zitzewitz, 2006), which potentially warned off innovations in mutual fund design. Despite the fact that Rule 22c-1 can allow for more frequent pricing times, few equity funds have adopted pricing outside of the typical 4:00pm NAV calculation.[4] Our results suggest that more frequency price by allowing for multiple mark-to-market NAV executions during a trade day could help lower investors' execution costs and help mutual funds compete with vehicles that trade continuously.

Second, we document how stock prices respond to fund flows within the day, beyond the monthly and quarterly horizons studied in prior work (Coval and Stafford, 2007; Lou, 2012; Koijen and Yogo, 2019; Wardlaw, 2020). The price pressure literature on institutional demand for assets has examined these coarse horizons because of limitations in the mutual fund data used for academic research. These datasets report Total Net Assets (TNA) only at monthly frequencies, which made it impossible to study the actual execution of fund orders. The horizon matters because price pressure

[4] Outside of a couple exceptions in equity funds, only prime money market funds adopted multiple intraday NAV strikes and redemption windows (Casavecchia, Ge, Li, and Tiwari, 2026).

fades quickly: Hendershott and Menkveld (2014) estimate a half-life of 0.92 days, so less than a tenth of the initial pressure survives three trading days, and almost none is visible in month-end data. Daily data allow us to examine pricing dynamics at substantially higher frequencies. We find that a large fraction of the price pressures associated with equity fund flows occur prior to the actual execution of these trades. This result indicates that either, 1) the information content of fund flows was likely anticipated the financial markets prior to their executions by mutual funds or that 2) the investors flow executed at the market close were affected by the underlying stocks' intraday pricing patterns, or more likely- the confounding consequences of both channels. In addition to other tests, we use retirement share classes that are less likely to be affected by the second channel to provide strong evidence of the anticipatory price impact.

Lastly, we add to the microstructure literature about the end of day closing auctions in the equity market. Prior papers have shown that index tracking (Bogousslavsky and Muravyev, 2023), price pressure imbalances (Jegadeesh, Narasimhan, and Yanbin Wu, 2022), and investor coordination in equilibrium (Admati and Pfleiderer, 1988) have all contributed to the dynamics of the modern closing day equity auctions. Due to their end-of-day NAV tracking structure, equity funds are particularly incentivized to place orders at market close. Such incentives are likely to face tradeoffs with the implicit execution costs that we document in the current paper: funds seeking to minimize such execution costs can trade stocks prior to the actual end of the trading day in exchange for more tracking errors. Overall, we add to this literature by directly relating a new source of demand, daily investor flows to equity funds, to stock returns at and before the closing auction.

The paper is organized as follows. Section II describes EPFR daily flow data and how we aggregate fund flows to the stock level. Section III shows the timing of the stock price impact from investor, addresses reverse causality using retirement share classes and vector autoregressions, and estimates the cost of the execution delay. Section IV turns to individual funds. It shows that fund

NAVs rise with systematic flows on the day investors trade and reverse over the following days, and that portfolios replicating fund holdings move mostly before the equity market closing. Section V concludes.

II. Data

Our primary data, the EPFR Global Fund Flows and Asset Allocation Intelligence, come from ISI Global Market Intelligence. This data service collects Total Net Assets (TNA), Net Asset Values (NAV), and daily returns directly from global mutual funds. Such histories are as reported, with no backfilling, interpolation, or revisions in its data entries.

This EPFR flow dataset has been used at coarser frequencies and levels of aggregation to study institutional investor behavior (Jotikasthira, Lundblad, and Ramadorai, 2012). Other papers use daily fund-level flows to study dilution and stale pricing (Greene and Hodges, 2002; Rakowski, 2010). We use the EPFR daily share-class files to link these flows to intraday stock returns.

EPFR computes daily fund flows using the identity that relates total net assets and daily returns to fund flows. For fund *i* on day *t*, EPFR observes Total Net Assets (TNA) at the close of days $t-1$ and t and the day-t net-of-fee NAV return (R):

$$Net\ Dollar\ Flow_{i,t} = TNA_{i,t} - TNA_{i,t-1} \times (1+R_{i,t})$$

Therefore, the *Net Dollar Flow* is the change in total net assets not explained by portfolio performance. Since there isn't any other period during which fund flow orders are executed besides at the end of day NAV values, we expect the *Net Dollar Flow* reported by EPFR to have little to no distortions from the actual net investor flows experienced by a mutual fund (Li and Zheng, 2025 reports that the distortion to monthly flow measures mainly arises from assumptions on the timing of daily flows within the month).

The EPFR data on fund flows are matched by share class tickers to the Center for Research in Security Prices (CRSP) dataset on Mutual Fund returns and holdings over our sample period. Specifically, we use the contemporaneous ticker that appears in both datasets for the matching. We limit our data sample to domestic US equity funds as indicated by both the EPFR and the CRSP mutual fund style codes. Our resultant sample runs from 2011 through 2024 with 5,055 funds, 17,104 share classes, and an average of $2.8 trillion in daily total net assets across the U.S. domestic equity fund universe. Additionally, CRSP stock files and Trades and Quotes (TAQ) databases are used to calculate security prices, and their daily, overnight, daytime, and intraday returns. We filter the cross-section of stocks to the standard common domestic stocks (security type "EQTY", subtype "COM", share type "NS", trading status "A", conditional type "RW", and US flag "Y").

A. Flow Induced Price Pressure

The primary variable of interest is *Daily Flow Order Executions* (*DFOE*), which aggregates mutual fund share orders to the stock level for each trading day *t*. It is calculated by assuming proportional trading of flow dollars to prior holdings by mutual funds. This variable is constructed similarly to the main stock level trading variables in Lou (2012)[5], as well as alternative channels of trading demand in Chen (2024), and Chen (2025) for aggregating quarterly trading demand from mutual funds. The numeraire is the total prior holdings of stocks in mutual funds in the past quarter.

Specifically, *Daily Flow Order Executions* is defined as:

$$DFOE_{s,t} = \frac{\sum_i Weight_{i,s,\tau} \times Net\ Dollar\ Flow_{i,t}}{\sum_i Price_{s,\tau} \times Shares_{i,s,\tau}}.$$

[5] The major difference is that our construction does not scale inflows and outflows differently. Using variable scaling to out and inflows gives no significant difference to our results.

$Shares_{i,s,\tau}$ and $Weight_{i,s,\tau}$ for stock s are the number of shares held and the portfolio weight from fund i from the last quarter end time (τ). $Price_{s,\tau}$ in the denominator use the same quarter end price. The numerator of *Daily Flow Order Executions* can be understood as the sum of trades in stock s held by the observed equity funds i on day t assuming that each fund is investing its dollars of investor flows by the same proportion as its previously reported holding. This numerator is scaled by the total dollar amount of the specific stock held by all observable equity funds.

One way to interpret *Daily Flow Order Executions* is that it captures the totality of investor flow driven trading for the observed equity funds for stock s each day if they had invested the net dollar flows into this stock in the same proportion as their quarter-end reported holdings. For investor redemptions, proportional selling is a natural benchmark, because a fund that sells pro rata keeps its portfolio weights unchanged. For investor inflows, while active funds have discretion in their allocation set, they are typically constrained by mandates and manager preference toward a limited set of stocks; as an alternative, one may use a smaller proportionality scaling of 0.8 for inflow allocations in Lou (2012). This would give similar quantitative results.

The denominator in *Daily Flow Order Execution* is the total value of individual stocks held by the observed equity funds. Using this scaling provides for a natural interpretation of the measure with respect to the totality of equity fund holdings. As an example, a *Daily Flow Order Executions* of -1% specifies that the daily investor flows, under the proportionality assumption, decrease the observed equity fund holdings of a stock by 1%.

B. Stock Returns and Intraday Returns through TAQ

The data for the panel of stocks come from Center for Research in Security Prices (CRSP). We limit the cross-section of stocks to standard common stocks (security type "EQTY", subtype "COM", share type "NS", trading status "A", conditional type "RW", and US flag "Y" in the modern

CRSP database). From CRSP we get open, close, and corporate-action adjusted close-to-close returns. Following Hendershott, Livdan, and Rösch (2020) and Lou, Polk, and Skouras (2019), we split close-to-close returns into daytime and overnight returns. Daytime return (r_{it}^{D}) is defined as the proportional change of the closing price of stock from its daily opening price. And we calculate overnight returns (r_{it}^{N}) as the residual of the total daily return adjusting for the daytime return, i.e.:

$$r_{it}^{D} = \frac{P_{it}}{O_{it}} - 1, \qquad r_{it}^{N} = \frac{1 + R_{it}}{1 + r_{it}^{D}} - 1.$$

with P_{it} the closing price, O_{it} the opening price, and R_{it} the corporate-action adjusted close-to-close return of stock i on day t.

The intraday returns come from the Trade and Quotes database, accessed via WRDS. We obtain half-hour returns by using the last valid trade price within each 30-minute block. All trades during the regular trading session, in general, from 9:30 a.m. to 4:00 p.m., with a positive price and a "tr_corr" flag equal to '00' are considered valid. We also construct closing auction returns, as the CRSP closing price divided by the last available trade price before 4pm minus one. The CRSP closing price is generally determined by the closing auction, but can also be the last trade price before 4pm (Bogousslavsky and Muravyev, 2023). In the latter case, we calculate the closing auction returns as zero, importantly the last 30-minute return within each day does not overlap with the closing auction return. Because such intraday returns are based on the last traded prices of each half hour block, which can be extremely noisy, we winsorize the intraday and closing auction panels of stock returns at the 1% and 99% levels by time to remove microstructure noise.

C. Summary Statistics

Table 1 Panel A reports the summary statistics on the daily fund flows data. The sample begins in 2011 and ends in 2024. The dataset contains 17,104 unique share classes contained by 5,055 unique

equity funds. They are observed at daily frequency. After restricting our analysis to larger funds (funds with more than $20 million TNA across all share classes) and fund shares (share classes with more than $10 million). The resultant data is composed of roughly 13 million daily observations at the share class level, and 4.9 million daily observations at the fund level. The median observed fund size is $378 million dollars of total net assets, with individual share classes being composed at $111 million. Mutual funds have received average outflows during our sample period, with a median daily average of -$0.03 million at the fund level. The performance of these funds averages 0.043% to 0.044% daily over the sample period.

Table 1 Panel B summarizes our cross-section of daily stocks. Our primary variable of interest, *Daily Flow Order Executions*, aggregates mutual fund level flows by assuming proportional investment into the underlying equity holdings. Consistent with the average outflow from equity funds during our sample period, we observe a median outflow impact of -0.015% per stock daily. We winsorize *Daily Flow Order Executions* and *Daily Flow Order Executions Retirement* at the 1% level on both tails each day, and 0.5% level unconditionally so that our analysis is not driven by extreme observations.

We decompose the CRSP panel of daily stock returns into an overnight and a daytime return. We observe that stocks have an average daily return of 4.7 basis points. Consistent with previous findings, e.g., in (Cliff, Cooper, and Gulen (2008) and (Hendershott, Livdan, and Rösch (2020), that average comes entirely overnight during this sample period, with daytime returns coming at -3 basis points on average. However, the daytime returns drive most of the variation in daily returns: their variance is roughly 70% of the total variance of daily returns.

Table 1 Panel C reports the summary statistics for our intraday returns. We decompose daytime returns into 30-minute intervals in addition to the closing-auction time returns. The first 30 minutes of return is the price appreciation of the stock from its CRSP opening price. The second 30

minutes of returns consist of price appreciation between 10:00am and 10:30am, etc. The 3:30pm to 4:00pm return consists of price appreciation of a stock outside of its final equity market closing auction price change. The closing auction return is a stock's closing price divided by its last traded price outside of the equity market closing auction minus one. We use these intraday panels for our main intraday pricing analysis.

III. The Cross-Section of Stocks

A. Day and Night-Time Returns

We begin our analysis by regressing daily stock returns and their daytime and overnight components against the aggregated net stock demand from equity mutual funds. Our primary variable of interest, *DFOE - Daily Flow Order Execution*, aggregates the change in the share of a stock held by all equity funds at the daily level by assuming proportional investment. A 1% *DFOE* can be interpreted as a 1% increase in the total equity fund shares of the stock in question. Table 2 regresses daily stock returns, as well as its nighttime and daytime components on *DFOE*. We observe that, consistent with the prior price pressure fund demand literature at lower frequencies, *DFOE* correlates significantly with contemporaneous stock returns.

In column 1 and 2, we observe that 1% *DFOE* is related to a 0.131% (*t = 6.03*) increase in a stock's daily return. However, those returns come almost entirely through their effect on the daytime component of daily stock returns. Most of the association between the *DFOE* and returns occurs through the open-to-close period's changes in the stock price. In columns 3 through 4, we see that a 1% *DFOE* reflects a cross-sectional increase of 0.123% (*t = 6.74*) return in the underlying stocks- a magnitude that represents roughly 94% of the total association in stock prices. Lastly, in columns 5

and 6, we observe that the 1% *DFOE* is associated with a negligible 0.0088% (*t = 0.88*) overnight returns.[6]

The overnight and daytime decomposition shows that fund flows primarily relate to the cross-sectional pricing of stocks during the trading hours of a market exchange, rather than the close to open auction mechanism from the previous day. That is, stocks that are likely purchased (sold) by equity funds due to deposits (redemptions) tend to be met with appreciation (depreciation) of their respective prices through the trading day hours. Since the price that investors incur for such trading of mutual funds only reflects the closing-day NAV value of the representative basket of stocks owned by their fund, the significant daytime return correlation to *DFOE* means that either the price appreciation occur only at the closing-time auction, or more likely throughout the trading day.

The next subsection investigates how much of the price change occurs throughout the trading day prior to the NAV close-end auction by the mutual funds.

B. Intraday Return Analysis

Table 3 decomposes the daytime returns of the cross-section of stocks into separate 30-minute intraday blocks in addition to a closing auction return; and regresses these returns on *DFOE*.

This table is organized with the regressions of the earliest half hour intraday block as the left-hand side variable in column (1), and the increases the timing by 30 minutes for each left-hand side variable in each subsequent column. The last 3:30pm to 4:00pm trading block and the end of day auction returns are tabulated in columns (13) and (14) respectively.

In the regression of the closing auction returns in column (14), we find that net investor flows to mutual funds are associated with increased stock demand during the end of day auction. 1% increase in *DFOE* coincides with a 0.0041% (*t = 1.86*) increase in the stock returns through the auction.

[6] Note that since returns are not additive, the coefficients in 3 and 5, and 4 and 6 do not add up to columns 1 and 2.

Nonetheless, in addition to the end-of-day auction demand, we also find that *DFOE* is also consistently associated with price reactions in the other intraday trading blocks.

In column (13), we observe that stock returns occurring between 3:30pm to 4:00pm outside of the closing auction itself most significantly relate to *DFOE*. 1% increase in *DFOE* indicates a 0.0329% (t = 7.00) increase at this 30-minute block. This period is particularly noteworthy as any order imbalances for individual stocks at the end of day auction are revealed to market participants by the NYSE and Nasdaq exchange operators. It is possible stock returns occurred to compensate for the increased imbalance due to the net demand from equity funds. However, we also find *DFOE* is also associated with intraday returns at other 30-minute blocks throughout the trading hours.

In columns (1) through (12) we observe consistently positive coefficients for *DFOE* in the regressions of cross-sectional stocks returns during the other intraday 30-minute blocks. Out of these 12 regressions, we observe significant coefficients at 5 of the half hour blocks. Despite of the fact that mutual fund share orders are being matched and executed at end of the day using end-of-day stock prices, prices in these underlying assets consistently and steadily adjust throughout the trading day.

Figure 1 plots the cumulative returns over the entire trading day using the same type of regression coefficients. We observe that the underlying stocks consistently increase their prices in relationship to daily flow orders of mutual fund shares. By 4:00pm, the underlying assets have become 0.14% more (less) expensive as a response to a 1% mutual fund induced purchases (sells).

To summarize the total implied costs of executing the net mutual fund orders, Table 4 regresses the total stock returns that occur outside of the final trading period blocks on *DFOE*. Column 1 regresses stock returns from overnight up to 4:00pm until the last traded price before the closing auction. Column 2 regresses stock returns from overnight up to 3:30pm to allow for when closing-auction imbalances are revealed to market participants. Column 3 regresses stock returns from 9:30 a.m. to 4:00 p.m., outside of the closing auction. Column 4 regresses stock returns from 9:30 a.m.

to 3:30 p.m.. In comparison, column 5 regresses the total stock return, mirroring column 1 of Table 2, to compare the magnitude of explanatory variation coefficients. We see that stock returns up to 4:00 p.m. (3:30 p.m.) captures 97% (74%) of total average run up in total daily stock returns that are associated with the impact of net mutual fund order flows.

We use these regression results as the framework for a back of the envelop calculation of implied costs. If the average mutual fund investor were able to trade at 9:30 a.m. instead of at the closing auction, he would have had the 9:30 a.m. to 4:00 p.m return as additional value for each share of the mutual fund he had bought or sold. This benchmark holds the price path fixed; if funds dealt at the open, price pressure would likely move with them. We therefore interpret the estimate as timing slippage relative to the open. This *Slippage Return* is the implied trading cost for each net change in the stock position. The total net implied cost for each stock held by equity funds is therefore:

$$\textit{Implied Cost} = \textit{Slippage Return} \times \textit{Net Trade by Equity Funds}.$$

Using the coefficient from column (3) of Table 4, this investor missed out on $0.136 \times DFOE$ in stock returns from the 9:30 a.m. to 4:00 p.m. price movement. *DFOE* can be interpreted as the net change in the stock held by the aggregate equity fund. Substituting $0.136 \times DFOE$ for *Slippage Return* and *DFOE* for the *Net Trade by Equity Funds*, our implied daily cost for each stock is

$$\textit{Implied Cost} = 0.136 \times DFOE^2$$

The average $DFOE^2$ for the daily stock return panel is 0.0000017. Therefore, the daily implied cost for the stocks held by equity funds is roughly 0.136×0.0000017.

Multiply by 252 trading days in a year, and the average equity funds experiences an implied cost of 0.006% of its total value held on an annual basis.

As another way to put it, mutual fund investors that contribute to the net turnover of equity fund shares would have had an additional 0.006% of the total equity portfolio in value each year if they had executed their trade at 9:30 a.m. instead of at the market closure. This estimate is

economically significant: equity mutual fund portfolios had a total TNA of $13.7 trillion in 2025, indicating an implied cost of $0.8 billion per annum in uncaptured stock returns. The calculation excludes the closing auction return, which is small (Table 3, column 14), and assumes that the flows in our sample are representative of the industry.

Additionally, this implied cost is borne mainly by the investors who contribute to the net turnover by equity funds; for these investors, the annual lost revenue is significantly higher than 0.006% of their net traded values. As this implied cost is hidden from the typical end-of-day NAV accounting that dominates the mutual fund industry, it has received little attention in the finance literature.

Our results are so far consistent with three explanations. First, it is possible that the leakage of net order flow to market participants (either directly or through pre-trading by asset managers) allows stock prices to adjust dynamically to mutual fund orders throughout the intraday period. Second, it is possible that, by reverse causality, the intra-day returns of the underlying stocks may drive investor orders to equity funds; that is mutual fund orders are the result of investors chasing returns. Lastly, it is possible that both fund flow and stock prices adjust to permanent information about the cross-section of stocks; and that the adjustments to prices are not directly related to the net order flows for mutual fund shares.

In the subsequent analysis, we find support for the first explanation. Using flows from retirement share class mutual fund shares, as well as other estimates of equity fund order flow timing, we still find a substantial intraday price effect, suggesting that return chasing does not explain the full effect. We also show, by vector autoregression at the stock level and Fama and MacBeth (1973) regressions at the fund level that the price impact of daily order flows partially reverts; that is, they are unlikely to be permanent information about the cross section of the prices, and more likely to be regarding the demand of the net equity order flow itself.

C. Retirement Share Classes and Intraday Prices

Retirement plans for 401(k) and 403(b) participants have very predictable and persistent investment schedules. Investors in these plans contribute portions of their salary to a delegated asset manager, most commonly a mutual fund, on a predetermined basis; additionally, when they withdraw, they must file a distribution schedule to their employer or their plan sponsor. While these plans have the benefit of employee matching and tax deductions, they are also very rigid in their institutional requirements for payroll and allocation. Depending on their employer, a retirement plan investor must request changes in their allocation schedule or file a withdrawal schedule several business days ahead of their actual contribution and distribution respectively. This rigidity makes the daily investor deposits and redemptions ideally very predictable to the delegated equity managers that receive these funds; and the daily flows themselves are unlikely to be affected by the contemporaneous intraday movement of stock prices.

The specific equity funds receiving these contributions from retirement plans can be identified by the share class designations. For instance, many fund families offer R-class shares that are sold only through employer-sponsored retirement plans.

We identify all the share classes that have "Y", "K" "R", "I", and "Inst" designations as those used by retirement plans. On average, these share classes represent 24% of the total net asset values in equity funds in our data. The average observed retirement dollar in our sample between 2011 to 2024 is roughly $0.7 trillion. As we do not have all U.S. equity funds in the sample nor do we capture other retirement funds that do not self-identify with the prior designations, this is below the yearly value of $1.4 to $2.9 trillion dollars in 401(k) equity funds across the same period (with an average of $1.9 trillion) reported by the Investment Company Institute (2026).

The average daily flow to these funds is -$130 million. This is in part because of competition arising from Collective Investment Trusts (CITs) and alternative delegated management vehicles (See Bollen, Pool, Stefanescu, and Vasilenko, 2026). While significant outflows from these funds are to twin managed CITs and would be irrelevant for the intraday stock pricing dynamics, we do not filter or reprocess these outflows in the current analysis. We consider it as simply attenuation noise in our data.

We construct the *Daily Flow Order Execution* using only dollar flows to retirement share classes (*DFOE Retirement*). Table 5 again regresses the separate period blocks of intraday returns on *DFOE Retirement*. Again, we find a similar pattern of retirement induced flow price impact. For 1% increase in stock purchased by these retirement funds in net, we observe a 2.5 basis point increase in their values through the prior closing to 4:00pm returns outside of the closing auction.

Figure 2 plots the cumulative returns over the entire trading day using the same regression model as Table 5 for retirement share classes. With the reduced concerns for reverse causality, we still observe that the underlying stocks consistently increase their prices in relationship to daily flow orders of mutual fund shares.

The magnitude of the *DFOE Retirement* coefficient in column 5 is significantly lower than that of *DFOE*. For 1% of net flow induced purchases on a stock to retirement funds, we observe 0.0284% of total price impact, instead of 0.144% by all the equity funds in our sample in Table 4. Out of these 0.026% occurs between overnight and 4:00pm, consisting of 92% of the total price impact.

We interpret the diminished magnitude of the coefficient as the consequences of 1) attenuation- from capturing a significantly smaller cross-section of the equity fund market- and 2) the fact that we reduced the possibility of reverse causality in intraday returns affecting the daily fund flows. High or low intraday returns in the target stocks of retirement equity funds are unlikely to

change the election of mutual funds by retirement investors due to payroll friction. Therefore, we obtain a cleaner estimate of the proportional impact of flows.

Using the estimates from Table 5, we construct an alternative measure of implied costs. We have *Annual Implied Cost* = 252 × *DFOE Coefficient* × (*DFOE Retirement*)^2. We use 0.0260 from column (1) as the *DFOE* coefficient since it is the smallest of the total price impact between overnight to 16:00 and the alternatives in columns (2), (3), and (4). The average (*DFOE Retirement*)^2 is 0.000004. Therefore, we have an average annual implied cost of 0.0026%. This value is economically important over the retirement portfolio of $2.9 trillion in 2024, adding to $76 million of trading costs in retirement dollars alone. If we use this implied cost estimate over the whole US domestic equity portfolio value of $13.7 trillion, we obtain an implied cost of $0.36 billion per annum.

D. Alternative Estimate of Implied Cost

Lastly, we use estimates of mutual fund order timing available in academic literature. Using a sample of mobile phone investors, Kalda, Loos, Previtero, and Hackethal (2021) find that roughly 60% of the mutual fund orders occur outside of market trading hours (Figure A1 in their paper). These orders could, in principle, execute at the open. If 60% of net flow dollars avoided the delay, the cost would be about 60% of $0.8 billion, or $0.5 billion. Because the 60% figure counts orders rather than dollars, we treat this estimate as illustrative.

E. Vector Auto Regression Reversals

We examine the joint dynamics of fund flows and stock returns using vector autoregressions (VARs) and impulse response functions (IRFs). VARs and IRFs are commonly used to examine the joint dynamics of potential endogenous variables (Roll, Schwartz, and Subrahmanyam, 2007; Rösch, 2021).

Each variable depends on its own lagged values and those of the other variable, allowing for feedback between flows and returns. The associated impulse response functions (IRFs) trace the response to an innovation as it propagates through the system. We estimate three bivariate panel VARs that pair the same daily flow measure, DFOE, with close-to-close, daytime, and overnight returns, respectively. Each specification includes five trading-day lags of both variables, and stock and date fixed effects.

We identify shocks recursively, ordering flows before returns. This ordering allows flow shocks to affect returns contemporaneously but restricts the response of flows to return shocks to subsequent periods. Delayed investor responses provide some motivation for this restriction. Edelen and Warner (2001) find that aggregate equity fund flows follow market returns with a one-day lag. Moreover, mutual fund orders receive the next applicable NAV: orders submitted after the cutoff for a given day's NAV are generally executed at the following trading day's NAV. Responses to closing returns therefore enter subsequently executed flows. These considerations motivate the ordering.

Table 6 reports the coefficients on lagged flows in the return equations (columns 1, 3, and 5) and flow equations (columns 2, 4, and 6). In the close-to-close return equation, the first-lag coefficient is positive, at 0.0327, and statistically significant at the 10% level. The coefficients at lags three through five are negative, suggesting that the initial positive association is subsequently offset. The sum of all five lagged flow coefficients explaining returns is −0.013750, which can be interpreted as the long-run impact of a change in flows on returns (Chaboud, Chiquoine, Hjalmarsson, and Vega, 2014, p. 2063). The associated Chi-square test statistic is 1.0121 indicating that long-run effects of flows on returns are statistically not significantly different from 0.

The positive first-lag association is concentrated in daytime returns. The corresponding coefficient is 0.0303 (t = 1.833), compared with −0.00520 (t = -0.581) for overnight returns. However, flows predict negative overnight returns at the fifth lag, with a coefficient of −0.0246 (t = -2.806).

Thus, the estimates suggest a positive association with next-day intraday returns and a delayed negative association with overnight returns. Flows themselves are persistent: all five own-lag coefficients are positive and highly statistically significant in each specification. This persistence reinforces the importance of examining responses that incorporate the dynamics of the entire system.

Figure 3 presents the cumulative return responses to a one-standard-deviation flow innovation over 20 trading days. Panel A shows an initial close-to-close response of approximately 1.9 basis points. The cumulative response peaks at approximately 2.3–2.4 basis points within the first few days and then declines to approximately 1.5 basis points by day 20. The point estimates therefore indicate partial reversal over the reported horizon. The cumulative response remains positive, with the displayed confidence band above zero.

Panels B and C locate the initial positive response primarily within trading hours. The cumulative daytime response begins at approximately 1.7 basis points, peaks near 2.1 basis points, and settles at approximately 1.8 basis points by day 20. The contemporaneous overnight response is small and statistically indistinguishable from zero. Its cumulative point estimate subsequently becomes negative, reaching approximately −0.4 basis points by day 20, although the confidence band includes zero throughout. These patterns are consistent with daytime price pressure followed by partial reversal. A flow shock has no contemporaneous effect on overnight returns, consistent with the timing assumed in the ordering. Because many fund orders arrive after the previous close (Kalda et al., 2021), the absence of an overnight response also suggests that prices move when funds or other traders act on these orders during trading hours. The ordering rules out same-day return chasing by assumption; the retirement-class results in Section III.C address that channel more directly.

We next examine whether these price effects reach the NAVs that fund investors pay.

IV. The Cross-section of Mutual Funds

A. Systematic Daily Mutual Fund Flows

After analyzing the approximate net stock demand in the prior section, we return to the panel of mutual funds returns to show that this source of return predictability also affects fund NAVs- the prices charged to investors. To confirm this, we conduct return-to-flow analysis directly on the daily panel of equity funds. Our two main variables of interest are the daily total percentage net flows to individual mutual funds (*Percentage Flow*), and systematic flow component to the net equity fund (*Systematic Flow Impact*). The idea here is that investment flows to individual mutual funds will not necessarily lead to a higher impacted price (a mutual fund receiving inflows could be holding stocks that are primarily held by other funds that are facing redemptions). However, the net investment flow demand of stocks across all equity funds will capture the price impact across individual equity funds on average.

Percentage Flow$_{i,t}$ is the *Net Dollar Flow*$_{i,t}$ to a fund *i* on date *t* divided by its *Total Net Assets* at the end of the prior trading date. *Systematic Flow Impact*$_{i,t}$ measures the degree to which a mutual fund portfolio gets affected by the net demand originating from our sample of all equity funds. It re-aggregates *DFOE* for each stock back up to a fund's portfolio composition. Specifically:

$$\textit{Systematic Flow Impact}_{i,t} = \sum_s Weight_{i,s,\tau} \times DFOE_{s,t}.$$

Here $Weight_{i,s,\tau}$ is the weight of each stock, *s*, for fund *i*, at the last available holdings date τ. A fund's daily returns will depend on the aggregate net demand of stocks by all equity mutual funds; not on its idiosyncratic patterns.

We begin our fund level analysis by explaining *Percentage Flows* with *Systematic Flow Impact*$_i$. Table 7 regresses the *Percentage Flow* against *Systematic Flow Impact* in the panel of daily mutual fund observations. We observe that individual flow to mutual funds loads significantly on the *Systematic Flow Impact* component, with a coefficient of roughly 1.55 (t = 53.4) in univariate regressions. Without any fixed effects, *Systematic Flow Impact* explains about 5% of the variation in the total individual fund flows

(column 1). The magnitude of the average flow loading to *Systematic Flow Impact* increases to 2.2 (*t = 72.3*) and 2.2 (*t = 69.2*) when we include date, as well as both date and fund fixed effects in columns (2) and (3).

These results show that *Systematic Flow Impact* explains a sizable variation of net mutual fund flows- the higher R^2 in columns (2) and (3) also reflect the fixed effects. However, 95% of the total variation in *Percentage Flows* is not related to their systematic component. As such, we expect *Percentage Flows* to have subdued effect on the net equity funds' daily NAVs due to its idiosyncratic variations; while *Systematic Flow Impact* will likely be more meaningful on average because it aggregates the flow impact on stocks across all observable equity funds.

B. Intraday Mutual Fund Returns

We thus take our decomposition of fund flows to fund returns. Table 8 performs regressions of daily mutual fund returns on *Systematic Flow Impact* and *Percentage Flow*. Consistent with prior literature on monthly flows (e.g. Coval and Stafford, 2007), column (1) shows that contemporaneous idiosyncratic flows to mutual funds is related to the fund return on the same day. However, all of the power is subsumed by the systematic effect from net mutual fund flow captured by *Systematic Flow Impact*. Column (2) shows that *Systematic Flow Impact* correlates significantly with daily returns for mutual funds; while column (3) shows that *Percentage Flow* loses all its predictable effect when the regressions control for the systematic impact. It appears that daily mutual fund investors, through their collective effect on prices- captured by *Systematic Flow Impact*- receive a higher (lower) NAV on the day of their net fund investment (redemption); consistent with aggregate price pressure and demand for assets.

The next question is whether this contemporaneous realized return persists or reverses over time. If the documented abnormal returns reverse, then the previous contemporaneous correlation

between returns and flows may be interpreted as the consequences of excess demand for mutual fund shares that drives asset prices (in this case, the NAV) to deviate from a persistent long-term fundamental value. Investors pay a high (low) price for shares of mutual funds when they buy (sell) on average in a day- relative to what they could have paid on the morning of their order (for the same stock portfolio) or on the subsequent days for those same fund shares.

We find evidence toward this excess demand channel. In Table 9, we predict mutual fund returns over the next several trading days using Fama-Macbeth (1973) style regressions of *Systematic Flow Impact*. Columns (1) through (6) regress fund level net returns (aggregated across share classes) on *Systematic Flow Impact* from the current to the past 5 days. We find that the coefficient of 0.344 (*t = 3.05)* contemporaneous returns in column (1) reverts insignificantly in the subsequent 3 trading days, with coefficients of -0.063, -0.067, and -0.010 individually. On the fourth trading day, the coefficient is -0.252 (t = -2.20). Together, lags 1 through 4 sum to -0.392, against 0.344 on impact. That is, mutual fund NAVs rise on the day of investor orders and fall back over the next four trading days.

We find that *Systematic Flow Impact*, while still relating significantly to contemporaneous returns, predicts negative returns over the next several trading days at the fund levels. Consistent with implied costs, mutual fund investors, in net, receive higher (lower) NAV prices for mutual funds when they invest (redeem) on average. In the subsequent days, the assets that experienced a run up (down) in prices due to these flows experience a depreciation (appreciation) in values. In other words, the net inflow (outflow) investors face higher (lower) prices for mutual fund shares on the day they trade.

C. Daily Fund Returns and Reversals

Equity mutual fund shares are priced at the Net Asset Values of their portfolios calculated at the day's closing auction. This price, at which investors redeem and purchase shares, only reveals itself after these orders were executed at 4pm (typically between 6pm and 7pm, after the market close). As

such, their shares price is not available throughout the trading day. Therefore, it is not possible to observe directly the intraday returns of mutual fund shares. To overcome this issue, we create approximate intraday share prices by using the last available holdings of the mutual fund portfolio from the end of the previous quarter. These prices naturally are our proxies of the mutual funds' respective intraday returns.

The intraday *Shadow NAV* value for a share of a mutual fund is the value-weighted price of its latest available holdings normalized by its 4pm price.[7] We reconstruct the returns of its shares throughout the intraday trading periods used in the prior analysis. The columns of Table 10 regress the returns of these shadow NAV portfolio as explained by *Percentage Flow* and *Systematic Flow Impact*.

We find again that *Systematic Flow Impact* is associated with intraday returns between the 9:30 a.m. to 3:30 p.m. period as well as the approximate end of day auction returns. The coefficient that describes the 9:30 a.m. to 3:30 p.m. in column 4 is 68% of the coefficient that describes the total return correlation in column (5); whereas the 9:30 a.m. to 4:00 p.m. returns contain essentially the entirety (93%) of the total stock return. Consistent with high implicit costs, *Systematic Flow Impact* occurs primarily during the intraday hours rather than purely at the market closing.

V. Conclusion

We link daily investor flows to equity funds with intraday stock returns. These data let us analyze stock price dynamics as responses to the execution of the net redemption and purchases orders for mutual fund shares in high frequency. We aggregate these flows to the stock level and find that, although these excess demands coincide with small returns at the closing auction, most of the price response occurs before it. Of the flow-related daily return, 95% occurs before the closing auction.

[7] Specifically, the 4pm value of a fund's portfolio is normalized at 1 dollar (with adjustments to the underlying portfolio weights to compensate for return drift). The 3:30pm value is this 1 dollar discounted by the 3:30pm to 4:00pm return of the shadow portfolio. The 3:00pm value is 1 dollar discounted by the 3:00pm to 4:00pm return, etc.

These stock price changes do affect the cross-section of Net Asset Value prices faced by mutual fund investors. When investors trade mutual funds, in net, they receive a lower (higher) NAV price at the execution of their redemption (deposit) on average. Yet, these price decreases (increases) revert over the next several trading days, acting as costs that are borne mainly by the investors who trade. We estimate the implicit cost from the delays in the execution of mutual fund orders at 0.25 to 0.6 basis points of equity fund assets per year, or $0.35 to $0.8 billion in 2025.

ETFs, managed investment accounts, and other structures that trade continuously and largely avoid these implicit costs will increase competitive pressure on existing mutual funds. As it is, we expect further declines in mutual fund allocations as the preferred structure for long-term delegated investment management. We propose a nuanced debate on the necessary reforms for the future of mutual funds in the asset management industry.

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Table 1 – Summary Statistics

	10th P.	Median	90th P.	Mean	Std.	N
Years	2013	2018	2023	2018	3.859	13,005,036
Daily Share Class Size ($ mils)	17.11	110.85	1,202.75	519.54	1,557.25	13,005,036
Daily Share Class Flow ($ mils)	-0.52	-0.01	0.27	-0.08	8.379	13,005,036
Daily Share Class Return (%)	-1.271	0.075	1.300	0.043	1.239	13,005,036
Daily Fund Size ($ mils)	44.05	377.87	3,363.22	1,392.06	3,421.62	4,862,273
Daily Fund Flow ($ mils)	-1.37	-0.03	0.71	-0.21	11.39	4,862,273
Daily Fund Return (%)	-1.261	0.074	1.293	0.044	1.237	4,886,071

Panel A. Daily Mutual Fund Characteristics at the Share Class and Fund Levels.

	10th P.	Median	90th P.	Mean	Std.	N
Daily Flow Order Executions (%)	-0.113	-0.015	0.074	-0.018	0.126	12,490,529
DFOE Retirement (%)	-0.130	-0.005	0.124	-0.004	0.192	11,232,505
Daily Return (%)	-3.072	0.000	3.030	0.047	3.842	12,490,529
Overnight Return (%)	-1.207	0.000	1.332	0.084	2.329	12,490,529
Daytime Return (%)	-2.949	0.000	2.746	-0.031	3.238	12,490,529

Panel B. Daily Stock Returns

	10th P.	Median	90th P.	Mean	Std.	N
Half Hour Intraday Returns (%)	-0.825	0.000	0.806	-0.003	0.880	147,906,361
Opening Half Hour Return (%)	-1.639	0.000	1.590	-0.015	1.591	11,682,931
Closing Half Hour Return (%)	-0.821	0.000	0.785	-0.010	0.857	11,688,936
Closing Auction Return (%)	-0.170	0.000	0.178	-0.002	0.397	11,679,693

Panel C. Intraday Stock Returns

This table summarizes the main statistics for the panel of daily fund flows to mutual funds (Panel A), the panel of daily stock returns (Panel B), and the intraday 30-minute stock returns (Panel C). We restrict the sample of mutual fund share classes to those with at least $10 million initial AUM, and the sample of mutual funds to those with at least $20 million across all their share classes. The half-hour intraday and closing auction returns are winsorized at the 1% and 99% per time block. The sample is from January 2011 to December 2024.

Table 2 –Regression of Total, Daytime, and Overnight Returns on Flow Induced Trading

	(1)	(2)	(3)	(4)	(5)	(6)
	Total Return		Daytime Return		Overnight Return	
DFOE	0.131***	0.133***	0.123***	0.128***	0.00883	0.00587
	(6.033)	(6.280)	(6.741)	(7.229)	(0.878)	(0.608)
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Stock Fixed Effects	No	Yes	No	Yes	No	Yes
N	12,490,529	12,490,528	12,490,529	12,490,528	12,490,529	12,490,528
Adj. R^2	0.117	0.117	0.099	0.101	0.094	0.097

This table regresses total daily return, the open to close return, and overnight return on *Daily Flow Order Executions* (*DFOE*) for the stock by date panel. *DFOE* is calculated as the net trade in a stock by equity funds assuming proportional investment in their pre-existing holdings. The t-statistics are clustered by date.

Table 3 – Regression of Intraday Returns on Flow Induced Trading

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Intraday Returns													
	9:30 to 10:00	10:00 to 10:30	10:30 to 11:00	11:00 to 11:30	11:30 to 12:00	12:00 to 12:30	12:30 to 13:00	13:00 to 13:30	13:30 to 14:00	14:00 to 14:30	14:30 to 15:00	15:00 to 15:30	15:30 to 16:00	Closing Auction
DFOE	0.0216**	0.00500	0.0239***	0.0141***	0.0118***	0.00279	0.00501	0.00461	0.00393	0.00706**	0.000514	0.00377	0.0329***	0.00414*
	(2.256)	(0.782)	(4.509)	(2.948)	(3.028)	(0.692)	(1.391)	(1.386)	(1.202)	(2.029)	(0.140)	(1.185)	(6.996)	(1.859)
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	11,210,361	10,884,042	10,914,752	10,925,043	10,892,736	10,874,957	10,889,759	10,889,534	10,872,776	10,889,345	10,893,781	10,969,254	11,212,232	11,203,192
Adj. R^2	0.078	0.100	0.105	0.104	0.097	0.098	0.098	0.092	0.101	0.118	0.120	0.111	0.130	0.016

This table regresses blocks of intraday return on *Daily Flow Order Executions (DFOE)* for the stock by date panel. Each 30-minute block stock return is regressed in columns 1 through 13. *Closing Auction* return is regressed separately from the 15:30 to 16:00 return in column 14. *DFOE* is calculated as the net trade in a stock by equity funds assuming proportional investment in their pre-existing holdings. The intraday returns are winsorized at the 1% to 99% levels for each half hour block. The t-statistics are clustered by date.

Table 4 – Main Blocks of Returns

	(1)	(2)	(3)	(4)	(5)
			Stock Returns		
	Overnight to 16:00	Overnight to 15:30	9:30 to 16:00	9:30 to 15:30	Overnight to Auction Close
DFOE	0.139***	0.106***	0.136***	0.102***	0.144***
	(6.962)	(5.483)	(8.065)	(6.379)	(7.107)
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes
N	11,180,313	11,180,313	11,180,313	11,180,313	11,180,313
Adj. R^2	0.167	0.158	0.153	0.144	0.169

This table regresses major blocks of daily returns on *Daily Flow Order Executions* (*DFOE*) for the stock by date panel. Overnight to 16:00 is the cumulative return occurring overnight and intraday up to 16:00 without the closing auction return. Overnight to 15:30 is the cumulative stock return occurring overnight and intraday up to 15:30. 9:30 to 16:00 and 9:30 to 15:30 are the cumulative stock return from market open to 16:00 and 15:30 without the close of auction return. *DFOE* is calculated as the net trade in a stock by equity funds assuming proportional investment in their pre-existing holdings. The intraday returns are winsorized at the 1% to 99% levels for each half hour block. The t-statistics are clustered by date.

Table 5 – Daily Flows Order Execution from Retirement Share Classes

	(1)	(2)	(3)	(4)	(5)
	Stock Returns				
	Overnight to 16:00	Overnight to 15:30	9:30 to 16:00	9:30 to 15:30	Overnight to Auction Close
DFOE Retirement	0.0260**	0.0267**	0.0319***	0.0325***	0.0284**
	(2.283)	(2.409)	(3.281)	(3.501)	(2.460)
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes
N	10,579,100	10,579,100	10,579,100	10,579,100	10,579,100
Adj. R^2	0.187	0.176	0.165	0.155	0.190

This table regresses major blocks of daily returns on *Daily Flow Order Executions Retirement* (*DFOE Retirement*) for the stock by date panel. Overnight to 16:00 is the cumulative return occurring overnight and intraday up to 16:00 without the closing auction return. Overnight to 15:30 is the cumulative stock return occurring overnight and intraday up to 15:30. 9:30 to 16:00 and 9:30 to 15:30 are the cumulative stock return from market open to 16:00 and 15:30 without the close of auction return. *DFOE* is calculated as the net trade in a stock by equity funds assuming proportional investment in their pre-existing holdings. The intraday returns are winsorized at the 1% to 99% levels by the time panel. The t-statistics are clustered by date.

Table 6 – Daily Flows Order Execution Vector Autoregression with Lags

	(1)	(2)	(3)	(4)	(5)	(6)
	Total		Intraday		Overnight	
	$Returns_t$	$DFOE_t$	$Returns_t$	$DFOE_t$	$Returns_t$	$DFOE_t$
$DFOE_{t-1}$	0.0327*	0.112***	0.0303*	0.112***	-0.00520	0.112***
	(1.702)	(25.93)	(1.833)	(25.93)	(-0.581)	(25.94)
$DFOE_{t-2}$	0.00437	0.109***	-0.000638	0.109***	0.000958	0.109***
	(0.229)	(31.79)	(-0.0380)	(31.79)	(0.114)	(31.80)
$DFOE_{t-3}$	-0.00132	0.0960***	-0.00634	0.0960***	0.00303	0.0960***
	(-0.0728)	(33.73)	(-0.393)	(33.73)	(0.368)	(33.74)
$DFOE_{t-4}$	-0.0187	0.0848***	-0.0247	0.0848***	0.00606	0.0848***
	(-1.055)	(30.19)	(-1.579)	(30.19)	(0.728)	(30.19)
$DFOE_{t-5}$	-0.0308	0.0850***	-0.00453	0.0850***	-0.0246***	0.0850***
	(-1.629)	(30.72)	(-0.275)	(30.71)	(-2.806)	(30.71)
5 Lags of Returns	Yes	Yes	Yes	Yes	Yes	Yes
Stock Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	12,206,388	12,206,388	12,206,388	12,206,388	12,206,388	12,206,388
Adj. R^2	0.135	0.178	0.112	0.178	0.118	0.178

This table generates the coefficients used in the vector autoregression of *DFOE* and total, intra, and overnight daily returns. *DFOE* is calculated as the net trade in a stock by equity funds assuming proportional investment in their pre-existing holdings. For each stock, *Total* is the net daily return; *Intraday* is the open to close return; *Overnight* is the residual overnight return. In addition to the lags of *DFOE*, the VAR includes 5 lags of the three return variables. The t-statistics are clustered by date.

Table 7 – Net Fund Flows and Systematic Price Impact

	(1)	(2)	(3)
	Percentage Flow		
Systematic Flow Impact	1.548***	2.201***	2.179***
	(53.40)	(72.25)	(69.21)
Date Fixed Effects	No	Yes	Yes
Fund Fixed Effects	No	No	Yes
Observations	4,862,752	4,862,752	4,862,743
Adj. R^2	0.050	0.065	0.094

This table regresses daily Percentage Flows on *Systematic Flow Impact* for the mutual fund by date panel. *Percentage Flow* is the daily Dollar Flow to a mutual fund (aggregated from share class levels) divided by their total starting *TNA*. *Systematic Flow Impact* is value weighted average *Daily Flow Order Executions* experienced by the fund portfolio. The t-statistics are clustered by date.

Table 8 - Daily Mutual Fund Flows and Contemporaneous Fund Returns

	(1)	(2)	(3)
	Daily Fund Returns$_t$		
Percentage Flow$_t$	0.00517**		-0.00122
	(2.024)		(-0.462)
Systematic Flow Impact$_t$		0.244**	0.246**
		(2.131)	(2.074)
Date Fixed Effects	Yes	Yes	Yes
Observations	4,862,273	4,885,583	4,862,273
Adj. R^2	0.775	0.774	0.775

This table regresses daily fund returns on the same day *Percentage Flow* and *Systematic Flow Impact*. We observe that Systematic Flow Impact subsumes any predictability from the total flow to individual mutual funds. *Percentage Flow* is the daily Dollar Flow to a mutual fund (aggregated from share class levels) divided by their total starting *TNA*. *Systematic Flow Impact* is value weighted average *Daily Flow Order Executions* experienced by the fund portfolio. The t-statistics are clustered by date.

Table 9 – Fama Macbeth Regressions of Fund Reversals

	(1)	(2)	(3)	(4)	(5)	(6)
	Daily Fund Returns$_t$					
Systematic Flow Impact$_t$	0.344***					
	(3.05)					
Systematic Flow Impact$_{t-1}$		-0.063				
		(-0.60)				
Systematic Flow Impact$_{t-2}$			-0.067			
			(-0.64)			
Systematic Flow Impact$_{t-3}$				-0.010		
				(-0.09)		
Systematic Flow Impact$_{t-4}$					-0.252**	
					(-2.20)	
Systematic Flow Impact$_{t-5}$						0.0160
						(0.13)
T	3,520	3,520	3,520	3,520	3,520	3,520
Avg N	1,388	1,386	1,384	1,383	1,381	1,380
Avg Adj. R^2	0.0566	0.0555	0.0573	0.0565	0.0584	0.0576

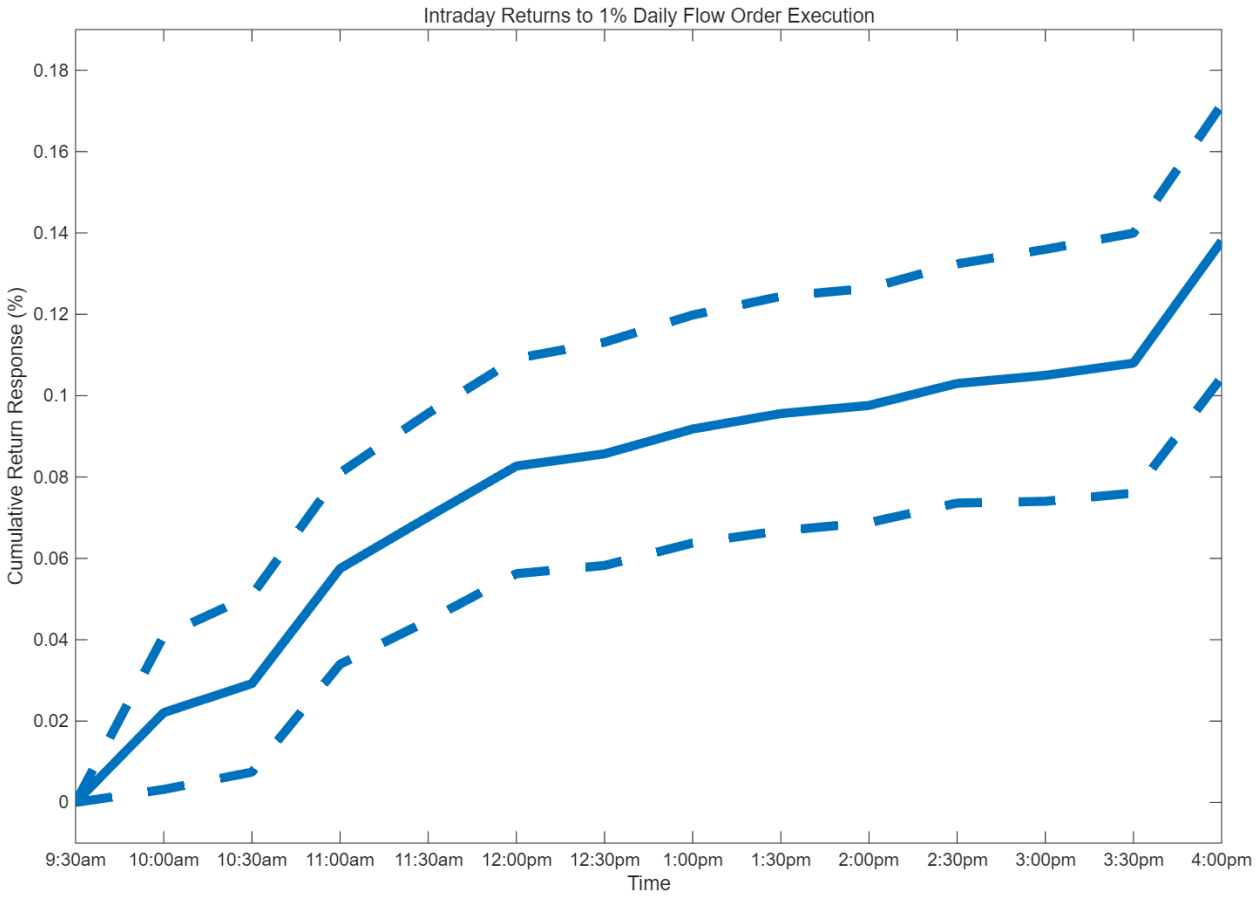
This table performs Fama-Macbeth regressions on daily mutual fund returns against contemporaneous and 5 lags of *Systematic Flow Impact*. The sample consists of a daily panel of fund level mutual returns between 2011 and 2024 with starting total net assets greater than $20 million USD. *Systematic Flow Impact* is value weighted average *Daily Flow Order Executions* experienced by the fund portfolio. The t-statistics are Newey-West adjusted standard errors using 10 lags.

Table 10 – Replicating Portfolio Returns

	(1)	(2)	(3)	(4)	(5)
	Shadow Fund Returns				
	Overnight to 16:00	Overnight to 15:30	9:30 to 16:00	9:30 to 15:30	Overnight to Auction Close
Systematic Flow Impact	0.321**	0.243**	0.299***	0.220**	0.321**
	(2.522)	(1.973)	(2.756)	(2.116)	(2.515)
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes
N	4,489,243	4,489,243	4,489,243	4,489,243	4,489,245
Adj. R^2	0.766	0.751	0.708	0.684	0.777

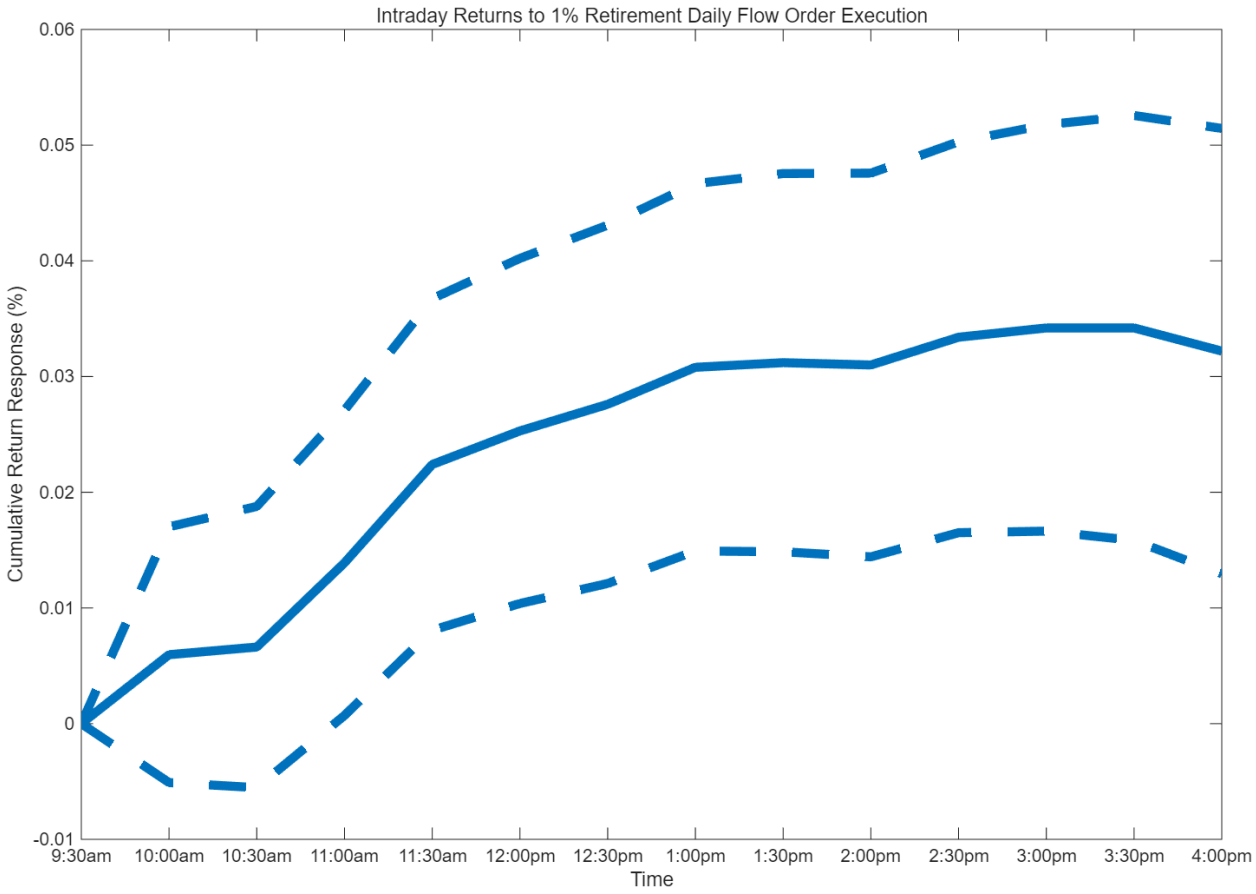
This table regresses approximated intraday mutual fund returns against contemporaneous *Systematic Flow Impact*. *Shadow Fund Returns* is the approximate intraday fund return constructed using intraday stock returns and the last fund portfolio composition from quarterly filings. *Systematic Flow Impact* is value weighted average *Daily Flow Order Executions* experienced by the fund portfolio. The t-statistics are clustered by date.

Figure 1 – Intraday Cumulative Return Associated with Flow Induced Trading from All Equity Funds.



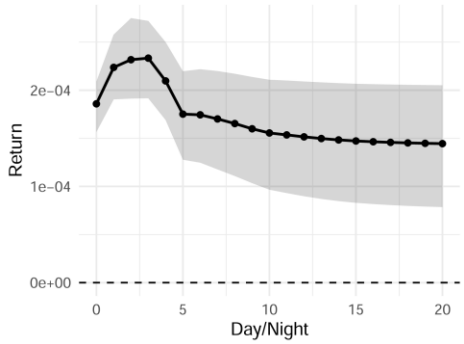
This figure plots the cumulative intraday return response to 1% *Daily Flow Order Execution*. Each point in the graph contains the stock by time regression coefficient of intraday cumulative returns up to the time against *Daily Flow Order Execution* with time fixed effects. The blue line plots the cumulative return response. The dashed blue lines contain the 95% confidence interval. The standard error is clustered by time.

Figure 2 – Intraday Cumulative Return Associated with Flow Induced Trading from Retirement Share Class Equity Funds.

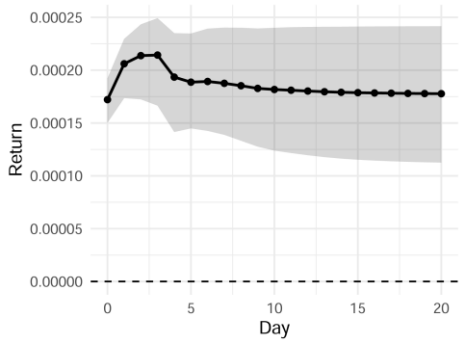


This figure plots the cumulative intraday return response to 1% *Daily Flow Order Execution Retirement*. Each point in the graph contains the stock by time regression coefficient of intraday cumulative returns up to the time against *Daily Flow Order Execution Retirement* with time fixed effects. The blue line plots the cumulative return response. The dashed blue lines contain the 95% confidence interval. The standard error is clustered by time.

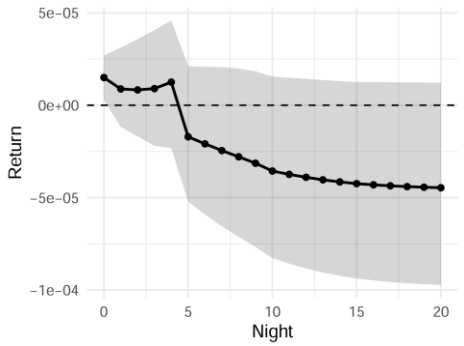
Figure 3 – Impulse Response Function of Daily Flow Order Execution on Returns



Panel A. Total Returns. This panel shows the close-to-close response of stock prices to investor flows over 20 trading days.



Panel B. Intraday Returns. This panel shows the open-to-close response of stock prices to investor flows over 20 trading days.



Panel C. Overnight Returns. This panel shows the close-to-open response of stock prices to investor flows over 20 trading days.