Portfolio Pumping in Mutual Fund Families

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Abstract

This paper investigates portfolio pumping at the fund family level, where non-star fund managers strategically purchase stocks held by star funds in the family to inflate their quarter-end performance. Star funds that engage in such activities show inflated performance after 2002 when the Securities and Exchange Commission increased regulation on portfolio pumping. Stocks pumped by the strategy show strong reversals at the quarter end. Moreover, despite a minor underperformance stemming from portfolio misallocation, non-star fund managers pumping for star funds receive abnormally high subsequent flows, suggesting a pattern of family subsidization.

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1 Introduction

Portfolio pumping, also known as painting the tape or leaning for the tape, is a market manipulative strategy, by which fund managers mark up their holdings at the end of the period by buying stocks they hold. The strategy can lead to inflated portfolio values and misleadingly high returns. Previous literature on portfolio pumping focuses on individual fund managers, and the rationale for portfolio pumping is to boost compensation at the end of the calendar year. Carhart, Kaniel, Musto, and Reed (2002) document the inflated net asset values (NAVs) of the mutual fund indices, and they find that the portfolio pumping strategy is employed by top-performing managers. Ben-David, Franzoni, Landier, and Moussawi (2013) find a similar pattern in the hedge fund industry.

Since 2002, it has become risky for star fund managers to pump portfolios themselves under the watch of the Securities and Exchange Commission (Burns (2001)), and fund-level pumping decreases (Duong and Meschke (2020)). Do mutual fund families cease pumping, or find alternative ways to manipulate star fund performance? The aim of this paper is to investigate whether there is a workaround where mutual fund families bypass regulators and continue to manipulate the market. Specifically, I examine a form of family-level pumping strategy, where the non-star funds buy stocks held by star funds in the family to drive up stock prices and inflate star funds' performance. The family-level pumping measure is then a sum of products between the purchases made by non-star funds and stock weights in star funds' portfolio in the family. I show that fund-level pumping activity decreases, and family-level pumping activity emerges after 2002. In particular, star funds with high family-level pumping activity show significant performance inflation at the quarter end, but there is no performance inflation for those with low family-level pumping activity. The inflated performance is driven by spikes in prices of the pumped stocks. Moreover, mutual fund families subsidize non-star fund managers for pumping star funds with increased subsequent advertisement and fund flows. My result points out a more severe agency problem than the one documented in the previous studies, as non-star fund managers do not act on behalf of their investors by distorting asset allocations to benefit star funds in the family.

The rationale for the family-level coordinated portfolio pumping is as follows. The profits of a mutual fund family are determined by the total assets managed and the fees they charge for their funds. By inflating returns of the star funds, family managers benefit from not only the convex flows to their star funds due to investors' performance-chasing behavior (Sirri and Tufano (1998)) but also the spillover flows to non-star funds in the family (Nanda, Wang, and Zheng (2004)). As a result, the family size grows. Furthermore, non-star fund managers also benefit from the inflated performance of star funds, as family size plays a crucial role in determining non-star managers' compensation (Ma, Tang, and Gomez (2019), and Ibert, Kaniel, Van Nieuwerburgh, and Vestman (2018)).

Using mutual fund quarterly holdings, I construct separate measures to capture family- and fund-level pumping activities. Before 2002, performance inflation of star funds at the quarter end monotonically increases with the fund-level pumping measure. That is, star funds with high fund-level pumping measures show positive quarter-end returns and negative quarter-beginning returns excess to the market (Carhart et al. (2002)). The finding suggests my holding-based pumping measure indeed captures cross-sectional variation in portfolio pumping activity. The family-level pumping measure, to the contrary, does not capture any cross-sectional variations in performance inflation of the same set of star funds. The results are consistent with the lack of regulation pressure on portfolio pumping prior to 2002. Star fund managers can simply buy stocks that they have already held so that the fund-level pumping is sufficient to inflate their performance.

When the SEC strengthened its portfolio pumping regulation in 2002, I show that some mutual fund families bypassed the regulations and continued inflating star fund performance by shifting their pumping strategy from the fund to the family level. Specifically, when non-star fund managers heavily buy stocks held by star funds, star funds show significant performance inflation at the quarter end. However, star funds' own trading activity no longer predicts their quarter-end inflation. Furthermore, the inflated performance at the quarter end is driven mostly by star funds that underperform their peer funds in the same style category during the quarter, consistent with their increased pumping incentives. The family-level pumping is effective, as these star funds show more flows in the subsequent quarter than other star funds after controlling for fund characteristics.

The shift from fund-level to family-level pumping makes it more difficult for regulators to detect price manipulation. Even though a mutual fund family shares a trading desk and has to report holdings of all funds through Form 13-F to the SEC, it is more challenging for regulators to connect the dots between pumping intentions and transactions across all possible funds in the family than to focus on a single fund. As pointed out in the media[1], "*regulators like the Securities and Exchange Commission generally can't match trades to the traders who placed them without first making a detailed examination of confidential records. And regulators must show that the trading was a deliberate attempt to distort prices, which can be difficult to prove, experts say.*" Pumping at the family level requires non-star fund managers to execute the trade, while star funds benefit from the price impact. Therefore, the family-level pumping is subtler than, but as effective as, the fund-level pumping strategy. Although such family-level coordination is not unprecedented, my paper provides additional evidence of market manipulation by mutual fund families in response to tightened regulation. For example, Gaspar, Massa, and Matos (2006) document a series of star-creation strategies employed by the mutual fund family. Star funds in the family tend to receive preferential IPO allocations. The family also coordinates trades of its member funds such that star funds minimize the transaction costs by swapping positions with non-star funds.

To closely tie the performance inflation of star funds at the quarter end to the family-level pumping, I then use institutional daily trading data from Ancerno. Families that extensively engage in family-level portfolio pumping show a more pronounced increase in purchases of stocks held by their star funds in the last three trading days than other fund families. The quarter-end spike in purchases intensifies for stocks with above-median portfolio weights in

[1] WSJ article: Fund Managers Lift Results With Timely Trading Sprees.

star funds. As a falsification test, there is no increased trading for stocks that are not held by star funds. Moreover, families that engage in pumping activities are also more likely to subsequently sell stocks purchased at the quarter end, which rules out the alternative explanation that they simply mimic the portfolio of star funds.

I also show that the inflated performance of star funds is indeed driven by the outperformance of the pumped stocks. I create a long/short portfolio of stocks by buying stocks pumped the most and selling stocks pumped the least by non-star funds at the quarter end. The cumulative return of the long/short portfolio spikes at the quarter end, and quickly reverses in the next trading days. The magnitude of inflation at the stock level is consistent with the fund-level evidence. Moreover, the result is robust to alternative measures such as CAPM and Carhart four-factor alphas, which rules out the alternative explanation that the performance inflation of pumped funds is driven by them having exposure to certain factors, which also exhibit reversal patterns. Furthermore, I use Trade and Quote (TAQ) intraday data and find that stocks heavily pumped by the family strategy show strong returns on the last trading day of the quarter, especially in the last 30 minutes before the market closes, consistent with anecdotal evidence.

From a non-star fund manager's perspective, pumping for the family seems non-optimal because it incurs portfolio distortions. Then what are their incentives to do so? I first show that non-star funds in the top quintile of pumping activity receive 0.8% more flows than other non-star funds in the family during the subsequent quarter. The additional flows are after accounting for performance, window dressing activities, return gap, and other fund characteristics. In terms of the pumping cost, funds that pump intensively indeed mildly underperform other funds in the family by 5.2 bps in the subsequent quarter, which translates to a small reduction in flows of 0.02% in a quarter, given the estimated flow-performance sensitivity. That is, these pumping funds do benefit by engaging in portfolio pumping. Note that the flow benefit does not account for the potential legal and reputation costs.

As investors make asset allocation decisions, how do mutual fund families direct flows to pumping managers? This paper proposes a channel through family-level advertising. The family manager advertises more for pumping funds, thus redirecting flows to pumping funds. Although investors make investment decisions, salespeople and financial advisors in the family can persuade investors to invest in pumping funds to compensate for the pumping manager's effort. Gallaher, Kaniel, and Starks (2015) document that the fund family makes all the advertising decisions, and advertising expenditure has a significant positive effect on fund flows. Using a small sample of funds with advertisement data, I find that funds with high pumping activity are more likely to be advertised exclusively on the print media, which supports the advertising channel.

Last, I show the fund-level and family-level determinants of pumping activities. Within a family, funds that share at least one common manager with star funds are more active in pumping, since a common manager knows which stocks are the most effective to pump. Senior managers are less likely to engage in pumping activity. Although they would benefit more from increased star fund performance because of their high stake in the firm, they also face greater reputation costs than junior managers. At the family level, families with a high level of daily return reversals at the year end in 2002 are more likely to pump heavily for their star funds after 2002. Large families with fewer star funds are more likely to engage in family-level pumping. The result is consistent with Nanda et al. (2004), which notes that families try hard to generate star funds.

An alternative explanation for the observed family-level pumping is that, non-star fund managers may simply buy good stocks, which are more likely to be held by star funds, regardless of whether the star funds and non-star funds are in the same family. To rule out this explanation, for each family, I create a pseudo star fund by aggregating holdings of star funds outside the family and excluding stocks held by star funds in the family, and create an alternative family-level pumping measure. There is no evidence of performance inflation under the alternative measure. The result suggests that mutual fund families pump stocks strategically, so that the price pressure generated by the pumping does not benefit competitors.

The remainder of the paper is organized as follows. Section 2 discusses the data and the construction of key variables. Section 3 shows the evidence of portfolio pumping. Section 4 discusses the within-family subsidization. Section 5 shows the characteristics of pumping families. Section 6 concludes.

2 Data and variable construction

2.1 Sample selection

I use the Center for Research in Security Prices (CRSP) Mutual Fund database, Thomson Reuters Mutual Fund database, TAQ data, and Morningstar Direct to construct the main dataset. The sample period is between 1990 and 2021, so there are 12 years before and 19 years after the publication of Carhart et al. (2002). I use Ancerno transaction-level trading data in Section 3.3, and the data cover the sample period between 1999 and 2010. Advertising data are obtained from Kaniel and Parham (2017) for the sample period between 2000 and 2012.

The CRSP Mutual Fund database provides the monthly fund return, fund total net assets (TNA), expense ratio, turnover ratio, management company, and fund age at the share class level, starting from December 1961. The CRSP provides daily fund returns starting from September 1998, and quarterly portfolio holdings starting from September 2003.[2] Thomson Reuters Mutual Fund database provides quarterly and semiannual holdings starting in 1980. Morningstar provides mutual fund overall ratings from 1986.

Because the CRSP provides fund data at the share class level with the unique identifier *crsp_fundno*, I use *wficn* from MFLink as fund identifiers to aggregate different share classes. I weight different share classes by their previous month's TNAs to construct fund-level returns, expense ratios, and turnover ratios.[3] Portfolio holding data are from Thomson Reuters.

[2] I use Morningstar Direct data to supplement fund daily returns from 1990 to 1998.

[3] Missing data in CRSP are coded as either -99 or missing. If the TNA for a share class of a previous

I use Morningstar mutual fund "overall rating" to identify star funds. The overall rating assigns 1 to 5 stars based on a fund's historical risk and load-adjusted returns versus category peers. Because CRSP does not provide detailed portfolio manager names[4], I merge CRSP with Morningstar to get star ratings and detailed manager histories[5].

Mutual fund families often open new funds with a limited amount of capital. At the end of an evaluation period, successful funds are opened to the public, while unsuccessful ones are shut down (see Evans (2010)). To account for the incubation bias, I exclude funds without a fund name in the CRSP database. I also exclude funds with an average TNA less than $5 million, or that hold fewer than 10 stocks. Fund styles are identified by Morningstar style categories. The sample includes only domestic equity funds that are actively managed, and excludes balanced, bond, international, money market, and sector funds. Since I am mostly interested in the performance inflation at the calendar quarter end, I limit the sample to funds that report their holdings at the calendar quarter end.[6]

2.2 Holding based measures of portfolio pumping

A family manager can pump a portfolio of star funds in two ways. Either non-star fund managers buy stocks held by star funds at the quarter end to inflate star fund performance, or star fund managers do it themselves. To measure the portfolio pumping inside the family, I construct variables *Family Pumping* and *Fund Pumping*. *Family Pumping* quantifies the magnitude of pumping activity by non-star fund managers in the family, whereas *Fund Pumping* measures the magnitude of pumping activity by star fund managers themselves.

Star funds are identified as funds of the highest Morningstar overall ratings in the family

month is missing or -99, I do not include it in the value-weighting. The fund level TNA is the sum of non-missing TNAs of all its share classes.

[4]In the CRSP, *mgr_name* only contains the last name of each portfolio manager. When the number of managers of a fund exceeds 3, it is usually coded as "Team Managed".

[5]I first merge CRSP with Morningstar Direct by fund *cusip* and *ticker*. For unsuccessful merge, I use a text-based merging algorithm by fund name and share class. I then verify the merge by fund returns and TNA.

[6]More than 80% of funds in the sample report at calendar quarter end.

with a minimum rating of four stars.[7] For family k and stock s at quarter t, I aggregate the portfolio holding of all star funds and denote it as $Star\ Holding_{k,s,t}$. For example, suppose there are two star funds in family k at quarter t, each holding 100 shares of stock s. Then $Star\ Holding_{k,s,t}$ is 200. I then compute the weight of stock s in the aggregated star portfolios, and denote it as $w^{Star}_{k,s,t}$,

$$w^{Star}_{k,s,t} = \frac{Star\ Holding_{k,s,t} \cdot P_{s,t}}{\sum_{l \in L_{k,t}} Star\ Holding_{k,l,t} \cdot P_{l,t}}, \tag{1}$$

where $P_{s,t}$ is the adjusted stock price of s at the end of quarter t, and $L_{k,t}$ is the set of stocks held by star funds in family k at quarter t. Aggregating all star funds in the family is not the only way to construct the pumping measure, as one can treat each star fund as a potential pumping target. Consider the case where a family decides to pump a stock held by more than one star funds. It is not clear which star funds the family is targeting. Therefore, grouping star funds in the family is a more conservative approach to measuring family-level pumping.

For family k, stock s, and time t, I aggregate the number of shares purchased by non-star fund managers in the family, normalize it by the trading volume of stock s, and denote it as $Shares\ Purchased^{Non-star}_{k,s,t}$. Normalizing the number of shares purchased by the trading volume is necessary since the price impacts generated by the pumping from non-star funds depend on the liquidity of the stock.[8] It can be viewed as the trading pressure imposed by the family. The potential benefit received by the star funds in the family, $Family\ Pumping_{k,t}$ is the weighted $Shares\ Purchased^{Non-star}_{k,s,t}$. The weights depend on the last quarter's holding

[7]Note that by construction, some mutual fund families may not have any star funds. In the Internet Appendix, I consider a version that relaxes the requirement of the minimum four-star rating. I also consider an alternative specification where star funds are identified as funds ranked in the top quintile based on the past 12-month Carhart alpha (excluding the most recent month).

[8]Normalizing the shares purchased by the last day trading volume or the total shares outstanding does not qualitatively change the result. Please see Internet Appendix Tables IA2 and IA4 for robustness of main results.

of the star fund portfolio.

$$Shares\ Purchased^{Non-star}_{k,s,t} = \sum_{i \in I_{k,t}} \frac{\max(Holding_{i,k,s,t} - Holding_{i,k,s,t-1}, 0)}{Vol_{s,t}}, \tag{2}$$

$$Family\ Pumping_{k,t} = \sum_{s} Shares\ Purchased^{Non-star}_{k,s,t} \cdot w^{Star}_{k,s,t-1}, \tag{3}$$

where $I_{k,t}$ is the set of non-star funds of family k at quarter t, and $Vol_{s,t}$ is the trading volume of stock s at quarter t. Using the one-quarter lag of stock weights in star funds is to avoid any potential looking ahead bias and alleviate concerns of herding behavior in the family. The result does not change qualitatively if the current quarter weights are used.

The construction of *Fund Pumping* is very similar to *Family Pumping*, except that it captures the purchase made by the star fund managers instead of the non-star fund managers.

$$Fund\ Pumping_{k,t} = \sum_{s} Shares\ Purchased^{Star}_{k,s,t} \cdot w^{Star}_{k,s,t-1}, \tag{4}$$

where $Shares\ Purchased^{Star}_{k,s,t}$ is the number of shares purchased by star fund managers in family k, normalized by the trading volume of stock s. Table 1 shows the summary statistics of key variables.

2.3 Other key variables

Fund Expense and *Fund Turnover* are the fund-level annual expense ratio and turnover ratio from CRSP, respectively. *Fund TNA* is the fund level total asset managed at the quarter end. Following the previous literature, I construct the following fund flows:

$$\%\ flow_t = [TNA_t - TNA_{t-1} \cdot (1 + r_t)]/TNA_{t-1} \tag{5}$$

CRSP provides daily and monthly return data at the share class level since September 1998. I aggregate returns using their previous month's TNA as weight and then estimate the fund's Carhart alpha using a 24-month rolling window.

Return Gap is the 12-month moving average of the return gap defined in Kacperczyk, Sialm, and Zheng (2008), which is the difference between the real return and the return of a hypothetical portfolio with last-reported holdings that are assumed to have been held throughout the quarter. Kacperczyk et al. (2008) find that *Return Gap* is positively correlated with future fund returns, and it is also used as a control in Agarwal, Gay, and Ling (2014). *Fund Age* is the number of years between the fund inception date provided by the CRSP and the observation date. $Winner\ Prop_{i,t}$ is the proportion of winner stocks held by fund i at quarter t. $Loser\ Prop_{i,t}$ is the proportion of loser stocks held by fund i at quarter t. Winner (loser) stocks are the top (bottom) quintile stocks sorted by the past quarter's performance. Window dressing funds tend to hold winner stocks and sell loser stocks at the quarter end, so that the disclosed portfolio looks attractive to investors. *Common Manager* is a dummy variable, which is equal to one if the fund shares at least one common manager with the star funds in the fund family.

To identify mutual fund families, I use *mgmt_cd*, which is a three-letter management company identifier from CRSP. In those cases where *mgmt_cd* of the fund i is missing at time t, if the management company name $mgmt\_name_{i,t}$ is not missing and there is some fund j at time t with the same management company name and non-missing *mgmt_cd*, I replace $mgmt\_cd_{i,t}$ with $mgmt\_cd_{j,t}$. I also consolidate cases where multiple *mgmt_cd* correspond to the same family. If both $mgmt\_name_{i,t}$ and $mgmt\_cd_{i,t}$ are missing, I use the first couple of words in the fund name to identify the fund family and fill missing values manually.

3 Portfolio pumping at family level

Carhart et al. (2002) document portfolio pumping of mutual funds and find that star fund managers pump to boost their compensation at the quarter end. Duong and Meschke (2020) show that performance inflation decreases sharply after 2002 when the SEC started to focus on portfolio pumping. This section tests a possible pumping strategy at the fund family level, where non-star fund managers buy and pump stocks held by star funds in the family. As the SEC increases its regulation on portfolio pumping after 2002, it becomes riskier for star fund managers to pump their portfolios. The strategy of the family-level pumping only requires the non-star fund managers to execute the trade, but achieves a similar price impact on star fund portfolios. By taking a detour to manipulate the market, families that adopt the strategy are less likely to be detected by regulators. From the perspective of family managers, the strategy is rational because investors reward the superior performance of the star funds with convex flows, which increase the family size and total fees they can charge. Moreover, non-star funds in the family benefit from the spillover effect because of the superior performance of their star funds.

3.1 The fall of fund-level pumping

To test the fund-level pumping, I sort star funds by *Fund Pumping* (see Equation (4)) into deciles and form ten equal-weighted portfolios. For each portfolio, I regress its daily return net of the market on a set of time dummies that indicate the beginning and end of quarters and months.

$$R_t = b_0 + b_1 \mathit{Quarter\ End}_t + b_2 \mathit{Quarter\ Beginning} + b_3 \mathit{Month\ End}_t + b_4 \mathit{Month\ Beginning}_t + \epsilon_t, \quad (6)$$

where *Quarter End* equals one if it is the last trading day of March, June, September, or December. The dummy *Quarter Beginning* equals one if it is the next trading day. *Month End* equals one if it is the last trading day of the month (excluding the quarter end), and *Month Beginning* equals one if it is the next trading day. The coefficient estimates b_1 and b_2 then capture average returns in excess of the market at the quarter end and quarter beginning. Finally, I plot the turn of quarter coefficient estimates and their confidence intervals in Figure 1.

Figure 1(a) shows the performance inflation before 2002. Graphically, performance inflation can be viewed as the spread between the top and the bottom bars. The spread widens, and performance inflation increases, as we move from the bottom to the top decile of *Fund Pumping*. Taking the top decile portfolio as an example, the average returns in excess of the market are about 25 basis points and -35 basis points at the quarter end and beginning, respectively. Both estimates are significant at 5% level. Importantly, the finding of portfolio pumping at the fund level alleviates concerns about the pumping measures used in the paper. Even though the pumping measure is constructed using quarterly holding data, it captures the cross-sectional variation in pumping activities and monotonically increases with the turn-of-quarter performance inflation.

Figure 1(b) shows that, after 2002, there are no significant patterns of performance inflation when we sort funds by *Fund Pumping*, which is consistent with the increased regulatory pressure on portfolio pumping, and star fund managers become reluctant to pump portfolios themselves. As a result, the fund-level pumping measure no longer captures the pumping activities, so the turn-of-quarter performance inflation becomes uncorrelated with the measure.

3.2 The rise of family-level pumping

Although it becomes risky and costly for star fund managers to pump portfolios, fund families could take a detour and pump their star funds at the expense of non-star funds. To test this hypothesis, I sort star funds by *Family Pumping* (see Equation (3)) into deciles and form ten equal-weighted portfolios. Similar to the approach in Figure 1, I regress the daily return in excess of the market for each portfolio on the same set of dummies in Equation (6) and plot the 95% confidence interval of the turn-of-quarter coefficient estimates in Figure 2.

After 2002, the spread between excess returns at the quarter end and beginning widens as *Family Pumping* increases, as shown in Figure 2(b). That is, star funds with high family-level pumping activity show significant performance inflation. Note that Figures 1(b) and 2(b) have the same set of star funds during the same sample period. Sorting star funds by

Family Pumping exhibits performance inflation at the quarter end, but sorting star funds by *Fund Pumping* does not. The difference suggests that family-level pumping emerges after fund-level pumping becomes too costly. Pumping at the family level only requires non-star managers to execute the trade, while star funds enjoy the pumping. More importantly, the strategy is discreet and less likely to be detected by regulators.

To further validate the emergence of family-level pumping, Table 2 shows the pumping evidence in a panel regression setting. The dependent variables are the weighted daily return of star funds in mutual fund families, net of either market return or style return in basis points. Using style-adjusted returns alleviates the concern that the performance inflation pattern may be driven by a set of funds loading on certain factors, which may also exhibit reversals at the quarter end. The dummy variable *Top Pumping Family* is equal to one if the family is ranked in the top quintile based on *Family Pumping* measure, and zero otherwise. I regress the daily excess return of fund families on a set of dummy variables and their interaction terms with *Top Pumping Family* dummy. If fund families started to pump star funds at the family level after 2002, we should expect significantly positive coefficient estimates of interaction terms *Top Pumping Family* × *YEND* and *Top Pumping Family* × *QEND* in the post-2002 sample. As shown in columns (1) and (2) of Table 2, star funds in *Top Pumping Families* exhibit significantly higher excess returns at the end of periods than the rest of the families.

Columns (3) and (4) conduct the same analyses in the pre-2002 sample. There is no significant difference in performance inflation between *Top Pumping Families* and other families. As also shown in Figure 2(a), all deciles, except for the bottom decile, show very strong performance inflation in the early sample, so that *Family Pumping* measure does not capture the cross-sectional variation in performance inflation in the early sample, which is due to the low cost of star funds conducting portfolio pumping by themselves.

Given the increased regulatory attention, fund families face a trade-off between inflated performance and regulatory sanctions. Ex-ante families may be more likely to pump their star funds when their star funds underperform or lose capital relative to their peers. To test whether performance or flow incentives play a role in portfolio pumping, I conduct the following analysis. For families with top-quintile pumping activities, star funds, conditional on being in the same style category, are sorted into high and low groups depending on 1) first-two-month of returns in the quarter, 2) past-year returns (excluding the most recent month), 3) first-two-month of flows in the quarter. I then regress star funds' daily excess returns to the market on those time dummies for each subsample.

Table 3 shows the regression results. Star funds that underperform in the short term relative to their peers are most likely to benefit from family pumping activities. Focusing on columns (1) and (2), we can see that star funds with below-median performance in the recent two months relative to their peers experience a 10 bps (8 bps) performance inflation at year (quarter) end. On the contrary, star funds that perform relatively well in the short term do not show any inflation at year end and only 5 bps inflation at the quarter end. On the other hand, portfolio pumping and its associated price inflation are less likely to be a function of long-term underperformance or flows, as the differences in price inflation between high and low groups in columns (3)-(6) are considerably smaller than the ones in columns (1) and (2).

In summary, the decrease in portfolio pumping at the fund level is consistent with closer attention by regulators and the media. While fund-level pumping falls, family-level pumping rises in response to the increased regulatory attention. As a result, we observe that star funds in families that employ family-level pumping strategy show significant performance inflation at the quarter end after 2002.

3.3 Evidence from transaction-level Ancerno data

One may be concerned that the *Family Pumping* measure is based on changes in quarterly holdings, which does not necessarily capture funds' pumping activities around the quarter end. To further validate the measure, I use Ancerno data that contain transaction-level records for their institution clients between 1999 and 2010.[9] I then match mutual fund families to CRSP by names based on text similarity, and then manually review the matching.

To show that the top pumping families indeed pump stocks held by star funds, I estimate the following regression at the family-stock-day level: the dependent variable is the number of shares of stock s traded by family f at day t, scaled by the stock's total daily volume from CRSP and in basis points. The independent variables include a dummy indicator *Top Pumping Family* that equals one if family f is ranked in the top quintile based on the *Family Pumping* measure, a dummy indicator that equals one if day t is in the last three trading days of the quarter, and their interaction term. The regression controls for stock $\times$ date fixed effects and family $\times$ quarter fixed effects. The stock $\times$ date fixed effects control for all time-varying stock-level information, such as past returns, firm size, and liquidity, and allow us to zoom in on the differential trading intensity of the same stock between families with and without top pumping activities. As families may have different trading strategies, the family $\times$ quarter fixed effects absorb all unobserved characteristics at the family-quarter level. As a result, the coefficient estimate of the interaction term captures the difference in differences in trading activities between the two types of fund families and between quarter-end trading days and regular trading days.

The regression results are shown in Table 4. Column (1) uses the sample of stocks that are held by the star funds in a family. Top pumping families indeed buy more shares of stocks held by their star funds at the quarter end compared with regular trading days than other families, as shown by the positive and significant interaction term. The magnitude almost doubles in column (2) when the sample includes only stocks with above-median weights in star funds' holdings. The finding is consistent with Hu, McLean, Pontiff, and Wang (2014), which find that institutions tend to buy stocks in which they already have large positions at the year end.

One potential explanation for the increased purchases of top pumping families is that

[9] Hu, Jo, Wang, and Xie (2018) find that Ancerno data cover 12% of trading volume in CRSP, and it stopped providing institution clients identifiers in September 2011.

their trading strategy may be more active at the quarter end than other families, so the effect documented in the first two columns is not driven by pumping their star funds. If this was the case, we should also expect to see increased purchases of stocks held by non-star funds. As a falsification test, column (3) uses the sample stocks that are not in the star funds' holdings, and there is no increased trading activity at the quarter end, which rules out this explanation.

Another potential explanation could be that non-star funds simply mimic the behavior of star funds in the same family and buy stocks in their portfolios. Such mimicking behavior would suggest that stocks purchased by non-star funds at the quarter end are likely to remain in their portfolio after the beginning of the new reporting period. On the contrary, the pumping channel will predict that those pumped stocks are more likely to be sold than other stocks.

To rule out the mimicking channel, for each family i and stock s at quarter t, I create a dummy variable $\textit{Quarter-End Purchase}_{ist}$, which is equal to one if the family purchases the stock in the last three days of the quarter, and zero otherwise. To examine the subsequent trading, I then sum up the order flow of stock s by family i at quarter $t+1$, scaled by the shares outstanding of stock s, denote it as $\textit{Trade}_{i,s,t+1}$, and use it as the dependent variable. I also create a dummy variable $\textit{Sell}_{i,s,t+1}$ that equals one if the order flow is negative in the subsequent quarter, and use it as an alternative dependent variable. Similar to the regression specification in Table 4, the independent variables include a dummy indicator that equals one if the family is ranked in the top quintile based on the family-level pumping measure in the quarter, the dummy indicator $\textit{Quarter-End Purchase}_{ist}$ that captures potential pumping at the quarter end, and their interaction term. The regression controls for stock $\times$ quarter fixed effects and family $\times$ quarter fixed effects, which capture time-varying stock-level and family-level information. I then estimate the regression among stocks that are held by the star funds in a family. As a result, the coefficient estimate of the interaction term captures the difference in differences in subsequent-quarter trading between the two types of fund families and between stocks with and without quarter-end purchase. The prediction is that, compared to other fund families, families that engage in pumping behavior are more likely to sell stocks that are purchased at the quarter end than other stocks.

The regression results are shown in Table 5. Column (1) uses the dummy variable $Sell_{i,s,t+1}$, and the coefficient estimate of the interaction term is positive and highly significant, consistent with pumping families are more likely to sell star holdings that they purchased at the quarter end. Column (2) uses the continuous variable $Trade_{i,s,t+1}$, and the coefficient estimate is negative and highly significant.

As a falsification test, columns (3) and (4) use the sample of stocks that are not in star funds' holdings, and the coefficient estimates of the interaction term are not significant. The results provide further support to the evidence that the subsequent selling only exists among star holdings, which is consistent with the pumping channel.

To get a sense of whether the trades made by top pumping families can generate the observed price inflation of their star funds, I conduct the following analysis. Because Ancerno data provide execution price (variable xp) and the price at the time of order placement (variable xpP), for every trade k of stock s executed by family i at the quarter end, I compute the associated effective spread following Van Kervel and Menkveld (2019):

$$effective\ spread_k = \frac{Execution\ Price_k - Placement\ Price_k}{Placement\ Price_k} \tag{7}$$

I then sum up the effective spread across all trades made by family i of stock s and denote it as the accumulated effective spread, which captures how much the trades made by family i move the price of stock s. Lastly, I take the weighted average of the accumulated effective spread across all stocks held by the star funds in family i, and the weight is based on the stock weight in the star fund portfolio. Among top pumping families, the measure is, on average, 5.7 basis points at the quarter end, which is slightly over half of the observed price inflation among star funds in top pumping families.

3.4 Stock-level evidence of family pumping

This section shows stock-level evidence of the family pumping strategy. Stocks pumped the most by non-star fund managers should show higher (abnormal) returns than stocks pumped the least at the end of quarters, following a reversal in the next couple of trading days.

To test the hypothesis, I sort stocks by *Pumping Pressure* defined in Equation (8), which is the aggregated *Shares Purchased*$^{Non-star}$ across all families. Stocks ranked in the top *Pumping Pressure* quintile are the ones pumped the most by fund families. I then form a long/short portfolio of stocks by buying stocks in the top quintile and selling stocks in the bottom quintiles, and evaluate the performance of the portfolio using an event-study approach with a one-week trading window around the quarter end.

$$Pumping\ Pressure_{s,t} = \sum_{k} Shares\ Purchased^{Non-star}_{k,s,t} \cdot w^{star}_{k,s,t-1}, \tag{8}$$

where k, s, and t represent fund family, stock, and time, respectively.

In Panel (a) of Figure 3, the solid red line, dashed blue line, and dotted green line represent the average cumulative return, CAPM alpha, and Carhart four-factor alpha of the long/short portfolio, respectively. The factor loadings are estimated over the half-year trading window before each quarter end. The cumulative return of the long/short portfolio earns over 40 basis points before the quarter end and then gradually reverses in the next week. The result is robust using the CAPM alpha and Carhart four-factor alpha, which rules out the explanation that the performance inflation at the quarter end is purely driven by reversals of common factors. Panel (b) of Figure 3 shows the cumulative returns of the top and bottom quintiles separately. All the price inflation and subsequent reversals are driven by the long leg, consistent with increased buying activity at the quarter end.

Column (1) of Table 6 shows the determinants of aggregated *Pumping Pressure*. Stocks in the top quintile of *Pumping Pressure* are not past winners, as the coefficient estimate on past year returns is negative and significant, which rules out the explanation that non-star fund managers simply pick stocks that performed well in the past for window dressing purposes. The result is consistent with the finding of Hu et al. (2014). Columns (2) to (7) replicate the findings in Figure 3 under a panel regression setting. Stocks that are in the top quintile of *Pumping Pressure* earn over 10 bps at the quarter end using various performance measures, followed by a reversal at the quarter beginning.

I also examine whether stocks with higher *Pumping Pressure* are subject to a larger price impact than other stocks. Using TAQ data, I compute the price impact following Holden and Jacobsen (2014):

$$Price\ Impact_k = \frac{2D_k(M_{k+5} - M_k)}{M_k}, \tag{9}$$

where D_k is an indicator variable that equals 1 if the k^{th} trade is a buy and -1 if the k^{th} trade is a sell, which is inferred following Lee and Ready (1991). M_k is the midpoint of the NBBO quotes, and M_{k+5} is the midpoint of the NBBO quotes five minutes after the midpoint M_k. The price impact measure captures the permanent component of the effective spread of a trade. I then compute the dollar-volume-weighted price impact for each stock at quarter end and regress it on *Pumping Pressure* (or the dummy variable *Top Pumping Pressure*), controlling for the firm's natural logarithm of market capitalization, book-to-market, and prior quarter Amihud ratio. The regression also includes time fixed effects. The regression results are reported in columns (1) and (2) of Table 7. As shown in column (1), stocks that are in the *Top Pumping Pressure* quintile experience a higher price impact of 0.88 basis points than other stocks, which translates to a 13.7% increase relative to the average price impact at the quarter end. Column (2) uses the continuous variable of *Pumping Pressure*, and both coefficient estimates are highly significant. In columns (3) and (4), I further include stock fixed effects to capture within-stock variations in *Pumping Pressure* and price impact. The results show that when a stock faces higher *Pumping Pressure* in a given quarter, the price impact at the quarter end increases by 0.42 basis points, or a 6.6% increase relative to the average price impact.

In Figure 4, I examine the intraday return of stocks in each *Pumping Pressure* quintile on the last trading day of each quarter. The horizontal axis is the time of the day at the quarter end, and the vertical axis is the average cumulative return in basis points. As we can see, stocks with the highest pumping pressure from mutual fund families show strong intraday returns, consistent with Figure 3. Moreover, the return of the highest pumping pressure stocks spikes in the last 30 minutes of the quarter, which supports the pumping hypothesis that non-star fund managers drive up stocks held by star funds in the family at the quarter end.

3.5 Do star funds benefit from family-level pumping?

After documenting that some families pump the performance of their star funds at the quarter end, I then examine whether these star funds benefit by attracting more flows than other star funds. The sample includes star funds with a Morningstar rating of 4 and above. The regression estimates the star fund's flows in quarter $t+1$ on its Carhart alpha in quarter t excluding the last week, Carhart alpha from quarter $t-4$ to $t-1$, fund size, expense ratio, turnover ratio, and fund flows in quarter t. I exclude the performance during the last week of quarter t, so that the effect of pumping would not be absorbed by its performance. The independent variables of interest are the *Top Pumping Family* dummy and its interaction with the year-end dummy, which is equal to one if it is the fourth quarter of the year. The regression also includes style $\times$ time fixed effects, so that all the style-level time-varying unobservables are captured, and the estimation focuses on the cross-sectional variations in flows within a style category.

The regression results are reported in Table 8. Star funds in families with top pumping activities earn 0.94% more flows than other star funds, as shown in column (1). After controlling for performance and fund characteristics, the magnitude drops to 0.7%, as shown in column (2). Moreover, the majority of the effect comes from the year end, which is shown by the positive and significant interaction with the year-end dummy in column (3). The result is consistent with family-level pumping and price inflation being more severe at the year end.

3.6 Robustness checks: Pumping outside family

Previous sections have shown that performance inflation of star funds with family pumping activity is unlikely to be driven by common factor reversals or non-star fund managers mimicking portfolios of star funds. In this section, I test whether managers pump a particular set of stocks so that the price impact only benefits star funds of their own family, but not star funds outside the family.

For each family k at time t, I first aggregate the holdings of star funds outside the family k, excluding stocks held by star funds in the family. The set of stocks that are in star funds of family k is denoted as K. Second, I calculate the stock weight in the aggregated portfolio, denoted as $w_{-k,s,t}^{Outside\ Family\ Star}$. Third, analogous to the measure of *Family Pumping*, I construct *Outside Family Pumping* as the sum of the products over all stocks between the number of shares purchased by non-star funds and the stock weight in the aggregated portfolio.

$$Outside\ Family\ Pumping_{k,s,t} = \sum_{s \notin K} Shares\ Purchased_{k,s,t}^{Non\text{-}star} \cdot w_{-k,s,t-1}^{Outside\ Family\ Star} \tag{10}$$

Star funds outside the family are then sorted by *Outside Family Pumping* into deciles, and portfolio excess returns to the market are regressed under the specification in Equation (6). Figure 5 shows the coefficient estimates and 95% confidence interval of time dummies. There is no significant performance inflation at the turn of quarters for star funds outside the family in the top *Outside Family Pumping* deciles. The result suggests that families target stocks to pump strategically so that the price impact does not benefit their competitors.

4 Do fund managers benefit from portfolio pumping?

The previous section shows that prices of star funds are inflated at the quarter end, but it is important to understand the incentives of the other side of fund families, non-star funds that engage in the family-level portfolio pumping. In this section, I investigate whether non-star fund managers benefit from pumping portfolios of star funds in the family and the distortion of portfolio allocation due to the pumping. In particular, Section 4.1 describes the measure to quantify the family-level pumping from the side of non-star managers. Section 4.2 shows evidence that pumping managers receive abnormally high future flows that cannot be explained by fund and family characteristics, such as performance and spillover effect. Section 4.3 documents the portfolio distortion and decreased future performance of pumping managers.

4.1 Measuring pumping from the side of non-star managers

To quantify the magnitude of non-star fund managers pumping for star funds in the family, I first construct the variable *Pumping Effort*. From a non-star fund manager's perspective, the capital devoted to pumping star funds is the most straightforward measure to quantify the pumping effort. For each non-star fund i in family k at quarter t, I calculate the purchase of each stock s, normalized by the total portfolio holding value of fund i at quarter t,

$$Purchase_{i,k,s,t} = P_{s,t} \cdot \frac{\max(Holding_{i,k,s,t} - Holding_{i,k,s,t-1}, 0)}{\sum_{l \in L_{i,t}} P_{l,t} \cdot Holding_{i,k,l,t}}, \tag{11}$$

where $Holding_{i,k,s,t}$ is the number of shares of stock s held by fund i in quarter t, and $L_{i,t}$ is the set of stocks held by fund i in quarter t. The normalization by portfolio value is necessary because I control for the fund size in the empirical analysis. Moreover, I choose stock prices at the end of each quarter. This is the most relevant timing since the performance of the fund is typically evaluated at the end of the quarter. I also test using prices at the beginning of the quarter as well as in the middle of the quarter. The result does not qualitatively change.

Pumping Effort$_{i,k,t}$ is the weighted summation of *Purchase*,

$$Pumping\ Effort_{i,k,t} = \sum_{s} w^{Star}_{k,s,t-1} \cdot Purchase_{i,k,s,t} \tag{12}$$

By construction, *Pumping Effort* increases as non-star fund managers buy stocks held by the star funds, and it increases if the stocks constitute a large portion of star funds in the family.

4.2 Flow subsidization for pumping managers

I first show that non-star funds that heavily pump their star funds receive flows that cannot be explained by their fund performance and other characteristics. Specifically, I estimate the following regression,

$$\%\ Flow_{i,t+1} = \alpha + \beta\, Top\ Pumping\ Effort_{i,t} + \gamma' \mathbf{X}_{i,t} + \psi_{f,t} + \epsilon_{i,t}, \tag{13}$$

where the dependent variable $\%\ Flow_{i,t+1}$ is the next quarter flow of the fund i. The dummy variable *Top Pumping Effort* is equal to one if the fund is ranked in the top quintile by the measure of *Pumping Effort*. $\mathbf{X}_{i,t}$ is a vector of fund characteristics, including fund performance, return gap, fund size, expense ratio, and turnover ratio. It also includes the proportion of winner and loser stocks, which captures the fund manager's window-dressing incentive. The regression also includes family $\times$ time fixed effects, $\psi_{f,t}$, which captures family-level characteristics and allows for the flow comparison between top pumping funds and other funds within the family.

The result is shown in Table 9. In column (1), the coefficient estimate of *Top Pumping Effort* is significantly positive and economically sizeable. Funds that extensively pump their star funds receive 0.75% more flows than other funds in the family in the subsequent quarter. This effect is after adjusting for funds' performance and other characteristics. Moreover, the effect exists both in retail and institutional share classes, as shown in columns (2) and (3).

The flow subsidization for pumping managers can be explained by the redirection of flows inside a fund family through the advertisement channel, as a fund family makes decisions for resource allocations and advertisement. If this is the case, we should see that pumping managers receive more exclusive advertisements than non-pumping managers within the family. To test the advertising channel, I use fund-level advertisement data and find that funds with high pumping activity indeed get more advertisements in the next quarter. The fund-level advertisement data are from Kaniel and Parham (2017) and cover from 2000 to 2012. Advertisements are typically designed to promote the entire family, but occasionally, a single fund is mentioned in the advertisement. Therefore, for a fund family to be included in the analysis, I require at least one fund in the family to be exclusively mentioned in the advertisements. After matching and merging with my sample, I have 9 fund companies and 48 distinct non-star mutual funds. I then run a set of logistic regressions. The dependent variable is a dummy variable that is equal to one if the fund is mentioned solely in the advertisement in the next quarter. The independent variable of interest is *Top Pumping Effort*, which is a dummy variable that equals one if the fund is in the top quintile of *Pumping Effort*.

Table 10 shows the logistic regression results. The coefficient estimate of *Top Pumping Effort* is positive and significant, which shows that funds with top pumping effort are more likely to get advertisements in the future. Column (2) adds the current quarter advertisement dummy, and column (3) adds the family and style fixed effects. In column (4), I further add a dummy variable *Broker-sold* that is equal to one if the fund is sold by brokers and zero if it is direct-sold by the family. Following Agarwal, Jiang, and Wen (2022), a fund is considered broker-sold if 75% of its assets are in share classes that meet any of the following three criteria: a front-end load, a back-end load, or a 12b-1 fee greater than 25 bps. The coefficient estimate of *Broker-sold* dummy is negative and significant, suggesting that families are more likely to advertise funds that are directly sold by in-house salesforce. The interaction term with *Top*

Pumping Effort is also negative but insignificant, which provides some suggestive indications that the redirection of flows to compensate for pumping effort is more likely for direct-sold funds rather than through brokers.

4.3 Short-term performance distortion of pumping funds

Family-level pumping alters the asset allocation of pumping funds, and they incur unnecessary transaction costs. As a result, we should see that pumping funds underperform non-pumping funds in the family, at least in the short term.

To test this hypothesis, I estimate a set of regressions among all non-star funds, where the dependent variables are the fund's Carhart alphas in the next quarter and the next year, respectively. The independent variables include fund performance and other characteristics, family $\times$ time fixed effects, and style fixed effects. Funds with *Top Pumping Effort* underperform other funds in the family by 5.2 bps in the next quarter, as shown in column (1). The underperformance becomes insignificant over the next year. Given the flow-performance sensitivity estimated in Table 9, the underperformance of 5.2 bps per quarter translates to a small reduction in flows of 0.02% in the next quarter, which is smaller than the pumping benefit of 0.8%.[10] Therefore, in net, funds that pump their star funds extensively receive more flows than other funds in the family. One caveat of this back-of-the-envelope calculation is that it doesn't take into account the potential legal and reputation cost associated with the portfolio pumping.

[10]The reduction in flows of 0.02% is calculated as 0.0052×35.03, which is taken from the coefficient estimate of *Recent Performance* from column (1) of Table 9, where the dependent variable, fund flow, is measured in percentage points.

5 What funds and families are more likely to pump star funds?

Lastly, I study the determinants of portfolio pumping at the fund and family levels. First, it is interesting to see which non-star funds in the family are more likely to engage in portfolio pumping. In Panel A of Table 12, I estimate a set of regressions, where the dependent variable is the dummy *Top Pumping Effort*, which is equal to one if the fund is sorted by *Pumping Effort* into the top quintile. The independent variables include fund characteristics, such as return gap, expense ratio, turnover ratio, fund size, fund age, and past performance. It also includes a dummy variable, *Common Manager*, which is equal to one if the fund shares at least one common manager with the star funds, and zero otherwise. *Outsourced* is a dummy variable that is equal to one if the fund is outsourced. *Inst Share* is the proportion of TNAs in institutional share classes of a fund. The regression also includes family $\times$ time fixed effects, so the estimation focuses on within-family variations in fund characteristics.

Column (1) of Panel A in Table 12 shows the result of the baseline specification. Funds that share a manager with their star funds are 13% more likely to engage in portfolio pumping than other funds in the family, as shown by the positive and significant coefficient estimate of *Common Manager*. The coefficient estimates of *Outsourced* are negative and insignificant, and the coefficient estimates of *Inst Share* are negative and significant at 10% level, suggesting that outsourced funds and funds with high institutional shares and potentially strong governance do not exhibit higher pumping intensity. Funds with high turnover are more likely to pump their star funds. On the one hand, the strong correlation is mechanical to some extent. The pumping measure captures buy orders by non-star funds, weighted by the stock weights in the star fund portfolio. CRSP calculates fund turnover as the minimum of buy dollars and sell dollars, scaled by the portfolio value. As a result, the two measures are positively correlated. On the other hand, we should only expect funds that can actively trade to execute the family-level pumping. For example, closet-index funds need to closely follow their benchmark and should not trade excessively. Both the pumping measure and turnover measure will be very low for these funds.

It is interesting to see whether senior managers are more likely to engage in family-level portfolio pumping. On the one hand, senior managers have more to gain if the pumping turns out to be successful, as they have a larger stake in the firm. They also have more power to pull the strings. On the other hand, senior managers have a high reputation cost of engaging portfolio pumping. Therefore, ex-ante, it is not clear which effects dominate. I measure the fund-level seniority of managers as the tenure of the most senior manager in the fund, denoted as *Maximum Tenure*. I then interact the *Common Manager* dummy with *Maximum Tenure*. Column (2) shows the estimation result. The coefficient estimates of *Maximum Tenure* and the interaction term are negative and significant. That is, funds with senior managers are less likely to pump their sister star funds than junior managers. The result suggests that the reputation cost channel dominates the incentive channel.

Lastly, I examine the determinants of portfolio pumping at the family level. The dependent variable is a dummy variable, *Top Pumping Family*, which is equal to one if the family is ranked by *Family Pumping* measure in the top quintile, and zero otherwise. The independent variables include a set of family characteristics, such as expense ratio, turnover ratio, family size, the number of funds, the proportion of star funds, the fraction of distinct style, the fraction of outsourced funds, and the family's past year performance. To test whether the heavily pumped mutual fund families before 2002 are the ones that employ the strategy of family-level pumping, I calculate the price inflation of star funds at the end of 2002, which is defined as the return difference between the last trading day of 2002 and the first trading day of 2003.

The regression result is reported in Panel B of Table 12. Larger families, both in terms of total net assets and the number of funds, are more likely to engage in portfolio pumping. The coefficient estimate of *proportion of star funds* is negative and weakly significant. That is, fund families with fewer star funds are more likely to engage in portfolio pumping at the family level. The result is consistent with the family strategy literature, where fund families with fewer star funds benefit from the star creation strategy and enjoy the spillover effect. Lastly, families that have greater price inflation prior to 2003 are more likely to engage in portfolio pumping, as shown by the positive and significant coefficient estimate of *Price Inflation in 2002*.

6 Conclusion

The paper contributes to the portfolio pumping literature. Previous literature focuses on portfolio pumping at the fund level. This paper is the first to investigate portfolio pumping strategy at the family level. Under the supervision of the SEC, performance inflation at the turn of quarters has decreased sharply since 2002. However, fund family managers still have the incentive to pump the portfolio of their top funds. Specifically, non-star fund managers buy stocks held by the star funds in the family to pump their portfolios. The strategy can achieve a similar price impact on stocks held by star funds at the quarter end as before, but is more discrete and less likely to be detected by regulators. Star funds in families that heavily employ such a trading strategy show substantial performance inflations even after 2002.

The paper also contributes to the mutual fund flow literature. I find that pumping funds receive more flows than non-pumping funds in the family, suggesting that managers of the fund family may redirect flows to compensate pumping managers. Although pumping results in portfolio distortions and short-term underperformance, the additional flows received by the pumping funds outweigh the cost of underperformance. The finding of flow subsidization for pumping managers also sheds light on agency conflict in delegated portfolio management. Non-star fund managers may not act on behalf of their investors. Instead, they pump stocks held by star funds at the expense of investors.

The paper is important to regulators, as it shows that fund families with relatively fewer top-performing funds and records of performance inflation before 2002 are more likely to pump star funds at the family level. Within a family, funds that share a common manager with star funds are more likely to engage in pumping than other funds.

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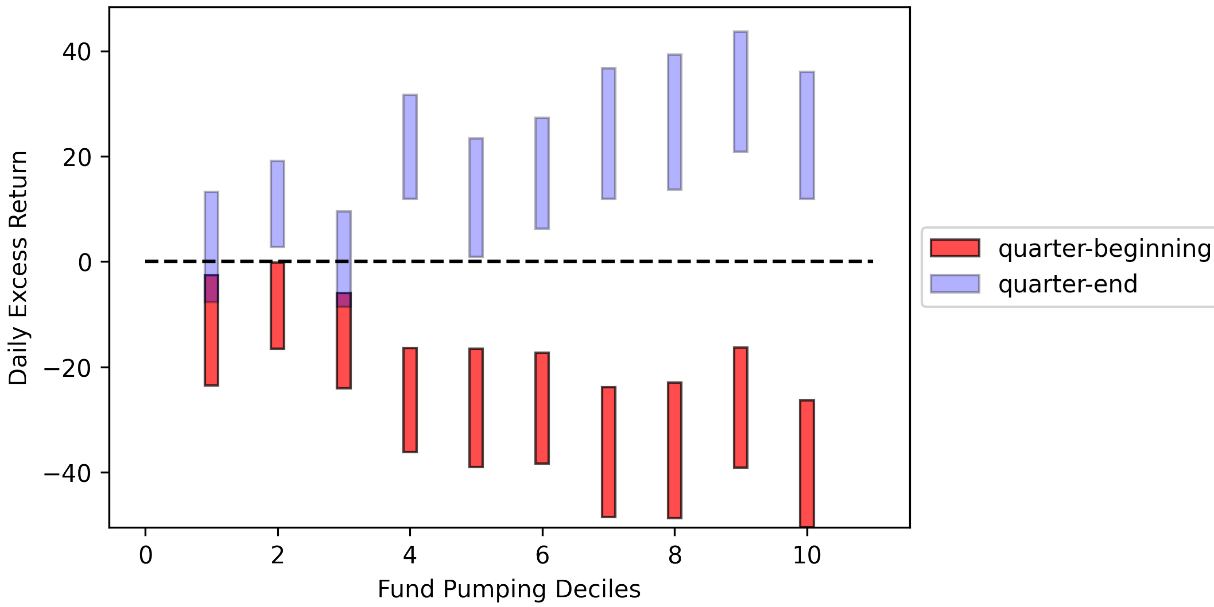
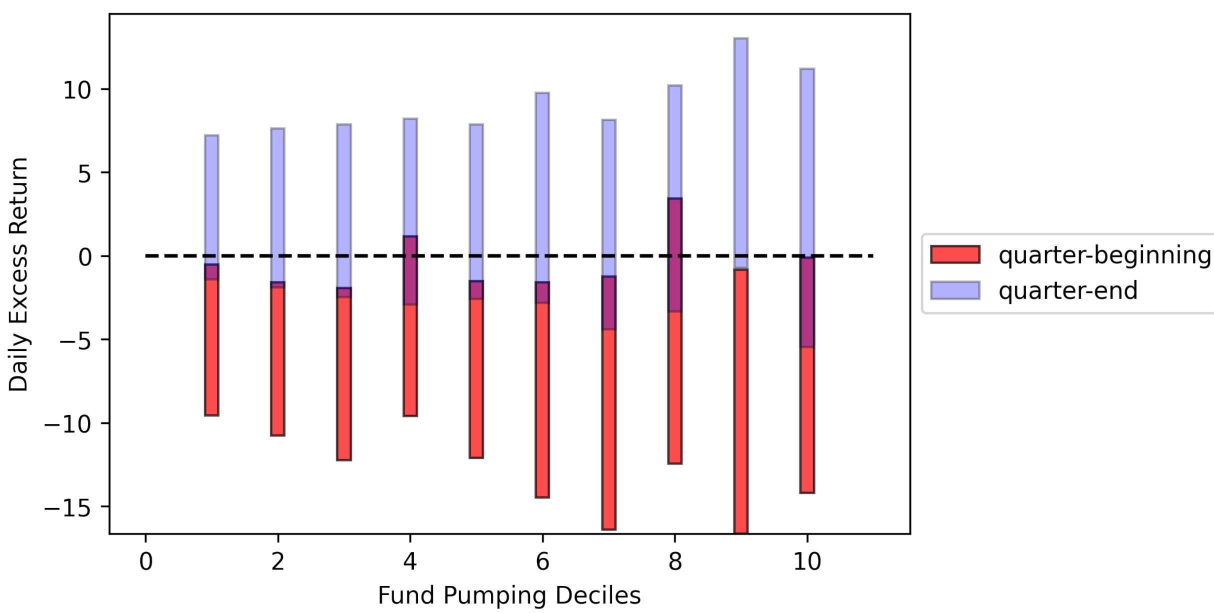
Figure 1

Performance Inflation and Individual Pumping

The figure shows the performance inflation of star funds in mutual fund families at the turn of quarters, sorted by *Fund Support* into deciles. For each decile of *Fund Support*, I construct an equal-weighted portfolio of funds. For each portfolio, I run the regression specification in Equation (6) to capture the inflation at the turn of quarters, and plot the 95% confidence intervals for dummy variables of quarter-end and quarter-beginning.



(a) 1990 - 2002

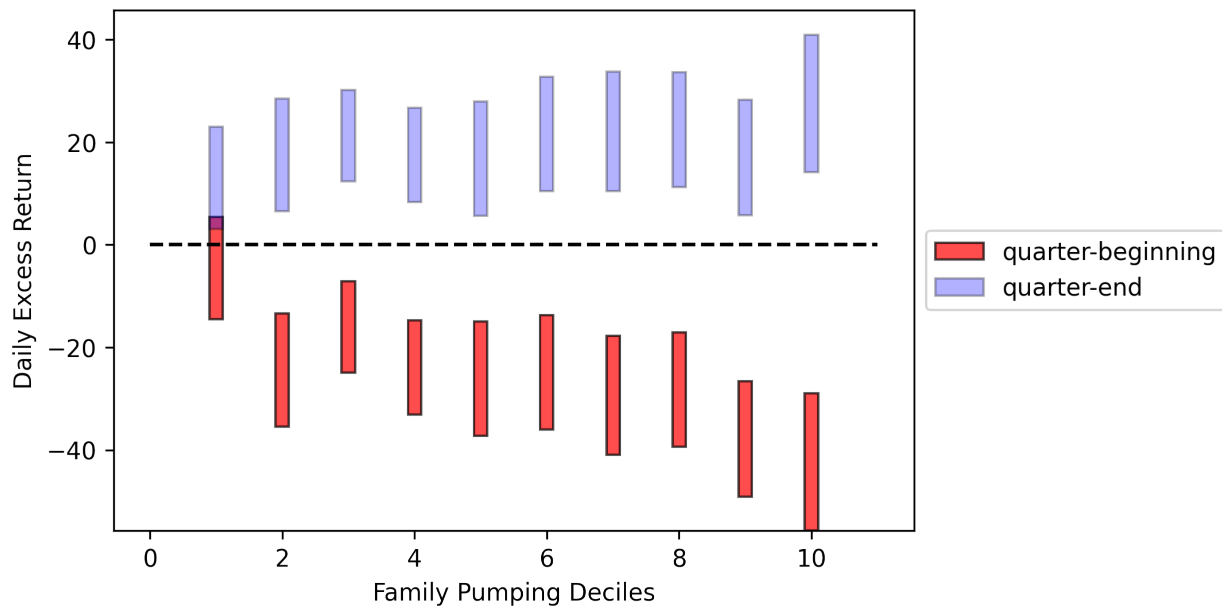


(b) 2003 - 2021

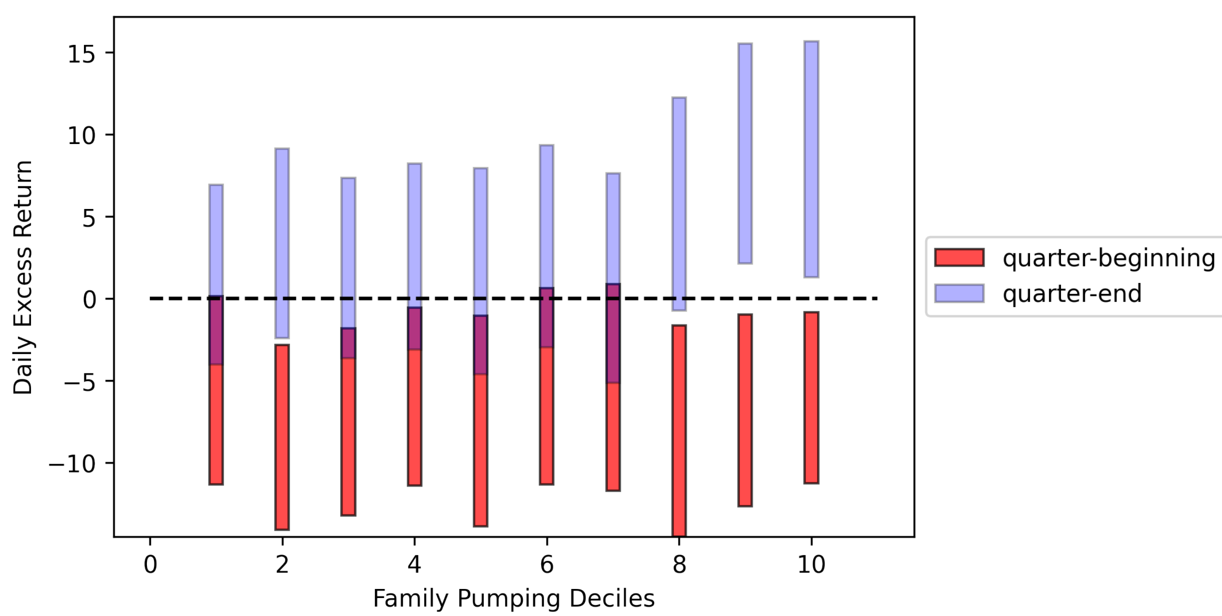
Figure 2

Performance Inflation and Family Pumping

The figure shows the performance inflation of star funds in mutual fund families at the turn of quarters, sorted by *Family Pumping* into deciles. For each decile of *Family Pumping*, I construct an equal-weighted portfolio of funds. For each portfolio, I run the regression specification in Equation (6) to capture the inflation at the turn of quarters, and plot the 95% confidence intervals for dummy variables of quarter-end and quarter-beginning.



(a) 1990 - 2002

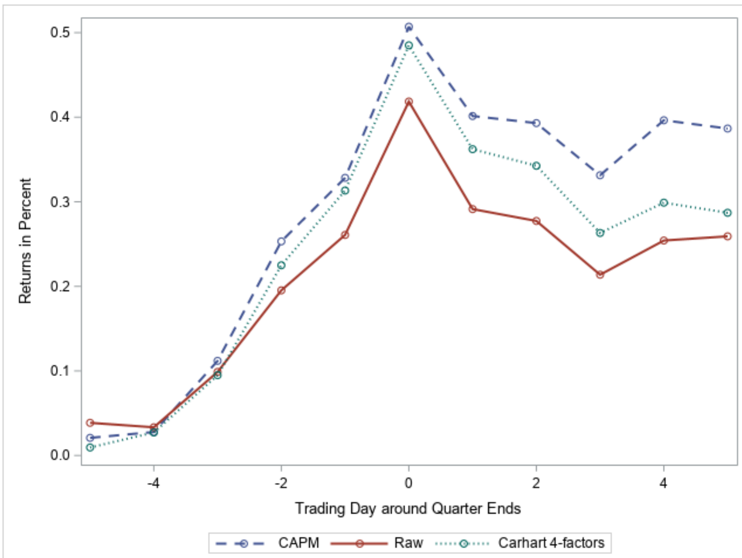


(b) 2003 - 2021

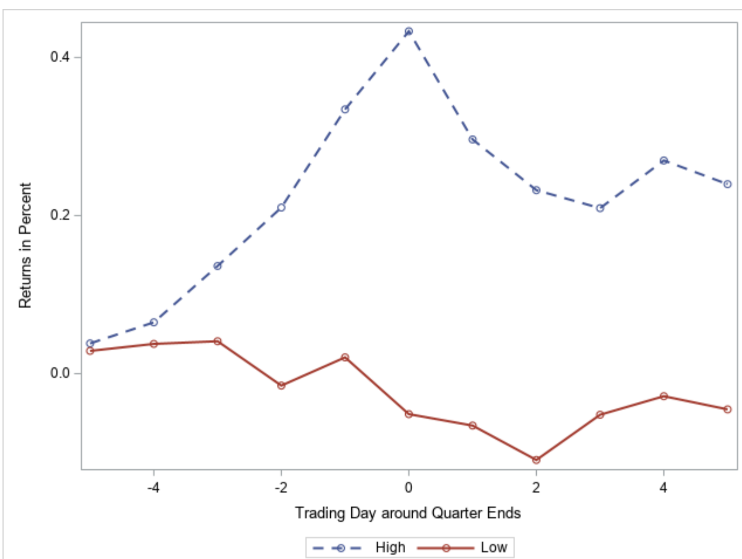
Figure 3

Stock Level Response

The figure shows the stock level response to portfolio pumping at the family level. Stocks are sorted into quintiles by *Pumping Pressure* defined in Equation (8). Panel (a) shows the performance of the long/short portfolio in the one-week trading window around the quarter end by buying stocks in the top quintile and selling stocks in the bottom quintile. The red solid line represents the average cumulative return of the long/short portfolio. The blue dashed line represents the average cumulative abnormal return based on the CAPM model. The green dotted line represents the average cumulative abnormal return based on Carhart's four factors. The factor loadings are estimated over the half-year trading window prior to the quarter end. Panel (b) shows the performance of the top and bottom quintiles separately.



(a) CAR of High minus Low Portfolio



(b) CAR of High and Low portfolios

Figure 4

Stock Intra-day Returns

The figure shows the stock level response to portfolio pumping at the family level. Stocks are sorted into quintiles by *Pumping Pressure* defined in Equation (8). For each group, I use TAQ data to examine the intraday return at the end of each quarter. Q5 is the group with the highest *Pumping Pressure*. The horizontal axis indicates the time of the day, and the vertical axis indicates the cumulative returns in basis points.

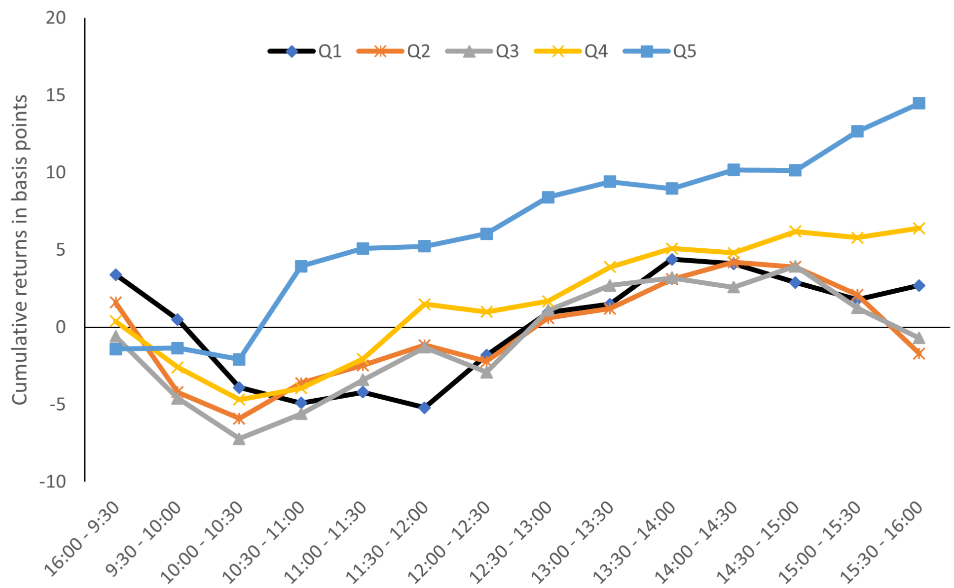


Figure 5
Pumping Outside Family
The figure tests an alternative explanation for family-level pumping. Star funds outside the family are sorted by *Outside Family Pumping* into deciles. For each decile, I construct an equal-weighted portfolio of funds. For each portfolio, I run the regression specification (6) to capture the inflation at the turn of quarters and plot the 95% confidence intervals for dummy variables of quarter-end and beginning.

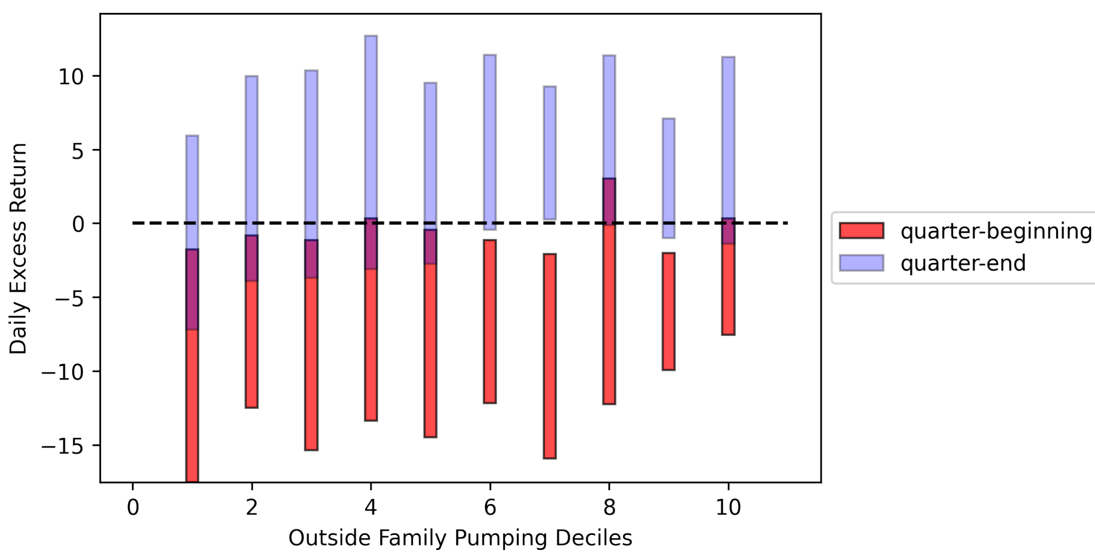


Table 1
Summary Statistics

The table reports the summary statistics of main variables. The sample includes all domestic equity funds from 1990 to 2021. The data are recorded on a fund-quarter level. *Fund Expense* and *Fund Turnover* are the fund-level annual expense ratio and turnover ratio from CRSP, respectively. *Fund TNA* is the fund level total asset managed at the quarter end. *Percent Flow* is the dollar flow normalized by the previous quarter's TNA. *Return Gap* is the 12-month moving average of the return gap defined in Kacperczyk et al. (2008). *Carhart Alpha* is calculated using Carhart (1997) four-factor model and a 24-month rolling regression. *Fund Age* is the number of years between the fund inception date provided by the CRSP and the observation date. *Winner Prop* is the proportion of winner stocks held by the fund. *Loser Prop* is the proportion of loser stocks held by the fund. Winner (loser) stocks are the top (bottom) quintile stocks sorted by the past-quarter performance. *Common Manager* is a dummy variable, which is equal to one if the fund shares at least one common manager with the star funds in the fund family. *Pumping Effort* captures the extent of a non-star fund pump for star funds in the family, and is constructed following Equation (12). *Number of Funds in Family* is the number of funds in the fund family. *Family Expense Ratio* and *Turnover Ratio* are the TNA-weighted expense ratio and turnover ratio of all funds in the family, respectively. *Family TNA* is the sum of TNAs in the family. *Inst Share* is the fraction of TNAs in institutional share classes. *Family Pumping* captures the extent of family-level pumping activity, and is constructed following Equation (3). *Fund Pumping* captures the extent of star funds pumping for themselves, and is constructed following Equation (4). *Outside Family Pumping* is constructed following Equation (10).

Variable	Mean	Std. Dev.	Min	Max	P25	P50	P75
Fund Level Summary Statistics							
Fund Expense	0.012	0.004	0.001	0.048	0.009	0.012	0.014
Fund Turnover	0.833	0.715	0.025	6.84	0.35	0.65	1.08
TNA	1204.89	3097.85	1.2	52696.4	69.5	255.6	930.1
Percent Flow	0.018	0.235	-0.681	1.125	-0.041	-0.009	0.038
Return Gap	-0.002	0.039	-0.398	0.348	-0.016	-0.003	0.011
Carhart Alpha	-0.003	0.033	-0.204	0.262	-0.019	-0.003	0.013
Net Return	0.024	0.104	-0.407	0.756	-0.024	0.032	0.083
Fund Age	12.17	10.25	2	63.92	4.75	9.42	16.75
Winner Prop	0.241	0.134	0	0.818	0.142	0.228	0.324
Loser Prop	0.107	0.073	0	0.677	0.051	0.096	0.149
Common Manager	0.369	0.482	0	1	0	0	1
Pumping Effort	0.051	0.075	0	0.518	0.007	0.023	0.061
Family Level Summary Statistics							
Number of Funds	5.413	10.21	1	69	1	2	6
Family Expense Ratio	0.012	0.005	0.006	0.043	0.01	0.012	0.015
Family Turnover Ratio	0.737	0.821	0.0065	4.147	0.286	0.52	0.886
Family TNA	5123	14090	5.7	216365	49.3	230.2	1565.6
Inst Share	0.619	0.349	0	1	0.291	0.811	1
Family Pumping	0.051	0.125	0	0.927	0	0	0.016
Fund Pumping	0.127	0.412	0	2.511	0.002	0.014	0.087
Outside Family Pumping	0.016	0.071	0	0.514	0	0	0.009

Table 2
Portfolio Pumping at Family Level

The table tests whether family-level portfolio pumping exists in mutual fund families after 2002. The dependent variables are the weighted daily return of star funds in mutual fund families, net of either market return or style return in basis points. I calculate the *Family Pumping* as the sum of products between the purchase of each stock made by all non-star funds in the family, and the weight of the corresponding stock held by the star funds, normalized by the stock's trading volume (detailed construction in Equation (3)). The dummy variable *Top Pumping Family* is equal to one if the *Family Pumping* is in the top quintile, and zero otherwise. $YEND_t$ is 1 if it is the last trading day of December. $YBEG_t$ is 1 if $YEND_{t-1}$ is 1. $QEND_t$ is 1 if it is the last trading day of March, June, or September, and $QBEG_t$ is 1 if $QEND_{t-1}$ is 1. *MEND* is 1 if it is the last trading day of January, February, April, May, July, August, October, or November. $MBEG_t$ is 1 if $MEND_{t-1}$ is 1. I regress the excess return of fund families on these dummy variables and their interaction terms. Standard errors are two-way clustered at family and time levels.

	2003 - 2021		1990 - 2002	
	(1)	(2)	(3)	(4)
	$Excess\ Return^{Market}$	$Excess\ Return^{Style}$	$Excess\ Return^{Market}$	$Excess\ Return^{Style}$
Top Pumping Family × YEND	4.472*	4.443***	1.019	-1.552
	(1.91)	(2.60)	(0.42)	(1.26)
Top Pumping Family × QEND	3.638**	3.192**	-1.481	-2.281
	(2.20)	(2.29)	(-1.25)	(-0.67)
Top Pumping Family × MEND	2.001*	1.065	5.024*	3.141
	(1.78)	(1.08)	(1.71)	(1.30)
Top Pumping Family × YBEG	-1.842	-4.291	-6.187	-5.701*
	(-0.52)	(-1.43)	(-1.58)	(-1.88)
Top Pumping Family × QBEG	-0.214	-1.242	-1.475	-1.361
	(-0.15)	(-0.82)	(-1.15)	(-1.02)
Top Pumping Family × MBEG	-0.444	-0.392	0.498	-0.437
	(-0.44)	(-0.43)	(0.21)	(-0.22)
Time Fixed Effects	Y	Y	Y	Y
N	729094	729094	290851	290851
Adjusted R^2	0.160	0.047	0.230	0.078

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3
Which Star Funds Benefit from Family-level Pumping?

The table shows which star funds within the *Top Pumping Family* are more likely to benefit from the family-level pumping. Within families with top quintile *Family Pumping* measure, star funds are sorted by either the first two months of returns, first two months of flows, or past-year returns into two groups within their Morningstar style category. I then regress the fund's return in excess of the market on the time dummies for each group. Standard errors are two-way clustered at fund and time levels.

	2-Month Return		2-Month Flow		11-Month Return	
	(1)	(2)	(3)	(4)	(5)	(6)
	Low	High	Low	High	Low	High
Year End	9.812***	-2.837	5.616**	1.316	5.317**	1.607
	(3.03)	(-1.61)	(2.48)	(0.56)	(2.41)	(0.87)
Quarter End	7.970***	5.390***	8.358***	5.012***	6.776***	6.543***
	(6.44)	(5.59)	(5.88)	(5.79)	(5.03)	(6.79)
Month End	3.683*	6.494***	5.709***	4.458***	3.567***	5.590***
	(1.95)	(6.43)	(4.57)	(3.04)	(2.60)	(5.05)
Year Beg	-10.02***	-16.57***	-13.02***	-13.85***	-12.73***	-13.93***
	(-3.52)	(-6.03)	(-4.68)	(-4.75)	(-4.94)	(-4.90)
Quarter Beg	-3.659*	-3.660***	-3.713***	-3.691***	-4.824***	-2.771**
	(-1.93)	(-3.37)	(-2.68)	(-2.72)	(-3.25)	(-2.21)
Month Beg	0.508	-1.457	1.406*	-0.186	0.598	0.596
	(0.58)	(-0.84)	(1.73)	(-0.22)	(0.68)	(0.72)
N	114595	125779	114812	116700	109714	117229
Adjusted R^2	0.001	0.002	0.001	0.001	0.001	0.001

t statistics in parentheses

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

Table 4
Family-level Pumping Evidence from Ancerno Trading

This table shows family-level pumping using Ancerno trading data at the family-stock-day level. The dependent variable is the number of shares of stock s traded by family f at day t, scaled by the stock's total daily volume from CRSP and in basis points. The independent variables include a dummy indicator *Top Pumping Family* that equals one if family f is ranked in the top quintile based on the pumping measure in the quarter, a dummy indicator *Last Three Day* that equals one if day t is in the last three trading days of the quarter, and their interaction term. The regression controls for stock $\times$ date fixed effects and family $\times$ quarter fixed effects. Columns (1) and (2) use the sample of stocks that are held by the star funds in a family. Column (3) uses the sample of stocks not in star funds' holdings as a falsification test. Moreover, column (1) uses all star funds' holdings, and column (2) uses stocks that have above-median weights in star funds' holdings. Standard errors are two-way clustered at family and time levels. The Ancerno data cover the sample period between 1999 and 2010.

	Dependent Variable: Daily Order Imbalance / Total Volume		
	Star Fund Holdings		Non-star Fund
	All Holdings	Above-median Holdings	Holdings
	(1)	(2)	(3)
Last Three Day $\times$ Top Pumping Family	22.78*	42.63**	1.523
	(1.83)	(2.46)	(0.37)
Family X Qtr Fixed Effects	Y	Y	Y
Stock X Date Fixed Effects	Y	Y	Y
N	338489	163653	2818049
Adjusted R^2	0.0662	0.0598	0.0227

t statistics in parentheses

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

Table 5
Subsequent Quarter Trading

This table shows evidence of the subsequent quarter's selling of pumped stocks by families that engage in family-level pumping. The dependent variable in columns (1) and (3) is a dummy variable equal to one if the family sells the stock in the subsequent quarter and zero otherwise. The dependent variables in columns (2) and (4) are denoted as *Trade*, which is the number of shares traded by the family in the subsequent quarter, scaled by the stock's number of shares outstanding and in basis points. The independent variables include a dummy indicator *Top Pumping Family* that equals one if family f is ranked in the top quintile based on the pumping measure in the quarter, a dummy indicator *Qtr-End Purchase* that equals one if the family purchased the stock in the last three days of the quarter, and their interaction term. The regression controls for stock $\times$ quarter fixed effects and family $\times$ quarter fixed effects. Columns (1) and (2) use the sample of stocks that are held by the star funds in a family. Columns (3) and (4) use the sample of stocks not in star funds' holdings as a falsification test. Standard errors are two-way clustered at family and time levels.

	Star Fund Holdings		Non-star Fund Holdings	
	(1)	(2)	(3)	(4)
	Sell	Trade	Sell	Trade
Qtr-End Purchase X Top Pumping Family	0.0932***	-15.81***	0.0172	0.174
	(3.60)	(-3.27)	(0.63)	(0.08)
Family X Quarter Fixed Effects	Y	Y	Y	Y
Stock X Quarter Fixed Effects	Y	Y	Y	Y
N	19821	19821	181637	181637
Adjusted R^2	0.0969	0.141	0.159	0.157

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6
Stock-level Regressions

This table shows results from stock-level regressions. In column (1), the dependent variable is the *Pumping Pressure* defined in Equation (8). In columns (2) to (7), the dependent variables are stock returns/alphas at the quarter end and quarter beginning, respectively. The independent variable *Top Pumping Pressure* is equal to one if the stock is ranked in the top quintile in a quarter by *Pumping Pressure*, and zero otherwise. The regressions also control the natural logarithm of market capitalization, book-to-market ratio, return on assets, leverage, net income ratio, past month returns, past quarter returns, and past year returns. The regressions also include time fixed effects. Standard errors are two-way clustered at stock and time levels.

	(1) Pumping Pressure	(2) QEND Excess Return	(3) QEND CAPM Alpha	(4) QEND FF4 Alpha	(5) QBEG Excess Return	(6) QBEG CAPM Alpha	(7) QBEG FF4 Alpha
Top Pumping Pressure		0.172***	0.198***	0.158***	-0.0686	-0.0913	-0.133**
		(3.56)	(4.57)	(4.57)	(-0.93)	(-1.50)	(-2.52)
Log(Market Cap)	-0.00311	-0.0538	-0.0527	0.0177	0.0851**	0.100***	0.0132
	(-0.40)	(-1.56)	(-1.64)	(1.29)	(2.19)	(2.82)	(0.79)
Book-to-market	-0.0357***	0.105	0.108	0.0808	0.130	0.0797	0.107*
	(-3.19)	(1.27)	(1.38)	(1.58)	(1.27)	(0.95)	(1.83)
ROA	0.298***	-0.816	0.181	-0.771	-0.00963	-0.0354	-0.396
	(2.91)	(-0.74)	(0.15)	(-1.01)	(-0.01)	(-0.03)	(-0.39)
Leverage	-0.00284**	-0.0183*	-0.0151*	-0.0126*	0.0152	0.0152	0.00272
	(-2.33)	(-1.74)	(-1.71)	(-1.91)	(1.22)	(1.08)	(0.23)
Net Income Ratio	-0.00643	-0.125	-0.254*	-0.156	0.0522	0.139	0.191
	(-0.28)	(-0.90)	(-1.74)	(-1.58)	(0.28)	(0.91)	(1.36)
past Month Return	0.0172	-0.0701	0.0314	-1.291**	0.720	0.599	-0.685
	(0.67)	(-0.05)	(0.02)	(-2.30)	(0.63)	(0.75)	(-0.89)
Past Quarter Return	0.0210	-0.907*	-0.641	-0.321	-0.474	-0.516	0.156
	(1.00)	(-1.75)	(-1.32)	(-1.17)	(-0.56)	(-0.75)	(0.28)
Past Year Return	-0.0230**	0.535*	0.449*	0.363***	-0.124	-0.136	0.0860
	(-2.55)	(1.87)	(1.87)	(3.84)	(-0.54)	(-0.74)	(0.76)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	109112	109112	109112	109112	109112	109112	109112
Adjusted R^2	0.066	0.039	0.030	0.014	0.036	0.032	0.015

t statistics in parentheses

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

Table 7

Stock-level Price Impact at the Quarter End

This table shows the price impact of pumped stocks at the quarter end. The dependent variables are the price impact measure from Lee and Ready (1991), estimated using the TAQ data at the quarter end. The independent variable in columns (1) and (3) is *Top Pumping Pressure*, which is equal to one if the stock is ranked in the top quintile in a quarter by *Pumping Pressure* (as defined in Equation (7)), and zero otherwise. The independent variable in columns (2) and (4) is *Pumping Pressure*. The regressions also control the natural logarithm of market capitalization, book-to-market ratio, and prior quarter Amihud ratio. All regressions include time fixed effects. Regressions in columns (3) and (4) also include stock fixed effects. Standard errors are two-way clustered at stock and time levels.

	Dependent Variable = Price Impact			
	(1)	(2)	(3)	(4)
Top Pumping Pressure	0.877***		0.417***	
	(5.31)		(3.25)	
Pumping Pressure		0.671***		0.225**
		(4.62)		(2.17)
Stock Controls	Y	Y	Y	Y
Stock Fixed Effects	N	N	Y	Y
Time Fixed Effects	Y	Y	Y	Y
N	105229	105229	105229	105229
Adjusted R^2	0.264	0.264	0.420	0.420

t statistics in parentheses

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

Table 8
Flows of Star Funds

The table shows flows of star funds in the next quarter as a result of family-level pumping. The sample includes star funds with a Morningstar rating of four or five. The dummy variable *Top Pumping Family* is equal to one if the *Family Pumping* is in the top quintile, and zero otherwise. *Recent Performance* is the fund's Carhart alpha in the quarter, excluding the last week. *Past Year Performance* is the fund's Carhart alpha from quarter t-4 to quarter t-1. *Winner Prop* is the proportion of winner stocks held by the star fund at the end of the quarter. *Loser Prop* is the proportion of loser stocks held by the star fund at the end of the quarter. Winner (loser) stocks are the top (bottom) quintile stocks sorted by the past-quarter performance. *Return Gap*$_{t-1}$ is the lag of the 12-month moving average of the return gap defined in Kacperczyk et al. (2008). *Fund Expense* and *Fund Turnover* are the fund-level annual expense ratio and turnover ratio, respectively. *Fund Size* is the natural logarithm of the fund's total net assets. *Fund Age* is the natural logarithm of the fund's age since inception.

	(1) Flow$_{t+1}$	(2) Flow$_{t+1}$	(3) Flow$_{t+1}$
Top Pumping	0.935***	0.677**	0.487**
	(2.84)	(2.15)	(2.06)
Top Pumping × Year End			0.714*
			(1.94)
Recent Performance		26.16***	26.16***
		(6.29)	(6.29)
Past Year Performance		15.66***	15.66***
		(6.48)	(6.48)
Winner Prop		-0.0582	-0.0558
		(-0.06)	(-0.06)
Loser Prop		-4.612***	-4.614***
		(-3.12)	(-3.12)
Return Gap		8.627**	8.629**
		(2.13)	(2.10)
Fund Expense		-40.69	-40.67
		(-1.09)	(-1.09)
Fund Turnover		-0.335*	-0.335*
		(-1.79)	(-1.79)
Fund Size		-0.0627	-0.0627
		(-0.99)	(-0.99)
Fund Age		-1.087***	-1.087***
		(-5.95)	(-5.95)
Flow		0.975***	0.975***
		(24.95)	(24.95)
Style × Time Fixed Effects	Y	Y	Y
N	19046	17115	17115
Adjusted R^2	0.076	0.337	0.337

t statistics in parentheses

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

Table 9
Flows of Non-star Funds

The table studies whether non-star funds receive more flows for pumping their star funds in the family. The sample includes all non-star funds in the fund family. The Dependent variable in all specifications is the fund's next quarter flow. The dummy *Top Pumping Effort* is equal to one if the fund is ranked in the top quintile of *Pumping Effort*. *Recent Performance* is the fund's Carhart alpha in the quarter. *Past Year Performance* is the fund's Carhart alpha from quarter t-4 to quarter t-1. *Winner Prop* is the proportion of winner stocks held by fund i at the end of the quarter t. *Loser Prop* is the proportion of loser stocks held by fund i at the end of the quarter t. Winner (loser) stocks are the top (bottom) quintile stocks sorted by the past-quarter performance. *Return Gap* is the lag of the 12-month moving average of the return gap defined in Kacperczyk et al. (2008). *Fund Expense* and *Fund Turnover* are the fund-level annual expense ratio and turnover ratio, respectively. *Fund Size* is the natural logarithm of the fund's total net assets. *Fund Age* is the natural logarithm of the fund's age since inception. All specifications include family × time fixed effects and style fixed effects, and all standard errors are two-way clustered at time and family levels.

	(1)	(2)	(3)
	$Flow_{t+1}$	$Retail\ Flow_{t+1}$	$Inst\ Flow_{t+1}$
Top Pumping Effort	0.754*	0.585**	1.671*
	(1.92)	(2.54)	(1.94)
Recent Performance	35.03***	39.26***	54.03
	(9.95)	(6.74)	(1.04)
Past Year Performance	34.78***	33.93***	85.53**
	(12.15)	(9.98)	(2.18)
Winner Prop	5.115***	6.729***	-146.7
	(2.93)	(3.10)	(-0.97)
Loser Prop	-4.852***	-4.141**	-30.84
	(-2.67)	(-2.02)	(-1.10)
Return Gap	9.552***	13.71***	16.62**
	(3.07)	(3.43)	(1.99)
Fund Expense	0.470	-3.862***	-10.94
	(1.10)	(-3.94)	(-0.95)
Fund Turnover	-0.355*	-0.243	-30.44
	(-1.89)	(-0.96)	(-1.03)
Fund Size	-0.340***	-0.780***	16.07
	(-3.93)	(-5.48)	(1.11)
Fund Age	-1.215***	-1.902***	32.41
	(-6.48)	(-7.37)	(0.99)
Flow	0.162**	0.161***	0.187***
	(2.21)	(4.52)	(8.13)
Family × Time Fixed Effects	Y	Y	Y
Style Fixed Effects	Y	Y	Y
N	48207	44711	38374
Adjusted R^2	0.292	0.205	0.176

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 10
Advertisement and Pumping Activity

The table shows the relation between the next quarter's advertisement exposure for a fund and its current quarter pumping activity. Advertisement data are obtained from Kaniel and Parham (2017) and cover a sample period between 2000 and 2012. I require at least one fund in the family to be exclusively mentioned in the advertisements. After matching and merging with the main sample, I have 9 fund companies and 48 distinct non-star mutual funds. The dependent variable Ad_{t+1} equals one if the fund has advertisement exposure in the next quarter. The dummy *Top Pumping Effort* equals one if the fund is ranked in the top quintile of *Pumping Effort*. A fund is considered broker-sold if 75% of its assets are in share classes that meet any of the following three criteria: a front-end load, a back-end load, or a 12b-1 fee greater than 25 bps. I run a set of logistic regression of Ad_{t+1} dummy on *Top Pumping Effort* dummy, controlling for fund and family characteristics. Standard errors are clustered at the family level.

	(1)	(2)	(3)	(4)
	Ad_{t+1}	Ad_{t+1}	Ad_{t+1}	Ad_{t+1}
Top Pumping Effort	0.634*	0.629*	0.850*	1.197**
	(1.81)	(1.77)	(1.86)	(2.42)
Broker-sold				-1.907***
				(-2.67)
Top Pumping Effort × Broker-sold				-0.735
				(-0.95)
Fund Size	0.0583	0.0582	0.161	0.248
	(0.39)	(0.38)	(0.54)	(0.86)
Fund Expense	-57.23	-57.83	-134.8	-49.32
	(-0.78)	(-0.77)	(-0.72)	(-0.30)
Fund Turnover	0.500	0.428	0.0620	0.242
	(0.02)	(0.02)	(0.22)	(0.77)
Past Year Performance	4.831	4.871	5.035	5.165
	(1.22)	(1.21)	(1.19)	(1.20)
Ad		-0.0848	-0.502	-0.516
		(-0.13)	(-0.79)	(-0.86)
Family Fixed Effects	N	N	Y	Y
Style Fixed Effects	N	N	Y	Y
N	345	345	329	329
Pseudo R^2	0.102	0.114	0.271	0.274

t statistics in parentheses

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

Table 11
Future Performance of Pumping Funds

The table shows the future performance of non-star funds. The dependent variables in columns (1) and (2) are the fund's Carhart alpha in the next quarter and year, respectively. The dummy *Top Pumping Effort* is equal to one if the fund is sorted into the top quintile of *Pumping Effort*. *Recent Performance* is the fund's Carhart alpha in the quarter. *Past Year Performance* is the fund's Carhart alpha from quarter t-4 to quarter t-1. *Winner Prop* is the proportion of winner stocks held by fund i at the end of the quarter t. *Loser Prop* is the proportion of loser stocks held by fund i at the end of the quarter t. Winner (loser) stocks are the top (bottom) quintile stocks sorted by the past-quarter performance. *Return Gap* is the lag of the 12-month moving average of the return gap defined in Kacperczyk et al. (2008). *Fund Expense* and *Fund Turnover* are the fund-level annual expense ratio and turnover ratio, respectively. *Fund Size* is the natural logarithm of the fund's total net assets. *Fund Age* is the natural logarithm of the fund's age since inception. All specifications control for family × time fixed effects and style fixed effects. Standard errors are two-way clustered at family and time levels.

	(1) $Alpha_{t+1}$	(2) $Alpha_{t+1,t+4}$
Top Pumping Effort	-0.0515*	-0.117
	(-1.85)	(-0.87)
Recent Performance	0.885	7.116***
	(0.95)	(3.36)
Past Year Performance	2.043***	2.264*
	(4.04)	(1.75)
Winner Prop	0.0898	-2.576***
	(0.31)	(-4.71)
Loser Prop	-1.288***	-0.0300
	(-3.35)	(-0.03)
Return Gap	2.401*	7.958***
	(1.85)	(2.96)
Fund Expense	-25.14***	-68.72***
	(-2.86)	(-2.65)
Fund Turnover	-0.0535	-0.0835
	(-1.10)	(-0.66)
Fund Size	-0.0415***	-0.147***
	(-2.82)	(-3.11)
Fund Age	0.00976	0.0148
	(0.34)	(0.19)
Flow	-0.00153*	0.00371
	(-1.80)	(1.12)
Family × Time Fixed Effects	Yes	Yes
Style Fixed Effects	Yes	Yes
N	45898	45664
Adjusted R^2	0.239	0.277

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 12
Determinants of Family-level Pumping

The table studies the determinants of family-level pumping activities. Panel A studies the fund-level determinants, where the sample includes all non-star funds in mutual fund families. Funds are sorted by *Pumping Effort* into quintiles, and *Top Pumping Effort* is a dummy variable that equals one if the fund is in the top quintile. *Common Manager* is a dummy variable, which is equal to one if the fund shares at least one common manager with the star funds of the family. *Max Tenure* is the tenure of the most senior manager in the fund. *Outsourced* is a dummy variable, which is equal to one if the fund is outsourced. *Inst Share* is the proportion of TNAs in institutional share classes of a fund. The regression includes family × time fixed effects and style fixed effects. Panel B studies the family-level determinants, where the dependent variable *Top Pumping Family* is equal to one if the family is sorted in the top quintile by the measure of *Family Pumping*. *Proportion of Star Funds* is the fraction of TNAs of star funds in the family. *Distinct Style* is the number of unique styles, scaled by the total number of funds in the family. *Fraction of Outsourced Funds* is the fraction of outsourced funds. *Past Year Performance* is the weighted average of funds' Carhart alpha over the past year in the family. *Price Inflation in 2002* is the return difference of star funds in the family between the last trading day of 2002 and the first trading day of 2003. All standard errors are clustered at the family level.

Panel A: Fund-Level Determinants

	(1) Top Pumping Effort	(2) Top Pumping Effort
Common Manager	0.134***	0.152***
	(6.53)	(5.22)
Max Tenure		-0.00291**
		(-2.44)
Common Manager × Max Tenure		-0.00488*
		(-1.79)
Out Source	-0.000799	-0.00115
	(-0.06)	(-0.09)
Inst Share	-0.00967*	-0.00943*
	(-1.75)	(-1.80)
Return Gap	0.0725	0.0648
	(0.89)	(0.80)
Fund Expense	-2.723*	-2.600
	(-1.68)	(-1.62)
Fund Turnover	0.0934***	0.0921***
	(10.08)	(10.11)
Fund Size	0.00203	0.00467
	(0.58)	(1.29)
Past Year Performance	0.0705	0.0670
	(1.15)	(1.08)
Fund Age	0.0128	0.0125
	(1.41)	(1.55)
Family × Time Fixed Effects	Y	Y
Style Fixed Effects	Y	Y
N	41898	41898
Adjusted R^2	0.222	0.222

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel B: Family-Level Determinants

	(1) Top Pumping Family
Family Expense	7.348
	(1.56)
Family Turnover	0.0155
	(0.63)
Family Size	0.0735***
	(6.76)
Number of Funds	0.00584**
	(1.97)
Proportion of Star Funds	-0.270*
	(-1.82)
Distinct Style	-0.0156
	(-0.16)
Fraction of Outsourced Funds	0.0121*
	(1.89)
Past Year Performance	0.299**
	(1.98)
Price Inflation in 2002	0.0263*
	(1.78)
Time Fixed Effects	Y
N	10748
Adjusted R^2	0.162

Internet Appendix

Table IA1
Portfolio Pumping at Family Level: Alternative Star Fund Definition

The table tests whether family-level portfolio pumping exists in mutual fund families after 2002, using two alternative star fund definitions. In columns (1) and (2), star funds are identified as funds with the highest Morningstar rating in the family. In columns (3) and (4), star funds are identified as funds with top quintile past-year Carhart alpha (excluding the most recent month). The dependent variables are the weighted daily return of star funds in mutual fund families, net of either market return or style return in basis points. I calculate the *Family Pumping* as the sum of products between the purchase of each stock made by all non-star funds in the family, and the weight of the corresponding stock held by the star funds, normalized by the stock's trading volume (detailed construction in Equation (3)). The dummy variable *Top Pumping Family* is equal to one if the *Family Pumping* is in the top quintile, and zero otherwise. $YEND_t$ is 1 if it is the last trading day of December. $YBEG_t$ is 1 if $YEND_{t-1}$ is 1. $QEND_t$ is 1 if it is the last trading day of March, June, or September, and $QBEG_t$ is 1 if $QEND_{t-1}$ is 1. $MEND$ is 1 if it is the last trading day of January, February, April, May, July, August, October, or November. $MBEG_t$ is 1 if $MEND_{t-1}$ is 1. I regress the excess return of fund families on these dummy variables and their interaction terms. Standard errors are two-way clustered at family and time levels.

	MS rating with all families		Past-year Performance	
	(1)	(2)	(3)	(4)
	$Excess\ Return^{Market}$	$Excess\ Return^{Style}$	$Excess\ Return^{Market}$	$Excess\ Return^{Style}$
Top Pumping Family × YEND	5.361**	5.147***	4.652**	4.884**
	(2.14)	(2.69)	(2.26)	(2.11)
Top Pumping Family × QEND	3.962**	3.840**	3.713**	3.335**
	(2.06)	(1.97)	(1.99)	(2.15)
Top Pumping Family × MEND	2.002*	1.011	2.364*	1.145
	(1.92)	(0.79)	(1.82)	(0.77)
Top Pumping Family × YBEG	-2.019	-4.002	-3.117*	-4.412
	(-1.34)	(-1.59)	(-1.86)	(-1.61)
Top Pumping Family × QBEG	-1.051	-1.466	-1.193	-1.652
	(-1.61)	(-1.08)	(-1.21)	(-1.34)
Top Pumping Family × MBEG	-0.327	-0.355	-0.421	-0.433
	(-0.51)	(-0.49)	(-0.48)	(-0.39)
Time Fixed Effects	Y	Y	Y	Y
N	753218	753218	761682	761682
Adjusted R^2	0.152	0.040	0.151	0.041

Table IA2

Portfolio Pumping at Family Level: Alternative Family Pumping Definition

The table tests whether family-level portfolio pumping exists in mutual fund families after 2002, using three alternative family pumping definitions. In columns (1) and (2), the stock weights of star funds in the current quarter are used to calculate *Family Pumping*. In columns (3) and (4), *Family Pumping* measure is scaled by the stock's quarter-end volume instead of the total volume in the quarter. In columns (5) and (6), *Family Pumping* measure is scaled by the stock's number of shares outstanding instead of the total volume in the quarter. The dependent variables are the weighted daily return of star funds in mutual fund families, net of either market return or style return in basis points. I calculate the *Family Pumping* as the sum of products between the purchase of each stock made by all non-star funds in the family, and the weight of the corresponding stock held by the star funds, normalized by the stock's trading volume (detailed construction in Equation (3)). The dummy variable *Top Pumping Family* is equal to one if the *Family Pumping* is in the top quintile, and zero otherwise. $YEND_t$ is 1 if it is the last trading day of December. $YBEG_t$ is 1 if $YEND_{t-1}$ is 1. $QEND_t$ is 1 if it is the last trading day of March, June, or September, and $QBEG_t$ is 1 if $QEND_{t-1}$ is 1. *MEND* is 1 if it is the last trading day of January, February, April, May, July, August, October, or November. $MBEG_t$ is 1 if $MEND_{t-1}$ is 1. I regress the excess return of fund families on these dummy variables and their interaction terms. Standard errors are two-way clustered at family and time levels.

	Star Weight in Current Quarter		Scale by Quarter-end Volume		Scale by Shares Outstanding	
	(1)	(2)	(3)	(4)	(5)	(6)
	Excess Return^{Market}	*Excess Return*^{Style}	*Excess Return*^{Market}	*Excess Return*^{Style}	*Excess Return*^{Market}	*Excess Return*^{Style}
Top Pumping Family × YEND	5.244*	4.968***	6.454**	5.099*	6.626***	5.273***
	(1.94)	(3.34)	(2.51)	(1.87)	(3.63)	(2.77)
Top Pumping Family × QEND	3.646**	3.897**	5.096**	4.493**	5.506***	4.586**
	(1.99)	(2.12)	(2.13)	(2.02)	(2.70)	(2.56)
Top Pumping Family × MEND	1.771	0.921	3.462	2.439	4.048**	3.040*
	(1.55)	(0.97)	(1.42)	(1.05)	(2.06)	(1.67)
Top Pumping Family × YBEG	-3.103	-2.977*	-1.370	-2.881	-2.456	-5.842*
	(-1.61)	(-1.79)	(-0.44)	(-1.08)	(-0.68)	(-1.76)
Top Pumping Family × QBEG	-2.004	-1.886	-2.077	-1.967	-2.017	-2.084
	(-0.91)	(-1.10)	(-0.86)	(-0.83)	(-1.08)	(-1.19)
Top Pumping Family × MBEG	-0.417	-0.311	-2.285	-1.868	-1.397	-1.022
	(-0.13)	(-0.18)	(-1.04)	(-0.89)	(-0.81)	(-0.61)
Time Fixed Effects	Y	Y	Y	Y	Y	Y
N	729094	729094	729094	729094	729094	729094
Adjusted R^2	0.141	0.052	0.146	0.053	0.152	0.065

t statistics in parentheses

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

Table IA3

Which Star Funds Benefit from Family-level Pumping: Alternative Star Fund Definition

The table shows which star funds within the *Top Pumping Family* are more likely to benefit from the family-level pumping, using two alternative star fund definitions. In columns (1) and (2), star funds are identified as funds with the highest Morningstar rating in the family. In columns (3) and (4), star funds are identified as funds with top quintile past-year Carhart alpha (excluding the most recent month). Within families with top quintile *Family Pumping* measure, star funds are sorted by the first two months of returns into two groups within their Morningstar style category. I then regress the fund's return in excess of the market on the time dummies for each group. Standard errors are two-way clustered at fund and time levels.

	MS rating with all families		Past-year Performance	
	(1)	(2)	(3)	(4)
	Low	High	Low	High
Year End	8.773***	-1.988	9.536***	-1.770
	(2.75)	(1.41)	(3.07)	(-0.93)
Quarter End	8.933***	5.621***	7.407***	5.974***
	(5.53)	(5.33)	(5.13)	(5.95)
Month End	6.414***	6.038***	5.667***	6.668***
	(5.76)	(5.85)	(5.72)	(5.87)
Year Beg	-13.72***	-12.63***	-11.71***	-14.31***
	(-5.21)	(-4.28)	(-4.85)	(-4.78)
Quarter Beg	-4.638***	-2.630*	-5.923***	-1.758
	(-3.09)	(-1.85)	(-3.79)	(-1.35)
Month Beg	-0.000	-1.903*	-0.967	-1.004
	(-0.00)	(-1.95)	(-0.96)	(-1.13)
N	120087	128664	121358	129477
Adjusted R^2	0.002	0.002	0.002	0.002

t statistics in parentheses

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

Table IA4

Which Star Funds Benefit from Family-level Pumping: Alternative Pumping Measure Definition

The table shows which star funds within the *Top Pumping Family* are more likely to benefit from the family-level pumping, using three alternative family pumping definitions. In columns (1) and (2), the stock weights of star funds in the current quarter are used to calculate *Family Pumping*. In columns (3) and (4), *Family Pumping* measure is scaled by the stock's quarter-end volume instead of the total volume in the quarter. In columns (5) and (6), *Family Pumping* measure is scaled by the stock's number of shares outstanding instead of the total volume in the quarter. Within families with top quintile *Family Pumping* measure, star funds are sorted by the first two months of returns into two groups within their Morningstar style category. I then regress the fund's return in excess of the market on the time dummies for each group. Standard errors are two-way clustered at fund and time levels.

	Star Weight in Current Quarter		Scale by Quarter-end Volume		Scale by Shares Outstanding	
	(1)	(2)	(3)	(4)	(5)	(6)
	Low	High	Low	High	Low	High
Year End	9.344***	-1.955	9.568***	0.536	9.980***	-2.423
	(3.04)	(-0.47)	(3.80)	(0.28)	(3.62)	(-1.32)
Quarter End	8.706***	8.595***	9.786***	6.929***	8.011***	7.360***
	(6.04)	(6.47)	(6.50)	(4.76)	(7.07)	(5.67)
Month End	5.629***	4.540***	4.438***	7.885***	3.141**	6.922***
	(4.74)	(3.87)	(4.13)	(7.61)	(2.28)	(7.08)
Year Beg	-13.86***	-14.95***	-7.475***	-12.18***	-10.71***	-17.86***
	(-4.89)	(-5.28)	(-2.84)	(-6.19)	(-4.12)	(-6.28)
Quarter Beg	-3.370**	-3.236**	-2.301	-4.889***	-2.949**	-3.661***
	(-2.47)	(-2.44)	(-1.49)	(-3.49)	(-2.08)	(-2.66)
Month Beg	1.779**	-0.465	-1.933**	-0.0130	1.342	0.0423
	(1.98)	(-0.55)	(-1.99)	(-0.01)	(1.49)	(0.04)
N	113248	127126	114689	125685	120474	119900
Adjusted R^2	0.001	0.001	0.001	0.002	0.001	0.002

t statistics in parentheses

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

Table IA5

Flows of Non-star Funds: Alternative *Pumping Effort* Definition

The table studies whether non-star funds receive more flows for pumping their star funds in the family, using alternative *Pumping Effort* definitions. Specifically, *Pumping Effort* is constructed using the stock price at the beginning of the quarter (columns 1-3) or in the middle of the quarter (columns 4-6) rather than at the end of the quarter. The Dependent variable in all specifications is the fund's next quarter flow. The dummy *Top Pumping Effort* is equal to one if the fund is sorted into the top quintile of *Pumping Effort*. *Recent Performance* is the fund's Carhart alpha in the quarter. *Past Year Performance* is the fund's Carhart alpha from quarter t-4 to quarter t-1. *Winner Prop* is the proportion of winner stocks held by fund i at the end of the quarter t. *Loser Prop* is the proportion of loser stocks held by fund i at the end of the quarter t. Winner (loser) stocks are the top (bottom) quintile stocks sorted by the past-quarter performance. *Return Gap* is the lag of the 12-month moving average of the return gap defined in Kacperczyk et al. (2008). *Fund Expense* and *Fund Turnover* are the fund-level annual expense ratio and turnover ratio, respectively. *Fund Size* is the natural logarithm of the fund's total net assets. *Fund Age* is the natural logarithm of the fund's age since inception. All specifications include family × time fixed effects and style fixed effects, and all standard errors are two-way clustered at time and family levels.

	Quarter-beginning Price			Mid-quarter Price		
	(1)	(2)	(3)	(4)	(5)	(6)
	$Flow_{t+1}$	$Retail\ Flow_{t+1}$	$Inst\ Flow_{t+1}$	$Flow_{t+1}$	$Retail\ Flow_{t+1}$	$Inst\ Flow_{t+1}$
Top Pumping Effort	0.842*	0.612***	1.472*	0.774*	0.647***	1.359*
	(1.87)	(3.22)	(1.88)	(1.90)	(3.52)	(1.84)
Recent Performance	35.00***	39.23***	54.03	35.03***	39.26***	54.03
	(9.96)	(6.74)	(1.04)	(9.96)	(6.74)	(1.04)
Past Year Performance	34.69***	33.89***	85.49**	34.73***	33.90***	85.51**
	(12.13)	(9.98)	(2.17)	(12.14)	(9.97)	(2.18)
Winner Prop	5.155***	6.727***	-146.5	5.129***	6.735***	-146.6
	(2.96)	(3.10)	(-0.97)	(2.94)	(3.10)	(-0.97)
Loser Prop	-4.710**	-4.128**	-30.47	-4.792***	-4.107**	-30.66
	(-2.59)	(-2.01)	(-1.08)	(-2.63)	(-1.98)	(-1.09)
Return Gap	9.503***	13.69***	16.55**	9.528***	13.70***	16.71**
	(3.07)	(3.44)	(2.03)	(3.07)	(3.44)	(2.11)
Fund Expense	0.470	-3.862***	-10.94	0.470	-3.862***	-10.94
	(1.10)	(-3.95)	(-0.95)	(1.09)	(-3.95)	(-0.95)
Fund Turnover	-0.380**	-0.244	-30.51	-0.364*	-0.247	-30.47
	(-2.02)	(-0.95)	(-1.03)	(-1.93)	(-0.97)	(-1.03)
Fund Size	-0.343***	-0.780***	16.07	-0.341***	-0.780***	16.07
	(-3.95)	(-5.48)	(1.11)	(-3.94)	(-5.48)	(1.11)
Fund Age	-1.212***	-1.899***	32.40	-1.214***	-1.901***	32.40
	(-6.51)	(-7.38)	(0.99)	(-6.49)	(-7.38)	(0.99)
Flow	0.161**	0.161***	0.184***	0.162**	0.161***	0.185***
	(2.14)	(4.35)	(8.00)	(2.11)	(4.29)	(8.26)
Family × Time Fixed Effects	Y	Y	Y	Y	Y	Y
Style Fixed Effects	Y	Y	Y	Y	Y	Y
N	48207	44711	38374	48207	44711	38374
Adjusted R^2	0.292	0.205	0.176	0.292	0.205	0.176

t statistics in parentheses

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