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Aggregate Price Effects of Institutional Trading: A Study of Mutual Fund Flow and Market Returns

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Abstract

We study the relation between market returns and aggregate flow into U.S. equity funds, using daily flow data. The concurrent daily relation is positive. Our tests show that this concurrent relation reflects flow and institutional trading affecting returns. This daily relation is similar in magnitude to the price impact reported for an individual institution's trades in a stock. Aggregate flow also follows market returns with a one-day lag. The lagged response of flow suggests either a common response of both returns and flow to new information, or positive feedback trading.

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1. Introduction and summary

This paper studies the relation between stock market returns and aggregate flow into U.S. equity mutual funds, using daily flow data. There is a substantial literature on institutional trading and in particular the impact of an institution's trades in a stock on the stock's price and daily return (e.g., Chan and Lakonishok (1993, 1995, 1997), Keim and Madhavan (1997), Jones and Lipson (1999)). The general conclusion is that institutional trading causes both permanent and temporary daily price effects. Our study parallels this research, but focuses on the aggregate level.

Whether existing results on the price impact of individual institutional trades would necessarily carry over to the aggregate level is unclear. Since institutions account for about 60% of all equity trading (*NYSE factbook, 1998*), it is conceivable that common components to such trade could have a significant effect on market returns. On the other hand, the price effect documented in the individual-trade studies is a result of the concentration of large trades in an individual stock. The resulting price effect could be strictly idiosyncratic in nature, bearing no relation to market returns. Further, if mutual fund investors are uninformed, then funds' flow-motivated trading potentially has a different pricing effect than funds' information-motivated trading.

Some of the literature raises the possibility of a strong causal relation between aggregate fund flow and daily market returns. First, there is substantial positive cross-correlation in fund flows (Edelen (1999)), indicating common factors affecting flow. Second, flow generates institutional trading (Keim (1999), Edelen (1999)). Thus, unexpected flow should proxy for subsequent unexpected institutional trading. Third, even if flow-motivated trades are spread out and therefore difficult to isolate statistically, price effects should occur when the unexpected flow is observed, in anticipation of trades. Moreover, as

discussed later, timely statistics on daily aggregate flow are public information, so potential price effects should be rapid. Taken together, these observations strongly suggest our premise that aggregate flow can be used to study the aggregate price effect of institutional trading.

We find a positive association between aggregate daily flows and concurrent market returns. For example, days with positive (negative) unexpected flow have estimated abnormal market returns of 25 (-25) basis points. These results are statistically significant, and the economic magnitude of this daily relation between aggregate flow and index returns is similar to the reported relation between an individual institution's trades and individual security returns.

The positive association between aggregate flow and market returns cannot necessarily be interpreted as price impact without additional tests, however (Warther (1995, 1998). Market returns could drive flow ("feedback trading"). Alternatively, both flow and market returns could each be driven by the arrival of new information, with no direct causal link between them. Our high-frequency data are particularly suited to addressing these issues. Our tests examine lead-lag daily flow-return relations and also use intraday returns. We conclude that flow responds to returns, or to the information driving returns, mainly with a one-day lag. Within the trading day, the main relation is that returns respond to flow, or flow-induced trades, and thus there is an aggregate price impact.

This price impact of mutual fund flows within the trading day has implications for the assessment of institutional trading costs. If an institution's trading is partly in response to flow and flow has a common component that affects market returns, then the return on the traded stock is partly due to coincidental market factors, rather than the institution's trading per se. The stock's concurrent daily return can therefore overstate trading costs. Under these circumstances, precise information of the time of trades and transactions level data (i.e.,

quote and price) would be required to remove this bias in estimating the idiosyncratic pricing effect of an institution's trades.

Our results also have implications for whether flow into mutual funds drives stock returns. A common notion in the popular press is that mutual fund flows are a key determinant of the level of stock prices. Our results do not support this view. Although we find measurable price impacts, we also find that variation in aggregate daily fund inflows does not explain a material fraction of the variation in daily market returns. This result contrasts with the high correlation between monthly aggregate flows and returns reported in Warther (1995), but we argue that the strong monthly relation is mainly due to flow following returns with a one day lag.

Section 2 discusses the flow data; further details of these data are given in the Appendix. Section 3 presents the paper's main results using daily data. Section 4 conducts further tests using daily flow data, coupled with both intraday and overnight return data. Section 5 discusses alternative explanations for flow lagging returns. Section 6 gives the conclusions.

2. Aggregate daily mutual fund flow

Our data on daily aggregate net flow at equity mutual funds (henceforth, "flow") are from Daily Liquidity Trim Tabs/Heads Up Alert, published by Trim Tabs (TT) Financial Services of Santa Rosa, California. TT reports net flow (inflow minus outflow) on a daily basis for a sample of 424 U.S. equity funds. The sample period is from February 2, 1998 through June 30, 1999. Although the time period is limited, daily data make for very sharp tests of the relation between flow and returns. We also examine semi-weekly data from 1994 through mid-1998 and find identical qualitative conclusions, but to save space the results are not reported.

2.1. Coverage

The TT sample contains 16.5% by number of funds and 20% by net assets of all U.S. equity mutual fund assets covered by the Investment Company Institute (ICI). The sample includes over 90 fund families, and has been essentially constant over the sample period. TT also provides subscribers with an estimate of aggregate ICI flow from its sample's flow and the historic relation with ICI flow, but we only use the actual TT flow. Since the correlation between TT flow and ICI flow (at the monthly level) is .72, TT flow contains significant information about overall fund activity.

2.2. Timeliness

The TT data are quite timely. A feature emphasized by Trim Tabs is that the sample includes only those funds that reliably provide total assets based on daily updates. The sequence of events surrounding TT reports can be summarized as follows. All times quoted are Eastern. Our discussion is based on interviews with TT personnel, mutual fund managers, accountants, fund-accounting consultants, transfer agents, and the Investment Company Institute operations division. Further details and our tests for the timeliness of the data are given in the Appendix.

Fund reporting. A fund's flow is generally not available to the fund manager on a real-time basis, although the fund manager likely has some knowledge of the day's flow prior to the close of trading. However, in every conversation that we had with knowledgeable personnel, the view was that the flow figure is not known until the following morning. This delay is related to the processing of orders for purchase or redemption. Orders can be sent to the fund or the transfer agent, and they can be in the form of wire transfers, telephone transfers, or in writing. Processing these orders and assimilating them into a single statement of the fund's flow is a substantial task, constituting the primary function of the transfer agent.

Transfer agents execute their task in batches, with no accounting done between batches. Batching is almost universally once daily, with processing beginning at 4 P.M. and continuing overnight. We are aware of no funds that employ continuous processing of the transfer agent's tasks.[1] After overnight processing, the transfer agent reports back to the fund manager the next morning (generally by 7:30 – 8 A.M.).

Aggregate data. Each morning, usually between 9 A.M. and noon, Trim Tabs receives data for the previous day's flow by fax or e-mail from each fund's customer service or public relations department. TT then aggregates the data and sends it to subscribers (usually electronically) in the afternoon. Thus, there is at most a one-day lag between when flow occurs and when it becomes public information.

2.3. Properties of daily flow

General characteristics. Table 1 describes the flow data. Dollar flow is expressed as a percentage of the previous day's asset base. This scaled per day flow is on average positive. From Panel A, the mean daily flow is 1.6 basis points (.016%) per day. In addition to positive flow, market returns over this period averaged 6.2 basis points per day, and the TT asset base increased from $450 to $600 billion. Given this asset base, a one standard deviation realization of flow (13.4 basis points) corresponds to $804 million. This is small in comparison to the NYSE daily trading volume (which averaged $29.0 billion in 1998), however, and the correlation between TT flow and NYSE volume is only marginally significant (not reported in Table 1).

Autocorrelations. Panel B shows the time series properties of flow. There is information in past flow that is relevant for future flow. In particular, there is statistically

[1] Several of the major fund families indicated that they are currently trying to put together systems to produce preliminary aggregation figures prior to the market close, but that these systems are not in place as of early 1999. This is confirmed by discussion with the major software producers who indicated that they are still developing the systems.

significant negative autocorrelation at lags 1 and 2, and positive autocorrelation at lag 6. Although none of the autocorrelations seem large, as discussed below it is important for our tests to control for such time-series dependencies.

For completeness, panel B also shows the autocorrelations for daily index returns. We use NYSE composite index returns. Generally, the returns show no significant autocorrelations. There is no significant autocorrelation at lag 5 for returns, or for flow. Thus, there are no apparent day of the week characteristics in either returns or flows that could potentially affect our tests.

3. Daily flow-return relations

The main focus of the paper is on the concurrent flow-return relation. Inferences about this relation are potentially affected by the time-series properties of each variable. In particular, flow is highly predictable. First, as shown in Table 1, flow is correlated with past flow. Second, as shown below, flow is strongly dependent on lagged returns. Because returns should only depend on the unexpected component of flow, our tests recognize these dependencies and explicitly separate expected and unexpected flow.

In Section 3.1, flow on return regressions examine the dependence of flow on concurrent and lagged returns and lagged flow, while establishing the correlates of flow and a time-series model of expected daily flow. In section 3.2, we regress returns on concurrent and lagged flow, using our expected-unexpected decomposition. In section 3.3, further details on the economic significance of our findings are presented.

3.1. Flow on return regressions

In Table 2, flow is regressed on concurrent and lagged returns and lagged flow. The first two columns develop the relation between daily flow and predetermined variables – lagged returns and flow. These regressions constitute the expected flow model used later.

While the time-series modeling of flow is important to clean inferences, the focus of Table 2 is the concurrent relation between daily flow and returns. Column 3 presents this relation, which controls for the dependence of flow on lagged returns and lagged flow.

From column 3, the relation between concurrent returns and flow is positive, with t-statistic of 4.1. The coefficient estimate, 0.017, implies that for every 1.13% (one standard deviation) move in returns there is an associated 1.9 basis-point shift in flow. Given that the standard deviation of flow is 13 basis points, this suggests that while a concurrent association is statistically reliable, it does not explain a great deal of the variation in flow. Goetzmann and Massa (1998) also report a concurrent daily return-flow relation, for index funds. Their sample consists of only three funds, however, and the relation they find is weaker.

Relative to the concurrent association, the relation between daily flow and lagged flow and lagged returns is very strong. In particular, one-day lagged returns have a coefficient of 0.073, with a t-statistic of 16. Thus, a one-standard deviation shock to returns is associated with an almost 2/3s of one standard deviation shock to flow on the following day. Curiously, the relation between flow and two-day lagged returns is negative, about half the magnitude of the one-day lagged relation. The source of this pattern is unclear, but it does create a possible explanation for the negative autocorrelation seen in flow (Table 1, panel B): shocks to returns generate negatively serially correlated shocks to flow. However, the negative autocorrelation of flow remains after controlling for lagged returns (see Table 2 columns 2 and 3).

Lagged returns explain almost half (48%) of the variation in daily flow (see column 1). The addition of lagged flow in column 2 contributes additional explanatory power, raising the explained variation to 53.1% of the total variation in daily flow. The concurrent association, while reliably positive, only raises the explained variation to 55.4%.

The concurrent association between flow and returns (column 3) potentially reflects a causal relation from flow to returns, but it could also reflect extremely rapid feedback trading

by fund investors (returns causing flow), or a joint same-day reaction of both returns and flow to economic news. One expects returns to react instantly to economic news, whereas an overnight delay (at the least) seems more plausible for flow. The very strong dependence of daily flow on daily returns lagged one day in Table 2 makes intraday feedback trading explanations somewhat more plausible, however. This is examined in Section 4.

3.2 Return on flow regressions

Table 3 presents regressions of returns on concurrent and lagged flow, using both the raw series and the expected-unexpected decomposition produced in the regression model of Table 2, column 2. Column 1 uses only the flow series but is provided for completeness in documenting the lead-lag relation between flow and returns. Columns 2 and 3 use expected and unexpected flow and capture most of the insights in the table.

From column 3, returns relate only to concurrent, unexpected flow. The coefficient on unexpected flow is 2.73, with a t-statistic of 4.1. Thus a one-standard deviation shock to flow, 13.4 basis points, is associated with an average abnormal return of 37 basis points. Expected flow (a linear combination of lagged returns and lagged flow) does not correlate with returns. The concurrent relation between returns and unexpected flow in column 3 simply mirrors that seen in Table 2, and like that table, no causality can be ascribed to this correlation.

Price pressure. From column 2, unexpected flow at lags one and two (and higher lags) has no significant relation to returns. The lack of statistical significance in the lagged flow regressors in Table 3 suggests that the concurrent positive return-flow association does not arise because flow exerts temporary price pressure. Under a temporary price pressure hypothesis one expects that high unexpected flow in the recent past results in lower current returns. The failure to find a correlation between returns and prior-day flow is consistent with

two offsetting factors: a positive correlation induced by a reporting lag, and a negative correlation induced by a reversal of the concurrent relation. This possibility is examined further in Section 4.

Reporting lags. The absence of a correlation between returns and the previous day's flow is informative. As discussed earlier, a fund's daily flow is generally not known, even by the fund's manager or transfer agent, until late in the evening or early the following day. Further, aggregate fund flow is not reported by Trim Tabs until the following afternoon. Thus, there could be uncertainty about day flow that is only resolved after 4:00 P.M. If flow causes returns, then a positive coefficient on lagged flow is plausible, but our results so far suggest that any reaction of returns to flow is so rapid that it occurs entirely within the trading day.

Does flow drive returns? The R^2s in Table 3 are about 3%. Thus, variation in unexpected flows explains little of the variation in market returns. These results do not support the notion in the popular press (see Warther (1995) for references) that mutual fund flows are an important determinant of the level of stock prices. Further, the low R^2s contrast with a figure of 55% reported for monthly return-unexpected flow regressions (Warther, 1995, Table 4). Our high frequency analysis establishes that the high monthly correlation does not occur because flow drives returns. Rather, the monthly correlation reflects the strong relation between flow and returns lagged one day. Our Table 2 regressions, which include lagged returns, show R^2s of about 50% and thus match monthly R^2s closely.

3.3 Economic significance

Table 4 provides additional perspectives on the economic significance of the Table 3 regressions. First, the table shows abnormal market returns for days with positive (negative) unexpected market flow, where unexpected flow is again taken from Table 2, column 2.

Second, to help gauge these numbers, the table shows the corresponding results from several recent papers on individual institutions' trades. In these studies, the average return (or abnormal return) on individual stocks for days with a known institutional purchase or sale is taken as a measure of the price impact of institutional trades. We caution that this comparison is simply to assess how the "macro" association we find compares to the "micro" association in the literature. The association between aggregate returns and unexpected flow in Table 4 appears to be of similar magnitude, but we cannot interpret it as price impact without further tests (Section 4).

From Table 4, positive (negative) aggregate unexpected flow days have inflows (outflows) of about $500 million, or about 2% of typical NYSE volume. Associated with these positive and negative unexpected flow days are abnormal market returns of 0.25% (t= 2.73) and –0.25% (t= -2.61), respectively. These figures are quite similar to those for individual institutions' trading. The published average price impact estimates for individual institutions' trades summarized in Table 4 are often in the 0.1% to 0.3% range, positive for buys and negative for sells. Although somewhat higher figures are reported in the Jones and Lipson (1999) paper, their sample of trades is from firms that switched Exchanges, and are thus relatively smaller than the firms in other studies.

As an additional check for economic significance of flow, we ranked all days in the sample period by unexpected flow, sorted into quintiles, and examined abnormal market returns. For quintiles 1 and 5, the average unexpected daily flows correspond to roughly a one standard deviation innovation in flow. The mean market abnormal returns for the two quintiles are .00374 (t =2.86) and -.00255 (t=-1.59), respectively. These point estimates are slightly larger than those in Table 4 for positive and negative unexpected flow days, consistent with a monotonic relation between returns and aggregate unexpected flow. When we repeated the entire Table 4 analysis using flow rather than unexpected flow, the reported

association was not found. Given that flow is somewhat predictable and has a large expected component, this is not surprising.

4. Daily flow and intraday returns

The concurrent statistical association between daily returns and flow seen in section 3 represents an upper bound on the causal effect of flow on returns, if there is indeed any such effect. This section uses intraday returns, specifically open-to-close, close-to-open, and within-day (e.g., hourly) returns, to study the question of causality. These returns are constructed from tick data on the S&P 500 cash index from the Futures Industry Institute.

4.1 Hypotheses with intraday returns

Intraday returns sharpen the inferences from the concurrent daily correlation between flow and returns seen in Tables 2 and 3, as well as the analysis of returns lagging flow. Under the hypothesis that trading causes the concurrent daily association between flow and returns, the correlation between daily flow and within-day returns should depend on the time of day. We expect trading in response to a day's (unknown) flow to be concentrated later in the day. Timely processing and assimilation of share transactions into a flow figure is costly (see the Appendix). If there is to be a preliminary flow calculation intraday, it is efficient to do so late in the day, when the potential information (realized fund-share transactions) is greatest yet it is still possible to be fully invested before the market closes. This implies that returns in the afternoon should show a higher correlation with daily flows than returns in the morning.

This prediction about the daily flow, intraday return association contrasts sharply with predictions under hypotheses where investors react to returns, or to the information driving returns. If the daily flow–return association arises because flow reacts to returns (information), daily flow should be correlated with returns for both morning and afternoon.

The correlation should be stronger using morning returns. It is difficult to imagine that flow reacts immediately to returns (information). With afternoon returns (or information arrival), the associated flow reaction is less likely to occur by the 4:00 P.M. market close.

As discussed in section 3.2, under the joint hypothesis that trading causes the concurrent daily association between flow and returns and that there is an overnight lag in the processing of flow, overnight returns should be positively associated with daily flow lagged one day. While Table 3 shows no apparent association, intraday returns sharpen this test.

4.2 Intraday return data

Table 5 presents summary characteristics of the intraday return data. Returns are shown for 4 non-overlapping periods: overnight (close to 9:40 A.M.), 9:40 to 11:00 A.M., 11:00 A.M. to 3:00 P.M., and 3:00 P.M. to close. Although the market opens at 9:30 A.M., overnight is defined to extend 10 minutes into the trading day so that most stocks will have opening transactions prices. Returns are also shown for 9:40 to close, representing open-to-closing returns.

From Panel A, each of the 4 non-overlapping periods has roughly equal volatility. Thus, both returns and information appear to be spread throughout the trading day; although close to opening returns have lower volatility than open to close returns. From Panel B, returns for the various subperiods within the day show little correlation with each other. Thus, there are no intraday return patterns that would complicate the interpretation of our tests.

4.3 Flow regressed on intraday returns

Table 6 repeats the regression of Table 2, column 3 with added intraday return regressors. The Table 2, column 3 regressors are provided as a control, both to sharpen inferences (effectively making the dependent variable unexpected flow) and to avoid

correlated-omitted variable biases arising from time-series correlations between intraday returns and past daily observations of flow and returns.

Results. From Table 6, the concurrent daily relation between flow and returns seen in Tables 2 and 3 is concentrated in the afternoon (11:00 A.M. onward). In particular, returns during the last hour of trading exhibit the highest correlation with the day's flow. The coefficient on the 9:40 to 11:00 return is only .010 ($t = 1.1$), compared to .022 ($t = 3.2$) and .019 ($t = 3.8$) for the 11:00-3:00 and 3:00 to close returns. Table 6 also shows that flow on day t is not materially related to the overnight return preceding day t. There is no significant relation when the overnight period is extended to 11:00 A.M. (results not presented), despite the fact that this makes for a roughly even break in the day's volatility.

Interpretation. These various results are most consistent with the hypothesis that the concurrent daily correlation between flow and returns arises because flow causes returns. It is difficult to interpret this pattern of results under the joint-reaction or flow-chasing-returns hypotheses. It seems implausible that flow reacts to returns or information in the last hours of trading, but to no other returns or information. Although a strong response of flow to returns, or the information driving returns was seen in the daily correlation between flow and previous-day returns (Table 2), the intraday results in Table 5 show that no immediate flow response occurs following overnight or morning returns (or information). This is further evidence that returns driving flow cannot explain the daily concurrent flow-return relation.

4.4 Intraday returns regressed on flow

To complete the picture, Table 7 examines the dependence of intraday returns on flow. Returns for various intraday periods are regressed against daily expected flow, as well as unexpected and lagged unexpected flow.

Mirroring the results in Table 6, the dependence of afternoon returns on the day's unexpected flow is much larger and more significant than the dependence of morning returns on the day's unexpected flow. Regressions using the close-to-open and 9:40-11:00 return as the dependent variable show no relation to the day's unexpected (or expected) flow. In contrast, the coefficients on unexpected flow in regressions using 11:00 to 3:00 and 3:00 to close returns are 2.08 (t = 3.7) and 0.77 (t = 2.3), respectively.

There is also an intriguing, though only marginally significant, pattern that emerges relating intraday returns to the previous day's unexpected flow. Overnight returns are positively related the previous day's unexpected flow, at the 90% significance level (t-statistic of 1.8). Further, there is evidence that this relation reverses later in the day. The remaining coefficients are all negative with the coefficient on the last-hour return significantly so. Although we caution that the statistical significance of this relation is marginal at conventional levels, the pattern is consistent with flow-induced temporary price pressure at the aggregate level.

5. Lagged flow response: discussion

Our analysis with daily return data (Section 3) shows that flow follows returns with a one-day lag. The intraday analysis (Section 4) provides further evidence and suggests that the response of flow is no faster than one day. Alternative explanations for the one-day lagged flow response are considered in more detailed below. We conclude that our analysis cannot fully distinguish between these explanations.

5.1 New information as a driver of returns and flow

Returns and flow could move together in response to new information that is relevant for valuation. This type of story is given structure in the dynamic rational expectations model of Brennan and Cao (1996). In this model, mutual fund investors are relatively

uninformed about the distribution of returns on the risky asset. When value-relevant information about the risky asset is publicly released, relatively informed investors already hold a different fraction of the asset in their portfolios to profit from the information. Conversely, relatively uninformed investors learn more from the public signal. Thus, after news is released mutual fund investors are net buyers (sellers) in response to public release of good (news). Informed investors take the other side of these trades, essentially unwinding the position established based on the pre-announcement information asymmetry.

Although the model does not explicitly predict that flow will lag returns, Brennan (1998) argues that a lag of one or several days is consistent with information driving returns and flow, if there are some investors who do not stay attuned to the latest news. This argument accords well with the one day lag in flow. However, the correlation between flow and returns lagged two periods is negative, which does not seem to fit with the intuition of Brennan and Cao. Further, the intraday evidence that flow drives returns is a puzzle under this story, as it implies that at least some fund investors are relatively informed. The Brennan and Cao explanation and the causal explanation are not mutually exclusive, so this does not refute the Brennan and Cao explanation.

5.2 Feedback trading

In the Brennan and Cao model, the predicted positive relation between flow and returns does not represent positive feedback trading or "return chasing". Further, it can be rational for uninformed investors to chase returns, if these returns are a sufficient statistic for public information releases. For these reasons, even explicit feedback trading by investors does not cause rejection of the hypothesis that the one-day lag in flow is explained by information driving both flow and return.

There is another situation in which positive feedback trading can make sense for mutual fund investors (see DeLong, Shleifer, Summers, and Waldmann (1990) for examples in other contexts). If some stocks react slowly to economic news, then a fund's portfolio return during the day will be positively autocorrelated. Trading in the direction of fund returns – particularly late-afternoon returns – then allows fund investors a profit opportunity if there is one-day positive autocorrelation. In principle, this could explain a concurrent late-afternoon return-flow relation, but there is no evidence of positive daily return autocorrelation in Table 1. Further, the presence of such an autocorrelation could not easily explain the observed one-day lag in flow. Trading fund shares after 4 P.M. based on today's return would not be profitable, as these transactions take place at the fund's closing price at 4 P.M. on the following trading day.

6. Conclusion

Aggregate mutual-fund flow is correlated with concurrent market returns at a daily frequency. This daily relation is conceivably due to flow reacting to returns within the trading day, or to flow reacting to the information driving returns within the trading day. However, further tests reject these alternative explanations in favor of a causal effect from flow to returns. When the day's return is decomposed into early and late in the day components, there is virtually no association between concurrent flow and early returns: all of the daily association is attributable to late returns. Thus, returns appear to follow flow within the day, consistent with causality running from flow to returns.

The apparent causal effect of flow on market returns that we find is generally similar in magnitude to the price effect inferred from the "micro" literature. The evidence in this paper suggests that institutional trade indeed has an effect on market returns, and is not just an idiosyncratic phenomenon.

We also find a very strong association between flow and the previous day's return. This association indicates flow reacting to returns, or to the information driving returns, but that investors generally require an overnight period to react. Our analysis is able to provide evidence on this association, but it is difficult to discriminate between alternative explanations for it.

Appendix: Mutual fund accounting & Trim Tabs' data-collection procedures

This Appendix focuses on the timeliness of the Trim Tabs (TT) data. Our tests show that the paper's findings, especially that flow follows returns with a one-day lag, are not due to reporting errors or reporting lags.

A.1 Reporting at the fund level

By law, when a fund receives a "good" order from an investor, the order must be executed at the next calculated net asset value (NAV).[2] Only after NAV is calculated can the transfer agent then process all orders, using this NAV to determine the change in the fund's receivables, payables, and cash on the one hand, and the change in shares outstanding on the other hand. NAV is typically calculated only once a day, after the market closes, using closing prices and the shares outstanding as of the close of business on the preceding day.[3] After the NAV is calculated it is reported to the National Association of Security Dealers (NASD) and the transfer agent. This must occur by 5:50 P.M.

This processing occurs overnight, with the numbers reported back to the fund manager and entered into the fund's balance sheet the next morning. Once the balance sheet is updated , the flow for the previous day can be calculated as the change in shares outstanding (excluding reinvested distributions) times NAV. Thus, the fund manager generally does not know day t flow until the morning of day t+1. This one-day lag in the updating of the balance sheet is referred to as "*t* plus one" accounting and is standard industry practice. It is

[2] While there is some flexibility as to what constitutes a good or bona fide request, it generally includes checks and applications received (even though the check is not yet cleared or the application not yet processed). Until the check is cleared, it is booked as a receivable.
[3] This has no effect on the determination of NAV. The NAV resulting from this calculation is exactly the exchange rate necessary to ensure that no dilution or accretion occurs with the subsequent exchange of shares for cash.

specifically provided for in the 1970 Amendment to the Investment Company Act.[4] This accounting practice is quite separate from the issue of check settlement. Settlement typically occurs on day *t*+3 to *t*+5, at which point a receivable (payable) is converted to a change in cash. In particular, checks received though not yet cleared are incorporated into the balance sheet at the time of receipt.

Trim Tabs receives a report of the fund's total assets between 9 A.M. and noon on day *t*+1. Using these data and the fund's NAV change, Trim Tabs calculates flow as the percentage change in assets, minus the percentage change in NAV. As long as the fund forwards the information provided in the most recent statement from the transfer agent, it should correctly reflect the previous day's flow.

A.2 Tests

Timing lags result if funds send one-day-old data to TT. We examine this possibility using a variety of tests.

A.2.1. The relative accuracy of day *t* and day *t*+1 reported flow

Mutual funds must file a semi-annual report with the Securities and Exchange Commission (SEC) that includes the fund's total assets and shares outstanding (Form N-30D). This report must be in conformance with GAAP, and thus reflect the true balance sheet as of the close of business on the last day of the fiscal period (i.e., include the flow on that last day in contradiction to *t*-plus-one accounting).[5] We have daily data on the individual-fund assets reported to Trim Tabs for the period Feb. 2, 1998 through July 7, 1998. We compare Trim Tabs' individual-fund reported assets for the last day of the fiscal period

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[4] *t*+1 accounting is not consistent with generally accepted accounting principals (GAAP). GAAP requires that end-of-year numbers be adjusted back one day to reflect the reality of the transactions. The data used in this study are not from official, audited financial statements and are not subjected to GAAP.

[5] Of course, the filing typically doesn't occur for another couple of months, so there is no difficulty with backdating the numbers.

(EOP) to the (correct) number reported to the SEC, and similarly compare Trim Tabs' reported assets for the first day of the next fiscal period (BONP) to the correct number.

The metric of interest is the absolute value of the difference in the two total asset figures (Trim Tabs versus SEC), divided by the SEC figure. The average absolute error using the Trim Tabs reported EOP figure is 0.31%. The average absolute error using the Trim Tabs BONP figure is 0.89%. Thus, the reported figure is far more accurate than the next-day reported figure. This suggests that the Trim Tabs data does not suffer from a one-day reporting lag resulting from the ubiquitous use of *t*-plus-one accounting. If the Trim Tabs data were one day late, the BONP total assets should be closer to the SEC figure.

A.2.2 Correlation patterns in the data

Nevertheless, in some cases the Trim Tabs BONP figure is closer to the audited number than the EOP figure (25% of the time). This fact is consistent with two hypotheses. It could indicate that some funds (e.g., 25%) systematically report a one-day late number to Trim Tabs, or it could be that other reporting noise is a factor in both the EOP and BONP data.

Systematic late reporting by some funds. Because of *t*-plus-one accounting, it is plausible that the total assets that some funds report to Trim Tabs (on, for example, Tuesday morning) does not reflect the net inflows of the previous day. As a result, flow calculations from the reported total assets do not correspond to flow as of the previous day (e.g., Monday), but rather the day before that (e.g., Friday). In that case, even if the only correlation between actual daily flow and market returns is concurrent (e.g., only Friday's actual flow is correlated with Friday returns), we will observe a correlation between next-day reported flow and returns (e.g. Monday reported flow is correlated with Friday returns). If such reporting errors were present in the data, the BONP figure would on occasion be closer to the audited figure than the EOP figure.

Other reporting errors. There are many possible sources of noise in the EOP and BONP data, including simple factors like transposing digits, reading the wrong line from the Balance Sheet, etc., and more formal factors like misalignment of distribution reinvestment, or subsequent changes to the Balance Sheet due to auditor restatement[7]. Other reporting noise would cause the BONP figure to be closer than the EOP figure on occasion, even if all funds report a timely figure. However, random reporting errors would not produce a correlation between flow and lagged returns.

Tests of these alternative hypotheses. Two observed patterns in the data cause us to reject the 'systematic late reporting' hypothesis in favor of the 'other reporting noise' hypothesis. First, from Panel B of Table 1 in the text, the first-order autocorrelation in the Trim Tabs flows is significantly negative. There is a strong common (systematic) component to flow (Edelen, 1999). Given this common component, the 'systematic late reporting' hypothesis implies positive first-order autocorrelation in the flow data, which is the opposite of what is found. Although we have no explanation for why the autocorrelation is negative (rather than zero), the failure to find a positive autocorrelation increases our confidence that the TT data are timely.

Second, the error in the EOP Trim Tabs figure is positively correlated with the error in the BONP Trim Tabs figure (the correlation is 0.31 with a *p*-value of 0.04). The 'systematic late reporting' hypothesis implies that the EOP error and the BONP error should be negatively correlated across observations. For example, under the first hypothesis, when the BONP error is small it is because the next-day total assets is the correct EOP figure. That being the case, the reported EOP figure is for the wrong day and thus exhibits a relatively large error. Conversely, when the BONP error is large, under the 'systematic late reporting'

[7] Recall that the SEC filing is not due until three months after the period ends. There are countless situations which could cause the concurrent (t+1) unaudited books to be restated to conform to GAAP.

hypothesis it must be because the BONP figure corresponds to the wrong day. That means that the fund is reporting on a timely basis, making the EOP figure accurate. In short, one error is large if and only if the other is small.

Therefore, we conclude that the tendency for the Trim Tabs BONP figure to sometimes be closer to the SEC figure is simply due to other noise and causes no bias in our estimate of the correlation between flow and lagged returns.

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Table 1. Daily aggregate equity mutual fund flow and daily returns statistics
Flow (new subscriptions less redemptions) is reported daily by TrimTabs.com. Flow is defined as the one day percentage change in assets under management, less the one-day percentage change in NAV. Distributions are not accounted for in these data. Returns are the percentage change in the NYSE Index, excluding dividends. All figures are expressed in basis points (i.e., 1.00 = .01%) per day.
Time period: 2/20/98 - 6/30/99 (343 observations)   Sample: 434 U.S. Equity Funds.

Panel A. Univariate statistics

	mean	median	standard deviation	standard error of mean
daily flow (close to close)	1.6	1.4	13.4	0.72
daily return (close to close)	6.2	4.8	113.2	6.11

Panel B. Partial autocorrelations of flow and of returns

The partial autocorrelation is the univariate correlation after controlling for the correlation at other lags. Asterisks indicate significance at .05 level, two-tailed test.

lag:	1	2	3	4	5	6	7
daily flow (close to close)	-.21*	-.16*	-.03	-.06	-.02	.12*	.05
daily returns (close to close)	.01	.01	-.03	.01	-.06	-.01	-.02

Table 2. Regressions of flow on returns and past flow
Daily flow (*$flow_t$*) is regressed on current and past observations of market returns (R_t) and past observations of flow. The subscripts indicate the days lagged. Three such regressions are presented, as columns in the table. t-statistics in parentheses.
Time period: 2/20/98 - 6/30/99 (343 observations) Sample: 434 U.S. Equity Funds.

	1	*2*	*3*
coefficient on:			
intercept	0.00014	0.00014	0.00013
	(2.8)	(3.3)	(3.3)
R_t			0.017
			(4.1)
R_{t-1}	0.075	0.079	0.073
	(16.1)	(18.0)	(16.4)
R_{t-2}	-0.036	-0.034	-0.036
	(-7.8)	(-7.2)	(-8.5)
R_{t-3}	-0.006	-0.004	
	(-1.1)	(-1.0)	
$flow_{t-1}$		-0.312	-0.315
		(-5.6)	(-5.8)
$flow_{t-2}$		-0.183	-0.159
		(-3.1)	(-2.8)
$flow_{t-5}$		0.116	0.104
		(2.1)	(1.9)
$flow_{t-6}$		0.133	0.128
		(2.4)	(2.3)
R^2	47.9%	53.1%	55.4%

Table 3. Return dependence on flow

Daily returns (R_t) are regressed on concurrent and lagged daily flow ($flow_t$) in column 1, and on concurrent and lagged unexpected daily flow ($Uflow_t$) and concurrent expected daily flow in columns 2 and 3. Expected daily flow is taken from the model in Table 2, column 2. Unexpected flow is actual minus expected. The subscripts indicate the days lagged. t-statistics in parentheses.

Time period: 2/20/98 - 6/30/99 (343 observations) Sample: 434 U.S. Equity Funds.

	1	*2*	*3*
coefficient on:			
intercept	0.00017	0.00027	0.00062
	(0.3)	(0.5)	(1.0)
$flow_t$	1.48		
	(3.1)		
$flow_{t-1}$	0.73		
	(1.5)		
$flow_{t-2}$	-0.07		
	(-0.1)		
$flow_{t-5}$	0.39		
	(0.9)		
$Uflow_t$		2.80	2.73
		(4.2)	(4.1)
$Uflow_{t-1}$		0.15	
		(0.2)	
$Uflow_{t-2}$		-0.90	
		(-1.3)	
expected $flow_t$		-0.01	0.90
		(0.0)	(0.2)
R^2	1.0%	2.9%	2.9%

Table 4. Comparison of aggregate fund flow – return association to individual-security institutional trading – return association
The association between aggregate daily unexpected mutual fund flow and mean abnormal daily market returns is compared to the reported association between individual stock returns and buy or sell stock trades of individual institutions (i.e., the price impact). Daily unexpected flow is estimated using the time-series model in Table 2. A day's aggregate unexpected flow is classified as positive if it exceeds zero, and negative otherwise. A day's abnormal market return is the difference between the NYSE index market return and the mean daily NYSE market return over the entire calendar time period.

Authors	**Sample**	**Mean unexpected flow or trade…**		**Mean abnormal return, with…**		**Time Period**
		inflow or buys	**outflow or sales**	**inflow or buys**	**outflow or sales**	
Edelen, Warner (this paper)	Aggregate mutual fund flow, TrimTabs sample	$496M	-$508M	0.25%	-0.25%	Close on previous day to close on day of flow
Chan, Lakonishok (1995)[a]	Trade packages of 37 Investment Management Firms	35300 shares $1.2 million		0.39%	-0.13%	Open on first day to close on last day of package
Chan, Lakonishok (1993)[b]	Individual trades of 37 Investment Management Firms	8400 shrs. $304,000	9400 shrs. $335,000	0.26%	0.02%	Open to close on trade date
Keim, Madhaven (1997)[c]	Orders of 21 Institutions	4800 shrs. $138,000	11600 shrs. $386,000	0.31	-0.34	Close on day prior to first trade to average price of all executed trades
Jones, Lipson (1999)[d]	Orders of 21 Institutions, Firms that switch from Nasdaq or AMEX to NYSE (smaller firms)	22900 shares $631,900		0.71%		Close on day prior to first trade to average price of all executed trades

[a] Tables II and III. Price impact estimate is equal weighted; principal-weighted estimates are 0.98% (buys) and –0.35% (sells).
[b] Tables 2 and 3. Price impact estimate is equal weighted; principal-weighted estimates are 0.34% (buys) and -.04% (sells).
[c] Table 2 reports the price effects on exchange-listed stocks – sizes in text.
[d] Table I and IV. Weighted average of pre-switch and post switch figures. Return is implementation cost only, not commissions.

Table 5. Intraday return statistics

Returns are the percentage change in the NYSE Index, excluding dividends. The market opens at 9:30 A.M. and closes at 4:00 P.M. Eastern. All figures are expressed in basis points (i.e., 1.00 = .01%) per day. Asterisks indicate significance at .05 level, two-tailed test.

Time period: 2/20/98 - 6/30/99 (343 observations) Sample: 434 U.S. Equity Funds.

PERIOD BEGIN:	$Close_{t-1}$	$9{:}40_t$	$11{:}00_t$	$3{:}00_t$	$9{:}40_t$
PERIOD END:	$9{:}40_t$	$11{:}00_t$	$3{:}00_t$	$Close_t$	$Close_t$
Panel A. Univariate statistics					
mean	8.2	-3.2	-3.4	7.2	0.7
std. deviation	59.3	50.8	67.2	57.3	112.0
Panel B. Correlations					
with return at time:					
$9{:}40_t$ - $11{:}00_t$	0.04				
$11{:}00_t$ – 3:00	-0.05	0.03			
$3{:}00_t$ - $Close_t$	0.04	0.18*	0.13*		
$9{:}40_t$ - $Close_t$	0.01	--	--	--	

Table 6. Daily flow regressed on intraday returns
Daily flow is regressed on past daily observations of market returns (at lags 1, 2, 3), past daily observations of flow (at lags 1, 2, 5, 6) and on the intraday return indicated in the row heading. Other than the intraday return regressor, this is the column 2 regression of Table 2. Five regressions, corresponding to five different intraday periods, are presented. The lagged daily return and flow regressors are included in each regression, but their coefficient estimates are not presented. In each case (columns 1 – 5) neither their values nor significance differ materially from the values in Table 2, column 2. Intraday returns are for the S&P 500 cash index, taken from tick data provided by the Futures Industry Institute. The subscripts indicate the day on which the time corresponds, where the flow dependent variable is day *t*. The market opens at 9:30 A.M. and closes at 4:00 P.M. t-statistics in parentheses.
Time period: 2/20/98 - 6/30/99 (343 observations) Sample: 434 U.S. Equity Funds.

	1	*2*	*3*	*4*	*5*
intercept	0.0001	0.0001	0.0001	0.0001	0.0001
	(3.2)	(3.4)	(3.6)	(3.0)	(3.0)
Coefficient estimate for intraday returns over the interval:					
$Close_{t-1}$ - $9{:}40_t$	0.006				
	(0.7)				
$9{:}40_t$ - $11{:}00_t$		0.010			
		(1.1)			
$11{:}00_t$ – $3{:}00_t$			0.022		
			(3.2)		
$3{:}00_t$ - $Close_t$				0.019	
				(3.8)	
$9{:}40_t$ - $Close_t$					0.019
					(2.3)

Table 7. Intraday returns regressed on daily flow

The intraday return indicated in the column heading (where the notation is "$TIME_{date}$") is regressed on concurrent and lagged daily unexpected flow ($Uflow_t$) and current expected flow ($Eflow_t$). Expected daily flow is taken from the model in Table 2, column 2. Unexpected flow is actual minus expected. Intraday returns are for the S&P 500 cash index, taken from tick data provided by the Futures Industry Institute.

The market opens at 9:30am and closes at 4:00pm. t-statistics in parentheses.

Time period: 2/20/98 - 6/30/98 (343 observations) Sample: 434 U.S. Equity Funds

PERIOD BEGIN:	$Close_{t-1}$	$9{:}40_t$	$11{:}00_t$	$3{:}00_t$	$9{:}40_t$
PERIOD END:	$9{:}40_t$	$11{:}00_t$	$3{:}00_t$	$Close_t$	$Close_t$
intercept	0.0007	-0.0003	0.0002	0.0007	-0.0003
	(2.3)	(-1.0)	(0.4)	(2.5)	(-0.4)
$Uflow_t$	0.29	0.45	2.08	0.77	2.27
	(0.9)	(1.5)	(3.7)	(2.3)	(3.4)
$Uflow_{t-1}$	0.64	-0.25	-0.45	-0.79	-0.76
	(1.8)	(-0.8)	(-0.8)	(-2.3)	(-1.1)
$Eflow_t$	0.44	0.18	0.93	-0.04	-0.39
	(1.2)	(0.6)	(1.2)	(-0.1)	(-0.6)