ELSEVIER

Journal of Financial Economics 59 (2001) 195–220

JOURNAL OF Financial ECONOMICS

www.elsevier.com/locate/econbase

Aggregate price effects of institutional trading: a study of mutual fund flow and market returns ☆

Roger M. Edelen[a], Jerold B. Warner[b,*]

[a]The Wharton School, University of Pennsylvania, Philadelphia, PA 19104, USA

[b]The William E. Simon Graduate School of Business Administration, University of Rochester, Rochester, NY 14627, USA

Received 22 December 1998; received in revised form 12 January 2000

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. © 2001 Elsevier Science S.A. All rights reserved.

JEL classification: G23; G14

Keywords: Mutual funds; Institutional trading; Price impact

☆We have received helpful comments from Mike Barclay, Stephen Brown, Jason Greene, Will Goetzmann, Josef Lakonishok (the referee), Craig MacKinlay, David Musto, Brian Reid, Bill Schwert, Jay Shanken, Rob Stambaugh, Nick Souleles, Russ Wermers, and workshop participants at Illinois, Rochester, Wharton, and the Rodney White Conference on Household Portfolio Decision-making and Asset Holding. We gratefully acknowledge financial support from the Wharton Financial Institutions Center, and thank Don Keim, Tony Santomero, and Carl Wittnebert for assistance. We also appreciate the excellent research assistance of Peter Wysocki.

* Corresponding author.

E-mail addresses: edelen@wharton.upenn.edu (R.M. Edelen), warner@simon.rochester.edu (J.B. Warner).

PII: S0304-405X(00)00085-4

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 on the impact of an institution's trades in a stock on the stock's price (see 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.

It is unclear whether existing results on the price impact of individual institutional trades would necessarily carry over to the aggregate level. Institutional investors own almost 50% of all equities (*NYSE factbook, 1998, p. 59*), and it is conceivable that common components to their trading 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 flow 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 appears to be that of returns responding to flow, or flow-induced trades, thus indicating an aggregate price impact.

This price impact of mutual fund flow 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. The stock's concurrent daily return can therefore overstate trading costs. Under these circumstances, precise information on 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 provide limited evidence on the common notion in the popular press that mutual fund flow causes security prices to rise and fall (see Warther, 1995, p. 210). Variation in aggregate daily fund flow explains only about 3% of the variation in daily market returns. This result contrasts with the high correlation between monthly aggregate flow and returns reported in Warther (1995), which we argue is largely due to a joint reaction of flow and returns to information, or flow following returns with a one day lag. The low daily correlation suggests that fund flow has little effect on the level of the stock market, but our tests do not fully address this issue. We focus on high-frequency relations during a relatively short sample period (e.g., 1998–1999). We do not study the cumulative effect of persistent positive flow surprises, nor the linkage between fund flow and the meteoric rise in stock prices throughout the 1990 s. Our evidence that there is a price impact of a day's unexpected flow raises the possibility of a cumulative effect. Rough calculations show that this cumulative effect could be substantial, but the issue of long run effects is left unresolved.

Section 2 discusses the flow data; further details of these data and the timing of events relating to flow 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 high-frequency 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 0.72, TT flow contains significant information about overall fund activity.

2.2. Timeliness

A feature emphasized by Trim Tabs is that the sample includes only those funds that reliably provide up-to-date daily net asset value (NAV). 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.

2.2.1. Fund reporting

A fund's actual 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 (see below). This delay is related to the processing of orders for purchase or redemption. Orders can be sent to the fund or the transfer agent, 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

[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.

processing, the transfer agent reports back to the fund manager the next morning (generally by 7: 30–8 A.M.).

Interviews with fund managers indicate that the actual flow figure provided by the transfer agent has some predictability. For example, some fund managers state that they have informal arrangements under which their transfer agent is expected to telephone them about any unusually large individual transactions by mid-afternoon. Another mechanism which assists predictability is that institutional investors in a fund sometimes give a day's advance notice for large wire transfers.[2]

2.2.2. Aggregate data

Each morning, usually between 9 A.M. and noon, Trim Tabs receives data for the previous day's activity 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, assuming there is timely reporting by each fund, there is at most a one-day lag between when flow occurs and when it becomes public information.

Our analysis in the Appendix suggests that the data sent to Trim Tabs by some funds do not fully reflect the day's activity (see also Greene and Hodges, 2000). However, as discussed in the Appendix, this only strengthens the paper's main conclusion that flow-motivated trade has an aggregate price impact.

2.3. Properties of daily flow

2.3.1. 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 (0.016%) 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 and thus not reported in Table 1.

2.3.2. 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 significant negative autocorrelation at lags 1 and 2, and positive autocorrelation at lag 6.

---

[2] In addition, the association between flow and lagged daily market returns that we find in our later analysis seems to be recognized in the mutual fund industry (see, for example "Pause in November Rally Causes Equity Redemptions of \$2. Billion", Mutual Fund Trim Tabs, 11/29/99).

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 = 0.01%) 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.

Lag:	1	2	3	4	5	6	7
Daily flow (close to close)	− 0.21[a]	− 0.16[a]	− 0.03	− 0.06	− 0.02	0.12[a]	0.05
Daily flow (close to close)	0.01	0.01	− 0.03	0.01	− 0.06	− 0.01	− 0.02

[a]Significant at 0.05 level, two-tailed test.

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. Additional checks show no material difference in flow across days of the week.[3] Thus, there are no apparent day of the week characteristics in either returns or flow 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

[3] In previous drafts, we also investigated within-week effects using semi-weekly flow data from 1994 through 1998. No material within-week effects were detected in that sample either. That sample does present evidence of higher beginning of month flows and returns, but modeling these effects did not change the results.

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, 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 a *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 than that reported here.

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 two-thirds of one standard deviation shock to flow on the following day. Goetzmann and Massa (1998) also report a flow-lagged return relation. Curiously, the Table 2 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

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 are 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%

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

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 are in parentheses.

Time period: 2/20/98 – 6/30/99 (343 observations)

Sample: 434 U.S. Equity funds

Raw flow	1	Expected-unexpected flow	2	3
intercept	0.00045	intercept	0.00061	0.00059
	(0.7)		(1.0)	(1.0)
coefficient on:		coefficient on:		
$flow_t$	1.42	$Uflow_t$	2.90	2.73
	(3.1)		(4.3)	(4.1)
$flow_{t-1}$	− 0.63	$Uflow_{t-1}$	− 0.15	—
	(− 1.3)		(− 0.2)	
$flow_{t-2}$	0.27	$Uflow_{t-2}$	− 0.90	—
	(0.6)		(− 1.3)	
$flow_{t-3}$	0.55	$Uflow_{t-3}$	0.97	—
	(1.1)		(1.4)	
$flow_{t-4}$	0.67	$Uflow_{t-4}$	1.6	—
	(1.4)		(2.4)	
$flow_{t-5}$	− 0.19	$Uflow_{t-5}$	− 0.8	—
	(− 0.4)		(− 1.3)	
		expected $flow_t$	− 0.20	0.08
			(− 0.3)	(0.1)
R^2	1.1%	R^2	3.9%	3.3%

relation between returns and unexpected flow in Column 3 simply mirrors that seen in Table 2, and as in that table, no causality can be ascribed to this correlation.

3.2.1. Price pressure

From Column 2, unexpected flow at lags one, two, and higher has no systematically significant relation to returns. The lack of a distinct sign pattern or 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 later using intraday returns (Section 4), but there is still little evidence of temporary price pressure.

3.2.2. 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 exactly, 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 a day's aggregate 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.

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 interpret it as price impact only in light of further tests in Section 4.

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 2 and 3. 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 − 0.04% (sells).
[c]Table 2 reports the price effects on exchange-listed stocks–sizes in text.
[d]Tables 1 and 4. Weighted average of pre-switch and post switch figures. Return is implementation cost only, not commissions.

From Table 4, positive (negative) aggregate unexpected flow days have inflows (outflows) of about $500 million to funds covered by TT, or about 2% of typical NYSE volume. Associated with these positive and negative unexpected flow days are abnormal market returns of 0.25% ($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 by Jones and Lipson (1999), their sample of trades is from firms that switched Exchanges, and are thus relatively smaller than firms in other studies.

3.3.1. Robustness

As an additional check for economic significance of flow, we ranked all days in the sample period by unexpected flow, sorted them into quintiles, and examined abnormal market returns. For quintiles one and five, 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 0.00374 ($t = 2.86$) and -0.00255 ($t = -1.59$), 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. Additional variations on the Table 4 analysis (e.g., returns for ranked deciles of unexpected flow, and unexpected flow for ranked deciles of returns) are examined in Section 4. These results yield additional insights, but do not change the basic picture of the return-flow or flow-lagged return relationships.

3.3.2. Long-run effects

The results in Tables 2–4 provide limited evidence on the view in the popular press that mutual fund flows cause security prices to rise and fall (see Warther, 1995, p. 210). From Table 3, the R^2's are only about 3%, far lower than the figure of 55% reported for monthly return-unexpected flow regressions (Warther, 1995, Table 4). Thus, our high frequency analysis suggests that the high monthly correlation does not occur because flow drives returns. Rather, it reflects the strong relation between flow and returns lagged one day. Our Table 2 regressions, which include lagged returns, show R^2's of about 50% and thus match month R^2's closely.

Although the low daily correlations suggest that flow does not drive returns, our tests do not fully address this issue. A limitation of our daily analysis is that it focuses on high-frequency relations, and the sample period is relatively short (e.g., 1998–1999). Our tests cannot capture the cumulative effect of persistent positive flow surprises. Although we are unable to study the linkage between fund flows and the meteoric rise in stock prices throughout the 1990 s, our price impact evidence is important because it opens up the possibility of a substantial cumulative price impact associated with flow shocks. For example, consider the following rough calculation. Suppose the market cannot perfectly predict long-term variation in flow, and that daily unexpected flow averages 0.5 basis point per day (the actual daily flow over our sample period is 1.6 basis points). Over a five year period (1250 trading days), this unexpected flow translates into a cumulative return of 17.1% (e.g., $1250 \times 0.5 \times 2.73$, where 2.73 is the flow-unexpected return regression coefficient in Table 3). Similar conclusions apply using the Table 4 price impact estimates; if the number of positive and negative unexpected flow days are 650 and 600, respectively (only slightly tilted towards positive days), the cumulative price impact is a fairly substantial 12.5% [e.g., $(650 - 600) \times 0.25\%$, where 0.25% is the mean abnormal market return on positive unexpected flow days].

4. Daily flow and intraday returns

The concurrent statistical association between daily returns and flow seen in Section 3 measures price impact only if the association is solely due to a causal effect of flow on returns. 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. The prediction is reinforced if in addition to flow driving returns, flow responds to returns with a one-day lag. If afternoon returns are high, fund managers expect additional flow the following day. They trade more in anticipation, further affecting afternoon returns.

This prediction about the association between daily flow and intraday returns 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. Indeed, the correlation should be stronger using morning returns.[4] 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 between returns and lagged flow, intraday returns sharpen this test.

4.2. Intraday return data

Table 5 presents summary characteristics of the intraday NYSE (spot) Index return data. Returns are shown for four 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 ten minutes into the trading day so that most stocks will have opening transactions prices. Returns are also shown for 9:40 A.M. to close, representing open-to-close returns. Results are similar using other definitions of the overnight period.

From Panel A, each of the four non-overlapping periods has roughly equal volatility. Thus, both returns and information appear to be spread throughout the trading day, although close to open 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.

[4] This prediction ignores any flow induced by NAVs which reflect stale prices. The possiblity of such flow is raised in several recent papers and complicates the predictions, but appears empirically relevant only for international funds (Greene and Hodges, 2000), which we exclude.

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 = 0.01%) per day.
Time period: 2/20/98 – 6/30/99 (343 observations)
Sample: 434 U.S. Equity funds

PERIOD START: PERIOD END:	$Close_{t-1}$ $9{:}40_t$	$9{:}40_t$ $11{:}00_t$	$11{:}00_t$ $3{:}00_t$	$3{:}00_t$ $Close_t$	$9{:}40_t$ $Close_t$
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[a]	0.13[a]	—	
$9{:}40_t$ – $Close_t$	0.01	—	—	—	

[a]Significant at 0.05 level, two-tailed test.

This sharpens inferences by effectively making the dependent variable unexpected flow, and by avoiding correlated-omitted variable biases arising from time-series correlations between intraday returns and past daily observations of flow and returns.

4.3.1. 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 0.010 ($t = 1.1$), compared to 0.022 ($t = 3.2$) and 0.019 ($t = 3.8$) for the 11:00–3:00 and 3:00 to close returns, respectively. 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.

4.3.2. 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

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 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 are 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)

returns or information in the last hours of trading, but to no other returns or information. Further, one expects that a same-day reaction of flow to returns or information, if there is one, would be more similar to the reaction of flow to overnight returns than to previous-day returns. Yet Table 5 shows no immediate flow response to overnight returns (or information), suggesting that reactions that rapid are immaterial.

4.4. *Intraday returns regressed on flow*

Table 7 examines the dependence of intraday returns on flow. Returns for various intraday periods are regressed against daily expected, 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 that of morning returns on the day's unexpected flow. Regressions using the close-to-open and

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 are in parentheses.
Time period: 2/20/98 – 6/30/98 (343 observations)
Sample: 434 U.S. Equity funds

Period start: Period end:	$Close_{t-1}$ $9{:}40_t$	$9{:}40_t$ $11{:}00_t$	$11{:}00_t$ $3{:}00_t$	$3{:}00_t$ $Close_t$	$9{:}40_t$ $Close_t$
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)

9:40–11:00 return as dependent variables 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.

4.5. Decile sorts

Table 8 provides additional information on the regression results in Tables 6 and 7. Panel A examines returns for days formed into deciles by unexpected flow, and Panel B examines flow and unexpected flow for days formed into deciles by returns. In both panels, extreme deciles 1 and 10 are each split into two subsamples (e.g., 1*x*, 1, 10, 10*x*, where *x* denotes the more extreme half of

Table 8
Decile analysis

In Panel A, days are ranked into deciles according to the unexpected flow from the model in Table 2, Column 2. In Panel B, days are ranked according to NYSE Index returns. The extreme deciles are further split into 5% groups, with an *x* indicating the more extreme subsample. Day *t* in the column heading refers to the ranking day. All figures are expressed in basis points (i.e., 1 = 0.01%).
Time period: 2/20/98 – 6/30/99 (343 observations)
Sample: 434 U.S. Equity funds

Panel A. Returns, for ranked unexpected flow ($Close_{t-1}$ to $Close_t$)

		Same day return			next day return	
Period start:		$Close_{t-1}$	$Close_{t-1}$	$9{:}40_t$	$Close_t$	$9{:}40_{t+1}$
Period end:		$Close_t$	$9{:}40_t$	$Close_t$	$9{:}40_{t+1}$	$Close_{t+1}$
Unexpected flow decile:	Flow					
1*x*	− 20.2	− 65	24	− 86[a]	− 18	48
1	− 12.3	− 17	− 22	4	6	− 15
2	− 9.3	− 11	6	− 13	− 10	1
3	− 5.8	− 10	3	− 9	4	− 7
4	− 2.5	− 42[a]	− 12	− 30	9	− 45[a]
5	− 0.6	− 2	− 3	6	7	8
6	1.4	7	8	5	3	5
7	3.5	18	4	14	15	− 4
8	5.7	8	3	2	− 5	27[a]
9	8.5	10	14	3	3	− 3
10	12.6	43[a]	− 4	37	31[a]	3
10*x*	17.9	84[a]	32	57[a]	24[a]	− 37

Panel B. Flow, for ranked returns ($Close_{t-1}$ to $Close_t$)

		$flow_t$	$Uflow_t$	$flow_{t+1}$	$Uflow_{t+1}$
Return decile:	Return				
1*x*	− 256	− 1.2	− 4.5[a]	− 12.1[a]	4.7
1	− 150	0.7	− 1.8	− 13.0[a]	− 3.5
2	− 96	− 3.0	− 2.8	− 10.6[a]	− 6.0[a]
3	− 53	1.6	0.9	− 6.7[a]	− 3.1[a]
4	− 27	1.2	− 0.6	− 1.4	0.7
5	− 6	− 0.8	− 3.3	− 1.1	− 2.5
6	17	1.7	0.8	5.1[a]	3.8[a]
7	44	4.3[a]	2.2	6.5[a]	2.1
8	74	4.9[a]	3.1[a]	10.7[a]	4.9[a]
9	113	0.7	− 0.8	11.3[a]	1.3
10	157	9.3[a]	4.9[a]	13.8[a]	1.0
10*x*	241	2.1	2.3	16.8[a]	− 4.2[a]

[a] Significant at 0.05 level, two-tailed test

a decile). The decile sorts provide additional robustness checks, and the results reinforce the paper's conclusions.

4.5.1. Returns for unexpected flow deciles

In Panel A, the first column indicates that the concurrent daily association between returns and unexpected flow is apparent throughout the distribution of unexpected flow. There appears to be a slight asymmetry between positive and negative unexpected flow days, with the former having the larger return association. We caution that this is only suggestive, as the standard errors are large.

Columns 2 and 3 in Panel A decompose the day's return into close-to-open and open-to-close periods. Confirming our earlier findings, the concurrent relation between returns and unexpected flow is mostly found during the trading day, where extreme negative (positive) flow is associated with −0.86% (0.57%) returns. Columns 4 and 5 examine the return on the day following flow, both close-to-open and open-to-close. Here, the asymmetry between positive flow and returns (stronger) and negative flow and returns (weaker) is more apparent. In particular, large unexpected inflows on day t bring about a statistically significant 0.24% (decile 10x) to 0.30% (decile 10) abnormal return by the following market open.

The last column of Panel A suggests that during the next trading day, returns tend to oppose the previous day's unexpected flow, but only if it is extreme. For example, on the most extreme negative flow days (decile 1x), the market is down an estimated 0.86% during that day's trading, down another 0.18% on the subsequent open, but then rises 0.48% during the subsequent trading day. On extreme positive flow days (decile 10x) the market is up 0.81% from open to subsequent open, but then falls the next day by 0.37%. These sign patterns and estimates are consistent with a reversal tendency and temporary price pressure only for extreme cases, however, and we emphasize that even there the results are not highly statistically significant.

4.5.2. Flow for return deciles

Panel B of Table 8 presents both flow and unexpected flow for the 10 return deciles. This panel again confirms that the relation between returns and flow (raw or unexpected) is largely apparent throughout the distribution, and there is no apparent asymmetry or nonlinearity in the flow-feedback trading result. Next-day flow is strongly related to today's return, but unexpected next-day flow shows a much weaker relation. This is consistent with our regression model of expected flow capturing much of the flow, lagged return relation.

5. Lagged flow response: discussion

Our analysis with daily return data (Section 3) shows that flow follows returns with a one-day lag. As discussed in the Appendix, a caution is that the true relation could be overstated due to some funds' late reporting. Explanations for a true one-day lagged flow response are considered 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 (bad) 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 some investors 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 (1996). 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 (1996) explanation and the causal explanation are not mutually exclusive, so this does not refute their explanation.

5.2. Feedback trading

In the Brennan and Cao (1996) 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 (DeLong, et al. (1990) provide examples in other contexts).[5] If some stocks react slowly to economic news, then a fund's portfolio

[5] Consistent with feedback trading, Sias and Starks (1997) present evidence that institutions trade in the direction of market returns lagged one day. Their finding could, however, simply reflect concurrent flow affecting returns, coupled with mutual funds investing some flow a day after it occurs.

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, or 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. Although our analysis is able to provide evidence on this association, it is difficult to discriminate between alternative explanations.

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

This Appendix examines the timeliness of the Trim Tabs (TT) data. Our analysis suggests that the data sent to Trim Tabs by some funds do not fully reflect the day's activity. However, as discussed below, this only strengthens the paper's main conclusion that flow-motivated trade has an aggregate price impact.

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).[6] 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 the day's closing prices and the shares outstanding as of the close of business on the preceding day.[7] After the NAV is calculated it is reported to the National Association of Security Dealers (NASD) and the transfer agent. This must occur by 5:30 P.M.

The transfer agent's 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 specifically provided for in the 1970 Amendment to the Investment Company Act.[8] 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. Day t flow is calculated as reported total assets day t less (reported total assets day $t-1$ * (1 + ret day t)), where ret is the fund's proportional change in NAV. As long as the fund forwards the information provided in the most recent statement from the transfer agent (i.e., the report received on the morning of day $t+1$), the Trim Tabs data will correctly reflect the previous day's flow.

---

[6] 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.

[7] 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.

[8] $t+1$ 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.

A.2. Tests

Timing lags result if funds send one-day-old data to TT, or if funds send only partially updated information (with updated NAV but not reflecting the day's fund-share transactions).[9] We examine these possibilities using a variety of tests. The tests are based on semi-annual reports that mutual funds file with the Securities and Exchange Commission (SEC) that include the fund's total assets and shares outstanding (Form N-30D). This report must be in conformance with GAAP, and thus reflects the correct balance sheet as of the close of business on the last day of the fiscal period (i.e., including the flow on that last day in contradiction to t-plus-one accounting).[10] In addition, we have daily data on the individual-fund assets reported to Trim Tabs for the period February 2, 1998 through July 7, 1998.

A.2.1. Tests for one-day old data

We compare Trim Tabs' individual-fund reported assets for the last day of the fiscal period (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 this correct number. Specifically, we examine the sample of all Trim Tabs funds with semi-annual EDGAR filings ($N = 79$) during the data period. 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 second test is provided by examining the correlation of the error in the EOP Trim Tabs figure with the error in the BONP Trim Tabs figure. If late reporting causes the error, then the EOP error and the BONP error should be negatively correlated across observations. When one is wrong the other is right, and vice versa. In fact, the correlation is 0.31 with a p-value of 0.04, suggesting that the observed error in day t reported assets is due to factors other than a simple one-day misalignment of the data.

A third test is from Panel B of Table 1. The first-order autocorrelation in the Trim Tabs flow is significantly negative. There is a common (systematic)

---

[9] We thank Jason Greene for pointing out the latter potential source of error.

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

component to flow (Edelen, 1999). Given this common component, if it were the case that some funds systematically report late whereas others are timely, we should observe positive first-order autocorrelation in the flow data, ceteris paribus. The failure to find a positive autocorrelation increases our confidence that the TT data are timely. We note, however, that the negative autocorrelation seen in daily flow indicates that some other phenomenon is at work, reducing the power of this test.

A.2.2. Tests for partially current, partially old data

The complexity of balance-sheet updates at mutual funds gives rise to another hypothesis of timing error. The assets of a mutual fund are marked to market and reported to the NASD on a per share basis by 5:30 P.M. on day t. However, the second adjustment to the balance sheet, which is the recognition of the day's transactions of fund shares, is not made until the following morning. It could be that the total assets figure reported to Trim Tabs includes the first balance-sheet update but not the second. There seems no particular reason to expect this error, because the total asset figure is typically sent to Trim Tabs several hours after the second adjustment is typically made to the balance sheet (i.e., a 9 A.M. to noon Eastern time reporting to Trim Tabs versus a 7–8 A.M. report, at the latest, from the transfer agent). Nevertheless, such an error is certainly plausible.

Flow is calculated by Trim Tabs as reported total assets day t less [reported total assets day $t-1$ * $(1 +$ ret day $t)$]. In the case just described, the *reported* day t total assets figure that TT uses to calculate flow is actually the true total assets on day $t-1$ * $(1 +$ ret day $t)$. This yields day $t-1$ flow rather than day t flow. Under this alternative hypothesis, the correct total assets for day t is the day $t+1$ figure reported by Trim Tabs, deflated by the day $t+1$ return.

To determine whether the total-assets figure sent to Trim Tabs is only partially adjusted in this way, we apply this hypothesized correction and assess the comparability to the correct SEC figure. Using this test, we find evidence of late reporting in the Trim Tabs data. Out of 79 funds examined, in 28 cases (35.4%) the hypothesized correction yields a total asset number closer to the SEC number than does no correction. Assets with the partial-adjustment-based correction are within 0.05% of the correct (SEC) amount 36% of the time. This compares to 40% using assets based on unadjusted Trim Tabs data. The remaining 24% of the observations differ by greater than 0.05% from the correct figure using both the unadjusted and partially adjusted figure. From these various comparisons, it appears that some funds, at some times, report a partially adjusted balance sheet, implying a one-day late flow number. Unfortunately, SEC reports are only twice per year, and we cannot simply repeat the paper's tests using only aggregated individual fund flows built up from these data. Further, even if a fund shows a one-day reporting lag based on our comparisons of SEC and TT data, whether there is also a one-day lag for all other days in unclear; merely adjusting the fund's data by one day is subject to potentially severe classification errors.

A.2.3. Implications of late reporting

Late reporting by some funds could have implications for interpreting our findings. Most importantly, late reporting reinforces the paper's main conclusion that fund flows have a price impact. The reported concurrent return-flow relation (Table 3) understates any price impact. The basic intuition is that some flow reported as today's occurred yesterday and influenced returns then; the reported concurrent relation does not reflect this price impact effect. The paper's reported relation between flow and lagged returns could be picking up this price impact, coupled with a one-day reporting lag. The one-day lag in some funds' reporting also causes any true one-day lagged response of flow to returns to be overstated in return-lagged flow regressions.

However, a simple test provides strong evidence that the paper's conclusions are robust to reporting lags.[11] Recall that in Table 6 we showed that afternoon returns are more highly correlated with daily flow than morning returns are. This supports the joint hypothesis that the bulk of flow is correctly reported and that flow affects returns. If significant flow is reported a day late, we should also find a stronger correlation between lagged afternoon returns and today's reported flow than between lagged morning returns and today's reported flow. Repeating the Table 6 tests but using lagged morning (or lagged afternoon) returns, there is no evidence supporting this prediction.

The failure to find the predicted differences in correlations also suggests that the relation reported in the paper between daily returns and flow lagged one day cannot be due solely to lagged reporting by some funds. From Table 2, the regression coefficient of flow on lagged returns is 0.073, which is over 4 times greater than the coefficient on concurrent return. If this stronger correlation with lagged returns were solely due to lagged reporting, it would be especially surprising to find the reported Table 6 results for morning versus afternoon returns and flow, yet no relation using lagged morning versus lagged afternoon returns and flow.

References

Brennan, M., 1998. Discussion: Has the rise of mutual funds increased market instability? Brookings-Wharton Papers on Financial Services, 263–267.

[11] Further, the preceding analysis of reporting lags could overstate the possible implications because our tests use unexpected flow. The time-series model for unexpected flow already captures some effects of reporting lags.

Brennan, M., Cao, H., 1996. Information, trade, and derivative securities. Review of Financial Studies 9 (1), 163–208.
Chan, L., Lakonishok, J., 1993. Institutional trades and intraday stock price behavior. Journal of Financial Economics 33, 173–200.
Chan, L., Lakonishok, J., 1995. The behavior of stock prices around institutional trades. Journal of Finance 50, 1147–1174.
Chan, L., Lakonishok, J., 1997. Institutional equity trading costs: NYSE versus NASDAQ. Journal of Finance 70, 713–735.
DeLong, J., Shleifer, A., Summers, L., Waldman, R., 1990. Positive feedback investment strategies and destabilizing rational speculation. Journal of Finance 45, 379–395.
Edelen, R., 1999. Investor flows and the assessed performance of open-end mutual funds. Journal of Financial Economics 53, 439–466.
Goetzmann, W., Massa, M., 1998. Index funds and stock market growth. Unpublished working paper. Yale University.
Greene, J., Hodges, C., 2000. The dilution impact of daily fund flows on open-end mutual funds. Unpublished working paper. Georgia State University.
Jones, C., Lipson, M., 1999. Execution costs of institutional equity orders. Journal of Financial Intermediation 8, 123–140.
Keim, D., 1999. An analysis of mutual fund design: the case of investing in small-cap stocks. Journal of Financial Economics 51, 173–194.
Keim, D., Madhavan, A., 1997. Transactions costs and investment style: an inter-exchange analysis of institutional equity trades. Journal of Financial Economics 46, 265–292.
Sias, R., Starks, L., 1997. Return autocorrelation and institutional investors. Journal of Financial Economics 46, 103–131.
Warther, V., 1995. Aggregate mutual fund flows and security returns. Journal of Financial Economics 39, 209–235.
Warther, V., 1998, Has the rise of mutual funds increased market instability? Brookings-Wharton Papers on Financial Services, 239–262.