Analyst Recommendations, Mutual Fund Herding, and Overreaction in Stock Prices[†]

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Abstract

This paper shows the first evidence that institutional trading destabilizes U.S. stock prices. Specifically, we show, during the 1994 to 2006 period, that mutual fund managers follow analyst recommendation revisions when they trade stocks, and that such analyst-motivated trades move stock prices. Mutual funds "herd" (trade together) into stocks with consensus analyst upgrades and (especially) herd out of stocks with consensus downgrades. Stronger fund herding occurs when analyst recommendation revisions are more unanimous.

Further, downgraded stocks heavily sold by herds initially underperform, then outperform their size, book-to-market, and momentum benchmarks, while upgraded stocks that are heavily bought exhibit the opposite pattern. An investment strategy that exploits these return reversals generates a benchmark-adjusted return exceeding six percent per year. Moreover, the sharpest return reversals occur when mutual funds with poor recent performance ("unskilled fund managers") herd on the sell-side following a consensus analyst downgrade.

Our analysis also shows that stock price reversals are better explained by the overreaction of unskilled mutual funds to analyst revisions than by flow-forced trading of funds or by reversals in fund herding or analyst revisions themselves. In addition, these stock return reversals increase over time during the 1985 to 2006 period, which is likely due to a large increase in the number and proportion of unskilled mutual fund managers. Overall, our evidence indicates that herding by mutual fund managers with short-term reputational concerns in response to analyst revisions leads to sharp stock price overreaction.

The efficient markets paradigm endures as a central focus of empirical tests by academic researchers, with many recent papers providing strong evidence against efficiency in U.S. equity markets. For instance, several researchers examine patterns in stock returns to find evidence suggestive of large groups of investors exhibiting irrationality, such as Jegadeesh and Titman (1993), who find evidence of investor underreaction, and DeBondt and Thaler (1985), who find evidence of overreaction. However, the literature provides little evidence on which investors exhibit such patterns of irrational trading—simply put, which investors move stock prices, and what motivates their trades?

Although some research has shown a tendency for individual investors to exhibit irrationality, such as Odean (1998), it is difficult to imagine individuals systematically moving the market by acting in concert.[1] By contrast, institutional investors are well-known to receive correlated information (see, for example, Coval and Moskowitz (1999)) and to exhibit correlated trading patterns (see, for example, Nofsinger and Sias (1999) and Sias (2004)). In addition, the large scale of trading by institutional managers magnifies the effect of any correlated trading patterns that may exist, relative to the small trades normally placed by individuals.

Among institutional investors, the strongest evidence of correlated trading is exhibited by equity mutual funds. For instance, Grinblatt, Titman, and Wermers (1995) document that momentum investing strategies are used by the majority of equity mutual funds, while Wermers (1999) finds that mutual funds tend to exhibit high levels of "herding" (simultaneous buying or selling) in growth stocks, small stocks, and extreme

[1] Recent research, however, finds evidence that small investor sentiment may be correlated, and that such correlated trading predicts future small stock returns (see, for example, Barber, Odean, and Zhu (2009)).

past-return stocks. Further, mutual funds have become increasingly important in setting stock prices; for example, mutual fund equity holdings have almost doubled relative to the total capitalization of equity markets—from 12.7 percent (at the end of 1994) to 22.2 percent (at the end of 2005) of all outstanding shares of U.S. equities—while turnover by mutual funds has substantially increased as well during this period.[2] As such, it is important to understand what motivates correlated mutual fund trading as well as the impact of such correlated trades on stock prices.

In this paper, we analyze correlated mutual fund trading behavior during the 1995 to 2006 period by focusing on instances of fund herding.[3] While we investigate the tendency of funds to herd in stocks with certain characteristics, such as extreme past-return, high information uncertainty, and small stocks, we are especially interested in the tendency of funds to herd in response to the release of sell-side analyst information and, in particular, analyst recommendation revisions.[4] We believe that mutual funds pay particular attention to analyst recommendations, perhaps even herding in the process, since prior studies indicate that institutional trades are sensitive to analyst recommendations (e.g., Chen and Cheng (2006), Kacperczyk and Seru (2007), and Mikhail, Walther, and Willis (2007), Busse, Green, and Jegadeesh (2008)). Furthermore, if funds do herd in

[2] Our analysis of mutual fund holdings shows that 432 stocks are each traded by more than 100 funds during the fourth quarter of 2005, while only 37 stocks experience such widespread fund trading during the fourth quarter of 1994—consistent with the larger role of mutual funds during recent years.

[3] In this paper, we define herding as a greater proportion of funds simultaneously trading a stock on the same side (either buying or selling), than expected from random and independent trading by the funds. We focus on fund herding, rather than aggregate trades of funds, in order to capture the concept of fund managers moving together, either by design or by acting on correlated information or incentives. Since the entire market cannot herd, we would expect, a priori, that the increased presence of mutual funds in stock market trading would be accompanied by a reduced level of herding.

[4] Recent papers that document the investment value of analyst revisions include Jegadeesh, Kim, Krische, and Lee (2004), Jegadeesh and Kim (2007), and Gao (2007).

response to analyst revisions, then we are interested in determining how herding through this unique mechanism impacts stock prices.

Our analysis shows that mutual funds are more likely to herd on the buy-side following a consensus analyst upgrade, and (especially) to herd on the sell-side following a downgrade. This relation between fund herding and analyst revisions remains strong after controlling for stock characteristics and investment signals that influence both fund trading and analyst recommendation revisions, such as size, book-to-market ratio, price momentum, analyst recommendation dispersion, and share turnover. Results are similar when we examine the response of fund herding to (1) the net proportion of analysts issuing recommendation upgrades or (2) the consensus analyst earnings forecast revision, rather than the consensus analyst recommendation revision.

Moreover, we show that the relation between analyst revisions and mutual fund herding is not solely driven by their sequential responses to common investment signals. Specifically, we examine which revisions lead to herding. First, we find that mutual fund herds react much more strongly to analyst downgrades than upgrades, consistent with existing literature that documents a stronger response of institutional investors to analyst sell recommendations because of the potential upward bias in sell-side research. However, we do not find the same asymmetric reaction to analyst earnings forecast revisions, consistent with the fact that the incentives for analysts to provide optimistic versus pessimistic earnings forecasts are not as clear cut as in the case of buy versus sell recommendations, especially since analysts have the tendency to walk down their forecasts to beatable targets. In addition, we show that fund managers exhibit a stronger reaction to analyst opinions that are more unanimous (i.e., analyst "herding" that is due either to

correlated information or to analyst career concerns). These findings suggest that mutual funds respond directly to the information content of analyst revisions, controlling for their response to other signals.

We also find that stocks bought by herds experience a sharp increase in price during the herding measurement quarter, while stocks sold by herds experience a sharp decrease in price. However, these returns reverse during the following year only when funds herd in the same direction as analyst revisions—indicating that fund managers appear to overreact to the information content of recommendation changes. Specifically, stocks sold by herds following a consensus analyst downgrade outperform stocks bought by herds following such a downgrade by about three percent during the fourth quarter subsequent to the herding measurement quarter. Similarly, upgraded stocks bought by mutual fund herds underperform upgraded stocks sold by herds by almost two percent during the same period. Further evidence indicates that mutual fund herding or analyst revisions, in general, are not associated with subsequent return reversals—only herding in response to consensus analyst revisions.

We explore potential sources of the overreaction effect and subsequent return reversals by examining changes in stock characteristics during the quarters following analyst revisions and extreme mutual fund herding. We find that stock price reversals are not explained by simple reversals in mutual fund herding, analyst revisions, or firms' cash flow news during these subsequent quarters. Next, we explore the role of concentrated fund trading forced by extreme money flows (Coval and Stafford (2007). We find that, although flow-driven mutual fund trading is associated with future return reversals, it does not explain the reversals associated with revision-prompted herding. In fact,

revision-prompted herding results in much sharper return reversals than flow-induced trading.

Since herding by mutual fund managers appears to be price destabilizing, it may be motivated by non-fundamental information related incentives, such as reputational concerns (e.g., Scharfstein and Stein (1990)). Our final tests compare herding by funds with good past performance ("skilled fund managers") with herding by funds with poor past performance ("unskilled fund managers"). Since managers of losing funds are more likely to focus on the short-term to avoid being fired, we would expect them to overinvest (relative to winning fund managers) in the common signal represented by analyst revisions—which is likely to pay off in the short-run—and to underinvest in other sources of valuation information that are slower to be reflected in stock prices (as modeled by Froot, Scharfstein, and Stein (1992)).

In addition, unskilled managers are less likely to be able to distinguish between analyst herding that is based on correlated information (informative analyst herding) and analyst herding that is based on career concerns (uninformative analyst herding)—thus, they are more likely to react to any instance of analyst consensus revisions. Indeed, Kacperczyk and Seru (2007) find that unskilled fund managers are more likely to react to (either with or against) analyst recommendation revisions. Consistent with this evidence, we find that a consensus analyst upgrade results in a greater proportion of losing funds buying a stock, relative to winning mutual funds. Similarly, a consensus analyst downgrade increases the proportion of sales made by losing funds, relative to winners. These results indicate that unskilled fund managers react more strongly to analyst revisions than skilled managers.

Finally, we find evidence that sell-herding by unskilled managers results in the strongest return reversals, which indicates that stock return reversals are primarily due to managers with short-term career concerns overreacting to analyst revisions. Unskilled managers do not appear to impact stock prices as much on the buy-side, perhaps because losing funds are more likely to quickly sell stocks in reaction to downward analyst revisions to window-dress and to minimize the price impact on their inventory of those stocks. In addition, losing funds face large outflows, which restrict their buying activity. Interestingly, we find a strong time trend in the response of unskilled managers to analyst revisions, and in the stock price return reversals—both increase during the 1985 to 2006 period. This finding is consistent with recent evidence (Barras, Scaillet, and Wermers (2009)) that documents a large increase in the number and proportion of unskilled domestic equity mutual fund managers. As such, our findings indicate that fund herding by unskilled managers represents an additional useful signal for stock valuation, above that of analyst recommendation revisions.

The remainder of this paper is organized as follows. In the next section, we develop hypotheses relating mutual fund herding to analyst revisions. Section II describes our data and research methodology. Section III examines the sensitivity of mutual fund herding to analyst revisions. Section IV assesses the price impact of herding through this particular mechanism. Section V examines the effect of reputation-based herding on return reversals. Finally, Section VI concludes the paper.

I. Herding and Analyst Revisions

Mutual funds pay for sell-side analyst research through costly soft-dollar arrangements (e.g., Conrad, Johnson, and Wahal (2001)), indicating that they use this information as a major input in their investment processes.[5] While some large fund families, such as Fidelity, maintain large pools of buy-side analysts, most funds have very few analysts to support their portfolio managers—these managers appear to depend heavily on sell-side analysts for much of their information on stocks. Indeed, past research shows that institutional trades are very sensitive to analyst recommendations (e.g., Chen and Cheng (2006), Kacperczyk and Seru (2007), and Mikhail, Walther, and Willis (2007)).

Further research indicates that analyst revisions have investment value that is short-lived (e.g., Brennan, Jegadeesh, and Swaminathan (1993) and Barber, Lehavy, McNichols and Trueman (2001)). Therefore, mutual funds wishing to capitalize on the investment value of analyst information must react quickly, and in the same direction, to the issuance of a revision. This leads to our first hypothesis:

> *Hypothesis 1 (H1): Mutual funds herd in response to analyst consensus revisions. Positive revisions result in a herd of funds buying a stock, while negative revisions result in a herd of funds selling.*

Prior studies document that sell-side analysts are reluctant to issue downgrades because of pressure to generate investment banking and brokerage business, and to gain or maintain access to management as a source of information. Due to these conflicts of

[5] Interestingly, Irvine, Lipson, and Puckett (2007) find evidence suggestive of institutions receiving valuable private information from sell-side analysts prior to their publicly disclosed stock recommendations, which likely provides further incentives for funds to herd on analyst revisions.

interest, several studies show that, relative to favorable recommendations, unfavorable recommendations are more informative, and often result in a stronger market reaction (see, for example, Agrawal and Chen (2008), Barber et al. (2001), Irvine (2004), Lin and McNichols (1998), and Michaely and Womack (1999)). Consistent with this evidence, Malmendier and Shanthikumar (2008), Mikhail, Walther, and Willis (2007), and He, Mian, and Sankaraguruswamy (2006) document that sophisticated investors (i.e., large traders) react more strongly to downgrades than to upgrades. Therefore, our second hypothesis is stated as follows:

> *Hypothesis 2 (H2): Mutual funds herd more strongly (on the sell-side) following a consensus analyst downgrade than they herd (on the buy-side) following a consensus analyst upgrade.*

If institutional investors do not blindly take analyst information at face value, then we expect that they will react more strongly to analyst revisions when analysts are more in agreement with each other. In addition, since prior research (e.g., Clement and Tse (2005), and Jegadeesh and Kim (2007)) documents that sell-side analysts herd when they issue recommendations or earnings forecasts, the herding behavior of analysts could also affect the tendency for mutual funds to herd. Analysts may herd toward the consensus for different reasons, including career concerns and/or the receipt of correlated information (Trueman (1994) and Hong, Kubik and Solomon (2000)). In the first case, we would expect analyst herding to be uninformative about stock values, since analysts may disregard useful private information as they herd. In the second case, we would expect analyst herding to be very informative about stock values, since information is aggregated.

Since mutual fund managers cannot perfectly distinguish between these two cases, we expect that herding by analysts is more likely to result in herding by mutual funds. Thus, we examine the following hypothesis:

> *Hypothesis 3 (H3): Mutual fund herds react more strongly to analyst recommendation revisions when the dispersion of analyst recommendations is lower and when analysts themselves are herding.*

Finally, prior evidence suggests that mutual fund managers with career concerns are more likely to herd in their stock trades (Chevalier and Ellison (1999)). Moreover, Barras, Scaillet, and Wermers (2009) find a strong trend toward less-skilled fund managers over the past 30 years, who will have greater career concerns than skilled managers. This observation suggests that herding by mutual funds in response to *uninformative* analyst recommendation revisions has likely increased, since low-skill managers are less likely to be able to distinguish between informative and uninformative analyst revisions. This leads to our final hypothesis:

> *Hypothesis 4 (H4): Mutual fund herding by unskilled managers, in response to consensus analyst revisions, exhibits an upward trend over time. In addition, the price impact of herds and the tendency of stocks to experience subsequent price reversals both exhibit an upward trend, since mutual fund herds (which impact prices) reflect a decreasing amount of useful valuation information.*

In our paper, we test the reaction of mutual fund managers to sell-side analyst recommendation revisions. We are motivated by prior research (e.g., Jegadeesh et al. (2004)) which shows that the predictive value of stock recommendation revisions is higher than that of recommendation levels and that analyst recommendation revisions have greater investment value than analyst forecasts (e.g., Francis and Soffer (1997), Brav and Lehavy (2003), and Asquith, Mikhail, and Wu (2004)). However, in tests of the robustness of our results, we also examine herding by fund managers in response to analyst earnings forecast revisions.

II. Data Description and Research Methodology

A. Data

We construct our sample from the following databases: the Thomson Financial mutual fund holdings database, the Zacks consensus recommendations history file, the CRSP mutual fund database, the CRSP monthly stock database, and Compustat. Thomson Financial provides quarter end "snapshots" of portfolio holdings for all U.S.-based mutual funds—we infer trades (buys and sells) from changes in the quarterly positions for each fund.[6] For funds not reporting at the end of a given quarter, we carry forward (for a maximum of three months) their most recent holdings to calculate trades in the following quarter. We mainly focus on mutual fund holdings from 1995 to 2006 to contrast our findings to earlier studies such as Wermers (1999), which examines mutual fund herding in the pre-1995 period.

Given our interest in analyst revision-induced herding, we exclude stocks that are newly issued within the prior four quarters since such stocks are likely to be traded in common by funds for reasons that are unrelated to analyst revisions. We also exclude all trades by index funds, international funds, municipal bond funds, "bond and preferred" funds, sector funds, and funds that cannot be linked to the CRSP mutual fund database via the MFLINKS dataset available from WRDS (almost all U.S. domestic equity funds have links available). We impose these restrictions to ensure that our sample of trades is representative of those made by actively managed, diversified U.S. domestic equity funds.

The Zacks consensus history file provides the average recommendation for each stock on a daily basis as well as the number of recommendations within each rating category (i.e., strong buy to strong sell). Compared to other sources of analyst recommendations data or the Zacks detailed history file, the Zacks consensus history file is most comprehensive as it includes recommendations issued by analysts from almost all brokerage firms.[7] Zacks standardizes each analyst's recommendation to a five-point rating scale between 1 (strong buy) and 5 (strong sell). For ease of interpretation, we reverse the standard scale so that favorable recommendations are assigned a higher numerical value; thus, an increased value indicates an upgrade, while a decreased value indicates a downgrade. At the end of each quarter, we take the most recent consensus recommendation

[6] We adjust quarterly portfolio holdings for stock splits and dividends using the end-of-quarter cumulative adjustment factor from CRSP.

[7] We use the consensus history file because the detailed file that Zacks provides to academics excludes 12 large brokerage houses such as Merrill Lynch, Morgan Stanley, Bear Stearns, and J.P. Morgan, among others. These exclusions hinder our analyses because recommendations issued by analysts from these large brokerage firms are likely to be more influential. Other analyst databases also suffer from this problem. For example, the I/B/E/S data excludes recommendations from Lehman Brothers and BB&T Capital. On the other hand, the only brokerage firm that is excluded from the Zacks consensus data file is Credit Suisse First Boston.

for each stock, while requiring that this consensus recommendation be updated no more than 90 days prior to the end-of-quarter date.

We next compute, for each stock traded by at least five funds during quarter *t*, the consensus recommendation change (*Revision*) during the prior quarter, i.e., $Revision_{it-1} = \overline{REC}_{it-1} - \overline{REC}_{it-2}$, where $\overline{REC}_{it-1}$ is the average (consensus) analyst recommendation at the end of quarter *t*–1. A stock is classified as receiving an "upgrade", "downgrade" or "no change" if its consensus recommendation change is positive, negative, or zero, respectively. Finally, we obtain monthly returns, price, market capitalization, and other stock information from the CRSP monthly stock files.

Panel A of Table 1 presents a count of the number of stocks traded by at least a given number of mutual funds during the fourth quarter of each year shown. Note that the average proportion of trades that are buys is slightly greater than 50%, consistent with a net inflow of money into equity funds during our sample period. It is also clear that large groups of mutual funds simultaneously trade the same stocks more frequently over time, which might be expected, given that the number of funds has increased faster than the number of stocks (and that individual fund turnover has increased). For example, the number of stocks covered by analysts and traded by at least 100 funds increases from 57 during the fourth quarter of 1995 to 454 during the fourth quarter of 2004, while the number of stocks covered by analysts and traded by at least 200 funds increases from 1 to 125. This finding suggests that mutual fund trading has become more important in setting stock prices over time. In the next section, we explore whether such clustered trading is predominantly due to same-direction trading by the funds—i.e., large groups of funds buying or selling the same stocks during the same quarter.

B. Measuring Herding

Various papers have proposed theories of correlated trading by agents based on (1) mimicry driven by reputational concerns (e.g., Scharfstein and Stein (1990)), (2) correlated trading driven by information externalities (e.g., Bikhchandani, Hirshleifer, and Welch (1992) and Froot, Scharfstein, and Stein (1992)) or by correlated information arrival (e.g., Hirshleifer, Subrahmanyam, and Titman (1994)), and (3) correlated trading driven by correlated preferences for stock characteristics (e.g., Falkenstein (1996)). To accommodate these disparate theories of herding behavior, we apply empirical measures of herding that simply capture "correlated trading in excess of random occurrences." In Section V, we will provide some insight into which of these theories appears to be consistent with the main findings of our paper.

Our main empirical measure of herding is the Lakonishok, Shleifer, and Vishny (henceforth LSV; 1992) metric, which has been widely used in prior studies (e.g., Grinblatt, Titman, and Wermers (1995) and Wermers (1999)). The LSV measure of herding in stock *i* during quarter *t* (HM_{it}) is

$$HM_{it} = \left| p_{it} - E\left[p_{it}\right] \right| - E\left| p_{it} - E\left[p_{it}\right] \right| \tag{1}$$

where p_{it} is the proportion of mutual funds buying stock *i* during quarter *t*, relative to the total number of funds trading that stock during that quarter; $E\left[p_{it}\right]$ is the expected proportion of stock *i* buys during quarter *t*, as proxied by the proportion of all fund trades (of all stocks) that are buys during quarter *t*. The expression $E\left| p_{it} - E\left[p_{it}\right] \right|$ is an adjustment factor which controls for random variation around the expected proportion of buys, under

the null hypothesis of random and independent trading by mutual funds.[8] Therefore, HM_{it} captures similarity in trading activity among a group of funds above that expected to result from random occurrences of same-side trading in the same stocks. To ensure that our herding measure reasonably captures the concept of a herd, we require each stock in our sample to be traded by at least five funds during any quarter in which we measure herding.

It is important to note that HM_{it} is a count of the unexpected proportion of managers trading in the same direction, without regard to the size of their trades. As discussed by Sias, Starks, and Titman (2006), a count of funds trading a stock will better predict stock returns if the market mainly responds to the information content of the trades—i.e., a larger number of managers trading a stock may represent a stronger signal about stock valuation.

To distinguish herding on the buy- and sell-sides, we first measure herding conditional on whether a stock has a higher or lower proportion of buys than the average stock. The buy-herd (BHM_{it}) and sell-herd (SHM_{it}) measures are defined as:

$$BHM_{it} = HM_{it} \big| p_{it} > E[p_{it}] \tag{2}$$

$$SHM_{it} = HM_{it} \big| p_{it} < E[p_{it}] \tag{3}$$

Finally, we construct an "adjusted herding measure," denoted as *ADJHERD*, which combines the buy- and sell-herding measures. Specifically, within each group of buy-herding (or sell-herding) stocks, we subtract the minimum value of *BHM* (or, alternatively, *SHM*) from each stock's *BHM* (or *SHM*), so that the differenced herding measure is always positive. We then set *ADJHERD* equal to the differenced value of *BHM*

[8] This quantity is easily computed by assuming a binomial process for the number of buys during each stock-quarter, where the binomial parameter n is the number of funds trading that stock during the quarter and p is the average proportion of all fund trades (of all stocks) that are buys during the quarter. Further details on this measure are available in LSV (1992).

if the stock is a buy-herding stock, and equal to −1 times the differenced value of *SHM* if the stock is a sell-herding stock during the quarter. Thus, a high *ADJHERD* measure indicates that the stock is heavily bought by herds of funds. Conversely, a low *ADJHERD* measure indicates that the stock is heavily sold by herds of funds.

Panel B of Table 1 presents summary statistics for our herding and analyst recommendation measures. The mean level of herding ($\overline{HM}$) across all stock-quarters is 3.9 percent, while the average levels of buy-herding ($\overline{BHM}$) and sell-herding ($\overline{SHM}$) are 3.5 and 4.2 percent, respectively, indicating that funds herd more strongly on the sell-side. This finding is noteworthy, since the short-sale constraint generally imposed by funds would suggest that we would find more herding on the buy-side—the strong sell-side herding indicates that funds are especially reluctant to hold a stock while other funds are selling it. Especially noteworthy is the large standard deviation (10.3 percent) of the herding measure relative to the average herding measure (3.9 percent). This large variation suggests that mutual funds are much more likely to herd in certain stock-quarters; these strong-herding stocks will become the subject of our later analysis.

C. Control Variables

Prior studies suggest that mutual fund herding is closely related to stock characteristics. For example, Wermers (1999) reports that mutual fund herding is much more pronounced among small stocks and stocks with extreme prior-quarter returns. Similarly, Sias (2004) and Chan, Hwang, and Mian (2005) provide evidence suggesting that institutional investors herd into and out of stocks with high levels of information uncertainty.

We aim to measure the impact of analyst recommendation revisions on mutual fund herding, while controlling for these stock characteristics. Therefore, we include the lagged value of the following variables in most of our analyses to follow: (1) market capitalization (*Size*); (2) quarterly return (*Ret*); (3) book-to-market ratio (*BM*); (4) the level of information uncertainty, as proxied by the dispersion of analysts' recommendations (*Dispersion*); and (5) the existence of private information as measured by return volatility (*Std*) and turnover (*Turn*). *BM* is calculated as the ratio of book value to market value of equity at the end of the most recent fiscal quarter (Compustat quarterly data item 59 divided by the product of data item 14 and data item 61). We use the log of *Size* and *BM* in all regression analyses to mitigate potential heteroskedasticity. Although the Zacks consensus history file does not provide the recommendations of individual analysts, it includes the number of recommendations within each rating category. We use this information to extract the dispersion of analyst recommendations (*Dispersion*), measured as the standard deviation of all outstanding recommendations at the end of each quarter, scaled by the consensus recommendation for the quarter. Finally, *Std* is defined as the standard deviation of daily stock returns during the quarter, and *Turn* is the average daily trading volume divided by the number of shares outstanding during the quarter. Since stocks traded on NASDAQ have significantly higher trading volume (due to its dealer market structure) than stocks traded on NYSE/AMEX, we standardize *Turn* by the average turnover for all stocks listed on the same exchange. Summary statistics for these control variables are also presented in Panel B of Table 1, though we do not discuss them for brevity.

III. Results

A. Mutual Fund Herding and Analyst Recommendation Revisions

To test Hypothesis 1, we investigate the relation between mutual fund herding and analyst recommendation revisions, while controlling for various stock characteristics. We therefore estimate the following regression during quarter *t*:

$$\begin{aligned} ADJHERD_{it} = {} & \beta_0 + \beta_1 Revision_{it-1} + \beta_2 Size_{it-1} + \beta_3 Ret_{it-1} + \beta_4 BM_{it-1} + \beta_5 Dispersion_{it-1} + \\ & \beta_6 Std_{it-1} + \beta_7 Turn_{it-1} + \beta_8 Strong\_Buy_{it-1} + \beta_9 Strong\_Sell_{it-1} + \\ & \beta_{10} Lag\_ADJHERD_{it-1} + + \beta_{11} Lag2\_ADJHERD_{it-2} + \beta_{12} Add\_Drop_{it-1} \end{aligned} \quad (4)$$

First, we include size, the book-to-market ratio, and prior quarter returns as control variables to account for correlated fund trading due to common investment styles. Furthermore, since information cascading (Bikhchandani, Hirshleifer and Welch (1992)) and reputational risk (Scharfstein and Stein (1990)) models suggest that herding can be driven by lack of reliable information, we control for the dispersion of analyst recommendations (*Dispersion*) in quarter *t*-1. Similarly, we account for the impact of private information on herding by including return volatility (*Std*) and trading volume (*Turn*) as additional controls. Note that higher information uncertainty is equally likely to induce herding on both the buy- and sell-side; thus, it is an empirical question as to how these information-related controls will affect *ADJHERD*.

Given the censored nature of recommendations, analysts cannot revise their recommendation upwards if a strong buy is already in place or downwards if a strong sell is already in place. Therefore, we include two dummy variables, *Strong_Buy* and *Strong_Sell* to control for such cases. Specifically, *Strong_Buy* (*Strong_Sell*) is set to "1" when *Revision* equals zero and the consensus recommendation is a strong buy (strong sell) in

quarter *t*–2; and "0" otherwise. To control for possible persistence in fund herding, we include the lagged values of *ADJHERD* for each stock during quarter *t*–1 (*Lag_ADJHERD*) and quarter *t*–2 (*Lag2_ADJHERD*).

Although our sample excludes index funds, funds that are "closet indexers" or funds that benchmark a portion of their holdings against major indexes may trade in the same direction following index changes. To control for this effect, we extract historical compositions of the S&P 500 index from CRSP, and create an indicator variable, denoted *Add_Drop*, to identify those stocks that were added or dropped from the S&P 500 during the prior quarter. Specifically, *Add_Drop* takes the value of "1" if the stock was added to the index, "-1" if it was dropped from the index, and "0" otherwise.

Table 2 presents quarterly Fama-MacBeth regression results for equation (4).[9] In column 1, the estimated coefficient on *Revision* is significantly positive, indicating that mutual funds herd in the same direction as prior-quarter analyst revisions. For instance, the coefficient on *Revision* in column 1 indicates that one unit of consensus upgrade during a particular calendar quarter results in a 5.4% increase in the level of mutual fund herding (*ADJHERD*)—which is economically large, compared to the median *ADJHERD* of 0.16% across all stock-quarters. The coefficients on *Lag_ADJHERD* and *Lag2_ADJHERD* indicate that mutual fund herding is persistent for only one quarter. [10]

Consistent with prior evidence, we find that herding is significantly related to stock characteristics such as prior quarter returns and the book-to-market ratio. Further, the coefficient on *Dispersion* indicates that mutual funds tend to herd more strongly on the buy-side when there is greater analyst disagreement and that this effect outweighs the

[10] The raw value of *ADJHERD* (rather than percentages) is used as the dependent variable for equation (4).
[10] In robustness tests, we include higher orders of lagged *ADJHERD* and find that all are insignificant.

impact on sell-herding. Conversely, return volatility and trading volume have stronger effects on sell-herding relative to buy-herding as indicated by the significantly negative coefficients on *Std* and *Turn*. Finally, mutual fund herds tend to buy stocks that have been recently added to the S&P 500 index and sell stocks that have been dropped from the index.

B. Alternative Measures of Analyst Revisions

B1. The Proportion of Analyst Upgrades

So far, we have focused on the magnitude of the consensus recommendation revision. An alternative approach to gauging the change in analysts' opinions of a stock is to compute the proportion of analysts that upgrade versus downgrade a stock relative to all analysts issuing recommendations during a particular quarter for that same stock. That is,

$$Revision\_Count = \frac{\#\ of\ upgrades\ -\#\ of\ downgrades}{\#\ of\ analysts\ making\ recommendations} \tag{5}$$

In contrast to consensus recommendation revisions, *Revision_Count* captures the ubiquity of analyst opinions but ignores the strength of each signal as well as the sentiment of those analysts who choose not to upgrade the stock (i.e., this measure ignores analysts who maintain their prior recommendation). Column 2 of Table 2 examines the relation between herding and the net proportion of analysts upgrading the stock during the previous quarter. Similar to the results based on the consensus recommendation change, we find that mutual fund herding is strongly influenced by the unanimity of analyst opinions. Specifically, funds herd on the buy-side more strongly when a greater proportion of analysts upgrade their recommendations of the stock. Therefore, our finding that analyst revisions trigger mutual fund herding is robust to this alternative measure of analyst recommendation revision.

B2. Analyst Earnings Forecast Revisions

We next investigate whether mutual funds also herd in response to analyst earnings forecast revisions and how this reaction may differ from their reaction to recommendation revisions. While analyst earnings forecasts have lower investment value than analyst recommendations (see, e.g., Francis and Soffer (1997), Brav and Lehavy (2003), and Asquith, Mikhail, and Au (2005)), they have the benefit of being less biased than analyst stock recommendations. Earnings forecasts have a clear short-horizon benchmark, i.e., the realized earnings number, against which to gauge any biases in analysts' forecasts. Therefore, as argued by Lin and McNichols (1998), it can be more costly for analysts to manipulate their earnings forecasts, compared to stock recommendations.

We define quarterly earnings forecast revisions (*Revision_Forecast*) as the change in the consensus one-year-ahead earnings forecast in the prior quarter, scaled by beginning-of-year stock price. When constructing the consensus, we only include individual forecasts that are issued within the past 90 days as reported in the I/B/E/S detailed history file.[11] We then re-estimate Equation (4) using quarterly Fama-MacBeth regressions of *ADJHERD* on prior-quarter consensus forecast revisions. Column 3 of Table 2 presents time-series average estimated coefficients, as well as their *t*-statistics. Consistent with our results based on recommendation revisions, we find that buy-herding increases for upward forecast revisions while sell-herding increases for downward revisions. For instance, a prior-quarter upward forecast revision of 10% for a given stock results in an increase of about 4% in *ADJHERD*.

[11] We use the I/B/E/S detailed file to construct the consensus earnings forecast since, as discussed previously, the Zacks detailed history file excludes earnings forecasts from 12 major brokerage houses.

Overall, our analyses of herding on recommendation revisions and earnings forecast revisions identify the reaction of mutual fund trading to analyst information as an important mechanism that induces fund herding.

C. Is Herding Directly Affected by Analyst Information?

In this study, we relate current-quarter herding to prior-quarter recommendation revisions to ensure that we are not simply capturing simultaneous changes in analyst recommendations and mutual fund holdings, or the tendency of analysts to revise their opinions in response to institutional trading. However, one may argue that the correlation between fund herding and analyst revisions is being driven by the sequential response of fund managers and analysts to other investment signals within a short time span. To address this concern, we examine the types of analyst revisions that lead to stronger herding.

First, we test Hypothesis 2 by investigating the asymmetric response of fund herding to analyst upgrades and downgrades. If mutual funds are indeed focusing on the information content of analyst revisions rather than responding to the same signals that analysts observe, we should expect funds to respond more strongly to analyst downgrades. To test this implication, we re-estimate equation (4) by allowing for separate slope coefficients on positive and negative values of *Revision* as follows: *Revision_Up* is equal to positive values of *Revision* and "0" otherwise; while *Revision_Down* is set to negative values of *Revision* and "0" otherwise. Consistent with our predictions, Column 1 of Table 3 indicates that the estimated coefficient on *Revision_Down* (0.0660) is significantly higher than that for *Revision_Up* (0.0410). This difference is significantly different at the 1%

level. This result suggests that mutual funds exercise discretion when responding to analyst revisions, possibly because of their awareness of potential biases in sell-side research. In Column 2 of the table, we further examine whether fund herding is affected differently by the proportion of analyst upgrades (*Count_Up*) relative to the proportion of analyst downgrades (*Count_Down*). Using these alternative measures of analyst revisions, we again find that mutual fund herds react more strongly to analyst downgrades than to upgrades. These findings are consistent with Malmendier and Shanthikumar (2008) and Mikhail et al. (2007), who document that sophisticated investors (i.e., large traders) react more strongly to downgrades than to upgrades.

In Column 3 of Table 3, we compare the effects of upward revisions versus downward revisions on mutual fund herding. Specifically, we regress *ADJHERD* on two separate variables: *Forecast_Up*, which equals positive values of *Revision_Forecast* and "0" otherwise; and *Forecast_Down*, which equals negative values of *Revision_Forecast* and "0" otherwise. Unlike the sensitivity of herding to recommendation revisions, the results in Column 3 indicate that the coefficient on *Revision_Forecast* is not significantly different between upward and downward revisions. This finding indicates the lack of an asymmetric relationship between herding and forecast revisions, which is not surprising, given that the incentives for analysts to provide optimistic versus pessimistic earnings forecasts are not as clear cut as in the case of buy versus sell recommendations.

The fact that mutual funds discount analyst upgrades relative to downgrades but react similarly to upward and downward earning forecast revisions is consistent with previous literature that documents weaker incentives for analysts to provide over-optimistic earnings forecasts, and thus, supports our argument that funds are indeed

responding to analyst signals and that the correlation between analyst revisions and fund herding is not spurious.

To further investigate whether mutual fund herds respond directly to analyst information, we examine Hypothesis 3, which focuses on how the reaction of mutual fund herds varies with the quality of analyst information. We believe that, if mutual funds truly learn from analyst revisions, then it is likely that they rely less heavily on revisions when analyst opinions are more diverse. To test this prediction, we extend Equation (4) by including the interaction between analyst recommendation revision (*Revision*) and the dispersion of analyst recommendations (*Dispersion*). If analyst recommendations directly impact mutual fund trades, then we expect the relation between recommendation revisions and fund herding to be stronger when analyst recommendations are more unanimous.

As reported in Column 1 of Table 4, the coefficient on the interaction term between *Revision* and *Dispersion* is significantly negative at the 1% level. This indicates that consensus recommendation revisions have a *smaller* impact on mutual fund herding when analyst opinions diverge from each other—controlling for the separate effects of the direction of the revision and the dispersion of recommendations. Similarly, in untabulated results, we find that mutual fund herds react more strongly to the net portion of analysts upgrading the stock as well as consensus earnings forecasts revisions when analyst opinions are more unanimous. These findings suggest that fund managers do not follow analyst recommendations mechanically. Rather, they tend to focus on the information content of analyst revisions when they trade.

Lastly, we further investigate Hypothesis 3 by examining the response of mutual fund herds to analyst revisions, conditional on the degree of analyst herding. Previous

studies (see, for instance, Hong, Kubik and Solomon (2000), Welch (2000), Clement and Tse (2005), Jegadeesh and Kim (2007)) have shown that sell-side analysts herd when they issue recommendations or forecasts. If analysts herd towards the consensus, it is possible that they either possess similar information or are attempting to mimic the behavior of more reputable analysts. Thus, their average recommendation may be seen as more credible to fund managers and thereby inducing a stronger reaction from funds. Since our data on consensus analyst recommendations do not allow us to investigate the sequence of recommendations made by individual analysts, we proxy for the degree of analyst herding on a stock using the change of analyst recommendation dispersion during two adjacent quarters. In essence, if the dispersion of analyst information has increased then this suggests that analyst opinions have diverged to a greater extent. Conversely, a decrease in the dispersion of analyst recommendations indicates that analyst opinions converge to the same valuation of the stock. Compared with our previous analysis that examines the impact of analyst dispersion on fund herding, investigating the change of analyst recommendation dispersion can alleviate the potential concern that analyst dispersion proxies for certain stock characteristics that are related to the speed at which common signals are observed by all market participants.

We examine whether mutual fund herds react more strongly analyst revisions when analyst themselves are herding by interacting *Revision* with the change in the recommendation dispersion in the prior quarter (*Dispersion_Change*). The regression results are presented in Column 2 of Table 4. As expected, we find that the interaction term is significantly negative, suggesting that mutual funds react less strongly to analyst revisions when analyst opinions have moved away from the prevailing consensus

recommendation. This result provides further support to our hypothesis that mutual fund herds react directly to the information content of analyst recommendations.

IV. The Price Impact of Herding Following Analyst Revisions

A. The Price Impact of Mutual Fund Herding

Our preliminary tests look at the relation between mutual fund herding and stock returns, without considering the influence of analyst revisions. Each quarter, we separately form quintile portfolios for subsamples of buy-herding and sell-herding stocks, respectively, based on each stock's buy-herd (*BHM*) or sell-herd (*SHM*) measure for that quarter. The top quintile portfolios include those stocks that mutual fund herds most strongly buy (B5) or sell (S5), respectively. Next, we calculate *quarterly* rebalanced DGTW (1997) characteristic-adjusted abnormal returns for each equal-weighted portfolio during the two quarters prior to the portfolio formation quarter, the formation quarter, and the following four quarters.[12] Finally, to investigate whether return reversals only occur for small or illiquid stocks, we also value-weight (rather than equal-weight) the portfolios sorted by mutual fund herding. Specifically, portfolios are rebalanced at the beginning of each quarter to value-weights.

Panel A of Table 5 reports the past and future raw returns (*Raw*), characteristic-adjusted equal-weighted (*DGTW_EW*) returns and characteristic-adjusted value-weighted (*DGTW_VW*) returns for the ten herding-sorted portfolios (B5 to S5) for our sample period of 1994 to 2006. To facilitate a comparison between the price impact of

[12] Note that we adjust the returns with quarterly (instead of annually) rebalanced DGTW benchmark portfolio returns in order to provide a stronger control for momentum, since many funds employ positive-feedback strategies when they trade. For details on the construction of the DGTW characteristic-based benchmarks, see Daniel, Grinblatt, Titman, and Wermers (1997) and Wermers (2004).

general mutual fund herding and the price impact of analyst revision-motivated herding, we include only stocks that are rated by analysts in this table. However, our results are qualitatively and quantitatively similar if we relax this data requirement. For each of the seven quarters, *t*–2 to *t*+4, we calculate the difference in the average raw and abnormal returns between S5 and B5 ("S5 minus B5"). This represents a zero-investment portfolio that buys the portfolio of strong sell-herding stocks (S5) and sells the portfolio of strong buy-herding stocks (S5). We also calculate the difference in average returns between all sell-herding and all buy-herding stocks ("S1 to S5 minus B1 to B5"). Consistent with our previous findings (see Tables 2 through 4), the direction and magnitude of herding is strongly related to past stock returns, suggesting that funds strongly engage in momentum investing.

The results show compelling evidence of an impact of mutual fund herding on stock prices. Specifically, portfolio B5 (strong buy) exhibits a Qtr +1 equal-weighted DGTW-adjusted return of 0.98%, followed by a gradual return reversal during the following three quarters that culminates with a significant -0.78% in Qtr+4. Portfolio S5 (strong sell) exhibits an even stronger return reversal pattern—in the opposite direction—that reaches an abnormal return of about 1.34% during quarters Qtr +3 and Qtr +4. Stronger return reversals following selling by the herd is consistent with a stronger tendency to herd on the sell-side, as we demonstrated previously. In addition, a similar pattern of return reversals is observed for value-weighted portfolios.

Also, since these returns are benchmarked against their size, book-to-market, and momentum cohorts (using the DGTW technique), our findings indicate that, in recent years, mutual funds pile into stocks and potentially exacerbate momentum returns during

the formation quarter (Qtr 0), followed by a correction during the following year—relative to their characteristic-matched portfolios.[13] We also note that the strongest reversals occur during Qtr +3 and Qtr +4, which may reflect our earlier finding that same-direction herding is persistent in the short term. We will investigate this issue further later in this paper.

Wermers (1999) documents that mutual fund herding is price stabilizing and leads to a permanent price effect during the period of 1975 to 1994. To compare the price impact of herding during recent years with that of the earlier period and to rule out that differences in our results may be due to the differences in data and methodology, we replicate the results in Wermers (1999) using mutual fund holdings from 1981 to 1994. The results are presented in Panel B of Table 5. Specifically, we report the past and future raw returns and DGTW-adjusted abnormal returns for the ten herding-sorted portfolios (B5 to S5). The results largely confirm the findings in Wermers (1999); we find almost no significant return reversal following mutual fund herding, especially on the sell side.

Figure 1 shows the time trend in the Quarter 0 (formation quarter) return difference between S5 and B5, as well as the trend in their difference during Quarters +3 and +4. Notice that the reversals, which can be visualized as the difference between the Quarter 0 results and the Quarter +3/+4 results, increases from 1985 to 2003—the time period during which the number of domestic equity mutual funds increases sharply, consistent with Hypothesis 4. After 2003, the reversals shrink, perhaps due to a substantial decrease in the

[13] Although we cannot observe whether herding during Q0 follows or precedes abnormal returns, some further tests lead us to believe that a substantial price impact follows fund herding. Specifically, in unreported tests, we examine abnormal returns of stocks during each of the three months of Q0. Although the large abnormal returns reside in month 1 of this quarter, substantial abnormal returns also reside in months 2 and 3, which is more likely to follow fund trades.

number of funds during the post-2003 period. Figure 2 shows similar results for Quarter 0 vs. Quarters +1 through +4.

What, then, explains that mutual fund herding has, only recently, become destabilizing to stock prices? Barras, Scaillet, and Wermers (2009) find that the huge growth in domestic equity mutual funds in the U.S. over the past 20 years has resulted exclusively from a huge increase (both in numbers and in proportions) of unskilled fund managers. Therefore, one potential explanation for our finding is that herds, during recent years, have become populated with increasing numbers of unskilled managers, who are more likely to herd because of career concerns, rather than to fund managers possessing correlated information on stock values. We explore this further in a later section.

B. Return Reversals, Analyst Revisions, and Mutual Fund Herding

In Section III, we presented evidence that mutual funds herd in the same direction as analyst recommendation revisions, supporting Hypothesis 1. However, it is not clear whether funds herd on informative or uninformative revisions in the consensus of analysts (or both). Specifically, if analysts herd in their revisions based on correlated new information about stock valuations, then we would expect mutual fund herding that follows analyst revisions to move stock prices closer to their true values—a price movement that is permanent. On the other hand, if analysts herd based on noise (due, for example, to career concerns), then we would expect fund herding to destabilize stock prices—a price movement (due to the large scale of trading) that is temporary, followed by a reversal.

In this section, we repeat the analysis of Table 5, separately for stocks which have experienced a downgrade (or upgrade) in the consensus recommendation during the prior

quarter.[14] Each quarter, we sort stocks into two groups, based on their prior-quarter consensus analyst recommendation change—i.e., we form separate groups of upgrade vs. downgrade stocks. Within each group, we next form quintile portfolios, based on each stock's *BHM* or *SHM* measure for that quarter. These quintile portfolios can be viewed as mutual fund herding portfolios, conditional on the direction of analyst revisions.

For brevity, Table 6 reports time-series average raw and DGTW-adjusted returns only for the light and strong buy (B1 and B5) portfolios as well as the light and strong sell (S1 and S5) portfolios. We report the differences in abnormal returns between portfolios B1 and S1 (B5 and S5) separately for each analyst revision group. We again report value-weighted DGTW-adjusted portfolio returns to gauge whether the return reversals are driven by small or illiquid stocks.

Panel A of Table 6 presents results for the light buy (B1) and light sell (S1) portfolios. Although light-buy stocks that received a prior-quarter recommendation upgrade (Upgrade-B1) realize substantially higher returns during quarters t–2 to t than light-sell stocks that have received a downgrade (Downgrade-S1), we observe no significant difference in the future return patterns between these two groups. Thus, in the absence of fund herding behavior, prices seem to adjust quickly to analyst revisions and do not revert during future periods. This finding is consistent with prior studies that find a short-lived effect of analyst recommendations on stock prices (e.g., Brennan, Jegadeesh, and Swaminathan (1993) and Barber et al. (2001)).

[16] The number of stock-quarters which experience no change in the consensus recommendation is relatively small. Therefore, we do not report the results for these portfolios in the tables to follow. In addition, since stocks with a consensus "1" (strong sell, using our rating scale) or "5" (strong buy) cannot be further downgraded or upgraded, respectively, we treat them as being downgraded (upgraded) if they maintain the same recommendation for two consecutive quarters.

In sharp contrast, Panel B of Table 6 shows that significant return reversals occur when mutual funds herd strongly and in the same direction as analyst recommendation changes. For example, relative to their returns during the portfolio formation quarter, upgrade stocks heavily bought by herds (Upgrade-B5) exhibit a sharp return reversal of about −2.04 percent during Quarters +3 and +4; whereas, downgrade stocks heavily bought by herds (Downgrade-B5) do not. Similarly, downgrade stocks heavily sold by herds (Downgrade-S5) exhibit a sharp reversal of 4.09 percent during Quarters +3 and +4, while upgrade stocks heavily sold by herds (Upgrade-S5) do not.

When we compare the returns on the light-herding portfolios to those on the strong-herding portfolios, it is clear that the overreaction we previously found (see Table 5) in strong-buy and strong-sell stocks is driven largely by the trades of funds in response to consensus recommendation revisions, and not solely to the trades themselves. In fact, an investment strategy that accounts for both mutual fund herding and analyst recommendations generates higher abnormal returns than a strategy that only accounts for either analyst recommendations or mutual fund herding.

For example, we calculate the difference in abnormal returns between upgrade stocks that are sold versus bought by herds (see "Upgrade-S5 minus Upgrade-B5") as amounting to about 1.02 percent during the following year. A much higher abnormal return (6.29 percent) accrues to a strategy of buying downgrade stocks heavily sold by herds while selling downgrade stocks heavily bought by herds (see "Downgrade-S5 minus Downgrade-B5"). Furthermore, the most profitable strategy involves investing in upgrade and downgrade stocks that experience extreme overreaction by funds. Specifically, buying downgrade stocks that are heavily sold by herds while selling upgrade stocks that are

heavily bought by herds generates an abnormal return of 6.63 percent over the following four quarters (see "Downgrade-S5 minus Upgrade-B5").

Finally, a strategy of buying all downgrade stocks that are sold by herds and selling all upgrade stocks that are bought by herds ("Downgrade-(S1 to S5) minus Upgrade-(B1 to B5)") still accrues a sizable abnormal return of about 2.91 percent in the following year. Note that the return patterns for the value-weighted portfolios are very similar to those for the equal-weighted portfolios. In some cases, the return reversals are even stronger. Thus, our finding of mutual fund overreaction to analyst revisions is strong among both small and large stocks.

We also examine the abnormal returns for an investment strategy that accounts for herding in the opposite direction of analysts' opinions, i.e., buying downgrade stocks bought by herds and selling upgrade stocks sold by herds ("Downgrade-B5 minus Upgrade-S5"). Mutual fund herds that trade opposite to analyst opinions most likely reflect private information-based trading. Panel B of Table 6 shows that this strategy generates an insignificant return of about −0.67% during the following year. Thus, the "overreaction effect" is much stronger than the "private information effect" (after the formation quarter) of herding by mutual funds in response to analyst recommendation revisions.

IV. Identifying the Source of Return Reversals

Since our previous results indicate that mutual fund herding intensifies following analyst revisions, the return reversals that we document may be driven by either analyst-prompted herding or simply by higher levels of herding. In addition, they may reflect reversals in analyst recommendation revisions or in mutual fund herding during

Quarters +1 to +4. For instance, perhaps analysts initially overreact to changing profitability information for a firm and then correct their assessment later.

To further disentangle the effect of analyst revisions and mutual fund herding, we first track changes in the level of fund herding, analyst revisions and firm fundamentals during periods following the portfolio formation quarter in order to investigate whether return reversals are likely due to reversals in mutual fund herding or analyst revisions (or both) during subsequent periods, or to changes in stocks' cash flow news. Specifically, we rank stocks into quintiles according to the absolute value of their *ADJHERD* measure during a given formation quarter *t*. This sorting procedure is performed separately for the buy-herd and sell-herd groups since a positive *ADJHERD* indicates buy herding while a negative value indicates sell herding.

To distinguish whether the return reversal is driven by changes in stock characteristics during quarters $t-2$ through $t+4$, we calculate *ADJHERD* and beginning-of-quarter analyst revision (*Revision*) for equal-weighted portfolios formed during quarter *t*. In addition, we track the average profitability of the firms in each portfolio during quarters $t-2$ through $t+4$ to determine whether abnormal returns reflect changes in firm fundamentals. We measure profitability as return on assets (*ROA*) during the most recent fiscal quarter that an earnings announcement was made.[15]

Panel A of Table 7 presents the past and future characteristics of stocks that are heavily bought (B5) or sold (S5) by mutual fund herds. The results indicate that, during the year following the portfolio formation quarter, mutual funds do not appear to strongly reverse their trades. A test of herding persistence indicates that stocks that are ranked in the

[15] We calculate return on assets (*ROA*) as Compustat quarterly data item 21 (operating income before depreciation) divided by prior quarter's data item 44 (total assets).

top *ADJHERD* decile continue to have significantly higher *ADJHERD* than stocks that are ranked in the bottom *ADJHERD* decile during quarters *t*+1 and *t*+2. By quarter *t*+3, there is little herding in these decile portfolios as the difference in *ADJHERD* between the strong buy-herding portfolio and the strong sell-herding portfolio is no longer significant. Thus, it appears that the return reversals are due to the trading of other market participants, and not to herding reversals by mutual funds. There is slightly stronger evidence that analysts correct their formation quarter revisions, but only when they upgrade stocks (see results for strong buy-herding stocks).[16] Furthermore, we find that firm profitability, proxied by *ROA*, improves over time for upgrade stocks bought by herds, and decreases for downgrade stocks sold by herds. Therefore, abnormal returns following the formation quarter are clearly not driven by changes in firm fundamentals.

We further investigate whether it is analyst revision-motivated herding or herding in general that causes reversals in a multivariate setting. In additional to controlling for the level of herding and analyst revisions, we control for another potential source of return reversals that relates to flow-driven trading. Coval and Stafford (2007) show that mutual funds that experience extreme money flows respond with forced trading, and that these forced transactions often result in significant price-pressure effects that take several quarters to reverse. For instance, it is possible that stocks that are downgraded by analysts contribute to the poor performance of fund portfolio holdings, which in turn could lead to subsequent capital outflows for these funds—with corresponding outflow-driven sell-trades. We investigate this possibility by exploring whether our finding of return reversals is mainly driven by the price-pressure effect of extreme capital flows.

[16] Note that this table reports beginning-of-quarter analyst revisions. Therefore, analyst revisions reported for each quarter actually occur during the prior quarter.

First, we compute quarterly flows as the change in total net assets, adjusted for investment returns (assuming flows occur at the end of each quarter). That is,

$$Flow_{it} = \frac{TNA_{it} - TNA_{it-1}(1 + R_{it})}{TNA_{it-1}} \tag{6}$$

where TNA_{it} is the total net assets for fund *i* at the end of quarter *t*, and R_{it} is the quarterly return for fund *i* during quarter *t*.[17] Using estimated quarterly flows, we then compare the price impact of herding that results from trades by funds with heavy versus light flows. In particular, for each stock-quarter, we measure the degree of flow-driven trading as the difference between the number of forced buys and the number of forced sales, scaled by the total number of trades. Similar to Coval and Stafford (2007), we define forced purchases (sales) as the buys (sells) made by funds that have experienced inflows (outflows) greater than 5% during the quarter. That is:

$$Forced_{it} = \frac{\sum_{j}(buy_{jit} \mid flow_{jt} > 5\%) - \sum_{j}(sell_{jit} \mid flow_{jt} < -5\%)}{\sum_{j} trade_{jit}}, \tag{7}$$

where buy_{jit} ($sell_{jit}$) is a binary variable that takes the value of "1" if fund *j* has purchased (sold) stock *i* during quarter *t*, and "0" otherwise. Similarly, $trade_{jit}$ equals "1" if fund *j* has either purchased or sold stock *i* during quarter *t*.

Panel B of Table 7 presents separate results of Fama-MacBeth regressions of post-formation quarter abnormal returns on herding and analyst revisions. Since Panel A indicates that mutual fund herding persists for approximately two quarters, the dependent variable is the cumulative quarterly rebalanced DGTW-adjusted return for stock *i* during

[17] Note that the CRSP mutual fund data treats different share classes of the same fund as stand-alone funds. We combine flows across all share classes of each fund and calculate fund returns as the weighted average of returns of all share classes, using lagged total net asset values as weights. In addition, we winsorize the flows at the top and bottom 2.5 percentiles to minimize the impact of outliers.

quarters *t*+3 and t+4, where quarter *t* is the herding portfolio formation quarter. Our independent variables include the formation quarter adjusted herding measures (*ADJHERD*), analyst recommendation revisions in quarter *t*-1 (*Revision*), and their interaction term. In addition, we include analyst revision during quarters *t* to *t*+2 to separately assess the impact of analyst revisions on abnormal returns. To evaluate whether return reversals are due to herding reversals, we expand the model by including $ADJHERD_{t+1}$ through $ADJHERD_{t+2}$ as explanatory variables. Lastly, we control for the net proportion of forced buy transactions (*Forced*) made by all funds trading stock *i* during *the* formation quarter to account for long-lived price pressure effects caused by heavy fund flows. Note that since the dependent variable is *quarterly* rebalanced DGTW (1997) characteristic-adjusted abnormal returns, it is not necessary to control for common return-predictive stock characteristics.

Column 1 of Panel B indicates that mutual fund herding, rather than analyst revisions by themselves, is responsible for the return reversals, as illustrated by the significantly negative coefficient on $ADJHERD_t$ and the insignificant coefficient on $Revision_{t-1}$. Table 6 suggests that reversals are particular strong when the stock return in the quarter of analyst revisions is more extreme. To see whether analyst revisions lead to return reversals only when they cause strong market reactions, we examine the joint the effect of analyst revisions and stock returns in quarter *t*-1 by including the interaction between these two variables. Since a higher value of this interaction term may be due to either more positive returns after upgrading or more negative returns after downgrading, we separately interact recommendation upgrades (*Revision_Up*) and downgrades (*Revision_Down*) with

t-1 returns. The result in Column 2 shows that neither of these two interaction terms can explain the return reversals.

In Table 8, we estimate the post-formation quarter abnormal returns for buy-herding and sell-herding stocks separately, while controlling for the interaction effect of herding and analyst revisions. Interestingly, Columns 1 and 2 of Table 8 shows that the interaction between $ADJHERD_t$ and prior quarter revision ($Revision_{t-1}$) has a significantly negative effect on post-formation quarter abnormal returns for buy-herding stocks and a significantly positive effect for sell-herding stocks. This finding indicates that upgrade-induced buy herding leads to lower future stock returns and downgrade-induced sell herding leads to higher future stock returns. On the other hand, once we account for the interaction between analyst revisions and herding, $ADJHERD_t$ itself fails to have significant impact on subsequent quarters' returns. These results are again consistent with our simple portfolio tests in Table 6—mutual fund herds overreact only when they herd in response to analyst recommendation revisions, and not when they herd in general.

We further identify the exact mechanism of return reversals by including the interaction between concurrent *ADJHERD* and analyst revisions in quarter *t* ($Revision_t$) to determine whether we should incorporate the impact of early quarter revisions on same-quarter fund herding. In addition, we interact $ADJHERD_t$ with abnormal returns in the same quarter to test whether reversals are only driven by herding that is accompanied by extreme returns. Again, these additional controls do not affect our main findings as indicated by the insignificant interaction terms in Columns 3 through 6 of Table 8. Finally, consistent with Coval and Stafford (2007), we find that the degree of flow-driven trading

(*Forced*) predicts return reversals during Quarters *t*+3 and *t*+4, primarily when funds engage in asset fire sales.

Together, our evidence supports that mutual funds overreact when trading in response to analyst revisions. We note that it is possible that other market participants also contribute to the overreaction in stock prices—our data does not allow us to attribute the reversals solely to overreaction by mutual funds.

V. Reputational Concerns and Return Reversals

Our price impact results suggest that mutual fund herding on analyst recommendation revisions tends to be price destabilizing, creating long-term reversals in stock returns. Thus, funds appear to overreact to fundamental information on stock values. Since Froot, Scharfstein, and Stein (1992) demonstrate that reputational risk can lead managers to overinvest in valuation signals that are more likely to be reflected in the short-term (such as analyst revisions), we investigate the role of career concerns in fund herding and return reversals. Specifically, we compare herding among funds with presumably greater short-term career concerns—funds with poor recent performance records ("losing funds")—with herding among other funds ("winning funds"). Due to the reluctance of (myopic) fund managers with poor performance records to trade away from the crowd when their employment is at risk in the short-term, we would expect a stronger herding effect (i.e., stronger return reversals) when losing funds follow analyst revisions.

We first identify winning and losing funds each quarter by estimating the fund's abnormal performance during the past 36 months using the Carhart (1997) four-factor model:

$$R_{it} - R_{ft} = \alpha_i + \beta_i^{MKT} MKT_t + \beta_i^{SML} SML_t + \beta_i^{HML} HML_t + \beta_i^{MOM} MOM_t + \varepsilon_{it} \qquad (8)$$

where R_{it} is the return of fund i in month t as reported in the CRSP mutual fund database;[18] R_{ft} is the one-month T-bill rate in month t; and MKT_t, SML_t, HML_t, and MOM_t are the returns on the mimicking portfolios for the market, size, book-to-market, and momentum factors, respectively. Next, during each quarter, we estimate the proportion of buys or sells attributed to losing funds by calculating the performance-weighted proportion of buys or sells as:

$$PWBUY_{i,t} = \frac{\sum_j I^B_{i,j,t} \alpha_{j,t}}{\sum_j I^B_{i,j,t}} \text{ and } PWSELL_{i,t} = \frac{\sum_j I^s_{i,j,t} \alpha_{j,t}}{\sum_j I^s_{i,j,t}} \qquad (9)$$

where

$I^B_{i,j,t} = 1$ if fund j buys stock i in quarter t, and 0 otherwise;
$I^S_{i,j,t} = 1$ if fund j sells stock i in quarter t, and 0 otherwise.

In essence, a lower performance-weighted buying (selling) measure means that more losing funds account for the total amount of buying (selling) activity. To reduce the influence of funds with extreme alphas, we use the percentile rank of the four-factor alpha, rather than the raw alpha, to weight each trade. For instance, an extremely low alpha fund that buys a stock along with many small, positive alpha funds would create the appearance that losing funds are strongly buying the stock.

To examine whether the response of fund trading to analyst revisions is related to fund performance, we separately regress the performance-weighted buying (*PWBUY*) and selling (*PWSELL*) measures on analyst recommendation revisions, along with the control

[18] We calculate monthly fund returns as the weighted average of monthly returns across all share classes of the fund, using lagged total net asset values as weights.

variables used in Equation (4). Table 9 indicates that consensus analyst upgrades lead to a greater proportion of losing funds buying the stock, relative to winning mutual funds. Similarly, consensus analyst downgrades increase the proportion of sales made by losing funds—and that this reaction is stronger than the reaction to upgrades. Interestingly, we note that this result is consistent with Kacperczyk and Seru (2007), who show that funds that more closely follow recommendation revisions often perform poorly. In addition, the negative coefficient on past stock returns in the buy regression and the positive coefficient in the sell regression indicate that losing funds also chase past returns more strongly.

The results in Table 9 suggest that losing funds rely more heavily than winning funds on analyst revisions. Therefore, when analysts revise their recommendations, the higher level of fund herding is driven more by an increase in the number of losing funds joining the herd. Since herding by losing funds is more likely to be driven by career concerns and less by stock fundamentals, we expect the return reversals caused by analyst-prompted herding to be attributed mostly to the trading behavior of losing funds.

In unreported tests, we examine the coefficients of the above regressions over time. We find, consistent with Hypothesis 4, that the response of unskilled fund managers to analyst consensus revisions increases over the 1985 to 2006 period. This finding is consistent both with our prior observation that the reversals have increased over this time period, and with recent research by Barras, Scaillet, and Wermers (2009) that indicates that the number and proportion of unskilled fund managers has increased dramatically during that period.

In Table 10, we investigate whether losing fund herding indeed causes greater return reversals by comparing the price impact of herding for different performance-

related compositions of the herd. Specifically, each quarter we first sort stocks into terciles according to their performance-weighted buying (*PWBUY*) and selling (*PWSELL*) measures. We then repeat the baseline analysis in Table 8 among each of the three groups of stocks. We again analyze buy-herding stocks and sell herding stocks separately. Essentially, we would like to determine whether the composition of the herd is related to the level of return reversals, while controlling for the level of herding.

In the case of buy-herding, the results in Table 10 indicate that revision-motivated herding causes reversals in the middle group of stocks having a moderate proportion of losing-fund buying. However, the coefficient of the interaction term, $ADJHERD_t \times Revision_{t-1}$, is not significantly different across groups of stocks with high, moderate, and low performance-weighted buying.

In sharp contrast, the result is quite different for the sell-side. Across different compositions of the herd, the interaction effect of $ADJHERD_t$ and $Revision_{t-1}$ increases monotonically, with the effect being significantly positive only among those stocks that are sold mostly by losing funds. Hence, the return reversals following sell herding are likely to be caused by analyst-motivated trading by losing fund managers who are concerned about their job security in the short-run. In fact, finding that the effect of past performance matters mostly on the sell-side is not surprising.

Why do losing fund managers affect stock prices mainly on the sell-side? This finding may not be as surprising as it might seem at first blush. First, funds can only sell what they already own, but funds can choose among several stocks to buy with the herd. This sell-side constraint, by construction, makes sell-side herding more likely than buy-side herding, in response to a consensus analyst revision. In addition, funds hold

relatively low levels of cash during the past 10 years, which may motivate them to respond more quickly to fund outflows than to inflows.

Taken together, our evidence suggests that losing funds follow analyst revisions more strongly, and that their sells are responsible for return reversals. Thus, the return reversals associated with sell herding that we presented earlier are mostly driven by the overreaction of poorly performing funds to analyst downgrades. While analyst recommendations are semi-public and often contain value-relevant information, winning funds appear to better process this information and invest appropriately, while losing funds appear to overreact to analysts due to their career concerns.

VI. Conclusion

This paper documents the tendency of mutual fund managers to follow analyst recommendation revisions when they trade stocks, and the impact of these analyst revision-motivated mutual fund "herds" on stock prices. We find evidence that mutual fund herding impacts stock prices to a much greater degree during our sample period (1995 to 2006) than during prior-studied periods. Most importantly, we find that mutual fund herds form most prominently following a consensus revision in analyst recommendations. Positive consensus recommendation revisions result, most frequently, in a herd of funds buying a stock, while negative revisions result, most frequently, in a herd of funds selling. This relation remains robust after we control for stock characteristics and investment signals that influence both fund trading and analyst revisions and after using alternative measures of analyst revisions. In addition, mutual funds react more strongly to analyst information when it appears to be more credible.

Perhaps our most interesting result is that mutual funds appear to overreact when they follow analyst revisions—upgraded stocks heavily bought by herds tend to underperform their size, book-to-market, and momentum cohorts during the following year, while downgraded stocks heavily sold outperform their cohorts. These findings suggest that funds initially overreact to analyst revisions. Further evidence indicates that once we account for herding in response to analyst recommendation revisions, herding, in general, does not cause subsequent return reversals, nor does analyst revisions by themselves.

Finally, we find that the selling of funds with greater career concerns (i.e., funds with poor past performance) plays a greater role in destabilizing stock prices, supporting the conjecture that analyst revision-induced herding is driven partly by non-information related incentives. Further investigation into other incentives that drive herding on analyst revisions is left to future research.

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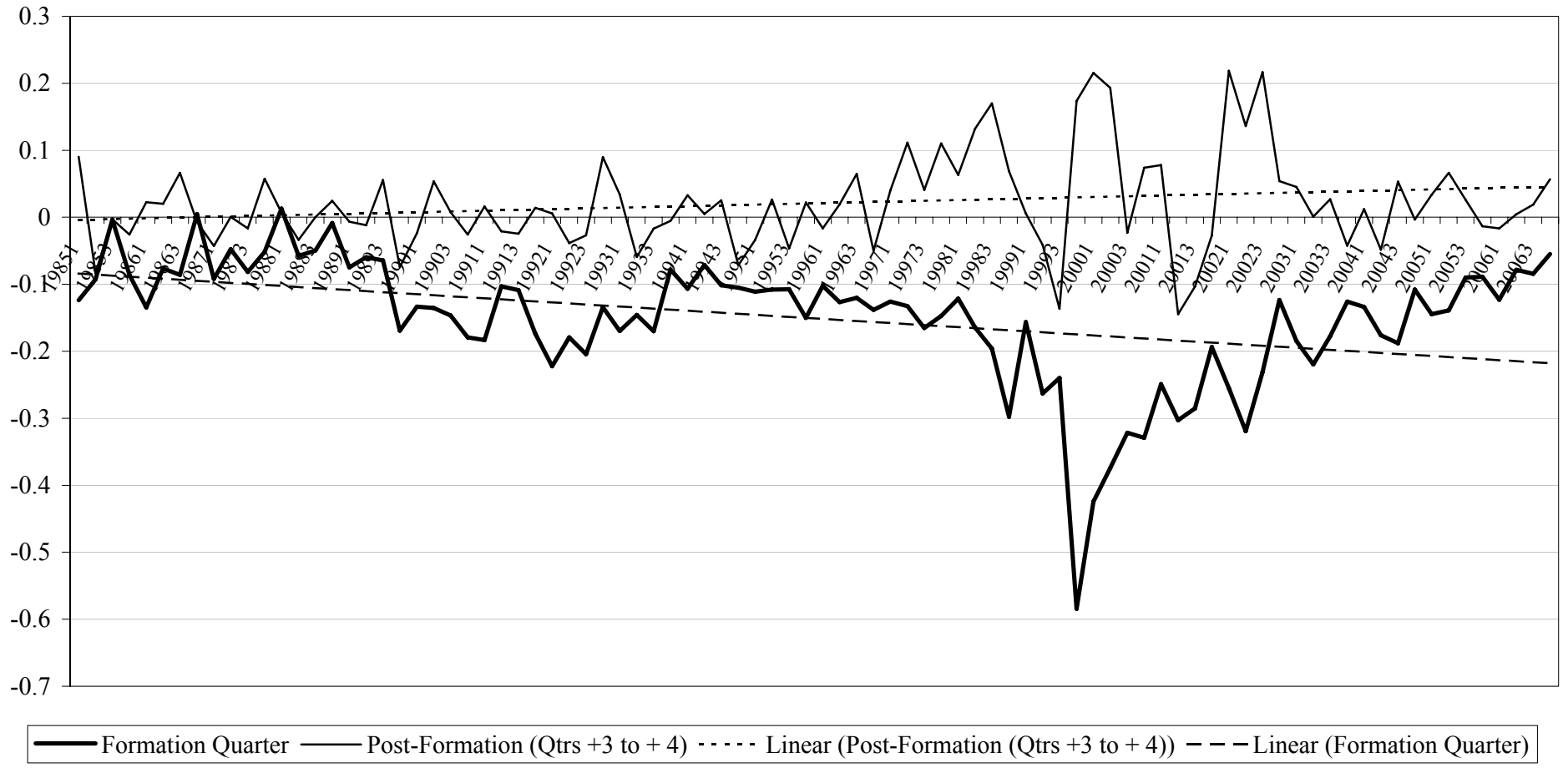

Figure 1: Quarterly average DGTW-adjusted abnormal returns for the quarters *t* +3 and *t* +4 for portfolio "S5 minus B5" over the period 1985 to 2006. This figure presents the time-series quarterly average DGTW-adjusted returns for an equal-weighted portfolio that longs stocks that are heavily sold by funds and shorts stocks that are heavily bought ("S5 minus B5"). We plot the DGTW-adjusted equal-weighted return for the portfolio formation quarter (Qtr 0) and the total return for the post-formation quarters, *t* +3 and *t* +4. To facilitate a comparison with our main results, we plot the returns for only those stocks that are rated by analysts during the period for which the Zacks recommendation data is available (1985 to 2006). A trend line, which is the slope from a regression of the zero-cost portfolio return on a time variable, is added to each time-series plot in both panels.

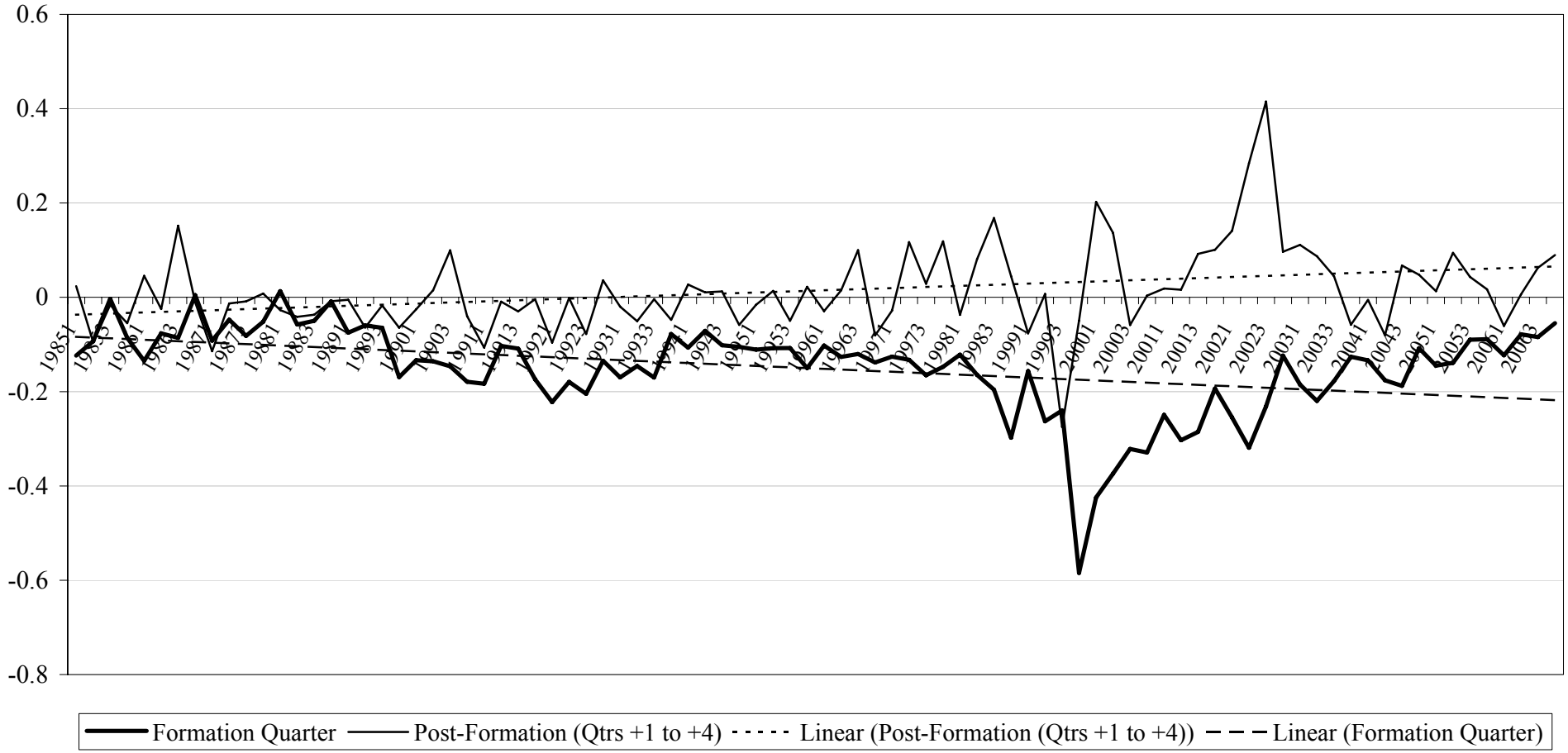

Figure 2: Quarterly average DGTW-adjusted abnormal returns for quarters *t*+1 to *t*+4 for the portfolio "S5 minus B5" over the period 1985 to 2006. This figure presents the time-series quarterly average DGTW-adjusted returns for an equal-weighted portfolio that longs stocks that are heavily sold by funds and shorts stocks that are heavily bought ("S5 minus B5"). We plot the DGTW-adjusted equal-weighted return for the portfolio formation quarter (Qtr 0) and the total return for the four post-formation quarters, *t*+1 through to *t*+4. To facilitate a comparison with our main results, we plot the returns for only those stocks that are rated by analysts during the period for which the Zacks recommendation data is available (1985 to 2006). A trend line, which is the slope from a regression of the zero-cost portfolio return on a time variable, is added to each time-series plot.

Table 1
Summary Statistics

Panel A presents summary trading statistics for all stocks traded by at least 5 funds and with analyst recommendations available from Zacks during the 4th quarter of 1994 to the 4th quarter of 2006 in three-year intervals. The first row of Panel A presents the proportion of stock trades that are buys. Panel B presents summary statistics for our herding measures, changes in analyst recommendations, and control variables. Statistics for the number of funds trading and the number of recommendations in a given quarter are also reported. *HM*, *BHM*, *SHM*, and *ADJHERD* are presented in percentage. *Revision* is the prior-quarter change in the consensus recommendation. *Dispersion* is the standard deviation of all outstanding recommendations at the end of the quarter, scaled by the average recommendation. *Size* is market capitalization at the beginning of the quarter. *Ret* is stock return in the previous quarter. *BM* is the ratio of book value to market value of equity as of the most recent fiscal quarter. *Std* is stock return volatility, defined as the standard deviation of daily returns over the previous quarter. *Turn* is turnover, which equals the average daily trading volume over the previous quarter, scaled by shares outstanding at the end of that quarter. *Turn* is standardized by the average turnover for all stocks listed on the same exchange.

Panel A: Trading statistics for stocks with recommendations and traded by at least 5 funds

Year/Quarter	1995/4	1998/4	2001/4	2004/4
Proportion of buys	54.91%	47.98%	54.45%	52.92%
No. of stocks traded by at least:				
≥ 5 funds	2,075	2,494	2,399	2,318
≥ 10 funds	1,465	1,918	1,984	2,114
≥ 20 funds	836	1,289	1,491	1,822
≥ 30 funds	548	888	1,158	1,568
≥ 50 funds	259	480	719	1,102
≥ 100 funds	57	153	303	454
≥ 200 funds	1	27	78	125

Panel B: Summary statistics for herding measures, recommendation revisions, and control variables

	Mean	Median	Std. Dev.	25th	75th
HM (in percent)	3.948	1.749	10.327	-2.963	8.898
BHM (in percent)	3.469	1.912	9.028	-3.299	8.637
SHM (in percent)	4.169	1.601	11.645	-3.321	9.254
ADJHERD (in percent)	-5.271	0.155	23.286	-23.929	13.605
No. of funds trading	44.984	28.906	49.942	14.198	55.677
Revision	-0.022	-0.002	0.329	-0.152	0.110
Dispersion	0.179	0.178	0.088	0.118	0.243
No. of recommendations	9.814	7.813	7.029	4.542	13.250
Size (in millions $)	4560	844	16781	343	2538
Ret	0.052	0.031	0.260	-0.091	0.161
BM	0.561	0.448	0.514	0.263	0.711
Std	0.030	0.026	0.015	0.019	0.037
Turn	1.342	0.961	1.326	0.582	1.646

Table 2
Multivariate Regressions of Mutual Fund Herding on Analyst Revisions

This table reports the results from quarterly Fama-MacBeth regressions of mutual fund herding (*ADJHERD*) on consensus recommendation revisions (Column 1), the proportion of recommendation upgrades (Column 2), and consensus earnings forecast revisions (Column 3). Within each group of buy-herding (or sell-herding) stocks, we first subtract the minimum value of *BHM* (or, alternatively, *SHM*) from each stock's *BHM* (or *SHM*), so that the differenced herding measure is always positive. We then construct an adjusted herding measure (*ADJHERD*), which is equal to the differenced value of *BHM* if the stock is a buy-herding stock, and equal to −1 times the differenced value of *SHM* if the stock is a sell-herding stock during the quarter. *Revision* is the prior-quarter change in the consensus recommendation. *Revision_Count* is the net proportion of analyst recommendation upgrades in the prior quarter. *Revision_Forecast* is the prior-quarter change in the one-year-ahead consensus earnings forecast, scaled by stock price as at the beginning of the year. *Dispersion* is the standard deviation of all outstanding recommendations at the end of the quarter, scaled by the average recommendation. *Dispersion_Forecast* is the dispersion of analysts earnings forecasts measured as the standard deviation of one-year-ahead earnings forecasts during the quarter, scaled by stock price at the end of the previous year. *Size* is the log of quarter $t-1$ market capitalization. *Ret* is quarter $t-1$ stock return. *BM* is the log of the ratio of book value to market value of equity as of the most recent fiscal quarter. *Std* is defined as the standard deviation of daily returns during quarter $t-1$, and *Turn* is the standardized share turnover in quarter $t-1$. *Strong_Buy* (*Strong_Sell*) is an indicator variable, which equals "1" for stocks with consecutive strong buy (strong sell) consensus recommendations in the previous two quarters; "0" otherwise. *Lag_ADJHERD* and *Lag2_ADJHERD* are lagged values of *ADJHERD* in quarters $t-1$ and $t-2$, respectively. *Add_Drop* equals "1" ("-1") if the stock has been added (dropped) from the S&P 500 index in the previous quarter; "0" otherwise. The time-series average coefficients and Fama-MacBeth t-statistics (in parentheses) are presented. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable:	*ADJHERD*	*ADJHERD*	*ADJHERD*
	(1)	(2)	(3)
Intercept	0.0421 (2.65)***	0.0462 (2.96)***	0.0639 (3.89)***
Revision	0.0544 (14.48)***		
Revision_Count		0.1098 (14.92)***	
Revision_Forecast			0.3962 (5.46)***
Dispersion	0.0282 (2.05)**	0.0282 (2.07)**	
Dispersion_Forecast			-0.0198 (-0.15)
Size	-0.0028 (-1.52)	-0.0032 (-1.78)*	-0.0043 (-2.16)**
Ret	0.0891 (12.18)***	0.0878 (11.69)***	0.1248 (15.11)***
BM	0.0026 (1.82)*	0.0025 (1.73)*	0.0054 (3.61)***
Std	-0.9260 (-5.73)***	-0.9407 (-5.87)***	-0.7979 (-4.73)***
Turn	-0.0086 (-7.56)***	-0.0086 (-7.88)***	-0.0080 (-7.53)***
Strong_Buy	0.0115 (0.95)	0.0213 (1.76)*	
Strong_Sell	-0.0072 (-1.05)	-0.0046 (-0.65)	
Lag_Adjherd	0.2294 (23.07)***	0.2293 (22.59)***	0.1834 (20.44)***
Lag2_Adjherd	0.0059 (0.92)	0.0070 (1.10)	0.0048 (0.73)
Add_Drop	0.0214 (1.88)*	0.0209 (1.85)*	0.0113 (1.05)
R-squared	0.1391	0.1401	0.1408

Table 3
The Impact of Analyst Upgrades versus Downgrades on Mutual Fund Herding

This table presents results from quarterly Fama-MacBeth regressions of mutual fund herding (*ADJHERD*) on analyst upgrades versus downgrades. *Revision_Up* (*Revision_Down*) is equal to positive (negative) values of *Revision*; "0" otherwise. *Count_Up* (*Count_Down*) is the proportion of recommendation upgrades (downgrades) relative to the total number of recommendations in the prior quarter. *Forecast_Up* (*Forecast_Down*) is equal to positive (negative) values of *Revision_Forecast*; "0" otherwise. *Dispersion* is the standard deviation of all outstanding recommendations at the end of the quarter, scaled by the average recommendation. *Dispersion_Forecast* is the dispersion of analysts earnings forecasts measured as the standard deviation of one-year-ahead earnings forecasts during the quarter, scaled by stock price at the end of the previous year. *Size* is the log of quarter $t-1$ market capitalization. *Ret* is quarter $t-1$ stock return. *BM* is the log of the ratio of book value to market value of equity as of the most recent fiscal quarter. *Std* is defined as the standard deviation of daily returns during quarter $t-1$, and *Turn* is the standardized share turnover in quarter $t-1$. *Strong_Buy* (*Strong_Sell*) is an indicator variable, which equals "1" for stocks with consecutive strong buy (strong sell) consensus recommendations in the previous two quarters; "0" otherwise. *Lag_ADJHERD* and *Lag2_ADJHERD* are lagged values of *ADJHERD* in quarters $t-2$ and $t-3$, respectively. *Add_Drop* equals "1" ("-1") if the stock has been added (dropped) from the S&P 500 index in the previous quarter; "0" otherwise. The time-series average coefficients and Fama-MacBeth *t*-statistics (in parentheses) are presented. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable:	*ADJHERD*	*ADJHERD*	*ADJHERD*
	(1)	(2)	(3)
Intercept	0.0452 (-2.87)***	0.0473 (3.04)***	0.0643 (3.91)***
Revision_Up	0.0410 (8.28)***		
Revision_Down	0.0660 (10.83)***		
Count_Up		0.0955 (10.95)***	
Count_Down		-0.1214 (-13.20)***	
Forecast_Up			0.5624 (2.37)***
Forecast_Down			0.3512 (4.83)***
Dispersion	0.0284 (2.05)**	0.0275 (2.02)**	
Dispersion_Forecast			-0.0800 (-0.74)
Size	-0.0030 (1.66)	-0.0032 (1.79)*	-0.0043 (2.18)**
Ret	0.0891 (12.22)***	0.0878 (11.78)***	0.1243 (15.24)***
BM	0.0026 (1.83)*	0.0026 (1.76)*	0.0054 (3.64)***
Std	-0.8961 (-5.61)***	-0.9151 (-5.75)***	-0.8081 (-4.78)***

Table 3 cont'd.

Dependent Variable:	*ADJHERD*	*ADJHERD*	*ADJHERD*
	(1)	(2)	(3)
Turn	-0.0085 (-7.53)***	-0.0085 (-7.78)***	-0.0081 (-7.56)***
Strong_Buy	0.0089 (0.74)	0.0197 (1.64)	
Strong_Sell	-0.0077 (-1.14)	-0.0047 (-0.65)	
Lag_Adjherd	0.2290 (23.07)***	0.2287 (22.57)***	0.1830 (20.36)***
Lag2_Adjherd	0.0059 (0.93)	0.0068 (1.08)	0.0049 (0.76)
Add_Drop	0.0218 (1.92)*	0.0209 (1.86)*	0.0117 (1.10)
R-squared	0.1396	0.1402	0.1414

Table 4
The Impact of Recommendation Dispersion and Analyst Herding on Mutual Fund Herding

This table reports results from quarterly Fama-MacBeth regressions of mutual fund herding (*ADJHERD*) on consensus recommendation revisions interacted with recommendation dispersion (Column 1) and the degree of analyst herding (Column 2). *Revision* is the prior-quarter change in the consensus recommendation. *Dispersion* is the standard deviation of all outstanding recommendations at the end of the quarter, scaled by the average recommendation. *Lag_Dispersion* is the lagged value of *Dispersion* in quarter $t-2$. *Dispersion_Change* is the prior-quarter change in the recommendation dispersion (*Dispersion* - *Lag_Dispersion*). *Size* is the log of quarter $t-1$ market capitalization. *Ret* is quarter $t-1$ stock return. *BM* is the log of the ratio of book value to market value of equity as of the most recent fiscal quarter. *Std* is defined as the standard deviation of daily returns during quarter $t-1$, and *Turn* is the standardized share turnover in quarter $t-1$. *Strong_Buy* (*Strong_Sell*) is an indicator variable, which equals "1" for stocks with consecutive strong buy (strong sell) consensus recommendations in the previous two quarters; "0" otherwise. *Lag_ADJHERD* and *Lag2_ADJHERD* are lagged values of *ADJHERD* in quarters $t-2$ and $t-3$, respectively. *Add_Drop* equals "1" ("-1") if the stock has been added (dropped) from the S&P 500 index in the previous quarter; "0" otherwise. The time-series average coefficients and Fama-MacBeth *t*-statistics (in parentheses) are presented. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

	Model 1	*Model 2*
Dependent Variable:	*ADJHERD*	*ADJHERD*
	(1)	(2)
Intercept	0.0424 (2.68)***	0.0431 (2.71)***
Revision	0.0818 (12.86)***	0.0534 (12.61)***
Dispersion	0.0286 (2.12)**	0.0424 (2.56)***
Lag_Dispersion		-0.0170 (-1.22)
Revision × *Dispersion*	-0.1539 (-5.94)***	-0.1214 (-13.20)***
Revision × *Dispersion_Change*		-0.0681 (-2.80)***
Size	-0.0028 (-1.54)	-0.0028 (1.54)
Ret	0.0884 (12.17)***	0.0874 (11.76)***
BM	0.0027 (1.86)*	0.0027 (1.88)*
Std	-0.9071 (-5.64)***	-0.9153 (-5.71)***
Turn	-0.0085 (-7.51)***	-0.0086 (-7.46)***
Strong_Buy	0.0109 (0.90)	0.0115 (0.86)
Strong_Sell	-0.0070 (-1.03)	-0.0085 (-1.64)
Lag_ADJHERD	0.2288 (23.13)***	0.2294 (23.09)***
Lag2_ADJHERD	0.0058 (0.92)	0.0051 (0.79)
Add_Drop	0.0215 (1.88)*	0.0212 (1.86)*
R-squared	0.1396	0.1392

Table 5
Quarterly Returns (in Percent) for Herding-Sorted Portfolios

Panel A presents quarterly returns for herding-sorted portfolios over the 1981 to 1994 period. Panel B presents quarterly portfolio returns over the 1995 to 2006 period. For each quarter t, stocks are sorted into quintiles according to their buy-herding measure (*BHM*) for that quarter. This procedure results in five portfolios (B1 to B5) where B1 includes those stocks that mutual fund herds lightly buy and B5 includes those stocks that herds most strongly buy. The sorting procedure is repeated for stocks with a higher than average proportion of sells based on their sell-herding measure (*SHM*) in each quarter, where S1 includes those stocks that mutual fund herds lightly sell and S5 includes those stocks that herds most strongly sell. The time-series quarterly raw (*Raw*) and equal-weighted (*DGTW_EW*) and value-weighted abnormal returns (*DGTW_VW*) for each quintile portolio are presented below along with time-series t-statistics in parentheses. The quarterly equal- and value-weighted abnormal returns for each portfolio are calculated using DGTW (1997) characteristic-based benchmark portfolio returns. Portfolio "S5 minus B5" represents a zero-investment portfolio that longs the S5 portfolio and shorts the B5 portfolio. "S1 to S5 minus B1 to B5" represents a zero-investment portfolio which equally weights long positions in S1 to S5 and equally weights short positions in B1 to B5. The raw and DGTW-adjusted abnormal returns and the respective t-statistics (in parentheses) are presented for these zero-investment portfolios. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Quarterly Returns (in Percent) for the 1995 to 2006 Period

Portfolios	Return	Qtr −2	Qtr −1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
B5 (Heavy buying)	*Raw*	12.49 (6.10)***	15.66 (7.03)***	16.15 (7.24)***	5.22 (3.11)***	3.90 (2.31)**	2.87 (1.76)*	2.34 (1.42)
	DGTW_EW	7.75 (9.68)***	10.62 (10.56)***	10.90 (10.10)***	0.98 (2.38)**	-0.04 (-0.13)	-0.36 (-1.16)	-0.78 (-2.66)**
	DGTW_VW	0.78 (1.56)	2.79 (5.00)***	5.88 (10.38)***	-0.31 (-0.70)	-0.27 (-0.54)	-0.52 (-1.00)	-1.06 (-2.91)***
B4	*Raw*	4.82 (9.10)***	5.54 (12.99)***	6.03 (12.40)***	0.13 (0.43)	0.17 (0.65)	-0.08 (-0.30)	-0.03 (-0.15)
	DGTW_EW	9.23 (5.20)***	10.01 (6.09)***	10.65 (6.59)***	3.82 (2.59)**	3.87 (2.53)**	3.08 (2.06)**	3.02 (1.99)*
	DGTW_VW	0.24 (0.68)	1.83 (6.20)***	3.41 (9.07)***	-0.11 (-0.32)	0.06 (0.16)	-0.17 (-0.49)	0.37 (1.10)
B3	*Raw*	7.82 (4.89)***	8.64 (5.32)***	8.35 (5.46)***	3.86 (2.66)**	3.89 (2.63)**	2.99 (2.01)**	2.93 (1.92)*
	DGTW_EW	3.53 (9.79)***	4.47 (11.03)***	3.96 (10.18)***	0.28 (1.17)	0.31 (1.20)	-0.26 (-1.04)	-0.16 (-0.62)
	DGTW_VW	0.49 (1.86)*	1.57 (4.38)***	2.82 (5.10)***	-0.02 (-0.06)	0.20 (0.77)	0.32 (1.08)	-0.23 (-0.62)
B2	*Raw*	7.18 (4.65)***	6.72 (4.39)***	6.25 (4.28)***	3.64 (2.48)**	3.41 (2.25)**	3.40 (2.42)**	3.42 (2.25)**
	DGTW_EW	3.09 (9.12)***	2.84 (10.56)***	2.19 (7.54)***	0.10 (0.36)	-0.18 (-0.73)	0.04 (0.16)	0.20 (0.80)
	DGTW_VW	0.46 (1.50)	0.75 (2.42)**	1.13 (3.72)***	0.03 (0.12)	-0.16 (-0.60)	-0.11 (-0.30)	-0.15 (-0.53)
B1 (Light buying)	*Raw*	5.30 (3.18)***	5.14 (3.11)***	5.42 (3.44)***	4.43 (2.67)**	4.61 (2.79)***	3.56 (2.30)**	3.97 (2.57)**
	DGTW_EW	1.16 (3.60)***	1.03 (3.69)***	1.24 (3.88)***	0.33 (0.88)	0.51 (1.46)	-0.06 (-0.16)	0.41 (1.35)
	DGTW_VW	-1.13 (-3.49)***	-0.72 (-2.06)**	0.05 (0.14)	0.05 (0.14)	0.86 (2.58)***	0.31 (0.86)	0.72 (1.87)*

Panel A cont'd.

Portfolios	Return	Qtr −2	Qtr −1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
S1 (Light selling)	*Raw*	3.73 (2.17)**	2.72 (1.57)	3.68 (2.10)**	4.08 (2.43)**	4.39 (2.64)**	3.98 (2.30)**	4.21 (2.46)**
	DGTW_EW	-0.35 (-0.98)	-1.12 (-3.07)***	-0.69 (-1.83)*	0.02 (0.09)	0.22 (0.75)	0.17 (0.46)	0.65 (1.88)*
	DGTW_VW	-2.49 (-5.38)***	-1.88 (-6.54)***	-1.09 (-3.39)***	-0.19 (-0.66)	0.36 (0.94)	0.33 (0.79)	0.85 (2.02)**
S2	*Raw*	4.74 (3.18)***	4.02 (2.65)**	2.76 (1.80)*	3.72 (2.50)**	3.93 (2.64)**	3.82 (2.47)**	3.58 (2.37)**
	DGTW_EW	0.99 (3.35)***	0.46 (1.64)	-0.83 (-3.32)***	0.09 (0.44)	0.46 (1.61)	0.49 (1.61)	0.36 (1.55)
	DGTW_VW	-0.12 (-0.33)	0.33 (0.90)	0.17 (0.56)	0.13 (0.31)	0.04 (0.10)	-0.01 (-0.02)	0.06 (0.18)
S3	*Raw*	4.21 (2.83)***	1.74 (1.11)	0.64 (0.39)	3.59 (2.28)**	3.90 (2.62)**	3.81 (2.53)**	3.86 (2.42)**
	DGTW_EW	0.72 (2.38)**	-1.45 (-4.91)***	-2.69 (-7.88)***	-0.14 (-0.56)	0.30 (1.25)	0.35 (1.55)	0.50 (1.36)
	DGTW_VW	0.24 (0.82)	-0.90 (-2.84)***	-1.78 (-5.78)***	0.03 (0.07)	0.45 (1.53)	0.00 (-0.01)	0.63 (1.72)*
S4	*Raw*	2.77 (1.74)*	0.06 (0.03)	-1.98 (-1.12)	3.56 (2.03)**	4.18 (2.44)**	3.98 (2.26)**	4.36 (2.50)**
	DGTW_EW	-0.62 (-1.65)	-2.92 (-7.12)***	-5.05 (-12.76)***	-0.01 (-0.01)	0.45 (1.39)	0.34 (1.04)	0.98 (2.67)**
	DGTW_VW	-0.38 (-0.70)	-2.06 (-6.45)***	-4.78 (-8.19)***	-0.19 (-0.64)	-0.16 (-0.39)	-0.16 (-0.38)	0.22 (0.72)
S5 (Heavy selling)	*Raw*	0.07 (0.04)	-5.26 (-2.64)**	-5.02 (-2.26)**	4.70 (1.92)*	4.41 (1.92)*	5.11 (2.22)**	4.87 (2.25)**
	DGTW_EW	-3.35 (-5.47)***	-8.23 (-12.07)***	-8.02 (-10.84)***	0.64 (0.80)	0.65 (0.86)	1.34 (1.87)*	1.34 (2.18)**
	DGTW_VW	-2.09 (-2.73)***	-5.41 (-6.13)***	-7.04 (-8.01)***	-0.11 (-0.20)	0.61 (1.06)	2.21 (3.39)***	0.88 (1.58)
S5 minus B5	*Raw*	-12.42 (-9.29)***	-20.92 (-12.03)***	-21.17 (-11.42)***	-0.52 (-0.34)	0.51 (0.42)	2.24 (1.61)	2.53 (2.46)**
	DGTW_EW	-11.09 (-9.89)***	-18.85 (-13.67)***	-18.93 (-12.78)***	-0.34 (-0.38)	0.69 (0.92)	1.70 (2.04)**	2.12 (2.99)***
	DGTW_VW	-2.87 (-3.15)***	-8.21 (-6.98)***	-12.92 (-10.50)***	0.20 (0.29)	0.89 (1.26)	2.73 (2.82)***	1.94 (2.94)***
(S1 to S5) minus (B1 to B5)	*Raw*	-5.30 (-8.59)***	-8.58 (-12.36)***	-9.35 (-12.83)***	-0.26 (-0.50)	0.23 (0.53)	0.96 (1.65)	1.04 (2.37)**
	DGTW_EW	-4.59 (-9.58)***	-7.55 (-14.71)***	-8.32 (-14.26)***	-0.24 (-0.80)	0.26 (1.23)	0.68 (2.11)**	0.84 (3.15)***
	DGTW_VW	-1.1348 (-3.41)***	-3.2278 (-9.53)***	-5.5596 (-11.05)***	0.0036 (0.01)	0.1197 (0.50)	0.5089 (1.58)	0.5949 (2.52)**

Panel B: Quarterly Returns (in Percent) for the 1981 to 1994 Period

Portfolios	Return	Qtr −2	Qtr −1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
B5 (Heavy buying)	*Raw*	7.20 (4.89)***	8.92 (5.57)***	11.15 (7.23)***	4.45 (3.06)***	3.93 (2.98)***	4.12 (3.21)***	3.45 (2.64)***
	DGTW_EW	3.15 (7.57)***	4.69 (9.23)***	6.78 (15.04)***	0.60 (1.92)*	-0.01 (-0.03)	-0.14 (-0.63)	-0.49 (-1.79)*
	DGTW_VW	-0.24 (-0.85)	0.39 (1.24)	3.67 (10.15)***	0.44 (1.70)*	-0.19 (-0.75)	0.27 (0.88)	-0.11 (-0.39)
B4	*Raw*	6.85 (4.88)***	7.02 (4.86)***	8.59 (5.90)***	4.21 (3.00)***	4.00 (2.92)***	4.09 (3.04)***	4.23 (3.27)***
	DGTW_EW	2.89 (8.17)***	2.97 (7.83)***	4.39 (13.70)***	0.42 (1.19)	0.19 (0.65)	-0.16 (-0.54)	0.28 (1.07)
	DGTW_VW	0.14 (0.53)	0.51 (1.71)*	2.66 (9.41)***	-0.05 (-0.22)	0.25 (1.05)	0.21 (0.82)	0.12 (0.52)
B3	*Raw*	5.82 (4.07)***	6.29 (4.80)***	6.83 (4.92)***	3.92 (3.03)***	3.53 (2.83)***	4.39 (3.41)***	3.80 (3.16)***
	DGTW_EW	1.91 (5.49)***	2.29 (8.43)***	2.90 (8.34)***	0.20 (0.70)	-0.24 (-0.87)	0.14 (0.47)	-0.24 (-1.04)
	DGTW_VW	-0.43 (-2.04)**	0.26 (1.39)	1.54 (6.52)***	0.31 (1.44)	-0.12 (-0.51)	0.09 (0.40)	-0.12 (-0.60)
B2	*Raw*	6.41 (4.82)***	6.24 (4.39)***	5.60 (3.89)***	3.82 (2.96)***	3.55 (2.67)***	4.07 (3.20)***	4.02 (3.38)***
	DGTW_EW	2.37 (7.93)***	2.32 (6.05)***	1.84 (5.45)***	0.17 (0.66)	-0.19 (-0.68)	0.10 (0.41)	0.06 (0.31)
	DGTW_VW	0.20 (0.75)	0.31 (1.54)	0.73 (3.33)***	-0.02 (-0.09)	0.20 (0.90)	0.04 (0.17)	-0.10 (-0.49)
B1 (Light buying)	*Raw*	5.94 (3.93)***	5.47 (3.80)***	4.99 (3.54)***	3.81 (2.75)***	3.58 (2.66)***	3.95 (3.22)***	3.86 (2.90)***
	DGTW_EW	1.93 (5.50)***	1.38 (4.26)***	1.38 (5.39)***	0.18 (0.64)	-0.08 (-0.31)	0.03 (0.12)	0.07 (0.31)
	DGTW_VW	-0.64 (-2.14)**	-0.30 (-1.05)	0.41 (1.70)*	-0.05 (-0.21)	-0.58 (-2.47)**	0.24 (0.84)	-0.13 (-0.62)

Panel B cont'd.

Portfolios	Return	Qtr −2	Qtr −1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
S1 (Light selling)	*Raw*	5.40 (3.67)***	4.65 (3.24)***	3.08 (2.18)**	3.00 (2.21)**	3.43 (2.49)**	3.83 (2.98)***	3.42 (2.64)**
	DGTW_EW	1.52 (4.11)***	0.72 (2.48)**	-0.30 (-1.06)	-0.55 (-1.96)*	0.04 (0.14)	-0.25 (-0.97)	-0.21 (-0.73)
	DGTW_VW	-0.50 (-1.63)	-0.54 (-2.00)**	-1.00 (-3.60)***	-0.45 (-1.82)*	-0.10 (-0.36)	0.00 (0.00)	-0.04 (-0.12)
S2	*Raw*	6.00 (4.39)***	4.87 (3.60)***	3.49 (2.66)***	4.01 (3.00)***	3.72 (2.90)***	4.17 (3.25)***	3.80 (3.02)***
	DGTW_EW	1.83 (6.88)***	0.91 (3.53)***	0.09 (0.36)	0.43 (1.81)*	-0.03 (-0.14)	0.12 (0.46)	0.16 (0.54)
	DGTW_VW	0.30 (1.28)	-0.16 (-0.60)	-0.30 (-1.08)	0.70 (2.89)***	0.28 (1.47)	-0.03 (-0.13)	0.29 (1.31)
S3	*Raw*	5.75 (4.12)***	4.64 (3.49)***	1.81 (1.32)	3.12 (2.43)**	2.71 (2.10)**	3.28 (2.68)***	3.46 (2.73)***
	DGTW_EW	1.70 (5.56)***	0.72 (2.32)**	-1.49 (-5.25)***	-0.40 (-1.81)*	-0.78 (-3.28)***	-0.54 (-1.90)*	-0.27 (-0.99)
	DGTW_VW	0.39 (1.81)*	0.31 (1.52)	-1.31 (-5.82)***	-0.27 (-1.40)	-0.31 (-1.42)	-0.42 (-2.06)**	-0.11 (-0.44)
S4	*Raw*	5.42 (3.79)***	3.80 (2.81)**	0.38 (0.28)	2.81 (2.08)**	3.37 (2.47)**	3.54 (2.77)***	3.49 (2.92)***
	DGTW_EW	1.29 (3.97)***	0.06 (0.23)	-2.50 (-8.33)***	-0.35 (-1.27)	-0.06 (-0.21)	-0.27 (-0.96)	-0.19 (-0.79)
	DGTW_VW	0.66 (2.32)**	0.00 (0.01)	-2.48 (-8.35)***	-0.39 (-1.37)	0.21 (0.66)	-0.47 (-1.96)*	-0.35 (-1.36)
S5 (Heavy selling)	*Raw*	5.00 (3.16)***	2.05 (1.39)	-1.14 (-0.84)	1.72 (1.25)	2.67 (1.97)*	3.10 (2.17)**	3.57 (2.60)***
	DGTW_EW	0.75 (1.81)*	-1.62 (-4.29)***	-3.97 (-8.49)***	-1.41 (-4.36)***	-0.56 (-1.74)*	-0.51 (-1.52)	0.15 (0.55)
	DGTW_VW	0.72 (1.74)*	-0.12 (-0.35)	-2.66 (-6.21)***	-1.18 (-3.35)***	-0.48 (-1.91)*	-0.46 (-1.46)	-0.33 (-1.03)
S5 minus B5	*Raw*	-2.20 (-3.75)***	-6.87 (-8.86)***	-12.29 (-13.69)***	-2.72 (-4.58)***	-1.26 (-2.19)**	-1.02 (-2.03)**	0.12 (0.30)
	DGTW_EW	-2.40 (-4.67)***	-6.31 (-9.32)***	-10.75 (-13.36)***	-2.01 (-4.27)***	-0.55 (-1.33)	-0.37 (-0.96)	0.65 (1.88)*
	DGTW_VW	0.95 (1.78)*	-0.52 (-0.99)	-6.34 (-10.27)***	-1.62 (-3.35)***	-0.29 (-0.73)	-0.72 (-1.43)	-0.22 (-0.48)
(S1 to S5) minus (B1 to B5)	*Raw*	-0.93 (-3.49)***	-2.79 (-8.72)***	-5.91 (-16.03)***	-1.11 (-4.34)***	-0.54 (-2.27)**	-0.54 (-2.13)**	-0.33 (-1.75)*
	DGTW_EW	-1.03 (-4.27)***	-2.57 (-9.71)***	-5.09 (-16.33)***	-0.77 (-3.93)***	-0.21 (-1.23)	-0.28 (-1.40)	-0.01 (-0.06)
	DGTW_VW	0.51 (2.25)**	-0.34 (-1.54)	-3.35 (-14.23)***	-0.44 (-2.43)**	0.01 (0.04)	-0.44 (-1.94)*	-0.04 (-0.24)

Table 6

Quarterly Returns (in Percent) for Revision- and Herding-Sorted Portfolios

For each quarter t, stocks are divided into two groups depending on whether they have experienced an analyst downgrade or upgrade in the previous quarter. Within each downgrade and upgrade group, stocks are then sorted into quintile portfolios according to their *BHM* and *SHM* measures, respectively. Panel A presents the time-series average quarterly raw and abnormal returns for stocks that are lightly bought (B1) and sold (S1) by funds, while Panel B presents the time-series quarterly raw and abnormal returns for stocks that are heavily bought (B5) and sold (S5) by funds. The quarterly equal-weighted (*DGTW_EW*) and value-weighted abnormal returns (*DGTW_VW*) for each portfolio are calculated using DGTW (1997) characteristic-based benchmark portfolio returns. The time-series *t*-statistics for the raw and DGTW-adjusted abnormal returns are presented in parentheses. The portfolio "Upgrade-S1 minus Upgrade-B1" represents a zero-investment portfolio that longs upgraded stocks that are lightly sold and shorts upgraded stocks that are lightly bought by funds. "Downgrade-S1 minus Downgrade-B1" is a zero-investment portfolio that longs downgraded stocks that are lightly sold and shorts downgraded stocks that are lightly bought by funds. Similar zero-investment portfolios are formed for stocks heavily bought and sold by funds. The raw and DGTW-adjusted abnormal returns and the respective *t*-statistics (in parentheses) for these zero-investment portfolios are presented. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Raw and DGTW-adjusted returns for light buying (B1) and light selling (S1) portfolios

Portfolios	Consensus Recommendation Revision	Return	Qtr −2	Qtr −1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
B1 (Light buying)	Downgrade	*Raw*	3.89 (2.26)**	1.59 (0.89)	5.12 (3.01)***	5.01 (2.76)***	5.22 (2.71)***	4.21 (2.68)**	3.36 (2.13)**
		DGTW_EW	-0.24 (-0.48)	-2.12 (-4.77)***	0.90 (2.00)**	0.94 (2.11)**	1.05 (1.73)*	0.48 (0.99)	-0.15 (-0.36)
		DGTW_VW	-1.80 (-3.35)***	-3.00 (-6.52)***	-0.22 (-0.40)	0.44 (0.94)	1.02 (1.68)*	0.75 (1.22)	0.49 (0.67)
	Upgrade	*Raw*	6.27 (3.86)***	8.91 (5.14)***	5.41 (3.53)***	4.26 (2.69)***	3.93 (2.56)**	3.20 (1.98)*	4.60 (2.73)***
		DGTW_EW	2.28 (4.20)***	4.91 (10.57)***	1.41 (3.35)***	0.25 (0.52)	0.12 (0.26)	-0.35 (-0.69)	1.13 (2.09)**
		DGTW_VW	-0.79 (-1.54)	2.25 (4.22)***	0.15 (0.31)	0.77 (1.38)	0.53 (1.09)	-0.04 (-0.10)	0.12 (0.21)
S1 (Light selling)	Downgrade	*Raw*	2.04 (1.16)	-0.90 (-0.51)	4.07 (2.24)**	3.52 (2.01)**	4.05 (2.33)**	3.80 (2.21)**	4.27 (2.55)**
		DGTW_EW	-1.71 (-3.20)***	-4.46 (-9.51)***	-0.20 (-0.39)	-0.33 (-0.86)	0.10 (0.23)	0.03 (0.07)	0.72 (1.56)
		DGTW_VW	-3.10 (-5.62)***	-4.14 (-9.42)***	-0.61 (-1.32)	0.24 (0.50)	-0.45 (-1.03)	-0.12 (-0.25)	1.84 (3.10)***
	Upgrade	*Raw*	4.77 (2.53)**	6.80 (3.74)***	3.38 (2.06)**	3.80 (2.14)**	4.99 (2.97)***	4.31 (2.30)**	3.87 (2.20)**
		DGTW_EW	0.76 (1.20)	2.75 (4.83)***	-0.88 (-1.73)*	-0.35 (-0.68)	0.84 (1.61)	0.53 (0.87)	0.38 (0.74)
		DGTW_VW	-2.26 (-3.82)***	0.12 (0.29)	-0.67 (-1.30)	0.39 (0.81)	0.91 (1.39)	0.73 (0.93)	0.58 (0.92)
Upgrade-S1 minus Upgrade-B1		*Raw*	-1.50 (-1.84)*	-2.11 (-2.83)***	-2.03 (-3.26)***	-0.46 (-0.62)	1.05 (1.46)	1.11 (1.71)*	-0.73 (-1.07)
		DGTW_EW	-1.52 (-1.93)*	-2.16 (-3.10)***	-2.29 (-4.11)***	-0.60 (-0.87)	0.73 (1.08)	0.88 (1.40)	-0.74 (-1.08)
		DGTW_VW	-1.47 (-1.95)*	-2.13 (-3.86)***	-0.82 (-1.33)	-0.38 (-0.55)	0.37 (0.49)	0.77 (1.03)	0.46 (0.52)
Downgrade-S1 minus Downgrade-B1		*Raw*	-1.85 (-2.41)**	-2.49 (-5.03)***	-1.05 (-1.68)*	-1.49 (-2.95)***	-1.17 (2.00)**	-0.41 (-0.65)	0.91 (1.40)
		DGTW_EW	-1.48 (-2.10)**	-2.34 (-4.71)***	-1.10 (-1.79)*	-1.27 (-2.56)**	-0.95 (-1.87)*	-0.45 (-0.76)	0.87 (1.49)
		DGTW_VW	-1.29 (-1.69)*	-1.14 (-1.74)*	-0.38 (-0.50)	-0.20 (-0.33)	-1.48 (-2.12)**	-0.87 (-1.29)	1.35 (1.47)

Panel B: Raw amd DGTW-adjusted returns for heavy buying (B5) and heavy selling (S5) portfolios

Portfolios	Consensus Recommendation Revision	Return	Qtr −2	Qtr −1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
B5 (Heavy buying)	Downgrade	*Raw*	10.69 (5.88)***	11.27 (5.54)***	14.71 (7.32)***	4.21 (2.41)**	3.57 (2.01)**	3.27 (1.94)*	2.71 (1.66)
		DGTW_EW	6.05 (9.87)***	6.46 (7.30)***	9.70 (11.09)***	0.24 (0.40)	-0.31 (-0.58)	0.21 (0.41)	-0.41 (-1.16)
		DGTW_VW	0.99 (0.91)	1.00 (1.67)	6.25 (7.51)***	0.87 (0.98)	-0.80 (-1.08)	-0.25 (-0.35)	-1.38 (-1.82)*
	Upgrade	*Raw*	13.98 (5.61)***	20.77 (7.74)***	16.74 (7.22)***	5.14 (2.97)***	4.31 (2.30)**	2.84 (1.73)*	1.26 (0.71)
		DGTW_EW	9.08 (6.97)***	15.51 (9.85)***	11.44 (9.26)***	0.92 (1.57)	0.51 (0.97)	-0.46 (-1.00)	-1.59 (-3.50)**
		DGTW_VW	1.83 (2.36)**	4.90 (7.57)***	5.27 (7.40)***	-0.35 (-0.61)	-0.26 (-0.40)	-1.01 (-1.39)	-1.78 (-3.28)***
S5 (Heavy selling)	Downgrade	*Raw*	-1.71 (-0.79)	-11.05 (-5.11)***	-5.19 (-2.20)**	5.15 (1.69)*	4.43 (1.69)*	5.21 (1.95)*	5.97 (2.38)**
		DGTW_EW	-4.88 (-5.66)***	-13.68 (-14.49)***	-8.24 (-10.20)***	1.28 (0.94)	0.66 (0.60)	1.58 (1.47)	2.51 (2.45)**
		DGTW_VW	-5.15 (-4.47)***	-10.40 (-7.56)***	-7.08 (-6.38)***	0.05 (0.05)	-0.46 (-0.51)	3.41 (3.22)***	1.40 (1.61)
	Upgrade	*Raw*	2.58 (1.36)	0.98 (0.53)	-6.07 (-2.71)***	3.69 (1.81)*	4.67 (2.06)**	3.64 (1.80)*	3.74 (1.91)*
		DGTW_EW	-0.95 (-1.39)	-2.15 (-3.16)***	-8.86 (-9.32)***	-0.30 (-0.46)	0.81 (0.84)	-0.23 (-0.42)	0.14 (0.24)
		DGTW_VW	0.27 (0.28)	-0.50 (-0.56)	-7.22 (-7.61)***	-0.65 (-0.87)	0.70 (0.86)	0.66 (0.84)	1.04 (1.67)
Upgrade-S5 minus Upgrade-B5		*Raw*	-11.40 (-6.35)***	-19.79 (-9.19)***	-22.81 (-10.62)***	-1.45 (-1.13)	0.36 (0.22)	0.80 (0.66)	2.48 (2.50)**
		DGTW_EW	-10.03 (-6.55)***	-17.66 (-10.27)***	-20.30 (-11.39)***	-1.23 (-1.41)	0.30 (0.27)	0.22 (0.29)	1.73 (2.41)***
		DGTW_VW	-1.56 (-1.21)	-5.40 (-4.73)***	-12.49 (-10.23)***	-0.30 (-0.34)	0.96 (0.90)	1.67 (1.59)	2.82 (3.46)***
Downgrade-S5 minus Downgrade-B5		*Raw*	-12.39 (-8.97)***	-22.32 (-12.53)***	-19.90 (-11.74)***	0.94 (0.40)	0.86 (0.56)	1.95 (1.11)	3.26 (2.25)**
		DGTW_EW	-10.93 (-9.40)***	-20.14 (-13.44)***	-17.94 (-13.40)***	1.03 (0.67)	0.97 (0.81)	1.37 (1.13)	2.92 (2.57)**
		DGTW_VW	-6.14 (-4.04)***	-11.40 (-7.44)***	-13.33 (-8.35)***	-0.81 (-0.55)	0.33 (0.31)	3.66 (2.70)***	2.78 (2.30)**
Downgrade-S5 minus Upgrade-B5		*Raw*	-15.69 (-8.44)***	-31.82 (-12.78)***	-21.93 (-10.28)***	0.01 (0.00)	0.12 (0.07)	2.37 (1.36)	4.71 (3.09)***
		DGTW_EW	-13.96 (-8.32)***	-29.19 (-14.25)***	-19.69 (-11.63)***	0.36 (0.24)	0.14 (0.14)	2.04 (1.71)*	4.10 (3.59)***
		DGTW_VW	-6.98 (-4.58)***	-15.30 (-9.26)***	-12.36 (-8.52)***	0.40 (0.38)	-0.20 (-0.18)	4.42 (3.40)***	3.18 (3.51)***
Upgrade-S5 minus Downgrade-B5		*Raw*	-8.10 (-6.58)***	-10.29 (-6.87)***	-20.78 (-11.42)***	-0.52 (-0.42)	1.10 (0.79)	0.38 (0.33)	1.03 (1.14)
		DGTW_EW	-7.00 (-7.42)***	-8.61 (-6.70)***	-18.56 (-12.18)***	-0.55 (-0.65)	1.12 (1.11)	-0.45 (-0.66)	0.55 (0.83)
		DGTW_VW	-0.72 (-0.53)	-1.50 (-1.28)	-13.47 (-9.57)***	-1.52 (-1.15)	1.49 (1.46)	0.91 (0.90)	2.42 (2.65)***

Table 7
Mutual Fund Herding, Analyst Recommendations, and Future Abnormal Returns

Panel A presents time-series averages for the adjusted herding measure (*ADJHERD*), the consensus recommendation revision (*Revision*), and firm profitability (*ROA*) over quarters $t-2$ to $t+4$ for portfolios of stocks most heavily bought (or sold) by funds during quarter t. Panel B presents quarterly Fama-MacBeth regression results of DGTW-adjusted equal-weighted abnormal returns for quarters $t+3$ and $t+4$ ($ABRET_{t+3,t+4}$) on lagged and current-quarter values of *ADJHERD*. We also control for the degree of flow-driven forced trading (*Forced*) during quarter t in each regression. The time-series average coefficients and Fama-MacBeth t-statistics (in parentheses) are presented. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Mutual fund herding, analyst recommendations, and stock fundamentals

Strong buy-herding stocks (B5)

	Qtr −2	Qtr −1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
ADJHERD	2.97	8.51	28.82	7.65	2.09	0.80	-0.54
Revision	-0.0071	0.0157	0.0373	0.0353	-0.0013	-0.0155	-0.0231
ROA	-0.0027	-0.0019	-0.0002	0.0014	0.0019	0.0025	0.0028

Strong sell-herding stocks (S5)

	Qtr −2	Qtr −1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
ADJHERD	-0.52	-7.24	-30.61	-8.93	-1.83	-0.01	1.50
Revision	-0.0237	-0.0496	-0.1025	-0.1169	-0.0365	-0.0152	-0.0106
ROA	0.0009	-0.0005	-0.0040	-0.0082	-0.0107	-0.0074	-0.0101

Difference in *ADJHERD* between strong buy-herding and strong sell-herding stocks

	Qtr −2	Qtr −1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
Difference in *ADJHERD*	3.49	15.75	59.43	16.57	3.92	0.81	-2.05
t-statistic	(8.13)***	(25.60)***	(80.40)***	(21.19)***	(7.61)***	(1.67)	(-3.66)***

Panel B: Regressions of DGTW-adjusted abnormal returns on herding and analyst recommendation revisions		
	Model 1	*Model 2*
Dependent Variable:	$ABRET_{t+3,\,t+4}$	$ABRET_{t+3,\,t+4}$
Intercept	0.0041 (1.54)	0.0040 (1.45)
$ADJHERD_t$	-0.0298 (-2.66)**	-0.0258 (-2.25)**
$Revision_{t-1}$	-0.0082 (-1.25)	-0.0092 (-1.40)
$ABRET_{t-1}$		-0.0275 (-1.80)*
$ABRET_{t-1} \times Revision\_Up$		0.0566 (0.97)
$ABRET_{t-1} \times Revision\_Down$		0.0246 (0.56)
$Revision_t$	-0.0011 (-0.18)	-0.0012 (-0.22)
$Revision_{t+1}$	-0.0038 (-0.68)	-0.0033 (-0.58)
$Revision_{t+2}$	0.0043 (0.74)	0.0048 (0.85)
$ADJHERD_{t+1}$	-0.0151 (-1.21)	-0.0122 (-1.05)
$ADJHERD_{t+2}$	0.0049 (0.37)	0.0027 (0.21)
$Forced_t$	-0.1295 (-2.46)**	-0.1212 (-2.36)**
R-squared	0.0102	0.0164

Table 8
Future Abnormal Returns and the Interaction Effect of Herding and Analyst Recommendation Revisions

This table presents quarterly Fama-MacBeth regression results of DGTW-adjusted equal-weighted abnormal returns for quarters t+3 and t +4 ($ABRET_{t+3,t+4}$) while accounting for the interaction effects of lagged and current-quarter values of the adjusted herding measure (*ADJHERD* consensus recommendation revisions (*Revision*), and pre-formation quarter abnormal returns ($ABRET_{t-1}$). For each regression model, we estimate separate results for groups of buy-herding and sell-herding stocks. We also control for the degree of flow-driven forced trading (*Forced*) during quarter t in each regression. The time-series average coefficients and Fama-MacBeth t- statistics (in parentheses) are presented. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

	Model 1		*Model 2*		*Model 3*	
	Buy-herding	Sell-herding	Buy-herding	Sell-herding	Buy-herding	Sell-herding
Dependent Variable:	$ABRET_{t+3,t+4}$	$ABRET_{t+3,t+4}$	$ABRET_{t+3,t+4}$	$ABRET_{t+3,t+4}$	$ABRET_{t+3,t+4}$	$ABRET_{t+3,t+4}$
Intercept	0.0019	0.0030	0.0025	0.0063	0.0032	0.0055
	(0.42)	(0.62)	(0.55)	(1.46)	(0.65)	(1.21)
$ADJHERD_t$	-0.0203	-0.0308	-0.0248	-0.0068	-0.0344	-0.0137
	(-0.97)	(-1.09)	(-1.26)	(-0.27)	(-1.22)	(-0.55)
$Revision_{t-1}$	0.0282	0.0103	0.0287	0.0156	0.0298	0.0195
	(2.12)**	(0.69)	(2.02)**	(1.01)	(2.34)**	(1.31)
$ADJHERD_t \times Revision_{t-1}$	-0.1789	0.1770	-0.1731	0.1971	-0.1919	0.2057
	(-2.13)**	(2.04)**	(-1.96)*	(2.21)**	(-2.38)**	(2.37)**
$ABRET_{t-1}$					-0.0111	-0.0319
					(-0.86)	(-1.89)*
$ADJHERD_t \times ABRET_{t-1}$					0.1465	0.0058
					(1.57)	(0.05)
$Revision_t$	0.0071	-0.006	0.0002	0.0156	0.0036	0.0139
	(0.87)	(-0.63)	(0.01)	(0.94)	(0.26)	(0.83)
$ADJHERD_t \times Revision_t$			0.0387	0.1175	0.0135	0.1204
			(0.48)	(1.38)	(0.18)	(1.25)
$Revision_{t+1}$	0.0003	-0.0055	0.0006	-0.0054	0.0016	-0.0046
	(0.04)	(-0.64)	(0.09)	(-0.66)	(0.22)	(-0.55)
$Revision_{t+2}$	-0.0070	0.0157	-0.0078	0.0171	-0.0076	0.0176
	(-0.83)	(1.62)	(-0.91)	(1.82)*	(-0.93)	(1.82)*
$ADJHERD_{t+1}$	-0.009	-0.0215	-0.0065	-0.0231	-0.0103	-0.0127
	(-0.58)	(-1.61)	(-0.42)	(-1.71)*	(-0.67)	(-1.03)
$ADJHERD_{t+2}$	0.005	0.0024	0.0065	0.0043	0.0024	0.0019
	(0.33)	(0.14)	(0.43)	(0.26)	(0.17)	(0.11)
$Forced_t$	-0.0936	-0.1537	-0.0955	-0.1436	-0.0818	-0.1431
	(-1.21)	(-3.03)***	(-1.25)	(2.91)***	(-1.16)	(-2.96)***
R-squared	0.0123	0.0125	0.0165	0.0163	0.0212	0.0216

Table 9

Multivariate Regressions of Performance-Weighted Trading on Analyst Recommendation Revisions

This table reports results from quarterly Fama-MacBeth regressions of performance-weighted buying (*PWBUY*) and selling (*PWSELL*) on consensus recommendation revisions and control variables. *Revision* is the prior-quarter change in the consensus recommendation. *Dispersion* is the standard deviation of all outstanding recommendations at the end of the quarter, scaled by the average recommendation. *Size* is the log of quarter $t-1$ market capitalization. *Ret* is quarter $t-1$ stock return. *BM* is the log of the ratio of book value to market value of equity as of the most recent fiscal quarter. *Std* is defined as the standard deviation of daily returns during quarter $t-1$, and *Turn* is the standardized share turnover in quarter $t-1$. *Strong_Buy* (*Strong_Sell*) is an indicator variable, which equals "1" for stocks with consecutive strong buy (strong sell) consensus recommendations in the previous two quarters; "0" otherwise. *Add_Drop* equals "1" ("-1") if the stock has been added (dropped) from the S&P 500 index in the previous quarter; "0" otherwise. The time-series average coefficients and Fama-MacBeth *t*-statistics (in parentheses) are presented. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable:	*PWBUY*	*PWSELL*
	(1)	(2)
Intercept	0.5459 (24.20)***	0.5144 (23.85)***
Revision	-0.0050 (-2.54)**	0.0067 (2.19)**
Dispersion	-0.0758 (-5.40)***	-0.1083 (-7.36)***
Size	-0.0036 (-1.24)	-0.0040 (-1.46)
Ret	-0.0318 (-5.82)***	0.0169 (2.80)***
BM	-0.0021 (-0.77)	0.0015 (0.61)
Std	0.1760 (0.82)	0.2111 (1.25)
Turn	-0.0051 (-4.27)***	-0.0006 (-0.48)
Strong_Buy	-0.0056 (-0.50)	0.0120 (1.02)
Strong_Sell	-0.0022 (-0.30)	0.0206 (1.98)*
Add_Drop	0.0036 (0.55)	0.0032 (0.52)
R-squared	0.1439	0.1388

Table 10

Multivariate Regressions of DGTW-Adjusted Abnormal Returns for Portfolios Sorted by Herding and Performance-Weighted Trading

This table reports quarterly Fama-MacBeth regression results of DGTW-adjusted abnormal returns for quarters $t+3$ and $t+4$ ($ABRET_{t+3,t+4}$) on lagged and current-quarter values of *ADJHERD* for buy-herding and sell-herding stocks. Within each buy-herding and sell-herding group, stocks are then sorted into three portfolios based on their performance-weighted buying (*PWBUY*) and selling (*PWSELL*) measures, respectively. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

	Buy-Herding			Sell-Herding		
	Degree of Performance-Weighted Buying			Degree of Performance-Weighted Selling		
	Low (Losers)	Mid	High (Winners)	Low (Losers)	Mid	High (Winners)
Dependent Variable:	$ABRET_{t+3,t+4}$	$ABRET_{t+3,t+4}$	$ABRET_{t+3,t+4}$	$ABRET_{t+3,t+4}$	$ABRET_{t+3,t+4}$	$ABRET_{t+3,t+4}$
Intercept	0.0079	-0.0008	-0.0002	0.0069	0.0042	0.0012
	(1.21)	(-0.09)	(-0.02)	(0.90)	(0.65)	(0.15)
$ADJHERD_t$	-0.0414	0.0267	-0.0210	-0.0496	-0.0059	-0.0200
	(-1.08)	(0.53)	(-0.42)	(-1.06)	(-0.14)	(-0.34)
$Revision_{t-1}$	0.0044	0.0434	0.0551	0.0531	0.0148	-0.0063
	(0.19)	(1.65)	(2.21)**	(1.39)	(0.55)	(-0.22)
$ADJHERD_t \times Revision_{t-1}$	-0.0752	-0.3172	-0.1788	0.4293	0.2096	-0.0533
	(-0.59)	(-2.12)**	(-1.32)	(2.02)**	(1.44)	(-0.34)
$Revision_t$	0.0016	0.0089	0.0145	-0.0084	-0.0187	-0.0034
	(0.12)	(0.76)	(0.96)	(-0.53)	(-1.43)	(-0.17)
$Revision_{t+1}$	-0.0040	-0.0079	0.0031	0.0104	-0.0159	-0.0080
	(-0.32)	(-0.73)	(0.28)	(0.71)	(-1.18)	(-0.54)
$Revision_{t+2}$	-0.0146	-0.0111	-0.0079	0.0103	0.0169	-0.0020
	(-1.77)*	(-1.02)	(-0.40)	(0.65)	(1.34)	(-0.13)
$ADJHERD_{t+1}$	-0.0055	-0.0153	-0.0193	-0.0306	-0.0246	0.0121
	(-0.23)	(-0.75)	(-0.75)	(-1.26)	(-1.24)	(0.51)
$ADJHERD_{t+2}$	0.0261	-0.0182	0.0183	0.0061	0.0131	-0.0105
	(1.43)	(-0.84)	(0.74)	(0.26)	(0.56)	(-0.40)
$Forced_t$	0.0278	-0.1519	-0.0899	-0.0589	-0.1263	-0.2019
	(0.31)	(-1.38)	(-1.09)	(-0.82)	(-1.63)	(-2.35)**
R-squared	0.0155	0.0250	0.0241	0.0220	0.0216	0.0225