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

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Analyst Recommendations, Mutual Fund Herding, and Overreaction in Stock Prices

Abstract

This paper documents the tendency of mutual fund managers to follow analyst recommendation revisions when they trade stocks, and the impact of analyst revision-induced mutual fund "herds" on stock prices. We find that mutual fund herds follow consensus revisions in analyst recommendations, controlling for common investment signals that affect both analyst revisions and mutual fund trading. Consensus upgrades result in herds of funds buying a stock, while consensus downgrades result in even bigger herds of funds selling.

Our most important finding is that mutual fund herding impacts stock prices to a much larger degree during our sample period (1994 to 2003) than during prior-studied periods. Further, we find the first evidence that mutual funds appear to overreact when they herd in their trades—stocks heavily bought by herds tend to underperform their size, book-to-market, and momentum cohorts during the following year, while stocks heavily sold outperform. These reversal patterns are even stronger when herds of mutual funds (especially funds with poor performance records) follow analyst recommendation revisions. An investment strategy that accounts for the direction of both analyst revisions and mutual fund herding generates a return (adjusted for size, book-to-market, and momentum) exceeding six percent during the following year. Our results remain robust when we condition fund herding on analyst earnings forecast revisions instead of recommendation revisions. Overall, our study finds that the interaction between sell-side analysts and mutual fund managers plays an important role in setting prices in equity markets.

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 provide little evidence on which investors exhibit such patterns of irrational trading, nor does it address the mechanism through which such patterns of trading might occur. 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. 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 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 exists for equity mutual funds. For instance, Grinblatt, Titman, and Wermers (1995) document that momentum investing strategies are used by the majority of equity mutual funds during 1975 to 1984, while Wermers (1999) finds that mutual funds tend to exhibit high levels of "herding" (simultaneous buying or selling) in growth stocks, small stocks, and

high past-return stocks during 1975 to 1994. In addition, Wermers (1999) finds that trading by herds of mutual funds moves stock prices in a stabilizing manner—that is, fund herding tends to bring stock prices closer to their fundamental values, and, if anything, mutual fund herds appear to underreact to information.

It is almost certain that equity mutual funds tend to play a much bigger role in setting stock prices today than during the period covered by Wermers (1999). Specifically, mutual fund equity holdings, which now total about $4 trillion, have more than doubled relative to the total capitalization of equity markets since 1994—from 12.5 percent to over 27 percent of all outstanding shares of U.S. equities. In addition, turnover by U.S. mutual funds has substantially increased during this time period; together, these statistics indicate that mutual funds are responsible for a much larger share of trading volume today than just 10 years ago. For example, our analysis of mutual fund holdings data shows that 297 stocks are each traded by more than 100 funds during the fourth quarter of 2003, while only 32 stocks experience such widespread fund trading during the fourth quarter of 1994. Thus, an important issue is whether mutual funds continue to herd in their trades of U.S. equities, as well as whether the impact of their trading (when they herd) has increased commensurate with their increased presence in equity markets.

In this paper, we study these issues by focusing on a potentially important price-setting mechanism in U.S. equity markets: the reaction of mutual fund managers (through their trades) to the recommendation revisions of sell-side analysts, and the impact of such fund manager trading on stock prices. We are motivated to study the link between analyst revisions and mutual fund trading by prior papers that indicate that analyst revisions are

useful in predicting stock returns, as well as papers that show that institutional investors pay attention to these analyst revisions.

Specifically, Elton, Gruber, and Grossman (1986, p. 699) note that the recommendations of analysts provide "a clear and unequivocal" signal of fundamental stock value. Further, Jegadeesh et al. (2004) show that the predictive value of stock recommendation revisions is higher than that of recommendation levels. We, therefore, expect money managers to consider analyst recommendation revisions before making trades, especially given that they often pay for sell-side analyst research through costly soft-dollar arrangements (Conrad, Johnson, and Wahal (2001)).[1] Indeed, Chen and Cheng (2005) find that the trades of institutional investors are sensitive to analyst recommendations, while Mikhail, Walther, and Willis (2005) show that institutions pay attention to the information content, and not merely to the occurrence of analyst recommendations.

Further, Mikhail, Walther, and Willis (2006) and He, Mian, and Sankaraguruswamy (2006) find that institutions seem to better understand the potential conflicts of interest in sell-side analyst research than small investors, and that institutions also consider the reputation of the analyst when interpreting the recommendation. Finally, Brennan, Jegadeesh, and Swaminathan (1993) and Barber, Lehavy, McNichols and Trueman (2001) document that the investment value of analyst recommendations is short-lived, indicating that institutions may have an incentive to trade quickly and simultaneously when new stock recommendations are released to the public.

[1] Under soft-dollar arrangements, institutional investors pay additional commissions for analyst research that is received either directly from sell-side firms or indirectly from research intermediaries.

In this paper, we investigate two major issues. First, we wish to determine whether mutual funds tend to react similarly to analyst recommendation revisions; that is, whether mutual funds "herd" (simultaneously trade in the same direction) in stocks after new revisions are released. Second, we wish to analyze how any such revision-induced mutual fund herding impacts stock prices. Here, we wish to separate the effect of institutional herding from the effect of analyst recommendation revisions on stock prices, since past literature has shown that each appears to have predictive power. Both of the issues that we investigate are important in determining the relative roles of analysts and institutional investors in setting equity prices, as well as understanding interactions between the two entities. For instance, if mutual fund herds form solely in response to analyst revisions, then we should focus on the behavior of analysts to further understand the price-setting process in equity markets.

To study these issues, we analyze quarterly stock trades by the universe of U.S. equity mutual funds following the recommendation revisions of sell-side analysts, across all U.S. stocks from 1994 to 2003. Our findings indicate that a strong link exists between analyst recommendation revisions and mutual fund trading. Specifically, we find clear evidence that mutual funds herd on analyst recommendation changes, and that this trading impacts stock prices in a manner consistent with overreaction by funds to the consensus signal provided by analysts.

First, we find that the average stock covered by analysts during 1994 to 2003 exhibits a higher level of herding among mutual funds than during the prior-studied 1975 to 1994 period. Further, consistent with earlier evidence, herding is more pronounced on the sell-side than the buy-side.

When we examine patterns of herding behavior more closely, we find that the formation of herds is significantly related to the direction of analyst recommendation changes. That is, 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. For instance, funds are more than twice as likely to herd on the sell-side (7.98 percent more funds sell together than would be predicted by randomness) relative to the buy-side (3.40 percent) when the consensus recommendation is a downgrade in a small stock.

Our next analysis looks at patterns of returns for stocks bought and sold by herds to determine whether the impact of herding has increased with the previously mentioned increase in trading by mutual funds in the average stock. The results show a dramatic change from prior results measured over earlier time periods: stocks bought by herds experience a sharp increase in price during the herding measurement quarter, followed by a decrease during the following year, while stocks sold by herds experience the opposite pattern. Specifically, the difference in returns, adjusted for their size, book-to-market, and momentum characteristics (using the Daniel et al. (DGTW; 1997) benchmark portfolios), between equal-weighted portfolios of stocks bought and sold by herds is about 21 percent during the herding measurement quarter. This abnormal return difference reverses during the following year—buy-herding stocks underperform sell-herding stocks by about four percent. These findings indicate that mutual funds may overreact when they trade together, and that stock prices subsequently exhibit reversals.

When we condition herding on analyst recommendation changes, we find even stronger evidence of overreaction by funds—indicating that fund managers overreact, at

least in part, to the information embedded in recommendation changes. Specifically, return reversals are stronger for stocks sold by a mutual fund herd following a consensus analyst downgrade than for stocks bought by a herd following such a downgrade—the difference in abnormal returns between these two portfolios is about 6.63 percent during the following year (the sell-herd/downgrade portfolio outperforms the buy-herd/downgrade portfolio). A similar result is present for stocks with consensus analyst upgrades: such upgrade stocks bought by mutual fund herds experience sharper return reversals than upgrade stocks sold by herds.

Our finding that revision-induced herding causes stock price overreaction suggests that mutual fund herding is partially due to non-information related incentives. We further explore one such incentive—the career concerns of fund managers—by comparing herding among funds with past good performance ("winner funds") versus those with past poor performance ("loser funds"). We expect that herding by loser funds following analyst revisions is driven less by fundamental information, and more by window-dressing incentives. As a result, their herding behavior may be more price destabilizing. Consistent with this conjecture, we find strong return reversals among stocks bought (sold) by herds of loser funds following analyst upgrades (downgrades). In contrast, we find little price overreaction among stocks traded by herds of winner funds.

Further, we show that our evidence of the association between herding and recommendation revisions are not driven by the potentially correlated response of mutual funds and analysts to stock fundamentals. First, we control for common investment signals, such as size, book-to-market ratio, earnings and price momentum, turnover, sales growth, capital expenditures, accruals, and analyst earnings forecasts. We find that, while

herding is related to momentum and contrarian strategies, as documented by prior studies, the relation between herding and analyst recommendation revisions remains strong. Second, we show that fund managers pay less attention to recommendation revisions for large stocks, i.e., in such stocks, herding is less sensitive to analyst revisions. This is consistent with the argument that mutual funds rely less on analyst opinions for stocks with highly transparent information environments.

Finally, although recommendation revisions are undisputed public signals of fundamental stock value, we check the robustness of our findings with consensus earnings forecast revisions as an alternative herding mechanism. The results using earnings forecast revisions are largely similar to those using recommendation revisions. Specifically, we find greater levels of buy-herding and sell-herding following large upward and downward forecast revisions, respectively. Moreover, we find evidence of overreaction by funds when we examine the price impact of herding conditional on forecast revisions.

In a related paper, Chan, Hwang, and Mian (2005) show that mutual fund herding is positively associated with analyst forecast dispersion, which suggests that herding is due primarily to the lack of reliable information rather than the existence of correlated information. By contrast, our study shows that mutual fund herding is a response to the information content in analyst recommendation revisions, but that funds (especially funds with poor performance records) overreact in their response.

To summarize, our study uniquely documents that mutual fund trading (which has grown substantially relative to the trading of stocks by all market participants) has become destabilizing to stock prices during the past 10 years, especially when herds

follow analyst revisions. As such, we provide insight into one mechanism for the observed patterns of prices among stocks: stocks strongly traded by herds on analyst revisions exhibit especially strong return reversals.

The remainder of this paper is organized as follows. Section I describes our data and research methodology. Section II examines the sensitivity of mutual fund herding to analyst revisions as well as the impact of herding through this particular mechanism on stock returns. Section III provides several robustness checks on our findings. Section IV concludes the paper.

I. Research Methodology

I.A. Data

We compile our main sample from the intersection of the following data sources: the Thomson Financial CDA/Spectrum mutual fund holdings data, the I/B/E/S recommendations history file, the CRSP mutual fund data, and the CRSP monthly stock data. The Thomson Financial data provides quarter end "snapshots" of portfolio holdings for all U.S.-based mutual funds. We infer mutual fund trades (buys and sells) from quarterly changes in the portfolio holdings of each fund.[2] For funds not reporting in the current quarter, we assume that they follow a buy-and-hold strategy and thus, use the most recent snapshot to infer their trades. We carry forward previous reported holdings for a maximum of one quarter to ensure an accurate measure of fund trades. Given our interest in analyst revision-induced trades, we exclude stocks that are newly issued within the prior four quarters or are delisted within the next four quarters. We also exclude index

funds, international funds, municipal bond funds, "bonds and preferred" funds, metals funds, and funds that cannot be linked to the CRSP mutual fund database via the MFLINKS dataset. This is done in order to ensure that our sample is representative of actively managed U.S. domestic equity funds and that information about their characteristics is available. To ensure that our herding measure reasonably captures the concept of a herd, we require each stock to be traded by at least five funds in any given quarter.

We then focus on mutual fund holdings of stocks that have analyst recommendations from I/B/E/S. I/B/E/S standardizes each analyst's recommendation to a five-point rating scale between 1 (strong buy) and 5 (strong sell). We reverse the standard scale so that favorable recommendations are assigned a higher numerical value, i.e., "1" represents strong sell; "2" sell; "3" hold; "4" buy; and "5" strong buy. An increase in this value indicates an upgrade; whereas, a decrease indicates a downgrade. Since it is impossible for a stock previously assigned a strong buy (sell) to be further upgraded (downgraded), we treat these stocks as being upgraded (downgraded) in the current period as long as their recommendation change is equal to zero.

We next match each stock holding to its consensus recommendation change (*CHGREC*) as of the end of the previous quarter. We calculate the consensus recommendation change as the difference between the mean of all outstanding recommendations ($\overline{REC}$) in quarter t–1 and the mean in quarter t–2, i.e., $CHGREC_{it-1} = \overline{REC}_{it-1} - \overline{REC}_{it-2}$. We refer to a negative (positive) change as a consensus downgrade (upgrade); zero changes are referred to as "no change". We only

[2] We adjust quarterly portfolio holdings for stock splits and dividends using the end-of-quarter cumulative

include the most recent recommendation issued by a given analyst covering a given stock. We also require each recommendation to be issued no more than 180 days prior to the end of each quarter. Although the I/B/E/S recommendations data is available from 1993, the number of recommendations published in 1993 is sparse. Hence, we calculate quarterly consensus recommendation changes using data from 1994 to 2003. Since we measure consensus recommendation changes at the end of the previous quarter, our analyses are conducted from the third quarter of 1994 to the fourth quarter of 2003.[3] Finally, we obtain monthly returns, price, market capitalization, and other stock information from the CRSP monthly data. These criteria result in a final sample of 82,326 stock-quarters over our sample period—the third quarter of 1994 to the fourth quarter of 2003.

Table I presents summary trading statistics, at three-year intervals, for the stocks in our sample. Panel A presents statistics for all stocks traded by U.S.-based equity funds. Panel B presents statistics for those stocks with available analyst recommendation information. Except for lightly traded stocks (which are typically small-cap stocks), we find no substantial difference in the statistics between the two panels. This indicates that the majority of stocks traded by mutual funds are covered by sell-side analysts. This finding is also consistent with Falkenstein (1996), which documents that mutual funds have a strong preference for stocks with high visibility. Consistent with Wermers (1999), the average proportion of trades that are buys are slightly greater than 50% in both panels. This suggests a net inflow of money into equity funds during our sample period,

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adjustment factor from CRSP.

[3] For example, we match our herding measure for the third quarter of 1994 with the consensus recommendation change from the end of the first quarter to the end of the second quarter of 1994.

most likely due to the tremendous growth of the mutual fund industry during the long economic boom in the late 1990s. We also note a significant increase over time in the number of stocks that are traded by the same funds. For example, in Panel A, the number of stocks traded by at least 100 funds increases from 32 in the fourth quarter of 1994 to 297 in the fourth quarter of 2003. This finding suggests that mutual fund trading have become much more important in setting stock prices since 1994.

I.B. Measures

We measure herding for stock *i* during quarter *t* (HM_{it}) using the Lakonishok, Shleifer, and Vishny (LSV; 1992) measure as follows:

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

where p_{it} is the proportion of mutual funds buying stock *i* during quarter *t* relative to the total number of funds trading stock *i* in quarter *t*; and $E\left[p_{it}\right]$ is the expected proportion of buys relative to the total number of trades in 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 no herding.

To examine mutual funds' reaction to signals conveyed through consensus upgrades or downgrades, we calculate conditional herding measures for those stock-quarters that have a higher or lower proportion of buys relative to the expected proportion in each quarter. These measures, which are detailed below, are referred to as our buy-herd (BHM_{it}) and sell-herd (SHM_{it}) measures.

$$BHM_{it} = HM_{it} \mid p_{it} > E[p_{it}]$$

$$SHM_{it} = HM_{it} \mid p_{it} < E[p_{it}]$$

Panel A of Table II presents summary statistics for our herding and analyst recommendation measures. The mean level of herding ($\overline{HM}$) for all stock-quarters is 4.16 percent, which is significantly higher than that reported by Wermers (1999) during 1975 to 1994. This indicates that, over our period, the average stock covered by analysts exhibits a significantly higher level of herding among funds compared to earlier periods. The mean level of buy-herding ($\overline{BHM}$) and sell-herding ($\overline{SHM}$) is 3.31 and 4.90 percent, respectively, which indicates that herding is higher for the sell-side relative to the buy-side. The mean number of funds making a trade in any given stock-quarter is 36.06 while the average number of analysts with outstanding recommendations is 4.51. The mean prior-quarter change in the consensus recommendation is negative (-0.01). This is consistent with prior studies that document a greater occurrence of downgrades relative to upgrades. For example, Jegadeesh et al. (2004) document an average decrease in consensus recommendations over their sample period of 1985 to 1998. Barber et al. (2006) also find a significant larger number of downgrades for the 1996 to 2003 period.

Prior studies suggest that mutual fund herding is closely related to the past performance, size, and the information environment of their stock holdings. For example, Grinblatt, Titman, and Wermers (1995) find that mutual funds systematically chase after stocks that are past winners; while, Wermers (1999) reports that mutual fund herding is much more pronounced among small stocks. In addition, Sias (2004) and Chan, Hwang, and Mian (2005) provides evidence suggesting that institutional investors herd into and out of stocks with high levels of information uncertainty. Finally, Chan, Chen, and

Lakonishok (2002) find that most mutual funds follow common investment styles that are closely related to size and the ratio of book-to-market value of equity. Therefore, it is possible that funds cluster in their trades simply because the characteristics of their underlying portfolio holdings have changed.

To separate the impact of these stock characteristics on mutual fund herding from that of analyst revisions, we include the following controls in most of our analyses: the level of information uncertainty as proxied by the dispersion of analysts' earnings forecasts (*DISP*), the lagged value of cumulative quarterly stock return (*RET*), market capitalization (*SIZE*), book-to-market ratio (*BM*), stock return volatility (*STD*), and stock turnover (*TURN*). *DISP* is defined as the standard deviation of all outstanding earnings forecasts in quarter $t-1$, scaled by stock price as at the end of quarter $t-1$. The book-to-marker ratio (*BM*) is calculated as the ratio of book value (Compustat quarterly data item 59) to market value of equity (Compustat quarterly data item 14 times data item 61) as of the most recent fiscal quarter. We use the logarithm of the raw values for *SIZE* and *BM* in all analyses to mitigate potential heteroskedasticity. *STD* is defined as the standard deviation of daily returns over the previous quarter and *TURN* is the average daily trading volume divided by shares outstanding over the previous quarter. Since stocks traded on NASDAQ have significantly higher reported trading volume relative to stocks traded on NYSE or AMEX due to its dealer market structure, we deflate a stock's turnover by the average turnover for all NASDAQ or NYSE/AMEX stocks according to the exchange to the stock is listed. Panel B of Table II presents summary statistics for these control variables.

II. Empirical Findings

II.A. Average levels of buy-herding and sell-herding

To investigate whether mutual fund herding is systematically influenced by analyst revision, we examine the average level of buy-herding ($\overline{BHM}$) and sell-herding ($\overline{SHM}$) for stocks which experience an upgrade, downgrade, or no change in the consensus recommendation in the previous quarter. Table III reports the average buy-herd and sell-herd measures in percentage for upgrade, downgrade, and no change stock-quarters. We report the averages for portfolios of stocks sorted by size and prior-quarter return quintiles since prior studies document differences in herding levels conditional on size and past performance (see, e.g., Lakonishok, Shleifer, and Vishny (1992), Grinblatt, Titman, and Wermers (1995), Wermers (1999), Chan, Hwang, and Mian (2005)). Panel A of Table III presents the results for portfolios of stocks sorted by size quintiles; Panel B presents the results by prior-quarter return quintiles. We form size quintiles using NYSE market capitalization breakpoints as of the beginning of quarter *t*. Within each size quintile, we further sort stocks into quintiles based on prior-quarter return.

Consistent with Wermers (1999), the overall averages in Panels A and B indicate that mutual funds herd more often when buying and selling small stocks (B1 and S1) and when trading stocks with extreme prior-quarter returns (R1 and R5). More interesting, we find that buy-herding increases with the degree of upgrading (see "Upgrade minus Downgrade"), while sell-herding increases with the degree of downgrading (see "Downgrade minus Upgrade"). These findings indicate that after controlling for size and past returns, mutual fund herds tend to move in the same direction as analyst recommendation changes. Furthermore, we find that within each size or past return

quintile, the sensitivity of herding is significantly greater for the sell-herd relative to the buy-herd (see "Differences in Sensitivity", which is the difference in the buy-herd and sell-herd measure between groups of upgraded and downgraded stocks). This suggests that, although mutual funds respond to analysts' opinions, they do not necessarily take them at face value.

It is well-documented in the literature that sell-side analysts are reluctant to issue negative investment reports because of pressures to generate investment banking and brokerage business, and/or to gain or maintain access to management as a source of information. Given these conflicts of interests, a number of studies show that unfavorable recommendations are more informative than favorable recommendations (see, e.g., Lin and McNichols (1998), Michaely and Womack (1999), Irvine (2004), Argawal and Chen (2006)). Similarly, prior research finds a stronger market response to recommendation downgrades versus upgrades (e.g., Barber et al. 2001). Therefore, our findings of a stronger trading response to downgrades suggest that fund managers are aware of the potential biases in recommendation changes and react accordingly. These findings are also consistent with recent evidence suggesting that sophisticated investors (i.e., large traders) react strongly to downgrades, but discount upgrades (Malmendier and Shanthikumar (2006), Mikhail, Walther, and Willis (2006), He, Mian, and Sankaraguruswamy (2006))

The results in Table III also indicate that the sensitivity of herding to analyst recommendations is decreasing in stock size. This finding is consistent with the conjecture that analyst information is most useful among small stocks given their highly uncertain information environments. With respect to prior-quarter returns, we find that

the sensitivity of herding is significantly higher for sales of stocks with low prior-quarter returns (R1). That is, when stocks experience large price declines, fund managers seem to rely more on analyst opinions.

II.B. Multivariate analysis of buy-herding and sell-herding

While our analysis of the previous section controls for size and past returns, mutual fund herding is likely to be affected by many other stock characteristics. Therefore, in this section, we further examine the association between mutual fund herding and recommendation changes, while controlling for various stock characteristics. We run separate regressions for buy-herd and sell-herd stock-quarters using the following specification:

$$\begin{aligned} BHM_{it}\left(SHM_{it}\right) = {} & \beta_1 + \beta_2 CHGREC_{it-1} + \beta_3 ULEVEL_{it-1} + \beta_4 DLEVEL_{it-1} + \\ & \beta_5 LAGBUY\left(LAGSELL\right)_{it-1} + \beta_6 ADD_{it} + \beta_7 DROP_{it} + \beta_8 DISP_{it-1} \\ & \beta_9 SIZE_{it-1} + \beta_{10} RET_{it-1} + \beta_{11} BM_{it-1} + \beta_{12} STD_{it-1} + \beta_{13} TURN_{it-1} \end{aligned} \quad (1)$$

Given the censored nature of recommendations, it is impossible for analysts to further revise their recommendation upwards if a strong buy (5) is already in place or downwards if a strong sell (1) is already in place. Therefore, we include two dummy variables, *ULEVEL* and *DLEVEL*, to control for this possible source of bias caused by the nature of the recommendations data. Specifically, *ULEVEL* is set to "1" when *CHGREC* = 0 and the consensus recommendation is equal to 5 in quarter *t*–2; "0" otherwise. Likewise, *DLEVEL* equals "1" when *CHGREC* = 0 and the consensus recommendation is equal to 1 in quarter *t*–2; "0" otherwise. In untabulated results, we find that mutual fund herding exhibits weak persistence in that stocks that are heavily bought (sold) by mutual funds in herds often continue to be bought (sold) in the subsequent quarter, although in a much

weaker pattern. To control for this persistence, we include two dummy variables, *LAGBUY* and *LAGSELL*, to identify the direction of herding for a given stock in the previous quarter. *LAGBUY* (*LAGSELL*) equals "1" if a current buy-herding (sell-herding) stock is also classified as a buy-herding (sell-herding) stock in the previous quarter; "0" otherwise.

Although we have excluded index funds, funds that are "closet indexers" or benchmark a portion of their holdings against major indexes may potentially buy and sell constituents of indexes and thus, trade in the same direction following index changes. Therefore, we extract historical compositions of the S&P 500 from CRSP and create dummy variables to identify those stocks that have been added (*ADD*) or dropped (*DROP*) from the S&P 500 in the previous quarter. Consistent with prior research, we include the following control variables: analyst earnings forecast dispersion (*DISP*), market capitalization (*SIZE*), past stock return (*RET*), book-to-market ratio (*BM*), stock return volatility (*STD*), and turnover (*TURN*).

Table IV presents the results of quarterly Fama-MacBeth regressions of herding on recommendation changes.[4] Columns 1 and 2 present results for buy-herding and sell-herding, respectively. The estimated coefficients on *CHGREC* are significantly positive for buy-herding and significantly negative for sell-herding. This indicates that mutual funds herd in the same direction as suggested by analysts, while controlling for stock characteristics that might influence both analyst revisions and mutual fund trades. In other words, upgrades lead to stronger buy-side herding, while downgrades lead to stronger sell-side herding. Moreover, the sensitivity of sell-herding to analyst revisions is almost double that of buy-herding. Specifically, the absolute value of the estimated

coefficient on *CHGREC* is significantly higher for sell-herding versus buy-herding (0.0060 versus 0.0031, respectively, with the difference statistically significant at the 7% level). This result provides further support of an asymmetric relationship between herding and the degree of recommendation revisions as discussed in the previous section.

Interestingly, the estimated coefficients on *LAGBUY* and *LAGSELL* indicate that buy-herding and sell-herding are both positively associated with past herding behavior. That is, stocks heavily bought and sold by herds in the previous quarter, continue to be bought and sold in the current quarter. As expected, mutual fund herds tend to buy stocks that maintain a "strong buy" recommendation from the previous period, even though there is no change in the consensus recommendation due to the discrete nature of recommendations. We do not observe the same relation between sell herding and stocks with consecutive "strong sell" recommendations because consecutive "strong sell" recommendations are very rare in our sample.[5]

The estimated coefficient on *DISP* is significantly positive in both the buy-herd and sell-herd regressions. This finding indicates that mutual funds are more likely to pile into and out of stocks with higher levels of information uncertainty. Moreover, consistent with prior studies, it provides evidence suggesting that funds herd into and out of stocks when there is less precise fundamental information (Wermers (1999), Sias (2004), Chan, Hwang, and Mian (2005)). The coefficients on *STD* and *TURN* also provide evidence of an association between herding and information uncertainty. In particular, the positive coefficient on *STD* indicates that herding is positively associated with total risk,

[3] The buy-herd (*BHM*) and sell-herd (*SHM*) measures are regressed as raw numbers and not as percentages.
[5] This may be due to the possibility that analysts seldom issue extreme negative opinions consecutively unless the firm is severely distressed and is close to being delisted. Therefore, these occurrences may not show up in our sample because we exclude stocks that are delisted within the next four quarters.

especially on the sell-side. Furthermore, the estimated coefficients on *TURN* are positive for both buy-herding (but insignificant) and sell-herding. This again indicates that funds herd more for stocks with high information uncertainty.[6] Consistent with greater uncertainty in the future cash flows of growth stocks, Table III shows that buy-herding is significantly stronger for stocks with lower book-to-market ratios; however, the degree of sell-herding is not significantly associated with the book-to-market ratio. Finally, the significant coefficients on past stock return (*RET*) indicate that mutual fund herds tend to engage in momentum trading strategies, i.e., herds are more likely to buy past winners and sell past losers.

Throughout the paper, we relate current period herding to past 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, it is still possible that the association between mutual fund herding and analyst revisions is spurious because mutual fund managers and analysts may observe the same signal and act on it sequentially. Although we are unable to observe the decision-making process of fund managers, it is conceivable that, if mutual funds truly learn from analyst revisions, then they may rely on revisions more heavily when other sources of information are scarce. Following prior research (e.g., Hong, Lim and Stein (2000)), we use firm size as a proxy for a firm's information environment.

[6] Following Harris and Raviv (1993), Holthausen and Verrecchia (1990), and Kim and Verrecchia (1991), we argue that the level of turnover for stocks with revised ratings is more closely related to differences in the private interpretations of public information. Bessembinder, Chan, and Seguin (1996) and Barron, Harris, and Stanford (2005) provide empirical evidence of a positive relationship between trading volume and private information surrounding public announcements.

In columns 2 and 3 of Table IV (denoted model 2), we extend equation (1) and estimate the incremental trading response to recommendation changes conditional on a stock's size ranking (i.e., *CHGREC* × *SIZERANK*). *SIZERANK* is a stock's size percentile ranking based on NYSE market capitalization breakpoints as of the beginning of quarter *t*. We use the size percentile ranking rather than raw market capitalization because the marginal effect of market capitalization on a firm's information environment is unlikely to be linear. If analyst recommendations directly impact mutual fund trades, then we expect the association between consensus recommendations and fund herding to vary across different size groups.

As shown in Table IV, the coefficient on *CHGREC* × *SIZERANK* is significantly negative in the buy-herd regression, and significantly positive in the sell-herd regression. This indicates that the total impact of recommendation revisions on both buy- and sell-herding decreases with a stock's size ranking. In other words, for the same consensus upgrade or downgrade, recommendation revisions have a *lower* impact on mutual fund herding for large stocks, which have highly transparent information environments. After controlling for the interaction between analyst recommendation revisions and stock size, we again find mutual fund herds to react stronger to downward revisions relative to upward revisions. That is, the marginal sensitivity of sell-herding to analyst revisions is significantly higher than that of buy-herding for the typical firm with average size percentile ranking. Taken together, these findings suggest that fund managers do not follow analyst recommendations mechanically, but rather, focus on the information content of analyst revisions when they trade.

II.C. The price impact of herding on recommendations

Our findings of the previous sections provide strong evidence that mutual funds herd in the same direction as analyst recommendation changes. This tendency is greater for small stocks (especially on the sell-side), for stocks with extreme prior-quarter returns, and for downgrades relative to upgrades. Given the high levels of herding across these groups, it is possible that herding on recommendation changes may be either stabilizing or destabilizing to stock prices. To investigate this issue, we employ a methodology similar to Wermers (1999). That is, we examine the relation between herding and both contemporaneous and future stock returns as well as the relation between herding and past returns, since herding is related to feedback trading strategies.

We first form quintile portfolios for the subsample of buy-herding and sell-herding stock-quarters based on each stock's buy-herd (*BHM*) or sell-herd (*SHM*) measure for that quarter. The top quintile portfolio for the buy-herd group includes those stocks that mutual fund herds most strongly buy (B1); the top quintile portfolio for the sell-herd includes those stocks that herds most strongly sell (S1). The bottom quintile portfolios for the buy-herd and sell-herd include those stocks with a slightly greater proportion of buys and sells, respectively, than for the average stock during that quarter. We then calculate quarterly rebalanced DGTW (1997) characteristic-adjusted abnormal returns for each equal-weighted portfolio during the two quarters prior to the formation quarter, the formation quarter, and the following four quarters.

Table V reports time-series average DGTW-adjusted returns for the ten herding-sorted portfolios (B1 to S1), calculated over 38 quarters—from the third quarter of 1994 through the fourth quarter of 2003. For each of the quarters, $t - 2$ to $t + 4$, we calculate

the difference in abnormal returns between B1 and S1 ("B1 minus S1"). This represents a zero-investment portfolio that is long the B1 portfolio and shorts the S1 portfolio. We calculate similar differences in the average returns between B1 through B5 and S1 through S5 ("B1 to B5 minus S1 to S5"). Consistent with our previous analyses (Tables III and IV), the direction and magnitude of herding is strongly related to the past returns of stocks. In fact, we find that funds look at the returns over (at least) the prior six months when deciding to trade a stock, consistent with prior evidence by Grinblatt, Titman, and Wermers (1995) and Wermers (1999).

It is noteworthy that mutual funds tend to focus on past returns much more strongly during our sample period (1994 to 2003) than during prior periods. Specifically, the difference in the DGTW-adjusted abnormal returns between portfolios B1 (strong buy-herding) and S1 (strong sell-herding) is almost 33 percent during the two quarters prior to the portfolio formation quarter, as compared to a less than 10 percent size-adjusted abnormal return during the 1985 to 1994 period (see Wermers (1999)). This finding indicates that funds may play a much bigger role in return continuations, or return reversals during recent years than during previous time periods. Perhaps even more interesting is the abnormal return difference during the portfolio formation quarter—about a 21 percent DGTW-adjusted return, as compared to a 9 percent size-adjusted return during the earlier period. This finding indicates that mutual funds herd on very recent returns, as well as (possibly) impacting stock prices when they trade as a herd. However, it is difficult to determine the direction of causality, since we do not know whether trading follows returns, or vice-versa.

To further investigate whether funds impact returns, we examine the pattern of returns to the herding-sorted portfolios during the four quarters following the formation quarter. Here, we find our most compelling evidence of the role of mutual fund trading on stock prices (see Qtr +1, +2, +3, and +4). Portfolio B1 exhibits a first-quarter abnormal return of 1.06 percent, followed by return reversals during the following three quarters that total roughly -0.56 percent. Portfolio S1 exhibits an even stronger return reversal pattern—in the opposite direction—that amounts to an abnormal return of about 4.46 percent during the four quarters following the formation quarter. Note that, since these returns are benchmarked against their size, book-to-market, and momentum cohorts (using the DGTW technique), our findings indicate that mutual funds pile into stocks and (possibly) exacerbate momentum returns during quarter 0 (the formation quarter), followed by a correction during the following year—relative to their cohort momentum stocks. We also note that, in most cases, this correction does not occur until Qtr +3, which may be due to the tendency for herding to persist during the following one to two quarters, as previously discussed.

Also, note that this pattern of return reversals is more widely present among all buy- and sell-herding stocks, although less dramatic than in the extreme buy- and sell-portfolios. Specifically, the equal-weighted portfolio of all stocks with higher-than-average buying activity (among the funds)—B1 to B5—exhibits lower following-year returns (by about 1.26 percent) than the equal-weighed portfolio of stocks with higher-than-average selling activity—S1 to S5.

Since our findings in the previous sections indicate that mutual fund herding is strongly influenced by analyst recommendation revisions, we further investigate whether

the return reversals we document in Table V is related to the reaction of mutual funds to analyst revisions. Specifically, we repeat the above analyses separately for stocks which experience a downgrade or upgrade in consensus recommendations during the previous quarter.[7] Each quarter we sort stocks into two groups based on their prior-quarter consensus recommendation change, i.e., groups of upgrade and downgrade stock-quarters. Within each upgrading or downgrading group, we then form quintile portfolios based on each stock's *BHM* or *SHM* measure for that quarter.

For brevity, Table VI reports time-series average abnormal returns for only the strong and light buy (B1 and B5) and the strong and light sell (S1 and S5) portfolios. To examine the reaction of mutual funds to analyst revisions, we report the differences in abnormal returns between portfolios B1 and S1 (B5 and S5) separately for each type of revision. Panel A of Table VI presents the results for light buying and selling portfolios. Although stocks that receive a recommendation upgrade in quarter t–1 realize higher returns in quarters t–1 and t than stocks with a downgrade, we observe no significant difference in the future return patterns between these two groups. Thus, in the absence of funds' herding behavior, prices seem to adjust quickly to analyst recommendation changes and do not revert in future periods. This is consistent with prior studies (e.g., Brennan, Jegadeesh, and Swaminathan (1993), Barber et al. (2001)), which show that analyst recommendations have a short-lived impact on stock prices.

In contrast, the results in Panel B show that return reversals are more pronounced when mutual funds herd strongly on analyst recommendation changes. For example, upgraded stocks heavily bought by herds (B1-Upgrade) exhibit a sharp return reversal

[7] 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 our tables.

during quarters +3 and +4, while downgraded stocks heavily bought by herds exhibit almost no reversal, relative to their returns during the portfolio formation quarter. Similarly, downgrade stocks sold by herds (S1-Downgrade) exhibit a sharper reversal than upgrade stocks sold by herds—about 4.88 versus 1.94 percent during quarters +3 and +4, respectively.

When we compare the returns on the light herding portfolios to those with strong herding, it is evident that the overreaction we previously found in stocks strongly bought or sold by the funds is driven largely by the herding response to consensus recommendation revisions, and not solely to the revision itself. In fact, an investment strategy that accounts for both mutual fund herding and analyst recommendations generates stronger 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 upgraded stocks that are sold vs. bought by herds (see "S1-Upgrade minus B1-Upgrade") as amounting to about 1.58 percent during the following year. An even higher abnormal return (5.99 percent) accrues to a strategy of buying downgraded stocks sold by herds and selling downgraded stocks bought by herds (see "S1-Downgrade minus B1-Downgrade"). Furthermore, the most profitable strategy involves investing in upgraded and downgraded stocks that experience extreme overreaction. Specifically, buying downgraded stocks that are sold by herds and selling upgraded stocks that are bought by herds generates an abnormal return of about 6.63 percent over the following four quarters (see "S1-Downgrade minus B1-Upgrade").

Finally, we examine the abnormal returns for an investment strategy that accounts for herding in the opposite direction of analysts' opinions, i.e., buying upgraded stocks

sold by herds and selling downgraded stocks bought by herds ("S1-Upgrade minus B1-Downgrade"). Mutual fund herds that trade opposite to analyst opinions most likely reflect private information-based trading. While this strategy generates a return of almost 0.95 percent in the following year, it underperforms those strategies which account for funds' overreaction to analyst recommendations and is not statistically significant. Thus, the "overreaction effect" appears to be stronger than the "private information effect" of herding by mutual funds in response to analyst recommendation revisions.

II.D. The price impact of trading imbalance

So far our analysis of mutual fund trades has been based upon the LSV (1992) herding measure. This measure uses the count of mutual fund trades in the same direction to capture the tendency for funds to buy or sell stocks in herds. As shown in Table VI, mutual fund trading tends to destabilize prices whenever funds flock in the same direction as recent analyst recommendation revisions. Alternatively, the price impact could be greater if mutual fund herds create large trading imbalances in terms of dollar holdings, regardless of the number of funds contributing to these trades. Therefore, in this section, we repeat our price impact analyses using the LSV (1992) dollar ratio (*Dratio*) trading imbalance measure as follows:

$$Dratio_{it} = \frac{\$buys_{it} - \$sells_{it}}{\$buys_{it} + \$sells_{it}}$$

where $\$buys_{it}$ ($\$sells_{it}$) is calculated as the total number of share purchases (sales) for stock *i* in quarter *t* by all mutual funds multiplied by the average price in quarter *t*. Essentially, *Dratio* measures the aggregate net increase in dollar holdings of stock *i* in quarter *t* by all mutual funds trading that stock. We expect stocks with higher (lower)

Dratio following a recommendation upgrade (downgrade) to experience stronger return reversals in the following four quarters.

Panel A of Table VII presents the average *Dratio* measure by DGTW (1997) size and momentum quintiles. Consistent with prior evidence, mutual funds dollar holdings increase with stock past returns, and most prominently in trades of small stocks. Specifically, stocks in the smallest size quintile (S1) and with the highest past returns (R5) experience a net dollar increase of about 17 percent. Whereas, the smallest stocks (S1) with the lowest past returns (R1) experience a net decrease of about 19 percent.

Panel B of Table VII repeats the analysis presented in Table VI for stocks heavily traded by herds (B1 and S1), but instead form portfolios based upon *Dratio* rather than *BHM* or *SHM*. Specifically, each quarter we separate stocks into groups of net-purchase and net-sale stocks depending on whether their *Dratios* are positive or negative. Among all stocks with a net increase of dollar holdings, we further sort them into quintiles based upon their *Dratios* within each recommendation revision group. A similar two-way sorting is performed among stocks with a net decrease in dollar holdings. Finally, we examine the quarterly DGTW-adjusted abnormal returns for these analyst revision- and *Dratio*-sorted portfolios in the two quarters before and four quarters after the portfolio formation quarter.

Consistent with our previous findings, the results in Table VII indicate that stocks in which mutual fund herds increase their dollar holdings following an analyst upgrade (B1-Upgrade) exhibit significantly higher abnormal returns in the current quarter and in the previous two quarters. However, these stocks also suffer significantly negative abnormal returns (about -2.30 percent) in quarters +2 through +4. Likewise, downgrade

stocks in which funds heavily decrease their dollar holdings (S1-Downgrade) exhibit an even stronger return reversal of about 4.51 percent. From Table VII, we also find that a strategy of buying downgraded stocks with net dollar sales by herds and selling downgraded stocks with net dollar purchases (S1-Downgrade minus B1-Downgrade) generates an abnormal return of 4.15 percent over the next four quarters, with the most significant return of 2.15 percent accruing in quarter +4. A similar but lower return (about 1.95 percent) emerges for a strategy that invests in upgraded stocks (S1-Upgrade minus B1-Upgrade). Again, the most profitable strategy involves buying upgraded and selling downgraded stocks which experience extreme overreaction. That is, buying downgraded stocks that are heavily sold by mutual fund herds and selling upgraded stocks that are heavily bought by herds generates an abnormal return of roughly 6.96 percent in the following year.

II.E. Price impact for winner and loser funds.

The price impact analyses thus far, shows that mutual fund herding on analyst recommendation revisions causes stocks to underperform their size, book-to-market, and momentum cohorts in future periods. This evidence suggests that funds' herding behavior may not be driven by the reaction to private information, but rather, by reputational or career concerns. To investigate this issue, we examine whether herding among funds with greater career concerns, such as fund with past poor performance ("loser funds"), is more likely to be price destabilizing. Moreover, to the extent that managers of funds with past good performance ("winner funds") are more skillful at interpreting and processing

information revealed in analyst revisions, we expect stronger return reversals following analyst revision-induced herding among loser funds versus winner funds.

To conduct separate price impact analyses for winner and loser funds, we first estimate fund factor loadings and abnormal performance using the Carhart (1997) four-factor model:

$$R_{it} - R_{ft} = \alpha_i + \beta_i^{MKT} MKT_t + \beta_i^{SML} SML_t + \beta_i^{HML} HML_t + \varepsilon_{it} \quad (2)$$

where R_{it} is the return of fund *i* in month *t* as reported in the CRSP mutual fund database; R_{ft} is the one-month T-bill rate in month *t*; and MKT_t, SML_t, and HML_t are the returns on the factor mimicking portfolios for the market, size, and book-to-market factors. We define a fund's Carhart four-factor adjusted return as $\alpha_i + \varepsilon_{i,t}$. Note that the CRSP mutual fund data considers different share classes of the same fund as stand-alone funds. To avoid double counting, we calculate monthly fund returns as the weighted average of monthly returns of all share classes with their lagged total net asset values as the weight.

Finally, in each quarter, we rank funds into groups of winner and loser funds depending on whether their Carhart four-factor adjusted performance over the past 12 months is above or below the sample average. We measure the tendency of winner and loser funds to herd by computing the buy-herding and sell-herding measures within the subset of stocks traded by each group of funds.[8] Specifically, each quarter within each past performance group, we sort stocks into buy-herding and sell-herding quintiles within each analyst revision group. Thus, we form 10 portfolios for the winner and loser funds,

[8] Since we calculate the herding measure for the "winner" and "loser" funds separately, for this analysis we only require a stock to be traded by at least 3 funds within each past fund performance group to avoid

respectively. We then compare the price reaction caused by analyst revision-induced herding by winner versus loser funds. Since herds of winner and loser funds may heavily buy or sell the same stock in the same period, we exclude those stocks with the same buy/sell-herd ranking in both groups so as to clearly identify the source of return reversals.

In untabulated results, we find a slightly higher average level of herding by loser funds relative to winner funds, especially when they purchase stocks following an analyst upgrade or sell stocks following a downgrade. In other words, loser funds are more likely to chase after stocks with revised analyst opinions. This finding provides some support to our conjecture that herding by loser funds is more likely driven by career concerns. It is also consistent with Kacperczyk and Seru (2006), who find that loser funds react more strongly to analyst recommendation changes.

Panels A and B of Table VIII present adjusted abnormal returns for the revision and herding-sorted portfolios for winner and loser funds, respectively. From Panel A, we find very small return reversals for stocks heavily bought and sold by winner funds, and in some cases even permanent return effects. For instance, both downgraded and upgraded stocks heavily bought by winner funds tend to outperform, generating abnormal returns of about 1.76 and 2.74 percent, respectively, over the next four quarters. Moreover, the abnormal returns generated by the zero-investment portfolios that either long upgraded stocks heavily sold by herds and short upgraded stocks bought by herds, or long downgrade stocks heavily sold by herds and short downgraded stocks bought by herds are mostly insignificant. In contrast, Panel B shows much larger return reversals for

losing too many observations. Our result, however, is very similar if we still require each stock to be traded by at least 5 winner funds or loser funds.

stocks heavily traded by loser funds, especially for downgraded stocks. Specifically, buying downgraded stocks heavily sold by loser funds and selling downgraded stocks heavily bought by loser funds generates a return of about 4.25 percent over the next four quarters. Overall, this evidence suggests that the overreaction we previously found is partly driven by the reaction of poorly performing funds to analyst recommendations. More important, it suggests that the destabilization of stock prices is most likely due to reputational herding rather than private information-based herding.

III. Robustness analyses

III.A. Controlling for common investment signals

We use past recommendation revisions to avoid potential endogeneity between analyst revisions and mutual fund herding, or the simultaneous reaction of analysts and fund managers to publicly observable investment signals. Nevertheless, given the quarterly frequency of fund trading data, it is still possible that the association between mutual fund herding and lagged analyst revisions is driven by the sequential response of mutual fund managers and analysts to other signals of investment value within a short period of time. To address this concern, we re-estimate equation (1) while controlling for other firm-specific investment signals that have been used in prior studies (e.g., Jegadeesh and Titman (2003); Jegadeesh et al. (2004); Titman, Wei, and Xie (2004); Wermers, Yao, and Zhao (2006)). We follow Jegadeesh et al. (2004) when constructing these variables.

The first four variables are momentum signals based on a stock's past return and past earnings performance. Past stock return, *RETP* and *RET2P*, are defined as the

cumulative market-adjusted return during months -6 through -1 and months -12 through -7, respectively, prior to the last month of quarter *t*-1. Analyst forecast revisions (*FREV*) measures earnings momentum and is defined as the sum of monthly analyst earnings forecast revisions scaled by stock price over the 6 months prior to the last month of quarter *t*–1. Standardized unexpected earnings (*SUE*) also measures earnings momentum and is defined as unexpected earnings over the past four quarters, scaled by the time-series standard deviation of unexpected quarterly earnings over the past eight quarters.

The next five variables measures contrarian signals. *BM* is the log of each stock's book-to-market ratio at the end of quarter *t*–1; *EP* is the average earnings-to-price ratio during the past four quarters. *LTG* is the average analyst long-term growth forecast as of the last month of quarter *t*-1. *SG* is the average sales growth rate over the past four quarters. *TA* is total accounting accruals during the past four quarters, scaled by average total assets; and *CAPEX* is capital expenditures during the past four quarters, scaled by average total assets.

Table IX presents quarterly Fama-Macbeth time-series coefficients and *t*-statistics for estimations of equation (1) with controls for other quantitative investment signals as well as the incremental trading response to recommendation revisions conditional on a stock's size ranking (*CHGREC* × *SIZERANK*). Since many of the investment signals have missing values in some quarters, including all of the signals in the same regression will substantially reduce our sample size. Therefore, in columns 1 and 2, we first present results using only those variables that are found to significantly affect analyst recommendation changes in Jegadeesh et al. (2004). That is, we augment equation (1) with market adjusted returns in the previous 6 months (*RETP*), analyst forecast revisions

(*FREV*), earnings-to-price ratio (*EP*), unexpected earnings (*SUE*), long-term growth forecast (*LTG*), and sales growth (*SG*).[9] If the link between mutual fund herding and analysts revisions is spurious because fund managers and analysts simply react to the same underlying investment signals, then the effect of analyst recommendation changes should diminish once we include these additional controls..

As shown in Table IX, the association between recommendation revisions and buy- and sell-herding remains significant in the extended model. In fact, the coefficients on recommendation revisions become even stronger once we control for other investment signals. We find very similar results in columns 3 and 4, which present results using all the signals, but with a significantly reduced sample. Thus, we believe it is unlikely that the significant impact of analyst recommendation revisions on mutual fund herding is spurious due to a possible endogeneity between these two measures. Furthermore, the estimated coefficients for the investment signals are mostly consistent with evidence provided in the literature. For example, the estimated coefficients on *RETP* and *FREV* suggest that mutual funds trade on past stock performance, while the coefficient on *CAPEX* suggests that funds buy (sell) stocks with low (high) levels of capital expenditures.

III.B. Herding on consensus earnings forecast revisions

While analyst recommendation revisions are a clear public signal of underlying fundamental value (Elton, Gruber, and Grossman (1986)), we investigate whether other sources of fundamental information also serve as a mechanism for mutual fund herding.

[9] Since cumulative raw return in the previous quarter is highly correlated with the cumulative market adjusted return in the past six months, we drop prior-quarter raw return from this regression.

To address this issue, we examine the relationship between mutual fund herding and analysts' earnings forecast revisions. Although analyst earnings forecasts have relatively lower investment value (see, e.g., Francis and Soffer (1997), Brav and Lehavy (2003), and Asquith, Mikhail, and Wu (2004)), they have the added 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 the analyst's forecast. Therefore, as argued by Lin and McNichols (1998), it can be more costly for analysts to manipulate their earnings forecasts compared to stock recommendations.

For each stock-quarter, we define the consensus forecast revision (*CHGREV*) as the increase (or decrease) in the consensus earnings forecasts from quarter t–2 to quarter t–1, scaled by stock price at the end of quarter t–2. When constructing the consensus, we only consider individual forecasts that are issued within the past 90 days. Following Hong, Lee, and Swaminathan (2003), if quarters t–2 and t–1 overlap two different fiscal years, we define the consensus forecast revision as the difference between the consensus one-year ahead earnings forecast as of quarter t–1 and the consensus two-year ahead earnings forecast as of quarter t–2. Given the continuous nature of analyst forecast revisions, we classify consensus revisions in the top (bottom) 33% of the sample as upward (downward) revisions; small positive and negative revisions in the middle group are classified as no change. To investigate whether herding is related to analyst earnings forecast revisions, we estimate quarterly Fama-MacBeth regressions of buy-herding and sell-herding on prior-quarter consensus forecast revisions, while controlling for inclusion

or exclusion from the S&P 500, size, past stock return, book-to-market ratio, the standard deviation of daily returns, and turnover in the previous quarter.

Table X presents the time-series average of the estimated coefficients and their Fama-MacBeth *t*-statistics. Consistent with our results based on recommendation revisions, we find a positive association between buy-herding and forecast revisions as well as a negative association between sell-herding and forecast revisions (see columns 1 and 2). However, unlike the sensitivity of herding to recommendation revisions, the absolute magnitude of the coefficients on *CHGREV* is not significantly different between the buy- and sell-herd regressions. 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.[10] Finally, in columns 3 and 4, we find that the sensitivity of buy- and sell-herding to forecast revisions decreases with the stock's size percentile ranking. Specifically, the interaction term between forecast revisions and size ranking, *CHGREV* × *SIZERANK*, is significantly negative in the buy-herd regression and significantly positive in the sell-herd regression.

Prior studies document an association between analyst earnings forecasts and stock recommendations (e.g., Bradshaw, 2004; Loh and Mian, 2006). This raises the question of whether earnings forecast revisions simply proxy for what mutual funds learn from recommendation revisions, and vice versa. We do not believe this is the case for the following reasons: First, while the sensitivity of sell-herding to downgrades is

[10] As documented by prior studies (e.g., Richardson, Teoh, and Wysocki (2004)), the tendency for firms to "walk-down" optimistic forecasts to "beatable" targets may reduce upward forecast biases. On the other hand, prior evidence suggests analysts may have incentives to provide upwardly biased forecasts to gain

significantly stronger than that of buy-herding to upgrades, we do not observe the same asymmetry with upward and downward earning forecast revisions. This suggests that earnings forecast revisions and recommendation revisions contain different information sets. Second, we address this concern by examining the effect of earnings forecast revisions again while controlling for recommendation revisions as shown in columns 5 & 6. While there exists a strong relation between herding and analyst recommendation revisions—consistent with our earlier findings, the effect of earnings forecast revisions remains strong. Therefore, although earnings forecast revisions and recommendation revisions are related, they convey different information and thus, both influence mutual fund trading.

Table XI presents the price impact analysis of forecast revision-induced herding. Similar to recommendation revisions, we find strong return reversals for stocks heavily traded by herds when they follow analyst forecast revisions. Taken together, our analyses of herding on earnings forecast revisions and recommendation revisions provide supporting evidence consistent with the arrival of correlated fundamental information as the mechanism to induce herding. Furthermore, the results provide strong support for the interaction between sell-side analysts and mutual fund managers in setting stock prices.

IV. 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-motivated mutual fund "herds" on stock prices. We find evidence that mutual fund

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access to either management information or investment banking business (e.g., Francis and Philbrick

trading impacts stock prices to a much greater degree during our sample period (1994 to 2003) than during prior periods. This finding is consistent with the greatly increased presence of mutual fund trading in stock markets, with funds accounting for over 27 percent of equity holdings during recent years, relative to about half that level of ownership during 1994.

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.

Perhaps our most interesting result is that mutual funds appear to overreact when they trade stocks—stocks heavily bought by herds tend to underperform their size, book-to-market, and momentum cohorts during the following year, while stocks heavily sold outperform their cohorts. These reversal patterns are even stronger when mutual fund herds follow analyst recommendation revisions. We also find similar overreaction when we condition our analyses of mutual fund herding on consensus earnings forecast revisions as an alternative signal of fundamental stock value. These findings suggest that analyst revision-induced herding is most consistent with herding due to non-information based reasons. Further analyses indicate that herds of funds with greater career concerns (i.e., funds with poor past performance) play a great role in destabilizing stock prices and thus, support the conjecture that herding on recommendation changes is driven partly by career incentives. Taken together, our findings suggest that the interaction between mutual funds and analysts is important in the formation of prices in equity markets.

(1993); Lin and McNichols (1998)).

References

Agrawal, Anup, and Mark A. Chen, 2006, Do analyst conflicts matter? Evidence from stock recommendations, Working Paper, University of Maryland.

Asquith, Paul, Michael B. Mikhail, and Andrea S. Au, 2005, Information content of equity analyst reports, *Journal of Financial Economics* 75, 245–282.

Banerjee, Abhijit V., 1992, A simple model of herd behavior, *Quarterly Journal of Economics* 57, 798–817.

Barber, Brad M., Rueven Lehavy, Maureen McNichols, and Brett Trueman, 2001, Can investors profit from the prophets? Security analyst recommendations and stock returns, *Journal of Finance* 56, 531–563.

Barber, Brad M., Rueven Lehavy, Maureen McNichols, and Brett Trueman, 2006, Buys, holds, and sells: The distribution of investment banks' stock ratings and the implications for the profitability of analysts' recommendations, *Journal of Accounting and Economics* 41, 87–117.

Barron, Orie E., David G. Harris, and Mary Stanford, 2005, Evidence that investors trade on private event-period information around earnings announcements, *Accounting Review* 80, 403–421.

Bessembinder, Hendrik, Kalok Chan, and Paul J. Seguin, 1996, An empirical examination of information, differences of opinion, and trading activity, *Journal of Financial Economics* 40, 105–134.

Bikhchandani, Sushil, David Hirshleifer, and Ivo Welch, 1992, A theory of fads, fashion, custom, and cultural change as informational cascades, *Journal of Political Economy* 100, 992–1026.

Bradshaw, Mark T, 2004, How do analysts use their earnings forecasts in generating stock recommendations? *Accounting Review* 79, 25-50.

Brav, Alon, and Reuven Lehavy, 2003, An empirical analysis of analysts' target prices: short-term informativeness and long-term dynamics, *Journal of Finance* 58, 1933–1968.

Brennan, Michael J., Narasimhan Jegadeesh, and Bhaskaran Swaminathan, 1993, Investment analysis and the adjustment of stock prices to common information, Review of Financial Studies 6, 799–824.

Chan, Louis K. C., Hsiu-Lang Chen, and Josef Lakonishok, 2002, On mutual fund investment styles. *The Review of Financial Studies* 15, 1407–1437.

Chan, Kalok, Chuan-Yang Hwang, and G. Mujtaba Mian, 2005, Mutual fund herding and dispersion of analysts' earnings forecasts, Working Paper, Hong Kong University of Science and Technology.

Carhart, Mark M., 1997, On persistence in mutual fund performance, *Journal of Finance*, 52, 57–82.

Chen, Xia, and Qiang Cheng, 2005, Institutional holdings and analysts' stock recommendations, *Journal of Accounting, Auditing, and Finance* 21, 399–440.

Cheng, Yingmei, Mark H. Liu, and Jun Qian, 2006, Buy-side analysts, sell-side analysts, and investment decisions of money managers, *Journal of Financial and Quantitative Analysis* 41.

Conrad, Jennifer S., Kevin M. Johnson, and Sunil Wahal, 2001, Institutional trading and soft dollars, *Journal of Finance* 56, 397–416.

Coval, Joshua D. and Tobias J. Moskowitz, 1999, Home bias at home: Local equity preference in domestic portfolios, *Journal of Finance*, 54, 2045–2073.

Cowen, Amanda, Boris Groysberg, and Paul Healy, 2006, Which types of analyst firms are more optimistic?, *Journal of Accounting and Economics* 41, 119–146.

Daniel, Kent, Mark Grinblatt, Sheridan Titman, and Russ Wermers, 1997, Measuring mutual fund performance with characteristic-based benchmarks, *Journal of Finance* 52, 1035–1058.

Dasgupta, Amil, Andrea Prat, and Michela Verardo, 2006, The price of conformism, Working paper.

DeBondt, Werner F. M. and Richard Thaler, 1985, Does the stock market overreact?, *Journal of Finance*, 40, 793-805.

Elton, J. Edwin, Martin K. Gruber, and Seth Grossman, 1986, Discrete expectational data and portfolio performance, *Journal of Finance* 41, 699–713.

Falkenstein, Eric G., 1996, Preferences for stock characteristics as revealed by mutual fund portfolio holdings, *Journal of Finance* 51, 111–135.

Francis, Jennifer, and Donna Philbrick, 1993, Analysts' decisions as products of a multi-task environment, *Journal of Accounting Research* 31, 216–230.

Francis, Jennifer, and Leonard Soffer, 1997, The relative informativeness of analysts' stock recommendations and earnings forecast revisions, Journal of Accounting Research 35, 193–211.

Froot, Kenneth A., David S. Scharfstein, and Jeremy C. Stein, 1992, Herd on the street: informational inefficiencies in a market with short-term speculation, *Journal of Finance* 47, 1461–1484.

Grinblatt, Mark, Sheridan Titman, and Russ Wermers, 1995, Momentum investment strategies, portfolio performance and herding: a study of mutual fund behavior, *The American Economic Review* 85, 1088–1105.

Harris, Milton, and Artur Raviv, 1993, Differences of opinion make a horse race, *Review of Financial Studies* 6, 473–506.

He, Wen, G. Mujtaba Mian, and Srinivasan Sankaraguruswamy, 2005, Who follows the prophets? Analysts' stock recommendations and the trading response of large and small traders, Working Paper, National University of Singapore.

Hirshleifer, David, Avanidhar Subrahmanyam, and Sheridan Titman, 1994, Security analysis and trading patterns when some investors receive information before others, *Journal of Finance* 49, 1665–1698.

Holthausen, R. W., and Robert E. Verrecchia, 1990, The effect of informedness and consensus on price and volume behavior, *Accounting Review* 65, 191–208.

Irvine, Paul J., 2004, Analysts' forecasts and brokerage-firm trading, *The Accounting Review* 79, 125–149.

Jegadeesh, Narasimhan, Joonghyuk Lim, Susan D. Krische, and Charles M. C. Lee, 2004, Analyzing the analysts: When do recommendations add value?, *Journal of Finance* 59, 1083–1124.

Jegadeesh, Narasimhan and Sheridan Titman, 1993, Returns to buying winners and selling losers: Implications for stock market efficiency, *Journal of Finance*, 48, 65–92.

Kacperczyk, Marcin, and Amit Seru, 2006, Fund manager use of public information: New evidence on managerial skills, *Journal of Finance* forthcoming.

Kim, Oliver, and Robert E. Verrecchia, 1991, Trading volume and price reactions to public announcements, *Journal of Accounting Research* 29, 302–321.

Lakonishok, Josef, Andrei Shleifer, and Robert Vishny, 1992, The impact of institutional trading on stock prices, *Journal of Financial Economics* 32, 23–43.

Lin, Hsiou-wei, and Maureen F. McNichols, 1998, Underwriting relationships, analysts' earnings forecasts and investment recommendations, *Journal of Accounting and Economics* 25, 101–127.

Ljungqvist, Alexander, Felicia Marston, and William J. Wilhelm Jr., 2006, Competing for securities underwriting mandates: banking relationships and analyst recommendations, *Journal of Finance* 61, 301–340.

Ljungqvist, Alexander, Felicia Marston, Laura T. Starks, Kelsey D. Wei, and Hong Yan, 2006, Conflicts of interests in sell-side research and the moderating role of institutional investors, *Journal of Financial Economics*, forthcoming.

Loh, Roger K., and G. Mujtaba Mian, 2006, Do accurate earnings forecasts facilitate superior investment recommendations? *Journal of Financial Economics* 80, 455–483.

Michaely, R., and K. Womack. 1999, Conflict of interest and the credibility of underwriter analyst recommendations, Review of Financial Studies 12, 653-686.

Mikhail, Michael B., Beverly R. Walther, and Richard H. Willis, 2006, When security analysts talk who listens? Working Paper, Northwestern University.

Odean, Terrance, 1998, Are investors reluctant to realize their losses?, *Journal of Finance*, 53, 1775-1798.

Scharfstein, David S., and Jeremy C. Stein, 1990, Herd behavior and investment, *The American Economic Review* 80, 465–479.

Sias, Richard W., 2004, Institutional herding, *Review of Financial Studies* 17, 165–206.

Nofsinger, John R. and Richard W. Sias, 1999, Herding and feedback trading by institutional and individual investors, *Journal of Finance*, 54, 2263-2295.

Michaely, Roni, and Kent L. Womack, 1999, Conflict of interest and the credibility of underwriter analyst recommendations, *Review of Financial Studies* 12, 653–686.

Nofsinger, John R., and Richard W. Sias, Herding and feedback trading by institutional and individual investors, *Journal of Finance* 54, 2263–2295.

Richardson, Scott, Siew Hong Teoh, and Peter D. Wysocki, 2004, The walk-down to beatable analyst forecasts: The role of equity issuance and insider trading incentives, *Contemporary Accounting Research* 21, 885–924.

Trueman, Brett, 1994, Analyst forecasts and herding behavior, *Review of Financial Studies* 7, 97–124.

Welch, Ivo, 1992, Sequential sales, learning, and cascades, *Journal of Finance* 47, 695–732.

Wermers, Russ, 1999, Mutual fund herding and the impact on stock prices, *Journal of Finance* 54, 581–622.

Wermers, Russ, Tong Yao, and Jane Zhao, 2006, The investment value of mutual fund portfolio disclosure, Working paper.

Womack, Kent, 1996, Do brokerage analysts' recommendations have investment value? *Journal of Finance* 51, 137–167.

Table I

Summary Trading Statistics

Summary trading statistics are presented for the last quarter of each year during the period of 1994 to 2003 in three-year intervals. Trades are inferred from changes in quarterly portfolio holdings and are calculated for the fourth quarter in each year shown. Panel A presents summary trading statistics for all stocks traded by U.S.-based equity funds. Panel B presents summary trading statistics for all stocks traded by at least 5 funds with available analyst recommendations from I/B/E/S. The first row in each panel presents, in percent, the proportion of stock trades that are buys.

	Year			
	1994	1997	2000	2003
Panel A: Trading statistics (fourth quarter) for stocks traded by all U.S. domestic equity funds				
Proportion of buys (in percent)	54.39	57.73	50.41	59.10
No. of stocks traded by				
≥ 1 fund	4,214	5,331	4,198	3,866
≥ 5 fund	2,291	3,213	2,811	2,822
≥ 10 fund	1,545	2,271	2,167	2,344
≥ 20 fund	825	1,373	1,497	1,756
≥ 30 fund	508	916	1,124	1,344
≥ 50 fund	206	449	686	833
≥ 100 fund	32	141	251	297
≥ 200 fund	0	19	74	77
Panel B: Trading statistics (fourth quarter) for stocks with recommendations and traded by at least 5 funds				
Proportion of buys (in percent)	52.51	55.87	49.56	56.46
No. of stocks traded by				
≥ 1 fund	2,644	3,132	2,756	2,583
≥ 5 fund	1,878	2,441	2,234	2,302
≥ 10 fund	1,366	1,872	1,855	2,034
≥ 20 fund	776	1,236	1,348	1,625
≥ 30 fund	490	863	1,034	1,287
≥ 50 fund	201	436	647	815
≥ 100 fund	31	141	245	293
≥ 200 fund	0	19	74	76

Table II

Summary Statistics for Herding Measures and Control Variables

Summary statistics are presented for all stock-quarters with available analysts' recommendations for the period of the fourth quarter in 1994 to the fourth quarter in 2003. Panel A present statistics for our herding measures. Summary statistics for the number of funds trading and the number of analysts issuing recommendations in a given stock quarter are also reported. The herding measure, *HM*, for each stock quarter is $|p - E[p]| - E|p - E[p]|$, where p equals the proportion of stock trades that are buys. The buy-herd (*BHM*) and sell-herd measures (*SHM*) are equal to *HM* conditioned on $p > E[p]$ and $p < E[p]$, respectively. *HM*, *BHM*, and *SHM* are presented in percent. Panel B present summary statistics for our control variables. *CHGREC* is the prior-quarter change in the consensus recommendation. *DISP* is the standard deviation of all outstanding earnings forecasts in quarter $t-1$, scaled by stock price as at the end of quarter $t-1$. *SIZE* is market capitalization at the beginning of the quarter, which is presented in $M for ease of interpretation. *RET* is the lagged value of cumulative quarterly stock return. *BM* is the logarithm of the ratio of book value (Compustat quarterly data item 59) to market value of equity (Compustat quarterly data item 14 times data item 61) as of the most recent fiscal quarter that an earnings announcement is made. *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 past 12 months deflated by the average turnover for all NASDAQ or NYSE/AMEX stocks according to the stock's listed exchange.

	Mean	Median	Std. Dev.	25th	75th
HM (in percent)	4.163	1.905	10.839	-3.325	9.500
BHM (in percent)	3.308	1.768	9.396	-3.888	8.850
SHM (in percent)	4.903	2.228	12.117	-3.216	10.842
CHGREC	-0.017	-0.008	0.568	-0.307	0.255
No. of funds trading	36.061	22.487	40.237	11.290	44.145
No. of analysts issuing recommendations	4.512	3.553	3.432	2.053	5.974
DISP	0.004	0.001	0.000	0.003	0.010
SIZE (in millions $)	4346	827	15622	334	2481
RET	0.052	0.028	0.286	-0.107	0.172
BM	0.485	0.409	0.376	0.244	0.630
STD	0.032	0.028	0.017	0.020	0.041
TURN	1.433	1.019	1.390	0.622	1.751

Table III
Mean Buy-Herd (BHM) and Sell-Herd (SHM) Measures (in percent) by Size and Prior-Quarter Return Quintiles

Panel A presents mean buy-herd (*BHM*) and mean sell-herd (*SHM*) measures by size quintiles. Panel B presents similar means by prior-quarter return quintiles. The mean herding measures are presented separately for stock-quarters with a downgrade, upgrade, and no change in the consensus recommendation. We measure the sensitivity of buy-herding (sell-herding) to consensus changes by calculating the difference in the mean buy-herd (sell-herd) measure between upgrade (downgrade) and downgrade (upgrade) stock-quarters and present the t-statistics for these differences in parentheses. Time series t-statistics (in parentheses) testing the differences between these sensitivities are presented at the bottom of each Panel. The buy-herd (*BHM*) and sell-herd measures (*SHM*) are equal to *HM* conditioned on $p > E[p]$ and $p < E[p]$, respectively. *BHM* and *SHM* are presented in percent. The size quintiles are based on NYSE market capitalization breakpoints at the beginning of quarter t. Within each size quintile, we then sort stocks into quintiles based on prior-quarter return. Only stocks with available price (Panel A) and return data (Panel B) are included. Given these restrictions, the total averages across the size quintiles (S1 to S5) are different from the total averages across the return quintiles (R1 to R5). The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Mean herding measures by size quintiles based upon NYSE breakpoints

Direction of Trade	Change in Consensus Recommendation	S1 (Small Stocks)	S2	S3	S4	S5 (Large Stocks)
Buy-Herd	Downgrade	3.40	2.87	2.71	2.39	2.34
	No change	3.72	3.35	2.66	1.98	2.79
	Upgrade	5.53	3.97	3.38	2.73	2.74
	Upgrade minus Downgrade	2.13	1.10	0.67	0.34	0.40
		(3.78)***	(5.50)***	(3.76)***	(1.76)*	(3.63)**
Sell-Herd	Downgrade	7.98	5.01	3.99	3.55	2.93
	No change	4.44	2.61	2.48	2.04	2.56
	Upgrade	4.17	2.79	2.34	2.46	2.34
	Downgrade minus Upgrade	3.81	2.22	1.65	1.09	0.59
		(7.23)***	(7.93)***	(6.14)***	(4.82)***	(3.65)***
Differences in sensitivity between buy-herd and sell-herd		1.68	1.12	0.98	0.75	0.19
		(2.18)**	(3.25)***	(3.04)***	(2.48)**	(0.96)

Panel B: Mean herding measures by prior-quarter return quintiles						
Direction of Trade	Change in Consensus Recommendation	R1 (Low Return)	R2	R3	R4	R5 (High Return)
Buy-Herd	Downgrade	1.38	2.10	2.54	3.03	4.58
	No change	1.40	2.59	2.89	3.24	4.69
	Upgrade	1.55	2.65	3.14	3.73	5.24
	Upgrade minus Downgrade	0.17	0.55	0.60	0.70	0.66
		(0.17)	(2.41)**	(2.38)***	(2.96)***	(3.54)***
Sell-Herd	Downgrade	7.43	3.41	2.75	2.11	2.61
	No change	5.18	3.32	1.81	1.80	1.37
	Upgrade	5.16	2.63	2.13	1.61	1.34
	Downgrade minus Upgrade	2.27	0.78	0.62	0.50	1.27
		(7.73)***	(3.26)***	(2.41)**	(2.34)**	(5.19)***
Differences in sensitivity between buy-herd and sell-herd		2.10	0.23	0.02	-0.20	0.61
		(5.70)***	(0.69)	(0.04)	(-0.61)	(1.97)*

Table IV

Multivariate Regressions of Buy-Herding and Sell-Herding on Consensus Recommendation Changes

Columns 1 and 2 presents quarterly Fama-Macbeth regressions of equation (1) for buy-herd and sell-herd stock-quarters. Columns 3 and 4 presents results for the incremental response to revisions conditional on a stock's size ranking. We report the times-series averages of the estimated coefficients. The time-series t-statistics are presented in parentheses. The buy-herd (*BHM*) and sell-herd measures (*SHM*) are equal to *HM* conditioned on $p > E[p]$ and $p < E[p]$, respectively. *CHGREC* is the prior-quarter change in the consensus recommendation. *SIZERANK* is a stock's size percentile ranking based on NYSE size breakpoints as of the beginning of quarter t. *ULEVEL* and *DLEVEL* are indicator variables, which equals "1" for those stock-quarters with consecutive strong buy and strong sell consensus recommendations between the two previous quarters, respectively; "0" otherwise. *LAGBUY* (*LAGSELL*) equals "1" if the stock is also classified as a buy-herding (sell-herding) stock in the previous quarter; "0" otherwise. *ADD* (*DROP*) equals "1" if the stock has been added (or dropped) from the S&P 500 index in the previous quarter; "0" otherwise. *DISP* is the standard deviation of all outstanding earnings forecasts in quarter t-1, scaled by stock price as at the end of quarter t-1. *SIZE* is the logarithm of beginning of quarter market capitalization. *RET* is prior-quarter stock return. *BM* is the logarithm of the ratio of book value (Compustat quarterly data item 59) to market value of equity (Compustat quarterly data item 14 times data item 61) as of the most recent fiscal quarter that an earnings announcement is made. *STD* is stock return volatility, which is the standard deviation of daily returns over the past 12 months. *TURN* is turnover, which equals the average daily trading volume over the past 12 months deflated by shares outstanding. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

	Model 1		Model 2	
	BHM	*SHM*	*BHM*	*SHM*
	(1)	(2)	(3)	(4)
Intercept	0.0403	-0.0269	0.0401	-0.0293
	(3.74)***	(-3.14)***	(3.70)***	(-3.42)***
CHGREC	0.0031	-0.0060	0.0066	-0.0120
	(3.42)***	(-5.44)***	(2.57)**	(-4.78)***
CHGREC × *SIZERANK*	-	-	-0.0077	0.0126
			(-1.79)*	(3.07)***
ULEVEL	0.0141	-0.0005	0.0141	-0.0003
	(3.48)***	(-0.16)	(3.49)***	(-0.10)
DLEVEL	0.0109	0.0039	0.0110	0.0039
	(1.13)	(0.78)	(1.13)	(0.78)
LAGBUY	0.0122	-	0.0121	-
	(9.25)***		(9.33)***	
LAGSELL	-	0.0116	-	0.0116
		(9.43)***		(9.42)***
ADD	-0.0028	-0.0067	-0.0030	-0.0066
	(-0.29)	(-1.24)	(-0.32)	(-1.23)
DROP	-0.0047	0.0024	-0.0049	0.0024
	(-0.77)	(0.21)	(-0.80)	(0.20)
DISP	0.4285	0.2203	0.4295	0.2190
	(4.91)***	(2.49)**	(4.90)***	(2.44)**
SIZE	-0.0022	0.0013	-0.0022	0.0015
	(-3.11)***	(2.44)**	(-3.09)***	(2.79)***
RET	0.0469	-0.0642	0.0469	-0.0638
	(13.76)***	(-11.66)***	(13.70)***	(-11.56)***
BM	-0.0035	0.0015	-0.0035	0.0015
	(-3.13)***	(1.37)	(-3.16)***	(1.36)
STD	0.0842	0.9051	0.0845	0.8957
	(1.04)	(9.05)***	(1.04)	(9.08)***
TURN	0.0002	0.0058	0.0002	0.0058
	(0.29)	(7.74)***	(0.27)	(7.77)***
R-squared	0.0445	0.1039	0.0448	0.1042

Table V
Quarterly Average DGTW Adjusted Abnormal Returns (in Percent) for Revision- and Herding-Sorted Portfolios

For each quarter t, stocks are sorted in quintiles according to their *BHM* measure during that quarter. This procedure results in five portfolios (B1 to B5) where B1 includes those stocks that mutual fund herds most strongly buy and B5 includes those stocks that they slightly buy. The sorting procedure is repeated for stocks with a higher than average proportion of sells based on their *SHM* measure in each quarter where S1 includes those stocks that mutual fund herds most strongly sell and S5 includes those stocks that they sightly sell. The quarterly abnormal return for each portfolio is calculated using DGTW (1997) characteristic-based benchmark portfolio returns. The time-series average quarterly abnormal return for each portfolio, calculated across all 38 formation quarters, is presented below. The portfolio "B1 minus S1" represents a zero-investment portfolio that is long the B1 portfolio and short the S1 portfolio. "B1 to B5 minus S1 to S5" represents a zero-investment portfolio which equally weights long positions in B1 through to B5 and equally weights short positions in S1 to S5. Time-series t-statistics are presented in parentheses. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

Portfolios	Qtr -2	Qtr -1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
B1 (Heavy buying)	8.97 (9.68)***	11.39 (10.02)***	11.91 (10.51)***	1.06 (1.96)*	0.49 (1.12)	-0.32 (-0.89)	-0.73 (-2.17)**
B2	5.14 (9.46)***	6.05 (13.41)***	6.52 (10.57)***	0.62 (1.76)*	-0.04 (-0.14)	-0.02 (-0.06)	-0.28 (-0.88)
B3	4.40 (8.93)***	4.79 (10.09)***	4.75 (9.31)***	0.21 (0.66)	0.33 (0.92)	-0.20 (-0.80)	0.19 (0.55)
B4	3.57 (8.38)***	3.12 (9.25)***	2.36 (5.67)***	-0.16 (-0.53)	0.19 (0.53)	0.07 (0.25)	0.32 (0.81)
B5 (Light buying)	1.65 (5.94)***	1.13 (3.31)***	1.55 (3.96)***	0.02 (0.03)	0.27 (0.61)	-0.09 (-0.24)	0.79 (1.75)*
S5 (Light selling)	-0.71 (-1.61)	-1.02 (-2.14)**	-1.03 (-2.87)***	0.03 (0.07)	0.35 (1.20)	0.07 (0.17)	0.54 (1.16)
S4	1.81 (5.26)***	0.73 (1.84)*	-0.51 (-1.58)	0.05 (0.18)	0.39 (1.20)	0.05 (0.14)	0.67 (2.13)**
S3	0.61 (1.48)	-1.30 (-3.49)***	-2.61 (-6.44)***	0.18 (0.60)	-0.04 (-0.12)	0.70 (1.72)*	0.50 (1.14)
S2	-0.61 (-1.19)	-3.00 (-6.50)***	-5.21 (-10.64)***	-0.23 (-0.45)	0.67 (1.48)	0.14 (0.28)	0.47 (1.01)
S1 (Heavy selling)	-4.13 (-5.33)***	-8.68 (-11.11)***	-9.49 (-11.45)***	0.06 (0.06)	0.81 (0.90)	1.83 (1.94)*	1.76 (1.92)*
B1 minus S1	13.10 (10.42)***	20.07 (14.62)***	21.40 (13.34)***	0.99 (0.86)	-0.32 (-0.34)	-2.15 (-2.09)**	-2.48 (-2.51)***
B1 to B5 minus S1 to S5	5.35 (10.17)***	7.95 (15.67)***	9.19 (13.18)***	0.33 (0.84)	-0.19 (-0.59)	-0.67 (-1.80)*	-0.73 (-2.04)**

Table VI

Quarterly Average DGTW Adjusted Abnormal Returns (in Percent) for Revision- and Herding-Sorted Portfolios

For each quarter *t*, stocks are divided into two groups depending on whether they experience a downgrade or an upgrade in recommendations in the previous quarter. Within each downgrading and upgrading group, stocks are then sorted into quintile portfolios according to their *BHM* and *SHM* measure, respectively. The quarterly abnormal return for each portfolio is calculated using DGTW (1997) characteristic-based benchmark portfolio returns. The time-series average quarterly abnormal returns for the light buying/selling (B5 and S5) portfolios and the heavy buying/selling (B1 and S1) portfolios, calculated across all 38 formation quarters,are presented below with their *t*-statistics in parentheses. The portfolio "S5-Upgrade minus B5-Upgrade" represents a zero-investment portfolio that is long upgraded stocks that are heavily sold and short upgraded stocks that are heavily bought. "S5-Downgrade minus B5-Downgrade" is a zero-investment portfolio that is long downgraded stocks that are lightly sold and short downgraded stocks that are lightly bought. Similar portfolios are formed for stocks heavily bought and sold. The abnormal returns and the associated *t*-statistics of these zero-investment portfolios are also presented. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

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

Portfolios	Change in Consensus Recommendation	Qtr -2	Qtr -1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
B5 (Light buying)	Downgrade	0.47 (0.90)	-0.87 (-1.62)	1.39 (2.21)**	-0.16 (-0.28)	0.38 (0.50)	-0.35 (-0.68)	0.86 (1.40)
	Upgrade	3.03 (5.82)***	4.19 (6.80)***	2.07 (4.26)***	-0.02 (-0.04)	-0.42 (-0.77)	0.60 (1.02)	0.40 (0.84)
S5 (Light selling)	Downgrade	-1.11 (-1.99)*	-3.64 (-6.33)***	-0.94 (1.90)*	-0.63 (-1.12)	-0.02 (-0.03)	0.50 (1.09)	0.17 (0.30)
	Upgrade	0.88 (1.38)	2.23 (3.32)***	-0.64 (-1.03)	-0.68 (-1.38)	-0.20 (-0.39)	-0.66 (-1.07)	1.02 (1.12)
S5-Upgrade minus B5-Upgrade		-2.15 (-3.36)***	-1.96 (-3.31)***	-2.71 (-3.77)***	-0.65 (-0.94)	0.21 (0.32)	-1.25 (-1.61)	0.62 (0.68)
S5-Downgrade minus B5-Downgrade		-1.58 (-2.44)**	-2.77 (-3.86)***	-2.33 (-3.18)***	-0.47 (-0.65)	-0.39 (-0.56)	0.85 (1.56)	-0.68 (-0.96)

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

Portfolios	Change in Consensus Recommendation	Qtr -2	Qtr -1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
B1	Downgrade	6.64	7.04	10.36	-0.11	0.24	0.28	0.11
(Heavy buying)		(6.64)***	(7.67)***	(9.77)***	(-0.18)	(0.52)	(0.56)	(0.20)
	Upgrade	11.42	15.34	12.55	1.30	0.66	-0.69	-1.38
		(9.96)***	(10.47)***	(10.30)***	(1.78)*	(0.97)	(-1.49)	(-3.20)***
S1	Downgrade	-6.03	-15.59	-11.21	0.25	1.38	1.75	3.13
(Heavy selling)		(-5.59)***	(-16.83)***	(-11.51)***	(0.20)	(1.05)	(1.45)	(2.60)**
	Upgrade	-1.16	-2.73	-12.03	0.32	-0.79	1.85	0.09
		(-1.70)*	(-3.49)***	(-13.28)***	(0.39)	(-1.11)	(2.21)**	(0.14)
S1-Upgrade minus B1-Upgrade		-12.58	-18.08	-24.58	-0.98	-1.45	2.54	1.47
		(-10.43)***	(-12.13)***	(-14.68)***	(-1.00)	(-1.42)	(2.68)***	(1.96)*
S1-Downgrade minus B1-Downgrade		-12.68	-22.63	-21.57	0.35	1.14	1.47	3.03
		(-8.16)***	(-15.28)***	(-13.50)***	(0.25)	(0.96)	(1.16)	(2.29)**
S1-Downgrade minus B1-Upgrade		-17.46	-30.93	-23.77	-1.05	0.71	2.45	4.52
		(-11.23)***	(-16.73)***	(-14.26)***	(-0.70)	(0.47)	(1.90)*	(3.63)***
S1-Upgrade minus B1-Downgrade		-7.80	-9.77	-22.39	0.43	-1.03	1.57	-0.02
		(-6.15)***	(-8.43)***	(-14.11)***	(0.43)	(-1.16)	(1.61)	(-0.02)

Table VII

Dollar Ratio Trade Imbalance Measures and DGTW-Adjusted Abnormal Returns (in Percent) for Revision- and Herding-Sorted Portfolios

Panel A presents the average dollar-ratio trade imbalance measures over size and prior-quarter return quintiles. The dollar-ratio trade imbalance measure for each stock-quarter equals ($\$buys_{it}$ - $\$sells_{it}$)/($\$buys_{it}$ + $\$sells_{it}$), where $\$buys_{it}$ ($\$sells_{it}$) equals the total number of share purchases (sales) by all mutual funds multiplied by the average price in quarter t. Panels B and C presents quarterly abnormal returns for lightly (B5 and S5) and heavily (B1 and S1) traded stocks sorted by recommendation revision and the dollar-ratio trade imbalance measure. For each quarter t, stocks are divided into two groups depending on whether their dollar-ratio measure is positive (net purchases) or negative (net sales). Within each net-purchases and net-sales group, we sort stocks into quintiles based on their dollar-ratio for each group of upgrading and downgrading stocks. The quarterly abnormal return for each portfolio is calculated using DGTW (1997) characteristic-based benchmark portfolio returns. The time-series average quarterly abnormal returns for the heavy buying (B1) and heavy selling (S1) portfolios, calculated across all 38 formation quarters,are presented below with their t-statistics in parentheses. The portfolio "S5-Upgrade minus B5-Upgrade" represents a zero-investment portfolio that is long upgraded stocks that are lightly sold and short upgraded stocks that are lightly bought. "S5-Downgrade minus B5-Downgrade" is a zero-investment portfolio that is long downgraded stocks that are lightly sold and short downgraded stocks that are lightly bought. Similar portfolios are formed for stocks heavily bought and sold. The abnormal returns and the associated t-statistics of these zero-investment portfolios are also presented. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Average dollar ratio trade imbalance measure sorted by size and prior-quarter return quintiles

	Size Quintiles				
Prior-quarter return quintiles	S1 (Small Stocks)	S2	S3	S4	S5 (Large Stocks)
R1 (Low Return)	-0.195	-0.060	-0.021	0.021	0.071
R2	-0.070	0.027	0.059	0.050	0.056
R3	-0.007	0.069	0.054	0.050	0.058
R4	0.064	0.075	0.075	0.059	0.050
R5 (High Return)	0.173	0.140	0.146	0.098	0.031

Panel B: Quarterly DGTW-adjusted abnormal for heavy buying (B5) and heaving selling (S5) portfolios

Portfolios	Change in Consensus Recommendation	Qtr -2	Qtr -1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
B1	Downgrade	3.41	3.13	6.24	0.12	0.61	0.29	0.31
(Heavy buying)		(6.21)***	(5.99)***	(7.45)***	(0.24)	(1.14)	(0.81)	(0.78)
	Upgrade	7.21	11.16	8.44	0.84	-0.27	-0.62	-1.41
		(7.92)***	(10.75)***	(9.37)***	(1.67)*	(-0.47)	(-1.22)	(-3.16)***
S1	Downgrade	-7.13	-12.81	-7.58	0.96	1.15	0.90	2.46
(Heavy selling)		(-7.72)***	(-14.19)***	(-8.63)***	(0.82)	(0.92)	(0.88)	(2.22)**
	Upgrade	-1.06	-2.25	-6.88	-0.05	-0.52	1.11	-0.07
		(-1.64)	(-2.69)**	(-9.21)***	(-0.06)	(-0.66)	(1.56)	(-0.13)
S1-Upgrade minus B1-Upgrade		-8.27	-13.41	-15.32	-0.88	-0.25	1.74	1.34
		(-6.74)***	(-10.74)***	(-11.89)***	(-0.85)	(-0.25)	(1.87)*	(1.81)*
S1-Downgrade minus B1-Downgrade		-10.54	-15.94	-13.82	0.84	0.55	0.61	2.15
		(-9.35)***	(-15.59)***	(-11.11)***	(0.74)	(0.41)	(0.56)	(1.80)*
S1-Downgrade minus B1-Upgrade		-14.34	-23.97	-16.02	0.12	1.43	1.53	3.88
		(-10.80)***	-16.98	(-12.33)***	(0.10)	(0.97)	(1.18)	(3.27)***
S1-Upgrade minus B1-Downgrade		-4.47	-5.38	-13.12	-0.17	-1.13	0.82	-0.38
		(-4.72)***	(-6.26)***	(-10.07)***	(-0.19)	(-1.20)	(1.14)	(0.59)

Table VIII

Quarterly Average DGTW Adjusted Abnormal Returns (in Percent) sorted by Winner and Loser Funds

For each quarter *t* , funds are classified as winners or losers depending on whether their Carhart (1997) four-factor adjusted return over the past 12 months is above or below the sample average. Stocks in each performance classification are divided into two groups based on whether they experience a consensus downgrade or upgrade in the previous quarter, and then sorted into quintiles based on their *BHM* and *SHM* measures. Panels A and B present the time-series average quarterly abnormal returns for winner and loser funds, respectively. We report abnormal returns for the heavy buying (B1) and heavy selling (S1) portfolios. The portfolio "S1-Upgrade minus B1-Upgrade" represents a zero-investment portfolio that is long upgraded stocks that are heavily sold and short upgraded stocks that are heavily bought. "S1-Downgrade minus B1-Downgrade" is a zero-investment portfolio that is long downgraded stocks that are heavily sold and short downgraded stocks that are heavily bought. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Winner funds

Portfolios	Change in Consensus Recommendation	Qtr -2	Qtr -1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
B1	Downgrade	1.81	1.30	4.50	0.17	0.56	0.98	0.05
(Heavy buying)		(2.46)**	(1.69)*	(5.05)***	(0.29)	(0.76)	(2.06)**	(0.09)
	Upgrade	4.92	8.11	6.36	1.16	0.49	-0.02	1.10
		(5.48)***	(8.31)***	(6.68)***	(1.51)	(0.84)	(-0.04)	(2.03)**
S1	Downgrade	-0.83	-6.36	-5.55	-0.71	1.09	-0.54	0.80
(Heavy selling)		(-1.07)	(-5.48)***	(-5.58)***	(-0.75)	(1.04)	(-0.58)	(0.80)
	Upgrade	3.44	3.01	-5.54	-1.23	-0.07	-0.14	0.30
		(3.79)***	(3.18)***	(-5.25)***	(-1.80)*	(-0.11)	(-0.17)	(0.43)
S1-Upgrade minus B1-Upgrade		-1.48	-5.09	-11.90	-2.40	-0.57	-0.12	-0.79
		(-1.16)	(-3.67)***	(-6.61)***	(-2.29)**	(-0.70)	(-0.16)	(-1.00)
S1-Downgrade minus B1-Downgrade		-2.64	-7.66	-10.05	-0.88	0.54	-1.52	0.75
		(-2.37)**	(-4.52)***	(-6.07)***	(-0.88)	(0.42)	(-1.55)	(0.67)
S1-Downgrade minus B1-Upgrade		-5.75	-14.47	-11.91	-1.88	0.60	-0.52	-0.30
		(-4.72)***	(-8.42)***	(-7.01)***	(-1.43)	(-0.61)	(-0.54)	(-0.26)

Panel B: Loser funds								
Portfolios	Change in Consensus Recommendation	Qtr -2	Qtr -1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
B1	Downgrade	6.95	6.17	9.07	-0.49	0.26	-0.87	0.20
(Heavy buying)		(6.43)***	(7.71)***	(9.04)***	(-0.91)	(0.40)	(-0.98)	(0.26)
	Upgrade	11.91	13.66	8.82	1.04	0.44	-0.78	-1.59
		(7.41)***	(11.72)***	(8.29)***	(1.74)*	(0.66)	(-1.35)	(-3.12)***
S1	Downgrade	-5.24	-12.14	-8.53	0.10	-0.11	2.06	1.29
(Heavy selling)		(-6.23)***	(-17.47)***	(-9.04)***	(0.12)	(-0.16)	(2.22)**	(1.60)
	Upgrade	-1.78	-2.66	-7.64	0.61	0.16	0.98	0.88
		(-2.27)***	(-4.15)***	(-9.51)***	(0.85)	(0.22)	(1.66)	(1.52)
S1-Upgrade minus B1-Upgrade		-13.69	-16.32	-16.46	-0.43	-0.28	1.76	2.46
		(-7.07)***	(-13.19)***	(-10.59)***	(-0.46)	(-0.29)	(2.16)***	(4.01)***
S1-Downgrade minus B1-Downgrade		-12.19	-18.31	-17.59	0.59	-0.37	2.93	1.09
		(-7.76)***	-16.90	(-12.31)***	(0.61)	(-0.44)	(2.26)***	(1.01)
S1-Downgrade minus B1-Upgrade		-17.15	-25.80	-17.34	-0.94	-0.55	2.84	2.88
		(-8.53)***	(-17.38)***	(-11.03)***	(-0.98)	(-0.61)	(2.56)***	(3.51)***

Table IX

Buy-Herding, Sell-Herding, and Other Investment Signals

We regress *BHM* and *SHM* on analyst recommendation revisions with controls for other quantitative investment signals. Columns 1 and 2 presents results using only those signals that have been found in prior research to affect analyst revisions. Columns 3 through 4 present results using all investment signals. *CHGREC* is the prior-quarter change in the consensus recommendation. *SIZERANK* is a stock's size percentile ranking based on NYSE size breakpoints as of the beginning of quarter *t*. *ULEVEL* and *DLEVEL* are indicator variables, which equals "1" for those stock-quarters with consecutive strong buy and strong sell consensus recommendations between the two previous quarters, respectively; "0" otherwise. *LAGBUY (LAGSELL)* equals "1" if the stock is also classified as a buy-herding (sell-herding) stock in the previous quarter; "0" otherwise. *ADD (DROP)* equals "1" if the stock has been added (or dropped) from the S&P 500 index in the previous quarter; "0" otherwise. *DISP* is the standard deviation of all outstanding earnings forecasts in quarter $t-1$, scaled by stock price as at the end of quarter $t-1$. *RETP* and *RET2P*, are the cumulative market-adjusted return during months -6 through -1 and months -12 through -7, respectively, prior to the last month of quarter $t-1$. *FREV* is the sum of monthly analyst earnings forecast revisions scaled by stock price over the 6 months prior to the last month of quarter $t-1$. *SUE* is unexpected earnings over the past four quarters, scaled by the time-series standard deviation of unexpected quarterly earnings over the past eight quarters. *BM* is the log of each stock's book-to-market ratio at the end of quarter $t-1$; *EP* is the average earnings-to-price ratio during the past four quarters. *LTG* is the average analyst long-term growth forecast as of the last month of quarter $t-1$. *SG* is the average sales growth rate over the past four quarters. *TA* is total accounting accruals during the past four quarters, scaled by average total assets. *CAPEX* is capital expenditures during the past four quarters, scaled by average total assets. *SIZE* is the logarithm of beginning of quarter market capitalization. *RET* is prior-quarter stock return. *STD* is stock return volatility, which is the standard deviation of daily returns over the past 12 months. *TURN* is turnover, which equals the average daily trading volume over the past 12 months deflated by shares outstanding. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

	BHM (1)	*SHM* (2)	*BHM* (3)	*SHM* (4)
Intercept	0.0214	-0.0221	0.0209	-0.0223
	(1.92)*	(-2.43)**	(1.82)*	(-2.51)**
CHGREC	0.0075	-0.0149	0.0073	-0.0144
	(2.96)***	(-5.85)***	(2.90)***	(-5.56)***
CHGREC × *SIZERANK*	-0.0067	0.0146	-0.0064	0.0138
	(-1.58)	(3.61)***	(-1.51)	(3.38)***
ULEVEL	0.0129	0.0002	0.0129	0.0012
	(3.18)***	(0.06)	(3.22)***	(0.34)
DLEVEL	0.0113	0.0052	0.0115	0.0049
	(1.15)	(0.92)	(1.17)	(0.87)
LAGBUY	0.0111		0.0111	
	(8.56)***		(8.55)***	
LAGSELL	-	0.0105		0.0103
		(8.36)***		(8.16)***
ADD	-0.0032	-0.0063	-0.0032	-0.0074
	(-0.34)	(-1.07)	(-0.34)	(-1.26)
DROP	-0.0028	-0.0048	-0.0026	-0.0044
	(-0.48)	(-0.39)	(-0.46)	(-0.36)

	BHM (1)	*SHM* (2)	*BHM* (3)	*SHM* (4)
DISP	0.1841 (2.11)**	0.2501 (2.31)**	0.1995 (2.17)**	0.2815 (2.62)**
RETP	0.0291 (12.19)***	-0.0387 (-9.17)***	0.0293 (12.30)***	-0.0396 (-9.17)***
RET2P	-	-	-0.0007 (-0.39)	-0.0031 (-1.31)
FREV	0.3932 (2.47)**	-0.3503 (-3.38)***	0.3869 (2.47)**	-0.3338 (-3.28)***
SUE	-0.0021 (-5.14)***	0.0015 (2.63)**	-0.0020 (-5.05)***	0.0015 (2.67)**
BM	0.0015 (1.39)	-0.0024 (-2.20)**	0.0015 (1.32)	-0.0027 (-2.58)**
EP	-0.1154 (-3.65)***	0.0295 (-0.68)	-0.1166 (-3.66)***	0.0253 (0.58)
LTG	0.0002 (2.40)**	0.0001 (0.86)	0.0003 (2.69)**	0.0001 (0.70)
SG	0.0036 (4.45)***	-0.0003 (-0.27)	0.0037 (4.38)***	-0.0003 (-0.30)
TA	-	-	0.0030 (0.42)	0.0122 (1.45)
CAPEX	-	-	-0.0090 (-1.19)	0.0045 (0.70)
SIZE	-0.0009 (-1.20)	0.0008 (1.38)	-0.0008 (-1.09)	0.0008 (1.40)
STD	0.1202 (1.42)	0.7816 (7.68)***	0.1213 (1.42)	0.7744 (7.89)***
TURN	-0.0010 (-1.45)	0.0067 (9.24)***	-0.0010 (-1.41)	0.0069 (9.61)***
R-squared	0.0489	0.1072	0.0500	0.1091

Table X

Multivariate Regressions of Buy-Herding and Sell-Herding on Consensus Earnings Forecast Revisions

We present regression results of buy-herding and sell-herding on consensus forecast revisions. All models are estimated using quarterly Fama-Macbeth regressions. Columns 1 and 2 presents results for equation (1). Columns 3 and 4 present results for the incremental trading response to revisions conditional on a stock's size ranking. Columns 5 and 6 present results while controlling for analyst recommendation revisions. *CHGREV* is the prior-quarter change in the consensus earnings forecast, scaled by stock price at the beginning of quarter $t-2$. *SIZERANK* is a stock's size percentile ranking based on NYSE size breakpoints as of the beginning of quarter t. *CHGREC* is the prior-quarter change in the consensus recommendation. *ULEVEL* and *DLEVEL* are indicator variables, which equals "1" for those stock-quarters with consecutive strong buy and strong sell consensus recommendations between the two previous quarters, respectively; "0" otherwise. *LAGBUY* (*LAGSELL*) equals "1" if the stock is also classified as a buy-herding (sell-herding) stock in the previous quarter; "0" otherwise. *ADD* (*DROP*) equals "1" if the stock has been added (or dropped) from the S&P 500 index in the previous quarter; "0" otherwise. *DISP* is the standard deviation of all outstanding earnings forecasts in quarter $t-1$, scaled by stock price as at the end of quarter $t-1$. *SIZE* is the logarithm of beginning of quarter market capitalization. *RET* is prior-quarter stock return. *BM* is the logarithm of the ratio of book value (Compustat quarterly data item 59) to market value of equity (Compustat quarterly data item 14 times data item 61) as of the most recent fiscal quarter that an earnings announcement is made. *STD* is stock return volatility, which is the standard deviation of daily returns over the past 12 months. *TURN* is turnover, which equals the average daily trading volume over the past 12 months deflated by shares outstanding. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

	Model 1		Model 2		Model 3	
	BHM	*SHM*	*BHM*	*SHM*	*BHM*	*SHM*
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.0433	-0.0338	0.0451	-0.0380	0.0408	-0.0289
	(3.88)***	(-3.94)***	(4.06)***	(-3.42)***	(3.76)***	(-3.42)***
CHGREV	0.1933	-0.2421	0.3107	-0.4500	0.4186	-0.5292
	(3.71)***	(-3.95)***	(2.57)**	(-5.57)***	(3.48)***	(-4.89)***
CHGREV × *SIZERANK*	-	-	-0.3113	0.6456	-0.4948	0.7236
			(-1.73)*	(3.36)***	(-2.34)**	(3.23)***
CHGREC	-	-	-	-	0.0027	-0.0058
					(2.99)***	(5.30)***
ULEVEL	-	-	-	-	0.0133	0.0007
					(3.33)***	(0.20)
DLEVEL					0.0099	0.0039
					(1.09)	(0.77)
LAGBUY	0.0129	-	0.0129	-	0.0118	-
	(11.54)***		(11.65)***		(9.00)***	
LAGSELL	-	0.0122	-	0.0122	-	0.0111
		(9.80)***		(9.88)***		(9.53)***
ADD	-0.0042	-0.0062	-0.0044	-0.0066	-0.0023	-0.0071
	(-0.48)	(-1.14)	(-0.50)	(-1.22)	(-0.25)	(-1.29)
DROP	-0.0083	0.0027	-0.0084	0.0031	-0.0051	0.0024
	(-1.26)	(0.22)	(-1.29)	(0.25)	(-0.82)	(0.21)
DISP	0.1843	0.1794	0.1843	0.1535	0.4930	-0.0028
	(2.05)**	(2.17)**	(2.05)**	(1.88)*	(5.17)***	(-0.02)
RET	0.0467	-0.0628	0.0467	-0.0629	0.0445	-0.0614
	(15.02)***	(-12.56)***	(15.02)***	(-12.60)***	(13.47)***	(-11.56)***
SIZE	-0.0025	0.0017	-0.0026	0.0021	-0.0022	0.0015
	(-3.38)***	(3.20)***	(-3.58)***	(3.84)***	(-3.13)***	(2.79)***
BM	-0.0035	0.0009	-0.0032	0.0010	-0.0031	0.0011
	(-2.99)***	(0.95)	(-2.99)***	(1.09)	(-2.79)***	(1.06)
STD	0.1703	0.8581	0.1743	0.8493	0.1132	0.8601
	(2.03)**	(8.30)***	(2.05)	(8.14)***	(1.37)	(8.62)***
TURN	0.0001	0.0062	0.0000	0.0063	0.0000	0.0059
	(0.06)	(7.91)***	(0.02)	(8.18)***	(-0.04)	(7.91)***
R-squared	0.0425	0.1020	0.0428	0.1032	0.0461	0.1063

Table XI

Quarterly Average DGTW Adjusted Abnormal Returns (in Percent) for Earnings Forecast Revision- and Herding-Sorted Portfolios

We present the price impact results of herding on consensus forecast revisions. Consensus revisions in the top 33% of the sample are classified as upward (Up) revisions; consensus revisions in the bottom 33% are classified as downward (Down) revisions. The quarterly abnormal return for each portfolio is calculated using DGTW (1997) characteristic-based benchmark portfolio returns. The time-series average quarterly abnormal returns for the heavy buying (B1) and heavy selling (S1) portfolios, calculated across all 38 formation quarters,are presented below with their *t*-statistics in parentheses. The portfolio "S1-Up minus B1-Up" represents a zero-investment portfolio that buys upward revision stocks that are heavily sold by mutual funds and sells upward revision stocks that are heavily bought by mutual funds. "S1-Down minus B1-Down" is a zero-investment portfolio that buys downward revision stocks that are heavily sold by mutual funds and sells downward revision stocks that are heavily bought by them. The symbols, *, **, and ***, indicate significance at the 10%, 5%, and 1% levels, respectively.

Portfolios	Change in Consensus Earnings Forecast	Qtr -2	Qtr -1	Portfolio Formation Quarter	Qtr +1	Qtr +2	Qtr +3	Qtr +4
B1	Down	0.91	6.75	11.48	0.43	-1.02	-0.53	-1.07
(Heavy buying)		(0.83)	(3.62)***	(7.55)***	(0.61)	(-1.36)	(-0.78)	(-1.69)*
	Up	14.85	19.12	13.79	0.69	-0.25	-0.76	-1.47
		(11.73)***	(12.82)***	(10.35)***	(1.39)	(-0.44)	(-1.34)	(-3.00)***
S1	Down	-10.58	-17.46	-9.88	0.15	1.09	1.71	2.29
(Heavy selling)		(-10.58)***	(-22.52)***	(-9.61)***	(0.11)	(0.96)	(1.62)	(2.03)**
	Up	3.24	0.15	-12.25	-0.99	0.77	1.08	0.80
		'(3.84)***	(0.17)	(-11.25)***	(-1.16)	(0.89)	(1.04)	(0.86)
S1-Up minus B1-Up		-11.60	-18.97	-26.04	-1.68	1.02	1.84	2.27
		(-6.80)***	(-11.16)***	(-12.98)***	(-1.79)*	(-0.97)	(1.61)	(2.62)**
S1-Down minus B1-Down		-11.49	-24.21	-21.36	-0.28	2.11	2.24	3.36
		(-7.95)***	(-11.86)***	(-11.04)***	(-0.17)	(1.86)*	(1.96)*	(2.38)**
S1-Down minus B1-Up		-25.43	-36.59	-23.66	-0.54	1.34	2.47	3.76
		(-14.90)***	(-22.59)***	(-13.14)***	(-0.36)	(-1.03)	(1.89)*	(3.03)***

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