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

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This paper documents that mutual funds "herd" (trade together) into stocks with consensus sell-side analyst upgrades, and herd out of stocks with consensus downgrades. This influence of analyst recommendation changes on fund herding is stronger for downgrades, and among managers with greater career concerns. These findings indicate that career-concerned managers are incentivized to follow analyst information, and that managers have a greater tendency to herd on negative stock information, given the greater reputational and litigation risk of holding losing stocks. Furthermore, starting in the mid-1990s (when aggregate mutual fund equity ownership is significantly higher), stocks traded by career-concerned herds of fund managers in response to analyst recommendation changes experience a significant same-quarter price impact, followed by a sharp subsequent price reversal. Our evidence suggests that analyst recommendation revisions induce herding by career-concerned fund managers, and that this type of trading has become price destabilizing with the increasing level of mutual fund ownership of stocks.

Key words: mutual fund herding; analyst recommendations; return reversals; managerial myopia
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1. Introduction

A large body of literature documents that sell-side analyst research has investment value (see, e.g., Stickel 1995, Womack 1996, Barber et al. 2001, Jegadeesh et al. 2004). Furthermore, existing evidence suggests that analyst opinions may be especially useful for large investors. For example, O'Brien and Bhushan (1990) and Frankel et al. (2006) show that institutional ownership is a key determinant of the demand for sell-side research and its informativeness. And, Cowen et al. (2006) and Ljungqvist et al. (2007) show that analyst opinions are less biased and timelier in the presence of institutional clients.

For their part, institutional investors use information generated by stock analysts, both internal (buy side) and external (sell side), as important inputs to their investment decisions. Larger management companies, such as Fidelity, maintain large pools of in-house industry specialists; however, most management companies are too small to conduct comprehensive in-house research, making them especially dependent on the sell side. Furthermore, mutual fund managers have added incentives to use analyst information. Specifically, the guidance provided by sell-side analysts helps to satisfy the prudent man rule that governs mutual fund managers—which suggests that even portfolio managers with in-house analysts pay attention to sell-side analyst opinions.[1] For example, even money managers at large fund complexes like Fidelity acknowledge that they monitor sell-side analyst opinions regularly—especially during the perilous days surrounding corporate scandals at firms such as Enron and Tyco (Healy 2002).[2] As the equity-investing chief of Fidelity highlights when explaining why his colleagues might check in regularly with sell-side analysts (Santoli 2007, p. L8),

> We do value sell-side research. We're wholly engaged in a dialogue with our research providers. We want inputs into the mosaic of what makes a stock go up or down.

In this paper, we explore whether mutual fund managers trade together (as "herds") in response to

[1] O'Brien and Bhushan (1990) cite several court cases in which funds refer to their use of sell-side analyst information as evidence that they follow prudent investment guidelines.

[2] Around 2005, Fidelity paid Lehman Brothers about $7 million a year for its U.S. equity research (Craig and Lauricella 2005).

the release of sell-side analyst information—in particular, analyst recommendation revisions.[3] Because the investment value of analyst research is known to be somewhat short-lived (e.g., less than one year), mutual funds wishing to capitalize on analyst information must react reasonably quickly to the issuance of a revision. If these funds are acting in concert, we expect that analyst revisions would lead to a herd of mutual funds trading over the next several weeks or even months.[4] We focus on the trades of mutual fund managers, since prior research has shown that, among institutional investors, mutual fund managers are most likely to exhibit herding behavior (Nofsinger and Sias 1999) because of their greater concerns with peer-relative performance.

In addition, since analyst recommendation revisions and mutual fund herding have each been documented to exert an impact on stock prices (e.g., Womack 1996, Wermers 1999), we are especially interested in determining whether mutual fund herding triggered by analyst recommendation revisions represents a price stabilizing or destabilizing force. Specifically, depending on what motivates managers to follow analyst information, the stock recommendation revisions of analysts may elicit fund herding that is more (or less) related to stock valuation fundamentals.

Our study presents several basic results that suggest a strong connection between analyst research and mutual fund herding. First, during our sample period of 1985 to 2008, we find that mutual fund herds are more likely to buy stocks following a consensus analyst upgrade, and (especially) to sell stocks following a downgrade. This relation between analyst recommendation revisions and fund herding remains strong even after controlling for stock characteristics known to influence both fund trading and analyst revisions, such as return momentum and earnings surprises.

We further examine the conditions under which fund managers are particularly likely to follow analyst recommendations. Froot et al. (1992) present a model suggesting that investors with short horizons will tend to overinvest in some informative signals that are likely to be used by other investors, and to be impounded into stock prices more quickly (e.g., analyst recommendations). In our setting, we expect managers with greater near-term career concerns to react more strongly to potentially informative analyst revisions, since it is well documented that analyst information has short-term investment value (Womack 1996, Barber et al. 2001).

Our empirical results show that mutual fund herds react much more strongly to analyst downgrades than upgrades, suggesting that fund managers know that downgrades are more informative than upgrades, and that they may find more comfort in following "prudent investment guidelines" in response to negative stock information due to its higher potential for triggering lawsuits (e.g., the large number of lawsuits against portfolio managers following the collapse of Enron). In addition, we expect that fund managers sell on downgrades because they suffer greater reputational harm when they are revealed to be holding a "disaster stock" (such as Enron). To directly investigate the career concerns hypothesis, we further compare the sensitivity of herding to analyst information across fund managers with varying degrees of reputational concerns. Using both managerial tenure (at a particular fund) and Morningstar star ratings as (negatively signed) proxies for career concerns, we find that career-concerned managers react much more strongly to analyst revisions than other managers.[5]

To establish, with greater precision, that mutual funds trade in reaction to analyst revisions, we use high-frequency (daily) mutual fund trading data on a subset of mutual funds obtained from Ancerno (formerly a unit of Abel Noser Corp.) over the 1998–2008 period to examine the pattern of fund trading around analyst recommendation revision events. Although there is some indication of fund trading in the direction of analyst revisions during the four-day period prior to the release of analyst reports, consistent with prior-documented analyst tipping (Irvine et al. 2007), the evidence indicates that fund trading *after* analyst revision releases is much stronger, both economically and statistically. Specifically, consistent with the lower-frequency (but much more complete) Thomson quarterly holdings data used in most of our paper, the high-frequency Ancerno trade data indicate that funds respond significantly to analyst revisions on the *day* of the revision. Further, funds exhibit larger

[3] We focus on recommendation revisions, since prior research shows that the predictive value of stock recommendation revisions is higher than that of recommendation levels (e.g., Jegadeesh et al. 2004), and that analyst recommendation revisions also have greater investment value than analyst earnings forecast revisions (e.g., Francis and Soffer 1997, Asquith et al. 2005). In an earlier draft of this paper, we find a similar, but slightly weaker, response of fund herding to consensus analyst earnings forecast revisions.

[4] Most mutual funds cannot react fully and immediately to new information, because they hold very large positions that take several weeks or even months to unwind (see, e.g., Wermers 2001). On the buy side, unexpected outflows can further delay the process of freeing up capital.

[5] This finding also helps to alleviate the concern that the observed fund herding on analyst information is driven solely by common valuation signals received by both analysts and fund managers, since career-concerned managers with poor performance likely possess less private value-relevant information than other managers, yet they react more strongly after analyst revisions, indicating that it is the revision itself that is responsible.

aggregate imbalances of buys relative to sells following upgrades relative to downgrades, for at least three months following the initial revision.

Since prior studies find mixed evidence on stock returns following institutional trading in response to analyst information releases (see, e.g., Mikhail et al. 2007, Busse et al. 2012), we further examine this issue in the context of mutual fund herding.[6] First, we find that mutual fund herding during quarter t is associated with a same quarter "price-pressure" effect on the stock: buy herds push stock prices up, and sell herds push prices down. However, when we condition these instances of herding on the direction of prior quarter analyst revisions, we find that herding in the same direction as analyst recommendation revisions results in a return reversal during the four-quarter period of quarters $t+3$ through $t+6$. For example, during 1997–2008, a one standard deviation decrease in the consensus analyst recommendation, followed by a 10% higher count of the number of funds selling a stock (as a proportion of those funds buying or selling, relative to the average proportion across all stocks during that quarter), results in a significantly positive abnormal return of about 1.4% for that stock during quarters $t+3$ to $t+6$. Further, a one standard deviation increase in the consensus recommendation, followed by a 10% greater proportion of funds buying, results in a significantly negative abnormal return of -0.5% during the same four quarters. This finding indicates that fund managers may often overreact to recommendation revisions and push prices out of equilibrium.

Further exploration finds a structural shift in the effect of analyst revision-induced mutual fund herding on stock returns: this reversal effect is stronger during the second half of our sample period (1997–2008). We show that this difference can be attributed to the dramatically increased aggregate mutual fund ownership of the average stock (over 25% by 2008) during the latter period, which magnifies the effect of herding behavior on stock prices. Furthermore, even during the earlier 1985–1996 period, we find that stocks with high mutual fund ownership also experience significant return reversals associated with analyst revision-prompted fund herding. These findings are robust to controlling for other potential sources of return reversals, such as the value effect and concentrated mutual fund trading forced by extreme money flows (Coval and Stafford 2007).

[6] Mikhail et al. (2007) and Busse et al. (2012) examine the performance of institutional trades following analyst revisions for short horizons that range from a few days to three months and find mixed evidence. In contrast, our paper studies the longer-term impact (up to two years) of *career-concerned* mutual fund manager herding in reaction to analyst revisions.

Since fund herding in response to analyst revisions appears to be price destabilizing, we explore whether its price impact is mostly attributed to herding driven by nonfundamental information related incentives, such as the above-mentioned short-term career concerns of some fund managers. As discussed earlier, managers with career concerns are more likely to herd on analyst revisions for reasons unrelated to valuation fundamentals, or to overreact to analyst information. Therefore, we expect their herding on analyst revisions to be less value relevant in setting stock prices, resulting in stronger subsequent return reversals of the initial price impact.

Consistent with this conjecture, we find that the return reversals we document are primarily concentrated in stocks traded (in response to analyst revisions) by managers with shorter tenure or funds with low Morningstar rankings, suggesting that the reversals are largely attributable to trading by managers with short-term career concerns—who often overreact to analyst revisions. Therefore, trading in response to analyst recommendations, per se, does not appear to be price destabilizing; rather, we find that the overreaction to analyst revisions by career-concerned managers is chiefly responsible for the observed return reversals. This finding supports the recent theoretical prediction in Dasgupta et al. (2011b) that the reputational concerns of fund managers may cause institutional herding to positively predict short-term returns, but negatively predict long-term returns.

Our study of analyst recommendation revisions and the resulting mutual fund herding contributes to the literature by demonstrating that the concerted activities of sell-side analysts and money managers, particularly those who strongly follow analysts due to career concerns, can potentially destabilize the market for some stocks. Although analyst recommendations, by themselves, are generally found to be valuable, they may be inadvertently associated with a price destabilizing effect if some institutional investors with career concerns overreact to their signals of valuation. In addition, we add to the stock-price predictability literature by identifying a clear mechanism through which stock prices are significantly destabilized. Several papers have developed theories of how fund managers with career concerns may preclude the efficient use of stock pricing information (e.g., Scharfstein and Stein 1990, Froot et al. 1992), but our study, to the best of our knowledge, is the first to empirically demonstrate a mechanism through which this occurs.

2. Data Description and Research Methodology

2.1. Data Description

We construct our main sample of mutual fund trading using the Thomson Reuters mutual fund holdings

database. Thomson Reuters provides quarter-end filings of portfolio holdings for all U.S.-based mutual funds—we infer trades (buys and sells) from changes in the quarterly positions for each fund.[7] To make our study comparable with the existing literature, we include only actively managed, diversified U.S. domestic equity funds.[8] Since our hypotheses focus on mutual fund herding on analyst revisions (as opposed to analyst revisions in response to mutual fund herding), it is important to pin down the exact quarter in which fund trades occur. Therefore, we concentrate on quarterly filings of holdings.[9] Our sample period is from 1985 to 2008. For some of our analyses of the price impact of mutual fund herding, we focus on the second half of the sample period, when equity mutual funds account for a significantly larger market share, and potentially have a more pronounced impact on stock prices through their trades.

We obtain the analyst recommendation data from the Zacks consensus history file.[10] For ease of interpretation, we reverse the standard five-point scale of Zacks recommendations so that an increased value indicates an upgrade, and a decreased value indicates a downgrade. Using quarter-end consensus recommendations to compute the revision (*Revision*), we classify stocks into three groups: "upgrade," "downgrade," or "no change." We consider a prior consensus recommendation record as valid if it is dated within the past 90 days when computing recommendation changes.[11] Finally, we obtain monthly stock information from the Center for Research in Security Prices (CRSP) monthly stock files and financial information from Compustat.

Given our interest in analyst revision-induced herding, we exclude stocks that are newly issued within the prior four quarters, since such stocks are likely to be traded in common by funds for reasons that are unrelated to analyst revisions.[12] We exclude all stocks with a price below \$5, since they are generally illiquid and are likely to have scarce fund holdings and analyst coverage.

Panel A of Table 1 presents a count of the number of stocks traded by at least a given number of mutual funds during the fourth quarter of each year shown. It is clear that large groups of mutual funds simultaneously trade the same stocks more frequently over time, which might be expected, given that the number of funds has increased (proportionately) faster than the number of stocks (and that individual fund turnover has increased). For example, the number of stocks covered by analysts and traded by at least 100 funds increases from 1 during the fourth quarter of 1988 to 518 during the fourth quarter of 2008. These observations suggest that mutual fund trading has become more important in setting stock prices over time.

2.2. Measuring Herding

Various papers have proposed theories of herding by agents (see, e.g., Scharfstein and Stein 1990, Bikhchandani et al. 1992, Froot et al. 1992, Hirshleifer et al. 1994, Falkenstein 1996). Empirically, we can only observe mutual funds trading together, and we cannot directly observe whether they are engaging in mimicry (Scharfstein and Stein 1990), herding on the same information (Froot et al. 1992), receiving the same information at different points in time (Hirshleifer et al. 1994), or simply exhibiting a preference for similar stocks (Falkenstein 1996). Thus, we follow prior papers that measure "empirical herding" as "correlated trading in excess of random occurrences," where funds are assumed (under the null hypothesis) to trade independently, cross sectionally, and over time.

Our main empirical measure of herding is the Lakonishok et al. (1992; henceforth LSV) metric, which has been widely used in past papers (e.g., Grinblatt et al. 1995, Wermers 1999). The LSV measure of herding in stock i during quarter t (HM_{it}) is

$$HM_{it} = |p_{it} - E[p_{it}]| - E|p_{it} - E[p_{it}]|, \qquad (1)$$

where p_{it} is the proportion of mutual funds buying stock i during quarter t, relative to the total number of funds trading that stock during that quarter; $E[p_{it}]$ is the expected proportion of stock i buys

[7] Prior to 2004, mutual funds were required to report their holdings with a semiannual frequency. However, more than 50% of the funds voluntarily reported their holdings with a quarterly frequency. Existing studies (see, e.g., Musto 1999, Ge and Zheng 2006, Agarwal et al. 2013) find that funds with a lower disclosure frequency include both those with an information advantage and those with greater agency problems. Empirically, we find (in an earlier version of this paper) that including funds with semiannual reporting does not substantially change our results.

[8] We exclude all trades by index funds, international funds, municipal bond funds, bond and preferred funds, sector funds, and funds that cannot be linked to the CRSP mutual fund database via the Mutual Fund Links data set available from Wharton Research Data Services (almost all U.S. domestic equity funds have links available).

[9] For funds that do not report quarterly holdings at calendar quarter ends, we carry their holdings forward to the next calendar quarter end. For example, holdings reported on February 28 are assumed to be valid until March 31. Our results do not change materially if we drop those fund-quarter observations.

[10] We use the consensus history file because the detailed file that Zacks provides to academics excludes 12 large brokerage houses, such as Merrill Lynch, Morgan Stanley, Bear Stearns, and J.P. Morgan. These exclusions hinder our analysis because recommendations issued by analysts from these large brokerage firms are potentially more influential. By contrast, Credit Suisse First Boston is the only brokerage firm excluded from the Zacks consensus file.

[11] The median gap between the date of the consensus recommendation revision and the quarter end date is 24 days in our sample.

[12] For delisted stocks, we use their delisting returns adjusted for the delisting bias according to Shumway (1997).

Table 1 Summary Statistics

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

Year/quarter:	1988/4	1992/4	1996/4	2000/4	2004/4	2008/4
Proportion of buys (%)	48.44	55.28	55.76	54.93	53.62	45.90
No. of stocks traded by at least						
$\geq$ 5 funds	1,012	1,316	2,271	2,227	2,188	2,081
$\geq$ 10 funds	611	813	1,641	1,888	2,046	1,971
$\geq$ 20 funds	249	336	952	1,370	1,791	1,742
$\geq$ 30 funds	135	170	597	1,055	1,554	1,521
$\geq$ 50 funds	19	39	257	648	1,124	1,146
$\geq$ 100 funds	1	2	50	231	450	518
$\geq$ 200 funds	0	0	1	67	126	126

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

	Mean	Median	Std. dev.	25th	75th
HM (in %)	3.330	1.273	10.603	−4.229	8.749
BHM (in %)	2.874	1.372	9.685	−5.117	8.651
SHM (in %)	3.783	1.262	11.608	−3.674	9.367
ADJHERD (in %)	−3.435	−0.568	19.806	−17.695	11.606
No. of funds trading	32.326	22.401	31.602	12.240	39.990
Revision	−0.011	−0.002	0.319	−0.147	0.134
No. of recommendations	10.755	9.104	6.957	5.411	14.844
Ret	0.054	0.036	0.211	−0.067	0.150
CumRet	0.275	0.158	0.624	−0.050	0.429
SUE	0.179	0.104	1.357	−0.651	0.867
Add_Drop	0.003	0	0.058	0	0
HM (in %): 1985–1996	2.978	0.882	11.396	−5.522	9.313
HM (in %): 1997–2008	3.683	1.664	9.809	−2.937	8.185
ADJHERD (in %): 1985–1996	−3.311	−0.802	19.829	−16.941	11.394
ADJHERD (in %): 1997–2008	−3.560	−0.334	19.782	−18.448	11.817

Notes. Panel A presents the number of stocks that are traded by (at least) a certain number of funds during the period of 1985 to 2008 in four-year intervals. It also presents the proportion of stock trades that are buys. Panel B presents summary statistics for the herding measures, analyst recommendation revisions, and our control variables. Statistics for the number of funds trading and the number of recommendations in a given quarter are also reported. *HM*, *BHM*, *SHM*, and *ADJHERD* are presented in percentage. *Revision* is the prior-quarter change in the consensus recommendation. *Ret* is stock return in the prior quarter. *CumRet* is the cumulative return during the 12-month period preceding the measurement quarter for *Ret*. *SUE* is the unexpected earnings for the most recent quarter relative to earnings four quarters before, scaled by the standard deviation of earnings over the prior six quarters. *Add_Drop* is a discrete variable indicating S&P membership, which takes the value of 1 if the stock was added to the index during the quarter, −1 if it was dropped from the index, and 0 otherwise. Summary statistics of *HM* and *ADJHERD* over the two subperiods are separately presented at the bottom of panel B.

during quarter t, as proxied by the proportion of all fund trades (of all stocks) that are buys during quarter t. The expression $E|p_{it} - E[p_{it}]|$ is an adjustment factor that controls for random variation around the expected proportion of buys, under the null hypothesis of random and independent trading by mutual funds.[13] Therefore, HM_{it} captures similarity in trading activity among a group of funds above that expected to result from random occurrences of same-side trading in the same stocks.[14]

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

$$BHM_{it} = HM_{it} \mid p_{it} > E[p_{it}], \tag{2}$$

$$SHM_{it} = HM_{it} \mid p_{it} < E[p_{it}]. \tag{3}$$

Finally, to capture the case where the direction of herding changes from one period to another for a specific stock, we construct an "adjusted herding measure" (*ADJHERD*), which combines the buy- and sell-herding measures. Specifically, for each quarter and within each group of buy-herding (or sell-herding) stocks, we subtract the minimum value of *BHM* (or, alternatively, *SHM*) from each stock's *BHM* (or *SHM*), so that the differenced herding measure is always nonnegative. We then set *ADJHERD* equal to the differenced value of *BHM* if the stock is a buy-herding

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

[14] It is important to note that *HM* is a count-based measure of trading. Sias et al. (2006) find evidence that count measures are better predictors of returns than dollar-based measures.

stock, and equal to −1 times the differenced value of *SHM* if the stock is a sell-herding stock during the quarter. Thus, a large positive (negative) *ADJHERD* measure indicates that the stock is heavily bought (sold) by herds of funds.[15]

Panel B of Table 1 presents summary statistics for herding and analyst recommendation measures. The mean level of herding ($\overline{HM}$) across all stock quarters is 3.3%, and the average levels of buy herding ($\overline{BHM}$) and sell herding ($\overline{SHM}$) are 2.9% and 3.8%, respectively, indicating that funds herd more strongly on the sell side. These statistics are comparable to those in earlier studies on mutual fund herding (e.g., Wermers 1999). Finally, to investigate whether mutual fund herding has changed over time as the fund industry expands, we separately report summary statistics of *HM* and *ADJHERD* for two equal-length subperiods: 1985–1996 and 1997–2008. The results at the bottom of the panel show that the intensity of herding is slightly higher during the recent period.

2.3. Control Variables

Since we are interested in the influence of analyst revisions on buy versus sell herding, we control for factors that may affect the direction as well as the magnitude of herding. Prior studies suggest that mutual fund herding is magnified in stocks with extreme prior returns (e.g., Wermers 1999, Sias 2004). We thus control for stock returns in the quarter immediately prior to the quarter in which we measure herding (*Ret*), as well as the cumulative returns over the 12 months preceding quarter $t-1$ (*CumRet*). We expect *ADJHERD* to be increasing with past returns, because higher past returns lead to greater buy (sell) herding. Previous studies find that the frequency of analyst reports is sharply higher around earnings announcements than on other days (see, e.g., Ivković and Jegadeesh 2004). To account for the possibility that mutual funds herd in response to earnings news as opposed to changes of analyst opinions, we include the standardized unexpected earnings (*SUE*) as an additional control variable. *SUE* is measured as the unexpected earnings for the most recent quarter relative to earnings four quarters prior, scaled by its standard deviation over the prior six quarters. Finally, we control for the effect of indexing by funds. Although our sample excludes index funds, funds that are "closet indexers" or funds that benchmark a portion of their holdings against major indexes may trade in the same direction following index changes. To mitigate this effect, we extract historical compositions of the S&P 500 index (the benchmark used by the great majority of funds) from CRSP, and create an indicator variable, denoted *Add_Drop*, which takes the value of 1 if the stock was added to the index, −1 if it was dropped from the index, and 0 otherwise. Summary statistics for these control variables are presented in Panel B of Table 1.

3. The Effect of Analyst Revisions on Mutual Fund Herding

3.1. Mutual Fund Herding and Analyst Recommendation Revisions

To test our hypothesis concerning the effect of analyst revisions on mutual fund herding, we first examine the trading imbalance of mutual funds before and after analyst revisions. Specifically, during each quarter, we classify a stock as a downgrade, no change, or upgrade stock, based on the change in the consensus analyst recommendation for that stock from the beginning to the end of that quarter. We then compute each stock's proportion of mutual fund trades that are buys (versus sells) during the quarter of the analyst revision, the quarters prior to the revision, and the quarters following the revision.

Table 2 shows that when analysts downgrade a stock, mutual fund purchases account for 52.1% of their trades during the same quarter. However, when analysts upgrade a stock, mutual fund purchases account for 56.1% of trades. In fact, there exists a monotonic relationship between analyst revisions (downgrades, no change, and upgrades) and the proportion of buys (52.1%, 54.7%, and 56.1%, respectively). We next examine mutual fund trading imbalances during the six quarters ($t+1$ to $t+6$) following analyst revisions. Similar to the pattern for quarter t, we find that the proportion of quarter $t+1$ mutual fund buys monotonically increases with the change in the consensus recommendation during the prior quarter. Specifically, during quarter $t+1$, the proportion of buys is 3.23% higher following prior-quarter upgrades, as compared to downgrades. This difference in the fund trading response to upgrades versus downgrades is almost as large as that for quarter t (3.98%), suggesting that a significant part of the fund trading reaction to analyst revisions is delayed until quarter $t+1$.[16] This is likely due to the difficulty experienced by most mutual funds in changing their portfolio weights rapidly (Wermers 2001). We also find that the positive relation between quarter t analyst revisions and subsequent mutual fund net buying becomes significantly weaker over time, and eventually becomes insignificant during quarter $t+3$.

[15] Note that our results remain qualitatively similar if we replace *ADJHERD* with the (unadjusted) proportion of mutual funds buying a stock during a specific quarter (*p*). These two measures have a correlation greater than 90%.

[16] Note that the trading response of 3.98% for quarter t should be interpreted with caution because it may also capture same-quarter fund herding occurring prior to analyst revisions.

Table 2 Analyst Revisions and Mutual Fund Trading Imbalance

	Proportion of buys (%)			
	Downgrades	No change	Upgrades	Upgrades minus downgrades
Qtr −2	54.83	55.20	54.74	−0.09
Qtr −1	54.30	55.27	55.11	0.81***
Qtr 0	52.15	54.75	56.13	3.98***
Qtr +1	51.09	53.39	54.32	3.23***
Qtr +2	51.45	52.70	52.79	1.34***
Qtr +3	51.68	52.19	51.90	0.22
Qtr +4	51.91	52.30	51.81	−0.10
Qtr +5	52.22	52.22	51.72	−0.49***
Qtr +6	52.12	52.26	51.95	−0.17
Average revision	−0.2850	0.0000	0.2591	
Average no. of stocks	549	406	519	

Notes. This table presents the average proportion of mutual fund buys during the quarter of the recommendation revision, the quarters before the revision, and the quarters following the revision. The total number of buys over the total number of trades by all mutual funds in a given quarter is reported separately for stocks that experience a consensus downgrade, no change, or upgrade in Qtr 0. The differences in the buy proportion across upgrades versus downgrades are reported along with indicators of their statistical significance. The average value of *Revision* and the number of stocks in each revision group are reported at the bottom of the table.

***Indicates significance at the 1% level.

Lastly, it is noteworthy that analyst revisions sometimes appear to lag fund trading. Specifically, during quarter $t-1$, about 0.8% more buying occurs when the stock is collectively upgraded rather than downgraded by analysts during quarter t. This can happen for a few reasons: (1) analysts consider institutional buying patterns when they revise;[17] (2) some analysts selectively disclose their forthcoming revisions to their favorite institutional clients (Irvine et al. 2007). Given these possibilities, we relate current-quarter herding to prior-quarter recommendation revisions to ensure that we are not simply capturing the tendency of analysts to revise their opinions after institutional trading.[18]

3.2. Multivariate Tests

In this subsection, we further investigate the relation between mutual fund herding and analyst recommendation revisions while controlling for various stock characteristics, as described in §2.3. Specifically, we control for fund herding that is driven by momentum trading by including both returns during quarter $t-1$ (*Ret*) and the cumulative 12-month returns (*CumRet*) during quarters $t-5$ to $t-2$. We also include *SUE* and dummy variables indicating index addition and exclusion (*Add_Drop*) as additional control variables.[19] Given the censored nature of recommendations, analysts cannot revise their recommendations upward beyond a strong buy, or downward beyond a strong sell. Therefore, we further include two dummy variables: *Strong_Buy* (*Strong_Sell*) is set to 1 when *Revision* equals 0 and the consensus is a strong buy (strong sell) during quarter $t-2$, and 0 otherwise. We then estimate the following panel regression:

$$\begin{aligned} ADJHERD_{it} = {} & \beta_0 + \beta_1 Revision_{it-1} + \beta_2 Ret_{it-1} \\ & + \beta_3 Cumret_{it-5,\,it-2} + \beta_4 SUE_{it-1} \\ & + \beta_5 Strong\_Buy_{it-1} + \beta_6 Strong\_Sell_{it-1} \\ & + \beta_7 Add\_Drop_{it-1} + \varepsilon_{it}. \end{aligned} \quad (4)$$

We include time fixed effects to account for the dynamics of fund herding. To control for potential serial correlation in the residuals, heteroskedasticity-robust standard errors are clustered by firm.

Table 3 presents regression results for Equation (4). In Model 1, the estimated coefficient on *Revision* is significantly positive, indicating that mutual funds herd in the same direction as prior-quarter analyst revisions. Specifically, the coefficient on *Revision* indicates that a one standard deviation increase in consensus recommendation during a particular calendar quarter results in a 1.24 (0.319×0.039) percentage point increase in the level of mutual fund herding

[17] For example, Irvine (2004) shows that sell-side analysts' earnings forecasts are more accurate for those stocks that are owned by their affiliated asset management departments, consistent with the hypothesis that analysts use the asset management department as an additional source of information.

[18] One limitation of this conservative approach is that we may miss the reaction of mutual fund trades to recommendation changes within the same quarter. In unreported analyses, we find a slightly stronger correlation between fund herding and contemporaneous-quarter recommendation revisions, although the direction of causality is less clear in this case.

[19] Previous studies suggest that the magnitude of herding is larger among small and growth stocks (Wermers 1999, Sias 2004). These stock characteristics, however, should not have any directional effects on *ADJHERD* since buy herding (positive *ADJHERD*) and sell herding (negative *ADJHERD*) are both higher among small and growth stocks.

Table 3 The Impact of Analyst Revisions on Mutual Fund Herding

Dependent variable: *ADJHERD*	Model 1	Model 2	Model 3	Model 4	Model 5
	Whole period	Whole period	1985–1996	1997–2008	Whole period
Intercept	−0.033***	−0.019***	−0.034***	−0.013***	−0.028***
	(0.009)	(0.003)	(0.009)	(0.005)	(0.010)
Revision	0.039***		0.040***	0.038***	0.030***
	(0.002)		(0.003)	(0.002)	(0.002)
Large Rev		0.011***			
		(0.001)			
Small Rev		0.007***			
		(0.000)			
Revision × *Downgrade*					0.016***
					(0.004)
Ret	0.081***	0.081***	0.080***	0.081***	0.081***
	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)
CumRet	0.003***	0.003***	0.002	0.003***	0.003***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
SUE	0.006***	0.006***	0.006***	0.006***	0.006***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Strong_Buy	0.031***	0.031***	0.022**	0.034***	0.029***
	(0.005)	−0.005	(0.011)	(0.005)	(0.005)
Strong_Sell	−0.016*	−0.016*	−0.031	−0.014	−0.016*
	(0.009)	(0.009)	(0.030)	(0.009)	(0.009)
Add_Drop	0.008	0.008	0.029**	−0.005	0.007
	(0.007)	(0.007)	(0.012)	(0.008)	(0.007)
R-squared	0.031	0.031	0.022	0.036	0.031
No. of observations	148,451	148,451	51,126	97,325	148,451

Notes. This table reports regression results of mutual fund herding (*ADJHERD*) on analyst recommendation changes. *Revision* is the prior-quarter ($t-1$) change in the consensus recommendation. *Large Rev* (*Small Rev*) takes the value of *Revision* for analyst revisions that are at least (less than) one standard deviation away from the mean and 0 otherwise. *Downgrade* is a dummy variable indicating negative recommendation changes. *Ret* is the stock return in quarter $t-1$. *CumRet* is the cumulative stock return during the 12 months preceding quarter $t-1$. *SUE* is the unexpected earnings for the most recent quarter relative to earnings four quarters before, scaled by the standard deviation of earnings over the prior six quarters. *Strong_Buy* (*Strong_Sell*) equals 1 for stocks with consecutive strong buy (strong sell) consensus recommendations in the previous two quarters and 0 otherwise. *Add_Drop* equals 1 (−1) if the stock has been added to (dropped from) the S&P 500 index in the previous quarter and 0 otherwise. Models 3 and 4 separately present the results of the baseline analysis for the two subperiods of 1985–1996 and 1997–2008, respectively. All regressions include time fixed effects. Heteroskedasticity-robust standard errors (in parentheses) are clustered by firm. The *R*-squared and the number of observations are reported at the bottom of the table.

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

(*ADJHERD*).[20] In robustness tests, we capture the ubiquity (rather than the average) of analyst opinions of a stock by computing the proportion of analysts that upgrade versus downgrade a stock relative to all analysts issuing recommendations during a particular quarter for that same stock. We find a similarly strong relation between mutual fund herding and lagged analyst revisions under this alternative aggregation of analyst information.

In Model 2 of Table 3, we further consider whether larger analyst revisions lead to more dramatic mutual trading reactions. Specifically, we split *Revision* into two variables indicating large and small analyst revisions, respectively: *Large Rev* and *Small Rev*. The variable *Large Rev* (*Small Rev*) takes the value of *Revision* for analyst revisions that are at least (less than) one standard deviation above or below the mean and 0 otherwise. To facilitate comparison across the coefficients for large and small analyst revisions, we standardize these two variables to have a mean of 0 and standard deviation of 1. The result in Model 2 of Table 3 indicates that the sensitivity of mutual fund herding to large analyst recommendation revisions is indeed significantly larger. The difference in coefficients for *Large Rev* versus *Small Rev* is statistically significant at the 1% level according to an *F*-test. In Models 3 and 4 of Table 3, we repeat our baseline analysis for the two subperiods of 1985–1996 and 1997–2008, respectively. In both subperiods, we find a highly significant reaction of mutual fund herds to analyst recommendation changes.

[20] This effect, although relatively small when compared with the standard deviation of 19.8% for *ADJHERD*, is about the same as that of a one standard deviation increase in prior-quarter return, *Ret*, which has been widely documented as a driver of herding behavior among institutional investors (Wermers 1999, Sias 2004).

Lastly, consistent with prior empirical evidence, we find that herding is significantly related to return momentum, *Ret* and *CumRet*: higher stock returns lead to stronger buy herding and weaker sell herding. In addition, mutual fund herding is related to earnings momentum, as indicated by the significant coefficient on *SUE*. Finally, we find buy (sell) herding to be stronger when analysts issue consecutive strong buy (sell) recommendations, suggesting that the market views the reaffirmation of strong buy (sell) recommendations as a positive (negative) signal about the stock.

In this paper, we focus on the relation between mutual fund herding and recommendation revisions, since prior research shows that the return predictive value of stock recommendation revisions is higher than that of recommendation levels (e.g., Jegadeesh et al. 2004), and that analyst recommendation revisions also have greater investment value than analyst earnings forecast revisions (e.g., Francis and Soffer 1997, Asquith et al. 2005). In unreported analyses, we also find a significant response of fund herding to consensus earnings forecast revisions. Further tests, however, indicate that mutual fund herding is more strongly influenced by recommendation revisions than earnings forecast revisions, confirming that recommendation revisions play a stronger role in influencing an important group of investors (mutual funds).

3.3. Career Concerns and Mutual Fund Herding on Analyst Revisions

One strong incentive that motivates fund managers to herd is their concern over job security, as modeled by Scharfstein and Stein (1990) and Froot et al. (1992) and empirically examined by Chevalier and Ellison (1999b). Highly career-concerned fund managers have a greater need to follow the investment signals followed by the majority of other fund managers. They may also have a greater need to demonstrate prudence by conforming to the average view (i.e., analyst opinions in our context) in the event of continued poor performance, to defer lawsuits. In addition, some poorly performing and, thus, career-concerned managers may be more likely to follow analysts because they may have less precise private information than their counterparts at other funds (Kacperczyk and Seru 2007).

To explore this issue, we first examine how fund managers react to analyst upgrades and downgrades. We expect that fund managers may fear more about "failing alone" due to career concerns and, thus, have a greater tendency to herd on negative stock information.[21] To test this hypothesis, we extend Equation (4) by interacting *Revision* with a dummy variable indicating a downgrade. Model 5 of Table 3 indicates that the estimated coefficient for *Revision* × *Downgrade* is significantly positive, suggesting that the reaction to downgrades is indeed stronger than that to upgrades.

Next, to more directly examine the role of portfolio managers' career concerns, we compare the sensitivity of fund trading to analyst revisions across stocks traded by fund managers with different degrees of career concerns. We use two alternative proxies for short-run career concerns. First, we classify funds based on the portfolio manager's current tenure with the fund. Each quarter, we count the number of months since a fund's most senior manager assumed control.[22] Based on prior evidence that the average mutual fund manager has a tenure of three to five years (e.g., Chevalier and Ellison 1999a, b; Jain and Wu 2000), funds whose managers have a tenure shorter than four years (48 months) are classified as those with "career-concerned" managers, whereas others are classified as funds with "unconcerned" managers.[23] Second, we examine funds' overall Morningstar rankings. Morningstar's star ratings system explicitly compares the risk-adjusted return of each fund, at various horizons, to those of its peers—and, these ratings are widely used by investors to choose funds.[24] As shown in Del Guercio and Tkac (2008), the Morningstar star rating affects investor flow independently of the influence of other common measures of fund performance. Therefore, managers of funds with high Morningstar ratings should have lower career concerns due to their high profile and star status. Funds with a Morningstar rating of four or five stars are labeled as funds whose managers have low career concerns, and all others as funds with career-concerned managers.[25]

For each quarter, we compute the average proportion of trades by all funds that are purchases made by highly career-concerned managers and the proportion

[21] Managers are incentivized to remove "disaster stocks" from their portfolios, because they must prominently report holdings to shareholders every quarter. Also, given the conflicts of interest in sell-side research, unfavorable recommendations may be perceived as more informative, and result in a stronger trading reaction from mutual fund herds (see, e.g., Lin and McNichols 1998, Barber et al. 2006).

[22] We obtain data on fund managers from Morningstar. We match CRSP mutual fund data with Morningstar data via fund name, CUSIP and TICKER, and hand-check dubious matches.

[23] Because of data limitations, we do not differentiate between funds and fund managers, and we use the terms "funds" and "fund managers" interchangeably for ease of exposition.

[24] See http://www.morningstar.com/Help/Data.html#RatingCalc for details on the Morningstar rating system.

[25] If a fund does not have a Morningstar ranking, then we classify it as a low-ranked fund, because funds without ranks are usually new funds with inexperienced fund managers.

Table 4 Career Concerns and Mutual Fund Trading Imbalances Following Analyst Recommendation Revisions

Career concern measure:	Managerial tenure		Morningstar rankings	
Dependent variable: % buys	Career concerned	Unconcerned	Career concerned	Unconcerned
Intercept	−0.036***	−0.002	−0.266***	0.353***
	(0.004)	(0.004)	(0.046)	(0.051)
Revision	0.160***	0.093***	0.194***	0.085***
	(0.008)	(0.008)	(0.009)	(0.008)
Ret	0.394***	0.078***	0.361***	0.214***
	(0.013)	(0.011)	(0.014)	(0.012)
CumRet	0.033***	−0.015***	0.001	0.032***
	(0.004)	(0.003)	(0.004)	(0.004)
SUE	0.031***	0.011***	0.044***	−0.006***
	(0.002)	(0.002)	(0.002)	(0.002)
Strong_Buy	0.039	0.159***	0.120***	0.133***
	(0.028)	(0.028)	(0.032)	(0.034)
Strong_Sell	−0.131**	−0.024	−0.0935	−0.0561
	(0.054)	(0.059)	(0.058)	(0.057)
Add_Drop	0.027	−0.018	0.036	0.064*
	(0.033)	(0.036)	(0.036)	(0.036)
R-squared	0.111	0.113	0.051	0.066
No. of observations	148,409	148,409	146,349	146,349

Notes. For each quarter, we compute the proportion of total trades accounted for by purchases made by fund managers with different levels of career concerns and examine its relation with analyst recommendation revisions. We classify funds into two groups based on managerial tenure and their Morningstar rankings. Funds whose managers have shorter than four years' tenure are classified as those with career-concerned managers. Alternatively, funds with a Morningstar ranking of four or five stars are classified as those without career-concerned managers and the rest is classified as funds with career-concerned managers. We separately regress standardized buy proportions accounted for by career-concerned and unconcerned managers on the prior-quarter ($t-1$) change in the consensus recommendation (*Revision*). Control variables in the regressions are defined in Table 3. All regressions include time fixed effects. Heteroskedasticity-robust standard errors (in parentheses) are clustered by firm.

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

that are purchases made by less concerned (henceforth, unconcerned) managers. This proportion measure essentially captures the contribution of the trading behavior of each group of funds to total mutual fund trades of a given stock quarter. We then separately regress (stock-quarter level) buy proportions accounted for by career-concerned and unconcerned managers on analyst recommendation changes, controlling for other factors that may also influence mutual fund trades. Because the number of managers (funds) with and without career concerns are unequal, which leads to differences in the portion of trades accounted for by each fund manager group, we standardize their buy proportions (so that each has a mean of 0 and standard deviation of 1) to facilitate a direct comparison across the two groups. The result in Table 4 illustrates that, regardless of whether we identify career-concerned managers based on manager tenure or their affiliated funds' Morningstar ratings, buying by career-concerned managers is significantly more sensitive to analyst revisions, as the coefficients on recommendation revisions for this fund manager group are always about twice those of the unconcerned manager group. A cross-equation F-test rejects, at the 1% significance level, equality of the coefficients on recommendation revisions, between career-concerned and unconcerned managers. Essentially, because fund managers with longer tenure or high Morningstar ratings are unlikely to be fired in the short run, they have a greater incentive to pursue their private information, rather than to simply herd on analyst information.

This finding of stronger herding on analyst revisions by career-concerned fund managers also suggests that the relation between mutual fund herding and analyst revisions cannot be driven entirely by common valuation signals received by both analysts and fund managers. If so, we would observe a weaker correlation between the direction of trades by career-concerned fund managers and analyst revisions, compared with other managers, since career-concerned managers may have poor investment skills and likely possess less value-relevant information.[26]

3.4. A High Frequency Analysis of Mutual Fund Trading Around Analyst Revisions

In the previous section, we illustrate that the reaction of mutual fund herding to analyst revisions is

[26] To the extent that Morningstar's rankings are related to fund managers' past performance, it is possible that some managers with low rankings may choose to deviate from the herd and engage in riskier strategies toward the end of the year (Brown et al. 1996).

unlikely to be driven by their concurrent or sequential reactions to the same underlying information, given that herding varies between favorable and unfavorable analyst recommendations as well as with fund managers' career concerns. In this section, we take a closer look at the reaction of funds to analyst revisions using a high-frequency data set on institutional trading. A more detailed analysis of the relative timing of analyst revisions and mutual fund trading allows us to better uncover the dynamics of their interaction.

Specifically, we analyze daily institutional investor trades during 1998 to 2008, obtained from Ancerno, a consulting firm that specializes in analyzing trade costs of institutions.[27] Ancerno's clients include brokers, money managers, and pension sponsors. The data set records the direction (buy or sell), size, date and time, execution price, and other details of every institutional stock order that was executed by all of Ancerno's institutional clients. According to Puckett and Yan (2011), Ancerno's institutional clients account for 10% of all institutional trading volume. Therefore, the Ancerno data set represents a significant subset of institutional trading and is used by several studies to analyze the trading behavior of institutional investors.[28]

For our study, we only examine trades made by "money manager" funds (mainly mutual funds) to remain consistent with our focus on mutual funds. In addition, we aggregate all trades of a particular stock by a particular client into daily net trades, because the data do not always have reliable time stamps for individual trades during the day. Since Ancerno does not reveal the actual identities of its institutional clients, we are unable to study the relation between fund trades and their past performance or other fund characteristics. Instead, we focus on the trade imbalance across all clients ($buy minus $sell) as a fraction of shares outstanding during different event windows, relative to an analyst revision occurring at day 0, and compare the difference in trade imbalance between downgrades and upgrades.[29]

We identify analyst upgrades and downgrades using the daily Zacks consensus history file. For each consensus analyst revision of a stock, we compute the aggregate trade imbalance across all "money manager" funds—during each event day surrounding the revision. Given the significant growth of the mutual fund industry in the past decade, the typical funds in Ancerno are net buyers. To adjust for this effect, we match each analyst consensus revision event with a control group of stocks covered in the Zacks daily consensus database that have no change in consensus recommendation during the same calendar day. Then, the "abnormal imbalance" for a stock during a particular calendar day is the difference between the treatment (with consensus change) and the control (no consensus change) group imbalances during that (calendar) day. Next, we compute, separately for analyst upgrades or downgrades occurring on day 0, the abnormal trade imbalance during each event window. Since fund trades are likely affected by many market-wide factors that may vary from one quarter to the next, we first compute the average abnormal trade imbalance over all stocks experiencing revisions during a particular calendar quarter (separately for upgrade versus downgrade events), then average these quarterly values, as well as the spread between upgrades and downgrades, across all quarters. Also because of any potential effects of unknown factors on the level of trade imbalance, our analysis will focus on the average *spread* in the trade imbalance between upgrades and downgrades during each event window.

Table 5 presents funds' abnormal trading imbalances during windows surrounding analyst revision events, starting 45 days prior to the revision, and ending 90 days after the revision. To facilitate a comparison across event windows of different lengths, we report the average daily trade imbalance for upgrades and downgrades, and the spread between these two revision directions. The results in the table suggest an increasing level of (per-day) buy trade imbalances during the five-day period prior to a consensus analyst upgrade, as compared with a downgrade. This increase in same-direction fund trading immediately prior to the analyst revision could be consistent with funds receiving advance "tips" from analysts ahead of upcoming recommendations (see Irvine et al. 2007), or with both analysts and funds reacting to recently released corporate news.

Furthermore, the average daily spreads in trade imbalance between upgrades and downgrades on day 0, as well as during event windows from day +1 through day +90, are all significantly positive, and are much larger than their values prior to the revision event, with the exception of days −5 to −1. Specifically, on the day of an analyst revision, we observe significant abnormal net selling for downgrade events, and significant abnormal net buying for upgrade events. The fact that same-direction fund

[27] The first year the Ancerno data set was made available to academics was 1997. However, our analysis starts in 1998, since the data for 1997 are very sparse.

[28] See also Chemmanur et al. (2009) and Goldstein et al. (2011).

[29] Because we are analyzing high-frequency institutional trading data, a dollar-based trade imbalance measure is likely to provide more reliable inference than a count-based measure given the common practice of order splitting by institutional investors. In addition, the Ancerno data set does not have a reliable identifier of individual funds as the reporting party to Ancerno could be the entire fund or (if appropriate) only the portion managed by a particular fund manager (in a team-management setting).

Table 5 A High-Frequency Analysis of Fund Herding in Reaction to Analyst Revisions

Trading window in days	Downgrades	Upgrades	Upgrades minus downgrades
[−45, −31]	0.059	0.112**	0.053*
	(0.058)	(0.055)	(0.026)
[−30, −16]	0.002	0.011	0.010
	(0.046)	(0.051)	(0.036)
[−15, −6]	−0.090	−0.081	0.010
	(0.070)	(0.106)	(0.066)
[−5, −1]	−0.208***	0.124*	0.332***
	(0.069)	(0.071)	(0.073)
Day 0	−1.064***	0.486**	1.550***
	(0.368)	(0.234)	(0.239)
[+1, +5]	−0.217**	0.232***	0.449***
	(0.097)	(0.081)	(0.061)
[+6, +15]	−0.173***	0.115**	0.288***
	(0.054)	(0.052)	(0.039)
[+16, +30]	−0.093**	0.090**	0.183***
	(0.039)	(0.043)	(0.042)
[+31, +45]	−0.138**	0.009	0.147***
	(0.052)	(0.052)	(0.035)
[+46, +60]	−0.133***	−0.052	0.080**
	(0.042)	(0.043)	(0.032)
[+61, +75]	−0.046	0.075	0.121***
	(0.078)	(0.072)	(0.033)
[+76, +90]	−0.122***	0.025	0.148***
	(0.039)	(0.054)	(0.052)

Notes. This table presents the trading imbalance of mutual funds over various daily windows around the issuance of an analyst recommendation downgrade or upgrade. For each individual analyst revision, we first examine each fund's net purchases (purchases minus sales, divided by shares outstanding) during the day that the revision is issued, as well as during nearby windows starting 45 days prior to the revision and ending 90 days after the revision. Next, separately for each analyst revision that is an upgrade versus downgrade, we examine the aggregate trading imbalance during each event window, across all funds. We then measure each revised stock's abnormal trading imbalance by subtracting the average trading imbalance of all stocks with no change of analyst recommendations from each revised stock's trading imbalance over the same calendar period. Next, we compute the average abnormal trading imbalance across each type of revision occurring within the same calendar quarter, and the difference in abnormal trading imbalance between upgrades and downgrades. Finally, averages across all quarters are presented below. For ease of presentation, we multiply the daily imbalance by 10,000. Standard errors of the differences between upgrades and downgrades are reported in parentheses.

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

trading following the revision date is at least several times stronger than that prior to the announcement suggests that funds indeed trade in reaction to the analyst revision itself, and not merely to the associated news.[30]

[30] In unreported analyses, we find that the spread in fund trading imbalance following an upgrade versus downgrade is significant through day +180. The relatively slow trading reaction of funds further suggests that our use of one-quarter lagged trades in the prior sections is a reasonable proxy for all trades in response to analyst revisions.

In unreported analysis, we also conduct several robustness checks of our findings. First, we repeat the analysis in Table 5, but we remove analyst recommendations that are issued within the 10-day window before or after the earnings announcement date of the underlying stock. This analysis helps alleviate the concern that fund trading and analyst revisions might be both affected by earnings news. Second, we restrict our analysis to those analyst revisions that are separated by at least 10 days from any other revision of the same stock. Although this approach likely eliminates revisions by those "influential analysts" that trigger similar revisions among their peers (i.e., those more representative of the consensus among analysts), it helps address any potential problem with the clustering of revision events. Using these more restrictive samples, we again find much stronger same-direction fund trading following analyst revisions, compared with fund trading prior to revisions.

4. The Price Impact of Analyst Revision-Motivated Herding

Prior research shows that analyst recommendations generate a significant short-term market reaction that persists for as long as a few months (see, e.g., Womack 1996, Jegadeesh et al. 2004). In contrast, institutional trading often has a longer term impact on stock prices (see, e.g., Chan and Lakonishok 1995, Coval and Stafford 2007, Dasgupta et al. 2011a). Furthermore, mutual funds have become increasingly important in setting stock prices; for example, U.S. open-end mutual fund equity holdings have almost doubled relative to the total capitalization of equity markets—from 5.2% at the end of 1985 to 25.5% at the end of 2009—while turnover by mutual funds has also substantially increased during this period.[31] As such, it is important to understand the impact of mutual fund herding on stock prices, especially when herding is motivated by analyst revisions. If mutual funds herd on analyst revisions because the revisions convey value-relevant information, then we would expect their trading to help the market better incorporate such information and move stock prices closer to their true values—a permanent price impact. On the other hand, if mutual fund herding is driven by managerial incentives to overuse analyst information (such as conforming to the actions of the crowd), we might expect fund herding to potentially destabilize stock prices. Therefore, the price impact of analyst revision-motivated herding may exhibit distinct patterns from that of analyst revisions or herding alone.

[31] *Source.* "Corporate Equities" table of Board of Governors of the Federal Reserve System (2010).

Table 6 The Effect of Analyst Revision-Prompted Herding on Current and Future Abnormal Returns

Dependent variable	Quarter t	Quarter $(t+3, t+6)$	Quarter $(t+3, t+6)$	Quarter $(t+3, t+6)$
	Model 1	Model 2	Model 3	Model 4
Intercept	0.015**	0.000	−0.000	−0.001
	(0.006)	(0.018)	(0.018)	(0.018)
$SellHerd_t \times Revision_{t-1}$			0.171***	0.171***
			(0.060)	(0.062)
$BuyHerd_t \times Revision_{t-1}$			−0.027	−0.022
			(0.058)	(0.058)
$SellHerd_t \times Revision_t$				−0.002
				(0.067)
$BuyHerd_t \times Revision_t$				0.037
				(0.060)
$ADJHERD_t$	0.238***	−0.022**		
	(0.005)	(0.010)		
$SellHerd_t$			−0.030	−0.029
			(0.020)	(0.020)
$BuyHerd_t$			−0.025	−0.028
			(0.019)	(0.019)
$Revision_{t-1}$	0.001	−0.001	0.011	0.012
	(0.002)	(0.004)	(0.008)	(0.008)
$Revision_t$				−0.001
				(0.008)
$Forced_t$	2.271***	−0.858**	−0.867**	−0.931***
	(0.138)	(0.339)	(0.339)	(0.349)
$Turnover_t$		3.256***	3.002***	3.026***
		(0.531)	(0.529)	(0.535)
BM_t		−0.004**	−0.004**	−0.004**
		(0.002)	(0.002)	(0.002)
$CUMRET_{t-4,t-1}$		−0.029***	−0.029***	−0.030***
		(0.003)	(0.003)	(0.003)
RET_t		−0.074***	−0.064***	−0.064***
		(0.011)	(0.019)	(0.019)
$SellHerd_t \times RET_t$			0.386***	0.387***
			(0.134)	(0.133)
$BuyHerd_t \times RET_t$			0.163	0.156
			(0.111)	(0.112)
R-squared	0.053	0.013	0.014	0.014
No. of observations	136,744	130,776	130,776	127,797

Notes. This table presents the results from regressing DGTW-adjusted abnormal returns during the quarter herding is measured (t) or during quarters $t+3$ to $t+6$ ($ABRET_{t+3,t+6}$) on mutual fund sell herding ($SellHerd_t$) and buy herding ($BuyHerd_t$), analyst revisions, and their interaction effects ($BuyHerd_t \times Revision_{t-1}$ and $SellHerd_t \times Revision_{t-1}$). The variable *SellHerd* (*BuyHerd*) is set to *ADJHERD* for *ADJHERD* < 0 (*ADJHERD* ≥ 0) and 0 otherwise. The control variables include the proportion of trading that is accounted for by mutual funds experiencing significant flows ($Forced_t$), the average daily turnover during the prior one-year period (*Turnover*), and the logarithm of book to market ratio as of the prior quarter (*BM*), cumulative returns during quarters $t-4$ to $t-1$ ($CUMRET_{t-4,t-1}$), stock return during quarter t (RET_t) and its interaction terms with $SellHerd_t$ and $BuyHerd_t$, respectively. All regressions include time fixed effects. Heteroskedasticity-robust standard errors (in parentheses) are clustered by firm. The R-squared and the number of observations are reported at the bottom of the table.

** and *** indicate significance at the 5% and 1% levels, respectively.

4.1. The Impact on Current and Future Abnormal Returns

Table 6 presents panel regressions of current and future abnormal returns on herding and analyst revisions. The dependent variable is the Daniel et al. (1997; hereafter, DGTW) characteristic-adjusted abnormal return for stock i during either quarter t (Model 1) or quarters $t+3$ through $t+6$ (Models 2–4). Our independent variables include the adjusted herding measure during quarter t ($ADJHERD_t$), analyst recommendation revisions during quarter $t-1$ ($Revision_{t-1}$), and the net trades of stock i made by funds experiencing extreme flows during quarter t to account for long-lived price pressure and reversal

effects driven by heavy fund flows, as documented by Coval and Stafford (2007).[32] We measure the degree of flow-forced trading (*Forced*) as the difference between the number of shares purchased by funds experiencing flows above the 90th percentile and that sold by funds experiencing flows below the 10th percentile among all funds during the quarter, scaled by the total number of shares outstanding.

Model 1 of Table 6 shows that mutual fund herding is associated with significant contemporaneous-quarter returns, which could be consistent with return chasing by funds, the ability of funds to predict short-term returns, or a price-pressure effect of herding. In unreported analyses, we find strong, positive relations between quarterly herding and stock returns during each of the three months within quarter t. Thus, the relation between herding and stock returns is unlikely to be solely due to return chasing by the funds. Consistent with our evidence in §3 that analyst revisions prompt stronger same-direction fund herding, analyst-prompted fund herding is associated with a large, same-direction contemporaneous price movement. Although this finding could be consistent with either a return-predictive effect or a price-pressure effect, the former suggests a permanent price impact and the latter would predict subsequent return reversals. Therefore, we next examine whether the contemporaneous-quarter price effect is permanent or temporary.

Models 2–4 of Table 6 examine future abnormal returns. Since Table 2 indicates that mutual fund herding on analyst revisions persists for approximately two quarters, we examine potential return reversals starting from quarter $t+3$. The dependent variable is the abnormal return for stock i during quarters $t+3$ to $t+6$. In these models, we control for long-run reversals related to the value effect and the associated volume effect (Lee and Swaminathan, 2000) by including logged book-to-market ratio (*BM*) and share turnover (*Turnover*) as control variables. *Turnover* is measured as average daily trading volume divided by the number of shares outstanding during the most recent four quarters. In addition, we control for stock returns in quarter t (RET_t) and the prior four quarters ($CUMRET_{t-4,\,t-1}$) to further account for the effect of return momentum. Again, to account for potential residual dependence, we employ heteroskedasticity-robust standard errors that correct for firm-level clustering. All specifications include time fixed effects.

When examining the long-run stand-alone price impact of herding in Model 2 of Table 6, we find that mutual fund herding leads to return reversals during $t+3$ to $t+6$, as illustrated by the significantly negative coefficient on $ADJHERD_{t-1}$. Specifically, an increase in same-direction trading by 10% of funds (that trade in a stock quarter) results in an increased reversal of about 22 basis points during quarters $t+3$ to $t+6$. This reversal shown in Model 2 of Table 6 suggests that the significant contemporaneous-quarter returns documented in Model 1 of Table 6 are consistent with a price-pressure effect of herding, rather than a return-predictive effect.

In Model 3 of Table 6, we examine the subsequent price impact of mutual fund herding that is prompted by consensus analyst revisions as proxied by the interaction between herding and prior-quarter revisions. Since a higher value of this interaction term may be due to either a more negative value of *ADJHERD* after downgrades or a more positive *ADJHERD* after upgrades, we split this interaction term into two conditional variables for sell-herding and buy-herding stocks: $SellHerd_t \times Revision_{t-1}$ and $BuyHerd_t \times Revision_{t-1}$, where *SellHerd* (*BuyHerd*) is set to *ADJHERD* for $ADJHERD < 0$ ($ADJHERD \geq 0$), and 0 otherwise. We also separately interact $SellHerd_t$ *and* $BuyHerd_t$ with Ret_t to account for any potential return reversals resulting from herding that is accompanied by extreme returns (during quarter t), rather than herding in response to analyst revisions.

The results show that mutual fund sell herding following analyst downward revisions leads to subsequent reversals, as indicated by the significantly positive coefficient on $SellHerd_t \times Revision_{t-1}$. There is also some indication of return reversals on the buy side, albeit not statistically significant.[33] Also noteworthy is that, once we account for the interaction between analyst revisions and herding, herding, by itself, does not predict subsequent quarters' returns. In addition, analyst revisions during quarter $t-1$ do not predict long-term returns, consistent with prior findings that they do not have a price impact beyond a few months. Finally, consistent with Coval and Stafford (2007), flow-driven trading leads to significant return reversals.

Since Table 2 shows that mutual fund trading is positively associated with concurrent, as well as lagged, analyst revisions, we further explore the mechanism of return reversals by including interaction terms $SellHerd_t \times Revision_t$ and $BuyHerd_t \times Revision_t$ in Model 4 of Table 6. Here, we find an insignificant interaction effect, whereas the interaction between mutual fund herding and $Revision_{t-1}$ remains

[32] Since the dependent variable is a DGTW (1997) characteristic-adjusted return, it is not necessary to control for common return-predictive stock characteristics, such as book-to-market or momentum.

[33] This result is consistent with the view that managers are especially motivated to sell poorly performing stocks to avoid having to list them in reported holdings, as well as to avoid litigation risk.

significant for sell herding, with almost the same coefficient point estimate as in Model 3 of Table 6. Given that the lead-lag relation between analyst revisions and mutual fund herding is unclear when we measure both within the same quarter, it is not surprising that their concurrent interaction effect does not lead to significant return reversals. For instance, mutual funds may trade independently based on their private information, whereas analysts may learn about institutional order flow from their affiliated brokers and revise their opinions accordingly. This (reverse) interaction between fund trading and analyst revisions is less likely to lead to a future return reversal if it helps stock prices impound new information more quickly.

4.2. Subperiod Analyses

Our finding of return reversals associated with analyst revision-prompted herding contrasts with Wermers (1999), who does not find mutual fund herding to be price destabilizing during the 1975–1994 period. Given our different results, we repeat our analysis over two equal-length subperiods, 1985–1996 and 1997–2008. Panel A of Table 7 indicates that the interaction between fund herding and prior quarter consensus analyst revision ($Revision_{t-1}$) has a negative impact on subsequent abnormal returns for sell-herding stocks, and a positive impact for buy-herding stocks during the first half of the sample period (i.e., 1985–1996), consistent with the evidence in Wermers (1999) for the 1975–1994 period. However, in sharp contrast, we find the opposite result for the coefficients for the interaction term during the second half of the sample period (1997–2008): downgrade-induced sell herding leads to higher future stock returns, whereas upgrade-induced buy herding leads to lower future stock returns. For instance, a one standard deviation decrease of the consensus recommendation, followed by a 10% greater proportion of funds selling results in a positive abnormal return of about 1.44% ($0.1 \times 0.319 \times 0.45$) during quarters $t+3$ to $t+6$; a one standard deviation increase of the consensus recommendation followed by a 10% greater proportion of funds buying results in a negative abnormal return of 0.6% ($0.1 \times 0.319 \times 0.184$). This finding of a differential price impact of mutual fund herding over time is consistent with Dasgupta et al. (2011a), who find that the negative association

Table 7 Subperiod Analyses of the Price Impact of Analyst Revision-Prompted Herding

Panel A: Subperiod analysis of return reversals

Dependent variable: $ABRET_{t+3,t+6}$	1985–1996	1997–2008
Intercept	−0.012	0.163***
	(0.018)	(0.020)
$SellHerd_t \times Revision_{t-1}$	−0.137**	0.450***
	(0.068)	(0.095)
$BuyHerd_t \times Revision_{t-1}$	0.182**	−0.184**
	(0.076)	(0.083)
$SellHerd_t$	−0.020	−0.048
	(0.022)	(0.032)
$BuyHerd_t$	0.012	−0.038
	(0.023)	(0.028)
$Revision_{t-1}$	−0.009	0.030***
	(0.010)	(0.011)
$Forced_t$	−0.404	−0.924**
	(0.530)	(0.423)
$Turnover_t$	2.248*	2.835***
	(1.161)	(0.591)
BM_t	0.012***	−0.014***
	(0.002)	(0.003)
$CUMRET_{t-4,t-1}$	0.004	−0.037***
	(0.007)	(0.003)
RET_t	−0.011	−0.087***
	(0.020)	(0.026)
$SellHerd_t \times RET_t$	0.125	0.518***
	(0.126)	(0.194)
$BuyHerd_t \times RET_t$	−0.133	0.260*
	(0.132)	(0.149)
R-squared	0.004	0.018
No. of observations	49,370	81,406

Table 7 (Continued)

Panel B: Effect of mutual fund ownership for the 1985–1996 period

Dependent variable: $ABRET_{t+3,t+6}$	1985–1996
Intercept	−0.014
	(0.019)
$SellHerd_t \times Revision_{t-1}$	−0.360***
	(0.106)
$BuyHerd_t \times Revision_{t-1}$	0.392***
	(0.121)
$SellHerd_t \times Revision_{t-1} \times Ownership_t$	1.765**
	(0.736)
$BuyHerd_t \times Revision_{t-1} \times Ownership_t$	−1.495**
	(0.736)
$SellHerd_t$	−0.003
	(0.035)
$BuyHerd_t$	0.062*
	(0.034)
$Revision_{t-1}$	−0.042***
	(0.016)
$SellHerd_t \times Ownership_t$	−0.166
	(0.244)
$BuyHerd_t \times Ownership_t$	−0.342
	(0.231)
$Revision_{t-1} \times Ownership_t$	0.241**
	(0.105)
$Ownership_t$	0.023
	(0.041)
$Forced_t$	−0.294
	(0.531)
$Turnover_t$	2.164*
	(1.209)
BM_t	0.011***
	(0.002)
$CUMRET_{t-4,t-1}$	0.004
	(0.007)
RET_t	−0.012
	(0.020)
$SellHerd_t \times RET_t$	0.132
	(0.126)
$BuyHerd_t \times RET_t$	−0.117
	(0.133)
R-squared	0.005
No. of observations	49,352

Table 7 (Continued)

Panel C: Two-way sorting by prior analyst revisions and *ADJHERD*

Quarter	Downgrade strong sell	Downgrade strong buy	Upgrade strong sell	Upgrade strong buy	Tests of differences (3) – (1)	(4) – (2)	(2) – (1)	(4) – (3)
	(1)	(2)	(3)	(4)				
−2	−2.644***	1.031	−0.207*	1.178*	2.435*	0.148	3.675***	1.387
	(0.809)	(0.659)	(0.838)	(0.622)	(1.222)	(0.708)	(1.066)	(1.125)
−1	−5.297***	0.489	0.717	4.469***	6.014***	3.980***	5.785***	3.752***
	(0.795)	(0.660)	(0.766)	(0.789)	(0.924)	(0.948)	(1.063)	(1.220)
0	−6.197***	5.994***	−6.162***	6.088***	0.035	0.095	12.191***	12.250***
	(0.917)	(0.736)	(0.907)	(0.667)	(0.929)	(0.570)	(1.517)	(1.186)
(1, 2)	−0.915	−0.306	−1.436	−0.315	−0.521	−0.008	0.609	1.122
	(0.871)	(0.962)	(1.112)	(1.016)	(1.463)	(1.466)	(1.411)	(1.444)
(3, 6)	4.556***	−1.624	0.908	−3.292***	−3.648*	−1.667	−6.180**	−4.200*
	(1.435)	(1.284)	(1.526)	(1.127)	(1.914)	(1.527)	(2.180)	(2.210)
N	125	92	78	112				
ADJHERD	−0.303	0.255	−0.283	0.267				

Notes. Panels A and B present the results from regressing DGTW-adjusted abnormal returns during quarters $t+3$ to $t+6$ ($ABRET_{t+3,t+6}$) on mutual fund sell herding ($SellHerd_t$) and buy herding ($BuyHerd_t$), analyst revisions and their interaction effects. The control variables include the proportion of trading accounted for by mutual funds experiencing significant flows ($Forced_t$), the average daily turnover during the prior one-year period (*Turnover*), the logarithm of book to market ratio in the prior quarter (*BM*), cumulative stock returns during quarters $t-4$ to $t-1$ ($CUMRET_{t-4,t-1}$), stock return during quarter t (RET_t) and its interaction terms with $SellHerd_t$ and $BuyHerd_t$, respectively. In panel B, we further augment the regression with $SellHerd_t \times Revision_{t-1} \times Ownership_t$, $BuyHerd_t \times Revision_{t-1} \times Ownership_t$ and their components, where $Ownership_t$ represents the aggregate mutual fund ownership of the stock as of quarter t. All regressions include time fixed effects. Heteroskedasticity-robust standard errors (in parentheses) are clustered by firm. The *R*-squared and the number of observations are reported at the bottom of each panel. Panel C presents the abnormal returns of portfolios double-sorted on analyst revisions and herding, along with their standard errors.

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

between institutional trade persistence and returns is only significant during the second half of their sample period (1994–2004).

This stark contrast between the earlier and the later periods suggests a structural shift in the price impact of mutual fund herding around the mid-1990s. Given that average mutual fund ownership is significantly higher at 25% during the latter portion of the sample period, relative to 12% for the first half, we further explore whether the growing market share of equity funds plays a role in reshaping the price impact of mutual fund herding. Specifically, in panel B of Table 7, we augment the regression analysis with the interaction terms $SellHerd_t \times Revision_{t-1} \times Ownership_t$ and $BuyHerd_t \times Revision_{t-1} \times Ownership_t$, where $Ownership_t$ is the aggregate mutual fund ownership of the stock as of quarter t. This analysis is performed for buy-herding and sell-herding stocks separately. Consistent with our conjecture, this three-way interaction term is significantly positive for sell herding and significantly negative for buy herding. Therefore, the return reversal associated with revision-prompted mutual fund herding is stronger for funds with higher mutual fund ownership. In summary, our findings suggest that the aggregate market share of equity funds plays an important role in determining the price impact of mutual fund herding. Therefore, our remaining analyses of the price impact of revision-prompted mutual fund herding focus on the post-1996 period, when the unprecedented growth of mutual funds makes them a larger part of the market for setting stock prices.

Lastly, to illustrate the economic significance of the return reversals associated with analyst revision-induced mutual fund herding, we present abnormal returns for portfolios formed on analyst revision and fund herding using a simple double-sort approach. For each quarter during the period of 1997 to 2008, we first group stocks that are upgraded or downgraded by analysts during the prior quarter into separate portfolios. We then sort stocks into quartile portfolios, within subsamples of buy-herding and sell-herding stocks, respectively, based on each stock's *ADJHERD* measure for that quarter. We calculate quarterly rebalanced DGTW (1997) characteristic-adjusted abnormal returns for each portfolio during the two quarters prior to the portfolio formation quarter, the formation quarter, and the following six quarters. Panel C of Table 7 reports the abnormal returns of these double-sorted portfolios surrounding the portfolio formation quarters. For brevity, we only present the returns of stocks in the top and bottom herding quartile portfolios (i.e., stocks that mutual fund herds most strongly buy or sell, respectively) along with return differences (and statistical significance) between these portfolios, for upgrades and downgrades, respectively.

The results in Panel C indicate that, within either the analyst upgrade or downgrade group, stocks that are strongly bought by funds significantly outperform those strongly sold by funds during quarter t, then underperform during quarters $(t+3,\ t+6)$. More interestingly, among stocks strongly sold by fund herds, those that are downgraded by analysts

during quarter $t-1$ significantly outperform those upgraded by analysts by 3.65% over the four-quarter period of $(t+3,\ t+6)$. A similar, albeit weaker, pattern is observed between downgrade/strong buy and upgrade/strong buy portfolios. Therefore, consistent with earlier regression evidence, the reversals are most pronounced and robust when mutual funds herd in the same direction as prior analyst recommendation revisions (i.e., strong sell herding following downgrades or strong buy herding following upgrades).[34]

5. Fund Manager Career Concerns and Return Reversals

Our results of the previous section indicate that mutual fund herding on analyst recommendation revisions tends to be price destabilizing during recent years, creating long-run reversals in stock returns. Therefore, such herding is at least partially driven by nonfundamental information-related incentives of fund managers, such as career concerns. Highly career-concerned managers may overreact to analyst recommendation revisions, and their herding activities may, in turn, destabilize stock prices.

To assess the differential price impact of fund herding driven by career-related incentives, we develop a stock-level measure that reflects the contribution of trades made by fund managers with different levels of career concerns. For each stock i during each quarter τ, we calculate career concern-weighted measures of buys and sells as

$$PWBUY_{i,\tau} = \frac{\sum_j I^B_{i,j,\tau}\alpha^r_{j,\tau}}{\sum_j I^B_{i,j,\tau}} \quad \text{and}$$

$$PWSELL_{i,\tau} = \frac{\sum_j I^S_{i,j,\tau}\alpha^r_{j,\tau}}{\sum_j I^S_{i,j,\tau}}; \tag{5}$$

$I^B_{i,j,\tau} = 1$ if fund j buys stock i during quarter τ, and 0 otherwise;

$I^S_{i,j,\tau} = 1$ if fund j sells stock i during quarter τ, and 0 otherwise.

When we use managerial tenure to measure career concerns, $\alpha^r_{j,\tau}$ equals the number of months between the month fund j's current manager assumes control of the fund and the end of quarter $\tau-1$. Alternatively, when we use the Morningstar ranking to classify funds, $\alpha^r_{j,\tau}$ equals the Morningstar overall performance ranking of fund j during quarter $\tau-1$.[35] Note that lower values of $PWBUY_{i,\tau}$ (or $PWSELL_{i,\tau}$) indicate that fund buying (or selling) reflects more trading by fund managers with inflated short-run career concerns. We expect return reversals resulting from analyst-prompted herding to be stronger in stocks with a lower value of $PWBUY_{i,\tau}$ or $PWSELL_{i,\tau}$.

In Table 8, we compare the price impact of revision-prompted herding across stocks with different compositions of trading by career-concerned managers from 1997 to 2008—a period when average mutual fund ownership is large enough for funds to exert a significant price impact on the average stock. Specifically, we classify buy-herding stock quarters with a below-median *PWBUY* measure, or sell-herding stock quarters with a below-median *PWSELL* measure, as those traded mostly by managers who have greater short-run career concerns ("Concerned"). All other stock quarters (that have full data) are classified as "Unconcerned" fund manager trades. We then repeat the baseline analysis in Table 7 among each group of stock quarters. In essence, we wish to determine whether the level of return reversals is related to the composition of the herd, while controlling for the level of herding.

For sell herding, the results in Table 8 indicate that the coefficient on the interaction term, $SellHerd_t \times Revision_{t-1}$, is much larger among stocks with low levels of *PWSELL* (those mainly traded by managers with greater immediate career concerns) under both career-concern measures, relative to its value when *PWSELL* has a high value (those mainly traded by managers with lower immediate career concerns). This finding indicates that selling by career-concerned managers in reaction to analyst downgrades leads to much larger subsequent return reversals. For instance, for a stock mostly sold by funds with a low Morningstar ranking ("concerned managers"), a one standard deviation decrease in the mean consensus recommendation revision (i.e., an incremental drop by 0.319 rating points; see Table 1) followed by an adjusted herding measure of −10% (i.e., sell herding) results in a 2% higher abnormal return ($0.626 \times (-0.319) \times (-0.1)$; i.e., a large reversal) for a stock during quarters $t+3$ to $t+6$, compared to the effect on the abnormal return of the revision and herding measures in isolation. For stocks mainly sold by funds with a high Morningstar ranking ("unconcerned managers"), this interaction effect on abnormal return is only about one-third as large. The difference in coefficients on the interaction term ($SellHerd_t \times Revision_{t-1}$),

[34] We note that the portfolio sorting result needs to be interpreted with caution. Because upgrades (downgrades) lead to buy (sell) herding, as we show in Tables 2–4, stocks upgraded (downgraded) by analysts and heavily bought (sold) by funds are likely to have greater intensity of herding than those downgraded (upgraded) and heavily bought (sold) by funds.

[35] Funds without Morningstar rankings are assigned the lowest rank of 1. However, our results are qualitatively and quantitatively similar if we simply assign missing values to these funds' performance rankings.

Table 8 Career Concerns and the Price Impact of Revision-Prompted Herding

	Managerial tenure		Morningstar rankings	
	Concerned	Unconcerned	Concerned	Unconcerned
Dependent variable: $ABRET_{t+3,t+6}$	(1)	(2)	(3)	(4)
Intercept	0.031***	0.005	0.021***	0.022***
	(0.007)	(0.008)	(0.008)	(0.007)
$SellHerd_t \times Revision_{t-1}$	0.534***	0.253*	0.626***	0.197*
	(0.170)	(0.129)	(0.148)	(0.106)
$BuyHerd_t \times Revision_{t-1}$	−0.316**	−0.001	−0.375***	0.037
	(0.142)	(0.104)	(0.134)	(0.092)
$SellHerd_t$	−0.023	−0.124***	−0.0670	−0.014
	(0.045)	(0.045)	(0.046)	(0.037)
$BuyHerd_t$	−0.065	0.023	−0.025	−0.072**
	(0.042)	(0.041)	(0.043)	(0.035)
$Revision_{t-1}$	0.046**	0.003	0.050***	0.004
	(0.019)	(0.015)	(0.018)	(0.012)
$Forced_t$	−1.721***	−0.499	−1.386**	0.472
	(0.630)	(0.581)	(0.698)	(0.406)
$Turnover_t$	1.000*	3.031***	4.299***	0.750
	(0.592)	(0.814)	(0.812)	(0.688)
BM_t	−0.017***	−0.010***	−0.017***	−0.011***
	(0.003)	(0.003)	(0.004)	(0.003)
$CUMRET_{t-4,t-1}$	−0.031***	−0.035***	−0.041***	−0.031***
	(0.004)	(0.005)	(0.006)	(0.004)
RET_t	−0.033	−0.113***	−0.098**	−0.078***
	(0.044)	(0.031)	(0.041)	(0.025)
$SellHerd_t \times RET_t$	0.822**	0.162	0.639**	0.207
	(0.358)	(0.201)	(0.286)	(0.175)
$BuyHerd_t \times RET_t$	0.088	0.199	0.359	0.128
	(0.228)	(0.172)	(0.222)	(0.142)
R-squared	0.019	0.020	0.025	0.013
No. of observations	37,631	35,988	41,519	39,887

Notes. This table presents the results from regressing DGTW-adjusted abnormal returns during quarters $t+3$ to $t+6$ ($ABRET_{t+3,t+6}$) on mutual fund sell herding ($SellHerd_t$) and buy herding ($BuyHerd_t$), analyst revisions and their interaction effects for stocks with different compositions of trades by career-concerned versus unconcerned managers. Each quarter during the 1997–2008 period, we classify sell-herding and buy-herding stocks into two groups depending on whether their career concern-weighted selling (*PWSELL*) and buying (*PWBUY*) measures are above or below the median, respectively. In columns (1) and (2), the career concern-weighted trading measures are based on managerial tenure. In columns (3) and (4), the career concern-weighted trading measures are based on funds' Morningstar ratings. We consider stocks with below-median *PWBUY* or *PWSELL* as traded mostly by career-concerned fund managers. All regressions include time fixed effects. Heteroskedasticity-robust standard errors (in parentheses) are clustered by firm. The *R*-squared and the number of observations are reported at the bottom of the table.

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

between the two fund groups, is statistically significant at the 5% level. This pattern is also present on the buy side: Only stocks that are heavily bought following analyst revisions by career-concerned managers experience significantly lower returns during subsequent quarters. The difference in coefficients for $BuyHerd_t \times Revision_{t-1}$ between career-concerned and unconcerned managers is always statistically significant at least at the 10% level. To the extent that career concerns are correlated with fund performance, our findings of return reversals associated with herding on analyst recommendations by career-concerned managers is consistent with Kacperczyk and Seru (2007), who find that funds relying on public information underperform in the long run.

In summary, the return reversals following revision-prompted herding that we documented earlier are almost entirely driven by career-concerned managers who overreact to consensus analyst revisions—especially on the sell side.[36] This comparison between herding by career-concerned and unconcerned managers suggests that analyst revisions may be associated with an unintended (reverse) price impact, depending on how investors with different incentives trade in response to the revisions.

[36] This finding is in contrast to the "crowding" effect modeled in Stein (2009), where even fund managers who rationally trade in response to analyst recommendation changes may cause price pressure because they do not precisely know the number of other investors trading on the same signal.

6. Conclusion

This paper provides evidence that positive consensus recommendation revisions result in a herd of mutual funds buying a stock, whereas negative revisions result in a herd of funds selling. In addition, mutual funds react more strongly to analyst downgrades than upgrades. We also find that managers with greater career concerns tend to follow analyst revisions more strongly. Lastly, evidence from high-frequency trading data of a subset of funds confirms our finding that mutual funds react strongly to analyst revisions.

Interestingly, we show that mutual fund herds sometimes cause return reversals when they follow analyst revisions, especially on the sell side. This finding suggests that mutual funds initially overreact to analyst revisions. Further evidence indicates that the return reversals we document are mainly concentrated in the second half of the sample period when mutual fund ownership becomes large enough for funds to exert significant price impact. Finally, we find that trades of fund managers with high career concerns play a significant role in generating return reversals, supporting the conjecture that analyst revision-induced herding is driven at least partly by noninformation related incentives.

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References

Agarwal V, Jiang W, Tang Y, Yang B (2013) Uncovering hedge fund skill from the portfolio holdings they hide. *J. Finance* 68(2): 739–783.

Asquith P, Mikhail M, Au A (2005) Information content of equity analyst reports. *J. Financial Econom.* 75(2):245–282.

Barber B, Lehavy R, McNichols M, Trueman B (2001) Can investors profit from the prophets? Consensus analyst recommendations and stock returns. *J. Finance* 56(2):773–806.

Barber B, Lehavy R, McNichols M, Trueman B (2006) Buys, holds, and sells: The distribution of investment banks' stock ratings and the implications for the profitability of analysts' recommendations. *J. Accounting Econom.* 41(1–2):87–117.

Bikhchandani S, Hirshleifer D, Welch I (1992) A theory of fads, fashion, custom, and cultural change as informational cascades. *J. Political Econom.* 100(5):992–1026.

Board of Governors of the Federal Reserve System (2010) Flow of funds accounts of the United States: Flows and outstandings fourth quarter 2009. Federal Reserve statistical release, Z.1. Board of Governors of the Federal Reserve System, Washington, DC. Accessed March 14, 2013, http://www.federalreserve.gov/releases/z1/20100311/z1.pdf.

Brown K, Harlow W, Starks L (1996) Of tournaments and temptations: An analysis of managerial incentives in the mutual fund industry. *J. Finance* 51(1):85–110.

Busse J, Green T, Jegadeesh N (2012) Buy-side traders and sell-side recommendations: Interactions and information content. *J. Financial Markets* 15(2):207–232.

Chan L, Lakonishok J (1995) The behavior of stock prices around institutional trades. *J. Finance* 50(4):1147–1174.

Chemmanur T, He S, Hu G (2009) The role of institutional investors in seasoned equity offerings. *J. Financial Econom.* 94(3):384–411.

Chevalier J, Ellison G (1999a) Are some mutual fund managers better than others? Cross-sectional patterns in behavior and performance. *J. Finance* 54(3):875–899.

Chevalier J, Ellison G (1999b) Career concerns of mutual fund managers. *Quart. J. Econom.* 114(2):389–432.

Coval J, Stafford E (2007) Asset fire sales (and purchases) in equity markets. *J. Financial Econom.* 86(2):479–512.

Cowen A, Groysberg B, Healy P (2006) Which types of analyst firms are more optimistic? *J. Accounting Econom.* 41(1–2):119–146.

Craig S, Lauricella T (2005) Fidelity's deal to pay cash to Lehman for research forces street to pay heed. *Wall Street Journal* (December 7) C3.

Daniel K, Grinblatt M, Titman S, Wermers R (1997) Measuring mutual fund performance with characteristic-based benchmarks. *J. Finance* 52(3):1035–1058.

Dasgupta A, Prat A, Verardo M (2011a) Institutional trade persistence and long-term equity returns. *J. Finance* 66(2):635–653.

Dasgupta A, Prat A, Verardo M (2011b) The price impact of institutional herding. *Rev. Financial Stud.* 24(3):892–925.

Del Guercio D, Tkac P (2008) Star power: The effect of Morningstar ratings on mutual fund flow. *J. Financial Quant. Anal.* 43(4): 907–936.

Falkenstein E (1996) Preferences for stock characteristics as revealed by mutual fund portfolio holdings. *J. Finance* 51(1):111–135.

Francis J, Soffer L (1997) The relative informativeness of analysts' stock recommendations and earnings forecast revisions. *J. Accounting Res.* 35(2):193–211.

Frankel R, Kothari SP, Weber J (2006) Determinants of the informativeness of analyst research. *J. Accounting Econom.* 41(1–2):29–54.

Froot K, Scharfstein S, Stein J (1992) Herd on the street: Informational inefficiencies in a market with short-term speculation. *J. Finance* 47(4):1461–1484.

Ge W, Zheng L (2006) The frequency of mutual fund portfolio disclosure. Working paper, University of California, Irvine, Irvine.

Goldstein M, Irvine P, Puckett A (2011) Purchasing IPOs with commissions. *J. Financial Quant. Anal.* 46(5):1193–1225.

Grinblatt M, Titman S, Wermers R (1995) Momentum investment strategies, portfolio performance, and herding: A study of mutual fund behavior. *Amer. Econom. Rev.* 85(5):1088–1105.

Healy B (2002) The herd mentality. *The Boston Globe* (December 22) E.1.

Hirshleifer D, Subrahmanyam A, Titman S (1994) Security analysis and trading patterns when some investors receive information before others. *J. Finance* 49(5):1665–1698.

Irvine P (2004) Analysts' forecasts and brokerage-firm trading. *Accounting Rev.* 79(1):125–149.

Irvine P, Lipson M, Puckett A (2007) Tipping. *Rev. Financial Stud.* 20(3):741–768.

Ivković Z, Jegadeesh N (2004) The timing and value of forecast and recommendation revisions. *J. Financial Econom.* 73(3): 433–463.

Jain P, Wu J (2000) Truth in mutual fund advertising: Evidence on future performance and fund flows. *J. Finance* 55(2):937–958.

Jegadeesh N, Kim J, Krische S, Lee C (2004) Analyzing the analysts: When do recommendations add value? *J. Finance* 59(3):1083–1124.

Kacperczyk M, Seru A (2007) Fund manager use of public information: New evidence on managerial skills. *J. Finance* 62(2):485–528.

Lakonishok J, Shleifer A, Vishny R (1992) The impact of institutional trading on stock prices. *J. Financial Econom.* 32(1):23–43.

Lee C, Swaminathan B (2000) Price momentum and trading volume. *J. Finance* 55(5):2017–2069.

Lin H, McNichols M (1998) Underwriting relationships, analysts' earnings forecasts and investment recommendations. *J. Accounting Econom.* 25(1):101–127.

Ljungqvist A, Marston F, Starks L, Wei K, Yan H (2007) Conflicts of interest in sell-side research and the moderating role of institutional investors. *J. Financial Econom.* 85(2):420–456.

Mikhail M, Walther B, Willis R (2007) When security analysts talk, who listens? *Accounting Rev.* 82(5):1227–1253.

Musto D (1999) Investment decisions depend on portfolio disclosures. *J. Finance* 54(3):935–952.

Nofsinger JR, Sias R (1999) Herding and feedback trading by institutional and individual investors. *J. Finance* 54(6):2263–2295.

O'Brien P, Bhushan R (1990) Analyst following and institutional ownership. *J. Accounting Res.* 28(Supplement):55–76.

Puckett A, Yan X (2011) The interim trading skills of institutional investors. *J. Finance* 66(2):601–633.

Santoli M (2007) Fixing Fidelity. *Barron's* (April 9) L5, L8–L9.

Scharfstein D, Stein J (1990) Herd behavior and investment. *Amer. Econom. Rev.* 80(3):465–479.

Shumway T (1997) The delisting bias in CRSP data. *J. Finance* 52(1):327–340.

Sias R (2004) Institutional herding. *Rev. Financial Stud.* 17(1):165–206.

Sias R, Starks L, Titman S (2006) Changes in institutional ownership and stock returns: Assessment and methodology. *J. Bus.* 79(6):2869–2910.

Stein J (2009) Presidential address: Sophisticated investors and market efficiency. *J. Finance* 64(4):1517–1548.

Stickel S (1995) The anatomy of the performance of buy and sell recommendations. *Financial Analysts J.* 51(5):25–39.

Wermers R (1999) Mutual fund herding and the impact on stock prices. *J. Finance* 54(2):581–622.

Wermers R (2001) The potential effects of more frequent portfolio disclosure on mutual fund performance. *Perspective* 7(3):1–11.

Womack K (1996) Do brokerage analysts' recommendations have investment value? *J. Finance* 51(1):137–167.