Two Essays on Mutual Fund Herding

Gokhan Sonaer

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Approved by:

Meir I. Schneller, Chair
Michael T. Cliff
John C. Easterwood
Ozgur S. Ince
Vijay Singal

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ABSTRACT

This dissertation consists of two chapters. First chapter examines whether herding by actively managed equity funds affects their performance. For this purpose, first the effect of herding on stock returns is reexamined and evidence is found that, during the herding quarter, stocks bought intensely by herds outperform stocks sold intensely by herds. Controlling for subsequent quarter herding, this performance difference reverses, an indication that herding drives prices away from their fundamental values. It is also shown that herding funds benefit from this activity during the quarter in which they herd. The evidence is provided that herded stocks positively contribute to the herding funds' trade portfolio returns in the following quarter, but no association is found between the extent to which funds herd and their holding-based and subsequent quarter net returns. Introducing the concept of leader and follower funds this study shows that the subsequent quarter performance of funds that lead the herd is superior to that of follower funds. However, because leader and follower funds do not strongly retain their status overtime, they exhibit similar long-run performances.

Second chapter examines whether mutual funds herd in industries and the extent to which such herding impacts industry valuations and fund performance. Using two herding measures proposed by Lakonishok, Shleifer, and Vishny (1992) and Sias (2004) it is documented that mutual funds herd in industries beyond what would be expected by chance. It is shown that industry herding is not driven by investor flows and that it is not a manifestation of individual stock herding. The evidence suggests that, during the herding quarter(s), industries that experience strong buy herding by mutual funds outperform industries that experience strong sell herding. Industries that are subjected to strong herding by mutual funds exhibit no return reversals indicating that this activity does not destabilize industry values. Using a modified Grinblatt, Titman and Wermers' (1995) fund herding measure that quantifies the degree to which a fund joins the herd during a given quarter, no compelling evidence is found that industry herding affects the subsequent performance of herding funds.

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Chapter 1

Mutual Fund Herding and Fund Performance

1.1 Introduction

U.S. equity mutual funds managed approximately $5 trillion in assets as of the end of 2009 (Investment Company Fact Book, 2010), and they continue to be an important vehicle for investors. The question of whether mutual funds tend to herd is therefore a natural subject for investigation. Previous studies examine whether mutual funds (as well as other financial institutions) tend to herd in individual stocks, and some proceed to explore whether this activity drives stock prices away from their fundamentals. This study, although revisiting the above question, shifts the focus of inquiry from the performance of the herded stocks to that of the herding funds.

In a pioneering work, Lakonishok, Shleifer and Vishny (1992) develop a herding measure (LSV measure hereafter) that quantifies the unexpected imbalance between the number of buyers and sellers from a particular group of investors in a security (or an industry) over a given period. Based on this measure, they report weak evidence of herding by pension funds in individual stocks. Grinblatt, Titman and Wermers (1995, hereafter GTW) apply the same measure to the examination of mutual funds and find moderate evidence of herding. Employing a larger sample of mutual funds, Wermers (1999) documents similar results for mutual fund herding and reports that fund herding does not seem to drive stock prices away from their fundamentals. In contrast, Brown, Wei and Wermers (2009) conclude that, when mutual funds herd in response to changes in sell-side analysts' recommendations, herding destabilizes stock prices. An alternative herding measure that relies on the degree to which institutions follow prior trades of other institutions is proposed by Sias (2004) who reports strong evidence of institutional herding in individual stocks but finds no support for the hypothesis that herding affects stock prices.[1] A recent study by Dasgupta, Prat, and Verardo (2011) provides evidence that, consistent with a destabilizing effect, persistent institutional herding negatively predicts long-term stock returns.

Our study is most closely related to GTW (1995), who examine the long-run relationship between mutual funds' stock herding tendency and their performance. Their paper, however, focuses mainly on mutual fund's momentum trading and its effect on their long-term performance.[2] In contrast, the main purpose of our paper is to investigate how herding impacts concurrent and subsequent quarterly fund performance. In order to examine this potential impact, we modify GTW's (1995) fund herding measure to quantify the extent to which a mutual fund trades with or against the herd in any given quarter and name it herding intensity measure.[3]

A necessary condition for stock herding to affect fund performance is that the return on stocks strongly bought by mutual fund herds is different from that on stocks strongly sold by them. We are able to confirm that, during the herding quarter, the former stocks significantly outperform the latter ones and that this outperformance continues to some degree into the immediate subsequent quarter. The data reveal no reversal of this outperformance in later quarters. On the face of it, this pattern seems to support the view that mutual fund herding helps nudge stock prices toward their fundamental values. Our study, however, documents that mutual fund herding frequently persists (in the same direction) for longer than one single quarter. The

[1] Another strain of studies investigates whether institutions (or their subsets) herd in industries or in particular stocks that belong to a specific industry. Sharma, Easterwood and Kumar (2006) document high level of institutional herding in internet stocks during the 1998 to 2001 period and conclude that institutional herding had contributed to the internet bubble. Using the Sias (2004) measure, Choi and Sias (2009) report strong evidence of industry herding by institutions.

[2] In this study we use a sample of 1317 mutual funds as compared to 155 examined by GTW (1995). Our sample covers the period from 1980 to 2007 whereas GTW's (1995) sample period is from 1974 to 1984.

[3] We also propose conditional buy and sell herding intensity measures to quantify the extent to which a fund joins sell and buy herds.

real nature of the subsequent quarter stock return might therefore be potentially obscured by herding that continues into this quarter. In order to glean the actual effect that herding may have on subsequent stock returns we separate stocks into groups according to whether herding continues, reverses or stops in this quarter. We find that the above reported formation quarter outperformance continues for the first group but is reversed for the other two. The subsequent quarter reversal of the above described outperformance for stocks whose herding stops is evidence that mutual fund herding tends to divert stock prices away from their fundamental values.

Before proceeding to examine the impact of herding on mutual fund performance, this study investigates whether our suggested herding intensity measure is related to various fund characteristics such as age, management tenure, size, cash flows, turnover, expenses and previous quarter return. We find that turnover is the most closely related to these herding intensity measures. However, low R-squared values indicate that this measure cannot be reasonably explained by means of these selected fund characteristics.

Our paper next proceeds to explore its main research question: does herding affect mutual fund performance. We focus first on fund performance during the herding quarter. Because fund holdings data are only available quarterly, we cannot trace intra-quarter trades to examine whether funds trade before or after abnormal returns on the herded stocks are fully realized. In order to pursue this examination, we employ the return gap measure proposed by Kacperczyk, Sialm, and Zheng (2008). This measure quantifies the impact of unobserved trades of mutual funds during a quarter by comparing each fund's actual returns with that of its previous quarter-end holding portfolio. If funds do benefit from herding, they should exhibit higher return gaps compared to funds that do not herd during the same quarter. We find evidence that, during the herding quarter, high herding intensity funds have higher return gaps than low herding intensity funds. Similar results are found for our proposed conditional buy and sell herding intensity measures, an indication that herding funds benefit from both buy and sell herding during the herded quarter.

The paper next examines the effect of herding on fund performance in the quarter immediately following the herding activity. We explore the relationship between funds' herding intensity and their trade portfolio performance and observe that the buy trades of high herding intensity funds outperform their sell trades during this quarter. This outperformance points to the profitability of all trades executed by high herding intensity funds including trades involving herded stocks. We find, however, no compelling difference between the subsequent performances of high and low herding intensity funds.

Several factors may be contributing to our failure to establish a relationship between herding intensity and fund performance during the subsequent quarter. One such factor is the possibility that herding intensity better manifests its impact on fund performance over a span of several quarters. This will be the case when herding intensity persists over time. We test for such persistence and find that its moderate level is insufficient to engender a longer-term return differential between high and low intensity funds. Another potential factor is the herded stocks' return behavior in the immediate subsequent quarter. As reported above, stocks during this quarter exhibit different return patterns depending on whether herding continues, reverses, or stops. This difference in return patterns may carry over to the performance of the herding funds; funds that join the herd during a quarter that is followed by a same-direction herding (leader funds) might perform differently from funds that join the herd just before it disperses or changes its direction (follower funds). The above reported lack of association between herding intensity and the subsequent quarter's returns might therefore be the result of aggregating all herding funds regardless of the phase in which they join the herd. We examine this possibility by creating two novel herding intensity measures that are conditioned on a fund being a leader or a follower of the herd. Using these measures, we identify high leader herding intensity and high follower herding intensity funds and compare their subsequent quarter performance. We conclude that high leader funds outperform high follower funds with respect to all three performance measures, namely the trade portfolio performance, holding-based returns, and net returns. This outperformance is shown to be robust with regard to most adjustment models. It should be noted, however, that our leader and follower herding intensity measures are forward looking and that these results indicate only that, after the fact, subsequent quarter performance of leader funds is superior to that of follower funds. If fund leadership or followership behavior is persistent over time, one should expect leader funds to outperform follower funds not only in the subsequent quarter but also in the long-run. We check for such persistence and find that, although statistically significant, it is too weak to translate into long-run performance difference between the leader and follower funds. In light of these results we conclude that the long-run performance of mutual funds is not affected by their herding activity.

The remainder of the paper is organized as follows. Section 1.2 describes the data. Section 1.3 reviews previously suggested herding and performance measures and describes our newly proposed quarterly herding intensity measures. Sections 1.4-1.7 present and discuss the results. Concluding comments are offered in Section 1.8.

1.2 Data

This study uses data mainly from four sources. Quarterly mutual fund holdings data are from the Thomson-Reuters database while mutual fund returns and fund characteristics are obtained from the CRSP Mutual Fund database. Monthly stock data are from the CRSP Monthly database. We also use the Mutual Funds Links Database to merge the CRSP Mutual Fund Database with the Thomson-Reuters Database. The study spans the period from 1980 to 2007.

Our sample consists of all funds in the Thomson-Reuters mutual funds holding database with several exceptions. In order to focus on actively managed diversified equity funds we exclude all index and sector funds and all funds with investment objectives other than aggressive growth, growth, and growth-income (indicated by codes 2, 3, and 4, respectively, by Thomson-Reuters). We also drop the first three and the last quarterly observations of all stocks in the CRSP database.[4] Thomson-Reuters provides mutual funds holdings and the date for which these holdings are valid (report date). However, there are many missing fund-quarter observations in this database.[5] When computing herding intensity measures, we therefore exclude all fund-quarter observations for which the preceding quarterly observation is not available. In the analyses of the effect of herding on fund performance, we exclude funds with average equity holding of less than 80% of total assets (as in Cremers and Petajisto (2009)) because these funds' performances are not likely to be affected by stock herding. Last, following Chen, Hong, Huang, and Kubik (2004), we also exclude all mutual funds with net assets of less than 15 million in 2007 US dollars.

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[4] IPO lock-up period usually varies between 90 to 180 days. At the end of this period we may observe artificial sell herding by mutual funds in IPO stocks. To focus on seasoned equities we exclude the first three quarterly observations in the CRSP database. Similarly prior to stock being delisted we may observe artificial (sell or buy) herding by mutual funds. For this reason we also exclude the last quarter observations of all stocks.

[5] For most of our sample period (1984-2004) mutual funds are required to report their holdings semi-annually. Although, most funds voluntarily reported their holdings quarterly, some funds report their holdings only semi-annually during this period.

After applying the above enumerated exclusions, we end up with 1,602 mutual funds and 36,755 fund-quarter observations. These figures drop to 1,317 and 30,717, respectively, after the CRSP Mutual Funds database is matched with the Thomson-Reuters Mutual Funds Holdings data. Panel A of Table 1.1 reports the number of mutual funds and observations used in this study.

1.3 Methodology

1.3.1 Preliminaries

LSV (1992) propose a herding measure that quantifies the unexpected imbalance of the number of buyers and sellers from a particular group of investors in a stock. More specifically, this measure is defined as

$$HM_{i,t} = \left| p_{i,t} - \overline{p}_t \right| - E\left| p_{i,t} - \overline{p}_t \right|, \tag{1}$$

where $p_{i,t}$ is the ratio of buyers to all traders from this group in stock *i* during quarter *t*, and $\overline{p}_t$ is the average ratio of the number of buyers to all traders over all stocks during this quarter for the group. The second term in this equation, the expected value of the absolute difference between $p_{i,t}$ and $\overline{p}_t$, adjusts for the fact that $| p_{i,t} - \overline{p}_t |$ can be greater than zero by chance.[6] It should be noted that our identification of buyers and sellers is slightly different from that of LSV (1992). We classify a mutual fund as a buyer (seller) in a particular stock-quarter if that mutual fund increases (decreases) its holdings both in terms of number of shares *and* in terms of that stock's weighting in its equity portfolio. In contrast, LSV (1992) require only the former condition. The

[6] See LSV (1992) for detailed explanation of this measure.

purpose of imposing the additional weight change condition is to control for the flow-induced trades. [7,8]

The LSV herding measure does not specify the direction of the herding. To separately measure the levels of buy and sell herding Wermers (1999) formulates the following conditional buy and sell herding measures for stock i in period t

$$HM_{i,t}^{buy} = HM_{i,t} \left| (p_{i,t} - \bar{p}_t) > 0 \right. \tag{2}$$

$$HM_{i,t}^{sell} = HM_{i,t} \left| (p_{i,t} - \bar{p}_t) < 0. \right. \tag{3}$$

In order to quantify the herding tendency of individual funds GTW (1995) construct a signed herding measure (SHM) that takes into account whether a fund trades with or against the herd:

$$SHM_{i,t} = I_{i,t} \times HM_{i,t} - E\left[I_{i,t} \times HM_{i,t} \right], \tag{4}$$

where $HM_{i,t}$ is as in equation (1) and $I_{i,t}$ is an indicator function which assumes the value of 1 (-1) if the fund trades stock i with (against) the herd during quarter t and 0 otherwise. The second term in equation (4) corrects for the possibility that a fund might go with or against the herd by

[7] We adjust for stock splits when computing the change in number of shares. Before adjusting for stock splits we reverse the split adjustment made by Thomson-Reuters for splits that take place between RDATE and FDATE. See Nicolosi (2009) for a justification of this procedure.

[8] If flows are correlated among funds that hold the same stocks, we should observe artificial herding due to flow-induced trades. Consider a hypothetical situation where a mutual fund experiences a net cash inflow in a particular quarter and invests this new cash in stocks it already holds as to keep their portfolio weights unchanged. If funds with common stock holdings experience correlated flows and trades in a similar fashion then we will observe herding according to LSV herding measure. However, according to our classification there will be no herding in these stocks since we also require a fund to change its weight in the same direction with its trade to be classified as a buyer or a seller.

chance. Using this signed herding measure, GTW (1995) define a fund herding measure for an individual fund as

$$FHM = \frac{1}{T}\sum_{t=1}^{T}\sum_{i=1}^{N}(w_{i,t} - w_{i,t-1}) \times SHM_{i,t}, \tag{5}$$

where T is the total number of periods for which the relevant fund data are available (120 months in GTW (1995)), N is the total number of stocks held by that particular fund, and $w_{i,t}$ is the weight of stock i in the fund's portfolio in quarter t.

1.3.2 Definition of Quarterly Herding Intensity Measures

To explore the relationship between fund herding and its performance during the contemporaneous and subsequent quarters we need to specify a quarterly fund herding measure. To this end, we first modify GTW's fund herding measure by removing the time averaging operator in equation (5). In addition, to avoid a negative (positive) contribution to this measure by stocks sold during a quarter in which they are subjected to sell (buy) herding, we also take the absolute value of their weight changes during the quarter.[9] Finally, we include an indicator function to set the contribution of a stock to the fund's herding measure to zero whenever there is a conflict between the direction of the weight change in the fund's portfolio and the direction of its actual trade.[10] These modifications result in the following measure which we refer to as fund herding intensity

[9] This modification is necessary because of the following potential situation: If fund j sells stock i when there is sell (buy) herding in that stock, the contribution of this stock to the FHM as defined in equation (5) for that quarter will be negative (positive), when it should have been positive (negative).
[10] This modification is needed in order to reduce the noise introduced to this measure in cases where the directions of the change in the number of shares held and the stock's weight change conflict.

$$HI_{j,t} = \sum_{i=1}^{N} \left| w_{j,i,t} - w_{j,i,t-1} \right| \times SHM_{j,i,t} \times IN_{j,i,t} \tag{6}$$

where $IN_{i,t}$ is an indicator function which assumes the value of 1 if the fund buys (sells) stock i and the change in weight of stock i is positive (negative), and gets the value of 0 otherwise.

To determine the degree to which a mutual fund joins buy or sell herds we next define separate buy and sell herding intensity measures

$$BHI_{j,t} = \sum_{i=1}^{N} \left| w_{j,i,t} - w_{j,i,t-1} \right| \times SHM_{j,i,t} \times BI_{j,i,t} \tag{7}$$

$$SHI_{j,t} = \sum_{i=1}^{N} \left| w_{j,i,t} - w_{j,i,t-1} \right| \times SHM_{j,i,t} \times SI_{j,i,t}, \tag{8}$$

where $BI_{j,i,t}$ ($SI_{j,i,t}$) is an indicator function that equals 1 if stock i is subjected to buy (sell) herding and the fund increases (decreases) both the number of stock i's shares and its weighting in its portfolio. Otherwise this function assumes a value of 0.

Mutual fund herding in individual stocks often continues for longer than one quarter during our sample period. In order to compare the performance of funds that join the herd as leaders with that of funds that join the herd as followers, we now use equation (6) to define two separate herding intensity measures conditional on a fund being a leader or a follower of the herd

$$HIL_{j,t} = \sum_{i=1}^{N} \left| w_{j,i,t} - w_{j,i,t-1} \right| \times SHM_{j,i,t} \times IN_{j,i,t} \times IL_{j,i,t} \tag{9}$$

$$HIF_{j,t} = \sum_{i=1}^{N} \left| w_{j,i,t} - w_{j,i,t-1} \right| \times SHM_{j,i,t} \times IN_{j,i,t} \times IF_{j,i,t}. \tag{10}$$

In the definition of $HIL_{j,t}$, the leader herding intensity measure, $IL_{j,i,t}$ is an indicator function that assumes the value of 1 if herding in stock i in quarter t is followed by a same-direction herding in the subsequent quarter $(t+1)$, and is 0 otherwise. Likewise, in the definition of $HIF_{j,t}$, the follower herding intensity measure, $IF_{j,i,t}$ is an indicator function that assumes the value of 1 if herding in stock i quarter $t-1$ is in the same direction as in quarter t and is not followed by a same-direction herding in the subsequent quarter $(t+1)$, and 0 otherwise.[11] Table 1.1, Panel B presents the means and standard deviations of these various herding intensity measures as well as of selected fund characteristics comprising fund size, age, management tenure, expense ratio, turnover ratio and fund flow.

1.3.3 Performance Evaluations

1.3.3.1 Performance Evaluation in the Subsequent Quarter(s)

In the ensuing investigation of the relationship between herding intensity and fund performance we use two alternative fund performance measures, holding-based returns and net returns. Holding-based returns are the monthly gross returns on a hypothetical portfolio in which each stock's weight in any particular month is determined by the most recent quarterly fund holdings. These weights are updated monthly using the previous month-end stock prices. Specifically, stock i's weight for month m held by mutual fund j is computed as

$$w_{j,i,m} = \frac{holdings_{i,j,t-1} \times price_{i,m-1}}{\sum_{i=1}^{N} holdings_{i,j,t-1} \times price_{i,m-1}}, \tag{11}$$

[11] Leader and follower funds can be defined in various ways. Our definition is motivated by the return patterns of herded stocks documented in section 1.4.

where $holdings_{i,j,t-1}$ is the number of shares of stock i held by mutual fund j at the end of the previous quarter $(t-1)$ *and* $price_{i,m-1}$ is the price of stock i at the end of the previous month. These weights are then used to compute holding-based return of mutual fund j for month m as follows

$$Ret_{j,m} = \sum_{i=1}^{N} w_{j,i,m} \times R_{i,m}, \tag{12}$$

where $R_{i,m}$ is the return of stock i in month m.

To compute abnormal holding-based returns, two alternative adjustments are made – the characteristic adjustment and the factor-based risk and style adjustment. The characteristic adjustment uses the characteristic selectivity measure (hereafter CS) proposed by Daniel, Grinblatt, Titman, and Wermers (1997, hereafter DGTW). Following their approach, for each quarter stocks are sequentially grouped into quintiles based on their size, book-to-market ratios, and their previous six month returns. Each stock is then matched quarterly to one of these 125 benchmark portfolios according to its size, book-to-market ratio, and past returns. The CS measure for a stock is then computed by subtracting the average return of the portfolio to which it is assigned from its own return. More specifically, the CS measure for a mutual j in month m is defined as

$$CS_{j,m} = \sum_{i=1}^{N} w_{j,i,m} \times (R_{i,m} - R_{m}^{b_{i,m-1}}), \tag{13}$$

where $R_{m}^{b_{i,m-1}}$ denotes the return of the stock's benchmark portfolio for the month $m-1$.[12] In line with previous studies we also offer the Fama and French (1993) three-factor and the Carhart (1997) four-factor adjustments.

[12] See DGTW (1997) and Wermers (2000) for detailed explanation of the computation of benchmark portfolios and the assignment of stocks to these portfolios. Different from DGTW (1997) we update the 125 portfolios quarterly rather than annually.

The above defined holding-based returns (raw and adjusted) are useful in examining the direct impact of herding on the performance of stock portfolios of mutual funds. They do not, however, reflect the returns to mutual fund investors due to three reasons: they ignore inter-quarter trades, they overlook returns from holdings other than equities, and they do not account for transaction costs and other expenses incurred by fund investors. Therefore, to investigate the implications of herding to investors, we also carry out the analysis using net mutual fund returns.

1.3.3.2 Performance Evaluation for the Herding Quarter

One of the objectives of this study is to examine whether fund investors are affected by mutual fund herding during the herding quarter. Because fund holdings data are available only quarterly, we have no direct way of measuring the potential gains from herding during the quarter in which herding occurs. To circumvent this obstacle, we use Kacperczyk, Sialm, and Zheng's (2008) return gap measure that quantifies the impact of the unobserved actions of a mutual fund in a given quarter by comparing its actual performance (net fund return) with the performance of its preceding quarter-end portfolio (holding-based return). More specifically, the return gap for fund *j* in month *m* is defined as

$$Retgap_{j,m} = Netret_{j,m} - \left(Ret_{j,m} - Exp_{j,y} / 12 \right), \tag{14}$$

where $Netret_{j,m}$ is the net monthly fund returns, $Ret_{j,m}$ is as defined in equation (12), and $Exp_{j,y}$ is the annual expense ratio.

1.4 Herding and Stock Returns

For an association between mutual fund herding and fund performance to exist, the herding activity under examination must affect the returns on the herded stocks. The evidence provided by previous studies on this point is mixed. Wermers (1999) shows that stocks that are subjected to high levels of buy herding outperform stocks that are subjected high levels of sell herding during both the herding quarter and the subsequent quarter. He finds no evidence of return reversals in these stocks and concludes that herding actually speeds up the incorporation of information into the stock prices. Similarly, Sias (2004) using his above mentioned measure concludes that herding by institutions does not destabilize stock prices. Brown, Wei and Wermers (2009) find that, when mutual funds herd in response to sell-side analyst recommendations, overreaction to this information destabilizes stock prices. A more recent study by Dasgupta, Prat, and Verardo (2010) documents that stocks that are persistently herded by institutions experience return reversals in the long run. Similarly, Gutierrez and Kelley (2009) provide evidence that stocks that are subjected to institutional herding experience return reversals in the second year after herding takes place, indicating that herding has a destabilizing effect on stock prices.

In the light of this prior evidence, we start our investigation by employing portfolio analysis (as in Wermers (1999)) to determine whether mutual fund herding has any impact on stock returns.[13] For this purpose, for each quarter we group stocks traded by at least five mutual funds into two based on their ratio of the buyers to all traders ($p_{i,t}$). Stocks are classified as buys (sells) if their ratio of the buyers to all traders, $p_{i,t}$, is greater (less) than the cross-sectional average, $\overline{p}_t$. Within each group, we then sort stocks into quintiles based on their herding measures as defined

[13] Reexamination of the potential effect of herding on stock returns is motivated by the discrepancy between our 1980-2007 and Wermers' (1999) 1974-1994 sample periods.

in equation (1). Stocks in the highest buy (sell) herding quintile are classified as top buy (top sell) herding stocks. We also form a difference portfolio that buys the top buy herding and shorts the top sell herding stocks. These portfolios are rebalanced quarterly. The average raw returns and CAPM, three- and four-factor alphas of the three portfolios are computed up to three years following the herding quarter. Jegadeesh and Titman's (1993) calendar time aggregation methodology is used to compute average returns and alphas of these three stock portfolios for overlapping observations.

Table 1.2 presents the result of this analysis for the herding quarter (q_0), the following two quarters (q_1, q_2) as well as for later longer periods (q_3 to q_4, q_5 to q_8 and q_9 to q_{12}). As indicated in the first two rows of this table, stocks strongly bought by herds significantly outperform stocks sold by herds by 9.26% (per month) during the herding quarter. This result remains significant after adjusting for three- and four-factors. The raw average monthly return of the difference portfolio in the quarter immediately following the herding is 49 basis points, but is only marginally significant. The corresponding CAPM and the three-factor alphas are 57 and 60 basis points, respectively and are both significant at the 5% level. However, after controlling for momentum the return difference between the top buy and the top sell herding portfolios vanishes. The return on the difference portfolio is not significantly different from zero in the quarters following the immediate subsequent quarter.

Previous studies provide evidence that stocks may occasionally be herded for longer than one quarter (Sharma, Easterwood, and Kumar (2006), Sias (2004)). If this is the case, the results presented in Table 1.2 for the immediate subsequent quarter may be contaminated by herding that continues into this quarter. A stock experiencing a continuing buy (sell) herding might exhibit a positive (negative) subsequent quarter return that is more likely to be associated with that quarter's herding rather than with the herding that took place in the previous quarter. The opposite effect should be expected for buy (sell) herds that are reversed To investigate this potential effect of continuing herding, we first examine whether stock herding by mutual funds indeed tends to continue for more than one quarter. For each quarter, we form buy and sell herding quintiles as described above and compute the average and the median proportions of stocks that are subjected to subsequent herding in the same direction, in the opposite direction or exhibit no subsequent herding and average these proportions over all quarters. The resulting averages for these mean and median values are tabulated in Table 1.3. As can be seen from this table, 38.5% of the top buy herding and 43.3% of the top sell herding stocks experience same-direction herding in the subsequent quarter. These figures increase monotonically from the lowest to the highest quintile for both herding types. These results point to the need to control subsequent stock returns for ongoing subsequent quarter herding. We therefore proceed to reexamine the impact of herding on stock returns by separating stocks that are subjected to continuing, reversing or no herding in the subsequent quarter. [14]

Table 1.4 presents the average return for the top quintiles of the buy and of the sell herding stocks in the herding quarter and in its immediate following quarter. The results are reported separately for stocks for which herding continues (Panel A), reverses (Panel B), and stops (Panel C). As is evident from the three panels, the average returns on the difference portfolio for the herding quarter is positive, and significantly so, for all three groups. From Panel A we are instructed that when herding continues in the same direction, the return on the difference portfolio in the subsequent quarter is significantly positive for the raw returns and all adjusted returns. Not surprisingly, when herding is reversed the return on the difference portfolio in this

[14] Sharma, Easterwood, and Kumar (2006) propose a methodology to control for the ongoing herding when examining the impact of herding on stock returns. In this analysis we follow their methodology.

quarter reflects the herding that takes place during this quarter and it is significantly negative for both raw and adjusted returns. Panel C, reporting the results for the case in which the subsequent quarter's returns are not affected by a concurrent herding, is most interesting as it sheds light on the uncontaminated effect that herding may have on returns in the subsequent quarter. As can be seen from this panel, despite the fact that no herding took place during this quarter the average return on the difference portfolio is significantly negative (-1.02% monthly) and remains so after all adjustments. This return reversal is consistent with a scenario in which mutual fund herding causes stock prices to deviate from their fundamental values during the herding quarter with a reversal toward such values in the subsequent quarter.

In sum, the results in this section provide evidence that stocks bought by herds outperform stocks sold by herds during the herding quarter. We further show that, unless a same-direction herding follows, this return difference reverses in the subsequent quarter. These findings are consistent with a situation in which herding exerts pressure on prices which then revert to their fundamental values when herding stops.

1.5 Determinants of Herding Intensity

In the methodology section of this paper we provide a definition for the unconditional (equation (6)) as well as for the conditional buy and sell herding intensity measures (equations (7) and (8) respectively). In this section we investigate whether these measures are related to fund attributes. For this purpose, we run Fama-MacBeth regressions (Fama and MacBeth (1973)) of these measures on various commonly used fund characteristics comprising fund age, size, flow, management tenure, turnover, and expense ratio [e.g. Chen et al. (2004), Cremers and Petajisto (2009) and Kacperczyk, Sialm, and Zheng (2005)]. We also include the funds' previous quarter's net returns as an independent variable to test whether past performance affects current herding behavior. Table 1.5 summarizes the results of these regressions. In this table *LOGAGE* and *LOGTENURE* are the natural logarithm of fund's age and management tenure measured in months, respectively. *LOGTNA* is the natural logarithm of total net fund assets. We use the natural logarithm of age, tenure and size because these variables are skewed to the right. *FLOW* is the new money growth.[15] *EXPENSE* and *TURNOVER* are the current year's expense ratio and turnover ratio, respectively. Because turnover and expense ratios are only available on annual basis we use the corresponding annual values for all quarters in that particular year. All other variables are available quarterly.

The first three columns of Table 1.5 present the results of regressing the unconditional herding intensity measure on the above fund attributes. We note that turnover and size are significantly positively related to herding intensity measure, but other variables are not significantly associated with it. In order to examine whether the direction of the herd affects these results, we repeat the analysis for the conditional buy and sell herding intensity measures. The fourth to sixth columns of Table 1.5 present the results for the buy herding intensity, while the remaining columns do the same for the sell herding intensity. It appears from these columns that, controlling for other characteristics, fund size is positively related to buy herding intensity, but not to sell herding intensity. Note also that fund flow is positively related to buy herding intensity and negatively related to sell herding intensity with both coefficients statistically significant at the 1% percent level. Neither of them, however, is economically important.[16]

In sum, this subsection documents a positive relation between herding intensity and turnover. It should, however, be pointed out that this relationship is to some extent mechanical. High

[15] New money growth formula is as defined in Gruber (1996) and Coval and Stafford (2007).

[16] One standard deviation change in flow changes the buy and the sell herding intensity measures by less than one tenth of their respective standard deviations.

herding intensity funds are likely to experience high turnover as they trade frequently when they join the herd. In contrast, high turnover funds should not necessarily have high herding intensity, as they can trade frequently without joining any herd or trade against the herd. The evidence presented above suggests that funds that tend to join herds, especially on the buy side, are relatively larger in size. We also report an economically weak association between herding intensity and fund flows, which is nevertheless consistent with a situation in which funds join buy (sell) herd when experiencing cash inflows (outflows). Low average R-squared values in these regressions suggest that herding measures cannot be satisfactorily explained by the selected fund characteristics.

1.6 Herding and Fund Performance

In this section we turn to investigate the main question of this paper: does stock herding affect herding funds' performance. To this end, we use several performance measures for mutual funds. The return gap is employed to assess whether funds benefit from herding during the herding period, while subsequent quarter performance is evaluated by examining funds' trade portfolio return, holding-based returns, and net fund returns.

1.6.1 Herding Intensity and Concurrent Fund Performance

Because the trade data of mutual funds are unavailable, we are prevented from directly measuring the effect that herding might have on the performance of herding funds during the quarter in which this activity takes place. The return gap measure proposed by Kacperczyk, Sialm, and Zheng (2008) is suitable to circumvent this difficulty. This monthly measure, explained in the methodology section, is the difference between the fund's net monthly returns and the return on its beginning-of-quarter portfolio. In section 1.4, we provide evidence that stocks bought (sold) by herds have positive (negative) abnormal returns during the herding quarter. If herding funds capture some of these abnormal returns then we would expect them to exhibit higher concurrent return gap measures than funds that do not herd.[17] To explore this hypothesis we again turn to portfolio analysis. For each quarter, mutual funds are sorted into quintiles based on this quarter's unconditional, buy, and sell herding intensity measures. We then compute the monthly average raw and factor adjusted return gap for each quintile and examine the difference in return gap between the highest and the lowest herding intensity quintiles. Adjusted return gaps are calculated by using the CAPM, and the three- and four-factor models. The first four columns of Table 1.6 present the results for the unconditional herding intensity, the next four for the buy herding intensity, and the last four for the sell herding intensity.[18] As can be seen from this table, for all three herding intensity measures the return gap increases monotonically as we move from the lowest to the highest quintile. Furthermore, the differences between the monthly return gaps of the highest and the lowest quintiles are 12, 8 and 11 basis points for the unconditional, the buy, and the sell herding intensity measures, respectively. All these differences are statistically significant at the 1% level and remain so after all adjustments.

To control for fund characteristics that may be associated with return gap we also carry out a Fama-Macbeth regression analysis. For each quarter we regress the return gap on the unconditional herding intensity measure and on fund variables including size, equity ratio,

[17] We cannot use fund net returns in this analysis because stocks that are purchased in the quarters preceding the herding also contribute to fund net returns. As a result, possible differences between net returns of funds with low and high levels of herding intensity cannot be reasonably attributed to their herding levels. We therefore examine the association between herding intensity and the improvement in fund performance as compared to their beginning of quarter holding returns.

[18] It should be noted that, because in our holding-based return computations we ignore the returns of holdings other than the CRSP stocks, our return gap measure is biased downward. However, this does not constitute a major problem since the average equity percent of the five herding intensity quintiles are similar (mainly because of our minimum 80% average equity holding requirement).

turnover, and expense ratio. We then compute the time-series average of the resulting regression coefficients over the sample period. We find the coefficient on the herding intensity measure to be significant at the 1% level even after controlling for other fund characteristics.[19] When the same analysis is performed for the buy and sell herding intensity measures we find that the coefficient of the sell herding intensity measure is significant at the 1% level, but that of the buy herding intensity only at the 10% level. Consistent with the results of the above portfolio analysis, the return gap is found to be significantly positively associated with all three herding intensity measures even after controlling for fund attributes.[20]

On the whole, the results of this subsection suggest that on average funds that join the herd act before the abnormal returns on the herded stocks are fully realized, implying that funds benefit from herding in the quarter in which this activity takes place. Moreover, the more intense their participation in this activity the more funds benefit from it during the herding quarter. The multivariate regression findings confirm these results even after fund characteristics are controlled for. In the following subsections we turn to investigate the effect that herding might have on fund performance in subsequent quarters.

1.6.2 Herding Intensity and Subsequent Trade Portfolio Returns

In this subsection we extend our examination to the possible association between herding intensity and the subsequent returns on the trade portfolio of mutual funds involved in herding. Trade portfolio returns reflect the performance of all observed trades by a fund during the herding quarter. To the effect that trading with the herd is beneficial (detrimental) to mutual

[19] The standard errors used to determine significance are adjusted for the Newey-West serial correlation (Newey and West (1987)).

[20] The Fama-Macbeth regressions are carried out to check for robustness. Due to space considerations the results of the regression analysis are not tabulated here.

funds, the trade portfolio of herding funds should outperform (underperform) those of funds that do no herd. Our examination follows a similar procedure to that in Kacperczyk, Sialm, and Zheng (2005). For each quarter, we first sort all mutual funds into quintiles in ascending order based on their herding intensity measures. We then compute each fund's subsequent quarter's monthly trade portfolio returns as the weighted average return of stocks purchased and stocks sold during the herding quarter.[21] Finally, equal-weighted average raw returns, CS measures and, three- and four-factor alphas are computed for each herding intensity quintile.

Table 1.7 summarizes the performance of the trade portfolios for the above described unconditional herding intensity quintiles.[22] We observe that stocks purchased appear to outperform stocks sold in all five quintiles, but that this outperformance is statistically significant only in quintiles 4 and 5. For the highest herding intensity quintile, the monthly raw return difference between the buy and the sell trade portfolios is 33 basis points (significant at the 1% level). This difference remains significant even after adjusting for CS, three- and four-factors. We note, though, that the difference between the buy and sell portfolio returns does not increase monotonically with the unconditional herding intensity. The difference in the return differences between the first and fifth quintile portfolios are 27 and 30 basis points for the raw returns and three-factor alpha, respectively, but are not statistically significant after the alternative adjustments for momentum.

In sum, the evidence suggests that buy trades of funds that herd intensely outperform their sell trades in the quarter after herding takes place. However, after controlling for momentum,

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[21] The weight of each buy (sell) trade in the trade portfolio of a fund is computed by dividing the dollar value of that trade by the total dollar value of all buy (sell) trades of that fund in that particular quarter.

[22] Quintile 5 (1) has positive (negative) herding intensity measure indicating that, on average, these funds tend to trade greater fraction of their trades with (against) the herd.

there is no significant difference between the subsequent returns of the buy trades of high herding intensity and those of low herding intensity funds.

1.6.3 Herding intensity and Subsequent Fund Performance Relationship

We now turn to examine the relationship between herding intensity and subsequent fund performance as measured by holding-based returns and by net fund returns, both described in section 1.3.3. We first investigate whether there is an association between herding intensity and subsequent quarter fund holding-based returns and then repeat the analysis for net returns.

To carry out the analysis for holding-based returns, for each quarter, mutual funds are sorted into quintiles in ascending order based on their previous quarter's unconditional herding intensity as described in previous subsections. We then compute the average raw and abnormal portfolio monthly returns for each quintile as well as the return difference between quintiles 5 and 1. The reported results in Table 1.8 indicate that the portfolio of funds with the highest unconditional herding intensity earns an average holding-based abnormal monthly return of 16 basis points according to three-factor model, which is significant at the 5% level. However, after controlling for momentum this abnormal return vanishes. The difference between the abnormal returns of Quintile 5 and Quintile 1 is not statistically significant except for the three-factor adjustment. These results do not as a whole point to a significant relationship between herding intensity and holding-portfolio returns in the subsequent quarter.

To examine whether mutual fund herding affects subsequent returns to their investors, we next repeat the above analysis using net returns as a measure of fund performance. The findings for these net returns, presented in the last three columns of Table 1.8, are similar to those reported above for the holding-based returns. The highest unconditional herding intensity quintile (Q5) earns subsequent adjusted (three- and four factor) net returns that are not significantly different from zero. In contrast, funds in the lowest herding intensity quintile (Q1) earn respective negative abnormal returns of 18 and 12 basis points adjusted for the three- and four-factors. The average raw return difference between Quintiles 5 and 1 is again not significantly different from zero.

Overall, the results in this subsection fail to support a significant association between the unconditional herding intensity measure and subsequent quarter fund performance as measured by holding-based and by net returns.

1.6.4 Persistence of Herding Intensity

In section 1.6.1 we document that funds benefit from herding in the quarter in which herding takes place. Had funds herded persistently we should have expected a positive relationship between herding intensity and long-run fund performance. In this section we prepare the ground for the exploration of this possibility by first investigating the persistence of the unconditional herding intensity measure. We address this question by first examining whether past unconditional herding intensity predicts future unconditional herding intensity.[23] For this purpose, for each quarter we first rank mutual funds into deciles based on their unconditional herding intensity measure and compute each decile's average rankings for each of the succeeding twelve quarters (t+1 to t+12). We then compute the time-series average of these average rankings over the entire sample period. If there is no persistence in herding intensity measure, funds that are initially assigned to a particular decile should be uniformly dispersed among all ten deciles in the subsequent quarter with a resulting average subsequent ranking of 5.50. As can

[23] We follow here a similar methodology to that employed by Kacperczyk, Sialm, and Zheng (2005) who examine persistence of industry concentration of mutual funds.

be seen from Panel A of Table 1.9, the average ranking of the top (bottom) decile funds falls (rises) to 7.59 (4.40) in the subsequent quarter. No dramatic change is observed in the remaining eleven quarters; the average ranking of the top (bottom) decile is still 7.04 (4.69) in the twelfth subsequent quarter. This indicates that, although there is some degree of reversion to the mean, funds in the highest herding intensity quintile maintain above-median herding intensity levels as far as three years after being assigned to it.

To further quantify the persistence of the unconditional herding intensity we also compute the cross-sectional Pearson and Spearman rank correlations of this measure between quarter *t* and each of the twelve subsequent quarters. We then calculate the time series averages of these cross-sectional correlations. Table 1.9, Panel B reports the mean correlation coefficients and corresponding t-statistics that are computed from the time-series standard errors. The average cross-sectional Pearson (Spearman rank) correlation between quarters *t* and *t+1* is 0.3689 (0.3882) and it decreases to 0.2866 (0.3096) by quarter *t+12*. The results provide evidence that there is a degree of persistence in herding intensity of mutual funds.

1.6.5 Herding Intensity and Long-run Performance

From the previous subsection it is evident that some degree of persistence is exhibited by the unconditional herding intensity measure. An examination of whether this persistence affects long-run fund performance is therefore in order. We start this examination by computing, for each quarter *t*, the average herding intensity measure for each fund over quarters *t-1* to *t-k* (the formation period), where *k* takes the values of 1, 2, 4, and 8. Funds are then sorted into quintiles based on their formation period's average herding intensity measures. We next form difference portfolios that buy the funds in the highest average herding intensity quintile and sell the funds in the lowest average herding intensity quintile. We then compute the average raw and abnormal net returns for each quintile as well as the return of the difference portfolio over quarters *t* to *t+k-1* (the holding period). Table 1.10 presents the average raw net returns and the three- and four-factor alphas of the difference portfolios with varying formation and holding periods. As can be seen from this table, there is no significant performance difference between the high herding intensity and the low herding intensity funds.

Despite the above documented evidence of a certain degree of persistence in herding intensity, the results fail to exhibit any significant association between herding and fund performance for the selected ranges of formation and holding periods.

1.7 Leader and Follower Funds

Once mutual funds form a herd in a particular stock, it can either continue or stop (reverse) in the subsequent quarter. In Section 1.4 we document that when herding continues, the top buy herding stocks earn higher returns than the top sell herding stocks during the subsequent quarter. The converse is true for stocks that experience subsequent herding reversal (or no continuing herding). This stock return pattern is bound to affect differently the performance of leader funds that join the herd at an early stage than that of follower funds that do so in the quarter before herding stops or reverses. In light of these potential differential effects, it is possible that the lack of association between herding intensity and subsequent fund performance reported in Table 1.8 is due to the fact that the analysis leading to this table lumps leader with follower funds. In this section, we venture to examine this possibility by separating between these types of funds to try and unveil an association between herding and subsequent fund returns. We carry out this investigation for the three fund performance measures used above: trade portfolio performance, holding based return, and net fund return.

1.7.1 Subsequent Trade Portfolio Performance of Leaders and Followers

This subsection looks into the question of whether the subsequent performance of leader funds' trade portfolio is different from that of follower funds. We follow a procedure similar to that used in section 1.6.2 that investigates the same question for the unconditional herding intensity measure. For each quarter, mutual funds are separately sorted into quintiles in ascending order based on their previous quarter's leader herding intensity and follower herding intensity measures (equations (9) and (10), respectively). We refer to funds in the top leader (follower) herding intensity quintile as leaders (followers). The average performances of the trade portfolios of the leader and follower funds, as well as the difference between their trade portfolios, are then computed and the results are presented in Table 1.11.[24] As is evident from this table, the difference between the subsequent quarter returns on the buy and sell trades of the leaders is 61 basis points monthly, statistically significant at the 1% level. This performance difference remains significant even after adjusting for stock characteristics and for the three- and four-factors. In contrast, there is no similar significant difference for the follower funds. Most important, the buy (sell) trades of leader funds significantly outperforms (underperforms) those of follower funds. The difference in differences between the trade portfolio performance of the leader and follower funds is also statistically significant (at the 1% level); 52 basis points monthly for the raw, and 41, 53, and 54 basis points for the CS, three- and four-factor adjusted

[24] It should be noted that our leader and follower herding intensity measures are forward looking; in computing leader herding intensity measure (equation (9)) we take into account stocks that are subjected to same-direction herding in both the current and subsequent quarter. Similarly, in computing the follower herding intensity measure (equation(10)) we consider only herded stocks that experience same-direction herding in the previous quarter and are not subjected to same-direction herding in the subsequent quarter.

returns, respectively. These results indicate that the trade portfolios of leader funds tend to outperform those of the follower funds. The question addressed to in the following subsection is whether this outperformance carries over to the funds' holding-base and net returns.

1.7.2 Subsequent Performance of Leaders and Followers

We begin the investigation of the subsequent holding-based returns of leaders and followers by first identifying these funds as in the previous subsection. Using both holding-based and net returns, we then compute the average raw and abnormal performance for these two groups of funds, as well as for the difference portfolio which buys leaders and sells followers. The results are presented in Table 1.12. It should be noted in this table that, although the holding-based raw returns of both types of funds are significantly positive, their abnormal returns are by and large not significantly different from zero (the three-factor adjusted return for the leader funds is the exception). The last row of this table suggests, however, that the average subsequent holding-based return of the leader funds is significantly higher (8 basis points per month) than that of the follower funds and it remains so after all adjustments. The results for net returns are presented in the last three columns are similar.

The findings presented in this section show that whether a fund is a leader or a follower is on average a matter of consequence; the subsequent quarter returns of leader funds are superior to those of follower funds. The question arises as to whether leadership and followership are persistent fund characteristics and as such affect long-run performance. If this is indeed the case then we would observe a long-run performance difference between leaders and followers. In an attempt to answer this question, we first investigate the persistence of funds' leadership and followership in the following subsection, and then examine whether such persistence translates into a long-term overperformance of leader funds over follower funds.

1.7.3 Persistence of Leadership and Followership

In order to determine whether funds that lead or follow the herd do so on a consistent basis, we apply the procedure used in section 1.6.4 for the unconditional herding intensity measure to the leader and follower herding intensity measures. For each quarter, we first separately rank mutual funds into deciles based on the two conditional measures. To simplify the analysis, we focus on funds that belong to the highest and the lowest deciles with regard to their respective measures. Untabulated results show that, for the leader intensity measure, funds in the top (bottom) decile assume an average ranking of 6.79 (5.01) in the subsequent quarter and that the equivalent figure for the follower herding intensity measure is 6.71 (5.12). These figures, when compared to 5.50 under the null hypothesis of no persistence, suggest that funds that belong to their respective highest quintile in a particular quarter still tend to belong to an above-expectation decile in the subsequent quarter. We also compute the Pearson and Spearman ranks correlations between current quarter (*t*) and in its succeeding twelve quarters (*t+1* to *t+12*) and find them to be statistically significant, though not very high. In sum, our analysis in this subsection indicates a degree of persistence of these conditional leader and follower herding intensity measures.

1.7.4 Performance Difference between Leaders and Followers in the Long-run

In section 1.7.2 we compare the performances of leader funds with that of follower funds and conclude that, ex-post, leaders outperform followers in the quarter subsequent to the herding activity. In this subsection, we investigate whether past leader funds outperform past follower funds in the long-run. We follow a similar methodology to that employed in section 1.6.5 with the exception that, in order to eliminate the forward looking bias inherent in the definition of leaders and followers we now skip one quarter between the portfolio formation and the holding periods. Table 1.13 reports the average net returns and the three- and four-factor alphas for the difference portfolios that buy funds in the highest leader herding intensity quintile and sell the funds in the highest follower herding intensity quintile. The results are presented for various length of formation and holding periods. We note from this table that short-term leaders (as measured over a single quarter formation period) weakly outperform short-term followers in quarter *t+1*. However, this weak outperformance fades quickly as we increase the length of the holding period. Similarly, no significant return difference between leaders and followers is evident when the length of the formation period is increased, a possible reflection of the dilution of the respective intensity measures when averaged over extended periods. [25]

In this subsection we focus on two extreme cases where herding might improve or impair subsequent fund performance and show that ex-post leaders outperform ex-post followers in the immediate subsequent quarter. Contrasted with the results for the unconditional herding intensity measure, this finding informs us that fund performance in the subsequent quarter *is* dependent on the strength of the two newly introduced conditional herding intensity measures. However, as funds apparently do not strongly sustain their leadership or followership status for an extended time period, and therefore no significant long-run performance difference between leaders and followers is observed.

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[25] An exception is the negative performance of the difference portfolio formed for an eight quarters formation period with two quarters holding period for which the difference is significantly negative. We have no plausible explanation for this exception.

1.8 Conclusion

Previous investigations of stock herding by financial institutions are concerned with evidence of herding and whether this activity, to the extent that it exists, affects stock returns. This study shifts the focus from the return on herded stocks to the performance of herding funds. It assesses the effect that herding has on the concurrent and subsequent performance of mutual funds that engage in this activity. A necessary condition for this effect to be present is that herding by mutual funds affects the returns on herded stocks. We use an LSV herding measure to test this hypothesis and in line with previous studies, we confirm that, during the herding quarter, stocks bought intensely by herds outperform stocks sold intensely by herds. This return difference does not, however, carry over to subsequent quarters in any significant way. To further refine the investigation, we document that, once a stock is being herded by mutual funds, it tends to be subjected to the same-direction herding in the subsequent quarter. In light of this persistence, we reexamine the subsequent quarter stock returns by focusing on stocks that experience no herding during this quarter. Whereas some previous studies report intermediate and long-run subsequent price reversals, we find that, when subsequent quarter herding is controlled for, a return reversal immediately follows. This finding indicates that herding tends to move stock prices away from their fundamental values with a correction taking place soon after.

Having established that the behavior of herded stocks may potentially affect fund performance, this paper then turns to examine such possible effects of herding. For this purpose, we modify GTW's (1995) long-term fund herding measure to define a fund herding intensity measure that quantifies the degree to which a fund is involved in herding in any given quarter. Using this measure, we find that herding funds capture (avoid) some of the contemporaneous positive (negative) abnormal returns experienced by herded stocks. We do not, however, detect any significant difference between the subsequent performances of high and low herding intensity funds. In addition, although the data indicate that mutual funds tend to herd persistently, we fail to find a significant relationship between herding intensity and long-run fund performance. We show that this failure is the result of aggregating the returns of all herding funds without distinguishing at what stage they join the herd. Applying a novel definition of fund herding intensity that quantifies the degree to which a fund joins the herd as a leader or as a follower, we document a clear relationship between herding intensity and subsequent quarter fund performance – funds that herd intensely as leaders subsequently outperform funds that herd as followers. Were leadership and followership persistent fund characteristics, long-run performance difference between the two fund types would be expected. Although some evidence of such persistence is found in the data, we observe that it is not sufficiently strong to induce long-run performance difference between leaders and followers.

Overall, our paper presents evidence that there is a positive contemporaneous association between herd membership and fund returns; on average, intense herding is beneficial to funds' performance during the herding period. With regard to subsequent performance, we show that no significant association between unconditional herding intensity and fund performance is evident in the data. After conditioning the herding intensity measure on a fund being an intense leader or intense follower, we document that leader funds outperform follower funds in the subsequent quarter. However, leadership and followership do not appear to be sufficiently persistent to support superior performance for the former in the long run.

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Table 1.1
Sample Description and Summary Statistics

Panel A reports the number of mutual funds and number of observations after each screen. Panel B presents the summary statistics of the mutual funds included in the paper. The herding intensity measure, $HI_{j,t}$, for each fund–quarter is defined as $HI_{j,t} = \sum | w_{i,j,t} - w_{i,j,t-1} | * SHM_{i,j,t} * IN_{i,j,t}$, where $w_{i,j,t}$ is weight of stock i in fund j's portfolio at the end of quarter t, $SHM_{i,j,t}$ is the signed herding measure, $IN_{i,t}$ is an indicator function which gets value of 1 if the fund buys (sells) stock i and the change in weight of stock i is positive (negative), and 0 otherwise. The leader herding intensity measure is defined as $HIL_{j,t} = \sum | w_{i,j,t} - w_{i,j,t-1} | * SHM_{i,j,t} * IN_{i,j,t} * IL_{i,j,t}$, where $IL_{i,j,t}$ assumes the value of 1 if herding in stock i quarter t is followed by herding in the same direction in the subsequent quarter (t+1), and the value of 0 otherwise. The follower herding intensity measure is defined as $HIF_{j,t} = \sum | w_{i,j,t} - w_{i,j,t-1} | * SHM_{i,j,t} * IN_{i,j,t} * IF_{i,j,t}$, where $IF_{i,j,t}$ assumes the value of 1 if herding in stock i quarter $t-1$ is in the same direction as in quarter t and is not followed by herding in the same direction in the subsequent quarter, and the value of 0 otherwise.

Panel A. Number of Funds and Observations

Filters	Number of Funds	Number of Fund-quarter Observations
1. Funds with investment objective code 2, 3 and 4	4,127	110,530
2. Funds with available adjacent quarterly observations	3,308	72,096
3. Funds with average equity percent => 0.80 and TNA> $15 Million	1,602	36,755
4. Funds matched with CRSP Mutual Funds Database	1,317	30,717

Panel B. Summary Statistics

	Mean	Std. Dev
HI	0.012	0.0144
BHI	0.008	0.0095
SHI	0.004	0.0077
HIL	0.005	0.0072
BHIL	0.003	0.0046
SHIL	0.002	0.0047
HIF	0.003	0.0053
BHIF	0.002	0.0040
SHIF	0.001	0.0029
TNA (total net assets) (in millions)	1058	5297
Age (months)	137	84
Manager Tenure (months)	79	59
Expense Ratio	0.012	0.005
Turnover Ratio	0.826	0.785
Flow (net fund growth ratio)	0.012	0.139

Table 1.2
Herding and Stock Returns

This table presents average monthly raw returns and monthly CAPM, three- and four-factor alphas for stocks subjected to high levels of herding by mutual funds. Results are presented for the herding period (q_0) and for the subsequent quarters (q1, q2, q3-q4, q5-q8, and q9-q12). To identify high buy and sell herding stocks, stocks are sorted into quintiles according to their buy and sell herding levels using the LSV-based herding measure. Stocks in the highest buy (sell) quintile are defined as top buy (sell) herding stocks. A difference portfolio that buys the top buy herding and shorts the top sell herding stocks is formed. Jegadeesh and Titman's (1993) calendar time aggregation methodology is used to compute average returns and alphas of these three portfolios for overlapping observations. Corresponding t-statistics are presented in parenthesis. The portfolios are rebalanced quarterly. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	Raw Returns			CAPM alphas			3 Factor alphas			4 Factor alphas		
	Top Buy Herding	Top Sell Herding	Difference	Top Buy Herding	Top Sell Herding	Difference	Top Buy Herding	Top Sell Herding	Difference	Top Buy Herding	Top Sell Herding	Difference
q_0	0.0621 ***	-0.0305***	0.0926 ***	0.0490 ***	-0.0446***	0.0936 ***	0.0498 ***	-0.0453 ***	0.0951***	0.0506 ***	-0.0436 ***	0.0942***
	(16.17)	(-7.45)	(24.62)	(20.21)	(-19.31)	(24.66)	(22.63)	(-19.4)	(24.72)	(22.39)	(-18.4)	(23.82)
q_1	0.0139 ***	0.0090 **	0.0049 *	0.0016	-0.0041*	0.0057 **	0.0018	-0.0042 *	0.0060**	-0.0003	0.0014	-0.0017
	(4.11)	(2.34)	(1.72)	(0.93)	(-1.95)	(2.00)	(1.27)	(-1.96)	(2.08)	(-0.21)	(0.78)	(-0.71)
q_2	0.0113 ***	0.0093 **	0.0020	-0.0011	-0.0032	0.0021	-0.0010	-0.0033	0.0023	-0.0014	0.0018	-0.0032
	(3.34)	(2.45)	(0.80)	(-0.74)	(-1.46)	(0.84)	(-0.79)	(-1.49)	(0.87)	(-1.08)	(0.96)	(-1.38)
q_3-q_4	0.0097***	0.0073 **	0.0024	-0.0024 *	-0.0048***	0.0024	-0.0021*	-0.0060***	0.0039	-0.0010	-0.0018	0.0007
	(2.93)	(2.07)	(1.45)	(-1.93)	(-2.76)	(1.43)	(-1.75)	(-3.54)	(2.29)	(-0.88)	(-1.31)	(0.47)
q_5-q_8	0.0115 ***	0.0105 ***	0.0009	-0.0007	-0.0013	0.0006	-0.0013	-0.0033**	0.0020	0.0019*	0.0002	0.0017
	(3.48)	(3.19)	(0.68)	(-0.55)	(-0.86)	(0.48)	(-1.06)	(-2.23)	(1.48)	(1.83)	(0.14)	(1.20)
q_9-q_{12}	0.0125 ***	0.0132 ***	-0.0007	-0.0002	0.0003	-0.0005	-0.0019	-0.0022*	0.0003	0.0010	0.0003	0.0007
	(3.91)	(4.03)	(-0.57)	(-0.17)	(0.19)	(-0.43)	(-1.36)	(-1.70)	(0.26)	(0.82)	(0.28)	(0.54)

Table 1.3
Continuation of Stock Herding

This table presents the proportions of stocks subjected to buy herding, sell herding, and no herding in the quarter after which herding takes place. For each quarter stocks are sorted separately into quintiles based on their buy and sell herding measures using LSV-based herding measures. The time series average of the mean and median ratios of stocks that are subjected to buy and sell herding are computed for each quintile.

Buy Herding				Sell Herding			
Quintiles	Subsequent Quarter Herding	Mean Ratio	Median Ratio	Quintiles	Subsequent Quarter Herding	Mean Ratio	Median Ratio
	No	0.483	0.500		No	0.481	0.486
1	Buy	0.249	0.250	1	Sell	0.293	0.288
	Sell	0.268	0.253		Buy	0.230	0.230
	No	0.457	0.455		No	0.461	0.462
2	Buy	0.277	0.277	2	Sell	0.336	0.329
	Sell	0.269	0.254		Buy	0.209	0.208
	No	0.451	0.441		No	0.449	0.453
3	Buy	0.307	0.299	3	Sell	0.368	0.365
	Sell	0.244	0.239		Buy	0.191	0.192
	No	0.437	0.436		No	0.445	0.441
4	Buy	0.348	0.338	4	Sell	0.393	0.395
	Sell	0.221	0.210		Buy	0.167	0.162
	No	0.434	0.438		No	0.450	0.440
5	Buy	0.385	0.391	5	Sell	0.433	0.432
	Sell	0.184	0.163		Buy	0.125	0.128

Table 1.4
Herding and Stock Returns-Controlling for Ongoing Herding

This table presents average monthly raw returns and monthly CAPM, three- and four-factor alphas for stocks subjected to high levels of herding by mutual funds during the herding (q_0) and the subsequent (q_1) quarters for the three cases where herding continues, reverses, and stops. To identify high buy and sell herding stocks, stocks are sorted into quintiles according to their buy and sell herding levels using the LSV-based herding measure. We define stocks in the highest buy (sell) herding quintile as top buy (sell) herding stocks. Difference portfolios that buy the top buy herding and short the top sell herding stocks are formed. Portfolios are rebalanced quarterly. Corresponding t-statistics are presented in parenthesis. Panel A reports the results for stocks in the top herding quintiles in the formation period that experience herding in the same direction in the subsequent quarter. Panel B presents the results for stocks in the top herding quintiles in the formation period that experience herding in the opposite direction in the subsequent quarter. Panel C reports the results for stocks in the top herding quintiles in the formation period that do not experience any herding in the subsequent quarter. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	Raw Returns			CAPM alphas			3 Factor alphas			4 Factor alphas		
	Top Buy Herding	Top Sell Herding	Difference	Top Buy Herding	Top Sell Herding	Difference	Top Buy Herding	Top Sell Herding	Difference	Top Buy Herding	Top Sell Herding	Difference
Panel A. Top Buy and Sell Herding Stocks - Herding Continues												
q_0	0.0596 ***	-0.0316***	0.0914***	0.0470***	-0.0453***	0.0926***	0.0478***	-0.0457***	0.0938***	0.0493***	-0.0440***	0.0937***
	(14.37)	(-7.34)	(20.82)	(15.92)	(-17.36)	(20.93)	(17.65)	(-17.16)	(21.11)	(17.87)	(-16.25)	(20.49)
q_1	0.0385***	-0.0132***	0.0523***	0.0266***	-0.0269***	0.0536***	0.0271***	-0.0275***	0.0547***	0.0252***	-0.0222***	0.0475***
	(10.39)	(-3.16)	(13.68)	(11.28)	(-10.94)	(13.96)	(12.30)	(-11.05)	(14.02)	(11.34)	(-10.09)	(13.20)
Panel B. Top Buy and Sell Herding Stocks - Herding Reverses												
q_0	0.0652***	-0.0378***	0.1016***	0.0511***	-0.0494***	0.1012***	0.0527***	-0.0497***	0.1032***	0.0536***	-0.0482***	0.1024***
	(14.77)	(-8.79)	(21.53)	(16.46)	(-16.64)	(21.24)	(17.76)	(-16.31)	(21.45)	(17.58)	(-15.51)	(20.74)
q_1	-0.0188***	0.0513***	-0.0725***	-0.0321***	0.0400***	-0.0728***	-0.0313***	0.0408***	-0.0730***	-0.0335***	0.0456***	-0.0793***
	(-4.52)	(11.44)	(-16.32)	(-12.17)	(11.85)	(-16.25)	(-12.60)	(11.88)	(-15.86)	(-13.42)	(13.85)	(-18.00)
Panel C. Top Buy and Sell Herding Stocks - Herding Stops												
q_0	0.0607***	-0.0335***	0.0942***	0.0477***	-0.0476***	0.0953***	0.0478***	-0.0486***	0.0964***	0.0479***	-0.0466***	0.0945***
	(15.57)	(-8.02)	(23.99)	(18.65)	(-19.45)	(24.07)	(19.12)	(-19.47)	(23.72)	(18.60)	(-18.46)	(22.73)
q_1	0.0103***	0.0205***	-0.0102**	-0.0020	0.0075***	-0.0095***	-0.0023	0.0072***	-0.0095***	-0.0041**	0.0119***	-0.0160***
	(2.80)	(4.95)	(-2.95)	(-0.90)	(2.78)	(-2.72)	(-1.12)	(2.61)	(-2.69)	(-2.00)	(4.58)	(-4.92)

Table 1.5
Determinants of Herding Intensity

This table presents the coefficients from quarterly Fama-Macbeth regressions of herding intensity measures on various fund characteristic variables. The sample includes actively managed equity mutual funds during the 1980-2007 period. $HI_{j,t}$, $BHI_{j,t}$, and $BHI_{j,t}$ are as defined in Table 1.1. *QRTLYRET* is the previous quarter net fund returns. *LOGAGE* is the natural logarithm of the age of the fund while *LOGTENURE* is the natural logarithm of the tenure of the fund manager, both measured in months. *LOGTNA* is the natural logarithm of total net assets. *FLOW* is new money growth. *EXPENSE* and *TURNOVER* are the annual expense ratio and turnover ratio respectively. Corresponding Newey-West adjusted t-statistics are reported in parentheses. In columns 1 to 3 the dependent variable is the unconditional herding intensity measure. In columns 4 to 5 and 7 to 9 the dependent variables are the buy herding intensity and the sell herding intensity, respectively. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	Dependent variable: HI			Dependent variable: BHI			Dependent variable: SHI		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$QTRLYRET_{t-1}$	-0.00280	-0.00099	-0.00130	0.00174	-0.00174	-0.00102	-0.00161	0.00237	0.00041
	(-0.52)	(-0.15)	(-0.26)	(0.56)	(-0.43)	(-0.33)	(-0.58)	(0.75)	(0.14)
LOGTNA	0.00038***	0.00055***	0.00039***	0.00036***	0.00042***	0.00031***	0.00001	0.00011**	0.00005
	(4.67)	(4.71)	(4.92)	(5.73)	(5.05)	(5.52)	(0.17)	(2.57)	(0.99)
LOGAGE	-0.00013	-0.00027	-0.00022	-0.00006	-0.00002	0.00005	-0.00033	-0.00044	-0.00052
	(-0.38)	(-0.76)	(-0.57)	(-0.44)	(-0.17)	(0.31)	(-0.99)	(-1.46)	(-1.47)
LOGTENURE	-0.00024	-0.00097	-0.00018	-0.00016	-0.00072***	-0.00016	-0.00005	-0.00017	-0.00002
	(-1.24)	(-3.60)	(-0.86)	(-1.28)	(-4.01)	(-1.26)	(-0.42)	(-1.42)	(-0.12)
FLOW	-	-0.00369**	-0.00160	-	0.00269**	0.00427***	-	-0.00435***	-0.00399***
		(-1.97)	(-1.05)		(2.36)	(5.09)		(-3.44)	(-3.08)
EXPENSE	0.02537	0.29459***	0.02883	-0.01084	0.15715***	-0.02539	0.01865	0.10749***	0.03246
	(0.51)	(5.50)	(0.62)	(-0.35)	(3.67)	(-0.78)	(0.56)	(4.07)	(1.01)
TURNOVER	0.00683***	-	0.00676***	0.00463***	-	0.00468***	0.00172***	-	0.00164***
	(12.93)		(12.16)	(11.39)		(11.58)	(7.98)		(7.66)
Number of observations	22538	22538	22538	22538	22538	22538	22538	22538	22538
R^2	0.2226	0.0849	0.2165	0.2537	0.0852	0.2557	0.1172	0.0774	0.1138

Table 1.6
Herding Intensity and Contemporaneous Return Gap

This table presents the average monthly return gap (Kacperczyk, Sialm, and Zheng (2008)) measure of mutual funds during the 1980-2007 period. The herding intensity measure, $HI_{j,t}$, is as defined in Table 1.1 . Return gap for fund *j* in month *m* is defined as $Retgap_{j,m}=Netret_{j,m} - (ret_{j,m}- Exp_{j,y}/12)$ where $Netret_{j,m}$ is the net fund returns, $ret_{j,m}$ is the holding portfolio returns, and $Exp_{j,y}$ is the annual expense ratio. The sample is divided into quintiles based on the respective herding intensity measures. The differences in the returns of quintile 5 and 1 are presented in the bottom row. Portfolios are rebalanced quarterly. The first four columns show the average return gap and CAPM, 3-factor and 4-factor adjusted return gaps for each herding intensity quintiles. The fifth to eighth and ninth to twelfth columns show the return gap for buy and sell herding intensity quintiles, respectively. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	Herding Intensity				Buy Herding Intensity				Sell Herding Intensity			
Quintiles	Raw	CAPM Alphas	3-Factor Alphas	4-Factor Alphas	Raw	CAPM Alphas	3-Factor Alphas	4-Factor Alphas	Raw	CAPM Alphas	3-Factor Alphas	4-Factor Alphas
1	-0.0011***	-0.0005***	-0.0006***	-0.0006***	-0.0010***	-0.0004***	-0.0005***	-0.0005***	-0.0010***	-0.0004**	-0.0004**	-0.0003**
	(-4.23)	(-3.32)	(-3.50)	(-3.44)	(-4.10)	(-3.09)	(-3.38)	(-3.52)	(-3.65)	(-2.41)	(-2.45)	(-2.07)
2	-0.0007***	-0.0002	-0.0002	-0.0001	-0.0007***	-0.0002	-0.0002	-0.0001	-0.0008***	-0.0003*	-0.0003**	-0.0003*
	(-2.99)	(-1.27)	(-1.16)	(-0.73)	(-3.01)	(-1.29)	(-1.52)	(-1.01)	(-3.38)	(-1.94)	(-2.14)	(-1.77)
3	-0.0006**	-0.0001	-0.0002	-0.0001	-0.0004	0.0002	0.0001	0.0002	-0.0007***	-0.0001	-0.0002	0.0000
	(-2.47)	(-0.43)	(-1.10)	(-0.34)	(-1.47)	(1.39)	(0.65)	(1.04)	(-2.83)	(-1.01)	(-1.25)	(-0.31)
4	-0.0004	0.0002	0.0001	0.0002	-0.0004	0.0002	0.0001	0.0002	-0.0003	0.0003*	0.0002	0.0002
	(-1.57)	(1.06)	(0.59)	(0.90)	(-1.51)	(1.31)	(0.66)	(0.95)	(-1.09)	(1.80)	(0.99)	(1.22)
5	0.0002	0.0009***	0.0006**	0.0006**	-0.0002	0.0005**	0.0004	0.0005*	0.0001	0.0008***	0.0006**	0.0005**
	(0.50)	(3.39)	(2.37)	(2.43)	(-0.45)	(2.17)	(1.44)	(1.84)	(0.42)	(3.41)	(2.37)	(2.21)
Q5-Q1	0.0012***	0.0014***	0.0012***	0.0012***	0.0008***	0.0010***	0.0009***	0.0010***	0.0011***	0.0012***	0.0010***	0.0009***
	(4.73)	(5.23)	(4.36)	(4.39)	(3.32)	(4.08)	(3.52)	(4.03)	(4.58)	(4.71)	(3.77)	(3.39)

Table 1.7

Herding Intensity and Subsequent Trade Portfolio Returns

This table presents the raw and abnormal returns of the trade portfolios of mutual funds during the 1980-2007 period. The herding intensity measure, $HI_{j,t}$ is as defined in Table 1.1. The buy (sell) portfolio returns are computed by multiplying the weight of each stock bought (sold) by its return. The weight of each buy (sell) trade in the trade portfolio is computed by dividing the dollar value of that trade by the total dollar value of all buy (sell) trades of that mutual fund in the particular quarter. The sample is divided into quintiles based on the lagged herding intensity measure. Portfolios are rebalanced quarterly. The first column shows the average herding intensity measures for each quintile. Second and third columns present the raw buy and sell trade portfolio returns, respectively. The fourth column shows the return difference between the buy and the sell portfolios. The fifth to seventh and the eighth to tenth columns present the characteristic adjusted (CS), three- and the four-factor alphas, respectively, for the buy, sell, and difference portfolios. Characteristic selectivity is defined as $CS = \sum w_{i,t-1}(R_{i,t} - BR_t^{i,t-1})$, where $BR_t^{i,t-1}$denotes the return of a benchmark portfolio during period t to which stock i was allocated in period $t-1$ according to its size, value, and momentum characteristics (DGTW (1997)). The differences between the returns of quintile 5 and 1 are presented in the bottom row. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

		Raw Returns			CS Measures			Three-Factor Alphas			Four-Factor Alphas		
Quintiles	Average Herding Intensity	Buy	Sell	Diff.	Buy	Sell	Diff.	Buy	Sell	Diff.	Buy	Sell	Diff.
1	-0.0015	0.0118***	0.0112***	0.0006	0.0009	0.0002	0.0008	-0.0007	-0.0011	0.0003	0.0010	-0.0011	0.0021***
		(4.17)	(4.16)	(0.79)	(1.43)	(0.31)	(1.12)	(-0.81)	(-1.48)	(0.41)	(1.19)	(-1.48)	(2.74)
2	0.0034	0.0120***	0.0109***	0.0011	0.0010*	-0.0005	0.0015***	-0.0002	-0.0011*	0.0009	0.0011	-0.0008	0.0020***
		(4.33)	(4.08)	(1.61)	(1.91)	(-0.91)	(2.61)	(-0.27)	(-1.72)	(1.36)	(1.59)	(-1.24)	(2.99)
3	0.0075	0.0117***	0.0109***	0.0008	0.0005	-0.0003	0.0008	-0.0002	-0.0008	0.0007	0.0002	-0.0004	0.0006
		(4.19)	(4.00)	(1.27)	(0.93)	(-0.60)	(1.41)	(-0.28)	(-1.30)	(1.04)	(0.29)	(-0.68)	(0.95)
4	0.0131	0.0120***	0.0101***	0.0019***	0.0006	-0.0007	0.0014**	0.0005	-0.0014**	0.0018***	0.0000	-0.0010	0.0011
		(4.11)	(3.55)	(2.93)	(1.04)	(-1.35)	(2.45)	(0.71)	(-2.20)	(2.71)	(0.07)	(-1.60)	(1.59)
5	0.0269	0.0122***	0.0089***	0.0033***	0.0003	-0.0021***	0.0025***	0.0011	-0.0023***	0.0034***	-0.0001	-0.0020**	0.0020**
		(3.84)	(2.82)	(3.72)	(0.44)	(-2.86)	(3.40)	(1.19)	(-2.76)	(3.67)	(-0.09)	(-2.36)	(2.21)
Q5-Q1	0.0285	0.0003	-0.0023**	0.0027*	-0.0006	-0.0023***	0.0017	0.0018	-0.0013	0.0030**	-0.0010	-0.0009	-0.0001
		(0.25)	(-1.97)	(1.91)	(-0.64)	(-2.81)	(1.46)	(1.37)	(-1.25)	(2.11)	(-0.90)	(-0.92)	(-0.08)

Table 1.8
Herding Intensity and Subsequent Quarter Mutual Fund Returns

This table presents the raw and abnormal returns for portfolios of mutual funds during the 1980-2007 period. Our mutual funds sample is divided into quintiles based on the lagged herding intensity measure. The return differences between the quintile 5 and 1 are presented in the last raw. Portfolios are rebalanced quarterly. The first column shows the average herding intensity measures for each quintile. The second and third columns show the raw and characteristic adjusted (CS measure) holding-based returns. Characteristic selectivity is as in Table 1.7. The fourth and fifth columns show the respective three- and four-factor alphas for the holding-based returns. The sixth to ninth columns report the raw and three- and four-factor adjusted net fund returns, respectively. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

		Holding-Based Returns (monthly)				Net Returns (monthly)		
Quintiles	Average Herding Intensity	Raw	CS	3-Factor Alphas	4-Factor Alphas	Raw	3-Factor Alphas	4-Factor Alphas
1	-0.0015	0.0109***	0.0002	-0.0009	-0.0004	0.0097***	-0.0018***	-0.0012**
		(4.21)	(0.49)	(-1.46)	(-0.56)	(4.00)	(-3.05)	(-2.04)
2	0.0034	0.0115***	0.0004	0.0000	0.0002	0.0100***	-0.0011**	-0.0008
		(4.46)	(1.43)	(-0.07)	(0.46)	(4.15)	(-2.12)	(-1.50)
3	0.0075	0.0112***	0.0000	0.0000	-0.0001	0.0100***	-0.0008*	-0.0008*
		(4.24)	(0.11)	(-0.01)	(-0.18)	(4.06)	(-1.90)	(-1.83)
4	0.0131	0.0114***	0.0000	0.0006	0.0000	0.0103***	-0.0001	-0.0007
		(4.12)	(0.04)	(1.30)	(-0.04)	(3.99)	(-0.16)	(-1.64)
5	0.0271	0.0119***	0.0000	0.0016**	0.0004	0.0106***	0.0007	-0.0005
		(3.86)	(-0.04)	(2.20)	(0.53)	(3.69)	(0.95)	(-0.80)
Q5-Q1	0.0285	0.0010	-0.0002	0.0025***	0.0007	0.0009	0.0025***	0.0007
		(0.77)	(-0.36)	(2.60)	(0.81)	(0.73)	(2.65)	(0.79)

Table 1.9
Persistence of Herding Intensity Measure

Panel A presents the average stock herding intensity rankings in quarters *t+1* to *t+12* for mutual fund deciles formed based on their herding intensity in quarter *t*. Herding intensity, $HI_{j,t}$, for each fund–quarter is as in Table 1.1. Panel B presents the cross-sectional Pearson and Spearman rank correlations between herding intensity measures in quarter *t* and in quarters from *t+1* to *t+12*. The reported figures are the time-series averages of these cross-sectional correlations. The t-statistics are computed from time-series standard errors.

Panel A. Herding Intensity Average Deciles

Quarter t	Quarter t+1	Quarter t+2	Quarter t+3	Quarter t+4	Quarter t+5	Quarter t+6	Quarter t+7	Quarter t+8	Quarter t+9	Quarter t+10	Quarter t+11	Quarter t+12
1	4.40	4.49	4.48	4.56	4.50	4.59	4.61	4.61	4.65	4.67	4.72	4.69
2	4.06	4.04	4.15	4.09	4.14	4.09	4.17	4.14	4.24	4.25	4.25	4.30
3	4.34	4.36	4.33	4.40	4.48	4.44	4.45	4.46	4.49	4.50	4.50	4.47
4	4.77	4.81	4.78	4.84	4.85	4.83	4.85	4.90	4.89	4.94	5.01	4.93
5	5.11	5.26	5.19	5.22	5.23	5.26	5.22	5.18	5.18	5.28	5.16	5.27
6	5.56	5.56	5.60	5.60	5.56	5.55	5.53	5.62	5.57	5.59	5.54	5.67
7	5.98	5.99	5.94	5.95	5.91	5.94	5.98	5.96	5.92	5.94	5.86	6.02
8	6.42	6.32	6.44	6.33	6.35	6.38	6.36	6.30	6.29	6.21	6.30	6.23
9	6.93	6.84	6.85	6.78	6.78	6.64	6.75	6.87	6.73	6.67	6.77	6.67
10	7.59	7.65	7.53	7.42	7.44	7.45	7.43	7.33	7.29	7.28	7.09	7.04

Panel B. Cross-sectional Correlations of Herding Intensity Measures

	Quarter t+1	Quarter t+2	Quarter t+3	Quarter t+4	Quarter t+5	Quarter t+6	Quarter t+7	Quarter t+8	Quarter t+9	Quarter t+10	Quarter t+11	Quarter t+12
Pearson												
Correlation	0.3689	0.3656	0.3591	0.3421	0.3415	0.3336	0.3277	0.3242	0.3101	0.2936	0.2937	0.2866
t-stat	(24.53)	(24.69)	(25.29)	(22.58)	(23.65)	(23.36)	(20.60)	(21.19)	(20.11)	(18.45)	(17.95)	(18.81)
Spearman												
Correlation	0.3882	0.3791	0.3711	0.3555	0.3538	0.3508	0.3469	0.3432	0.3269	0.3219	0.3116	0.3096
t-stat	(29.94)	(29.99)	(29.45)	(28.66)	(29.31)	(27.46)	(26.73)	(27.95)	(24.09)	(23.69)	(21.77)	(22.79)

Table 1.10

Performance Difference between High and Low Herding Intensity Funds

This table presents the net (after expenses) raw and abnormal return difference between past high herding intensity and past low herding intensity funds during the 1980-2007 period. For each quarter *t*, the average herding intensity measures are computed for each fund over the quarters *t-1* to *t-k* (formation period), where *k* takes the values of 1, 2, 4, and 8. Funds are sorted into quintiles based on these average herding intensity measures. Difference portfolios that buy the funds in the highest herding intensity quintile and sell the funds in the lowest herding intensity quintile are formed. These difference portfolios are held over the quarter(s) *t* to *t+k-1* (holding period). *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	1 Quarter Formation Period			2 Quarters Formation Period			4 Quarters Formation Period			8 Quarters Formation Period		
Holding Period	Raw	3 Factor Alphas	4 Factor Alphas	Raw	3 Factor Alphas	4 Factor Alphas	Raw	3 Factor Alphas	4 Factor Alphas	Raw	3 Factor Alphas	4 Factor Alphas
1	0.0009	0.0025***	0.0007	0.0005	0.0019**	-0.0001	0.0002	0.0018*	-0.0002	0.0003	0.0014	-0.0003
Quarter	(0.73)	(2.65)	(0.79)	(0.46)	(2.07)	(-0.18)	(0.20)	(1.94)	(-0.23)	(0.30)	(1.53)	(-0.40)
2	0.0006	0.0019**	0.0001	0.0005	0.0018**	-0.0002	-0.0001	0.0013	-0.0006	0.0000	0.0010	-0.0008
Quarters	(0.59)	(2.32)	(0.12)	(0.48)	(2.08)	(-0.32)	(-0.12)	(1.49)	(-0.74)	(0.02)	(1.11)	(-1.00)
4	0.0006	0.0018**	0.0001	0.0005	0.0017**	-0.0001	0.0000	0.0012	-0.0005	-0.0001	0.0006	-0.0011
Quarters	(0.65)	(2.41)	(0.23)	(0.51)	(2.13)	(-0.19)	(0.01)	(1.45)	(-0.71)	(-0.13)	(0.71)	(-1.54)
8	0.0004	0.0015**	0.0001	0.0004	0.0016**	-0.0001	0.0000	0.0012	-0.0006	-0.0004	0.0004	-0.0013*
Quarters	(0.45)	(2.17)	(0.10)	(0.43)	(2.11)	(-0.17)	(-0.03)	(1.46)	(-0.80)	(-0.34)	(0.44)	(-1.84)

Table 1.11
Subsequent Quarter Trade Portfolio Returns of Leaders and Followers

This table presents the raw and abnormal returns of the trade portfolios of leader and follower funds during the 1980-2007 period. The leader ($LHI_{j,t}$) and the follower ($FHI_{j,t}$) herding intensity measures are as defined in Table 1.1. To identify leader (follower) funds the sample is divided into quintiles based on the lagged leader (follower) herding intensity measure. The funds that are in the highest leader (follower) herding intensity quintile are identified as leaders (followers). Portfolios of leader and follower funds are rebalanced quarterly. The buy (sell) portfolio returns are computed by multiplying the weight of each stock that is bought (sold) by its return. The weight of each buy (sell) trade in the trade portfolio is computed by dividing the dollar value of that trade by the total dollar value of all buy (sell) trades by that mutual fund in that particular quarter. The first and second columns present the raw buy and sell trade portfolio returns, respectively. The third column shows the difference between returns to these buy and sell portfolios. The fourth to sixth and the seventh to ninth columns report the characteristic adjusted (CS), three-factor, and the four-factor alphas, respectively, for these buy, sell and difference portfolios. Characteristic selectivity is as in Table 1.7. The differences between the trade portfolio returns of leaders and followers (L-F) are presented in the bottom row. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	Raw Returns			CS Measures			Three-Factor Alphas			Four-Factor Alphas		
Quintiles	Buy	Sell	Diff.	Buy	Sell	Diff.	Buy	Sell	Diff.	Buy	Sell	Diff.
Followers (F)	0.0111***	0.0103***	0.0009	-0.0003	-0.0009	0.0006	-0.0001	-0.0012	0.0011	-0.0012	-0.0008	-0.0003
	(3.70)	(3.44)	(1.11)	(-0.49)	(-1.41)	(0.90)	(-0.13)	(-1.54)	(1.33)	(-1.55)	(-1.03)	(-0.45)
Leaders (L)	0.0140***	0.0079**	0.0061***	0.0020***	-0.0027***	0.0047***	0.0031***	-0.0032***	0.0063***	0.0022***	-0.0029***	0.0050***
	(4.57)	(2.59)	(7.67)	(2.81)	(-3.91)	(7.28)	(3.78)	(-4.16)	(7.68)	(2.65)	(-3.61)	(6.37)
L - F	0.0029***	-0.0023***	0.0052***	0.0023***	-0.0018***	0.0041***	0.0032***	-0.0020***	0.0053***	0.0033***	-0.0021***	0.0054***
	(5.76)	(-4.12)	(8.37)	(5.91)	(-3.80)	(7.21)	(6.45)	(-3.56)	(8.19)	(6.46)	(-3.49)	(8.13)

Table 1.12
Subsequent Quarter Returns of Leaders and Followers

The table presents the raw and abnormal fund returns for portfolios of leader and follower funds during the 1980-2007 period. Leader and follower funds portfolios are formed as in Table 1.11. The first and second columns show the raw and characteristic adjusted (CS measure) holding-based returns. Characteristic Selectivity is as in Table 1.7. The third and fourth columns show the three- and four-factor alphas respectively. The last three columns present the raw and adjusted net fund returns of the leaders, followers, and their difference. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	Holding-Based Returns (monthly)				Net Returns (monthly)		
Quintiles	Raw	CS	3-Factor Alphas	4-Factor Alphas	Raw	3-Factor Alphas	4-Factor Alphas
Followers (F)	0.0114***	-0.0002	0.0008	-0.0003	0.0102***	0.0000	-0.0011**
	(3.89)	(-0.39)	(1.28)	(-0.58)	(3.73)	(0.04)	(-2.07)
Leaders (L)	0.0122***	0.0003	0.0020***	0.0009	0.0111***	0.0013**	0.0002
	(4.11)	(0.61)	(3.05)	(1.42)	(4.03)	(2.02)	(0.38)
L-F	0.0008**	0.0005**	0.0012***	0.0012***	0.0009**	0.0013***	0.0014***
	(2.33)	(2.13)	(3.32)	(3.29)	(2.45)	(3.35)	(3.45)

Table 1.13
Performance Difference between Leaders and Followers

This table presents the net (after expenses) raw and abnormal net fund return difference between mutual funds with past high leader herding intensity and high follower herding intensity during the 1980-2007 period. For each quarter *t*, the respective average herding intensity measures are computed for each fund over quarters *t-1* to *t-k* (formation period), where *k* takes the values of 1, 2, 4, and 8. Funds are sorted into quintiles based on their average leader (follower) herding intensity measures and top quintile funds are identified as leaders (followers). The difference portfolios that buy funds in the highest leader herding intensity quintile and sell funds in the highest follower herding intensity quintile are formed. These difference portfolios are held over quarter(s) *t+1* to *t+k* (holding period). *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

		1 Quarter Formation Period			2 Quarters Formation Period			4 Quarters Formation Period			8 Quarters Formation Period		
Holding Period		Raw	3 Factor Alphas	4 Factor Alphas	Raw	3 Factor Alphas	4 Factor Alphas	Raw	3 Factor Alphas	4 Factor Alphas	Raw	3 Factor Alphas	4 Factor Alphas
1	L-F	0.0011*	0.0015**	0.0012*	0.0008	0.0013*	0.0004	-0.0003	0.0000	-0.0006	-0.0014	-0.0008	-0.0014
Quarter		(1.79)	(2.54)	(1.91)	(1.00)	(1.91)	(0.56)	(-0.29)	(0.04)	(-0.87)	(-1.30)	(-0.85)	(-1.43)
2	L-F	0.0006	0.0009*	0.0003	0.0003	0.0006	-0.0001	-0.0002	-0.0001	-0.0004	-0.0009**	-0.0009**	-0.0009**
Quarters		(1.12)	(1.84)	(0.74)	(0.46)	(1.25)	(-0.28)	(-0.40)	(-0.33)	(-0.93)	(-2.13)	(-2.08)	(-2.11)
4	L-F	0.0002	0.0004	0.0001	0.0001	0.0003	-0.0001	-0.0004	-0.0003	-0.0003	-0.0004	-0.0005	-0.0004
Quarters		(0.68)	(1.38)	(0.47)	(0.23)	(1.01)	(-0.19)	(-0.92)	(-0.72)	(-0.86)	(-1.20)	(-1.25)	(-0.96)
8	L-F	0.0000	0.0002	0.0001	0.0000	0.0003	0.0000	-0.0003	-0.0004	-0.0003	-0.0003	-0.0003	-0.0002
Quarters		(0.08)	(1.00)	(0.31)	(0.08)	(1.08)	(0.00)	(-1.16)	(-1.33)	(-1.17)	(-0.90)	(-1.03)	(-0.80)

Chapter 2

Do Mutual Funds Herd in Industries?

2.1 Introduction

Herding is commonly defined as the similarities in trading of a group of market participants. Previous studies propose two main herding measures to examine evidence of herding. Lakonishok, Shleifer and Vishny (1992, hereafter LSV) construct a herding measure that detects quarterly imbalances in the number of buyers and sellers from a particular group in specific stocks while Sias (2004, hereafter Sias) proposes a measure that quantifies the degree to which such imbalances tend to persist over adjacent quarters.

The extant literature provide mixed evidence of herding using either one of the two proposed herding measures. LSV report weak evidence of herding by pension funds in individual stocks and find no evidence that such herding has a destabilizing effect on stock prices. Likewise, Grinblatt, Titman, and Wermers (1995, hereafter GTW) use the LSV measure to examine mutual fund herding in individual stocks and report considerable herding levels. Wermers (1999) carries out a similar analysis on a larger sample of mutual funds and finds similar evidence of herding. In addition, he documents that stocks that are subjected to buy herding outperform stocks that are subjected to sell herding in both the herding quarter and in the following two quarters. Sias uses his above mentioned alternative herding measure and finds strong evidence of herding by institutions in individual stocks.

The above surveyed studies focus on stock herding and on the effect that such herding may have on the returns of herded stocks. Different from the above literature, a related recent study by Choi and Sias (2009) investigates industry herding by institutional investors. They provide several justifications for their focus on herding at the industry level. They first contend that the reasons that may motivate institutions to herd in individual stocks may also lead them to herd at the industry level.[26] Second, they cite evidence in the literature that information is not incorporated simultaneously in the prices of all stocks in the same industry, and that investors can therefore infer information about a given stock from other stocks in the same industry.[27] Employing the Sias measure Choi and Sias (2009) find high levels of industry herding by institutional investors but document only weak evidence that industries that are subjected to high levels of herding exhibit subsequent price reversals.

This study examines whether mutual funds herd in industries and the extent to which such herding impacts industry valuations as well as fund performance. Although this study shares a similar motivation to that offered by Choi and Sias (2009) in investigating herding in industries, it focuses on herding by mutual funds rather than institutions.[28] The focus on mutual funds follows in the footsteps of GTW (1995) and Wermers (1999). Evidence in the literature that mutual funds have tendencies to follow certain behavioral patterns that might result in herding further justifies this focus on mutual funds.[29] Furthermore, in contrast to institutions, mutual funds return data are readily available thus affording us the opportunity of testing the effect that industry herding might have on fund returns.

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[26] Previous studies propose five main theories to explain why institutional managers may herd when they trade securities. Institutional managers may herd if they follow correlated signals (investigative herding (Froot, Sharfstein and Stein (1992)), infer information from the prior trades of better informed managers, (informational cascades (Bikhchandani, Hirshleifer, and Welch (1992), Welch (1992))), follow the crowd due to reputational concerns (reputational herding (Scharfstein and Stein (1990), Zwiebel (1995))), follow fads (Friedman (1984)), or chase certain characteristics (Falkenstein (1996)).

[27] E.g. Moskowitz and Grinblatt, (1999) and Hou (2007).

[28] Institutions include banks, insurance companies, pension funds, mutual funds, independent advisers, endowments, and other institutions.

[29] There is evidence in the literature that mutual funds tend to chase certain characteristics (Falkenstein (1996)), mimic the trades of other funds with good performance (Friend, Blume and Crockett (1970)), trade due to reputational concerns (Chevalier and Ellison (1999)), and trade on the same new information (Brown, Wei and Wermers (2009)). These types of behaviors may also drive mutual funds to herd in industries.

To investigate whether mutual funds herd in industries, this study employs both the LSV and the Sias herding measures. The LSV measure, as applied to industries, quantifies the imbalance between the number of buyers and sellers from a particular investor group in a specific industry during a given quarter. In contrast, the Sias measure gauges the degree to which members of an investor group (mutual funds in our study) follow each others' industry trades in adjacent quarters. Using the LSV measure we find that the level of industry herding by mutual funds is statistically significant, but not very strong for the 1980-2007 period. However, there are many industry-quarters during this period in which high levels of herding are observed. Using the alternative Sias measure we find strong evidence of industry herding by mutual funds. We use simulations to show that industry herding by mutual funds is significantly greater than that is expected by chance. We also examine whether investor flows drives industry herding and find evidence of industry herding even after controlling for fund flows. Our findings also indicate that the reported industry herding evidence is not solely driven by individual stock herding.

In line with the previous studies, we also examine whether industry herding by mutual funds affects industry returns. We find strong positive contemporaneous relationship between industry herding and returns. Industries that are subjected to buy herding by mutual funds outperform industries that are subjected to sell herding in the herding quarter(s). We find no evidence of return reversals for these industries in the periods following the herding, thus concluding that mutual fund herding in industries does not drive industry values away from their fundamentals.

The novelty of this paper lies in the fact that it examines the effect that industry herding by mutual funds might have on fund performance. We use the LSV and the Sias frameworks to define herding intensity measures that evaluate the degree to which each fund is involved in industry herding in a given quarter. We then employ portfolio analysis to relate these herding intensity measures to fund performance. For the LSV-based measure, our results provide only weak evidence that funds that herd intensely earn superior raw returns both before and after expenses in the quarter following the industry herding. We find no relationship between industry herding intensity and subsequent quarter fund performance for the Sias-based measure. These results therefore suggest that industry herding does not significantly affect fund performance.

Last, this study examines whether a fund's inclination to herd in industries is related to its characteristics such as size, age, flow, expense ratio, and turnover. We find that both the LSV and the Sias herding intensity measures are associated with fund turnover, i.e., funds that tend to herd intensely also tend to frequently turn over their holdings.

The remainder of the paper is organized as follows. Section 2.2 describes the data. Section 2.3 explains the methodology. Sections 2.4 to 2.7 present the empirical evidence and discuss the results. Section 2.8 includes our concluding remarks.

2.2 Data

To compute industry herding measures we merge the Thomson-Reuters Mutual Fund Holdings Database with the monthly stock files of CRSP. Monthly mutual fund returns data and fund specific information are obtained from the CRSP Mutual Fund Database. The Thomson-Reuters Mutual Fund Holdings Database is merged with the CRSP Mutual Fund Database using MFLINKS Database.

Our sample consists of all funds in Thomson-Reuters mutual funds holding database excluding all international funds and non-equity funds over the 1980-2007 period. We use Thomson-Reuters classification to identify funds' investment objectives. Thomson-Reuters classification for investment objectives are as follows: 1-International, 2-aggressive growth, 3-

growth, 4-growth-income, 5-municipal bonds, 6-bond and preferred, 7-balanced, 8-metals and 9-unclassified. To focus on actively managed diversified equity funds we only include funds with investment objective classification codes 2, 3 and 4 and also exclude all index and sector funds.[30] We use CRSP Mutual Funds Database fund style codes to identify index and sector funds. Panel A of Table 2.1 presents the number of funds as well as the mean and median assets of mutual funds over the sample period (1980-2007).

Thomson-Reuters provides mutual fund holdings and the date for which these holdings are valid (report date, RDATE). For most funds the holdings information is available at the end of each quarter on this database. However, for some funds there are quarters for which this information is missing. In this paper, we include observations with adjacent fund-stock-quarter observations.

Another complication with the holdings data is that Thomson-Reuters database includes fund holdings for a date prior to the end-of-quarter. We consider such reports to be as of the end of the respective quarter following Wermers (1999). In addition, for occasional cases where more than one holdings per quarter are reported, we ignore the number with the earlier date. Stock information such as price, SIC, cumulative factor to adjust shares outstanding and returns are obtained from CRSP monthly stock data and matched with mutual fund database. Fund-stock observations which cannot be matched with the CRSP are omitted.[31] This does not constitute a major problem since the stocks which are not in the CRSP database are usually very small, and are therefore not likely to be widely held by mutual funds. Panel B of Table 2.1, presents the average and median ratios of the total value of CRSP stocks holdings to total assets of mutual

[30] This study focuses only on the funds with self declared investment objective classification codes 2, 3 and 4, because these are the types of funds which have significant portion of their total assets invested in CRSP stocks.
[31] We also exclude holdings other than common ordinary shares of U.S. incorporated companies (CRSP share type code 10 or 11).

funds for various years during the sample period. As can be seen from this panel, CRSP stocks constitutes significant portion of total assets of mutual funds. Industries are classified in this paper by using Fama and French 49 Industry specification.[32]

2.3 Methodology

2.3.1 The LSV Herding Measure

One of the main objectives of this study is to examine whether mutual funds herd in and out of industries. In this sub-section we apply the LSV herding measure to industries to evaluate industry herding. We start by computing the dollar amount of quarterly change of each mutual fund's holdings in each industry (*dolch*) as in Choi and Sias (2009).

$$dolch_{j,k,t} = \sum_{i=1}^{N} (price_{i,t-1})(holdings_{i,j,t} - holdings_{i,j,t-1}), \tag{15}$$

where N is the number of stocks held by mutual fund j over quarter $t-1$ to t and belong to industry k, $holdings_{i,j,t}$ is the number of shares of stock i owned by mutual fund j at the end of quarter t adjusted for stock splits, and $price_{i,t-1}$ is the per-share price of the stock i at the end of quarter $t-1$.[33] Because of changes in stock prices, a mutual fund's dollar holding in an industry might increase or decrease even when the fund does not trade stocks in that industry. To eliminate the effect of stock price changes on the dollar amount of change (*dolch*), we use the previous quarter-end prices and the change in the number of shares to compute dollar amount of change. We next define mutual fund k as a buyer (seller) in industry j during quarter t if $dolch_{i,j,k} > 0$

[32] Fama and French 49 industry classification (Fama and French (1997)) has 48 industry categories plus a 49th category defined as Other. We exclude the 49th industry category in the analyses.

[33] Thomson-Reuters adjusts the number of shares (holdings) for stock splits that occur between the RDATE and FDATE. RDATE represents the date for which the holdings are valid while FDATE is the date that is used to merge different tables in Thomson. If FDATE and RDATE are not the same for an observation and a stock split occurs between these two dates, the number of shares represents the split adjusted value. Since in this paper we merge all CRSP stock data using RDATE, before making any split adjustments that occur between the two consecutive RDATEs, we first reverse the split adjustments made by Thomson-Reuters.

($dolch_{i,j,k}$ <0). Using this definition we then compute the ratio of number of buyers to total number buyers and sellers in industry k during quarter t as

$$p_{k,t} = \frac{B_{k,t}}{(B_{k,t} + S_{k,t})}, \tag{16}$$

where $B_{k,t}$ ($S_{k,t}$) is the number of mutual funds that are buyers (seller) in the industry k in quarter t. Finally, the LSV herding measure, for industry k and quarter t, $HM_{k,t}$, is computed as

$$HM_{k,t} = \left| p_{k,t} - p_t \right| - AF_{k,t}, \tag{17}$$

where p_t is the cross-sectional average of fraction of buyers (across *all* industries) in quarter t. $AF_{k,t}$ is an adjustment factor as defined in LSV (1992).[34]

It should be noted that the LSV herding measure in equation (3) measures the imbalance in the number of mutual funds that are buyers and sellers in industries without distinguishing whether the imbalance is on the buy or on the sell side. Such distinction is proposed by Wemers (1999) who extends LSV's measure to define buy and sell herding measures as

$$HM_{k,t}^{buy} = HM_{k,t} \left| (p_{k,t} - p_t) > 0 \right., \tag{18}$$

$$HM_{k,t}^{sell} = HM_{k,t} \left| (p_{k,t} - p_t) < 0. \right. \tag{19}$$

[34] See LSV (1992) and Sharma et al. (2006) for more detailed explanations of computation of the adjustment factor.

2.3.2 The Sias herding measure

The LSV herding measure as defined in equation (17) detects herding only when the number of investors (from a specific group) that trade in the same direction exceeds what is expected during the same time period. Sias (2004) proposes an alternative herding measure that quantifies the degree to which investors follow trades of other investors (in the same group) in consecutive periods. The Sias herding measure is defined as

$$\rho(p_{k,t}, p_{k,t-1}) = \left[\frac{1}{(K-1)\sigma(p_{k,t})\sigma(p_{k,t-1})}\right]\sum_{k=1}^{K}(p_{k,t} - p_t)(p_{k,t-1} - p_{t-1}), \tag{20}$$

where $\rho(p_{k,t}\ ,\ p_{k,t-1})$ is the cross-sectional correlation between ratios of buyers to all traders in consecutive quarters, K is the number of industries, $\sigma(p_{k,t})$ is the standard deviation of number of buyers to all traders ratio across industries at time t, and $p_{k,t}$ is computed as in equation (16). We will observe a positive cross-sectional correlation (equation (6)) if funds follow other funds' previous quarter trades or if they repeat their previous quarter trades. The latter case obviously cannot be considered herding and thus its influence should be purged. For this reason, Sias (2004) segregates the cross-sectional correlation into two parts:

$$\rho(p_{k,t}, p_{k,t-1}) = \left[\frac{1}{(K-1)\sigma(p_{k,t})\sigma(p_{k,t-1})}\right]\sum_{k=1}^{K}\left[\sum_{n=1}^{N_{k,t}}\left(\frac{D_{n,k,t} - p_t}{N_{k,t}} \cdot \frac{D_{n,k,t-1} - p_{t-1}}{N_{k,t-1}}\right)\right] + \left[\frac{1}{(K-1)\sigma(p_{k,t})\sigma(p_{k,t-1})}\right]\sum_{k=1}^{K}\left[\sum_{n=1}^{N_{k,t}}\sum_{m=1,m\neq n}^{N_{k,t-1}}\left(\frac{D_{n,k,t} - p_t}{N_{k,t}} \cdot \frac{D_{n,k,t-1} - p_{t-1}}{N_{k,t-1}}\right)\right]. \tag{21}$$

The first term on the right hand side of the equation (21) is the contribution to cross-sectional correlation of funds following their own trades in the previous quarter while the second term is the contribution of funds following other funds' trades in the previous quarter. $D_{n,k,t}$ is a dummy variable that takes the value of 1 (0) if fund n buys industry k in quarter t.

2.3.3 Quarterly Herding Intensity Measures

Up to this point, we have drawn on established herding measures to examine evidence of industry herding. Our aim in this section is to propose a methodology that allows us to investigate the relationship between fund herding in industries and subsequent fund performance. To this end, we need to quantify the extent to which individual funds tend to join the buy or sell industry herds in any given quarter. We apply herding intensity measure proposed in Chapter 1 to industries to compute such quarterly measure in the LSV framework. We also propose a new industry herding intensity measure for the Sias framework.

2.3.3.1 LSV-based Industry Herding Intensity

Grinblatt, Titman and Wermers (1995) provide a life-time measure for the herding tendency of mutual funds which they denote by FHM (Fund Herding Measure). To define this measure GTW (1995) first propose a signed herding measure (SHM) that provides an indication of whether a fund trades a stock with or against the herd. SHM can be applied to industry herding as

$$SHM_{k,t} = I_{k,t} \times HM_{k,t} - E\left[I_{k,t} \times HM_{k,t} \right], \tag{22}$$

where $I_{k,t}$ is the indicator function which gets value of 1 (-1) if the fund trades industry k with (against) the herd during quarter t and 0 if no herding takes place, and $HM_{k,t}$ is as in equation (22) . The second term in the right hand side of the equation (22) is the expected value of the first term and adjusts for the possibility that a fund might follow or go against the herd by chance. Using SHM GTW's (1995) fund herding measure can be computed for industry herding as

$$FHM = \frac{1}{T}\sum_{t=1}^{T}\sum_{k=1}^{N}(w_{k,t} - w_{k,t-1}) \times SHM_{k,t}, \tag{23}$$

where T is the total number of periods for which the relevant data are available for the fund in question, N is the total number of industries held by that fund, and $w_{k,t}$ is the fund's portfolio weight of industry k in quarter t.[35]

In Chapter 1 we modify GTW's (1995) FHM and propose a quarterly individual stock herding intensity measure.[36] We now built on this measure to define the industry herding intensity. The herding intensity applied to industry herding for mutual fund j and quarter t can be computed as

$$HI_{j,t} = \sum_{k=1}^{K}\left|w_{j,k,t} - w_{j,k,t-1}\right| \times SHM_{j,k,t} \times IN_{j,k,t}, \tag{24}$$

where $IN_{k,t}$ is the indicator function which gets value of 1 if the mutual fund j both buys (sells) industry k and increases (decreases) the weight of industry k in its equity portfolio, and 0 otherwise.

To distinguish between the degrees to which a mutual fund joins the buy or the sell industry herd we also define buy and sell herding intensity measures separately as follows:

[35] Note that different from GTW (1995) who sum over N stocks traded by fund, we sum over N industries held by fund.

[36] Please see Chapter 1 for the detailed explanation of this new measure and the justifications for these modifications.

$$BHI_{j,t} = \sum_{i=1}^{N} \left| w_{j,k,t} - w_{j,k,t-1} \right| \times SHM_{j,k,t} \times BI_{j,k,t} \quad (25)$$

$$SHI_{j,t} = \sum_{i=1}^{N} \left| w_{j,k,t} - w_{j,k,t-1} \right| \times SHM_{j,k,t} \times SI_{j,k,t}, \quad (26)$$

where $BI_{j,k,t}$ ($SI_{j,k,t}$) is an indicator function which equals 1 if the industry k is subjected to buy (sell) herding and the directions of the dollar change and the weight change in that industry for mutual fund j do not contradict each other, and equals 0 otherwise.

2.3.3.2 Sias- based Herding Intensity Measure

In the previous section we define an industry herding intensity based on the LSV herding measure. We now proceed to develop a similar measure in the Sias framework. The Sias-based herding intensity HI^S measure is computed as

$$HI^S_{j,t} = \sum_{k=1}^{K} \left| w_{j,k,t} - w_{j,k,t-1} \right| \times WI_{k,t,t-1} \times IN^*_{j,k,t,t-1} \times IN_{j,k,t}, \quad (27)$$

where $WI_{k,t,t-1}$ is the weight of contribution of industry k to the cross-sectional correlation as defined in equation (20) over the *t-1* to *t* period.[37] $IN^*_{j,k,t,t-1}$ is an indicator function which assumes a value of 1 (-1) if industry k contributes positively to the cross-sectional correlation over the *t-1* to *t* period and the fund j trades industry k in the same direction (opposite) with the herd. It assumes a value of 0 if industry k contributes negatively to the cross-sectional

[37] The weight of contribution of industry k to the cross-sectional correlation is computed as $(p_{k,t-1} - p_{t-1})(p_{k,t} - p_t)$ divided by the total contribution of all industries. However, industries that contribute negatively are not taken into consideration in total contribution computation. We use this weighting scheme so that industries that experience high levels of herding contribute more to the herding intensity measure as in GTW's (1995) FHM.

correlation. $IN_{j,k,t}$ is as in equation (6). We also define buy (sell) herding intensity based on Sias measure as follows:

$$BHI_{j,t}^{S} = \sum_{k=1}^{K} \left| w_{j,k,t} - w_{j,k,t-1} \right| \times WI_{k,t,t-1} \times BIN_{j,k,t,t-1}^{*} \times BI_{j,k,t} \ , \tag{28}$$

$$SHI_{j,t}^{S} = \sum_{k=1}^{K} \left| w_{j,k,t} - w_{j,k,t-1} \right| \times WI_{k,t,t-1} \times SIN_{j,k,t,t-1}^{*} \times SI_{j,k,t} \ , \tag{29}$$

where $BIN_{j,k,t,t-1}^{*}$ ($SIN_{j,k,t,t-1}^{*}$) is an indicator function that equals to 1 if fund j buys (sells) industry k in quarter t and both ($p_{k,t-1} - p_{t-1}$) and ($p_{k,t} - p_t$) are positive (negative), equals to -1 if fund j buys (sells) industry k in quarter t and both ($p_{k,t-1} - p_{t-1}$) and ($p_{k,t} - p_t$) are negative (positive), and equals to 0 if industry k contributes negatively to the cross-sectional correlation or fund j sells (buys) industry k in quarter t. $BI_{j,i,t}$ and $SI_{j,i,t}$ are as in equation (6).

2.4 Evidence of Industry Herding By Mutual Funds

This section reports the empirical evidence of industry herding by mutual funds using the previously established industry herding measures (equations (17), (4), (5) and (7)). All such measures are estimated over the 1980-2007 period and by employing the Fama and French 49-industry classification. We first report the statistical outcome of this investigation and continue to present Monte Carlo simulation results that contrast the distribution of the LSV and Sias herding measures as compared to those implied by a no-herding null hypothesis. We then examine whether investor flows drives industry herding. Last, we explore whether industry herding is mainly driven by individual stock herding.

2.4.1 LSV Herding Measure – The evidence

Table 2.2 displays the mean and median levels for the LSV herding measure (HM) and the Wermers' (1999) buy (BHM) and sell herding (SHM) measures. Following Wermers (1999) the results are presented for industry-quarters for which there are at least five, twenty and fifty active mutual funds. The three respective mean values for the industry herding measure (HM) as reported in Panel A are 1.645%, 1.596% and 1.563%, all significant at the 1% level. These figures are in line with Choi and Sias' (2009) findings for all institutions and are slightly higher than that reported by LSV (1992) for pension funds. Panel A also presents the corresponding medians values. All medians are also statistically significantly at the 1% level and are considerably lower than their respective means, signifying right-skewness of this herding measure.[38] Panel B presents the mean and median values for the buy and sell herding for the three required number of active mutual funds. As can be seen from this panel, the sell herding figures are slightly greater than the buy herding figures, but not significantly so for the case where there are fifty active mutual funds.[39]

As a whole, these results provide evidence of herding in industries by mutual funds. The observed overall mean herding levels, though statistically significant, are not high. As indicated by Table 2.2 for the case where there are 50 active mutual funds on average 1.563% more mutual trade industries in the same direction than what is expected. However, this figure alone does not fully depict the variability of herding levels cross-sectionally and over time. To examine such possible variability, the quarterly mean, median, maximum and minimum levels of herding are over the 1980-2007 period are plotted in Figure 2.1. As can be seen from these graphs there is

[38] We perform Wilcoxon signed-rank statistic to test for significance of the median values. For the sake of brevity these results are not tabulated.

[39] The difference between buy and sell herding averages is statistically significant at 10% (5%) level for the case where there are at least 5 (20) mutual funds are active. The buy and sell herding medians are not statistically significantly different from each other for all three cases.

considerable cross-sectional and time series variation in industry herding levels. Although, the industry herding intensity averaged across all industries and the sample period is low there are many industry-quarters where the herding is quite intense.

2.4.2 Sias Herding Measure – The Evidence

In this subsection we examine whether mutual funds herd in industries using the Sias herding measure as defined in equation (7). This measure is the average cross-sectional correlation of fraction of buyers to all traders between all pairs of consecutive quarters. However, what we are after is the contribution of funds following other mutual funds' industry trades to this cross-sectional correlation (second term on the right hand side of equation (7)). Table 2.3, Panel A presents the average and median values and the corresponding Newey-West (Newey and West (1987)) adjusted t-statistics of 109 cross-correlations. The mean values of the cross-sectional correlation are 24%, 25%, and 31% for the cases where there are at least 5, 20, and 50 mutual funds are active, respectively.[40] These figures are slightly lower than what Choi and Sias (2009) find for all institutions, but are still quite high and statically significant at the 1% level. Median values for cross-sectional correlations are very close to the mean levels. Panel B of this table reports the component of cross-sectional correlation that is due to funds following their own previous quarter industry trades (first term in equation (7)), while Panel C presents the component that arises from funds following other funds' previous quarter industry trades (second term in equation (7)). As can be seen from this table the contribution of funds following other funds constitutes significant portion of the total cross-sectional correlation.

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[40] We find similar figures when we use two-digit SIC codes classify industries. For example the mean cross-sectional correlation is 29% for the cases where there are at least 50 active funds. For the sake of brevity these results are not tabulated.

In sum, the results presented in this section provide strong evidence of industry herding by mutual funds in the Sias herding framework, that is, mutual funds follow other mutual funds' previous quarter industry trades. To see how this Sias measure and the contribution of its two components vary over time quarterly contributions are plotted over the 1980-2007 period in Figure 2.2. The light shaded area represents the contribution of funds following their own industry lagged trades to the cross-sectional correlation while dark shaded area represents the contribution of funds following other funds' industry trades. As can be seen from this figure, the contribution funds following other funds' industry trades constitutes significant portion of the total cross-sectional correlation over the sample period.

2.4.3 Simulation Results vs. Actual Data

In this section, we run Monte Carlo simulations to examine whether the actual distributions of the LSV and Sias herding measures are different from those we would observe if no herding takes place. To generate the simulated distributions of the two herding measures, we follow a similar procedure to that employed by Wermers (1999). The number of mutual funds that are buyers in industry k in quarter t is modeled as a binomial distribution, $b(n_{k,t}, p_t)$ where $n_{k,t}$ is the actual total number of mutual funds that are either buyers or sellers in industry k in quarter t ($B_{k,t} + S_{k,t}$), and p_t is the actual cross-sectional average of the fraction of buyers (across all industries) in quarter t. For each industry-quarter, we draw a random number between 0 and 1, round it to 0 if the random draw is less than $1- p_t$ and to 1 otherwise. 0 indicates that fund is a seller while 1 indicates that fund is a buyer. This step is repeated $n_{k,t}$ times to give a draw from binomial distribution, $b(n_{k,t}, p_t)$. We then repeat these steps for each industry-quarter. Using the drawn number of buyers and sellers, we compute the simulated fraction of buyers to all traders, $p_{k,t}$* for each industry-quarter and the simulated cross-sectional average of fraction of buyers, p_t* (across K industries), for each quarter. We use the simulated fraction of buyers $p_{k,t}$* and the simulated cross-sectional average of fraction of buyers, p_t* to compute the simulated LSV (HM*) and the simulated Sias ($\rho(p_{k,t}*, p_{k,t-1}*)$) herding measures. We repeat this procedure to generate 1000 simulated industry-quarter observations for each actual industry-quarter observation.

Panel A of Figure 2.3 presents the simulated and actual distributions of the LSV herding measure. As can be seen from this figure the actual distribution of this measure has fatter right tail than the simulated one, indicating that mutual funds engage in herding behavior in industries beyond the level that is expected by random chance. Figure 2.3, Panel B shows the actual and the simulated distributions of the Sias herding measure. The actual distribution lies to the right of the simulated distribution, which is likewise consistent with actual cross-sectional correlations being much higher than that we may observe just by random chance. We employ Kolmogorov-Smirnov two-sample test and find that the actual sample distributions of the LSV and Sias herding measures are statistically different from their corresponding simulated distributions at the 1% significance level. These results provide evidence of mutual fund herding in industries.

2.4.4 Is Industry Herding Driven by Fund Flows?

In this section we examine whether the evidence of industry herding that is presented in the preceding section is driven by fund flows. Coval and Stafford (2007) show that mutual funds buy more of the stocks that they already hold when they experience cash inflows. Likewise, mutual funds have to sell their holdings when they suffer excessive cash outflows. If inflows and/or outflows are concentrated on funds that have similar industry allocations, even in the absence of any herding behavior, flows might induce funds to trade in the same direction and cause imbalance between the proportion of number of buyers and sellers. However, in the case of no herding, investor flows should not cause funds to change the industry allocation of their portfolios. To control for the effect of flows on industry herding measures, we therefore require that a fund must both change the industry allocation and trade in the direction of this change, to be counted as an active trader in a given industry-quarter.

Panel A and Panel B of Table 2.4 present the mean and median herding levels of the LSV and Sias measures after controlling for fund flows. As can be seen from Panel A of this table the respective mean LSV herding measures are 3.575%, 3.583%, and 3.718% (significant at the 1% level) for the case where there are at least five, twenty , and fifty active mutual funds. These figures are considerably higher than that reported in Table 2.2.[41] In contrast, we observe that controlling for fund decreases the observed Sias measures as reported in Panel B.[42] The corresponding mean Sias measures are 13%, 13%, and 15% for the filters of number of active mutual funds. However, these figures are still significant at the 1% level. The contribution of funds following other funds continues to be a significant portion of total cross-sectional correlation. In sum, these results reveal that industry herding is not driven by fund flows.

2.4.5 Is Industry Herding Driven by Individual Stock Herding?

The preceding subsections provide evidence of mutual fund herding in industries. In this subsection, we examine whether this observed industry herding is a manifestation of individual stock herding. It is possible that our findings for the industry herding are driven by individual stock herding. To explore this possibility in the LSV framework we repeat the analysis in

[41] One possible explanation for this could be that industry trades of mutual funds to reverse the change in industry allocation of their portfolio due to difference in industry returns introduce noise to the LSV herding measure.
[42] This decrease in Sias measure could potentially be driven by a serial correlation in fund flows to funds with particular industry concentration.

section 2.4.1 by excluding the stock with the highest level of herding for each industry-quarter. The rationale for this filter is that, if we still find evidence of industry herding even when the contribution of highest herded stock is not taken into account then the observed industry herding cannot be a manifestation of stock herding. We find that after excluding the stock with the highest herding level in each-industry quarter, the mean LSV herding measure is 1.0963 % and statistically significant at the 1% level for the case where there 50 active mutual funds.

To examine the same question in the Sias framework we follow Choi and Sias' (2009) methodology. Choi and Sias (2009) first define the ratio of buyers to all traders for and industry-quarter as the weighted average of this ratio for individual stocks belonging to the same industry where the previous quarter-end market value is used to compute the weights. They then decompose the cross-sectional correlation of the current and previous quarter weighted ratio of number of buyers to all traders into four components: the contribution of funds following their own stock trades, contribution of funds following other funds' individual stock trades, contribution of funds following themselves into other stocks belonging to the same industry and contribution of funds following other funds into other stocks belonging to same industry. We need to focus on the fourth component of cross-sectional correlation. For our sample, the mean values for the first, second, third and fourth components are 5%, 17%, 6%, and 6%, respectively.[43] The total cross-sectional correlation is 34%. All these figures are statistically significant at the 1% level. These results indicate that while the individual stock herding contributes to the total cross-sectional correlation, a nontrivial portion arises from funds following other funds into different stocks within the same industry.

[43] In this sub-section we limit our analysis to industry-quarters where there are at least fifty active mutual funds.

To sum, the findings in this section reveal that although individual stock herding by mutual funds contributes to the industry herding that we observe, it is not a manifestation of individual stock herding.

2.5 Does Mutual Fund Herding in Industries Destabilize Industry Market Values?

In the preceding sections we provide evidence of mutual fund herding in industries. We now proceed to investigate whether this observed herding impacts industry values. To test the price impact of industry herding by mutual funds, we first rank industries according to their previous quarter buy and sell LSV herding levels (equations (2) and (5)). We form portfolios of top five industries that experience the highest level of buy (sell) herding. We then compute the equal-weighted average of value weighted industry returns for these portfolios in the quarters following the herding.[44] We also form a difference portfolio which buys the top five buy and shorts the top five sell herding industries. Jegadeesh and Titman's (1993) calendar time aggregation methodology is used to compute the average returns of these three industry portfolios for overlapping observations.[45] All of the above defined portfolios are rebalanced quarterly.

Table 2.5, Panel A, presents the monthly raw returns as well as the CAPM, Fama-French three-factor, and four-factor alphas for these three portfolios. The corresponding t-statistics are reported in parenthesis. The first row of Panel A presents the contemporaneous returns and alphas for the formation period in which top five buy and sell industries are identified. The raw returns and alphas for the formation period are positive and statistically significant for the difference portfolio. The mean monthly raw return as well as the monthly CAPM, three-factor,

[44] Value-weighted industry returns are obtained from Kenneth French's website.
http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

[45] If the holding period is longer than a quarter then top five herding portfolios consist of current and previous quarters' top five herding industries. For example, for one year holding period, quarter *t* the top five buy herding consists of top five buy herding industries of quarter *t*, *t-1, t-2, and t-3*.

and four factor alphas are 0.96%, 0.94%, 1.05%, and 1.25%, respectively which are also economically significant. This finding is consistent with prior studies which find contemporaneous positive relationship between returns and herding by mutual funds and institutions [Nofsinger and Sias (1999), Wermers (1999), Choi and Sias (2009)]. The remaining rows present the results for subsequent periods (q_1, q_2, q_3-q_4, q_5-q_8, and q_9-q_{12}). The difference portfolio continues to earn positive returns in the quarter q_2. The q_2 return on the difference portfolio is statistically significant even after controlling for Fama-French three-factors (Fama and French (1993)), and the momentum factor. The return on the difference portfolio turns negative in quarters q_5-q_8, albeit not statistically significantly different from zero. It can be therefore inferred that there is no evidence of return reversals for the industries that are subjected to high levels of buy and sell herding.[46,47]

Panel B of Table 2.5 repeats the analysis in the Sias framework. Since the Sias herding measure cannot be calculated for each industry-quarter we compute the contributions of each industry to the cross-sectional correlation for each consecutive pairs of quarters. To distinguish between buy and sell herding industries we rank these contributions separately for the industries with positive and negative differences for both quarters, q_0^1 and q_0^2 (formation quarters). The industries with the top five highest contributions among the ones with positive (negative) differences for both quarters are identified as top five buy (sell) herding industries. The first four rows of Panel B present the average raw returns as well as CAPM, three-factor, and four-factor

[46] We repeat the same analysis using two-digit SIC industry classification and find similar results.

[47] Sharma, Easterwood and Kumar (2006) point out that when examining the impact of herding on stock returns the ongoing herding in the subsequent period needs to be controlled for. We repeat the above analysis by controlling for the subsequent quarter herding. Since there are five industries in each of top buy and top sell portfolios for some quarters we end up with no observations in these groups after conditioning on no herding in the subsequent quarter. To circumvent this problem, we form top ten buy (sell) industries that experience the highest levels of buy (sell) herding. For each quarter we then exclude the industries that are subjected to herding in the subsequent quarter. We find no evidence of return reversals even after controlling for the ongoing herding in the subsequent quarter.

alphas during the formation quarters. As in Panel A, the difference portfolio has positive and statistically significant raw and abnormal returns in the formation quarters. Raw returns for the difference portfolio are 0.70% and 0.69% for quarters q_0^1 and q_0^2, respectively, and the various monthly alphas for these formation quarters range between 0.62% and 0.91%. Panel B also presents the results for the two quarters (q_1 and q_2). There is also some evidence that difference portfolio continues to earn positive returns in the two quarters following the formation period ; the four-factor alpha is significant at the 10% level, for quarter q_1 and at the 5% level for quarter q_2. The difference portfolio returns are not significantly different from zero in periods q_3-q_4, q_5-q_8, and q_9-q_{12}.[48]

The findings in Table 2.5 point to a positive contemporaneous relationship between industry herding and industry returns. There is no evidence of return reversals in industries that are subjected to high levels of buy and sell herding. Therefore, the hypothesis that that herding does not drive industry values away from fundamentals cannot be rejected. These findings however, are not consistent with Choi and Sias (2009) who provide some evidence that industries that experience persistently high levels of herding by institutions experience negative abnormal returns in the subsequent years. This discrepancy between their and our findings may be attributable to the fact that we investigate the impact of herding by subset of institutions, namely, actively managed equity mutual funds. It is possible that, the industries that experience high levels of herding are different by mutual funds and all institutions.

[48] The same analysis is repeated using two-digit SIC industry classification. The results are not reported since they are not meaningfully different from the ones for Fama-French 49 industry classification.

2.6 Does Industry Herding by Mutual Funds Impact Fund Returns?

In the previous section we examine whether herding has any impact on industry returns. Extant studies, which investigate mutual fund or institutional herding, focus on the impact of such herding on returns of stock or industries that are subjected to herding. We now shift the focus to the effect of herding on the performance of funds that engage in this behavior. The question we address in this section is whether industry herding has any effect on the fund performance.

To quantify the extent to which a mutual fund joins industry herding, we employ the LSV-based and Sias-based herding intensity measures as depicted in equations (10) and (13), respectively. We then relate it to the fund performance as measured by holding-based returns and net fund returns. Holding-based returns are the hypothetical monthly gross portfolio returns, where each stock's weight in funds' portfolio for any given month is computed by using the most recent fund holdings information.[49] These weights are updated monthly, using the previous month end stock price of each stock in the portfolio. Then using these weights and individual stock returns the holding portfolio returns are computed for each mutual fund. To compute abnormal holding-based returns, we use characteristic selectivity measure (CS hereafter) proposed by Daniel, Grinblatt, Titman, and Wermers (1997) – DGTW, Fama and French (1993) three-factor model and Carhart (1997) four-factor model.[50]

[49] Holding-based fund returns are used to asses fund performance by various studies such as Wermers (2000), Kacperczyk, Sialm and Zheng (2005), Cremers and Petajisto (2009).

[50] To compute the CS measure, each quarter group stocks into quintiles dependently, first based on their size, then based on their book-to-market ratios, and last based on their previous six month returns. We rebalance these portfolios quarterly. We assign each stock holding of a mutual fund quarterly to one of these 125 portfolios according to its size, industry adjusted book-to-market ratio and past returns. We follow Wermers' (2000) methodology to compute industry adjusted book-to-market ratios. We then subtract the average return of the assigned portfolio from stocks return and use this excess return in portfolio return computations. More specifically, CS measure for mutual fund j month m is calculated as

The above defined holding-based returns (raw and adjusted) are useful in examining the direct impact of herding on the performance of stock-portfolios of mutual funds. These returns however ignore inter-quarter trades and do not account for transaction costs as well as other expenses and thus do not reflect the returns to mutual fund investors. We therefore also carry out the analysis using net mutual fund returns, adjusted by the three- and four-factor models.[51]

We employ portfolio analysis to examine the relationship between industry herding and fund performance. For each quarter funds are sorted into quintiles in ascending order based on the herding intensity measures. We then compute the subsequent quarter's raw returns, CS measures, as well as the three- and four-factor alphas for each quintile. We also form a difference portfolio which buys (sells) the funds in the highest (lowest) herding intensity quintile.

Panel A of Table 2.5 presents the results for the holding based returns where the quintiles are formed using LSV-based herding intensity measure. Funds in the highest herding quintile outperforms funds subsequently outperform funds in the lowest one by 11, 14, and 12 basis points (per month) based on raw returns, three-factor alpha, and four-factor alpha, respectively (statistically significant at the 10%, 5%, and 10% levels, respectively). However, after adjusting for characteristics (CS measure) there is no significant performance difference between high and low herding intensity funds. Panel A also presents the four-factor loadings of the herding intensity quintiles. It seems that funds with the highest herding intensity measures invest in small-growth stocks with high past returns. The findings are similar for the net fund returns as reported in Panel B.

$$CS_{j,m} = \sum_{i=1}^{N} w_{j,i,m} \times (R_{i,m} - R_m^{b_{i,m-1}}), \qquad (18)$$

where $R_m^{b_{i,m-1}}$ denotes the return of the benchmark portfolio that is matched to stock i with respect to size, value and momentum characteristics for the month *m-1*. See DGTW (1997) and Wermers (2000) for detailed explanation of the computation of benchmark portfolios and assignment of stocks to these portfolios.

[51] Net return data are obtained from CRSP Mutual Fund database.

The above analysis is repeated for the Sias-based herding intensity measure and the results are presented in Table 2.6. Panel A and B of Table 2.7 show the respective results for the holding-based returns and net fund returns. As can be seen in Panel A, high herding intensity funds outperform low herding intensity funds in terms of holding-based returns in the subsequent quarter, but the difference in returns of these two groups is not significant after controlling for momentum. There is no meaningful difference between net returns (raw and factor adjusted) of funds with high and low industry herding as presented in Panel B of Table 2.7. Four-factor loadings indicates that funds with high Sias-based herding intensity measures invest in small-growth stocks with high past returns.[52]

We, next extend the analyses up to four quarters following the quarter in which herding intensity measured. This analysis will allow us to examine whether there is any difference between abnormal returns of funds with high and low herding intensity in the quarters following the immediate subsequent quarter. Table 2.8 presents the three- and four-factor alphas based on holding-based and net returns for the high and low herding intensity quintiles as well as for the difference portfolio during quarters t+2 , t+3 and t+4 where t is the quarter where herding intensity is measured. As can be seen from Panel A of this table, which presents the results for the LSV-based herding intensity measure, high herding intensity funds outperform low herding intensity funds in quarter t+2. There is no significant difference between alphas of high and low herding intensity funds in the quarters t+3 and t+4.

[52] In order to control for other fund variables that may drive the return differences we reexamine the relationship between industry herding intensity and subsequent quarter fund performance by employing multivariate Fama-Macbeth (1973) regressions. This procedure also allows the factor loadings to vary with time. We use the CS measure (for the holding-based returns) and the four-factor abnormal returns (for the net fund returns) to examine the relationship between herding intensity and performance. In this multivariate regression setting, we include commonly used fund characteristics including fund size, age, net flow, expense ratio and turnover ratio as control variables [e.g. Chen et al. (2004), Cremers and Petajisto(2009)]. We find no association between fund performance and industry herding intensity in this multivariate regression setting.

Panel B reports the parallel results for the SIAS-based herding intensity measure. For this measure there is no significant difference between the alphas of high and low herding intensity funds in quarters t+2 and t+4. The four-factor alpha of the difference portfolio in quarter t+3 is negative and statistically significant at the 5% level although the three-factor alpha for this difference portfolio is not significantly different from zero.[53] This negative four-factor alpha might be driven by large positive loading on the momentum factor.

To sum this section provides some evidence that funds that join the herd outperform funds that do not do so in the subsequent quarter. However, this performance difference is not robust to difference abnormal return computations or to different herding definitions. In the light of these results we conclude that industry herding does not have significant effect on fund performance.

2.7 Determinants of Industry Herding Intensity

In this section we investigate what fund characteristics are associated with industry herding intensity. To address this question, we run Fama-Macbeth (1973) regressions of industry herding intensity on various fund variables including fund size, age, flow, turnover, and expenses. Table 2.9 presents the summary statistics for these fund variables as well the industry herding intensity measures. *LOGAGE* is the natural logarithm of the fund's age (measured in months) and *LOGTNA* is the natural logarithm of total net assets. We use natural logarithm of fund size and fund age because these variables are skewed to the right. *FLOW* is the new money growth and defined as in Gruber (1996). *EXPENSE* and *TURNOVER* is the expense ratio and turnover ratio respectively. Mean and standard deviation of these variables are presented in Table 2.9.

[53] The raw and three-factor alpha for the difference portfolio is -0.00027 and - 0.00024, respectively, and both are statistically insignificant.

For each quarter we run cross-sectional regressions of industry herding intensity on these explanatory variables. We then compute the time-series averages of the coefficients on these variables. Because turnover and expense ratios are only available on annual basis, we use the corresponding annual values for all quarters in that particular year. All other variables are available quarterly, and thus contemporaneous quarterly values are used in the regressions.

The first column of Table 2.10 presents the results for the case where the dependent variable is the LSV-based industry herding intensity measure. The corresponding t-statistics are computed from the Newey-West (1987) adjusted time series standard errors and are reported in parenthesis. There is significant positive association between fund turnover and industry herding intensity. The coefficient on funds size is positive, but only marginally significant. We observe no significant relationship between herding intensity and other fund variables. To explore the possibility that these relationships may differ for buy and sell herding intensity measures herding intensity is segregated into buy and sell herding intensity (as defined in equations (25) and (26), respectively) and the analysis is repeated using these two measures as the dependent variables. As can be seen from second and third columns of this table, flow is positively related to buy herding intensity and negatively related to sell herding intensity. These relationships are both statistically significant at the 1% level. These results indicate that funds join buy (sell) industry herding more when they experience cash inflow (outflows), but not strongly so.[54] The findings are similar for the Sias-based herding intensity measures, which are presented in the remaining columns of this table.

[54] One standard deviation change in flow changes buy and sell herding intensity by approximately one tenth of their respective standard deviation.

In sum, we find evidence that funds with high turnover join industry herding more. The findings also indicate that industry herding intensity is related to fund flows. Although, this relationship is statistically significant, it is not economically so.

2.8 Conclusion

Using the LSV (1992) and the Sias (2004) herding measures this study documents that mutual funds engage in industry herding. Monte Carlo simulations provide strong evidence that observed levels of industry herding are significantly higher than what could be expected by chance. We further document that industry herding by mutual funds is not driven by investor flows and is not a manifestation of individual stock herding.

This study also comments on the relation between mutual fund herding and the returns on herded industries. We document that industries that are bought by herds outperform industries that are sold by herds in the quarter in which herding takes place. We find no evidence of return reversals for these industries, indicating that mutual fund herding has no destabilizing effect on industry values.

The focus of this study then shifts to the yet unexplored relationship between industry herding and the performance of funds that engage in this activity. The results provide some evidence that, funds that herd intensely in industries enjoy higher returns than funds that do not herd. However, this performance difference is not robust to different abnormal return computations or to different herding definitions. We conclude that industry herding has no significant effect on fund performance.

Last, this study investigates what fund characteristics are associated with industry herding intensity measures. Our results point out to a positive relation between funds herding intensity and turnover. The evidence also indicates that fund herding intensity is weakly related to flows; funds tend to join buy industry herds when they experience cash inflows and sell industry herds when they suffer cash outflows.

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Table 2.1
Descriptive Statistics of the Mutual Fund Holdings Database

Key statistics, at five year intervals are presented for the Thomson-Reuters mutual fund holdings database. Mutual funds with investment objectives other than 2-aggressive growth, 3-growth, and 4-growth-income are excluded. For each column, statistics are shown at the end of the listed year. Panel A reports the number of funds as well as the mean and median total net assets (in million $) of mutual funds. Panel B documents the mean and median ratios of the total value of CRSP stocks holdings to total assets of mutual funds.

	Year						
	1980	1985	1990	1995	2000	2005	2007
Panel A . Number and Assets of Mutual Funds							
Number of Mutual Funds	423	496	797	2,235	2,423	1,820	1,637
Mean TNA (in million $)	123,467	236,812	263,423	538,967	1,290,868	1,872,231	2,488,445
Median TNA (in million $)	38,100	84,110	70,320	99,630	222,130	382,285	484,490
Panel B . Asset Allocation of Mutual Funds							
Mean Ratio of CRSP Stocks by Value	83.51%	83.34%	79.00%	78.79%	81.67%	81.67%	81.52%
Median Ratio of CRSP Stocks by Value	87.43%	86.35%	83.80%	89.28%	93.80%	92.03%	91.82%

Table 2.2
Evidence of Herding-LSV Measure

The LSV herding measure, $HM_{k,t}$, for each industry–quarter is defined as $HM_{k,t} = | p_{k,t} - p_t | - AF_{k,t}$, where $p_{k,t}$ is the ratio of number of buyers to total number of mutual funds that are either buyers or sellers, p_t is the cross-sectional average of fraction of buyers (across K industries) in quarter t, and $AF_{k,t}$ is an adjustment factor that accounts for the fact that even in the case of no herding $| p_{k,t} - p_t |$ can be greater than zero (by chance or an odd number of traders). The buy herding measure is computed by conditioning $HM_{k,t}$ on $(p_{k,t} - p_t) > 0$, and the sell herding measure is computed by conditioning $HM_{k,t}$ on $(p_{k,t} - p_t) < 0$. All stocks that have price information in the CRSP database are included. All sector and index funds are excluded. Industries are classified by using Fama and French 49 Industry specification. This table presents the mean and median values of three herding measures (unconditional, buy, and sell) for the industry-quarters where there 5, 20 and 50 active mutual funds during the 1980-2007 period.

Panel A. Herding Measure

	At least 5 active mutual funds	At least 20 active mutual funds	At least 50 active mutual funds
Herding Measure (HM)			
Mean	0.01645	0.01596	0.01563
t-stat	(26.56)	(27.28)	(28.40)
Median	0.00834	0.00827	0.00830

Panel B. Buy and Sell Herding Measures

Buy Herding Measure			
Mean	0.01531	0.01472	0.01518
t-stat	(17.32)	(17.57)	(18.87)
Median	0.00782	0.00749	0.00786
Sell Herding Measure			
Mean	0.01750	0.01708	0.01604
t-stat	(20.18)	(20.92)	(21.25)
Median	0.00864	0.00876	0.00847

Table 2.3
Evidence of Herding-Sias Measure

This table presents mean and median levels, and the corresponding t-statistics based on Newey-West adjusted standard errors of the Sias herding measure for industry quarters where there are 5, 20 and 50 active mutual funds during the 1980-2007 period. The Sias herding measure is defined as the cross-sectional correlation between ratios of buyers to all traders in current and previous quarter, $\rho(p_{k,t}\ ,\ p_{k,t-1})$. This cross sectional correlation is segregated into two parts, cross-sectional correlation due to funds following their own trades into the same industries and cross-sectional correlation due to funds following other funds into the same industries. All stocks that have price information in the CRSP database are included. All sector and index funds are excluded. Industries are classified by using Fama and French 49 Industry specification.

Panel A. Total Cross-seectional Correlation

	At least 5 active mutual funds	At least 20 active mutual funds	At least 50 active mutual funds
Mean	0.23885	0.25099	0.30783
t-stat	(10.44)	(12.45)	(18.86)
Median	0.23330	0.26310	0.30852

Panel B. Contribution of Mutual Funds Following Their Own Industry Trades

	At least 5 active mutual funds	At least 20 active mutual funds	At least 50 active mutual funds
Mean	0.06313	0.05467	0.04876
t-stat	(16.55)	(19.10)	(17.25)
Median	0.05737	0.05302	0.04955

Panel C. Contribution of Mutual Funds Following Other Funds' Industry Trades

	At least 5 active mutual funds	At least 20 active mutual funds	At least 50 active mutual funds
Mean	0.17572	0.19632	0.25907
t-stat	(7.72)	(9.54)	(16.21)
Median	0.17277	0.20313	0.26169

Table 2.4
Herding Levels after Controlling for Fund Flows

This table presents the industry herding levels of mutual funds controlling for fund flows. Different from Table 2.1 and Table 2.2, in this table, we require a mutual fund to change the allocation of a industry as well as trade in the same direction to be counted as an active trader (buyer or seller). The LSV herding measures (unconditional, buy, and sell) are as in Table 2.2. All sector and index funds are excluded. Industries are classified by using Fama and French 49 Industry specification. Panel A presents the mean and median values of these herding measures for the industry-quarters where there are 5, 20 and 50 active mutual funds during the 1980-2007 period. Panel B presents mean and median levels, and the corresponding t-statistics based on Newey-West adjusted standard errors of the Sias herding measure. The Sias herding measure is defined as the cross-sectional correlation between ratios of buyers to all traders in current and previous quarter, $\rho(p_{k,t},p_{k,t-1})$. This cross sectional correlation is segregated into two parts, cross-sectional correlation due to funds following their own trades into the same industries and cross-sectional correlation due to funds following other funds into the same industries.

Panel A. LSV Herding Measure

	At least 5 active mutual funds	At least 20 active mutual funds	At least 50 active mutual funds
Herding Measure (HM)			
Mean	0.03575	0.03583	0.03718
t-stat	(42.20)	(43.35)	(43.93)
Median	0.02386	0.02413	0.02524
Buy Herding Measure			
Mean	0.03351	0.03383	0.03571
t-stat	(29.41)	(30.12)	(31.06)
Median	0.02305	0.02313	0.02462
Sell Herding Measure			
Mean	0.03806	0.03789	0.03870
t-stat	(30.30)	(31.21)	(31.09)
Median	0.02461	0.02502	0.02579

Panel B. Sias Herding Measure

		At least 5 active mutual funds	At least 20 active mutual funds	At least 50 active mutual funds
Mean	Mutual funds	0.03502	0.03017	0.02460
t-stat	following	(8.89)	(10.08)	(9.46)
Median	their own trades	0.03126	0.02827	0.02257
Mean	Mutual funds	0.09627	0.09596	0.12393
t-stat	following	(4.43)	(4.13)	(5.02)
Median	other funds' trades	0.11839	0.12125	0.12996
Mean	Total	0.13129	0.12613	0.14853
t-stat	cross-sectional	(5.61)	(5.33)	(5.79)
Median	correlation	0.15026	0.14523	0.15091

Table 2.5
Mutual Fund Herding and Industry Returns

Panel A presents the formation period (q_0) and subsequent quarters (q_1, q_2, q_3-q_4, q_5-q_8, and q_9-q_{12}) average monthly raw returns, and monthly CAPM, three- and four-factor alphas top five buy herding, top five sell herding and the difference portfolios. The corresponding t-statistics are presented in parenthesis. To identify these top five buy and sell herding industries, industries are ranked according to their previous quarter buy and sell herding levels using the LSV herding measure. Top five industries that experience the highest level of buy (sell) herding are defined as top five buy (sell) herding industries. A difference portfolio that buys top five buy herding and shorts top five sell herding industries is formed. Jegadeesh and Titman's (1993) data aggregation methodology is used to compute average returns and herding measures of these three industry portfolios for overlapping observations. The portfolios are rebalanced quarterly. Panel B reports the result of the same analysis for the industries that experience consistently high buy and sell herding levels according to the Sias herding measure. To identify these industries, for each quarter, the difference between the fraction of buyers and cross-sectional average of fraction of buyers of past two quarters [$(p_{k,t-2}-p_{t-2})(p_{k,t-1}-p_{t-1})$] are multiplied. The groups that have positive and negative difference for quarters, *t-2* and *t-1* are separately ranked. The industries with the top five highest rank and positive (negative) differences for both quarters is identified as top five buy (sell) herding industries. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

Panel A. LSV Herding Measure

	Raw Industry Returns			CAPM alphas			3 Factor alphas			4 Factor alphas		
	Top 5 Buy Herding	Top 5 Sell Herding	Difference	Top 5 Buy Herding	Top 5 Sell Herding	Difference	Top 5 Buy Herding	Top 5 Sell Herding	Difference	Top 5 Buy Herding	Top 5 Sell Herding	Difference
q_0	0.0163***	0.0066***	0.0096***	0.0049***	-0.0045***	0.0094***	0.0035***	-0.0070***	0.0105***	0.0049***	-0.0076***	0.0125***
	(6.02)	(2.41)	(4.80)	(3.65)	(-2.87)	(4.62)	(2.63)	(-4.51)	(5.01)	(3.64)	(-4.80)	(5.93)
q_1	0.0138***	0.0123***	0.0015	0.0027**	0.0019	0.0009	0.0012	-0.0006	0.0019	0.0023*	-0.0009	0.0033
	(5.05)	(4.68)	(0.77)	(2.01)	(1.20)	(0.43)	(0.91)	(-0.43)	(0.92)	(1.73)	(-0.62)	(1.60)
q_2	0.0135***	0.0084***	0.0051***	0.0030**	-0.0017	0.0047***	0.0011	-0.0037**	0.0048***	0.0015	-0.0044***	0.0059***
	(5.02)	(3.20)	(2.88)	(2.24)	(-1.12)	(2.64)	(0.85)	(-2.54)	(2.63)	(1.08)	(-2.97)	(3.15)
q_3-q_4	0.0124***	0.0102***	0.0022	0.0024**	0.0007	0.0017	0.0006	-0.0013	0.0019	0.0009	-0.0008	0.0016
	(4.92)	(3.97)	(1.41)	(2.13)	(0.53)	(1.11)	(0.56)	(-0.98)	(1.19)	(0.78)	(-0.59)	(1.02)
q_5-q_8	0.0103***	0.0105***	-0.0002	0.0005	0.0007	-0.0002	-0.0011	-0.0012	0.0001	-0.0003	-0.0002	-0.0001
	(4.09)	(4.07)	(-0.17)	(0.47)	(0.59)	(-0.17)	(-1.12)	(-1.04)	(0.06)	(-0.28)	(-0.18)	(-0.06)
q_9-q_{12}	0.0123***	0.0116***	0.0007	0.0017	0.0010	0.0006	0.0003	-0.0012	0.0014	0.0006	-0.0003	0.0008
	(4.77)	(4.49)	(0.60)	(1.63)	(0.91)	(0.56)	(0.29)	(-1.11)	(1.25)	(0.56)	(-0.26)	(0.71)

Table 2.5-Continued

Panel B. SIAS Herding Measure

	Raw Industry Returns			CAPM alphas			3 Factor alphas			4 Factor alphas		
	Top 5 Buy Herding	Top 5 Sell Herding	Difference	Top 5 Buy Herding	Top 5 Sell Herding	Difference	Top 5 Buy Herding	Top 5 Sell Herding	Difference	Top 5 Buy Herding	Top 5 Sell Herding	Difference
q_0^1	0.0144***	0.0075***	0.0070***	0.0029**	-0.0034**	0.0062***	0.0015	-0.0060***	0.0075***	0.0025*	-0.0060***	0.0085***
	(5.20)	(2.69)	(3.60)	(2.23)	(-1.98)	(3.21)	(1.16)	(-3.57)	(3.75)	(1.96)	(-3.45)	(4.18)
q_0^2	0.0148***	0.0079***	0.0069***	0.0037***	-0.0026	0.0063***	0.0028***	-0.0054***	0.0082***	0.0041***	-0.0049***	0.0091***
	(5.41)	(2.92)	(3.53)	(2.73)	(-1.56)	(3.21)	(2.02)	(-3.34)	(4.07)	(2.98)	(-3.00)	(4.42)
q_1	0.0120***	0.0092***	0.0029	0.0012	-0.0010	0.0023	-0.0003	-0.0036**	0.0033*	0.0004	-0.0034**	0.0038*
	(4.46)	(3.44)	(1.55)	(0.98)	(-0.63)	(1.21)	(-0.26)	(-2.33)	(1.71)	(0.34)	(-2.11)	(1.93)
q_2	0.0129***	0.0094***	0.0035*	0.0027**	-0.0004	0.0031*	0.0012	-0.0031**	0.0043**	0.0019	-0.0031*	0.0049**
	(4.99)	(3.52)	(1.92)	(2.23)	(-0.27)	(1.69)	(0.97)	(-2.00)	(2.26)	(1.53)	(-1.91)	(2.54)
q_3-q_4	0.0113***	0.0103***	0.0010	0.0015*	0.0010	0.0005	0.0001	-0.0018	0.0019	0.0004	-0.0011	0.0015
	(4.42)	(3.86)	(0.61)	(1.40)	(0.64)	(0.31)	(0.14)	(-1.23)	(1.10)	(0.33)	(-0.75)	(0.82)
q_5-q_8	0.0104***	0.0106***	-0.0002	-0.0002	0.0007	-0.0009	-0.0015	-0.0018	0.0003	-0.0007	-0.0014	0.0007
	(3.96)	(4.18)	(-0.12)	(-0.16)	(0.54)	(-0.61)	(-1.47)	(-1.46)	(0.22)	(-0.68)	(-1.09)	(0.47)
q_9-q_{12}	0.0111***	0.0109***	0.0001	0.0006	0.0010	-0.0004	-0.0007	-0.0016	0.0009	-0.0002	-0.0010	0.0008
	(4.22)	(4.26)	(0.09)	(0.53)	(0.73)	(-0.32)	(-0.64)	(-1.30)	(0.70)	(-0.21)	(-0.80)	(0.57)

Table 2.6

LSV-based Industry Herding Intensity Measure and Subsequent Quarter Mutual Fund Returns

This table presents the raw and abnormal returns and the four-factor loadings for portfolios of mutual funds during the 1980-2007 period. The industry herding intensity measure, $HI_{j,t}$, for each fund–quarter is defined as $HI_{j,t} = \sum | w_{k,j,t} - w_{k,j,t} | * SHM_{k,j,t} * IN_{k,j,t}$, where $w_{k,j,t}$ is weight of industry k in fund j's portfolio at the end of quarter t, $SHM_{k,j,t}$ is the signed herding measure, $IN_{k,t}$ is the indicator function which gets value of 1 if the fund buys (sells) industry k and the change in weight of industry k is positive (negative), and 0 otherwise. The sample is divided into quintiles based on the lagged herding intensity measure. Portfolios are rebalanced quarterly. The first column shows the average herding intensity measures for each quintile. The second and the third columns show the subsequent raw and characteristic adjusted (CS) holding-based returns. Characteristic selectivity is defined as $CS = \sum w_{i,t-1}(R_{i,t} - BR_t^{i,t-1})$, where $BR_t^{i,t-1}$ denotes the return of a benchmark portfolio during period t to which stock i was allocated during period $t-1$ according to its size, value, and momentum characteristics (DGTW (1997)). The fourth and the fifth columns show the three- and the four-factor alphas. The sixth to ninth columns present the four-factor loadings. The differences in the returns of quintiles 5 and 1 are presented in the bottom row. Industries are classified by using Fama-French 49 Industry specification. Panel B reports the results for net (after-expense) returns. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

Panel A. Holding-Based Returns and Factor Loadings

		Holding-Based Returns (monthly)				Factor Loadings			
Quintiles	Average Herding Intensity	Raw	CS	3-Factor Alphas	4-Factor Alphas	Market	Size	Value	Momentum
1	-0.0024	0.0114 ***	0.0001	-0.0002	-0.0006	1.0980 ***	0.2441 ***	-0.0246	0.0325 ***
		(4.08)	(0.31)	(-0.42)	(-1.04)	(80.70)	(14.51)	(-1.23)	(2.73)
2	-0.0001	0.0114 ***	0.0002	-0.0002	-0.0002	1.0738 ***	0.1194 ***	0.0232	0.0001
		(4.36)	(0.50)	(-0.44)	(-0.43)	(89.84)	(8.08)	(1.32)	(0.01)
3	0.0007	0.0117 ***	0.0002	0.0001	0.0001	1.0761 ***	0.0955 ***	0.0263	0.0044
		(4.49)	(0.76)	(0.24)	(0.14)	(89.00)	(6.39)	(1.48)	(0.42)
4	0.0018	0.0120 ***	0.0000	0.0005	0.0004	1.0795 ***	0.1336 ***	-0.0169	0.0181
		(4.48)	(0.14)	(1.09)	(0.70)	(81.72)	(8.18)	(-0.87)	(1.56)
5	0.0049	0.0125 ***	0.0003	0.0012 *	0.0006	1.1067 ***	0.2202 ***	-0.0990 ***	0.0604 ***
		(4.33)	(0.63)	(1.86)	(0.92)	(65.00)	(10.46)	(-3.96)	(4.05)
Q5-Q1	0.0073	0.0011 *	0.0002	0.0014 **	0.0012 *	0.0087	-0.0239	-0.0744 ***	0.0279 *
		(1.83)	(0.50)	(2.30)	(1.80)	(0.53)	(-1.17)	(-3.05)	(1.92)

Table 2.6 - Continued

Panel B. Net Returns and Factor Loadings

		Net Returns (monthly)			Factor Loadings			
Quintiles	Average Herding Intensity	Raw	3-Factor Alphas	4-Factor Alphas	Market	Size	Value	Momentum
1	-0.0024	0.0100 ***	-0.0010 **	-0.0014 ***	1.0085 ***	0.2554 ***	-0.0162	0.0352 ***
		(3.90)	(-2.12)	(-2.81)	(78.54)	(16.09)	(-0.86)	(3.13)
2	-0.0001	0.0101 ***	-0.0011 ***	-0.0010 **	1.0074 ***	0.1339 ***	0.0369 **	-0.0103
		(4.13)	(-2.66)	(-2.35)	(89.07)	(9.58)	(2.22)	(-1.04)
3	0.0007	0.0103 ***	-0.0008 *	-0.0008 *	1.0030 ***	0.1108 ***	0.0350 **	-0.0002
		(4.27)	(-1.96)	(-1.90)	(91.49)	(8.17)	(2.17)	(-0.02)
4	0.0018	0.0108 ***	-0.0002	-0.0004	1.0049 ***	0.1513 ***	-0.0111	0.0180 *
		(4.31)	(-0.49)	(-0.86)	(81.36)	(9.91)	(-0.61)	(1.66)
5	0.0049	0.0110 ***	0.0001	-0.0004	1.0242 ***	0.2306 ***	-0.0785 ***	0.0512 ***
		(4.11)	(0.22)	(-0.65)	(66.06)	(12.03)	(-3.44)	(3.77)
Q5-Q1	0.0073	0.0010 *	0.0012 **	0.0010 *	0.0157	-0.0248	-0.0623 ***	0.0160
		(1.74)	(2.05)	(1.72)	(1.04)	(-1.33)	(-2.80)	(1.21)

Table 2.7

Sias-based Industry Herding Intensity Measure and Subsequent Quarter Mutual Fund Returns

This table presents the raw and abnormal returns and the four-factor loadings for portfolios of mutual funds during the 1980-2007 period. The industry Sias-based herding intensity measure, $HI^S_{j,t}$, for each fund–quarter is defined as $HI^S_{j,t} = \sum \left| w_{j,k,t} - w_{j,k,t-1} \right| x WI_{k,t,t-1} x\ IN^*_{j,k,t-1} x\ IN_{j,k,t}$, where $WI_{k,t,t-1}$ is the weight of contribution of industry k to the cross-sectional correlation, $IN^*_{j,k,t-1}$ is an indicator function which equals to 1 (-1) if industry k contributes positively to the cross-sectional correlation over the $t-1$ to t period and the fund j trades industry k in the same direction (opposite) with the herd and equals to 0 if industry k contributes negatively to the cross-sectional correlation, $IN_{k,t}$ is the indicator function which gets value of 1 if the fund buys (sells) industry k and the change in weight of industry k is positive (negative), and 0 otherwise. The sample is divided into quintiles based on the lagged herding intensity measure. Portfolios are rebalanced quarterly. The first column shows the average herding intensity measures for each quintile. The second and the third columns show the subsequent raw and characteristic adjusted (CS) holding-based returns. Characteristic selectivity is defined as $CS = \sum w_{i,t-1}(R_{i,t} - BR_t^{i,t-1})$, where $BR_t^{i,t-1}$ denotes the return of a benchmark portfolio during period t to which stock i was allocated during period $t-1$ according to its size, value, and momentum characteristics (DGTW (1997)). The fourth and the fifth columns show the three- and the four-factor alphas. The sixth to ninth columns present the four-factor loadings. The differences in the returns of quintile 5 and 1 are presented in the bottom row. Industries are classified by using Fama-French 49 Industry specification. Panel B reports the results for net (after-expense) returns. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

Panel A. Holding-Based Returns and Factor Loadings

		Holding-Based Returns (monthly)				Factor Loadings			
Quintiles	Average Herding Intensity	Raw	CS	3-Factor Alphas	4-Factor Alphas	Market	Size	Value	Momentum
1	-0.0018	0.0110***	0.0001	-0.0002	-0.0003	1.1000***	0.1887***	-0.0100	0.0092
		(4.00)	(0.37)	(-0.44)	(-0.59)	(75.40)	(10.45)	(-0.46)	(0.72)
2	-0.0002	0.0110***	0.0001	-0.0003	-0.0003	1.0754***	0.1358***	0.0425**	0.0007
		(4.20)	(0.35)	(-0.71)	(-0.71)	(85.73)	(8.75)	(2.29)	(0.06)
3	0.0003	0.0116***	0.0001	0.0004	0.0004	1.0538***	0.1312***	-0.0088	0.0037
		(4.46)	(0.26)	(0.93)	(0.82)	(90.93)	(9.18)	(-0.52)	(0.36)
4	0.0010	0.0115***	0.0001	0.0005	0.0002	1.0826***	0.1455***	-0.0399**	0.0305***
		(4.23)	(0.18)	(1.08)	(0.41)	(90.24)	(9.80)	(-2.25)	(2.90)
5	0.0033	0.0122***	0.0003	0.0011*	0.0004	1.1139***	0.2157***	-0.0652***	0.0691***
		(4.23)	(0.83)	(1.85)	(0.71)	(72.66)	(11.37)	(-2.88)	(5.14)
Q5-Q1	0.0051	0.0011*	0.0002	0.0014**	0.0008	0.0139	0.0271	-0.0552**	0.0599***
		(1.92)	(0.71)	(2.35)	(1.31)	(0.94)	(1.47)	(-2.51)	(4.61)

Table 2.7-Continued

Panel B. Net Returns and Factor Loadings

		Net Returns (monthly)			Factor Loadings			
Quintiles	Average Herding Intensity	Raw	3-Factor Alphas	4-Factor Alphas	Market	Size	Value	Momentum
1	-0.0018	0.0098 ***	-0.0010 *	-0.0012 **	1.0129 ***	0.1925 ***	0.0017	0.0135
		(3.85)	(-1.94)	(-2.15)	(73.79)	(11.33)	(0.08)	(1.12)
2	-0.0002	0.0097 ***	-0.0013 ***	-0.0012 **	1.0048 ***	0.1594 ***	0.0496 ***	-0.0076
		(3.96)	(-2.79)	(-2.55)	(83.93)	(10.75)	(2.80)	(-0.73)
3	0.0003	0.0104 ***	-0.0005	-0.0005	0.9862 ***	0.1507 ***	0.0049	-0.0011
		(4.25)	(-1.23)	(-1.17)	(90.84)	(11.25)	(0.31)	(-0.11)
4	0.0010	0.0104 ***	-0.0002	-0.0004	1.0088 ***	0.1555 ***	-0.0361 **	0.0275 ***
		(4.11)	(-0.41)	(-1.07)	(94.18)	(11.72)	(-2.28)	(2.93)
5	0.0033	0.0105 ***	-0.0001	-0.0007	1.0284 ***	0.2333 ***	-0.0477 **	0.0619 ***
		(3.95)	(-0.20)	(-1.32)	(71.82)	(13.16)	(-2.25)	(4.93)
Q5-Q1	0.0051	0.0007	0.0009	0.0004	0.0154	0.0408 **	-0.0494 **	0.0484 ***
		(1.29)	(1.63)	(0.74)	(1.08)	(2.31)	(-2.35)	(3.88)

Table 2.8
Herding Intensity Measures and Mutual Fund Returns in Quarters t+2, t+3, and t+4

This table presents the three and four-factor alphas based on holding-based (before expense) and net returns (after expense) for high intensity and low herding intensity quintiles and for the difference portfolio for quarters t+2, t+3, and t+4, quarter t is the quarter in which herding intensity is measured. Panel A presents the results for the LSV-based herding intensity measure. The LSV-based herding intensity measure is defined the same as in Table 2.6. Panel B presents the results for the Sias-based herding intensity measure. The Sias-based herding intensity measure is the same as is defined in Table 2.7. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

Panel A. LSV-based Herding Intensity

	Holding-Based Returns (monthly)						Net Returns (monthly)					
	Quarter t+2		Quarter t+3		Quarter t+4		Quarter t+2		Quarter t+3		Quarter t+4	
Quintiles	3-Factor Alphas	4-Factor Alphas	3-Factor Alphas	4-Factor Alphas	3-Factor Alphas	4-Factor Alphas	3-Factor Alphas	4-Factor Alphas	3-Factor Alphas	4-Factor Alphas	3-Factor Alphas	4-Factor Alphas
1	-0.0004	-0.0006	-0.0003	-0.0002	-0.0003	-0.0003	-0.0013***	-0.0014***	-0.0009*	-0.0009*	-0.0011**	-0.0011**
	(-0.75)	(-1.03)	(-0.50)	(-0.45)	(-0.58)	(-0.58)	(-2.61)	(-2.69)	(-1.84)	(-1.74)	(-2.26)	(-2.17)
5	0.0015**	0.0008	0.0007	0.0000	0.0000	-0.0005	0.0006	-0.0001	-0.0003	-0.0011*	-0.0008	-0.0013**
	(2.38)	(1.31)	(1.11)	(0.03)	(0.05)	(-0.74)	(1.04)	(-0.19)	(-0.54)	(-1.85)	(-1.23)	(-1.99)
Q5-Q1	0.0018***	0.0014**	0.0010	0.0003	0.0003	-0.0002	0.0019***	0.0013**	0.0006	-0.0002	0.0003	-0.0002
	(3.02)	(2.19)	(1.61)	(0.43)	(0.64)	(-0.34)	(3.13)	(2.10)	(1.00)	(-0.30)	(0.63)	(-0.32)

Panel B. Sias-based Herding Intensity

	Holding-Based Returns (monthly)						Net Returns (monthly)					
	Quarter t+2		Quarter t+3		Quarter t+4		Quarter t+2		Quarter t+3		Quarter t+4	
Quintiles	3-Factor Alphas	4-Factor Alphas	3-Factor Alphas	4-Factor Alphas	3-Factor Alphas	4-Factor Alphas	3-Factor Alphas	4-Factor Alphas	3-Factor Alphas	4-Factor Alphas	3-Factor Alphas	4-Factor Alphas
1	0.0002	0.0001	0.0005	0.0005	0.0001	-0.0001	-0.0009*	-0.0010*	-0.0004	-0.0004	-0.0010**	-0.0012**
	(0.29)	(0.10)	(0.89)	(0.86)	(0.11)	(-0.23)	(-1.81)	(-1.83)	(-0.77)	(-0.68)	(-2.05)	(-2.46)
5	0.0008	0.0001	0.0003	-0.0006	-0.0001	-0.0007	0.0001	-0.0006	-0.0005	-0.0015**	-0.0013**	-0.0018***
	(1.33)	(0.10)	(0.44)	(-0.94)	(-0.21)	(-1.05)	(0.15)	(-1.10)	(-0.91)	(-2.55)	(-2.26)	(-3.05)
Q5-Q1	0.0007	0.0000	-0.0002	-0.0011**	-0.0002	-0.0005	0.0010*	0.0003	-0.0001	-0.0011**	-0.0004	-0.0006
	(1.18)	(0.02)	(-0.41)	(-2.03)	(-0.42)	(-1.15)	(1.75)	(0.59)	(-0.25)	(-1.99)	(-0.79)	(-1.34)

Table 2.9
Summary Statistics

This table presents the mean and standard deviation of LSV- and Sias-based herding intensity measures (herding intensity (HI), buy herding intensity (BI), and sell herding intensity (SI)) as well as of various fund characteristic variables. The sample includes actively managed equity mutual funds during the 1980-2007 period. *LOGAGE* is the natural logarithm of the age of the fund measured in months. *LOGTNA* is the natural logarithm of total net assets. *FLOW* is the new money growth. *EXPENSE* and *TURNOVER* is the annual expense ratio and turnover ratio, respectively.

Panel B. Summary Statistics

	Mean	Std. Dev
HI	0.0008	0.0031
BHI	0.0007	0.0023
SHI	0.0001	0.0017
HI^S	0.0005	0.0023
BHI^S	0.0004	0.0018
SHI^S	0.0001	0.0013
LOGTNA	19.385	1.541
LOGAGE	4.720	0.706
EXPENSE	0.012	0.005
TURNOVER	0.826	0.785
FLOW	0.012	0.139

Table 2.10
Determinants of Industry Herding Intensity

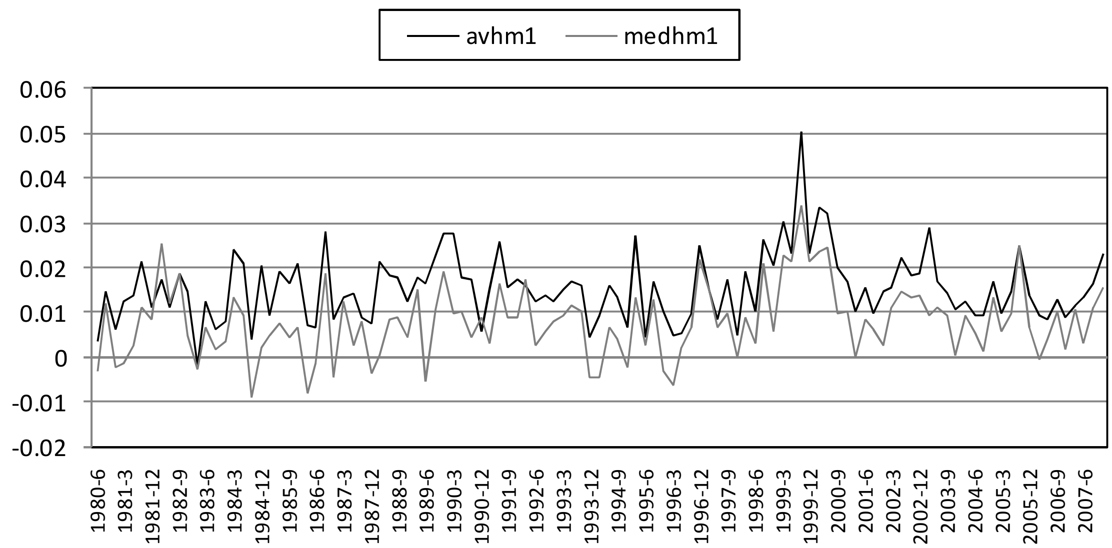
This table presents the coefficients from quarterly Fama-Macbeth regressions of LSV and Sias-based industry herding intensity measures (herding intensity (HI), buy herding intensity (BI), and sell herding intensity (SI)) on various fund characteristic variables. The sample includes actively managed equity mutual funds during the 1980-2007 period. *LOGAGE* is the natural logarithm of the age of the fund measured in months. *LOGTNA* is the natural logarithm of total net assets. *FLOW* is the new money growth. *EXPENSE* and *TURNOVER* is the annual expense ratio and turnover ratio, respectively. Corresponding Newey-West adjusted t-statistics are reported in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	LSV-based Herding Intensity			*Sias-based Herding Intensity*		
Dependent variable:	HI	BHI	SHI	HI^S	BHI^S	SHI^S
	(1)	(2)	(3)	(4)	(5)	(6)
LOGTNAx1000	0.04917*	0.03196*	0.01720	0.06662***	0.03152***	0.03510**
	(1.86)	(1.97)	(0.75)	(3.53)	(3.27)	(2.16)
LOGAGE	0.00019	0.00002	0.00018	-0.00005	-0.00011**	0.00006
	(1.03)	(0.19)	(1.40)	(-0.82)	(-2.61)	(0.96)
FLOWx1000	-0.00667	1.58275***	-1.58943***	0.10822	0.70641***	-0.59819***
	(-0.02)	(7.54)	(-4.77)	(0.53)	(4.30)	(-3.09)
EXPENSE	0.01134	0.00236	0.00898	0.01425***	0.00541	0.00884*
	(0.89)	(0.38)	(0.98)	(2.85)	(1.60)	(1.81)
TURNOVERx1000	0.76892***	0.58124***	0.18768**	0.36934***	0.33314***	0.03619
	(4.73)	(6.08)	(2.11)	(4.33)	(7.03)	(0.79)
Number of observations	24547	24547	24547	24547	24547	24547
Adj. R^2	0.0550	0.0692	0.0530	0.0390	0.0481	0.0277

Figure 2.1
Plot of the LSV Herding Measure

The LSV herding measure, $HM_{k,t}$, is define as in Table 2.1. Panel A presents the plot of the mean and median values of $HM_{k,t}$ for the industry quarters where there 50 active mutual funds during the 1980-2007 time period. Panel B presents the plot of the minimum and maximum values of $HM_{k,t}$ for the industry-quarters where there 50 active mutual funds during the 1980-2007 period.

Panel A. Plot of Average and Median Herding Measures (HM)



Panel B. Plot of Minimum and Maximum Herding Measures (HM)

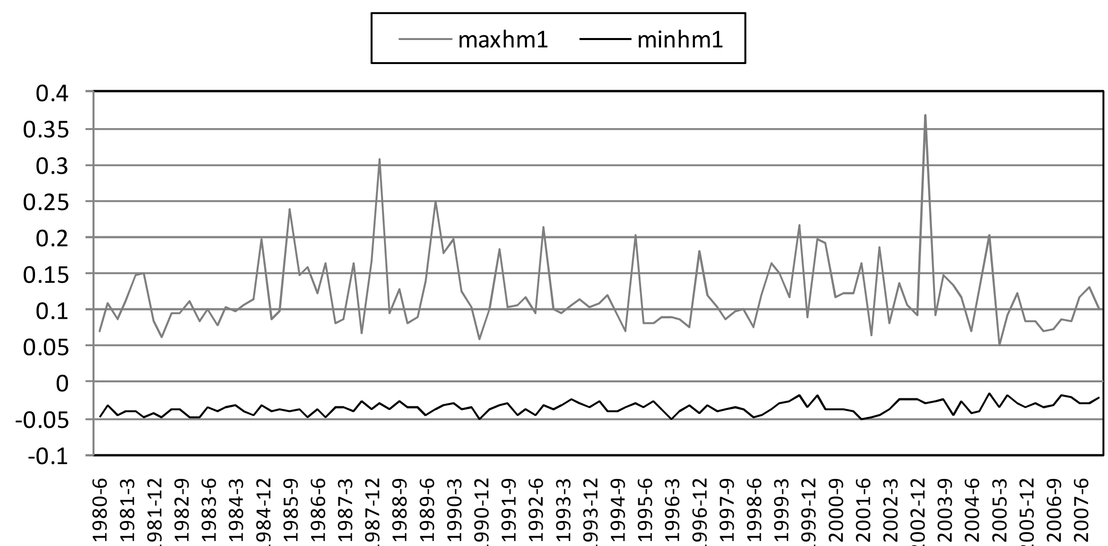


Figure 2.2
Plot of the Sias Herding Measure

The Sias herding measure is defined as the cross-sectional correlation between ratios of buyers to all traders in current and previous quarter, $\rho(p_{k,t}, p_{k,t-1})$. This cross sectional correlation is segregated into two parts, cross-sectional correlation due to funds following their own trades into the same industries and cross-sectional correlation due to funds following other funds into the same industries. This figure presents the contribution of each part to the total cross-sectional correlation for the industry-quarters where there 50 active mutual funds over the 1980-2007 period. The light shaded area represents the contribution of funds following their own industry trades in the previous quarter to the cross-sectional correlation. The dark shaded area represents the contribution of funds following other funds' industry trades in the previous quarter to the cross-sectional correlation.

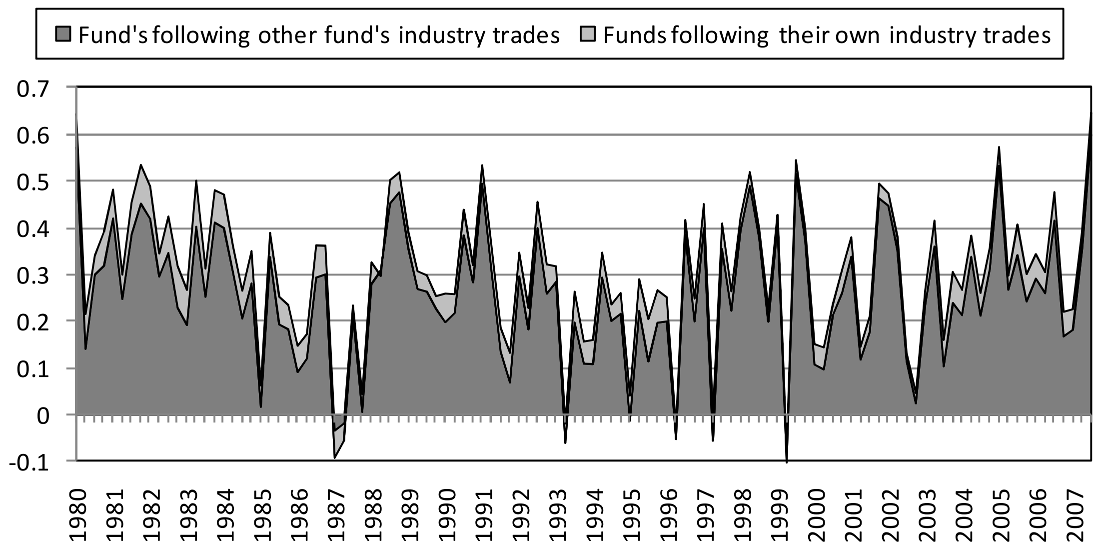


Figure 2.3
Distributions of Actual and Simulated Herding Measures

The number of mutual funds that are buyers in industry k in quarter t, is modeled as a binomial distribution, $b(n_{k,t}, p_t)$ where $n_{k,t}$ is the actual total number of mutual funds that are either buyers or sellers in industry k in quarter t ($B_{k,t} + S_{k,t}$), and p_t is the actual cross-sectional average of fraction of buyers (across K industries) in quarter t. First, for each industry-quarter, a random number between 0 and 1 is drawn, and is rounded to 0 if the random draw is less than $1 - p_t$ and 1 otherwise. This step is repeated $n_{k,t}$ times and then for each industry-quarter. Then, using the simulated number of buyers and sellers, the simulated fraction of buyers ,$p_{k,t}$*, and the simulated cross-sectional average of fraction of buyers, p_t* (across K industries) are computed in quarter t. Finally, the simulated LSV Herding Measure , $HM^*_{k,t}$, is computed for each industry –quarter as $HM^*_{k,t} = \left| p^*_{k,t} - p^*_t \right| - AF_{k,t}$. For each adjacent quarters, simulated Sias measure, $\rho(p^*_{k,t}, p^*_{k,t-1})$, the cross-sectional correlation between ratios of simulated number of buyers to all traders in current and previous quarter, is also computed. This procedure is repeated to generate 1000 simulated industry-quarter observations for each actual industry-quarter observation. Panel A presents the simulated and actual distribution of the LSV Herding Measure ($HM^*_{k,t}$, $HM_{k,t}$). Panel B presents the simulated and actual distribution of the Sias Herding Measure ($\rho(p^*_{k,t}, p^*_{k,t-1})$, $\rho(p_{k,t}, p_{k,t-1})$). We use bin widths of 0.01 and 0.1 for Panel A and Panel B, respectively.

Panel A. Distributions of the Actual and Simulated LSV Herding Measure

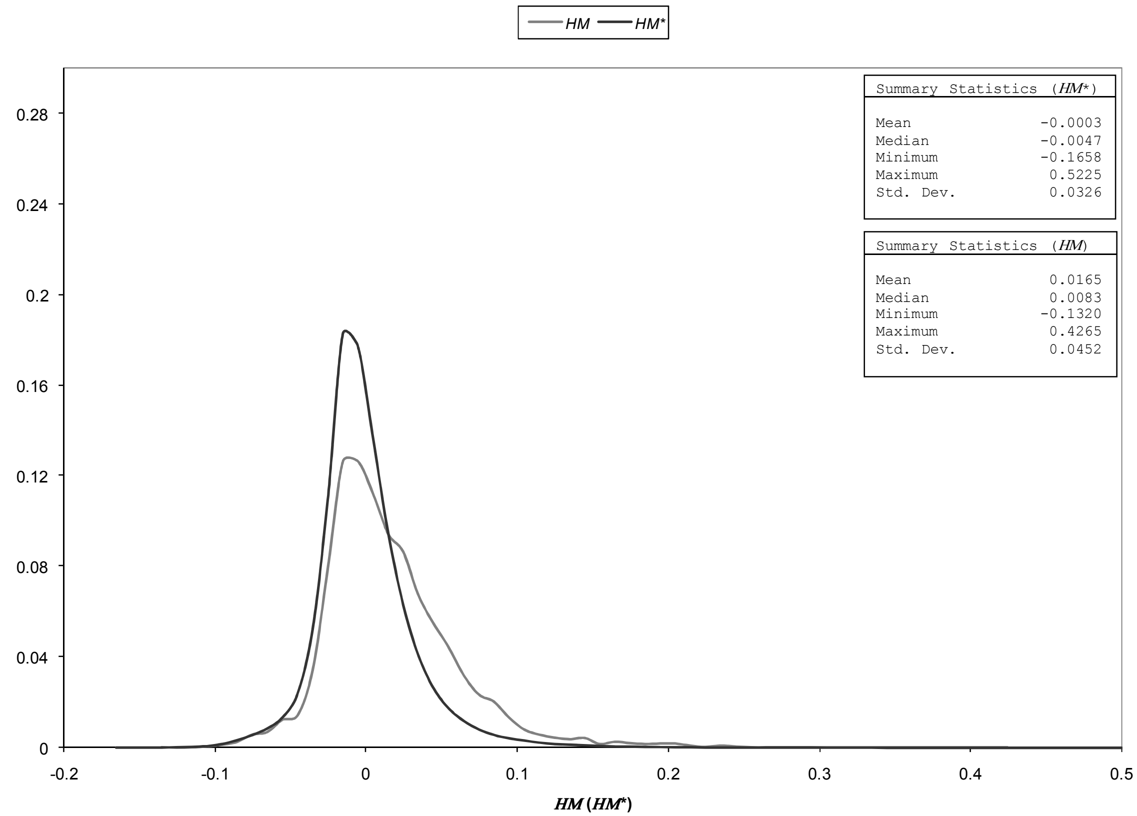


Figure 2.3-Continued

Panel B. Distributions of the Actual and Simulated Sias Herding Measure