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Do Institutional Investors Herd in Emerging Markets?

Evidence from the Taiwan Stock Market

Jonchi Shyu (Corresponding author)
Department of Business Administration,
National Taiwan University of Science and Technology
No. 43, Keelung Road, Sec. 4, Taipei, Taiwan, R.O.C.
Tel: 886 2 2730 1083 E-mail: jonchi.shyu@msa.hinet.net

Hsin-Ming Sun
Sinopac Securities
9F, 306 Bade Road Sec.2, Taipei, Taiwan, R.O.C.
Tel: 886-2-81618090 E-mail: planes.walker@msa.hinet.net

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Abstract

This study employs daily trading data to examine the herding behavior of institutional investors in Taiwan's stock market. Our results show evidence of herding for institutional investors; indeed, they would follow both other institutional trades and their own trades. We also find that institutional investors are not driven principally by impulse or instinct and that "herded into" stocks do not exhibit unusual return reversals. Moreover, the intensity of herding is negatively related to firm size, which suggests that institutional herding in Taiwan's stock market is driven primarily by information cascades.

Keywords: Institutional investor, Herding behavior, Information cascade, Emerging markets

***JEL Classifications*:** G11, G20, N25

1.Introduction

Participants in Taiwan's stock market have long been dominated by individual investors, despite the rapidly rising weight of institutional trading in recent years. The Taiwanese government opened markets for foreign institutional investors in 1983. Thereafter, it gradually removed various restrictions. By 2003, all restrictions on investment positions for foreign institutional investors had been removed. During this period, the government likewise enforced the protection of intellectual property rights and reformed tax regulations to protect and encourage foreign investments. The impact of foreign institutional investors on Taiwan's stock market has grown exponentially since then. By the end of 2004, the market shares of foreign institutional investors have risen significantly to 10.87% from only 2.40% in 1999. The shares further grew to 22.12% in 2008 and stood at 16.32% in 2009. In contrast, the market shareholdings of domestic institutional investors only slightly increased from 9.36% in 1999 to 11.56% in 2004, to 13.97% in 2008 and 11.59% in 2009. As institutional investors, foreign institutional investors have played an increasingly prominent role in Taiwan and in other emerging markets. Their trading behaviors have had a greater effect on—and have attracted more attention to—the marketplace.

In contrast to individual investors, institutional investors have immense resources and professional teams to gather and analyze information and make trading decisions based on specialized knowledge. Since institutional investors are equipped with sufficient information and specialized knowledge, they should be able to make independent and rational investment decisions to generate a reasonable profit (Grinblatt and Keloharju, 2000; Goodfellow et al., 2009). However, some empirical studies indicate that institutional investors often follow other institutional investors to engage in herding, that is, in buying or selling the same stocks over a period of time (Grinblatt et al., 1995; Nofsinger and Sias, 1999; Wermers, 1999; Wylie, 2005; Walter and Weber, 2006; Agudo et al., 2008; Andreu et al., 2009). Moreover, such a phenomenon is particularly apparent in emerging markets (Lobao and Serra, 2002; Voronkova and Bohl, 2005; Tan et al., 2008).

Does institutional herding exist in Taiwan's stock market? Would foreign institutional investors who play a decisive role therein but who do not understand the local markets follow the activities of domestic institutional investors? If institutional herding exists, what are the reasons for such behavior? The tendency of institutional investors to herd has important implications for capital markets because herding implies that institutional investors herd in and out of stocks without fundamental justification. Due to its high trading volume, this kind of institutional herding is suspected of diluting stock-price information, exacerbating stock-price volatility, and destabilizing capital markets by driving prices away from fundamentals (Scharfstein and Stein, 1990). This irrational herding behavior may also cause the formation of bubbles (Gleason et al., 2004).

In addition to investigating herding behavior in different markets or regions, researchers are also interested in knowing whether herding behavior will change from one economic environment to another, such as during extreme market volatility or a financial crisis. The tendency to herd may be the strongest during periods of high market stress, when investors seek the comfort of consensus opinion. Obtaining additional reliable information during periods of market stress may also be viewed as a better solution for reducing the costs of limited information. In a study of herding behavior in US equity markets, Christie and Huang (1995) report that herding does not take place in periods of market stress. Gleason et al.

(2004), using sector-based exchange-traded funds (ETFs), analyze intraday data to determine whether traders herd during periods of market volatility. The aforementioned authors find that investors do not herd during periods of extreme market movements. In addition, market reaction to news is not symmetrical between up markets and down markets. Hwang and Salmon (2004) find evidence of herding in the US and South Korean stock markets and these herding behaviors exist in both up and down markets. Choe et al. (1999) find strong evidence of positive feedback trading and herding by foreign investors before the period of Korea's economic crisis, but no such evidence during the crisis period. Kim and Wei (2002) examine the behavior of resident and non-resident investors in the South Korean market, and find that non-resident investors tend to herd more than resident investors.

The above findings substantiate the idea that herding may be related to limited information. Because the information structure, trading strategies, investments rules, and sociocultural background of foreign institutional investors are different from those of domestic investors, the herding behavior of the former type of investor may differ from that of the latter. Shiller et al. (1996) provide additional evidence that expectations about market returns differ vary significantly between the United States and Japan. They find that the Japanese were uniformly more optimistic in their short-turn expectations for the stock market than were the Americans. This suggests that geographic location or country of origin may play some role in information acquisition and in beliefs about different countries' returns. Dahlquist and Robertson (2001) posit that because foreign institutional investors do not understand local stock markets as well as local investors do, the former tend to mirror one another regarding which stocks they trade or hold. Similarly, Scharfstein and Stein (1990) argue that investors may herd if they have access only to limited information resources. Hence, the findings of institutional investors' stronger herding behavior in emerging markets than in mature markets (Lobao and Serra, 2002; Voronkova and Bohl, 2005; Tan et al., 2008), implies that the soundness of markets may also influence institutional investors' herding behavior.

Most of the earlier herding studies have focused only on the existence and the extent of investors' herding behavior and, to date, have revealed very little empirical evidence regarding the determinants of institutional herding behavior in emerging markets. Understanding the determinants of institutional herding behaviors may provide better solutions for reducing market instability that stems from irrational herding behavior, particularly in an emerging market. Also, earlier studies of herding relied mainly on monthly or quarterly data to investigate herding behavior among institutional investors. However, Taiwan's stock market turnover ranks among the highest worldwide, and short-term speculation often exists in the market.[1] In this case, daily data instead of monthly or quarterly data allow a better observation of short-term herding behavior.[2] Thus, our current study uses daily data and a large sample of trading information to investigate the herding behavior and the causes of herding for institutional investors in Taiwan's stock market.

We first examine whether the three types of institutional investors in Taiwan's stock market herd, and whether there is a significant difference in the level of herding among them. The empirical results show that in Taiwan's stock market, herding is most apparent among domestic mutual–funds investors, is somewhat apparent among foreign institutional investors,

[1] According to the statistics published by the Taiwan Stock Exchange, Taiwan's stock market turnover rate was 288% in 1999 and 177% in 2004, ranking Number 3 and Number 2 around the world, respectively.
[2] More recent studies on herding behavior have integrated daily data into empirical investigations; see Demirer and Kutan (2006), Agudo, et al. (2008), Zhou and Lai (2008), and Goodfellow, et al. (2009).

and is relatively insignificant among domestic securities dealers. Interestingly, institutional investors tend to follow both their own previous trades and the trades of other institutions. Domestic securities dealers behave in a strikingly different manner in that they lack the propensity to follow either their peers or foreign institutional investors. They exhibit only a relatively weak follower relationship with domestic mutual-funds investors. In examining the impact of extraordinary events on herding behavior, we find that neither the severe acute respiratory syndrome (SARS) outbreak nor Taiwan's 2004 presidential-election debacle have significantly affected the herding behavior of institutional investors. The above findings show that market pressure has little influence on institutional herding, and suggest both that the majority of institutional investors would not panic in the face of a market crisis and that their herding behavior is not driven principally by emotion or impulse.

We have also found that return reversal does not exist in stocks where institutional investors herd. In addition, momentum trading is not the primary reason for the herding behavior of institutional investors. These preliminary findings have prompted us to further investigate whether institutional herding is driven by informational cascades or investigative herding. When comparing herding in firms of varying size, we find evidence that although herding exists in firms of all sizes, the smaller the firm, the stronger the level of herding. We therefore conclude that informational cascades are the main reason for institutional herding in Taiwan's stock market, in line with research by Sias (2004) on the U.S. stock market.

2. Data

This study sampled trading data over a period of six years (from January 1999- December 2004), covering 1,613 trading days. This period encompassed both a bull and a bear market and underwent many significant transformations. For example, in 2003, Taiwan's government removed all the restrictions on the investment position limits for foreign institutional investors. During this transformation period, there was not only a significant increase in the number of listed companies traded by institutional investors, but also a significant tightening of regulator's requirements governing listed companies' disclosure of related information. Those transformations helped foreign institutional investors boost their market shareholdings from 2.4% in 1999 to 10.9% in 2004. Additionally, the inclusion of both up and down markets during the period of 1999-2004 also aviod sample bias problem, since different market situations may cause different herding behavior (Gleason et al., 2004). For the current study, we used the Taiwan Stock Exchange (TSE) database for calculating herding measures, including data on daily purchases and sales of individual stocks by institutional investors. These data sources constituted 3,606,146 pieces of daily-trading information. The data for individual stock returns, market indexes, bull-or-bear market conditions, and the size of individual stocks derive from the database of the Taiwan Economic Journal (TEJ).

Since the current study targets the herding of institutional investors, stocks that institutional investors seldom traded in were not suitable for the sample. Thus, in our measure of overall institutional herding, we excluded from our monthly samples any stock that was not bought or sold by an institutional investor during one or more trading days in a month. When measuring the herding behavior for the three types of institutional investors, we excluded from monthly samples any stock that was not bought or sold by a foreign institutional investor, by a domestic mutual-fund investor, or by a domestic securities dealer during one or more trading days in a given month. In addition, we excluded stocks with unusual characteristics (e.g., stocks requiring full delivery and newly listed stocks).

Table 1 shows the average daily trades conducted by institutional investors in the sample. The average daily trades by the three types of institutional investors grew from 1,113 in 1999 to 3,147 in 2004, rising by as much as 183%. Average daily trades by foreign institutional investors underwent a nearly threefold jump over the same period, from 522 to 1,921. The number of trades by domestic mutual-funds investors and domestic securities dealers did not rise as significantly as the corresponding number of trades by foreign institutional investors, but showed steady growth, suggesting an increasingly active role by institutional investors in Taiwan's stock market.

Table 1. Daily average of trades by institutional investors

	1999	2000	2001	2002	2003	2004
Total	1113	1325	1732	2069	2606	3147
Foreign institutional investor	522	758	1033	1238	1546	1921
Domestic mutual-fund investor	326	324	430	497	558	564
Domestic securities dealers	265	243	269	334	502	662

3. Do institutional investors herd?

Lakonishok-Shleifer-Vishny (LSV) herding model is most commonly employed to measure herding, very few empirical studies that concern US markets and that use LSV measurements have found significant herding in the markets (Lakonishok et al., 1992; Grinblatt et al., 1995; Wermers, 1999). The reason for such findings, as explained by Sias (2004), is that the LSV herding model measures the propensity of investors to trade in the same direction over a period of time, where part of the propensity is a random or a fortuitous event, and trades occur sequentially because not all trades by different investors take place at the same time. Therefore, Sias (2004) redesign a measurement that allows for direct observation of the extent to which market investors follow each other in buying or selling the same stock. Our study has modified Sias' (2004) model to measure the herding behavior attributable to three types of institutional investors in Taiwan's stock market.

Because the information structure, trading strategies and sociocultural backgrounds of foreign institutional investors, domestic mutual–funds investors, and domestic securities dealers differ from one group to the other, their herding behavior could vary. For instance, Grinblatt and Keloharju (2000) suggest that foreign institutional investors have an information advantage over domestic investors insofar as the former type of investor can more accurately assess the intrinsic value of local stocks. Alternately, Choe et al. (2001) and Dahlquist and Robertson (2001) posit that because foreign institutional investors do not understand the local stock market as well as local investors, the former tend to trade or hold similar stocks. Thus, we have classified institutional investors into foreign institutional investors, domestic mutual-funds investors, and domestic securities dealers to compare the extent of the herding propensity of respective institution types and to explore the situations attributable to different types of institutions that follow each other's buying or selling patterns.

In the following equations, we denote foreign institutional investors, domestic mutual-funds investors, and domestic securities dealers respectively as F, I, and S. The respective number of foreign institutional investors, domestic mutual-funds investors, and domestic securities dealers that trade security k on day t are $F_{k,t}$, $I_{k,t}$, and $S_{k,t}$; $F_{k,t-1}$, $I_{k,t-1}$, and $S_{k,t-1}$ are the

number of foreign institutional investors, domestic mutual–funds investors, and domestic securities dealers that trade security k on day $t-1$ respectively. Also, $F^{*}_{k,t}$, $I^{*}_{k,t}$, and $S^{*}_{k,t}$ represent the number of foreign institutional investors, domestic mutual-funds investors, and domestic securities dealers that trade stock k on both day t and $t-1$. Taking foreign institutional investors as an example, first, we calculate the raw fraction of foreign institutional investors' buying as follows:

$$Raw\ \Delta^{f}_{k,t} = \frac{B^{f}_{k,t}}{B^{f}_{k,t} + S^{f}_{k,t}} \tag{1}$$

where $B^{f}_{k,t}$ is the number of foreign institutional investors buying stock k on day t and $S^{f}_{k,t}$ is the number of foreign institutional investors selling stock k on day t. If foreign institutional investors herd or if they follow their own lag trades, the fraction of foreign institutional investors buying on the current day will be positively correlated with the fraction of foreign institutional investors buying on the previous day.

To allow for aggregation over time and the comparison of coefficients in our regression model, we have to standardize the dependent and independent variables such that both variables have zero mean and unit variance. The standardized fraction of foreign institutional investors buying stock k on day t is defined as follows:

$$\Delta^{f}_{k,t} = \frac{Raw\Delta^{f}_{k,t} - \overline{Raw\Delta^{f}_{t}}}{\sigma\left(Raw\Delta^{f}_{k,t}\right)} \tag{2}$$

Where $\overline{Raw\Delta^{f}_{t}}$ is the cross-sectional average (across K securities) of the raw fraction of foreign institutional investors buying on day t and $\sigma\left(Raw\Delta^{f}_{k,t}\right)$ is the cross-sectional standard deviation (across K securities) of the raw fraction of foreign institutional investors buying on day t. Because standardization is simply a linear rescaling, correlations between the variables and the R^2s associated with the regressions are not affected.

We continue by estimating, for each day, a cross-sectional regression of the standardized fraction of foreign institutional investors buying of stock k ($\Delta^{f}_{k,t}$) on the current day in relation to the standardized fraction of foreign institutional investors buying of stock k ($\Delta^{f}_{k,t-1}$) on the previous day:

$$\Delta^{f}_{k,t} = \beta^{f}_{t}\Delta_{k,t-1} + \varepsilon_{k,t} \tag{3}$$

The coefficient β^{f}_{t} is equal to the correlation between $\Delta^{f}_{k,t}$ and $\Delta^{f}_{k,t-1}$, because there is only a single independent variable and because both of the standard deviations of the variables are 1.

The fraction of foreign institutional investors buying can be replaced by the sum of a series of dummy variables for each trader (that equals '1' if the trader is a buyer and equals '0' if the trader is a seller) divided by the number of traders. Then, β^{f}_{t} can be divided into two components: the portion of foreign institutional investors following themselves into and out

of the same securities over adjacent days, and the portion of foreign institutional investors following other institutions (i.e., herding) over adjacent days.[3]

$$\beta_t^f = \rho\left(\Delta_{k,t}^f, \Delta_{k,t-1}\right) = \left[\frac{1}{(K-1)\sigma\left(Raw\Delta_{k,t}^f\right)\sigma\left(Raw\Delta_{k,t-1}\right)}\right] \times \sum_{k=1}^{k}\left[\sum_{f=1}^{F_{k,t}^*}\frac{\left(D_{f,k,t}-\overline{Raw\Delta_t^f}\right)\left(D_{f,k,t-1}-\overline{Raw\Delta_{t-1}}\right)}{F_{k,t}N_{k,t-1}}\right]$$

$$+\left[\frac{1}{(K-1)\sigma\left(Raw\Delta_{k,t}^f\right)\sigma\left(Raw\Delta_{k,t-1}\right)}\right] \times \sum_{k=1}^{K}\left[\sum_{f=1}^{F_{k,t}}\sum_{m=1,m\neq f}^{N_{k,t-1}}\frac{\left(D_{f,k,t}-\overline{Raw\Delta_t^f}\right)\left(D_{m,k,t-1}-\overline{Raw\Delta_{t-1}}\right)}{F_{k,t}N_{k,t-1}}\right] \quad (4)$$

where $N_{k,t-1}$ is the number of institutional investors trading security k on day $t-1$, $D_{f,k,t}$ is a dummy variable that equals 1 (0) when foreign institutional investor f is a buyer (seller) of stock k on day t, *and* $D_{f,k,t-1}$ is a dummy variable that equals 1 (0) when foreign institutional investor f is a buyer (seller) of stock k on day $t-1$.

The first term on the right side of Equation (4) is the portion of the correlation that results from foreign institutional investors' following their own trades over adjacent days. If foreign institutional investors tend to follow their own trades over adjacent days, the first term will be positive. Alternatively, if foreign institutional investors tend to reverse their own trades on adjacent days, the first term will be negative. If the trades of foreign institutional investors on a current day are independent of their own trades on the previous day, the first term will be 0. The second term on the right side of Equation (4) is the portion of the correlation that results from foreign institutional investors' following other institutional investors. Similarly, if foreign institutional investors tend to follow others' trades over adjacent days, the second term will be positive; if the direction of foreign institutional investors' trades tends to be the reverse of the direction of other's trades over adjacent days, the second term will be negative; if the trades of foreign institutional investors on a current day are independent of the activities of others on the previous day, the second term will be 0.

The portion of the correlation that results from foreign institutional investors' following other institutional investors can be further decomposed into three components: foreign institutional investors who are following other foreign institutional investors, foreign institutional investors who are following domestic mutual–funds investors, and foreign institutional investors who are following domestic securities dealers—as in Equation (5).

$$\left[\frac{1}{(K-1)\sigma\left(Raw\Delta_{k,t}^f\right)\sigma\left(Raw\Delta_{k,t-1}\right)}\right] \times \sum_{k=1}^{K}\left[\sum_{f=1}^{F_{k,t}}\sum_{m=1,m\neq f}^{N_{k,t-1}}\frac{\left(D_{f,k,t}-\overline{Raw\Delta_t^f}\right)\left(D_{m,k,t-1}-\overline{Raw\Delta_{t-1}}\right)}{F_{k,t}N_{k,t-1}}\right]$$

$$=\left[\frac{1}{(K-1)\sigma\left(Raw\Delta_{k,t}^f\right)\sigma\left(Raw\Delta_{k,t-1}\right)}\right] \times \sum_{k=1}^{k}\left[\sum_{f=1}^{F_{k,t}}\sum_{m=1,m\neq f}^{F_{k,t-1}}\frac{\left(D_{f,k,t}-\overline{Raw\Delta_t^f}\right)\left(D_{m,k,t-1}-\overline{Raw\Delta_{t-1}}\right)}{F_{k,t}N_{k,t-1}}\right]$$

[3] The decomposition of the regression coefficient into two parts serves to avoid a situation where a part of the observed herding measurement might have resulted from traders following their own activities on the previous day. As pointed out by Kyle (1985) and Grossman and Miller (1988), to reduce liquidity risks or to keep their own trading activities unknown to other traders, many institutional investors realize their intentions to buy or sell certain stock by strategically placing separate orders over a period of time. Such investment behavior, however, does not meet the definition of 'herding'.

$$+\left[\frac{1}{(K-1)\sigma\left(Raw\Delta_{k,t}^{f}\right)\sigma\left(Raw\Delta_{k,t-1}\right)}\right]\times\sum_{k=1}^{K}\left[\sum_{f=1}^{F_{k,t}}\sum_{m=1,m\in I}^{I_{k,t-1}}\frac{\left(D_{f,k,t}-\overline{Raw\Delta_{t}^{f}}\right)\left(D_{m,k,t-1}-\overline{Raw\Delta_{t-1}}\right)}{F_{k,t}N_{k,t-1}}\right]$$

$$+\left[\frac{1}{(K-1)\sigma\left(Raw\Delta_{k,t}^{f}\right)\sigma\left(Raw\Delta_{k,t-1}\right)}\right]\times\sum_{k=1}^{K}\left[\sum_{f=1}^{F_{k,t}}\sum_{m=1,m\in S}^{S_{k,t-1}}\frac{\left(D_{f,k,t}-\overline{Raw\Delta_{t}^{f}}\right)\left(D_{m,k,t-1}-\overline{Raw\Delta_{t-1}}\right)}{F_{k,t}N_{k,t-1}}\right] \quad (5)$$

Sias (2004) has proposed that the differences in the number of traders within each classification render the computation of herding measure, it is unfeasible to use the aforementioned measures (correlations across investor types) to directly compare levels of herding across investor types. When the number of institutions making the trade increases, the weight of herding in β_t^f tends to increase, while the weight of following one's own trades over adjacent periods tends to decrease. In addition, when the trades of many institutions involve a certain stock, the standard deviation of the fraction of buying institutions usually drops, which will affect the standardized regression coefficient of the fraction of buying institutions. Given the important influence of the aforementioned factors, we need a measure not subject to the influence of the number of trading institutions so that we can directly compare the levels of herding across investor types. Thus, the contribution of herding in β_t^f and the contribution of following one's own trades over adjacent periods in β_t^f must be averaged as a new measure, if there is to be a rigorous comparison regarding the levels of herding across investor types[4].

The resulting average contributions are not affected by either the number of institutional traders or the cross-sectional standard deviation of institutions buying. This average contribution can serve as new measures regarding foreign institutional investors who follow their own trades, who follow other foreign institutional investors' trades, who follow domestic mutual-funds investors' trades, and who follow domestic securities dealers' trades. Then, this result can compare directly with the measures of domestic mutual-funds investors and domestic securities dealers.

Table 2 illustrates the resulting time-series average contributions from following one's own trades and from following other trades for foreign institutional investors, domestic mutual-funds investors and domestic securities dealers, as well as t statistics.

[4] For more details, please see Sias (2004). Institutional Herding. *The Review of Financial Studies* 17, 165-206.

Table 2. Herding measures of three major institutional investors

	Following one's own previous-day trades	Following others' previous-day trades		
		Foreign institutional investors	Domestic mutual-fund investors	Domestic securities dealers
Foreign institutional investors	0.092407	0.009193	0.004722	0.000677
	(62.606)***	(24.165)***	(11.045)***	(1.866)
Domestic mutual-fund investors	0.133418	0.003614	0.026915	0.003532
	(96.453)***	(8.593)***	(42.325)***	(7.069)***
Domestic securities dealers	0.054869	-0.000450	0.002078	0.000467
	(37.007)***	(-1.282)	(4.015)***	(0.932)

Note: ** and *** indicate significance at 5% and 1% level, respectively. Figures in parentheses are t-statistics.

As shown in Table 2, the measures attributable to foreign institutional investors who follow their own trades, who follow other foreign institutional investors' trades or who follow domestic mutual-funds investors' trades are all statistically significant at the 1% level. Only the herding measure attributable to foreign institutional investors who follow domestic securities dealers is not significantly different from 0. For domestic mutual-funds investors, all measures are statistically significant at the 1% level. As for domestic securities dealers, only the measures of following one's own trades and following domestic mutual–funds investors' trades over adjacent days are statistically significant, the measures of following other domestic mutual-funds investors' trades are not.

The results in Table 2 indicate that in Taiwan's stock market, foreign institutional investors and domestic mutual-funds investors tend to herd, while domestic securities dealers exhibit no marked herding behavior. In addition, except for domestic securities dealers, the average herding measures of foreign institution investors and domestic mutual-funds investors are all greater than the values obtained by Sias (2004), who studied the herding behavior of different types of investors in the U.S. stock markets.

We surmise that foreign institutional investors and domestic mutual-funds investors in Taiwan engage in similar herding behaviors. This similarity might reflect the tendency of both foreign institutional investors and domestic mutual-funds investors to search for similar information or to adopt similar operational strategies. The findings in this study concerning domestic securities dealers coincide with the assertion of Li and Laih (2005) that the herding behavior of domestic securities dealers is relatively inconspicuous and independent. It might have to do with the characteristics of domestic securities dealers that are starkly different from those of foreign institutional investors and domestic mutual funds, and that bring about dissimilar operating directions and strategies. In Taiwan, domestic securities dealers are typically a division of domestic brokerage houses. Therefore, some dealing departments need carry out trades to hedge the warrants that issue by brokerage houses which might offset some ordinary trades of the dealing departments. Also, domestic securities dealers, unlike domestic mutual-funds investors, are not subject to the pressure of performance comparison, and this difference could be another factor explaining why the herding behavior of domestic

securities dealers is not as conspicuous as that of domestic mutual-funds investors.

Regardless of whether it is foreign institutional investors, domestic mutual-funds investors, or domestic securities dealers, the measure of following one's own trade from the previous day is much greater than the measure of following other investors' trades from the previous day. The gap between the two measures, following a paired t-test, is significantly different at the 1% level for all three types of institutional investors. This finding suggest that (1) foreign institutional investors' tendency to follow their own trades from the previous day is greater than the same investors' tendency to herd, and (2) institutional investors practice a trading strategy of spreading the buy or sell tickets for the same stock over a period of time.

4. What drives herding?

Since Scharfstein and Stein (1990) first propose a theoretical interpretation of herding behavior, many scholars have followed suit in an attempt to find reasonable explanations for the same phenomenon. According to the wealth of explanatory models proposed so far, institutional herding can be classified into five types—impulsive or emotional herding (Montgomery, 1991; Sornette and Johansen, 1997; Pretcher, 2001), herding related to reputation and salary concerns[5] (Scharfstein and Stein, 1990; Lakonishok et al., 1992; Wermers, 1999), herding stemming from informational cascades (Banerjee, 1992; Bikhchandani et al., 1992; Welch, 1992), investigative herding (Froot et al., 1992; Hirshleifer et al., 1994), and characteristic herding (Falkenstein, 1996; Gompers and Metrick, 2001; Jegadeesh and Titman, 1993). The present study reflects our attempt to identify and to analyze the main reasons for institutional herding in Taiwan's stock market by examining market stress, momentum trading, return reversal, and firm size. In the following section, Section 4.1 deals with impulsive or emotional herding, Section 4.2 examines the characteristic of herding, Section 4.3 investigates herding as related to reputation and salary concerns, and Section 4.4 discusses herding from informational cascades or investigative herding.

4.1 Market stress and herding

Sornette and Johansen (1997) and Pretcher (2001) argue that impulsive or emotional herding is a human biological instinct inherited from ancestors. It is a response similar to the way animals in a herd flee when they see others in the herd starting to stampede, even though they do not sense the presence of a predator or an enemy. Montgomery (1991) proposes that when uncertainty or market volatility increases, investors are prone to err under strong pressure, and the impulse to herd becomes particularly strong. At that time, investors are no longer concerned about a reasonable price from discounted future cash flow; they hope only to be relieved of strong pressure. If investors herd out of impulse or emotion, herding behavior would markedly intensify during periods of great market pressure. Demirer and Kutan (2006) study the impact of the Asian financial crisis on herd behavior in the Chinese stock market. Their results indicate that the crisis did not affect herd formation in the Chinese stock market. Similar results are also found in a study by Hatemi-J and Roca (2004). On the other hand, Song et al. (2009) find that analysts are more likely to herd to a consensus forecast when there is little uncertainty in earnings.

[5] Institutional herding out of reputation and salary concern is a consequence of fund managers' willingness to forgo their private information, and emulate the trading decisions of others in order to avoid the predicament of lagging performance attributable to the fund managers' trading decisions. As such, even if the trading decisions of others are wrong, there is a sharing-the-blame effect. This phenomenon reflects the presence of an agency problem between the fund managers and the investors.

To further explore the correlation between herding and market pressure, our current study identifies two events, the SARS outbreak and the 2004 Taiwan presidential-election debacle, as extraordinary events likely to affect the stock market. We examine whether there existed significant herding differences between each of these events and a control period. Panel A in Table 3 reveals the absence of a significant difference between the herding of institutional investors during the SARS outbreak and a control period. Panel B in Table 3 shows the absence of significant differences between the herding behavior of institutional investors in the week after the 2004 presidential elections and a control period. Only foreign institutional investors exhibited markedly enhanced herding behavior following the presidential election.

One plausible explanation of this finding could involve the particular sensitivity of foreign institutional investors to country-based risk in Taiwan's stock market, so they tend to liquidate their holdings swiftly in the event of a major and unfamiliar political crisis. In contrast, most local institutional investors conducted business as usual after the 2004 presidential election, possibly because they were accustomed to political pandemonium in Taiwan. From Panel A and Panel B of Table 3, it can be seen that except for foreign institutional investors who displayed an enhanced level of herding following the 2004 presidential election, institutional herding in Taiwan's stock market in general did not change significantly under increased market pressure owing to the occurrence of a sudden material event. This finding further supports the assertion that institutional herding in Taiwan's stock market is not primarily driven by impulse or instinct.

Table 3. Changes in institutional herding under market stress

Panel A: Changes in institutional herding during the SARS outbreak and a control period

Period	Overall	Foreign institutional investors	Domestic mutual-fund investors	Domestic securities dealers
SARS episode: 2003/1/24 – 2003/4/28	0.212185	0.00704	0.010284	-0.00154
Control period: 2002/10/28 – 2003/1/23 2003/4/2 – 2003/7/25	0.223733	0.006423	0.009225	-0.00124
t statistic	-0.539	0.515	0.659	-0.224
Panel B: Changes in institutional herding during the post-"2004 presidential election" period and a control period				
Post-"2004 presidential election": 2004/3/22 – 2004/3/26	0.152982	0.013223	0.007486	0.001783
Control period: 2004/3/15 – 2004/3/19 2004/3/29 – 2004/4/02	0.167873	0.00544	0.0004711	0.001275
t statistic	-0.25	2.517**	0.449	0.075

Note: ** indicates statistical significance at 5% level.

4.2 Momentum trading and herding

During a certain period or under certain market conditions, institutional investors would have

a common preference for—or a common aversion to—stocks with certain characteristics. For example, Falkenstein (1996) finds that mutual-fund portfolio managers are exhibiting a distinct preference for stocks with high return volatility, high information transparency, low transaction costs, and large capitalization. The work of Jegadeesh and Titman (1993) suggests that the momentum strategy or contrarian strategy of investors can be regarded as a herding behavior driven by preference for certain stocks.

If the majority of institutional investors are momentum traders[6], they would follow past winners and distance themselves from past losers, thereby creating the phenomenon of characteristic herding. The contrary also holds true. In order to measure the role that feedback trading plays in herding, this study adds previous-day returns in the regression equation (3) as another independent variable. To allow for direct comparison between variables, the previous-day returns $R_{k,t-1}$ would also undergo standardization. Next, the following regression equation is calculated:

$$\Delta_{k,t} = \beta_{1,t}\Delta_{k,t-1} + \beta_{2,t}R_{k,t-1} + \varepsilon_{k,t} \quad (6)$$

Regression analysis is carried out using standardized current-day fraction of institutions buying as dependent variables, and standardized previous-day returns and standardized previous-day fraction of institutions buying as independent variables. A positive $\beta_{2,t}$ means that institutional investors adopt the momentum strategy; a negative $\beta_{2,t}$ means that institutional investors employ a contrarian strategy. If the coefficient of $\beta_{2,t}$ is insignificant or if the average of $\beta_{1,t}$ is far greater than $\beta_{2,t}$ after we take into account the effect of feedback trading, one can reasonably conclude that institutional herding is not being driven principally by momentum trading or contrarian trading.

Table 4 depicts the time-series average of regression coefficients and associated t-statistics. The regression coefficient of a previous-day returns is statistically significant at the 1% level, indicates that institutional investors in Taiwan's stock market are positive feedback traders (momentum traders), a finding that is consistent with the findings of Grinblatt and Timan (1993), Grinblatt et al. (1995), Wermers (1999, 2000), Nofsinger and Sias (1999) and Sias et al. (2002). After factoring in feedback trading, we find that the regression coefficient of the fraction of previous-day institutional buying remained significant at the 1% level.

Table 4. Regression analysis of current-day institutional buying vs. previous-day institutional buying and previous-day returns

$$\Delta_{k,t} = \beta_{1,t}\Delta_{k,t-1} + \beta_{2,t}R_{k,t-1} + \varepsilon_{k,t}$$

Regression coefficient of previous-day institutional buying (β_1)	Regression coefficient of previous-day returns (β_2)	$\overline{R^2}$
0.3119	0.2107	15.31%
(61.746) ***	(62.013) ***	

[6] Some of the studies find that institutional investors are momentum traders, see Grinblatt and Timan, 1993; Grinblatt et al., 1995; Wermers, 1999, 2000; Nofsinger and Sias, 1999; Cai et al., 2000; Sias et al., 2002.

Note: *** indicates statistical significance at the 1% level. Figures in parentheses are t-statistics.

As all the variables are standardized, we can directly compare the coefficients of previous-day institutional buying with previous-day returns and find that the average of the former is 48% greater than that of the latter. The paired t-test result at 1% level rejects the hypothesis that the average of the two being equal, which means current institutional demand, is far more influenced by previous institutional demand than by previous returns. On the basis of the results above, we propose that although institutional investors in Taiwan's stock market are momentum traders, momentum trading is not the primary reason for institutional herding in Taiwan's marketplace given feedback trading's limited interpretative power over institutional demand.

4.3 Return reversal and herding

Nofsinger and Sias (1999) and Sias (2004) observe that if impulse, emotion, reputation, salary concern, or stock characteristics drive herding in the stock market, herding's effect on stock prices is not information-based and the herded stock should exhibit return reversal. Alternatively, if institutional herding is driven by informational cascades or is a form of investigative herding, the herded stock should not exhibit return reversal. This study uses the correlation coefficient between the fraction of institutions buying (herding) and stock returns to determine the presence of return reversal. A significantly negative correlation coefficient means that the herded stock would have return reversal. To prevent a situation where a very few institutional investors' buying or selling has an excessive effect on the fraction of institutions buying and the correlation coefficient, we have screened the sample further so that it includes only stocks with five or more institutions trading each day. This screening has strengthened our calculation of the correlation coefficient between institutions that are buying and stock return.

Table 5 reports the time-series average of the correlation coefficients between the fraction of institutions buying and the previous-day returns, the same-day returns, the next-day returns, the next-two-day returns, the next-five-day returns, the next-ten-day returns, and associated t-statistics. The correlation coefficients, except for the coefficients of the next-ten-day returns, are all positive and significant at the 1% level. We find a positive correlation coefficient between the institutions that are buying and the previous-day returns, the same-day returns, the next-day returns, the next-two-day returns, and the next-five-day returns, indicating that herded stock will not exhibit conspicuous return reversal; furthermore, this finding is consistent with the findings of Grinblatt, et al. (1995), Wermers (1999, 2000), Nofsinger and Sias (1999), Sias et al. (2002), and Sias (2004).

Table 5. Correlation coefficient between the fraction of institutions buying (herding) and stock return

Previous-day return	Same-day return	Next-day return	Next-2-day return	Next-5-day return	Next-10-day return
0.1570	0.1862	0.0927	0.0315	0.025	0.007
(47.932) ***	(51.933)***	(26.182)***	(9.004)***	(5.710)***	(0.849)

Note: *** indicates statistical significance at the 1% level. Figures in parentheses are t-statistics.

Nofsinger and Sias (1999) and Sias (2004) suggest that subsequent return reversal of herded stock indicates impulsive or emotional herding, an agency problem, or characteristic herding. The absence of return reversal, meanwhile, represents information cascades or investigative herding functioning as the primary reasons for institutional herding. The preliminary results in this study pointed to an absence of return reversal in herded stocks; hence, we further tested whether institutional herding in Taiwan's stock market is driven primarily by informational cascades or investigative herding.

4.4 Firm size and herding

Informational cascades usually occur when private information is limited or unreliable, and when it is difficult for information holders to contact each other. So followers assess the information they have by observing the behavior of a given leader, believing that the leader's information is more valuable than their own, which they consequently abandon. If several leaders make the same moves, it will result in informational dominance that gradually weakens the influence of an individual's information in the market. Consequently, followers are more likely to abandon their private information and mimic the actions of the leaders. Such emulative behavior is like a series of descending waterfalls, and leads to the herding phenomenon of informational cascades (Welch, 1992). Investigative herding arises when investors search for investment decisions and come to similar conclusions because they hold or process similar information and use the same analytical methods or indicators (Hirshleifer et al., 1994).

Although Taiwan's Securities and Exchange Act requires listed companies to fully disclose corporate information, plenty of erroneous information continues to circulate regarding untimely disclosure. With respect to the size of listed stock, small firms do not attract as much attention from investors as large firms and their information is not as transparent. According to Wermers (1999) and Sias (2004), it is usually easier for investors to obtain substantial and relevant information on larger firms. For this reason, investigative herding is more likely to affect large-cap stocks. In contrast, information on small-cap stocks is not readily accessible, and is less reliable. As it is more difficult to price a stock with unreliable information, investors would rather forsake their own information, and follow the trading activities of others. Thus, herding driven by information cascades is more likely to affect small-cap stocks.

This study divides all stocks by capitalization into quintiles from smallest to largest with each group having the same number of stocks. Next, in each quintile of stocks, we compute the contribution from "following one's own trades from the previous day" and the contribution from "following others' trades from the previous day". There are typically more institutions trading large-cap stocks than small-cap stocks, and the number of institutions trading a stock would affect herding measures. Therefore, when examining the relationship between herding and firm size, it is necessary to adjust the method of measurement by averaging the contribution from herding and the contribution from following one's own trades in Equation (4) relative to β_t for all institutional investors.

Because the average contributions from following one's own trades and from herding are unaffected by either the number of institutional trader or the cross-sectional standard deviation of institutions buying, we have calculated the cross-sectional average of those two

values for all stocks in each quintile to obtain each quintile's average contribution from following one's own trades and from herding. Using the aforementioned method, we can directly compare the intensity of herding across capitalization quintiles. If the results indicate that the herding relative to small-cap stocks exhibits greater intensity than the herding relative to large-cap stocks, then it is reasonable to conclude that herding is driven primarily by information cascades. Otherwise, herding would be driven primarily by institutions both investigating the same information and using similar methodologies (i.e., investigative herding).

After dividing all the stocks by capitalization into quintiles from smallest to largest and calculating both the average contribution from following one's own trades from the previous day and the average contribution from following others' trades from the previous day, we were able to identify the time-series averages and associated t statistics (computed from time-series standard error), which are presented in Table 6.

Table 6. Herding and firm size

Capitalization quintile	Average contribution from following one's own previous-day trades	Average contribution from following others' previous-day trades
Small firms	0.1137 (64.47955) ***	0.0096 (26.44624) ***
Quintile 2	0.0965 (59.76591) ***	0.0074 (23.67362) ***
Quintile 3	0.0838 (57.12935) ***	0.0051 (19.20106) ***
Quintile 4	0.0826 (59.96285) ***	0.0049 (21.39148) ***
Large firms	0.0719 (57.51551) ***	0.0031 (18.82660) ***
F-statistics (*p*-value)	22.11059 *** 0.000	16.6242 *** 0.000

Note: *** indicates statistical significance at the 1% level. Figures in parentheses are t-statistics.

Table 6 shows that both the tendency to follow one's own trades and the tendency to herd exist, regardless of stock capitalization. Measurements pertaining to investors who both follow their own trades and herd show that the trend decreases as firm size increases. The results of an ANOVA also show that measures pertaining to investors who both follow their own trades and herd differ significantly at the 1% level across firms of all sizes, a finding that is consistent with studies on U.S. stock markets (Lakonishok et al., 1992; Wermers, 1999; Sias, 2004). Smaller-cap stocks are less liquid, and one or several orders to buy or sell a smaller-cap stock in a short period is more likely to attract the attention of other traders,

resulting in higher liquidity risk and price effects associated with the trading. Thus, institutional investors who trade small-cap stocks exhibit a stronger tendency to accumulate and spread orders over a period of time to reduce transaction costs.

The finding of a monotonic inverse relationship between the intensity of herding and firm size indicates that institutional herding in Taiwan's stock market is driven primarily by informational cascades. That is, many institutional investors choose to abandon their own information and judgment, and try to follow in the footsteps of the so-called "smart funds" or institutions with the power to influence the market.

5. Conclusion

This study use the methodology proposed by Sias(2004) to measure the herding behavior of three major institutional investors in Taiwan's stock market, namely foreign institutional investors, domestic mutual–funds investors, and domestic securities dealers. Our use of daily data in the study has enabled us to examine herding behavior if it occurs for a very short period of time, and if it is masked by the aggregate nature of the data. In addition, the large number of observations can also enable us to draw inferences of greater precision. Aside from discussing the overall phenomenon of institutional herding, we also examine the influence of extraordinary events on herding, and the relationships between herding and momentum trading, between herding and return reversal, and between herding and firm size, all in an attempt to propose the primary reasons for institutional herding in Taiwan's stock market.

Overall, our finding show that institutional herding exists in Taiwan's stock market. However, institutions tend to follow both their own trades and other institutional trades. By examining each type of institutional investor, we discover that domestic mutual-funds investors exhibit the strongest tendency to herd. The herding behavior of foreign institutional investors is also rather conspicuous. We observe little evidence that domestic securities dealers engage in herding behavior.

With regard to the effect of extraordinary events, we did not in general observe significant changes in institutional herding behavior during the SARS outbreak or the 2004 presidential election in Taiwan. One exception is that more foreign institutional investors dumped their holdings in the week following the 2004 presidential election to avoid the nonrecurring political risk in Taiwan's stock market, a behavior that tended to enhance these investors' herding activities during that period. The above findings suggest that institutional herding in Taiwan's stock market is not driven principally by emotion or impulse.

We find that institutional investors in Taiwan's stock market are momentum traders. But given that the regression coefficient between previous-day institutional investors demand and current-day institutional investors demand is little affected after momentum trading is factored in, and that the regression coefficient of previous-day institutional investors' demand is significantly larger than that of previous-day returns, we surmise that momentum trading is not the main reason for the herding behavior of institutional investors. Furthermore, if institutional herding comes from agency problems or characteristic herding, then the herded stocks should have exhibited return reversal. However, such phenomena are not observed in our preliminary findings.

Lastly, we divide the sampled stocks into quintiles by capitalization to observe herding in firms of varying size and find that although herding exists in every capitalization quintile, the level of herding increases as firm size decreases. Hence, we conclude that institutional herding in Taiwan's stock market is driven primarily by informational cascades. The evidence

backing up this assertion suggests that, from the perspective of some institutional investors, the information they have is limited or unreliable, so rather than use their own information in making trading decisions, they follow so-called smart funds. In addition, our findings reveal that the herding behavior of institutional investors continued over the sample period[7]. This continuation indicates that there is a room for improvement in terms of market efficiency and information transparency in Taiwan's stock market, especially for smaller securities.

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[7] To explore whether the market environment during different periods would influence herding behavior, we also divide the sample into two sub-periods (1999–2001 and 2002–2004) to discern whether significant differences exist between the herding behaviors in the two sub-periods. The empirical findings show that the yearly variations in average herding measures of respective investor types are statistically significant at the 1% level for institutional investors overall, foreign institutional investors, and domestic mutual funds. The herding measure of domestic securities dealers is significant at 5% only in the year 2000 and insignificant for all other years.

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