"The decomposition and causes of securities dealers' cascades in the Taiwan stock market"

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The decomposition and causes of securities dealers' cascades in the Taiwan stock market

Abstract

This study follows Sias (2004) in examining whether the herding phenomenon exists for securities dealers and investigating the main reasons for their herding behavior in the Taiwan stock market. By testing the cross-sectional dependence in dealers' demand over two adjacent weeks and decomposing the dependence into dealers' own cascades and other cascades, the paper demonstrates that dealers' cascades mainly result from other cascades (herding), but their own trades are still significant for securities with at least low to medium trading activity. The authors find little evidence that dealers' herding behavior is driven by habit investing in stocks that dealers trade with at least medium to high activity. The momentum trading of dealers accounts for little of the herding phenomenon, and the obviously positive relationship between dealers' demand and their lag demand changes little even with momentum trading taken into consideration. Most importantly, dealers are more likely to herd in association with large capitalization securities; thus, investigative herding rather than informational cascades is the main reason for dealers' herding in the Taiwan stock market. Other investors can follow dealers' cascades to trade in large-capitalization securities because the post-herding prices of these stocks can be easily pushed up as a result of dealers responding to the same indicators.

Introduction

Securities dealers, one of the three major types of institutional investors in the Taiwan stock market, are well funded and well equipped to perform data research and analysis and engage in professional investment. These investors place a greater emphasis on short-term strategies than foreign institutional investors and mutual fund managers, and they have close relationships with listed companies. Thus, their trading behavior and stock operating strategies are more flexible and rational, and they possess more advantageous information than general investors. In recent years, the number of dealers investing in the Taiwan stock market has gradually increased. Moreover, as a result of strong competition and information asymmetry, dealers may follow each other into and out of the same securities. This behavior is known as "herding". Like the impact of herding by foreign institutional investors and mutual funds in the stock market (Walter and Weber, 2006; Scharfstein and Stein, 1990), the herding behavior of securities dealers increases stock price volatility and drives prices away from fundamentals. Most studies explore the herding behavior of foreign institutional investors and mutual fund managers in the emerging stock market. However, whether the dynamic herding of dealers is significantly present in the Taiwan stock market and the causes of this herding phenomenon have not been thoroughly explored.

There are two primary models of investor herding in the recent literature. One model focuses on the degree of dispersion of investors with respect to the security return. The other model focuses on the number of transactions of investors involving a specific security. Demirer, Kutan and Chen (2010) and Lin, Huang and Chen (2007) use the CSSD model of return dispersions to test investors' herding tendencies in the market and find that herding effects are more prominent in specific market circumstances. In contrast, the present paper uses a herding model that measures the number of trading investors to examine the following behaviors of securities dealers in relation to each other rather than in relation to the consistent market tendency. In the model on the number of transactions of investors, many studies, such as Lakonishok et al. (1992), Grinblatt et al. (1995), Wermers (1999), Choe et al. (1999) and Wylie (2005), have used the Lakonishok, Shleifer and Vishny (1992) (LSV, hereafter) measure to examine herding among institutional investors; thus, this measure has become a standard in the herding literature. However, the static LSV herding measure indirectly tests for the cross-sectional dependence of institutional investors' trades within a given period, and it can result in the highest number of institutional traders on one side of the trade within that period. In contrast, Sias (2004) uses the cross-sectional correlation of the fraction of institutions buying stocks to explore whether institutional herding exists. The cross-sectional correlation between the fraction of institutions buying over adjacent periods can be directly decomposed into "own cascades", which result from individual institutions following their own trades, and "other cascades", which result from institutions following other institutions' trades. Chen, Wang and Lin (2008) follow Sias' (2004) herding model to demonstrate the

existence of herding among foreign institutional investors in the Taiwan stock market, even if own trades still are the majority of their cascades. Hung, Lu and Lee (2010) use the herding model of Sias (2004) to analyze the herding of mutual funds in the Taiwan stock market and its impact on stock profitability. By extending Sias' (2004) model, the present paper first examines whether securities' herding (other cascades) significantly exists in the Taiwan stock market.

Moreover, Falkenstein (1996), Del Guercio (1996) and Gompers and Metrick (2001) have claimed that institutional investors may herd because the majority of them are attracted to securities with specific characteristics. A special case of this so-called 'characteristic herding' is habit investing, in which institutional investors follow each other into and out of the same stocks as a result of the appeal of securities with similar characteristics, causing these investors to hold similar portfolios. Thus, this paper further determines whether dealers' herding is a result of habit investing. We also extend Sias' (2004) measure and use the cross-sectional correlation regarding the fraction of dealers that increase the weight of their portfolios over adjacent weeks. In addition, although a few studies, such as Wylie (2005), propose that institutional investors are contrarians, most of the literature supports the existence of momentum trading among institutional investors (Grinblatt et al., 1995; Wermers, 1999, 2000; Jones and Winters, 1999; Sias et al., 2002). Jones and Winters (1999) and Sias (2004) also show that institutional cascading clearly exists, even after accounting for momentum trading. The findings of Sias (2004) further demonstrate that institutional demand is more strongly related to lag institutional demand than lag returns. Thus, the present paper examines whether the cascading behavior of dealers is still evident after considering momentum trading and, if this is the case, whether this behavior is more conspicuous than these investors' momentum trading on the Taiwan stock market.

Furthermore, Banerjee (1992) and Bikhchandani, Hirshleifer and Welch (1992) propose that informational cascades result from institutional investors who ignore their own noisy information and trade with the herd because they infer information from other institutional trading behavior. Froot, Scharfstein and Stein (1992) and Hirshleifer, Subrahmanyam and Titman (1994) assert that "investigative herding" occurs when the information of institutional investors is positively cross-sectionally correlated, possibly because these investors follow the same signals. Wermers (1999) contends that informational cascades are more likely to occur in small-capitalization securities, whereas investigative herding

is more likely to occur in large-capitalization securities. The present study also extends Sias (2004) and examines herding by capitalization quintile. Thus, the final objective of this paper is to examine whether dealers' herding is a result of informational cascades or investigative herding.

Our paper seeks to fill a gap in the literature by addressing the following issues. First, different from the static LSV herding measure, we follow and extend the dynamic herding measure of Sias (2004) to examine the lead-lag trades among securities dealers in emerging markets such as Taiwan. In this way, we can confirm the inter-temporal dependence of dealers' demand over two adjacent weeks mainly from their own trades or other trades (namely, herding). Second, compared with most previous studies, which have focused on the analysis of herding by foreign institutional investors who are engaged in long-term strategies, this paper generates findings that provide new insights into the herding behavior of domestic institutional investors who place greater emphasis on short-term strategies in emerging stock markets. Third, this paper deeply explores the possible causes of herding by securities dealers in the Taiwan stock market. More specifically, we investigate whether dealers' herding results from habit investing by analyzing the fraction of dealers who increase the weight of a particular security in their portfolios and whether their herding results from momentum trading by adding the lag returns into our regression. In addition, we clarify whether dealers' herding results from informational cascades or investigative herding by separately running the cross-sectional regressions for the stocks with the largest and smallest capitalizations.

Consistent with the findings of Sias (2004), our empirical results show that dealers' cascades mainly result from their herding, even if little trading activity is involved. Dealers' own trades account for a minority of the correlation but still reach a statistically significant level. In contrast to the results of Chen et al. (2008), which were based on daily data and indicated that own trades constitute the majority of the cascades from foreign institutional investors, our findings, which are based on weekly data, present that institutional herding accounts for the majority of their cascades. The difference in the majority of cascades by institutional investors may be that institutional herding usually occurs on a continuous basis because securities dealers focusing on short-term strategies still tend to overbuy or oversell stocks for many days to pull stock prices up or down. Moreover, regardless of the fractional increase in their position or return-adjusted portfolio weights, our results demonstrate that dealers' cascades are more obvious than their momentum trading, even if momentum trading is

considered. These findings are similar to those of Sias (2004) and confirm that dealers' herding significantly exists even after considering momentum trading. Furthermore, our results show that dealers are more likely to exhibit herding behavior in relation to large capitalization securities, which contrasts with the results of Sias (2004). The difference in institutional herding for the stocks of large- or small-capitalization may be because institutional herding in emerging markets such as Taiwan primarily results from correlated signals (investigative herding) rather than inferred information from each other's trades (informational cascades). That is, investigative herding is the main reason for dealers' herding in the Taiwan stock market. Lu, Fang and Nieh (2012) and Lin and Swanson (2003) demonstrate that the subsequent performance of institutional investors' large herding for large-size stocks is better than that of their large herding for small-size stocks in the Taiwan stock market. Thus, other investors in the Taiwan stock market can follow dealers' cascades involving trading in large-capitalization securities to make a profit.

The rest of this paper is organized as follows. Section 1 explains the research design and methodology, including the source, scope and analysis of the data; the fraction of dealer buying; and the operating definition of our testing hypothesis for dealers' herding. Section 2 discusses the empirical results, including the results on the existence of dealers' herding, whether habit investing exists, whether momentum trading exists and whether investigative herding or informational cascades exist. The final section summarizes our conclusions.

1. Research design and methodology

1.1. Source, scope and analysis of the data. Even though securities dealers place greater emphasis on short-term strategies than foreign institutional investors in the Taiwan stock market, they still tend to overbuy or oversell stocks on a continuous basis for a sectional period, even many days or several weeks, to pull stock prices up or down, which is why we use a weekly frequency rather than a daily frequency for data to measure the degree of dealers' herding. The raw data in this study include the weekly individual stock returns, outstanding shares, firm capitalizations, the closing prices of stocks and the number of shares traded as listed on the Taiwan Stock Exchange Corporation (TSEC) and the number of shares of TSEC-listed stocks traded by specific dealers every week from January 2002 to October 2009. The number of shares traded and the

closing prices are further transformed into the fraction of dealers buying individual stock based on equation (1). After the Financial Holding Company Act was passed in 1999, the securities industry experienced a high volume of merger and acquisition activity for a period of approximately two years. Thus, the data prior to 2002 are too fragile to analyze. The data are obtained from the Winner Databank of the *China Times*.

The second through ninth columns in Panel A of Table 1 show the average dollar amount of stocks each week traded by dealers each year, and the first column reports the average dollar amount for the 402 weeks over the entire period. Panel B reports the average number of stocks in each month traded by at least one, five, ten or 15 dealers in each year. Panel C shows the average dollar amount of stocks each week traded by each dealer each year. On average, dealers traded a total of NT$ 27,231,103,000 in stocks each week, and there were 623 stocks with at least one dealer trader each week. Moreover, the average dealer traded NT$ 762,674,000 in stocks each week. With the exception of the decrease following the outbreak of the subprime crisis, the steady growth in the average dollar amount traded by all dealers each week confirms that there has been an increasing trend in trading by dealers in the Taiwan stock market. By observing the discontinuous increase in the average dollar amount traded by a dealer each week, we find that the average dealer's trading is discontinuously increasing. The increasing trend in terms of the total and average dealer's trading has tended to promote the dealers' herding or their own cascades, which may be the driving force in significantly pushing up the post-herding prices of their herding stocks.

1.2. The fraction of dealer buying. Wermers (1999) indirectly tested for cross-sectional temporal dependence within a certain period and found that when later institutional traders follow earlier institutional investors' trading behavior, it results in most institutional traders being on the same side of the trade within that period. The present study adopts the institutional herding measures of Sias (2004) to directly investigate whether dealers follow other dealers' trades in the Taiwan stock market. In other words, we examine the cross-sectional correlation between some dealers' trades in one period and other dealers' trades in the next period.

We follow Sias (2004) and calculate the raw fraction of the number of dealers' buying "security i during week t":

$$Raw\Delta_{i,t}^{n} = No.\ of\ dealers\ buying_{i,t}\ /(No.\ of\ dealers\ buying_{i,t} + No.\ of\ dealers\ selling_{i,t}). \qquad (1)$$

A dealer is defined as a buyer if his ownership in the stock increases and as a seller if his ownership of a security decreases during the week. For the denominator to be greater than zero, the security must have at least one dealer trading it during the week. To allow for aggregation over time and to directly compare coefficients of momentum trading and different measures of dealers' demand, we standardize the fraction of dealers' buying security i in week t (denoted $\Delta_{i,t}$) as follows:

$$\Delta_{i,t} = \frac{Raw\Delta_{i,t} - \overline{Raw\Delta_t}}{\sigma(Raw\Delta_{i,t})}, \tag{2}$$

where $\overline{Raw\Delta_t}$ is the cross-sectional average (across i securities) raw fraction of dealers buying in week t and $\sigma(Raw\Delta_{i,t})$ is the cross-sectional standard deviation (across i securities) of the raw fraction of dealers buying in week t.

After substituting quarters for weeks because of the frequent and short-span dealers' cascades in the stock markets of emerging markets such as Taiwan, we estimate a cross-sectional regression of the standardized fraction of dealers buying security i ($\Delta_{i,t}$) in the current week on the standardized fraction of dealers buying security i in the previous week ($\Delta_{i,t-1}$):

$$\Delta_{i,t} = \beta_1 \Delta_{i,t-1} + \varepsilon_{i,t}. \tag{3}$$

Sias (2004) proposes that the correlation between the current fraction and lag fraction of institutional buying can be decomposed as an institution following itself into and out of the same securities and other institutions over adjacent periods; thus, we write the slope coefficient in equation (3) as follows:

$$\beta_t = \rho\left(\Delta_{i,t}, \Delta_{i,t-1}\right) = [1/(i-1)\sigma(Raw\Delta_{i,t})\sigma(Raw\Delta_{i,t-1}) \times \sum_{i=1}^{I}\left[\sum_{n=1}^{N_{i,t}}(D_{n,i,t} - \overline{Raw\Delta_t})(D_{n,i,t-1} - \overline{Raw\Delta_{t-1}})/N_{i,t}N_{i,t-1}\right] +$$

$$+[1/(i-1)\sigma(Raw\Delta_{i,t})\sigma(Raw\Delta_{i,t-1}) \times \sum_{i=1}^{I}\left[\sum_{n=1}^{N_{i,t}}\sum_{m=1,m\neq n}^{N_{i,t-1}}(D_{n,i,t} - \overline{Raw\Delta_t})(D_{m,i,t-1} - \overline{Raw\Delta_{t-1}})/N_{i,t}N_{i,t-1}\right]. \tag{4}$$

If dealers tend to follow their own trades over adjacent weeks, the first term on the right-hand side of equation (4) will be positive[1]. If investor m buys (sells) security i in week t-1 and investor n buys (sells) security i in week t, the second term will be positive[2].

1.3. Does dealers' herding result from habit investing? To test whether habit investing explains dealers' herding and following their own lag trades, we examine the correlation between the fraction of dealers increasing their portfolio weights in a given week and those increasing them in the previous week. If dealers follow themselves and each other into and out of the same securities as a result of habit investing, then the portfolio weights should be independent over adjacent weeks. Alternatively, if dealers follow themselves and each other into the same securities for reasons other than time-series and cross-sectional correlations in net flows (habit investing), then the fraction of dealers increasing their portfolio weights will be positively correlated over adjacent weeks.

To purge return-induced noise from the measure of the fraction of dealers increasing portfolio weights,

this study follows Sias (2004) by using changes in "return-adjusted" portfolio weights rather than changes in raw portfolio weights to accurately identify whether dealer n is a buyer or a seller[3]. The return-adjusted portfolio weight is defined as what the end-of-week portfolio weight would be if a dealer's increase in security value did not cause a rebalancing of his portfolio toward the initial weight. $V_{n,i,t}$ is defined as the value that the price at the end of week t times the number of shares held by dealer n at the end of week t, which is regarded as dealer n's position in security i at the end of week t. If dealer n's end-of-week portfolio weight is greater than his return-adjusted beginning-of-month portfolio weight, then dealer n is classified as increasing his return-adjusted portfolio weight (making this dealer a buyer):

$$\frac{V_{n,i,t}}{\sum_{i=1}^{I}V_{n,i,t}} > \frac{V_{n,i,t-1}\left(1+R_{i,t}\right)}{\sum_{i=1}^{I}V_{n,i,t-1}\left(1+R_{i,t}\right)}, \tag{5}$$

where $R_{i,t}$ is the return for security i over week t. If the sign is reversed in equation (5), dealer n is classified as a seller[4]. Thus, the raw fraction of dealers increasing their security i return-adjusted portfolio weights in week t is defined as follows:

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[1] Alternatively, if dealers tend to reverse their previous week's trades, the first term will be negative. If an individual dealer's transactions in the week are independent of his own transactions, the first term will be zero.

[2] If dealers tend to sell (buy) securities that other dealers purchased (sold) in the previous week, this term will be negative. If dealers' transactions in the week are independent of other dealers' transactions in the previous week, this term will be zero.

[3] We focus on return-adjusted portfolio weights because the fraction of institutions increasing raw portfolio weights is highly correlated with same-period returns.

[4] If the left-hand and right-hand sides of equation (5) are equal, then dealer n is not classified as a buyer or seller.

$$RawRA\Delta_{i,t} = \frac{No.\ of\ dealers\ with\ increased\ return-adj.\ weight_{i,t}}{No.\ of\ dealers\ with\ increased\ return-adj.\ weight_{i,t} + No.\ of\ dealers\ with\ decreased\ return-adj.\ weight_{i,t})}. \tag{6}$$

1.4. Does dealers' herding result from momen-tum trading? Furthermore, recent studies such as Wermers (1999, 2000) and Sias, Starks and Titman (2002) propose that institutional investors herd toward (away from) stocks with high (low) past returns. That is, dealers may follow each other into and out of the same stocks due to their momentum trading. The present study follows Sias (2004) and adds a lag return to equation (3) to evaluate dealers' momentum trading to explain the relationships in their buying cascades. We regress the weekly standardized fraction of dealers' buying on the lag weekly standardized fraction of dealers' buying and the lag weekly standardized return, which is expressed as follows[1].

$$\Delta_{i,t} = \beta_1\Delta_{i,t-1} + \beta_2 R_{i,t-1} + \varepsilon_{i,t}. \tag{7}$$

1.4. Does dealers' herding result from investigative herding or informational cascades? Wermers (1999) asserts that informational cascades are more likely to occur in small-capitalization securities because institutional investors tend to attach a clearly greater weight to what the herd is doing and less weight to their own noisy private information. Sias (2004) proposes that the cross-sectional correlation between signals is likely to be stronger for larger stocks with less noisy signals. We follow

the hypothesis of Wermers (1999) and Sias (2004) that dealers following others' trades tend to intensively trade in smaller stocks and those following correlated signals tend to intensively trade in larger stocks. If dealers' herding primarily arises from informational cascades, herding should be strongest in small-capitalization securities. Alternatively, if dealers' herding primarily arises from investigative herding, herding should be strongest in large-capitalization securities.

Because there may be more institutional investors trading in a large-capitalization security than in a small-capitalization security, as Sias (2004) suggests, the number of "herding" terms increases much faster than the number of "following their own trades" terms as the number of dealers increases. It will also affect the correlation because the cross-sectional standard deviation of the fraction of dealers buying tends to be reduced as the number of traders increases. Thus, we follow Sias (2004) to compute the average "following their own trades" contribution and "herding" contribution for each security-week as the numerators of the first and the second terms on the right-hand side of equation (5), separately, divided by the number of terms used in the first and the second terms on the right-hand side of equation (5) for security i in week t:

$$The\ average\ "following\ their\ own\ trades"\ contribution\ i,t = \sum_{n=1}^{N^*_{i,t}}(D_{n,i,t} - \overline{Raw\Delta_t})(D_{n,i,t-1} - \overline{Raw\Delta_{t-1}})/N^*_{i,t}, \tag{8}$$

where $N^*_{i,t}$ is the number of managers trading security i in both week t-1 and week t.

$$The\ average\ "following\ the\ herd"\ contribution\ i,t = \sum_{n=1}^{N_{i,t}}\sum_{m=1,m\neq n}^{N^*_{i,t-1}}(D_{n,i,t} - \overline{Raw\Delta_t})(D_{m,i,t-1} - \overline{Raw\Delta_{t-1}})/N_{i,t}N^*_{i,t-1}, \tag{10}$$

where $N_{i,t}$ is the number of managers trading security i in week t and $N^*_{i,t-1}$ is the number of different managers trading security i in week t-1. Through these calculations, the number of traders and the cross-sectional standard deviations of the fraction of dealers buying are found not to affect the measures in equations (8) and (9).

2. Empirical results

The average coefficients of the 401 regressions and associated t-statistics (computed from the time-series standard errors) in equation (3) are reported in the first column of Table 2. The results depicted in

Table 2 consistently show that there is significant evidence that dealers follow other dealers or themselves into and out of the same securities for securities with ≥ 1 and ≥ 5 dealer traders. Dealers' cascading behavior is evidently focused on securities traded with low activity by dealers. Differing from the results of Sias (2004) for the definition of a buyer that has increased its position, dealers' cascades are not significant for securities with ≥ 10 dealer traders. There are no securities with ≥ 20 dealer traders in the Taiwan stock market over the sample period. These results indicate that for the definition of a buyer that has increased its position, institutional cascading behavior is not present for securities traded by dealers at medium or high activity, which is contrary to the scenario in the U.S. This result may be because for those securities with ≥ 10 dealer traders, the phenomenon

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[1] The coefficient of β_1 represents the extent of dealers' cascading, and that of β_2 represents the extent of their feedback trading.

indicating that the bullish and bearish positions are offset can be produced in the Taiwan stock market based on this definition.

The coefficients associated with the lag standardized fraction of the number of dealers buying securities with ≥ 1 and ≥ 5 dealer traders average 0.0478 and 0.0773, respectively, with both values significantly differing from zero at the 1% level. The results of Table 2 reveal that, on average, the majority of the correlations (i.e., 0.0741/0.0478 for securities with ≥ 1 dealer trader and 0.0538/0.0773 for securities with ≥ 5 dealer traders) between the fraction of dealers buying this week and the fraction buying last week in the Taiwan stock market results from other dealers' cascades (herding), which is statistically significant at the 1% level. Own cascades account for a minority of the correlation between the fraction of dealers buying this week and the fraction buying last week, and individual dealers continue to buy (sell) the securities they bought (sold) the previous week (i.e., -0.0263/0.0478 for securities with ≥ 1 dealer trader and 0.0235/0.0773 for securities with ≥ 5 dealer traders), which still reaches a statistically significant level. Therefore, the analytical results reveal that dealers' cascades mainly result from their herding, which is consistent with the findings of Sias (2004). However, dealers' herding only accounts for their cascades in relation to securities in which the dealers trade with lower activity.

The time-series average correlation (analogous to equation (3)), its components (analogous to equation (4)) and associated t-statistics with return-adjusted portfolio weights are reported in Table 3. Differing from the results in Table 2, the correlation between the fraction of dealers increasing their return-adjusted portfolio weights and the lag fraction is primarily attributed to individual dealers following their own return-adjusted portfolio weight changes (i.e., 0.0324/0.0392 for securities with ≥ 5 dealer traders, 0.0347/0.0523 for securities with ≥ 10 dealer traders and 0.0327/0.0411 for securities with ≥ 15 dealer traders). More importantly, the analytical results are consistent with the conclusions of Sias (2004) in that the dealers' portfolio weights will change. Thus, their herding is not primarily driven by habit investing.

The results of the standardized regression of dealers' demand on lag dealers' demand and lag returns in Table 4 indicate that, with the exception of securities with ≥ 1 dealer trader, the dealers' positive feedback trading is not significant, but their cascading behavior is significant even after momentum trading is taken into account. Adding a standardized lag return to the regression has little impact on the average coefficient associated with the previous weeks' fractional increase in the dealers'

position or return-adjusted portfolio weights. For example, the average coefficient associated with lag dealers increasing their position in securities with ≥ 5 dealer traders shifts from 0.0773 in Table 2 to 0.0755 in Table 4, and the average coefficient associated with lag dealers increasing their return-adjusted portfolio weights in securities with ≥ 5 dealer traders shifts from 0.0392 in Table 3 to 0.0397 in Table 4. In summary, in close agreement with the findings of Sias (2004), our results consistently indicate that dealers' demand is more evidently related to their lag demand than lag returns, especially for securities with ≥ 5 dealer traders in their increased positions and for securities with ≥ 5, ≥ 10 and ≥ 15 dealer traders with their increased portfolio weights with ≥ 1 and ≥ 5 dealer traders. Momentum trading is consistently not regarded as the primary source of dealers' herding, regardless of the dealers' trading activity, and habit investing is also not regarded as the main reason for their herding.

Table 5 only reports the time-series averages of the 402 cross-sectional averages and associated t-statistics for securities within each capitalization quintile separately for securities with ≥ 1 and ≥ 5 dealer traders, as the herding of dealers accounts for their cascades for securities with the two trading activities. The lower rows of Panels A and B report the F-statistics associated with the null hypothesis that the estimates are equal across capitalization quintiles. Inconsistent with Table 2, the results in the first column of panels A and B in Table 5 provide evidence of dealers' following their own trades for large capitalization quintiles. In addition, there exists a nearly positive relationship between the average contribution of "following their own trades" and capitalization, especially for securities with ≥ 5 dealer traders. The rejection of the F-statistic shows that the average contribution of "following their own trades" is not equal across capitalization quintiles. The second columns in panels A and B show that, regardless of whether the securities have ≥ 1 or ≥ 5 dealer traders, the average herding contributions are positive and statistically significant for small and large capitalization quintiles. Dealers' herding is more likely to be focused on large-capitalization securities than on small-capitalization securities. The F-statistics are also rejected, demonstrating that the average herding contribution is not equal across capitalization quintiles.

Dealers are more likely to follow their own prior-week trades in large securities, which is consistent with the hypothesis that institutions following their own lag trades take trading costs into account. Moreover, dealers are also more likely to herd in large capitalization securities, which is consistent with the hypothesis that dealers' herding results

primarily from the cross-sectional correlation signals as a result of dealers following the same indicators. Therefore, the main cause of dealers' herding may come from investigative herding rather than informational cascades in the Taiwan stock market. Most importantly, other investors can follow dealers' cascades to trade in large-capitalization TSEC-listed stocks because the post-herding abnormal returns of these stocks are high as a result of dealers following the same signals.

Conclusion

In line with Sias (2004), this study attempts to clarify whether the herding phenomenon exists for securities dealers and the main cause of their herding in the Taiwan stock market. By directly decomposing the cross-sectional correlation in dealers' demand over adjacent weeks into their own cascades and other cascades, our results confirm that dealers significantly follow other dealers' trades and their own trades for securities with ≥ 1 or ≥ 5 dealer traders, and dealers' cascades mainly result from their herding. Differing from the results of Sias (2004), we do not find significant evidence of the cascading phenomenon for dealers for securities with ≥ 10 dealer traders.

However, for securities with ≥ 5, ≥ 10 or ≥ 15 dealer traders, dealers' cascades in the fraction of dealers increasing their return-adjusted portfolio weights result primarily from dealers following their own trades. This finding further confirms that dealers' herding is not primarily driven by habit investing in

stocks in which dealers trade with at least medium to high activity.

The momentum trading of dealers contributes little to their herding behavior; however, the obviously positive relationship between dealers' demand and their lag demand changes little regardless of the fraction of dealers' increasing their position or return-adjusted portfolio weights, even after momentum trading has been considered. In particular, for securities with ≥ 5 and ≥ 10 dealer traders, the positive relationship is highly significant. Momentum trading, then, is consistently disregarded as the main reason for the herding of dealers, regardless of how low or high their trading activity is in the Taiwan stock market.

Dealers are more likely to follow their own lag trades in large securities. By classifying securities with capitalization, the empirical results are consistent with the hypothesis that institutions follow their own trades in consideration of trading costs. Moreover, dealers are more likely to herd in large capitalization securities. In a departure from the results of Sias (2004), our results show that investigative herding rather than informational cascades is the main reason for dealers engaging in herding behavior in the Taiwan stock market. Other investors can follow dealers' cascades to trade in large-capitalization securities because the post-herding prices of these stocks can be easily pushed up as a result of dealers responding to the same indicators.

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Appendix

Table 1. Descriptive statistics of dealers' trades

	402-week average, all periods	2002 weekly average	2003 weekly average	2004 weekly average	2005 weekly average	2006 weekly average	2007 weekly average	2008 weekly average	2009 weekly average
Panel A. Dollar amount of trading by all dealers (unit: 1000 $NT)									
	27,231,103	16,792,019	20,538,640	31,960,150	30,213,109	32,615,861	37,805,825	22,942,054	24,981,165
Panel B: Average number of stocks with:									
≥ 1	623	366	531	586	666	686	757	694	696
≥ 5	149	69	88	103	139	161	228	201	203
≥ 10	64	16	29	36	55	64	89	97	125
≥ 15	22	4	10	11	19	22	26	35	51
Panel C. Average dollar amount of stocks traded by each dealer (unit: 1000 $NT)									
	762,674	507,915	742,176	1,088,403	848,854	771,873	792,510	579,959	769,704

Table 2. Tests for herding for the raw fraction of the number of dealers buying $\Delta_{i,t} = \beta_1 \Delta_{i,t-1} + \varepsilon_{i,t}$

Average coefficient (β)	Partitioned slope coefficient		Average R^2
	Dealers following their own trades	Dealers following others' trades	
Panel A. Securities with ≥ 1 dealer trader			
0.0478 (3.9871***)	-0.0263 (-1.8985*)	0.0741 (15.1043***)	5.991%
Panel B. Securities with ≥ 5 dealer traders			
0.0773 (9.9306***)	0.0235 (5.0161***)	0.0538 (8.2450***)	3.026%
Panel C. Securities with ≥ 10 dealer traders			
0.0167 (1.3422)	0.0099 (1.2340)	0.0068 (0.5444)	6.169%
Panel D. Securities with ≥ 15 dealer traders			
-0.0079 (-0.3860)	-0.0254 (-0.830)	0.0175 (0.4550)	14.848%

Note: Numbers in brackets indicate the *t*-statistics. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 3. Tests for herding for the fraction of the number of dealers increasing return-adjusted
portfolio weights $\Delta_{i,t} = \beta_1 \Delta_{i,t-1} + \varepsilon_{i,t}$

Average coefficient (β)	Partitioned slope coefficient		Average R^2
	Dealers following their own trades	Dealers following others' trades	
Panel A. Securities with $\geq$ 1 dealer trader			
-0.0135 (-1.0645)	-0.0149 (-1.1934)	0.0014 (1.2133)	6.491%
Panel B. Securities with $\geq$ 5 dealer traders			
0.0392 (4.6088***)	0.0324 (3.9637***)	0.0068 (1.2126)	3.045%
Panel C. Securities with $\geq$ 10 dealer traders			
0.0523 (5.9019***)	0.0347 (4.5190***)	0.0176 (2.5163**)	3.417%
Panel D. Securities with $\geq$ 15 dealer traders			
0.0411 (4.3204***)	0.0327 (4.6134***)	0.0085 (1.0368)	3.798%

Note: Numbers in brackets indicate the *t*-statistics. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 4. Standardized regression of dealers' demand on lag dealers' demand and
lag returns $\Delta_{i,t} = \beta_{1,t} \Delta_{i,t-1} + \beta_{2,t} R_{i,t-1} + \varepsilon_{i,t}$

Average coefficient associated with lag dealers' demand (β_1)	Average coefficient associated with lag return (β_2)	Average R^2
Panel A. Securities with $\geq$ 1 dealer trader		
Regression 1. Buyer if increased position		
0.0437 (3.2093***)	0.0159 (4.4017***)	6.774%
Regression 2. Buyer if increased return-adjusted portfolio weight		
-0.0051 (-0.3696)	0.0088 (2.7265***)	7.236%
Panel B. Securities with $\geq$ 5 dealer traders		
Regression 1. Buyer if increased position		
0.0755 (9.4150***)	-0.0056 (-0.8286)	4.657%
Regression 2. Buyer if increased return-adjusted portfolio weight		
0.0397 (4.6326***)	0.0069 (1.6027)	3.778%
Panel C. Securities with $\geq$ 10 dealer traders		
Regression 1. Buyer if increased position		
0.0179 (1.6454*)	-0.0223 (-1.5438)	10.03%
Regression 2. Buyer if increased return-adjusted portfolio weight		
0.0537 (6.0105***)	-0.0013 (-0.2436)	4.444%
Panel D. Securities with $\geq$ 15 dealer traders		
Regression 1. Buyer if increased position		
0.0050 (0.1170)	-0.0458 (-1.0838)	23.957%
Regression 2. Buyer if increased return-adjusted portfolio weight		
0.0479 (5.0064***)	-0.0107 (-1.5881)	5.296%

Note: Numbers in brackets indicate the *t*-statistics. ***, ** and * indicate statistical significance at the 1, 5 and 10% levels, respectively.

Table 5. Average contributions from following dealers' own trades and others' trades

	Average contribution from following their own trades	Average contribution from following others' trades
Panel A. Securities with $\geq$ 1 dealer traders		
Small firms	0.0785 (11.6957***)	0.0296 (8.4939***)
Quintile 2	0.0357 (2.0073**)	0.0151 (3.3843***)

Table 5 (cont.). Average contributions from following dealers' own trades and others' trades

	Average contribution from following their own trades	Average contribution from following others' trades
Quintile 3	0.0026 (0.1450)	0.0092 (1.7743*)
Quintile 4	0.0280 (1.3292)	0.0000 (0.0000)
Large firms	0.1692 (5.5884***)	0.0452 (2.2405**)
F-statistic (*p*-value)	15.82 [0.000]	2.22 [0.084]
	Average contribution from following their own trades	Average contribution from following others' trades
Panel B. Securities with ≥ 5 dealer traders		
Small firms	-0.0345 (-0.6627)	0.0418 (3.2849***)
Quintile 2	-0.06627 (-0.0004)	0.0372 (3.1537***)
Quintile 3	0.1554 (2.3157**)	0.0603 (4.5949***)
Quintile 4	0.2530 (3.2396***)	0.0000 (0.0000)
Large firms	0.6399 (8.4007***)	0.1365 (2.3507**)
F-statistic (*p*-value)	16.71 [0.000]	3.31 [0.01]

Note: Numbers in brackets indicate the *t*-statistics, and numbers in square brackets indicate the *p*-values. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.