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## Institutional herding premium in the Taiwan stock market

### Abstract

This study extends the research designs of Nofsinger and Sias (1999) and Wermers (1999) in constructing a more rigorous two-way research procedure to clarify which combination of factors – previous changes in institutional ownership with past earnings, book-to-market ratio effect, or size effect – is able to effectively interpret abnormal returns on stocks in the Taiwan stock market. This study also extends the works of Nofsinger and Sias (1999) and Jones and Winters (1999) in investigating the cross-sectional and time-series correlations between abnormal returns during holding periods and corresponding changes in institutional ownership in Taiwan. The two-way research procedure revealed that all of the above variables and changes in share ownership of the three major types of institutional investors have remarkable influences on abnormal returns over various holding periods. In addition, the abnormal returns driven by any of the three variables proposed previously may be positively related to the level of herding. Furthermore, the empirical results show that, in the Taiwan stock market, investors may regard “changes in shareholding by three major institutional investors during the holding period” as a signal of “short-term following and reverse adjustment.”

**Keywords:** changes in institutional share ownership, three major types of institutional investors, momentum, book-to-market ratio effect.

**JEL Classification:** G11, G12, G14, G21.

### Introduction

Most previous studies of the influence of foreign institutional investors, mutual funds and securities dealers on the Taiwan stock market show that the overbuying and overselling activities of the three major types of institutional investors would affect the movement of the weighted stock price index (Shiu and Liao, 2005; and Lee, Ou and Zhang, 2000). Chen, Kao and Liu (2005) demonstrated that abnormal returns driven by the buy herding of mutual funds are obviously larger than those driven by the sell herding. Lu, Wong and Fang (2007) identified the influence levels of changes in share ownership of the three major types of institutional investors on persistence in abnormal returns of individual stocks. The price-impact of institutional herding evidently exists in emerging markets such as Taiwan due to inefficiency of the markets and large scale of individual investors even while considering other factors that influence returns. Thus, in comparison with the general sorting procedure adopted by many studies to analyze the price-impact of institutional herding in American stock market, it is worthy to adopt more precise research design in exploring this issue in Taiwan.

Nofsinger and Sias (1999) used a two-pass sorting procedure to evaluate the correlations between changes in institutional ownership, past returns and subsequent returns, and found that changes in institutional ownership help to forecast returns, even after controlling for return momentum. Wermers (1999) also used a two-pass sorting procedure to analyze the correlations between institutional herd-

ing, firm size and post-herding returns. He found that subsequent abnormal returns of heavy buying portfolio are significantly larger than those of heavy selling portfolio, and the impact of herding on abnormal returns for small stocks is larger than that for large stocks. That is, post-herding abnormal returns may reflect the return from institutional herding, from return momentum as verified by Jegadeesh and Titman (1993, 2004) and from size effect as confirmed by Fama and French (1993). Such returns may also reflect the return from earnings momentum as shown by Chan, Jegadeesh and Lakonishok (1996) and from book-to-market ratio effect as confirmed by Fama and French (1993). Past studies like Nofsinger and Sias (1999) and Wermers (1999), however, have not undertaken an integrated analysis of institutional herding and other effective variables that influence returns on securities market. Nofsinger and Sias (1999) further studied the correlations between abnormal returns from stocks with the largest increase/decrease in institutional ownership and changes in institutional ownership, based on the sorting of changes in institutional ownerships during a fixed holding period. Nevertheless, they did not examine the degree of dependence between the increase/decrease in abnormal returns during different holding periods and the corresponding increase/decrease in institutional ownership. In addition, Jones and Winters (1999) examined the correlation between the increase/decrease in cumulative abnormal returns during different holding periods and the corresponding increase/decrease in the average number of institutional investors to evaluate whether the momentum persistence is affected by the number of institutional investors. Exploring changes in institutional ownership, Jones and Winters (1999) did not evaluate the correlations between

returns during the same holding period and the corresponding degree of institutional following.

Adopting a more precise sorting procedure to carry out an integrated analysis of institutional herding and other factors that influence returns, together with research designs of Nofsinger and Sias (1999) and Jones and Winters (1999) on clarifying the cross-sectional and time-series correlations between subsequent performance persistence and the corresponding changes in institutional ownership would extend the dimensions for herding research<sup>1</sup>. Integration of these two studies could better help to determine the related issues of institutional herding in emerging markets such as Taiwan. Hence, this study focuses on two issues. First, it adopts a precise two-way simultaneous sorting procedure to examine the correlations between changes in the shareholdings of three major types of institutional investors and either of earnings, book-to-market ratio and firm size over the same interval as well as post-herding abnormal returns during different continuing periods. This is undertaken to determine which variable between changes in institutional ownership and either earnings, book-to-market ratio or firm size significantly drives abnormal returns, thereby clarifying which variable is able to adequately explain and forecast abnormal returns. Second, this study evaluates whether subsequent changes in institutional ownerships would positively adjust the persistence of abnormal returns driven by earnings, book-to-market ratio, and firm size. This study also analyzes whether the abnormal returns on the original winners and losers during different holding periods would be positively (negatively) influenced by a gradual increase (or decrease) in the changes in institutional ownerships.

Empirical analysis of our two-way sorting procedure indicates that changes in the shareholdings of the three major types of institutional investors and standardized unexpected earnings, book-to-market ratio, and firm size all have significant influences on post-herding abnormal returns. Nevertheless, the influence levels and directions may vary depending on the length of the formation period, the portfolios of the winner or loser, and the directions of changes in institutional ownerships. This study expands upon the research designs of Nofsinger and Sias (1999) and Wermers (1999) in the Taiwan stock market to

reveal that abnormal returns driven by earnings, book-to-market ratio, and firm size may all vary depending on the subsequent level of herding among the three major types of institutional investors; their correlations are positive. Furthermore, empirical results show that for the original winner or loser portfolios with the largest increase in subsequent institutional shareholdings, the gradual increase in the changes in the institutional ownership of those stocks may reversely facilitate a gradual decrease in buy-and-hold abnormal returns. Regarding the influence of return performance persistence in the Taiwan stock market, the changes in shareholding by the three major types of institutional investors can be regarded as a signaling indicator of short-term following and reverse adjustment. The remaining sections of this paper are structured as follows: Section 1 outlines the research design and methodology of this study; section 2 details the empirical analysis using the two-way simultaneous sorting procedure and the influence of subsequent changes in the three major institutional investors' share ownership; and the last section presents the conclusions of our analysis.

## 1. Research design and methodology

**1.1. Measurements of the variables and types of sampling.** *1.1.1. Measure of changes in institutional ownerships.* Shareholding by the three major types of institutional investors is defined as the ratio of shares outstanding held separately by foreign institutional investors, mutual funds and securities dealers<sup>2</sup>. The increase (decrease) in the ratio of shares held by these three types of institutional investors is therefore equivalent to the decrease (increase) in the ratio of shares held by other investors.

*1.1.2. Types of sampling.* This study uses data on the monthly shareholdings of individual stocks by foreign institutional investors between January 1994 and December 2007, monthly shareholdings of individual stocks by mutual funds between May 1993 and June 2002, and monthly shareholdings of individual stocks by securities dealers between October 1996 and December 2007<sup>3</sup>. Moreover, this study uses the monthly returns on individual listed stocks by Taiwan Stock Exchange Corporation and the returns on the weighted stock index during the pe-

<sup>1</sup> To avoid complicating the model and diluting the impact results, we do not measure the impact of traditional returns on price and keep the extension of the original model to include unexpected return, book-to-market ratio and firm size. This redesign would avoid the possible interaction induced by high correlation between traditional returns and unexpected returns (book-to-market ratio or firm size) due to the similar basis of market price.

<sup>2</sup> The three major types of institutional investors in this study are foreign institutional investors, mutual funds, and securities dealers in Taiwan, wherein foreign institutional investors include qualified foreign institutional investors (QFII) and general foreign institutional investors (GFII).

<sup>3</sup> The trade volume and frequency of foreign institutional investors prior to 1994 were low and relevant data records are not available; the data that record the ratio of shareholdings by mutual funds were recorded up to June of 2002, because monthly announcements of such data were discontinued at this time. The record of data showing the ratio of shareholding by dealers has been available since October 1996.

riod from January 1994 to December 2007<sup>1</sup>. The study respectively divides the time bases of earnings, book-to-market ratio, and firm size on a monthly basis and adjusts the data for the same period. This is undertaken to proceed with the two-way sorting on the basis of changes in institutional ownership and any of the three previously proposed variables in the same period, and to investigate whether subsequent changes in institutional ownership adjust the persistence of momentum returns in the original portfolios.

*1.1.3. Measure of abnormal returns.* The abnormal return of individual stock *i* in each month is calculated based on capital asset pricing model<sup>2</sup>:

$$r_i^a = (r_{i,t1} - r_{f,t1}) - \beta_i (r_{m,t1} - r_{f,t1}) \quad t_1 = -11, \dots, 0. \quad (1)$$

This study calculates the equally weighted buy-and-hold abnormal returns of the stocks in winner/loser and overbought/oversold portfolios for each formation period during the test period. For example, the average monthly buy-and-hold abnormal return at point *T* holding *k* month(s) for the winner and overbought portfolio ( $WBR_{T,K}$ ) is computed as follows:

$$WBR_{T,k} = \left[ \prod_{t=1}^k \left[ 1 + \frac{1}{WB_T} \sum_{i=1}^{WB_T} (r_{iWB,T+t}^a) \right] - 1 \right] / k, \quad (2)$$

where  $WB_T$  – share number of the winner and overbought portfolio;  $r_{iWB,T+t}^a$  – abnormal return of stock *i* of the winner and overbought portfolio at *T + t*.

*1.1.4. Measure of earnings.* This study follows work of Chan, Jegadeesh and Lakonishok (1996) and uses “standardized unexpected earnings” (SUE) to measure the expected earnings of the preceding period<sup>3</sup>. The formula for SUE is modified as follows<sup>4</sup>:

$$SUE_{it} = \frac{e_{im} - e_{im-12}}{\sigma_{it}}, \quad (3)$$

where  $e_{im}$  indicates the monthly earnings per share of stock *i* in the  $t^{th}$  month,  $e_{im-12}$  indicates the monthly earnings per share of stock *i* in the preceding 12 months, and  $\sigma_{it}$  – the standard deviation of  $e_{im} - e_{im-12}$  over the previous two-year unexpected earnings.

The standardized unexpected earnings of stock *i* during *J* months over a formation period are represented by the average standardized unexpected earnings in the *J* months preceding the time point *T*, as follows:

$$SUE_{i,t,J} = \frac{\sum_{t=-(J-1)}^0 SUE_{i,T+t}}{J}, \quad (4)$$

where *J* and *T* are defined as above, and  $SUE_{i,T+t}$  is the monthly standard unexpected earnings of stock *i* at time point *T + t*.

*1.1.5. Measure of book-to-market ratio.* The book-to-market ratio is measured by dividing the net value per share by the closing price of ordinary shares, wherein the net value per share is the result of dividing the book value of common stock by the number of ordinary shares outstanding. The book-to-market ratio of stock *i* over *J* months during the formation period is defined as the average book-to-market ratio over the *J* months preceding time point *T*, as follows:

$$BM_{i,T,J} = \frac{\sum_{t=-(J-1)}^0 BM_{i,T+t}}{J}, \quad (5)$$

$$BM_{i,t} = \frac{EP_{i,t}}{P_{i,t}} = \frac{BE_{i,t} / Q_{i,t}}{P_{i,t}}, \quad (6)$$

where *J* and *T* are defined as above,  $BM_{i,T+t}$  ( $BE_{i,t}$ ) is the monthly book-to-market ratio (book value of equity) of stock *i* in the *T + t* ( $t^{th}$ ) month, and  $Q_{i,t}$  ( $P_{i,t}$ ) is the number of shares outstanding (closing price) of stock *i* in the  $t^{th}$  month.

*1.1.6. Measure of firm size.* Firm size is measured by the market value of common shares, i.e., the closing price of stock *i* in the  $t^{th}$  month multiplied by the number of shares outstanding. The firm size of stock *i* over the *J* months during the formation period is defined as follows:

<sup>1</sup> The returns on individual stocks, returns on the weighted stock index and the ratio of institutional shareholding are collected at the end of each month. The sources of data used in this study are mainly derived from the Taiwan Economic Journal Data Bank.

<sup>2</sup>  $r_{i,t}$  is the monthly return for individual stock *i* in this month and past 11 months;  $r_{f,t}$  is the risk-free rate in this month and past 11 months, which is the one-month time-deposit interest rate offered by Taiwan First Bank.  $r_{m,t}$  is the change ratio of net value of TAIEX in this month and past 11 months.

<sup>3</sup> As information on the changes in earnings forecasts by analysts in Taiwan was established only in 1990 and the objectivity and maturity of such earning forecasts come into question when compared to mature markets, this study does not use “changes in earnings forecasts by analysts” to measure the previous expected earnings.

<sup>4</sup> To investigate abnormal returns driven by changes in the share ownership of the three major institutional investors, this study adopts the same formula for the standardized unexpected earnings as that used by Chan et al. (1996), but the quarterly earnings per share is converted into a monthly earnings per share.

$$ME_{i,t} = Q_{i,t} \times P_{i,t}, \tag{7}$$

$$ME_{i,T,J} = \frac{\sum_{t=-(J-1)}^0 ME_{i,T+t}}{J}, \tag{8}$$

where the definitions of  $J$ ,  $T$ ,  $Q_{i,t}$ , and  $P_{i,t}$  are as above, and  $ME_{i,T+t}$  is the monthly firm size of stock  $i$  at time point  $T+t$ .

**1.2. Two-way sorting and the influence of subsequent changes in institutional ownership.** This study uses the design of a moving window to divide the research interval into several periods. Each period comprises a formation period and a test period. We use the formation periods of one, two, three, and six months to simultaneously distinguish the individual stocks in terms of high or low changes in institutional ownership and high or low earnings (book-to-market ratio or firm size)<sup>1</sup>. Furthermore, the test period is designed to observe the persistence of abnormal returns in the upcoming one, two, three, four, six, eight, ten, and twelve months. We use the two-way dimension to sort the stocks in a 3\*3 matrix<sup>2</sup>. Subsequently, we select (1) the portfolios of “winners with an increase in institutional ownership”, (2) the portfolios of “winners with a decrease in institutional ownership”, (3) the portfolios of

“losers with an increase in institutional ownership”, and (4) the portfolios of “losers with a decrease in institutional ownership”<sup>3</sup>. Following this, we observe the persistence of the average abnormal returns of these portfolios. By following this procedure, we are able to ascertain which combination factor of changes in institutional shareholding with any of the three previously proposed variables is able to better interpret abnormal returns. In addition, we attempt to determine which lengths of formation period and test period might enable investors to gain better abnormal returns.

Finally, this study accurately analyzes whether the performance of earnings momentum (book-to-market ratio effect, and size effect) or the contrary effect is positively influenced by changes in institutional ownership. We also attempt to ascertain whether a gradual increase (or decrease) in the average abnormal returns of the original winner and loser portfolios during different holding periods partially stems from a continuing increase (or decrease) in the changes in institutional ownerships. The two-way simultaneous sorting of this study is shown in Figure 1. Figure 2 shows the study design that tests whether subsequent changes in the institutional ownership have an apparent influence on abnormal returns driven by the three previously proposed variables<sup>4</sup>.

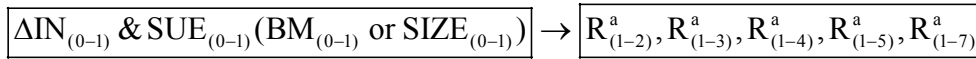


Fig. 1. Two-way simultaneous sorting procedure

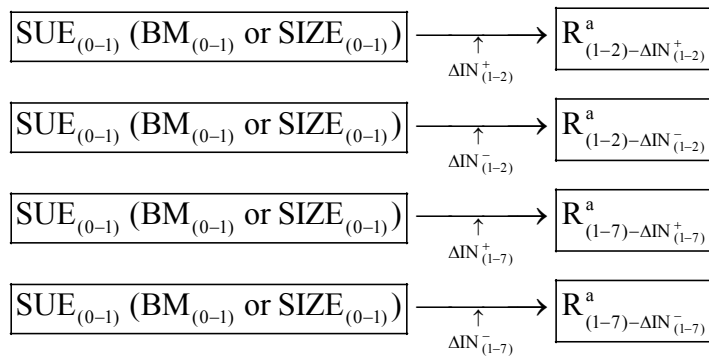


Fig. 2. The mediating influence of subsequent changes in share ownership of the three major types of institutional investors on abnormal returns

<sup>1</sup> The empirical results of this study reveal that the trends of abnormal returns of the stocks over six months formation periods are similar to the trends of abnormal returns of the stocks during the six months of formation periods. Therefore, the study requires no further research into the stocks for more than six months of formation periods.

<sup>2</sup> The matrix is formed by either means of standardized unexpected earnings, book-to-market ratio or firm size and the changes in institutional ownerships in the respective formation periods.

<sup>3</sup> The portfolio of “winners with an increase in institutional shareholding” is the same as a large increase in shareholding by institutional investors with the maximum values of standardized unexpected earnings and book-to-market ratio (or the minimum value of firm size), that of “winners with a decrease in institutional shareholding” is the same as a large decrease in shareholding by institutional investors with the maximum values of the former two variables (or the minimum value of the latter variable), that of “losers with an increase in institutional shareholding” is the same as a large increase in shareholding by institutional investors with the minimum values of the former two variables (or the maximum value of the latter variable), and that of “losers with a decrease in institutional shareholding” is the same as a large decrease in shareholding by institutional investors with minimum values of the former two variables (or the maximum value of the latter variable).

<sup>4</sup> For simplicity, the figures illustrate the situation of the portfolios during a one-month formation period.

## 2. Empirical results

**2.1. Two-way sorting results.** This study arranges the portfolios in a 3\*3 matrix by simultaneously sorting the average standardized unexpected earnings (book-to-market ratio or firm size) and changes in institutional ownership across all stocks over the past one, two, three, and six months. Panels A-D in Tables 1-3 illustrate the time-series average of the cross-sectional mean abnormal returns in the subsequent six months of the portfolios, using the two-way sorting procedure<sup>1</sup>. The overall results of Tables 1-3 show that regardless of the changes in share ownership of foreign institutional investors, mutual funds or securities dealers over a given formation months, the abnormal returns driven by the winners (losers) sorted by book-to-market ratio and changes in institutional ownership are all higher (lower) than those driven by the winners (losers) sorted by firm size or standardized unexpected earnings and their changes in institutional ownership<sup>2</sup>. The above results appear to imply that if other investors buy the winner portfolios sorted simultaneously by book-to-market ratio and changes in institutional ownership, they will gain better and more significant post-herding abnormal returns compared to other portfolios.

The F-statistics in the last row and the last column of Panels A-D in Table 1 illustrate that the changes in institutional ownership and standardized unexpected earnings both tend to have an influence on post-herding abnormal returns. Nonetheless, abnormal returns will be interpreted diversely depending on the length of the formation period, the original winners or losers, and the directions of changes in institutional ownership. Except where the influence of standardized unexpected earnings and the changes in shareholding by mutual funds sorted simultaneously during a formation period of six months is negative, standardized unexpected earnings have a positive influence on post-herding abnormal returns. For a formation period of one-to-three months, subsequent abnormal returns are

higher for stocks with a large increase in shareholding by mutual funds, whereas those are higher for stocks with a large decrease in shareholding by securities dealers. During the one-month formation period, subsequent abnormal returns of stocks with a large increase in shareholdings by foreign institutional investors are larger; nevertheless, during formation periods of two and three months, those of stocks with a large decrease in their shareholdings are larger. During a formation period of six months, subsequent abnormal returns on stocks with a large increase in shareholding by foreign institutional investors and securities dealers become higher; whereas subsequent abnormal returns of stocks with a large decrease in shareholding by mutual funds become higher<sup>3</sup>. Average abnormal returns during a formation period of one month are higher than those during other formation periods<sup>4</sup>.

The F-statistics in the last row and the last column of Panels A-D in Table 2 illustrate that the changes in institutional ownership and book-to-market ratio both play important roles in interpreting post-herding abnormal returns. The book-to-market ratio has a consistently and significant positive influence on post-herding abnormal returns (i.e., book-to-market ratio effect)<sup>5</sup>. Nevertheless, the directions of changes in institutional ownership of the three major types of institutional investors and the length of the formation period have contrasting influences on post-herding abnormal returns.

During formation periods of one, two, and three months, subsequent abnormal returns are higher for stocks with a large decrease in shareholding by foreign institutional investors and securities dealers; returns are also higher for stocks with a large increase in shareholding by mutual funds. Nevertheless, during a formation period of six months, subsequent abnormal returns on stocks with a large increase in shareholding by foreign institutional investors and securities dealers become higher, whereas those of stocks with a large decrease in shareholding by mutual funds become higher<sup>6</sup>. In addition, the average abnormal returns during a

<sup>1</sup> The average abnormal returns on stocks held for six months after the two-way sorting by standardized unexpected earnings, book-to-market ratio or firm size and changes in institutional ownerships are apparently reduced. To save space, Tables 1-3 illustrate only the results of the original and larger performance persistence for less than six months of the holding periods. Each row (column) illustrates the subsequent average abnormal returns of the portfolios when experiencing different average changes in institutional ownership (standardized unexpected earnings, book-to-market ratio or firm size) with the same average standardized unexpected earnings, book-to-market ratio or firm size (changes in institutional ownership).

<sup>2</sup> The abnormal returns driven by the winners (losers) sorted by book-to-market ratio and changes in institutional ownership are all higher (lower) than those driven by the winners (losers) sorted by firm size and changes in institutional ownership. Moreover, the latter are higher (lower) than those driven by the winners (losers) sorted by standardized unexpected earnings and changes in institutional ownership.

<sup>3</sup> The results in Table 1 show that abnormal returns after the two-way sorting by standardized unexpected earnings and changes in institutional ownerships continue consistently for one month among different institutional investors.

<sup>4</sup> If other investors follow foreign institutional investors to buy the portfolios that experienced large increases in institutional ownership for one month and had been the winners of earnings in the past one month, and hold them for one month, abnormal returns will be highest at 1.603%; however, the performance persistence is shorter.

<sup>5</sup> The abnormal returns during the different holding periods consistently show an under-reaction for at least one year, implying that the book-to-market ratio effect is stable.

<sup>6</sup> The results in Table 2 show that the persistence of the abnormal returns after the two-way sorting by book-to-market ratio and changes in institutional ownership varies among different institutional investors.

formation period of one month are higher than those during other formation periods. If other investors follow foreign institutional investors to buy the portfolios that largely experience decreases in institutional ownership for one month and have been the winners of the book-to-market ratio in the past one month, and hold them for two months, the abnormal returns will be the highest, reaching 2.734%.

The F-statistics in the last row and last column of Panels A-D in Table 3 demonstrate that the changes

in institutional ownership of the three major types of institutional investors and size both play roles in interpreting post-herding abnormal returns. The levels of interpretation, however, vary depending on the length of the formation period, the original winners or losers, and an increase or a decrease in shareholding by institutional investors. Size exhibits a negative influence on post-herding abnormal returns (size effect), except for stocks held for one or two months.

Table 1. Subsequent returns for stocks sorted by earnings and institutional ownership changes

| Panel A. Subsequent returns for stocks sorted on herding 1 month SUE ( $t = 0$ to 1) and change in three types institutional share ownership ( $t = 0$ to 1)      |                                 |                |             |                |                |             |                |                |             |
|---|---------------------------------|----------------|-------------|----------------|----------------|-------------|----------------|----------------|-------------|
|   | Foreign institutional investors |                |             | Mutual funds   |                |             | Dealers        |                |             |
|   | Large decrease                  | Large increase | F-statistic | Large decrease | Large increase | F-statistic | Large decrease | Large increase | F-statistic |
| $t = 1$ to 2 losers   | 0.064                           | 0.099          | 3.853*      | 0.005          | -0.118         | 2.198       | -0.158         | 0.202          | 2.189       |
| Winners   | 1.482                           | 1.603          | 4.014*      | 0.845          | 1.37           | 6.640***    | 1.349          | 0.996          | 5.126**     |
| F-statistic   | 5.030**                         | 5.061**        |             | 4.095*         | 5.123**        |             | 5.143**        | 3.860*         |             |
| $t = 1$ to 3 losers   | 0.262                           | 0.334          | 2.103       | 0.273          | 0.251          | 0.193       | -0.061         | 0.249          | 2.235       |
| Winners   | 1.419                           | 1.475          | 1.972       | 0.978          | 1.183          | 4.960*      | 1.124          | 1.009          | 3.890*      |
| F-statistic   | 4.335*                          | 4.146*         |             | 4.123*         | 4.089*         |             | 4.268*         | 4.082*         |             |
| $t = 1$ to 4 losers   | 0.430                           | 0.361          | 1.901       | 0.535          | 0.322          | 2.988       | -0.043         | 0.228          | 2.017       |
| Winners   | 1.348                           | 1.426          | 2.011       | 0.970          | 1.172          | 4.352*      | 1.103          | 0.988          | 3.903*      |
| F-statistic   | 4.009*                          | 4.115*         |             | 3.905*         | 4.010*         |             | 3.907*         | 3.810          |             |
| Panel B. Subsequent returns for stocks sorted on herding 2 months SUE ( $t = 0$ to 2) and the change in three types institutional share ownership ( $t = 0$ to 2) |                                 |                |             |                |                |             |                |                |             |
|   | Foreign institutional investors |                |             | Mutual funds   |                |             | Dealers        |                |             |
|   | Large decrease                  | Large increase | F-statistic | Large decrease | Large increase | F-statistic | Large decrease | Large increase | F-statistic |
| $t = 2$ to 3 losers   | 0.313                           | 0.235          | 1.026       | -0.002         | -0.081         | 1.002       | -0.099         | 0.024          | 3.071       |
| Winners   | 1.452                           | 1.37           | 4.270*      | 0.817          | 1.136          |             | 1.019          | 0.917          |             |
| F-statistic   | 5.864**                         | 4.466*         |             | 4.012*         | 4.832*         |             | 4.903*         | 4.706*         |             |
| $t = 2$ to 4 losers   | 0.296                           | 0.188          | 2.988       | 0.527          | 0.697          | 1.012       | -0.217         | 0.094          | 2.108       |
| Winners   | 1.386                           | 1.319          | 3.871*      | 0.911          | 1.030          | 4.783*      | 0.993          | 0.965          | 2.053       |
| F-statistic   | 4.838*                          | 4.903*         |             | 3.980*         | 4.250*         |             | 4.889*         | 4.861*         |             |
| $t = 2$ to 5 losers   | 0.488                           | 0.297          | 3.086       | 0.713          | 0.765          | 1.324       | -0.152         | 0.028          | 2.227       |
| Winners   | 1.362                           | 1.287          | 3.904*      | 0.954          | 1.007          | 3.969*      | 0.964          | 0.798          | 4.014*      |
| F-statistic   | 3.904*                          | 3.938*         |             | 3.912*         | 4.059*         |             | 4.685*         | 4.115*         |             |
| Panel C. Subsequent returns for stocks sorted on herding 3 months SUE ( $t = 0$ to 3) and change in three types institutional share ownership ( $t = 0$ to 3)     |                                 |                |             |                |                |             |                |                |             |
|   | Foreign institutional investors |                |             | Mutual funds   |                |             | Dealers        |                |             |
|   | Large decrease                  | Large increase | F-statistic | Large decrease | Large increase | F-statistic | Large decrease | Large increase | F-statistic |
| $t = 3$ to 4 losers   | 0.200                           | 0.120          | 2.015       | 0.234          | 0.318          | 1.210       | -0.360         | -0.117         | 2.000       |
| Winners   | 1.349                           | 1.276          | 3.903*      | 0.502          | 1.068          | 5.158**     | 1.015          | 0.616          | 5.988**     |
| F-statistic   | 6.685***                        | 5.854**        |             | 3.905*         | 6.669***       |             | 6.064**        | 4.148*         |             |
| $t = 3$ to 5 losers   | 0.439                           | 0.262          | 4.000*      | 0.625          | 0.704          | 1.315       | -0.094         | -0.143         | 1.983       |
| Winners   | 1.339                           | 1.242          | 3.846*      | 0.736          | 0.913          | 3.860*      | 0.829          | 0.809          | 3.900*      |
| F-statistic   | 5.982**                         | 5.107**        |             |                | 4.568*         |             | 5.682**        | 5.128**        |             |
| $t = 3$ to 6 losers   | 0.518                           | 0.372          | 4.360*      | 0.769          | 0.799          | 0.998       | -0.035         | -0.223         | 2.004       |
| Winners   | 1.299                           | 1.185          | 3.911*      | 0.789          | 0.930          | 3.900*      | 0.692          | 0.628          | 2.950       |
| F-statistic   | 4.780*                          | 4.539*         |             | 1.234          | 4.693*         |             | 5.340**        | 4.923*         |             |

Table 1 (cont.). Subsequent returns for stocks sorted by earnings and institutional ownership changes

| Panel D. Subsequent returns for stocks sorted on herding 6 months SUE (t = 0 to 6) and change in three types institutional share ownership (t = 0 to 6) |                                 |                |             |                |                |             |                |                |             |
|---|---------------------------------|----------------|-------------|----------------|----------------|-------------|----------------|----------------|-------------|
|   | Foreign institutional Investors |                |             | Mutual funds   |                |             | Dealers        |                |             |
|   | Large decrease                  | Large increase | F-statistic | Large decrease | Large increase | F-statistic | Large decrease | Large increase | F-statistic |
| t = 6 to 7 losers   | 0.384                           | 0.459          | 1.096       | 0.489          | 0.305          | 4.051*      | -0.622         | -0.448         | 2.820       |
| Winners   | 0.946                           | 1.037          | 4.012*      | 0.301          | 0.278          | 2.962       | 0.495          | 0.577          | 3.870*      |
| F-statistic   | 5.703**                         | 5.985**        |             | 2.905          | 1.846          |             | 4.110*         | 4.230*         |             |
| t = 6 to 8 losers   | 0.510                           | 0.654          | 1.834       | 0.735          | 0.228          | 4.983*      | -0.249         | -0.458         | 1.543       |
| Winners   | 0.826                           | 0.923          | 2.256       | 0.478          | 0.342          | 2.703       | 0.566          | 0.674          | 3.864*      |
| F-statistic   | 4.286*                          | 4.597*         |             | 3.855*         | 0.768          |             | 4.221*         | 4.357*         |             |
| t = 6 to 9 losers   | 0.573                           | 0.685          | 1.759       | 0.848          | 0.487          | 4.385*      | -0.264         | -0.219         | 0.990       |
| Winners   | 0.721                           | 0.834          | 2.087       | 0.498          | 0.334          | 1.705       | 0.358          | 0.596          | 4.015*      |
| F-statistic   | 3.982*                          | 3.908*         |             | 3.910*         | 2.180          |             | 3.854*         | 4.053*         |             |

Notes: \*, \*\* and \* denote statistical significance at the 1, 5, and 10 percent levels, respectively. In panels A, B, C and D, stocks are sorted simultaneously into quintiles based on the standardized unexpected earnings (SUE) and changes in the fraction of shares held by the three major types institutional investors over each herding (t = 0 to 1, 2, 3, and 6) months separately. The time-series averages of the monthly cross-sectional mean buy-and-hold abnormal returns over the following months are reported (Because average abnormal returns of the stocks held for six months are apparently decreased and space is considered to save, this table merely illustrates the results of original and larger performance persistence below six months of the holding periods.). The last column (row) reports an F-statistics based on the null hypothesis that the time-series averages of cross-sectional mean buy-and-hold abnormal returns are equal across the change in ownership (earnings performance) portfolios within each herding (t = 0 to 1, 2, 3, and 6) months earnings performance (ownership change) quintile.

Table 2. Subsequent returns for stocks sorted by B/M and institutional ownership changes

| Panel A. Subsequent returns for stocks sorted on herding 1 month BE/ME (t = 0 to 1) and change in three types institutional share ownership (t = 0 to 1)  |                                 |                |             |                |                |             |                |                |             |
|---|---------------------------------|----------------|-------------|----------------|----------------|-------------|----------------|----------------|-------------|
|   | Foreign institutional investors |                |             | Mutual funds   |                |             | Dealers        |                |             |
|   | Large decrease                  | Large increase | F-statistic | Large decrease | Large increase | F-statistic | Large decrease | Large increase | F-statistic |
| t = 1 to 2 losers   | 0.534                           | 0.093          | 4.001*      | -0.719         | 0.306          | 4.650*      | 1.046          | -0.138         | 4.520*      |
| Winners   | 2.599                           | 2.109          | 4.054*      | 1.879          | 2.483          | 4.041*      | 2.542          | 1.894          | 4.081*      |
| F-statistic   | 6.782***                        | 6.436**        |             | 6.043**        | 5.986**        |             | 3.982*         | 3.900*         |             |
| t = 1 to 3 losers   | 0.489                           | 0.159          | 3.860*      | -0.350         | 0.339          | 4.034*      | 0.788          | -0.341         | 4.124*      |
| Winners   | 2.734                           | 2.143          | 4.098*      | 2.118          | 2.565          | 3.908*      | 2.578          | 2.109          | 3.965*      |
| F-statistic   | 6.834***                        | 6.312**        |             | 7.082***       | 6.820***       |             | 4.846*         | 4.043*         |             |
| t = 1 to 4 losers   | 0.411                           | 0.060          | 3.871*      | -0.279         | 0.174          | 4.105*      | 0.732          | -0.388         | 4.008*      |
| Winners   | 2.706                           | 2.291          | 3.880*      | 2.382          | 2.586          | 4.007*      | 2.414          | 2.151          | 3.857*      |
| F-statistic   | 6.650***                        | 6.125**        |             | 7.115***       | 6.934***       |             | 4.708*         | 4.052*         |             |
| Panel B. Subsequent returns for stocks sorted on herding 2 months BE/ME (t = 0 to 2) and change in three types institutional share ownership (t = 0 to 2) |                                 |                |             |                |                |             |                |                |             |
|   | Foreign institutional Investors |                |             | Mutual funds   |                |             | Dealers        |                |             |
|   | Large decrease                  | Large increase | F-statistic | Large decrease | Large increase | F-statistic | Large decrease | Large increase | F-statistic |
| t = 2 to 3 losers   | 0.607                           | 0.075          | 4.011*      | -0.319         | 0.643          | 3.852*      | 0.871          | -0.713         | 4.000*      |
| Winners   | 2.327                           | 2.095          | 3.982*      | 1.791          | 2.193          | 4.004*      | 2.352          | 1.244          | 4.139*      |
| F-statistic   | 5.983**                         | 5.710**        |             | 4.015*         | 5.703**        |             | 5.823**        | 4.980*         |             |
| t = 2 to 4 losers   | 0.515                           | 0.036          | 4.002*      | -0.154         | 0.538          | 4.104*      | 0.784          | -0.752         | 3.982*      |
| Winners   | 2.451                           | 2.180          | 3.899*      | 2.276          | 2.292          | 3.907*      | 2.215          | 1.571          | 4.015*      |
| F-statistic   | 6.001**                         | 5.614**        |             | 5.965**        | 5.814**        |             | 5.610**        | 4.996*         |             |
| t = 2 to 5 losers   | 0.427                           | 0.021          | 3.870*      | -0.115         | 0.315          | 4.120*      | 0.821          | -0.553         | 4.124*      |
| Winners   | 2.488                           | 2.323          | 3.603       | 2.295          | 2.396          | 3.844*      | 2.033          | 1.795          | 4.007*      |
| F-statistic   | 6.109**                         | 5.714**        |             | 5.987**        | 5.990**        |             | 5.307**        | 5.007*         |             |

Table 2 (cont.). Subsequent returns for stocks sorted by B/M and institutional ownership changes

| Panel C. Subsequent returns for stocks sorted on herding 3 months BE/ME (t = 0 to 3) and change in three types institutional share ownership (t = 0 to 3) |                                 |                |             |                |                |             |                |                |             |
|---|---------------------------------|----------------|-------------|----------------|----------------|-------------|----------------|----------------|-------------|
|   | Foreign institutional investors |                |             | Mutual funds   |                |             | Dealers        |                |             |
|   | Large decrease                  | Large increase | F-statistic | Large decrease | Large increase | F-statistic | Large decrease | Large increase | F-statistic |
| t = 3 to 4 losers   | 0.651                           | -0.025         | 4.010*      | -0.381         | 0.748          | 4.285*      | 1.109          | -1.138         | 3.870*      |
| Winners   | 2.377                           | 1.899          | 4.125*      | 1.969          | 2.329          | 4.124*      | 1.916          | 1.600          | 3.952*      |
| F-statistic   | 5.996**                         | 4.976*         |             | 4.150*         | 5.538**        |             | 3.900*         | 3.732          |             |
| t = 3 to 5 losers   | 0.537                           | -0.049         | 3.991*      | -0.125         | 0.607          | 4.000*      | 0.949          | -1.016         | 4.018*      |
| Winners   | 2.480                           | 2.047          | 3.907*      | 2.308          | 2.316          | 3.705       | 1.984          | 1.660          | 4.015*      |
| F-statistic   | 6.043**                         | 5.024**        |             | 5.048**        | 5.416**        |             | 4.012*         | 3.845*         |             |
| t = 3 to 6 losers   | 0.499                           | 0.031          | 3.803       | -0.160         | 0.347          | 3.870*      | 0.816          | -0.803         | 4.105*      |
| Winners   | 2.496                           | 2.215          | 3.851*      | 2.304          | 2.354          | 3.866*      | 1.866          | 1.719          | 3.806       |
| F-statistic   | 6.550**                         | 5.145**        |             | 5.057**        | 5.123**        |             | 4.134*         | 3.915*         |             |
| Panel D. Subsequent returns for stocks sorted on herding 6 months BE/ME (t = 0 to 6) and change in three types institutional share ownership (t = 0 to 6) |                                 |                |             |                |                |             |                |                |             |
|   | Foreign institutional investors |                |             | Mutual funds   |                |             | Dealers        |                |             |
|   | Large decrease                  | Large increase | F-statistic | Large decrease | Large increase | F-statistic | Large decrease | Large increase | F-statistic |
| t = 6 to 7 losers   | -0.815                          | 0.015          | 4.015*      | 0.400          | -0.930         | 4.018*      | 0.236          | -1.029         | 4.030*      |
| Winners   | 2.081                           | 2.439          | 4.146*      | 1.821          | 1.483          | 4.243*      | 1.128          | 1.203          | 3.082       |
| F-statistic   | 5.905**                         | 5.834**        |             | 5.607**        | 5.320**        |             | 5.231**        | 4.024*         |             |
| t = 6 to 8 losers   | -0.678                          | 0.114          | 4.018*      | 0.353          | -0.783         | 4.082*      | 0.906          | 1.071          | 4.212*      |
| Winners   | 2.041                           | 2.234          | 3.937*      | 2.029          | 1.367          | 5.034**     | 1.035          | 1.121          | 3.500       |
| F-statistic   | 5.897**                         | 5.021*         |             | 5.813**        | 5.334**        |             | 3.850*         | 3.125          |             |
| t = 6 to 9 losers   | -0.642                          | 0.140          | 4.238*      | 0.282          | -0.637         | 3.990*      | 0.844          | 1.028          | 4.123*      |
| Winners   | 1.988                           | 2.003          | 3.880*      | 2.073          | 1.445          | 5.115**     | 0.853          | 1.358          | 3.912*      |
| F-statistic   | 5.612**                         | 4.326*         |             | 6.424**        | 5.350**        |             | 1.255          | 3.851*         |             |

Notes: \*\*\*, \*\* and \* denote statistical significance at the 1, 5, and 10 percent levels, respectively. In panels A, B, C and D, stocks are sorted simultaneously into quintiles based on the book to market ratios (BE/ME) and changes in the fraction of shares held by the three major types institutional investors over each herding (t = 0 to 1, 2, 3, and 6) month separately. The time-series averages of the monthly cross-sectional mean buy-and-hold abnormal returns over the following months are reported (Because average abnormal returns of the stocks held for six months are apparently decreased and space is considered to save, this table merely illustrates the results of original and larger performance persistence below six months of the holding periods.). The last column (row) reports an F-statistics based on the null hypothesis that the time-series averages of cross-sectional mean buy-and-hold abnormal returns are equal across the change in ownership (book to market) portfolios within each herding (t = 0 to 1, 2, 3, and 6) months book to market (ownership change) quintile.

Table 3. Subsequent returns for stocks sorted by size and institutional ownership changes

| Panel A. Subsequent returns for stocks sorted on herding 1 month size (t = 0 to 1) and change in three types institutional share ownership (t = 0 to 1) |                                 |                |             |                |                |             |                |                |             |
|---|---------------------------------|----------------|-------------|----------------|----------------|-------------|----------------|----------------|-------------|
|   | Foreign institutional investors |                |             | Mutual funds   |                |             | Dealers        |                |             |
|   | Large decrease                  | Large increase | F-statistic | Large decrease | Large increase | F-statistic | Large decrease | Large increase | F-statistic |
| t = 1 to 2 losers   | 0.835                           | 1.038          | 3.907*      | 0.324          | 1.215          | 4.986*      | 0.725          | 0.726          | 0.980       |
| Winners   | 0.294                           | 0.61           | 4.050*      | 0.496          | 0.915          | 4.063*      | -0.351         | 0.406          | 4.123*      |
| F-statistic   | 4.060*                          | 4.023*         |             | 2.108          | 2.131          |             | 4.023*         | 4.227*         |             |
| t = 1 to 5 losers   | 0.490                           | 0.598          | 3.023       | 0.349          | 0.388          | 2.118       | 0.134          | 0.419          | 3.872*      |
| Winners   | 1.432                           | 1.693          | 3.861*      | 1.520          | 1.908          | 4.008*      | 0.503          | 0.533          | 0.943       |
| F-statistic   | 5.982**                         | 6.783***       |             | 5.234**        | 5.399**        |             | 3.898*         | 2.966          |             |
| t = 1 to 7 losers   | 0.276                           | 0.456          | 3.904*      | 0.212          | 0.269          | 2.017       | -0.058         | 0.116          | 2.994       |
| Winners   | 1.531                           | 1.863          | 4.001*      | 1.493          | 1.920          | 4.023*      | 0.326          | 0.596          | 2.168       |
| F-statistic   | 6.030**                         | 7.005***       |             | 5.125**        | 5.698**        |             | 3.911*         | 3.904*         |             |



Table 3 (cont.). Subsequent returns for stocks sorted by size and institutional ownership changes

| Panel B. Subsequent returns for stocks sorted on herding 2 months size (t = 0 to 2) and change in three types institutional share ownership (t = 0 to 2) |                                 |                |             |                |                |             |                |                |             |
|--|---------------------------------|----------------|-------------|----------------|----------------|-------------|----------------|----------------|-------------|
|  | Foreign institutional Investors |                |             | Mutual funds   |                |             | Dealers        |                |             |
|  | Large decrease                  | Large increase | F-statistic | Large decrease | Large increase | F-statistic | Large decrease | Large increase | F-statistic |
| t = 2 to 3 losers  | 0.737                           | 0.917          | 3.890*      | 0.286          | 0.487          | 3.902*      | 0.313          | 0.838          | 3.911*      |
| Winners  | 0.999                           | 1.084          | 3.015       | 0.654          | 0.776          | 3.103       | 0.372          | 0.450          | 2.810       |
| F-statistic  | 2.966                           | 2.896          |             | 3.982*         | 3.891*         |             | 1.005          | 2.982          |             |
| Winners  | 1.622                           | 1.790          | 3.097*      | 1.585          | 1.703          | 2.906       | 0.403          | 0.625          | 2.225       |
| F-statistic  | 5.005*                          | 5.124**        |             | 6.138**        | 6.043**        |             | 3.905*         | 3.123          |             |
| t = 2 to 8 losers  | 0.188                           | 0.324          | 3.995*      | 0.177          | 0.409          | 3.966*      | -0.173         | 0.066          | 1.231       |
| Winners  | 1.620                           | 1.686          | 2.004       | 1.516          | 1.716          | 2.415       | 0.314          | 0.565          | 2.998       |
| F-statistic  | 5.108**                         | 5.871**        |             | 6.022**        | 6.257**        |             | 4.098*         | 4.125*         |             |
| Panel C. Subsequent returns for stocks sorted on herding 3 months size (t = 0 to 3) and change in three types institutional share ownership (t = 0 to 3) |                                 |                |             |                |                |             |                |                |             |
|  | Foreign institutional Investors |                |             | Mutual funds   |                |             | Dealers        |                |             |
|  | Large decrease                  | Large increase | F-statistic | Large decrease | Large increase | F-statistic | Large decrease | Large increase | F-statistic |
| t = 3 to 4 losers  | 0.553                           | 0.558          | 0.982       | 0.079          | 0.385          | 4.103*      | -0.178         | 0.596          | 4.298*      |
| Winners  | 1.361                           | 1.697          | 4.025*      | 0.845          | 0.885          | 1.254       | 0.468          | 0.559          | 2.314       |
| F-statistic  | 4.013*                          | 4.238*         |             | 4.065*         | 4.231*         |             | 3.871*         | 1.002          |             |
| t = 3 to 7 losers  | 0.254                           | 0.317          | 2.104       | 0.252          | 0.476          | 4.002*      | -0.168         | 0.036          | 1.299       |
| Winners  | 1.595                           | 1.747          | 3.890*      | 1.441          | 1.587          | 2.980       | 0.445          | 0.552          | 2.111       |
| F-statistic  | 4.986*                          | 4.806*         |             | 5.360**        | 5.234**        |             | 4.006*         | 4.015*         |             |
| t = 3 to 9 losers  | 0.122                           | 0.205          | 2.003       | 0.130          | 0.464          | 4.115*      | -0.320         | -0.186         | 1.117       |
| Winners  | 1.597                           | 1.652          | 2.110       | 1.492          | 1.493          | 1.003       | 0.313          | 0.599          | 3.904*      |
| F-statistic  | 5.024**                         | 4.975*         |             | 6.043**        | 5.075**        |             | 4.205*         | 4.127*         |             |
| Panel D. Subsequent returns for stocks sorted on herding 6 months size (t = 0 to 6) and change in three types institutional share ownership (t = 0 to 6) |                                 |                |             |                |                |             |                |                |             |
|  | Foreign institutional investors |                |             | Mutual funds   |                |             | Dealers        |                |             |
|  | Large decrease                  | Large increase | F-statistic | Large decrease | Large increase | F-statistic | Large decrease | Large increase | F-statistic |
| t = 6 to 7 losers  | 0.147                           | 0.343          | 3.860*      | 0.273          | -0.132         | 3.905*      | -0.185         | 0.191          | 2.820       |
| Winners  | 1.199                           | 1.421          | 3.900*      | 0.971          | 0.769          | 3.897*      | -0.210         | 0.177          | 2.930       |
| F-statistic  | 4.686*                          | 4.115*         |             | 5.001*         | 4.907*         |             | 2.114          | 1.783          |             |
| t = 6 to 10 losers   | 0.048                           | 0.167          | 1.445       | 0.299          | -0.137         | 3.705       | -0.149         | 0.344          | 3.894*      |
| Winners  | 1.354                           | 1.515          | 3.087       | 1.472          | 1.158          | 3.905*      | -0.001         | 0.564          | 4.285*      |
| F-statistic  | 4.928*                          | 5.004*         |             | 5.200**        | 5.128**        |             | 1.118          | 3.754          |             |
| t = 6 to 12 losers   | 0.024                           | 0.088          | 2.152       | -0.005         | -0.085         | 1.225       | -0.305         | 0.363          | 2.008       |
| Winners  | 1.450                           | 1.500          | 3.010       | 1.376          | 1.241          | 2.004       | 0.065          | 0.386          | 3.861*      |
| F-statistic  | 5.019*                          | 5.025**        |             | 4.485*         | 5.264**        |             | 1.438          | 1.251          |             |

Note: \*\*\*, \*\* and \* denote statistical significance at the 1, 5, and 10 percent levels, respectively. In panels A, B, C and D, stocks are sorted simultaneously into quintiles based on size and changes in the fraction of shares held by the three major types institutional investors over each herding (t = 0 to 1, 2, 3, and 6) month separately. The time-series averages of the monthly cross-sectional mean buy-and-hold abnormal returns over the following months are reported (Because average abnormal returns of the stocks held for six months are apparently decreased and space is considered to save, this table merely illustrates the results of original and larger performance persistence below six months of the holding periods.). The last column (row) reports an F-statistics based on the null hypothesis that the time-series averages of cross-sectional mean buy-and-hold abnormal returns are equal across the change in ownership (size) portfolios within each herding (t = 0 to 1, 2, 3, and 6) months size (ownership change) quintile.

Except for a formation period of six months where subsequent abnormal returns of the portfolios with a large decrease in shareholding by mutual funds become higher, the results during other formation periods consistently show that abnormal returns are higher for portfolios with large increases in institutional shareholding<sup>1</sup>. In addition, the average abnormal returns during a formation period of two months are higher than those during formation periods of three and six months<sup>2</sup>.

**2.2. Influence of changes in institutional ownership on persistence.** To further evaluate the relations between subsequent changes in institutional ownerships and return performance driven by earnings, book-to-market ratio, and firm size separately, Panels A-D in Tables 4-6 separately illustrate the cross-sectional time-series means of changes in institutional ownerships and the corresponding abnormal returns with the largest increase and decrease in institutional ownership during respective holding periods of one, two, or three months among the winners and losers of different formation periods<sup>3</sup>. The empirical results consistently demonstrate a positive relationship between the abnormal returns driven by the three previously proposed variables and changes in institutional shareholding during the holding periods. The portfolios that experience the largest increase in institutional shareholding during the holding periods exhibit an apparent increase in returns; in contrast, the portfolios that experience the largest decrease in institutional shareholding during the same holding periods experience an evident decrease in returns. The empirical results consistently suggest that the subsequent returns performance of the winners or losers is significantly and positively influenced by the level of herding among the three major types of institutional investors; this concurs with the findings of Nofsinger and Sias (1999). Furthermore, this study extends the research design of Nofsinger and Sias (1999) with the result that, except for the performance of return momentum, the abnormal returns driven by earnings, book-to-market ratio, and firm size are also clearly differen-

tiated by the level of herding among the three major types of institutional investors; the correlations are positive. The difference in the abnormal returns of the original winners and losers is not as significant or as consistent as the difference in the corresponding abnormal returns between the largest increase and decrease in institutional shareholding during the holding periods for the original winners and losers. Moreover, the empirical results of this study illustrate that with the largest increase in subsequent institutional shareholding, subsequent abnormal returns originally sorted by book-to-market ratio are significantly higher than those originally sorted by firm size or standardized unexpected earnings. Subsequent abnormal returns on stocks with the largest increase in shareholding by mutual funds are higher than those with the largest increase in shareholding by foreign institutional investors or securities dealers. These results indicate that if other investors use the book-to-market ratio to diversify the portfolios and buy the stocks among the winners or losers with the largest increase in shareholding by mutual funds during the holding periods, they would apparently obtain larger abnormal returns.

The results of Panels A-D in Tables 4-6 consistently show that if other investors buy the original winners or losers with the largest increase in institutional shareholding during the holding period and hold for only one month, they would obtain the largest average buy-and-hold abnormal returns, especially during the three months of the formation period. If they hold the stocks for two months or more, the average abnormal returns will gradually decrease<sup>4</sup>. The empirical results of this study reveal that of the losers or winners sorted by the three previously proposed variables with the largest increase in institutional shareholding during the holding periods, the gradual increase in changes in institutional ownership with an increase in the holding periods may have a negative influence on a gradual decrease in abnormal returns during the corresponding periods. Nevertheless, among the original losers or winners with the largest decrease in institutional shareholding during the holding periods, the gradual decrease in changes in their institutional shareholding with an increase in the holding periods may have a negative influence on the gradual increase in abnormal returns during the corre-

<sup>1</sup> The results in Table 3 show that the persistence of abnormal returns following the two-way sorting by size and the changes in institutional ownership varies slightly among different institutional investors.

<sup>2</sup> If other investors follow mutual funds to buy the portfolios that largely experience an increase in their institutional ownership for one month and have also been the winners of size in the past one month and hold these for six months, the average abnormal returns are the highest, amounting to 1.920%; in addition, the performance persistence is longer.

<sup>3</sup> Given that the average abnormal returns on the stocks held for more than two months are apparently decreased, in the interests of saving space we chose not to list the respective results of the subsequent four, six, eight, ten and twelve months in Tables 4-6.

<sup>4</sup> For example, if other investors hold the losers sorted by book-to-market ratio during the formation period of three months and the largest increase in shareholding by foreign institutional investors, mutual funds and securities dealers during the one-month holding periods, the average abnormal returns will be 3.221%, 6.295%, and 2.470%, respectively.

sponding periods. The results indicate that for stocks among the original winners or losers sorted by the three previously proposed variables with the largest increase (decrease) in institutional shareholding during the holding periods, a gradual increase (decrease) in changes in their share ownership may inversely promote the tendency whereby the buy-and-hold abnormal returns of these stocks gradually decrease (increase) from the second month. The results of this study are contrary to the findings of Jones and Winters (1999), i.e., a gradual increase in the average number of institutional investors among the original winners may positively influence a gradual increase in subsequent abnormal returns<sup>1</sup>. In summary, the empirical results of this study re-

veal that the performance persistence produced by return momentum, earnings momentum, the book-to-market ratio effect or size effect in the Taiwan stock market is positively correlated with the directions of changes in institutional ownership during the holding period, and there exists an inverse phenomenon when the holding period exceeds one month. “The changes in institutional ownership during the holding period” may therefore be regarded as a signal of “short-term following and reverse adjustment”<sup>2</sup>. If investors hold those stocks among the original winners or losers sorted by book-to-market ratio, firm size or standardized unexpected earnings with the largest increase in institutional ownership for less than one month, they would obtain higher abnormal returns.

Table 4. Performance and persistence of stocks with subsequent biggest increase and decrease in institutional share ownership in earnings’ winners and losers

| Panel A. Abnormal returns and changes in three major institutional share ownership for stocks with subsequent biggest increase and decrease in their ownership in past 1 month winners and losers  |                                 |       |         |        |              |       |         |        |         |       |         |        |
|--|---------------------------------|-------|---------|--------|--------------|-------|---------|--------|---------|-------|---------|--------|
|  | Foreign institutional investors |       |         |        | Mutual funds |       |         |        | Dealers |       |         |        |
|  | Ra,ΔIN+                         | ΔIN+  | Ra,ΔIN- | ΔIN-   | Ra,ΔIN+      | ΔIN+  | Ra,ΔIN- | ΔIN-   | Ra,ΔIN+ | ΔIN+  | Ra,ΔIN- | ΔIN-   |
| t = 1 to 2 losers  | 2.714                           | 0.618 | -1.076  | -0.538 | 4.914        | 0.941 | -3.326  | -0.940 | 2.088   | 0.306 | 0.254   | -0.341 |
| Winners  | 2.911                           | 0.654 | -1.195  | -0.543 | 5.586        | 1.056 | -3.635  | -1.062 | 2.339   | 0.337 | 0.636   | -0.377 |
| t = 1 to 3 losers  | 2.009                           | 0.973 | -0.419  | -0.845 | 4.314        | 1.408 | -2.277  | -1.409 | 1.636   | 2.441 | 0.539   | -0.434 |
| Winners  | 2.271                           | 1.052 | -0.480  | -0.859 | 4.431        | 1.519 | -2.408  | -1.599 | 1.905   | 0.483 | 0.541   | -0.508 |
| t = 1 to 4 losers  | 1.815                           | 1.262 | -0.307  | -1.123 | 3.702        | 1.676 | -1.828  | -1.707 | 1.491   | 0.535 | 0.475   | -0.509 |
| Winners  | 2.013                           | 1.377 | -0.256  | -1.143 | 3.65         | 1.746 | -2.025  | -2.016 | 1.655   | 0.581 | 0.510   | -0.607 |
| Panel B. Abnormal returns and changes in three major institutional share ownership for stocks with subsequent biggest increase and decrease in their ownership in past 2 months winners and losers |                                 |       |         |        |              |       |         |        |         |       |         |        |
|  | Foreign institutional investors |       |         |        | Mutual funds |       |         |        | Dealers |       |         |        |
|  | Ra,ΔIN+                         | ΔIN+  | Ra,ΔIN- | ΔIN-   | Ra,ΔIN+      | ΔIN+  | Ra,ΔIN- | ΔIN-   | Ra,ΔIN+ | ΔIN+  | Ra,ΔIN- | ΔIN-   |
| t = 2 to 3 losers  | 2.775                           | 0.616 | -1.027  | -0.539 | 5.157        | 0.955 | -3.252  | -0.932 | 1.956   | 0.306 | 0.264   | -0.338 |
| Winners  | 3.085                           | 0.657 | -1.099  | -0.537 | 5.619        | 1.037 | -3.602  | -1.077 | 2.213   | 0.335 | 0.577   | -0.379 |
| t = 2 to 4 losers  | 2.119                           | 0.980 | -0.405  | -0.854 | 4.442        | 1.408 | -2.224  | -1.384 | 1.613   | 0.446 | 0.525   | -0.432 |
| Winners  | 2.335                           | 1.046 | -0.435  | -0.858 | 4.470        | 1.488 | -2.466  | -1.627 | 1.856   | 0.482 | 0.573   | -0.511 |
| t = 2 to 5 losers  | 1.811                           | 1.264 | -0.303  | -1.128 | 3.783        | 1.979 | -1.791  | -1.506 | 1.588   | 0.537 | 0.418   | -0.508 |
| Winners  | 2.003                           | 1.384 | -0.241  | -1.143 | 3.651        | 1.728 | -2.094  | -2.059 | 1.584   | 0.567 | 0.397   | -0.613 |

<sup>1</sup> Moreover, among the original winners or losers with the largest increase in subsequent institutional shareholding, the speed of changes in the shareholding gradually increasing is consistent with that of abnormal returns gradually decreasing.

<sup>2</sup> The gradually strengthening behaviors where the three major types of institutional investors largely buy stock portfolios in the spot market are not focused on abnormal returns in the spot market, but on lowering prices in the spot market and gaining abnormal returns from the futures or options market.

Table 4 (cont.). Performance and persistence of stocks with subsequent biggest increase and decrease in institutional share ownership in earnings' winners and losers

| Panel C. Abnormal returns and changes in three major institutional share ownership for stocks with subsequent biggest increase and decrease in their ownership in past 3 months winners and losers |                                 |               |                  |               |                  |               |                  |               |                  |               |                  |               |  |
|--|---------------------------------|---------------|------------------|---------------|------------------|---------------|------------------|---------------|------------------|---------------|------------------|---------------|--|
|  | Foreign institutional investors |               |                  |               | Mutual funds     |               |                  |               | Dealers          |               |                  |               |  |
|  | $Ra,\Delta IN^+$                | $\Delta IN^+$ | $Ra,\Delta IN^-$ | $\Delta IN^-$ | $Ra,\Delta IN^+$ | $\Delta IN^+$ | $Ra,\Delta IN^-$ | $\Delta IN^-$ | $Ra,\Delta IN^+$ | $\Delta IN^+$ | $Ra,\Delta IN^-$ | $\Delta IN^-$ |  |
| t = 3 to 4 losers  | 2.839                           | 0.621         | -1.001           | -0.544        | 5.277            | 0.942         | -3.234           | -0.928        | 2.030            | 0.305         | 0.176            | -0.334        |  |
| Winners  | 3.099                           | 0.660         | -1.117           | -0.550        | 5.748            | 1.026         | -3.596           | -1.076        | 2.127            | 0.328         | 0.431            | -0.378        |  |
| t = 3 to 5 losers  | 2.099                           | 0.971         | -0.471           | -0.853        | 4.474            | 1.406         | -2.269           | -1.374        | 1.554            | 0.447         | 0.448            | -0.434        |  |
| Winners  | 2.299                           | 1.055         | -0.452           | -0.875        | 4.328            | 1.446         | -2.528           | -1.654        | 1.841            | 0.475         | 0.406            | -0.517        |  |
| t = 3 to 6 losers  | 1.854                           | 1.269         | -0.351           | -1.132        | 3.810            | 1.672         | -1.877           | -1.643        | 1.441            | 0.537         | 0.259            | -0.511        |  |
| Winners  | 1.983                           | 1.403         | -0.254           | -1.158        | 3.597            | 1.664         | -2.123           | -2.068        | -1.546           | 0.559         | 0.358            | -0.614        |  |
| Panel D. Abnormal returns and changes in three major institutional share ownership for stocks with subsequent biggest increase and decrease in their ownership in past 6 months winners and losers |                                 |               |                  |               |                  |               |                  |               |                  |               |                  |               |  |
|  | Foreign institutional investors |               |                  |               | Mutual funds     |               |                  |               | Dealers          |               |                  |               |  |
|  | $Ra,\Delta IN^+$                | $\Delta IN^+$ | $Ra,\Delta IN^-$ | $\Delta IN^-$ | $Ra,\Delta IN^+$ | $\Delta IN^+$ | $Ra,\Delta IN^-$ | $\Delta IN^-$ | $Ra,\Delta IN^+$ | $\Delta IN^+$ | $Ra,\Delta IN^-$ | $\Delta IN^-$ |  |
| t = 6 to 7 losers  | 2.758                           | 0.626         | -1.281           | -0.554        | 5.383            | 0.937         | -3.337           | -0.901        | 1.723            | 0.291         | -0.165           | -0.325        |  |
| Winners  | 2.975                           | 0.663         | -1.343           | -0.571        | 5.549            | 0.987         | -3.796           | -1.106        | 1.867            | 0.316         | 0.096            | -0.383        |  |
| t = 6 to 8 losers  | 1.962                           | 1.000         | -0.600           | -0.858        | 4.302            | 1.366         | -2.344           | -1.334        | 1.437            | 0.440         | 0.265            | -0.433        |  |
| Winners  | 2.193                           | 1.080         | -0.590           | -0.890        | 3.699            | 1.356         | -2.712           | -1.669        | 1.627            | 0.465         | 0.297            | -0.516        |  |
| t = 6 to 9 losers  | 1.676                           | 1.299         | -0.406           | -1.144        | 3.417            | 1.584         | -1.933           | -1.807        | 1.371            | 0.528         | 0.176            | -0.513        |  |
| Winners  | 1.774                           | 1.403         | -0.382           | -1.159        | 3.125            | 1.572         | -2.271           | -2.128        | 1.437            | 0.546         | 0.184            | -0.608        |  |

Notes: Panels A, B, C and D report separately the average buy-and-hold abnormal returns and changes in share ownership of the three major types institutional investors for stocks with the biggest increase and decrease in their share ownership over the holding period in the past ( $t = 0$  to 1, 2, 3, and 6) winners (stocks are sorted in the biggest decile of the standardized unexpected earnings in the past) and losers (stocks are sorted in the smallest decile of the standardized unexpected earnings in the past) separately over the following 1, 2, and 3 months relative to changes in their share ownership at  $t = 0$  to 1, 2, 3, and 6 months (To save space, this table does not show the results over the following 4, 6, 8, 10, and 12 months). The equally weighted buy-and-hold abnormal returns are also computed in the winners and losers.  $Ra,\Delta IN^+$  ( $Ra,\Delta IN^-$ ) and  $\Delta IN^+$  ( $\Delta IN^-$ ) are presented separately as the mean buy-and-hold abnormal returns and changes in share ownership of three major institutional investors for stocks with the biggest increase (decrease) in their share ownership over the holding period in the past winners or losers.

Table 5. Performance and persistence of stocks with subsequent biggest increase and decrease in institutional share ownership in BE/ME winners and losers

| Panel A. Abnormal returns and changes in three major institutional share ownership for stocks with subsequent biggest increase and decrease in their ownership in past 1 month winners and losers |                                 |               |                        |                     |                  |               |                        |                     |                  |               |                        |                     |  |
|---|---------------------------------|---------------|------------------------|---------------------|------------------|---------------|------------------------|---------------------|------------------|---------------|------------------------|---------------------|--|
|   | Foreign institutional investors |               |                        |                     | Mutual funds     |               |                        |                     | Dealers          |               |                        |                     |  |
|   | $Ra,\Delta IN^+$                | $\Delta IN^+$ | $Ra,\Delta IN^\square$ | $\Delta IN^\square$ | $Ra,\Delta IN^+$ | $\Delta IN^+$ | $Ra,\Delta IN^\square$ | $\Delta IN^\square$ | $Ra,\Delta IN^+$ | $\Delta IN^+$ | $Ra,\Delta IN^\square$ | $\Delta IN^\square$ |  |
| t = 1 to 2 losers   | 3.143                           | 0.735         | -1.338                 | -0.573              | 6.128            | 1.049         | -4.124                 | -1.179              | 2.519            | 0.359         | 0.393                  | -0.413              |  |
| Winners   | 2.782                           | 0.622         | -1.157                 | -0.548              | 5.361            | 1.049         | -2.992                 | -0.895              | 2.100            | 0.309         | 0.020                  | -0.344              |  |
| t = 1 to 3 losers   | 2.206                           | 1.195         | -0.582                 | -0.582              | 4.353            | 1.425         | -2.760                 | -1.772              | 2.039            | 0.439         | 0.636                  | 0.636               |  |
| Winners   | 2.164                           | 0.977         | -0.445                 | -0.871              | 4.574            | 1.606         | -2.117                 | -1.309              | 1.673            | 0.435         | 0.442                  | -0.460              |  |
| t = 1 to 4 losers   | 1.984                           | 1.574         | -0.225                 | -1.263              | 3.598            | 1.67          | -2.276                 | -2.259              | 1.676            | 0.576         | 0.484                  | 0.484               |  |
| Winners   | 1.953                           | 1.266         | -0.217                 | -1.150              | 3.970            | 1.950         | -1.691                 | -1.590              | 1.473            | 0.542         | 0.351                  | -0.554              |  |

Table 5 (cont.). Performance and persistence of stocks with subsequent biggest increase and decrease in institutional share ownership in BE/ME winners and losers

| Panel B. Abnormal returns and changes in three major institutional share ownership for stocks with subsequent biggest increase and decrease in their ownership in past 2 months winners and losers |                                 |               |                         |                     |                   |               |                         |                     |                   |               |                         |                     |
|--|---------------------------------|---------------|-------------------------|---------------------|-------------------|---------------|-------------------------|---------------------|-------------------|---------------|-------------------------|---------------------|
|  | Foreign institutional investors |               |                         |                     | Mutual funds      |               |                         |                     | Dealers           |               |                         |                     |
|  | $Ra, \Delta IN^+$               | $\Delta IN^+$ | $Ra, \Delta IN^\square$ | $\Delta IN^\square$ | $Ra, \Delta IN^+$ | $\Delta IN^+$ | $Ra, \Delta IN^\square$ | $\Delta IN^\square$ | $Ra, \Delta IN^+$ | $\Delta IN^+$ | $Ra, \Delta IN^\square$ | $\Delta IN^\square$ |
| t = 2 to 3 losers  | 3.151                           | 0.727         | -1.256                  | -0.581              | 6.214             | 1.041         | -4.148                  | -1.179              | 2.459             | 0.350         | 0.390                   | -0.413              |
| Winners  | 2.862                           | 0.620         | -1.140                  | -0.551              | 5.579             | 1.064         | -2.991                  | -0.891              | 1.991             | 0.360         | 0.076                   | -0.351              |
| t = 2 to 4 losers  | 2.250                           | 1.183         | -0.577                  | -0.946              | 4.356             | 1.422         | -2.669                  | -1.763              | 1.983             | 0.490         | 0.634                   | -0.546              |
| Winners  | 2.246                           | 0.972         | -0.429                  | -0.888              | 4.646             | 1.613         | -2.035                  | -1.319              | 1.655             | 0.446         | 0.409                   | -0.465              |
| t = 2 to 5 losers  | 1.954                           | 1.541         | -0.260                  | 1.276               | 3.584             | 1.666         | -2.192                  | -2.226              | 1.592             | 0.563         | 0.537                   | -0.651              |
| Winners  | 2.009                           | 1.251         | -0.250                  | -1.163              | 3.959             | 1.939         | -1.671                  | -1.605              | 1.528             | 0.542         | 0.332                   | -0.556              |
| Panel C. Abnormal returns and changes in three major institutional share ownership for stocks with subsequent biggest increase and decrease in their ownership in past 3 months winners and losers |                                 |               |                         |                     |                   |               |                         |                     |                   |               |                         |                     |
|  | Foreign institutional investors |               |                         |                     | Mutual funds      |               |                         |                     | Dealers           |               |                         |                     |
|  | $Ra, \Delta IN^+$               | $\Delta IN^+$ | $Ra, \Delta IN^\square$ | $\Delta IN^\square$ | $Ra, \Delta IN^+$ | $\Delta IN^+$ | $Ra, \Delta IN^\square$ | $\Delta IN^\square$ | $Ra, \Delta IN^+$ | $\Delta IN^+$ | $Ra, \Delta IN^\square$ | $\Delta IN^\square$ |
| t = 3 to 4 losers  | 3.221                           | 0.731         | -1.245                  | -0.582              | 6.295             | 1.012         | -4.030                  | -1.158              | 2.470             | 0.347         | 0.397                   | -0.406              |
| Winners  | 2.948                           | 0.624         | -1.048                  | -0.556              | 5.729             | 1.047         | -2.932                  | -0.900              | 2.001             | 0.310         | 0.063                   | -0.347              |
| t = 3 to 5 losers  | 2.283                           | 1.184         | -0.574                  | -0.942              | 4.308             | 1.415         | -3.864                  | -1.749              | 1.920             | 0.482         | 0.591                   | -0.536              |
| Winners  | 2.226                           | 0.985         | -0.467                  | -0.896              | 4.545             | 1.603         | -2.022                  | -1.331              | 1.580             | 0.438         | 0.301                   | -0.470              |
| t = 3 to 6 losers  | 1.949                           | 1.553         | -0.971                  | -1.289              | 3.515             | 1.642         | -2.641                  | -2.194              | 1.487             | 0.552         | 0.357                   | -0.643              |
| Winners  | 1.950                           | 1.265         | -0.269                  | -1.169              | 3.923             | 1.906         | -1.655                  | -1.611              | 1.382             | 0.545         | 0.296                   | -0.564              |
| Panel D. Abnormal returns and changes in three major institutional share ownership for stocks with subsequent biggest increase and decrease in their ownership in past 6 months winners and losers |                                 |               |                         |                     |                   |               |                         |                     |                   |               |                         |                     |
|  | Foreign institutional investors |               |                         |                     | Mutual funds      |               |                         |                     | Dealers           |               |                         |                     |
|  | $Ra, \Delta IN^+$               | $\Delta IN^+$ | $Ra, \Delta IN^\square$ | $\Delta IN^\square$ | $Ra, \Delta IN^+$ | $\Delta IN^+$ | $Ra, \Delta IN^\square$ | $\Delta IN^\square$ | $Ra, \Delta IN^+$ | $\Delta IN^+$ | $Ra, \Delta IN^\square$ | $\Delta IN^\square$ |
| t = 6 to 7 losers  | 2.998                           | 0.725         | -1.404                  | -0.596              | 5.761             | 0.998         | -4.313                  | -1.124              | 2.038             | 0.337         | 0.076                   | -0.397              |
| Winners  | 2.875                           | 0.637         | -1.256                  | -0.576              | 5.696             | 1.044         | -3.280                  | -0.909              | 1.721             | 0.301         | -0.305                  | -0.341              |
| t = 6 to 8 losers  | 2.053                           | 1.178         | -0.699                  | -0.970              | 4.063             | 1.364         | -2.703                  | -1.675              | 1.757             | 0.469         | 0.177                   | -0.529              |
| Winners  | 2.088                           | 1.004         | -0.606                  | -0.936              | 4.222             | 1.543         | -2.202                  | -1.331              | 1.463             | 0.432         | -0.057                  | -0.472              |
| t = 6 to 9 losers  | 1.641                           | 1.527         | -0.434                  | -1.320              | 2.996             | 1.591         | -2.334                  | -2.114              | 1.341             | 0.538         | 0.353                   | -0.630              |
| Winners  | 1.735                           | 1.272         | -0.431                  | -1.207              | 3.314             | 1.821         | -1.888                  | -1.623              | 1.297             | 0.527         | 0.105                   | -0.563              |

Notes: Panels A, B, C and D report separately the average buy-and-hold abnormal returns and changes in share ownership of the three major types institutional investors for stocks with the biggest increase and decrease in their share ownership over the holding period in the past ( $t = 0$  to 1, 2, 3, and 6) winners (stocks are sorted in the biggest decile of book to market ratio in the past) and losers (stocks are sorted in the smallest decile of book to market ratio in the past) separately over the following 1, 2, and 3 months relative to changes in their share ownership at  $t = 0$  to 1, 2, 3, and 6 months (To save space, this table does not show the results over the following 4, 6, 8, 10, and 12 months). The equally weighted buy-and-hold abnormal returns are also computed in the winners and losers.  $Ra, \Delta IN^+$  ( $Ra, \Delta IN^\square$ ) and  $\Delta IN^+$  ( $\Delta IN^\square$ ) are presented separately as the mean buy-and-hold abnormal returns and changes in share ownership of three major institutional investors for stocks with the biggest increase (decrease) over their share ownership in the holding period in the past winners or losers.

Table 6. Performance and persistence of stocks with subsequent biggest increase and decrease in institutional share ownership in size's winners and losers

| Panel A. Abnormal returns and changes in three major institutional share ownership for stocks with subsequent biggest increase and decrease in their ownership in past 1 month winners and losers  |                                 |                  |                     |                  |                     |                  |                     |                  |                     |                  |                     |                  |
|--|---------------------------------|------------------|---------------------|------------------|---------------------|------------------|---------------------|------------------|---------------------|------------------|---------------------|------------------|
|  | Foreign institutional investors |                  |                     |                  | Mutual funds        |                  |                     |                  | Dealers             |                  |                     |                  |
|  | Ra,ΔIN <sup>+</sup>             | ΔIN <sup>+</sup> | Ra,ΔIN <sup>□</sup> | ΔIN <sup>□</sup> | Ra,ΔIN <sup>+</sup> | ΔIN <sup>+</sup> | Ra,ΔIN <sup>□</sup> | ΔIN <sup>□</sup> | Ra,ΔIN <sup>+</sup> | ΔIN <sup>+</sup> | Ra,ΔIN <sup>□</sup> | ΔIN <sup>□</sup> |
| t = 1 to 2 losers  | 3.648                           | 0.881            | -1.504              | -0.697           | 5.588               | 0.994            | -3.301              | -0.959           | 2.179               | 0.325            | 0.160               | -0.338           |
| Winners  | 2.555                           | 0.575            | -1.080              | -0.480           | 5.055               | 0.943            | -3.135              | -0.899           | 1.908               | 0.292            | 0.335               | -0.364           |
| t = 1 to 3 losers  | 2.789                           | 1.418            | -0.550              | -1.065           | 4.223               | 1.385            | -2.235              | -1.396           | 1.730               | 0.439            | 0.424               | -0.440           |
| Winners  | 1.938                           | 0.879            | -0.475              | -0.716           | 4.167               | 1.39             | -2.168              | -1.348           | 1.626               | 0.426            | 0.520               | -0.489           |
| t = 1 to 4 losers  | 2.352                           | 1.848            | -0.281              | -1.356           | 3.439               | 1.611            | -1.758              | -1.715           | 1.615               | 0.520            | 0.371               | -0.515           |
| Winners  | 1.673                           | 1.110            | -0.235              | -0.935           | 3.701               | 1.683            | -1.765              | -1.642           | 1.428               | 0.534            | 0.396               | -0.593           |
| Panel B. Abnormal returns and changes in three major institutional share ownership for stocks with subsequent biggest increase and decrease in their ownership in past 2 months winners and losers |                                 |                  |                     |                  |                     |                  |                     |                  |                     |                  |                     |                  |
|  | Foreign institutional investors |                  |                     |                  | Mutual funds        |                  |                     |                  | Dealers             |                  |                     |                  |
|  | Ra,ΔIN <sup>+</sup>             | ΔIN <sup>+</sup> | Ra,ΔIN <sup>□</sup> | ΔIN <sup>□</sup> | Ra,ΔIN <sup>+</sup> | ΔIN <sup>+</sup> | Ra,ΔIN <sup>□</sup> | ΔIN <sup>□</sup> | Ra,ΔIN <sup>+</sup> | ΔIN <sup>+</sup> | Ra,ΔIN <sup>□</sup> | ΔIN <sup>□</sup> |
| t = 2 to 3 losers  | 3.711                           | 0.886            | -1.422              | -0.697           | 5.714               | 1.002            | -3.252              | -0.961           | 2.226               | 0.323            | 0.158               | -0.340           |
| Winners  | 2.655                           | 0.579            | -1.017              | -0.485           | 5.187               | 0.949            | -3.077              | -0.901           | 1.844               | 0.292            | 0.287               | -0.365           |
| t = 2 to 4 losers  | 2.905                           | 1.424            | -0.527              | -1.064           | 4.267               | 1.381            | -2.187              | -1.406           | 1.685               | 0.439            | 0.402               | -0.440           |
| Winners  | 2.012                           | 0.883            | -0.424              | -0.727           | 4.276               | 1.390            | -2.079              | -1.351           | 1.568               | 0.428            | 0.492               | -0.490           |
| t = 2 to 5 losers  | 2.354                           | 1.847            | -0.289              | -1.348           | 3.434               | 1.597            | -1.721              | -1.724           | 1.507               | 0.510            | 0.321               | -0.515           |
| Winners  | 1.693                           | 1.114            | -0.210              | -0.942           | 3.742               | 1.684            | -1.740              | -1.647           | 1.354               | 0.529            | 0.344               | -0.598           |
| Panel C. Abnormal returns and changes in three major institutional share ownership for stocks with subsequent biggest increase and decrease in their ownership in past 3 months winners and losers |                                 |                  |                     |                  |                     |                  |                     |                  |                     |                  |                     |                  |
|  | Foreign institutional investors |                  |                     |                  | Mutual funds        |                  |                     |                  | Dealers             |                  |                     |                  |
|  | Ra,ΔIN <sup>+</sup>             | ΔIN <sup>+</sup> | Ra,ΔIN <sup>□</sup> | ΔIN <sup>□</sup> | Ra,ΔIN <sup>+</sup> | ΔIN <sup>+</sup> | Ra,ΔIN <sup>□</sup> | ΔIN <sup>□</sup> | Ra,ΔIN <sup>+</sup> | ΔIN <sup>+</sup> | Ra,ΔIN <sup>□</sup> | ΔIN <sup>□</sup> |
| t = 3 to 4 losers  | 3.794                           | 0.890            | -1.468              | -0.694           | 5.737               | 0.999            | -3.173              | -0.963           | 2.319               | 0.325            | 0.111               | -0.338           |
| Winners  | 2.741                           | 0.581            | -0.995              | -0.488           | 5.258               | 0.946            | -2.990              | -0.905           | 1.785               | 0.294            | 0.267               | -0.360           |
| t = 3 to 5 losers  | 2.893                           | 1.428            | -0.568              | -1.060           | 4.263               | 1.376            | -2.205              | -1.404           | 1.600               | 0.437            | 0.349               | -0.440           |
| Winners  | 1.993                           | 0.885            | -0.432              | -0.733           | 4.26                | 1.383            | -2.095              | -1.358           | 1.458               | 0.424            | 0.422               | -0.491           |
| t = 3 to 6 losers  | 2.359                           | 1.857            | -0.310              | -1.346           | 3.375               | 1.581            | -1.736              | -1.733           | 1.461               | 0.513            | 0.196               | -0.513           |
| Winners  | 1.699                           | 1.124            | -0.767              | -0.950           | 3.676               | 1.661            | -4.571              | -1.660           | 1.268               | 0.527            | 0.292               | -0.594           |
| Panel D. Abnormal returns and changes in three major institutional share ownership for stocks with subsequent biggest increase and decrease in their ownership in past 6 months winners and losers |                                 |                  |                     |                  |                     |                  |                     |                  |                     |                  |                     |                  |
|  | Foreign institutional investors |                  |                     |                  | Mutual funds        |                  |                     |                  | Dealers             |                  |                     |                  |
|  | Ra,ΔIN <sup>+</sup>             | ΔIN <sup>+</sup> | Ra,ΔIN <sup>□</sup> | ΔIN <sup>□</sup> | Ra,ΔIN <sup>+</sup> | ΔIN <sup>+</sup> | Ra,ΔIN <sup>□</sup> | ΔIN <sup>□</sup> | Ra,ΔIN <sup>+</sup> | ΔIN <sup>+</sup> | Ra,ΔIN <sup>□</sup> | ΔIN <sup>□</sup> |
| t = 6 to 7 losers  | 3.752                           | 0.903            | -1.578              | -0.680           | 5.573               | 1.006            | -3.382              | -0.959           | 1.896               | 0.317            | -0.091              | -0.335           |
| Winners  | 2.636                           | 0.587            | -1.134              | -0.499           | 5.115               | 0.922            | -3.243              | -0.894           | 1.559               | 0.285            | -0.008              | -0.357           |

Table 6 (cont.). Performance and persistence of stocks with subsequent biggest increase and decrease in institutional share ownership in size's winners and losers

|                   | Foreign institutional investors |               |                         |                     | Mutual funds      |               |                         |                     | Dealers           |               |                         |                     |
|-------------------|---------------------------------|---------------|-------------------------|---------------------|-------------------|---------------|-------------------------|---------------------|-------------------|---------------|-------------------------|---------------------|
|                   | $Ra, \Delta IN^+$               | $\Delta IN^+$ | $Ra, \Delta IN^\square$ | $\Delta IN^\square$ | $Ra, \Delta IN^+$ | $\Delta IN^+$ | $Ra, \Delta IN^\square$ | $\Delta IN^\square$ | $Ra, \Delta IN^+$ | $\Delta IN^+$ | $Ra, \Delta IN^\square$ | $\Delta IN^\square$ |
| t = 6 to 8 losers | 2.679                           | 1.450         | -0.629                  | -1.034              | 4.062             | 1.371         | -2.340                  | -1.391              | 1.460             | 0.446         | 0.149                   | -0.440              |
| Winners           | 1.906                           | 0.898         | -0.529                  | -0.748              | 4.100             | 1.342         | -2.195                  | -1.323              | 1.317             | 0.419         | 0.184                   | -0.490              |
| t = 6 to 9 losers | 2.139                           | 1.862         | -0.398                  | -1.313              | 3.147             | 1.589         | -1.891                  | -1.681              | 1.424             | 0.513         | 0.114                   | -0.519              |
| Winners           | 1.569                           | 1.133         | -0.337                  | -0.971              | 0.360             | 1.607         | -1.886                  | -1.645              | 1.201             | 0.520         | 0.116                   | -0.595              |

Notes: Panels A, B, C and D report separately the average buy-and-hold abnormal returns and changes in share ownership of the three major types institutional investors for stocks with the biggest increase and decrease in their share ownership over the holding period in the past ( $t = 0$  to 1, 2, 3, and 6) winners (stocks are sorted in the smallest decile of past size) and losers (stocks are sorted in the biggest decile of past size) separately over the following 1, 2, and 3 months relative to changes in their share ownership at  $t = 0$  to 1, 2, 3, and 6 months (To save space, this table does not show the results over the following 4, 6, 8, 10 and 12 months). The equally weighted buy-and-hold abnormal returns are also computed in the winners and losers.  $Ra, \Delta IN^+(Ra, \Delta IN^-)$  and  $\Delta IN^+(\Delta IN^-)$  are presented separately as the mean buy-and-hold abnormal returns and changes in share ownership of three major institutional investors for stocks with the biggest increase (decrease) in their share ownership over the holding period in the past winners or losers.

## Conclusion

In terms of the price-impact of changes in institutional ownership, this study extends the methodologies of Nofsinger and Sias (1999) and Wermers (1999) in clarifying which combination factor of previous changes in institutional ownership with past earnings, book-to-market ratio, or size would present significant correlations with abnormal returns in the Taiwan stock market. In addition to expanding the work of Nofsinger and Sias (1999) and Wermers (1999) to investigate the dependence between earnings (book-to-market ratio or size) and changes in institutional ownership during the same holding period, this study further extends the designs of Jones and Winters (1999) in analyzing the dependence between the increase/decrease in abnormal returns during different holding periods and the corresponding increase/decrease in changes in institutional ownership. By following this procedure, we are able to explore cross-sectional and time-series information on subsequent abnormal returns and the corresponding changes in institutional ownership.

The two-way sorting procedure used in this study reveals that in addition to standardized unexpected earnings, book-to-market ratio or firm size, it is necessary to bring the changes in the three major institutional investors' share ownership into the model to represent abnormal returns in the Taiwan stock market with higher accuracy when using the diversified momentum strategy. Moreover, if other investors prioritize buying the portfolios that have been winners of the book-to-market ratios and have experienced large decreases in shareholding by foreign institutional investors, and hold them for two months, the abnormal returns will be highest.

In terms of the question of whether subsequent changes in institutional ownership have an obvious influence on abnormal returns driven by earnings, book-to-market ratio and firm size, it is consistently found that the performance persistence of both the original winners and losers is positively influenced by the herding levels of subsequent shareholding, which is consistent with the findings of returns by Nofsinger and Sias (1999). If investors purchase the winners or losers sorted by one of the three previously proposed variables with the largest increase in institutional shareholding under a one-month holding period, the average positive abnormal returns would then be the most significant in Taiwan. Furthermore, the empirical results indicate that for the original winners or losers with the largest increase in institutional shareholding during the holding period, the gradual increase in the changes in institutional ownership may facilitate a reverse in the gradual decrease in buy-and-hold abnormal returns. These findings in Taiwan differ from the conclusions drawn by Jones and Winters (1999). As for the influence of return performance persistence in the Taiwan stock market, investors may regard "changes in institutional ownership during the holding period" as a signal of "short-term (one month) following and reverse adjustment."

The major contributions of this study may lie in the development of a more precise two-way simultaneous sorting procedure to clarify which combination factor(s) of previous changes in the institutional ownership with past earnings, book-to-market ratio or firm size might be the source(s) of momentum for abnormal returns in the Taiwan stock market. Furthermore, this study clarifies the cross-sectional and time-series correlations and information connotations between subsequent abnormal returns and corresponding changes in institutional ownership.

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