African Journal of Business Management Vol.5 (8), pp. 3121-3131, 18 April 2011
Available online at http://www.academicjournals.org/AJBM
DOI: 10.5897/AJBM10.314
ISSN 1993-8233 ©2011 Academic Journals

Full Length Research Paper

The impact of foreign institutional herding on low-turnover stocks in the Taiwan stock market

Yen-Hsien Lee[1]* and Hao Fang[2]

[1]Department of Finance, Chung Yuan Christian University, No. 200, Chung Pei Rd., Chung Li, Taiwan 320, R.O.C.
[2] Graduate Institute of Assets and Property Management, Hwa Hsia Institute of Technology, No. 111, Gong Jhuan Rd., Chung Ho, Taipei, Taiwan 23568, R.O.C.

Accepted 20 July 2010

This study uses panel threshold regression to analyze the impact of institutional herding behavior on abnormal stock returns in Taiwan. Our panel threshold model is constructed to explore whether or not and how the price impact of foreign institutional investors' herding is modulated by stock turnover in the Taiwan stock market. The empirical results of this study find significant evidence of a threshold effect which divides the stocks into lower-turnover and higher-turnover firms. It is found that there is an apparent increase in the subsequent abnormal returns on lower-turnover stocks bought in bulk by foreign investors. To be specific, if other investors follow foreign investors by purchasing the stocks of lower-turnover firms on the TAIEX belonging to the Electronics and Textiles sectors and hold them for one month, the subsequent performance persistence is significantly better. The signals for combining the price impact of changes in share ownership by foreign institutional investors with stock liquidity reveal further information for improving the performance of asset reallocation decisions in Taiwan.

Key words: Institutional herding, the price-impact of herding, stock turnover, panel threshold, Taiwan stock market.

INTRODUCTION

Foreign institutional investors in the Taiwan stock market are well funded and well equipped to engage in professional investment. Being characterized by trading behavior and stock picking strategies that are more rational than those of general investors, they place a greater emphasis on long-term strategies than domestic institutional investors. Although foreign institutional investors hold just 20% of total equity and their trading accounts for only 8% of total turnover in the Taiwan stock market, their share ownership and trading amounts are greater than those of local institutional investors, implying the possibility of a greater influence on stock prices. Since the government has gradually loosened the restrictions on the share ownership of foreign investors, the Taiwan stock market has become more attractive to them. Based on the market structure of the plain-plate type and the smaller firm sizes of traded stocks than those in the developed stock markets, the impact of their herding behavior on the post-herding abnormal returns of these stocks in the Taiwan stock market is greater than that in the developed stock markets. It is also the reason why foreign institutional investors in emerging stock markets such as Taiwan trade stocks on a shorter-term basis than in more mature stock markets.

Nofsinger and Sias (1999) define herding behavior as one group of investors trading in the same direction over a section of periods. Some studies (such as Lakonishok, Shleifer and Vishny (1992) and Wermers (1999)) measure the overbought and oversold by institutional investors based on the changes in the numbers of institutional investors, while many studies (such as Nofsinger and Sias (1999), Cai, Kaul and Zheng (2000) and Sias, Starks and Titman (2002)) measure the overbought and oversold by institutional investors based on their changes in share ownership. Borensztein and Gaston (2003) propose that when the trading of a particular stock is frequent and primarily flows in one direction, the direction with fewer trades might have the

*Corresponding author. E-mail: yh@cycu.edu.tw

greater dollar amount. To be more specific, the overbought–oversold measure based on the number of institutional investors in a stock joining or withdrawing represents the average overbought–oversold willingness of all institutional investors, whereas the overbought–oversold measure based on the change in the share ownership of institutional investors further implies a corresponding joining in or withdrawal of the security position held by institutional investors against individual investors in the market. Thus, this study uses the change in the share ownership of foreign institutional investors as a measure of their herding.

Dennis and Weston (2000), Chakravarty (2001), and Sias, Starks and Titman (2002) demonstrate that the relationship between changes in institutional ownership and returns measured over the same period results primarily from the price effects of institutional herding. The results of Nofsinger and Sias (1999) and Wermers (1999) show that subsequent abnormal returns of heavy buying portfolios by institutional investors are significantly larger than those of heavy selling portfolios. Sias (2004) and Grinblatt, Titman and Wermers (1995) find that institutional herding is weakly positively correlated with future returns; however, the results of Dennis and Weston (2000), Chakravarty (2001), Sias, Starks and Titman (2002) suggest that the subsequent returns of institutional herding from fads, reputation herding, or characteristic herding are reversed. The different conclusion shows that an important variable is possibly ignored when we consider the price impact of institutional herding.

Both financial academics (such as Blume, Easley and O'Hara (1994), Lee and Swaminathan (1998)) and practitioners have recognized that past trading volume provides valuable information in the prediction of future stock returns.[1] To avoid the situation where raw trading volume is likely to be highly correlated with firm size, most previous studies have used turnover as a measure of the trading volume in a stock. Although few studies display contrasting results, most studies (Lee and Swaminathan, 2000; Datar, Naik and Radcliffe, 1998) conform to the liquidity hypothesis that firms with relatively low turnover are less liquid and command a higher expected return. In an emerging equity market like Taiwan with very high turnover, it is of interest for us to combine the herding index of changes in foreign institutional ownership and the volume index of turnover to accurately predict future stock returns.

Falkenstein (1996) and Gompers and Metrick (2001) propose that institutional investors have a liquidity preference; that is, institutional investors prefer liquid stocks with larger turnovers. However, according to the liquidity hypothesis, the subsequent performance of lower turnover stocks with large herding by institutional investors should be stronger. The results of Elton, Gruber, Das and Hlavka (1993) and Carhart (1997) also provide evidence that the subsequent abnormal returns of lower-turnover mutual funds are larger. The post-herding prices of less liquid stocks should be higher especially in the Taiwan stock market with very high turnover; thus, the price impact of foreign institutional herding where there is lower turnover may occur in emerging equity markets such as Taiwan. It is thus worth adopting an objective research method when exploring the price impact of foreign institutional herding on the stocks that are less liquid in Taiwan.

To be specific, we apply the panel threshold model proposed by Hansen (1999) and use observations of threshold variables to estimate the adaptive threshold in a panel data set. We employ stock liquidity as the threshold variable to explore the impact of foreign institutional herding on stocks' abnormal returns while controlling for the variation caused by stock turnover. We observe the relationship between changes in foreign institutional investors' share ownership and stock turnover in the same interval with post-herding abnormal returns by adopting the panel threshold method. Through this procedure, we can evaluate whether abnormal returns driven by changes in foreign institutional investors' share ownership are markedly differentiated by stock turnover and analyze the information content embedded therein.

The empirical results of this study indicate that there is one threshold which separates the firms based on stock turnover. Lower-turnover firms in terms of the TSE-listed stocks are significantly affected by the price impact of foreign institutional investors' herding. If other investors follow the foreign institutional investors and purchase the stocks of lower-turnover firms, especially in the Electronics and Textiles sectors, the average abnormal return would be better if those stocks were held for one month or so. This study contributes to the literature in three main areas. First, it demonstrates that the price impact of institutional herding focuses on the less liquid stocks, which supports the liquidity hypothesis and the price impact of institutional herding. Second, the design of a panel threshold model can objectively quantify the extent of stock turnover rather than assuming in advance the degree of such constraints. Third, the ability to explain the impact of foreign institutional herding on stocks' abnormal returns in Taiwan is significantly enhanced by our econometric method. The remainder of this paper is organized as follows. Section 2 describes the research design and methodology, including variable measurement, sample type and the establishment of the panel threshold model. The empirical results are discussed in Section 3, including the data, basic statistics and results of the estimation. The conclusions are summarized in Section 4.

Measurement of the variables and scope of data

Measurement of the variables

Abnormal returns: This study calculates the equally

[1] Lee and Swaminathan (2000) find that past trading volume predicts both the magnitude and the persistence of future price momentum.

weighted buy-and-hold abnormal return of individual stock i for a given month based on the following capital asset pricing model:[2]

$$R_i^a = \left(r_{i,t1-}r_{f,t1}\right) - \beta_i\left(r_{m,t1} - r_{f,t1}\right),\ t1 = -11,\ldots,\ 0. \quad (1)$$

Measurement of changes in institutional ownership: The share ownership of foreign institutional investors is defined as their shareholdings divided by the number of shares outstanding. The foreign institutional investors referred to in this study are qualified foreign institutional investors (QFIIs) and general foreign institutional investors (GFIIs). An increase (decrease) in the fraction of shares held by foreign investors represents a decrease (increase) in the proportion held by other investors.

Liquidity: Since raw trading volume is unscaled and is likely to be highly correlated with firm size, this study follows the approach used by most previous studies [such as Lee et al. (2000) and Campbell, Grossman and Wang (1993)] whereby turnover is regarded as a measure of the trading volume in a stock. We define the average monthly turnover as the ratio of the number of shares traded each month to the number of shares outstanding at the end of the month:

$$TO_{i,t} = T_{i,t} / Q_{i,t} \quad (2)$$

where $T_{i,t}$ ($Q_{i,t}$) is the number of shares traded (the number of shares outstanding) of stock *i* in the t^{th} month, and $TO_{i,t}$ is the monthly turnover of stock *i* in the t^{th} month.

Scope of data

Since most foreign institutional investors prefer to trade listed stocks based on the considerations of good visibility and high liquidity, we select listed companies excluding preferred stocks, warrants and full-cash delivery stocks in the Taiwan stock market. To satisfy the requirement that there can not be a vacancy in each variable or period of the panel threshold model, this study uses the monthly shareholding ratio of foreign institutional investors over the period from January 2000 to June 2008. To compute the abnormal returns of individual stocks, we use the monthly returns on individual TSE-listed stocks that are all traded over the above period and the monthly returns on the Taiwan weighted stock index (TAIEX) during the same period.

METHODOLOGY

Nofsinger and Sias (1999) found that changes in institutional ownership help to forecast stock returns, even after controlling for return momentum. Chakravarty (2001), Dennis and Weston (2000), and Sias, Starks, and Titman (2002) conclude that institutions trading in the same direction measured by the changes in institutional ownership impact security prices. Moreover, Falkenstein (1996) and Gompers and Metrick (2001) demonstrate that institutional investors prefer liquid stocks with larger turnover. In addition to changes in institutional ownership, most studies propose that security trading volume is helpful to other investors in predicting stock prices. However, there is no consistent point of view regarding how past volumes affect stock prices. According to the liquidity hypothesis of Amihud and Mendelson (1986),[3] Campbell, Grossman and Wang (1993), Conrad, Hameed, and Niden (1994), Brennan and Subrahmanyam (1996), Datar, Naik and Radcliffe (1998), Cooper (1999) and Lee and Swaminathan (2000) propose that firms with low trading volume will generate higher expected returns, and firms with high trading volume will generate price reversals. Nevertheless, a few studies such as Ying (1966), Morse (1980) and Karpoff (1987) find that lower volumes are accompanied by price declines, and higher volumes are accompanied by price increases. To simultaneously explore the impact of institutional herding and stock liquidity on subsequent stock prices, this study first uses a panel data model to analyze the relationship between changes in institutional ownership, stock turnover and subsequently abnormal returns. In addition, foreign institutional investors place a greater emphasis on long-term strategies than domestic institutional investors in the Taiwan stock market. They often overbuy or oversell the stocks on a continuous basis for a sectional period, even for many days or several months, to pull stock prices up or down. Thus, we use past changes in the institutional ownership ($\Delta IN_{i,t-1}$) other than the contemporaneous ownership change ($\Delta IN_{i,t}$) to measure the degree of foreign institutional herding. In addition, this is the reason why we use monthly data frequency other than daily data frequency. The relationship between these variables can be summarized as the following regression:

$$R_{i,t}^a = u_i + \alpha_1 \Delta IN_{i,t-1} + \alpha_2 TO_{i,t-1},\ i = 1,2,\ldots,N,\ t = 1,2,\ldots,T.. \quad (3)$$

$R_{i,t}^a$ indicates the abnormal returns of stock *i* in the t^{th} month, $\Delta IN_{i,t-1}$ indicates changes in the share ownership of stock *i* held by foreign institutional investors in the last month, and $TO_{i,t-1}$ indicates the turnover of stock *i* in the previous month. *T* is the number of months considered, and *N* is the number of TSE-listed stocks selected in this study.

The coefficient α_1 of $\Delta IN_{i,t-1}$ represents the predictability of the impact of changes in the share ownership of foreign institutional investors in the last month on abnormal returns in the current month. To effectively combine the price impact of institutional herding and the liquidity hypothesis of stock turnover, this study further adopts the panel threshold method of Hansen (1999) in

[2] $r_{i,t1}$ is the monthly return for individual stock i for this month and the past 11 months; $r_{f,t1}$ is the risk-free rate for this month and the past 11 months, which is the interest rate for a 1-month term deposit offered by Taiwan's First Bank; $r_{m,t1}$ is the change ratio of the net value of the TAIEX for this month and the past 11 months.

[3] According to the liquidity hypothesis, firms with relatively low trading volume are less liquid and therefore command a higher expected return.

order to explore whether the subsequent price impact of institutional herding on the less liquid stocks with lower turnover is larger than in the case of the liquid stocks.[4]

$$R^a_{i,t} = u_i + \theta TO_{i,t-1} + \beta^{1)} \Delta IN_{i,t-1} I(TO_{i,t-1} > \gamma) + \beta^{2)} \Delta IN_{i,t-1} I(TO_{i,t-1} \le \gamma) + e_{i,t} \quad (4)$$

where $I(.)$ is the indicator function, which is equal to 1 when $TO_{i,t-1} > \gamma$, and 0 otherwise. γ is the value of the threshold, which is unknown but can be estimated. The coefficient $\beta^{(1)}$ denotes the parameter vector in the higher stock turnover regime, and $\beta^{(2)}$ denotes the parameter vector in the lower regime.

The meaning of equation (4) is accounted for as follows. Our sample is divided into two regimes depending on whether the threshold variable of $TO_{i,t-1}$ is lower or higher than the threshold value γ. Thus, when $TO_{i,t-1} > \gamma$, firms are in a high regime of threshold variables; otherwise, firms are in a low regime. Moreover, if the turnover of the stock that foreign investors buy gradually decreases, it indicates that foreign investors do not deem the share price to be reasonable at the moment, and they will not increase their holdings until the share price gradually stabilizes. At this time the buyers' strength will surpass the sellers' strength, and the share price will be pushed up. Thus, this study assumes that the abnormal returns of lower-turnover firms are significantly positive when foreign institutional investors increase their share ownership in firms with lower turnover, suggesting a positive $\beta^{(2)}$.[5] Alternatively, based on the foreign investors' long-term investment considerations, if the turnover of the stock that they bought gradually increases, it indicates that foreign investors deem the share price reasonable and they thus substantially increase their holdings. After both the share price and the trading volume soar for a period of time, the price trend will reverse, and foreign investors will gradually reduce their holdings. At this time the sellers' strength will surpass the buyers' strength, and the share price will fall. Thus, this study assumes that the abnormal returns of higher-turnover firms are negative when foreign institutional investors increase their share ownership in firms with higher turnover, suggesting aninsignificantly negative $\beta^{(1)}$. According to the liquidity hypothesis identified by Campbell, Grossman and Wang (1993), Conrad, Hameed and Niden (1994), and Lee and Swaminathan (2000), we create the following null hypothesis to explore whether there is a similar result in the Taiwan stock market with very high turnover. The null hypothesis constrained by the above statement is to test $H_0 : \beta^{(2)} > 0, \beta^{(1)} \le 0$.

[4] Foreign institutional investors prefer to trade in the stocks of high-turnover firms rather than the stocks of low-turnover firms in the Taiwan stock market; however, we mainly explore whether there is a difference between the post-herding premium of foreign institutional investors trading in the lower-turnover stocks and the post-herding premium of their trading in the higher-turnover stocks. That is, we focus on the point of view that the trading itself reflects information signals created by these foreign trading activities rather than the trading of foreign institutional investors being based on information asymmetry.

[5] In practice, since the total volumes of the securities the investors are intending to sell are limited to being smaller than the total volumes of the securities they are planning to buy in the stock market, the impact on price of institutional investors selling the stocks is smaller than the price impact of their buying the stocks. In addition, the securities authorities mainly encourage investors to buy the stocks rather than sell the stocks. Thus, this study does not consider the situation in terms of the impact on price of institutional investors selling stocks and the level of these stocks' turnover.

This study is based on Hansen's (1999) suggestions to estimate and test the panel threshold model. First, we rewrite equation (4) as shown in equation (5).

$$R^a_{i,t} = u_i + \theta\, TO_{i,t-1} + \beta \Delta IN_{i,t-1}(\gamma) + e_{i,t} \quad (5)$$

where $\beta \Delta IN_{i,t-1}(\gamma) = \begin{cases} \beta^{(1)} \Delta IN_{i,t-1}, & if \;\; TO_{i,t-1} > \gamma ; \\ \beta^{(2)} \Delta IN_{i,t-1}, & if \;\; TO_{i,t-1} \le \gamma . \end{cases}$

To delete individual-specific means, this study sets up the de-meaning regression model. Then, we stack the time series data for an individual with one time period deleted, and let the data be stacked over all individuals. We can obtain equation (5) as equation (6):[6]

$$R^{a*} = TO^* \theta + \Delta IN^*(\gamma)\beta + e^* \quad (6)$$

For any given γ, the slope coefficient β can be estimated by ordinary least squares (OLS). Hansen (1999) recommended the estimation of γ by using least squares. Hence, the least squares estimator of $\hat{\gamma}$ is obtained, and the slope coefficient estimate is $\hat{\beta} = \hat{\beta}(\gamma)$.

It is important to determine whether the threshold effect is statistically significant. This can be examined by testing whether the coefficients $\beta^{(1)}$ and $\beta^{(2)}$ in the two regimes are the same. The coefficients in the two regimes have different explanations, implying that there is an asymmetric threshold effect at least on the value of threshold variable $TO_{i,t-1}$ for changes in share ownership by foreign institutional investors explaining abnormal returns. The null hypothesis of no threshold effect is as follows:

$$H_0 : \beta^{(1)} = \beta^{(2)} \quad (7)$$

The likelihood ratio of H_0 suggested by Hansen (1999) is based on the following test statistic:[7]

[6] $R^{a*} = \begin{bmatrix} R^{a*}_1 \\ \vdots \\ R^{a*}_i \\ \vdots \\ R^{a*}_n \end{bmatrix}, TO^* = \begin{bmatrix} TO^*_1 \\ \vdots \\ TO^*_i \\ \vdots \\ TO^*_n \end{bmatrix}, \Delta IN^*(\gamma) = \begin{bmatrix} \Delta IN^*_1(\gamma) \\ \vdots \\ \Delta IN^*_i(\gamma) \\ \vdots \\ \Delta IN^*_n(\gamma) \end{bmatrix}, e^* = \begin{bmatrix} e^*_1 \\ \vdots \\ e^*_i \\ \vdots \\ e^*_n \end{bmatrix}$.

$R^{a*}_i = \begin{bmatrix} R^{a*}_{i2} \\ \vdots \\ R^{a*}_{iT} \end{bmatrix}, TO^*_i = \begin{bmatrix} TO^*_{i2} \\ \vdots \\ TO^*_{iT} \end{bmatrix}, \Delta IN^*_i(\gamma) = \begin{bmatrix} \Delta IN^*_{i2}(\gamma) \\ \vdots \\ \Delta IN^*_{iT}(\gamma) \end{bmatrix}, e^*_i = \begin{bmatrix} e^*_{i2} \\ \vdots \\ e^*_{iT} \end{bmatrix}$.

[7] Where S_0 and S_1 are the residual sum of squares under the null and alternative of (8) respectively, and $\hat{\sigma}^2 = \hat{e}^{*'} \hat{e}^* / n(T-1)$ is the residual variance under H_1, where the residual vector is $\hat{e}^* = \hat{e}^*(\hat{\gamma})$.

$$F_1 = S_0 - S_1(\hat{\gamma}) / \hat{\sigma}^2 \quad (8)$$

Hansen (1996) suggested a bootstrap procedure which attains the first-order asymptotic distribution to simulate the asymptotic distribution of the likelihood ratio test. However, it is necessary to examine whether the system in this study has more than one threshold. First, we employ the F_1 test to assess the null hypothesis of no threshold. If this null hypothesis is rejected, implying at least one threshold, we proceed to test the null of one threshold against the two thresholds. F_2 is used to denote this test.[8]

$$F_2 = S_1(\hat{\gamma}_1) - S_2^{\tau}(\hat{\gamma}_2^{\tau}) / \hat{\sigma}^2 \quad (9)$$

If F_2 is significant, the null of one threshold is rejected and two thresholds are expected. We repeat this procedure to test for the existence of two or more thresholds.

When there is a threshold effect (that is, $\beta^{(1)} \neq \beta^{(2)}$), $\hat{\gamma}$ is consistent for the true value γ_0 and the asymptotic distribution is highly non-standard. Hansen (1999) argues that the best way to form confidence intervals for γ is to form the no-rejection region $C(\alpha)$. The no-rejection region of confidence level $(1-\alpha)$ is $LR_1(\gamma) \leq C(\alpha)$ and is used to test the hypothesis $H_0 : \gamma = \gamma_0$, where[9]

$$LR_1(\gamma) = S_1(\gamma_0) - S_1(\hat{\gamma}) / \hat{\sigma}^2 \quad (10)$$

If the two thresholds cannot be rejected, the confidence intervals for the two threshold parameters (γ_1, γ_2) subsequently need to be constructed.

EMPIRICAL RESULTS

The findings of the panel unit root and basic statistics

To avoid spurious regression, the variables in Hansen's (1999) panel threshold regression need to be stationary. We use the well-known LLC (Levin, Lin and Chu, 2002), IPS (Im, Pesaran and Shin, 1997) and Hadri (2000) methods to proceed with the panel unit root tests since the data are all panel data in this study.[10] Regardless of the stationarity test used, all the panels ($\Delta IN_{i,t-1}$, $TO_{i,t-1}$, and $R^a_{i,t}$) are stationary by nature. The stationary characteristics of these variables enable the estimations of the panel threshold regression to move forward.

In this study, TSE-listed stocks including a subset of 247 firms during the January 2000- June2008 period are designed for balanced panels. Table 1 reports the basic statistics of the main variables. The means of $R^a_{i,t}$, $\Delta IN_{i,t-1}$, and $TO_{i,t-1}$ are 0.767, 0.052, and 16.800, respectively, and the standard deviations, maximum and minimum values, and skewness and kurtosis values of these variables are also reported.[11] The large values of the average abnormal returns show that the price impact of foreign institutional herding in the Taiwan stock market is larger than in the mature stock market. The stock turnover has the largest standard deviation of 21.636, in sharp contrast to the 4.038 and 1.355 for the remaining two variables, respectively. In addition, the skewness is far from 0 and the kurtosis is far from 3; thus, these variables all follow non-normal distributions.

Results of tests and estimation of panel threshold

This study first adopts the panel data model to explore whether there is a simultaneous impact of foreign institutional herding and stock liquidity on subsequent stock performance in the Taiwan stock market. Through the results of the Hausman test in Table 2a, we decide to use the estimate for the fixed effects model. The results of the estimation of the panel data model in Table 2b confirm that changes in foreign institutional ownership and stock turnover in the previous month will significantly and positively affect the subsequent stocks' abnormal returns. On the one hand, the evident and positive impact of stock turnover on subsequent stock performance is not unusual since this reflects the total market phenomenon of high trading volumes in the previous month promoting stock prices in an emerging market like Taiwan with very high turnover. On the other hand, the evident and positive impact of changes in foreign institutional ownership in the previous month on the subsequent stocks' abnormal returns shows that foreign institutional investors in the Taiwan stock market trade stocks based on shorter-term strategies than those in more mature stock markets.[12]

This study then uses the *F* statistic to examine the presence of the threshold effect in the two turnover regimes, and adopts the *LR* test to examine the potential threshold value. Table 3 shows that F_1 exceeds the critical

[8] Where $\hat{\sigma}^2 = S_2^{\tau}(\hat{\gamma}_2^{\tau}) / n(T-1)$ and γ_2 is the second threshold.

[9] $S_1(\gamma_0)$ and $S_1(\hat{\gamma})$ are the residual sum of squares given the true threshold γ_0 and estimated threshold $\hat{\gamma}$, respectively.

[10] The LLC (2001) and IPS (1997) techniques assume that the null hypothesis is set as a unit root, and Hadri (2001) assumes that the null hypothesis is set as stationary.

[11] The means of the one-month abnormal returns $R^a_{i,t}$ from 2000.01 to 2005.12, 2006.12, 2007.12 and 2008.06 are 0.630, 0.600, 0.728 and 0.767, respectively. That is, the one-month abnormal returns present the stable increase in price.

[12] Many studies (such as Nofsinger and Sias (1999), Wermers (1999) and Sias (2004)) have demonstrated that institutional investors in mature stock markets like the U.S. trade stocks on a quarterly frequency.

Table 1. Summary statistics of variables.

Variables	Mean	Std. dev.	Max	Min	Skew.	Kurt.
$R_{i,t}^{a}$	0.76688	4.03801	33.22512	-15.19706	1.22901	4.29466
$\Delta IN_{i,t-1}$	0.05186	1.35509	30.44	-42.61	-4.05897	181.14920
$TO_{i,t-1}$	16.80002	21.63623	264.4124	0.001	2.945232	12.27619

Table 2a. Hausman test for fixed effects or random effects.

Hausman test	P-value	Test result
7.5383	0.0231*	fix effect

H_0: the random effects model is established; H_1: the fixed effects model is established. * denotes significance at the 10% level.

Table 2b. Estimation results for the panel data model.

Regressor	Coefficient estimate	T-value
constant	-0.37915	-5.78680***
$TO_{i,t-1}$	0.06899	54.04328***
$\Delta IN_{i,t-1}$	0.02926	1.69542*

Note: *** denotes significance at the 1% level, and * denotes significance at the 10% level.

value at the 10% significance level, while F_2 and F_3 are smaller than the critical values at the same significance level. Thus, the null hypothesis of no threshold is not accepted and one threshold is clearly suggested. Table 1 indicates that the standard deviation of the stock turnover is nearly 21.636, and the maximum and minimum values are nearly 264.412 and 0.001, respectively. Therefore, using at least one threshold may avoid neglecting the change in stock liquidity. The bottom part of Table 3 reports the estimated threshold, which is 41.317% and reaches the statistically significant level. That is, the impact of changes in the foreign investors' share ownership on abnormal returns may be further divided into two regimes, which are referred to as lower turnover if their stock turnover falls below 41.317% and results in higher turnover if it exceeds 41.317%, respectively.

Subsequently, we can estimate the corresponding confidence intervals by conducting the *LR* test. Figure 1 shows that the 95% confidence intervals range from 31.634% to 49.298% for the significant threshold, while the likelihood ratio lies beneath the dotted line. Table 4 reports the number of firms in each category and in eachyear.[13] Figure 2 indicates that, on average, roughly 222-223 firms fall in the lower-turnover regime each month, while approximately 24-25 firms fall in the higher-turnover regime in each month. The use of two regimes could take the heteroskedasticity due to the stock turnover into account.

In addition to the conventional OLS standard errors, this study uses the White-corrected standard errors to consider the heteroskedasticity which violates one of the assumptions of our asymptotic analysis.[14] The regression slope estimates, OLS and White-corrected standard errors are shown in Table 5. We confirm that, similar to the results in Table 2b, $TO_{i,t-1}$ and its powers are statistically significant, indicating an obviously positive relationship between stock turnover and abnormal returns. The coefficients of changes in the foreign institutional investors' share ownership of primary interest suggest that the firms with the lower turnover as expected have the larger and significantly positive coefficient of 0.13593, and the firms with the higher turnover have the smaller

[13] First, we find the number of firms in each regime for each month. Then, we take an average of the number of firms in a specific regime for each month for each year.

[14] Based on the theory of Hansen (1999) for least squares threshold regression, we would expect the threshold estimates to be consistent and the distribution theory of Theorem 1 to be correct up to a scale effect.

Table 3. Tests for threshold effects and threshold estimates of turnover.

Panel A: F statistic and Bootstrap p-value		
Null Hypothesis	**F Statistic**	**Bootstrap p-value**
H_0 : no threshold H_1 : single threshold	F_1 = 24.600***	0.000
(Critical values of 10, 5, and 1%)		(12.115, 14.495, 19.778)
H_0 : single threshold H_1 : double threshold	F_2 = 17.294	0.110
(Critical values of 10, 5, and 1%)		(17.312, 20.678, 23.312)
H_0 : double threshold H_1 : triple threshold	F_3 =7.391	0.350
(Critical values of 10, 5, and 1%)		(11.543 , 17.067, 21.721)
Panel B: Threshold estimates		
Estimate	41.317	
95% confidence interval	[31.634, 41.317]	

The numbers in ( ) indicate the p-values of the bootstrap, and the numbers in [ ] indicate the confidence interval of the threshold estimates at the 95% significance level.
***, ** and * denote significance at the 1, 5 and 10% levels, respectively.

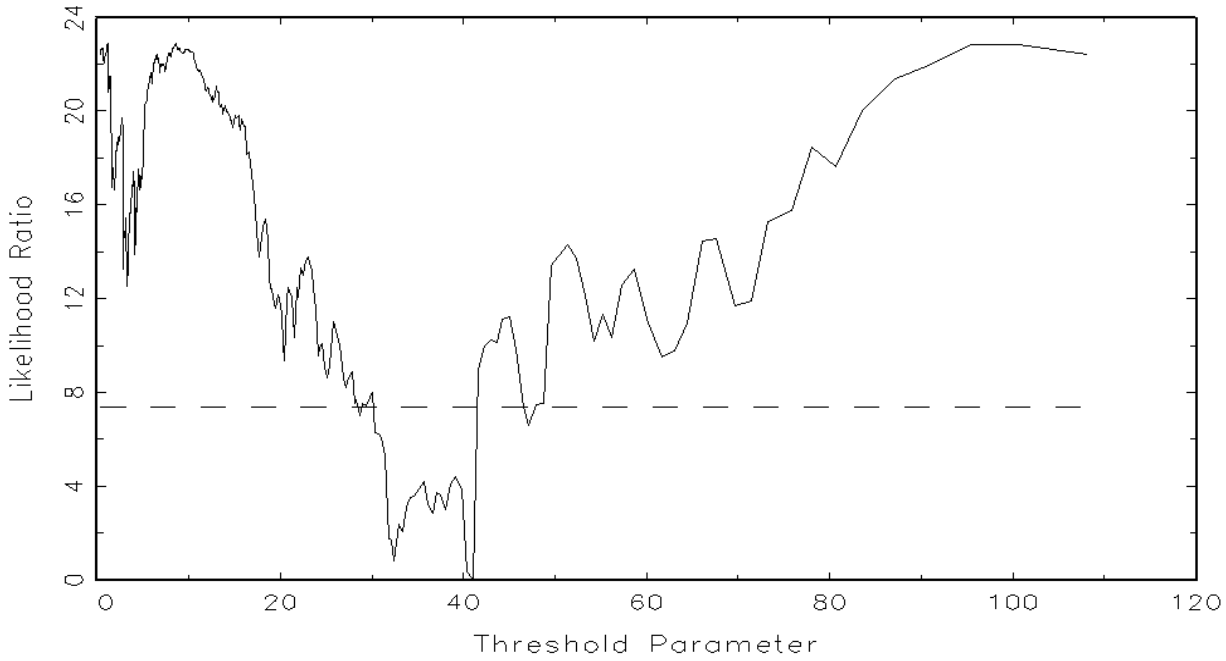

Figure 1. Confidence interval for turnover construction in the single threshold model.

smaller and insignificantly negative coefficient of -0.07735. The signs of the two coefficients support the price impact of the institutional herding of lower-turnover stocks. To be specific, the abnormal returns of lower-turnover firms (stock turnover of less than 41.317%) obviously increase when foreign investors increase their

Table 4. Number of firms in each regime by year.

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
$\Delta IN_{i,t-1}(TO_{i,t-1} \leq 41.3173)$	2633	2679	2573	2559	2539	2822	2768	2670	1373
$\Delta IN_{i,t-1}(TO_{i,t-1} > 41.3173)$	331	285	391	405	425	142	196	294	109
Total Number	2964	2964	2964	2964	2964	2964	2964	2964	1482

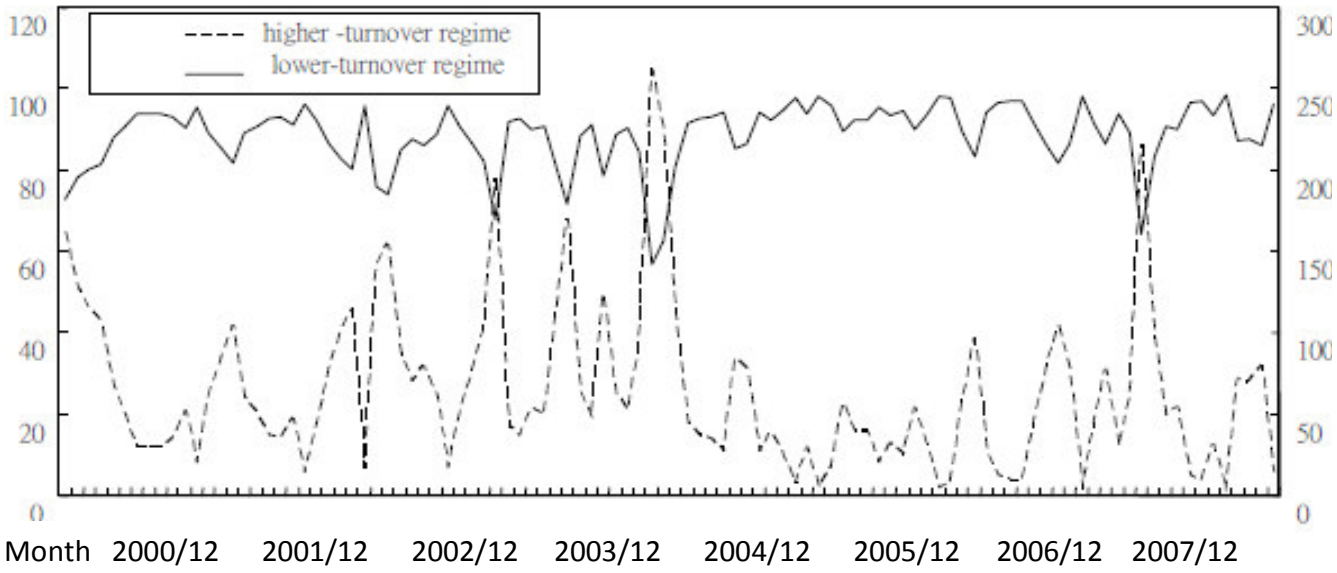

Figure 2. Number of firms in the higher-turnover and lower-turnover regimes in each.

Table 5. Regression estimates: single threshold model of turnover.

Regressor	Coefficient estimate	OLS SE	White SE
$TO_{i,t-1}$	0.07434***	0.00126	0.00194
$\Delta IN_{i,t-1}(TO_{i,t-1} \leq 41.3173)$	0.13593***	0.01979	0.02310
$\Delta IN_{i,t-1}(TO_{i,t-1} > 41.3173)$	-0.07735	0.04841	0.05398

*** denotes significance at the 1% level.

share ownership in them, with the regime attaining the 1% significance level. Since foreign institutional investors do not deem the share price to be reasonable at the buying point, the turnover of the stocks that they bought decreases and they will increase their holdings after the share price gradually stabilizes. At this time the buyers' strength will surpass the sellers' strength, and the share price will be pushed up. As expected, when foreign investors increase their share ownership in higher-turnover firms, the abnormal returns of these firms will decrease insignificantly. Since foreign institutional investors deem the share price to be reasonable, the turnover of the stocks that they bought increases and they will reduce their holdings after both the share price and the trading volume soar for a period of time. At this time the sellers' strength will surpass the buyers' strength, and the share price will fall. As Falkenstein (1996) and Gompers and Metrick (2001) demonstrated that institutional investors prefer to hold large-turnover stocks with good liquidity. Nevertheless, based on the liquidity hypothesis supported

by Conrad, Hameed and Niden (1994), Datar, Naik, Radcliffe (1998) and Lee and Swaminathan (2000), the large-scale herding on the part of foreign investors in relation to lower-turnover stocks easily pushes the prices of these stocks up; that is, there is a greater impact on the price movements of lower-turnover stocks. On the other hand, the stock turnover of most TSE-listed firms in Taiwan is obviously higher than that of firms in the developed countries. Thus, the subsequent abnormal returns of the lower-turnover stocks tend to increase significantly.

To clarify the industry distribution of lower-turnover stocks in the Taiwan stock markets, the 247 balanced panels in the TSE-listed stocks were divided into fifteen sectors based on the industry categories of the TSEC.[15] The results in Table 6 indicate that the average turnover of the Steel & Iron sector was higher, but its standard deviation was the largest among all sectors. Furthermore, we found that firms in the lower-turnover regime were apparently concentrated in five sectors, with the highest number of observations in the Electronics sector, followed in sequence by Textiles, Others, Food, and Electric & Machinery. Such results imply that, among the TSE-listed firms that foreign investors prefer to hold, subsequent abnormal returns on lower-turnover firms, especially those in the Electronics and Textiles sectors, are stronger. In other words, if other investors follow foreign investors in purchasing the stocks of lower-turnover firms in the TAIEX belonging to these two sectors and hold them for one month, the performance persistence of subsequent abnormal returns is significantly better.

CONCLUSION AND SUGGESTION

This study uses a panel threshold regression model to combine the price impact of foreign institutional herding and stock liquidity on firms listed on the Taiwan Stock Exchange during January 2000 to June 2008. By examining the presence of a threshold effect, this study analyzes whether stock turnover would obviously and asymmetrically affect the explanation of the effect of changes in foreign investors' share ownership on abnormal returns. We find significant evidence of one threshold which separates the firms based on stock turnover in Taiwan.

The empirical results of this study indicate that, among firms in a lower-turnover regime, the price impact of changes in the share ownership of foreign investors is positively significant. According to the liquidity preference of institutional investors, foreign investors tend to hold high-turnover firms in the TSE; nevertheless, low volume stocks behave like value stocks (Lee and Swaminathan (2000)), which means that the subsequent prices of these stocks due to the large-scale herding will be pushed up. While foreign investors increase their share ownership in firms with the stock turnover being lower than the estimated threshold of about 41.317%, the abnormal returns on these stocks obviously increase one month later. This result is similar to the results of Elton, Martin, Sanjiv and Matthew (1993) and Carhart (1997) in that the subsequent performances of lower-turnover mutual funds are larger, which is consistent with the liquidity hypothesis. Moreover, the panel threshold model proposed in this paper is able to objectively quantify the extent of the stock turnover rather than assuming the degree of such constraints in advance. It could also strengthen the reliability of explanations regarding abnormal returns due to institutional herding.

This study further finds that, among the TSE-listed firms whose shares are held by foreign investors, the price impact of the institutional herding of lower-turnover firms, especially in the Electronics and Textiles sectors, is particularly strong. The signals of changes in share ownership initiated by foreign investors will reveal further information for improving the performance of asset reallocation decisions in Taiwan. The results of this study contribute to studies on the price effects of institutional herding such as Chakravarty (2001), Dennis and Weston et al. (2000) and Sias, Starks, Titman (2002), and will be integrated with a series of studies on herding by controlling for the effect caused by firm characteristics. The panel threshold model constructed in this paper provides a good description of how the price impact of institutional herding is modulated by stock liquidity.

Previous studies (such as Nofsinger and Sias (1999), Wermers (1999) and Lin and Swanson (2003)) also found that firm size is one of the determinants for the subsequent performance of institutional herding. Nofsinger and Sias (1999) demonstrated that the subsequent performance of small-size stocks with a large increase in share ownership by institutional investors is stronger. Wermers (1999) found that the impact of herding on abnormal returns for small-size stocks is larger than that for large-size stocks. However, the results of Lin and Swanson (2003) showed that foreign short-term performance for large-size stocks is better than performance for small-size stocks after controlling the firm size. Therefore, the different conclusion also reveals that it is worthy of further research to clarify whether the subsequent performance of institutional herding on the small-size or large-size stocks is larger. Thus, other investors can use this information as a reference to trade. In addition, subsequent research can combine the price impact of institutional herding and both firm sizes and turnover to explore how the two factors simultaneously influence subsequent performance of institutional herding. The more complete integration of the price effects of institutional herding and firm characteristics might well improve analyses of the related issues of herding by institutional investors.

[15] The TSEC is the Taiwan Stock Exchange Corporation.

Table 6. The basic statistics of turnover in lower-and higher-turnover regimes for different industries.

SIC	Industry	Regime	Obs.	Turnover (unit: %)			
				Mean	Std. dev.	Max	Min
11	Cement	higher-turnover regime	21	55.2524	12.4592	81.8360	42.7604
		lower-turnover regime	693	8.2878	8.8087	40.9005	0.1284
12	Food	higher-turnover regime	55	61.8731	20.6089	160.3338	41.4481
		lower-turnover regime	1373	7.7841	8.2329	41.3062	0.1049
13	Plastics	higher-turnover regime	226	68.7916	26.5018	177.5060	41.5363
		lower-turnover regime	1304	11.3779	10.0074	40.8175	0.0586
14	Textiles	higher-turnover regime	129	62.0214	21.6529	145.2402	41.5297
		lower-turnover regime	2829	8.3749	8.4667	41.1073	0.1703
15	Electric & Machinery	higher-turnover regime	93	60.4047	19.8968	153.7868	41.3590
		lower-turnover regime	1335	11.4051	9.4826	41.2805	0.2988
16	Electric Appliance & Cable	higher-turnover regime	64	66.6430	31.8588	232.7389	42.1204
		lower-turnover regime	816	14.3472	19.6935	232.7389	0.1049
17	Chemicals	higher-turnover regime	154	65.2340	26.9735	189.8878	41.4530
		lower-turnover regime	1682	11.7105	9.4366	41.3173	0.1614
18	Glass	higher-turnover regime	14	65.7277	20.5432	114.4421	41.4275
		lower-turnover regime	190	6.7995	6.5313	31.9480	0.7460
19	Papermaking	higher-turnover regime	36	61.7379	16.5714	122.2393	41.3320
		lower-turnover regime	474	11.1003	9.8386	41.1151	0.3156
20	Steel & Iron	higher-turnover regime	211	75.9547	34.3468	217.7464	41.3246
		lower-turnover regime	1319	11.7451	9.9723	41.1745	0.2032
21	Rubber	higher-turnover regime	106	68.1116	27.2951	193.0859	41.3826
		lower-turnover regime	608	15.0481	9.7866	40.9737	1.5233
22	Automobile	higher-turnover regime	11	52.9851	8.4944	70.1424	41.7956
		lower-turnover regime	397	8.0614	8.7825	41.1498	0.0747
23	Electronics	higher-turnover regime	1009	71.8555	29.3454	264.4124	41.3340
		lower-turnover regime	3683	15.5665	10.0134	41.3013	0.2036
24	Electronic Component	higher-turnover regime	1	48.4378	0	48.4378	48.4378
		lower-turnover regime	101	8.2672	7.1760	39.5709	0.3482
25	Construction	higher-turnover regime	124	70.8098	27.1771	169.0479	41.3355
		lower-turnover regime	896	11.4710	9.8779	41.0851	0.2913
26	Transportation	higher-turnover regime	98	60.2952	21.2457	165.9166	41.4509
		lower-turnover regime	1228	11.1644	9.3915	41.1031	0.2643
27	Tourism	higher-turnover regime	39	72.9866	29.3179	179.6443	42.0766
		lower-turnover regime	471	9.5613	10.5109	41.0190	0.1766
28	Finance	higher-turnover regime	62	66.5870	28.6594	194.1453	41.9726
		lower-turnover regime	856	9.9503	8.8597	41.2464	0.4643
29	Department Stores	higher-turnover regime	32	58.3258	12.5694	81.4610	41.4686
		lower-turnover regime	886	7.7817	8.3128	40.0200	0.0010
99	Others	higher-turnover regime	93	60.1342	18.9666	124.1852	41.4149
		lower-turnover regime	1539	8.3072	9.0697	41.1178	0.0566
	Total	higher-turnover regime	2578	68.5358	27.7641	264.4124	41.3246
		lower-turnover regime	22616	10.9027	9.6826	41.3173	0.0010

Notes: “Non” indicates that no firm is ascribed in this regime as the panel threshold is used.

REFERENCES

Amihud Y, Mendelson H (1986). Asset pricing and the bid-ask spread. J. Fin. Econ., 17: 223-249.
Blume L, Easley D, O’Hara M (1994). Market statistics and technical analysis: The role of volume. J. Fin., 49: 153-181.
Borensztein E, Gelos RG (2003). A panic-prone pack? The behavior of emerging market mutual funds, Staff Papers. International Monetary Fund, 50(1): 43-63.
Brennan MJ, Subrahmanyam A (1996). Market microstructure and asset

pricing: On the compensation for illiquidity in stock returns. J. Fin. Econ., 41: 441-464.
Cai F, Kaul G, Zheng L (2000). Institutional trading and stock returns, working paper, University of Michigan.
Campbell JY, Grossman SJ, Wang J (1993). Trading volume and serial correlation in stock returns. Quarterly. J. Econ., 107: 905-939.
Carhart MM (1997). On persistence in mutual fund performance. J. Finan., 52: 57-82.
Chakravarty S (2001). Stealth trading: which traders' trades move prices? J. Fin. Econ., 61: 289-307.
Chan KS (1993). Consistency and limiting distribution of the least squares estimator of a threshold autoregressive model. Ann. Stat., 21: 520-533.
Cooper M (1999). Filter rules based on price and volume in individual security overreaction. J. Finan., 40: 793-905.
Conrad JS, Hameed A, Niden C (1994). Volume and autocovariances in short-horizon individual security returns. J. Finan., 48: 39-64.
Datar V, Naik N, Radcliffe R (1998). Liquidity and asset return: An alternative test. J. Finan. Mark., 1: 203-220.
Davies RB (1977). Hypothesis testing when a nuisance parameter is present only under the alternative. Biometrika. 64: 247-254.
Dennis P, Weston J (2000). Who's informed? an analysis of stock ownership and informed trading. Working Paper, University of Virginia and Rice University.
Elton EJ, Martin JG, Sanjiv D, Matthew H (1993). Efficiency with costly information: A reinterpretation of evidence from managed portfolios. Rev. Finan. Stud., 6: 1-22.
Falkenstein EG (1996). Preferences for stock characteristics as revealed by mutual fund portfolio holdings. J. Fin., 51: 111-136.
Gompers P, Metrick A (2001). Institutional investors and equity prices. Quarterl. J. Econ., 116: 229-260.
Grinblatt M, Titman S, Wermer R (1995). Momentum investment strategies, portfolio performance, and herding: A study of mutual fund behavior. Am. Econ. Rev., 85(5): 1088-1105.
Hadri K (2000). Testing for stationarity in heterogeneous panel data. Econ. J., 3: 148-161.
Hansen BE (1996). Inference when a nuisance parameter is not identified under the null hypothesis. Econ., 64: 413-430.
Hansen BE (1999). Threshold effects in non-dynamic panels: estimation, testing and inference. J. Econ., 93: 345-368.
Im SK, Pesaran MH, Shin Y (1997). Testing for unit roots in heterogeneous panels. Department of Applied Economics, University of Cambridge.
Karpoff JM (1997). The relation between price changes and trading volume: a survey. J. Finan. Quantitative. Anal., 22: 109-126.
Lakonishok J, Shleifer A, Vishny RW (1992). The impact of institutional trading on stock prices. J. Fin. Econ., 32(1): 23-43.
Lee CMC, Myers J, Swaminathan B (1999). What is the intrinsic value of the Dow? J. Finan., 54: 1693-1741.
Lee CM, Swaminathan B (2000). Price momentum and trading volume. J. Finan., 5: 2017-2069.
Levin A, Lin CF, Chu C (2002). Unit root tests in panel data: asymptotic and finite-sample properties. J. Econ., 108: 1-24.
Morse D (1980). Asymmetrical information in securities markets and trading volume. J. Fin. Quantitative. Analysis., 15: 1129-1148.
Nofsinger JR, Sias RW (1999). Herding and feedback trading by institutional and individual investors. J. Finan., 54: 2263-2295.
Sias R, Starks L, Titman S (2002). The price impact of institutional trading. Working Paper, Washington State University and University of Texas.
Sias RW (2004). Institutional herding. Rev. Fin. Stud., 17: 165-206.
Wermers R (1999). Mutual fund herding and the impact on stock prices. J. Finan., 54: 581-622.
Ying CC (1966). Stock market prices and volume of sales. Econometrica, 34: 676-686.