*International Review of Accounting, Banking and Finance*

Vol 12, No. 4, Winter, 2020, Pages 22-38

IRABF

Ⓒ2020

# The Existence of Buying and Selling Herding Behavior by Institutional Investors and its Impact on Liquidity and Liquidity Risk in the Taiwanese Stock Market

**Hao Fang [1], Joseph C. P. Shieh[1] , Jen-Sin Lee[2,*], and Xiaoru Lee[3]**

1. *Doctoral student, Graduate Institute of Finance, National Taiwan University of Science and Technology, Taipei, Taiwan, ROC*
2. *Professor, Fuzhou University of International Studies and Trade, Fujian, China*
3. *School of Economics, Qufu Normal University, Shandong, China*

*Accepted November 2020*

**A B S T R A C T**

First, this study is few study that distinguishes the rational factors and irrational portion from overall buying and selling herding behaviors of institutional investors in the stock market. Then, using a stock's turnover and its standard deviation to measure a stock's liquidity and its liquidity risk, we find that overall buying herding and irrational buying herding by foreign institutional investors (FIIs) are more likely to increase the individual stock liquidity than their overall selling herding and irrational selling herding. However, FIIs' buying herding behavior is more likely to accompany with the simultaneous increase in the individual stock liquidity risk than their selling herding behavior. Furthermore, FIIs' irrational buying herding more significantly raises stocks' liquidity but also more significantly expands stocks' liquidity risk than their overall buying herding. Finally, FIIs' irrational buying and selling herding behaviors more significantly expand stocks' liquidity and its risks during a recessionary period. This study provides a reference for supervisors to strengthen their management of FIIs' irrational buying herding behavior.



*Keywords:* Institutional Investors, Irrational Herding Behavior, Stock Liquidity, Liquidity Risk.

*JEL classification:* G23, G10, G14, G23

* Jen-Sin Lee is a corresponding author.

# 1. Introduction

**H**erding refers to a group of investors buying or selling the same stocks at the same time, and it is also defined as an investment strategy involving imitating other investors' actions. The herding behavior of institutional investors in the stock market leads to excessive volatility and drives prices away from fundamental levels (Walter and Weber, 2006; Scharfstein and Stein, 1990). Most previous studies investigating institutional herding have used data from developed countries, but it is inappropriate to apply their findings to emerging markets with different microstructures. The ratio of average total stock value to GDP is greater in Taiwan than in the US (Demirer, Kutan and Chen, 2010), which implies that there may be evidence of herding in a relatively developed yet still emerging stock market such as Taiwan's. The ownership of foreign institutional investors (hereafter, FIIs) has been growing quickly in recent years. FIIs are thought to be better informed about emerging markets than domestic investors (Fang et al., 2013; Chang, 2010), and FIIs place greater emphasis on long-run strategies than do domestic institutional investors in emerging stock markets. Because a few studies, such as Hung et al. (2010), Nofsinger and Sias (1999) and Wermers (1999), have found that the buying herding behavior of institutional investors is more informational-based than their selling herding behavior, it is worthwhile to simultaneously explore and compare the buying- and selling- herding behaviors of FIIs in the Taiwanese stock market. The first objective of this study is to explore the existence of and differences between FIIs' buying herding and selling herding in the Taiwanese stock market, which should generate novel findings for and provide new insights into institutional herding behaviors in the emerging stock market.

Then, herding of trading stocks could account for the conditions of industrial economic growth and individual stock performance. In fact, rational herd behavior could exist among fund managers with a similar comparative advantages (i.e., Falkenstein, 1996) or when there are payoff externalities after herding (i.e., Devenow and Welch, 1996; Froot et al., 1992; Hirshleifer et al., 1994). By summarizing the previous herding literature, we suggest two major motivations for institutional herding behavior: rational herding and irrational herding.[1] Rational herding results from institutions' similar reactions to public signals and information. In contrast, irrational herding occurs when institutional investors ignore their own private information and blindly infer information from others' trades. According to the institutional herding classification proposed by Hung et al. (2010), investigative herding can be classified as rational herding, and informational cascades and reputational herding can be classified as irrational herding.[2] Rational herding tends to be efficient if the correlated trading signals are driven by fundamental values. If institutional herding is based on rational factors, institutional investors are seemingly not to blame for their subsequent performance. However, irrational herding may destabilize stock prices and thus destroy a function of the stock market. Hence, distinguishing the rational and irrational herding of institutional investors from their overall herding is critical to analyze whether irrational herding of institutional investors leads to a greater reinforce of stock liquidity and its risk than their overall herding. There are few studies that explore the irrationality of institutional herding directly by classifying institutional herding into the rational and irrational parts in the model design. The second objective of this study is to analyze the differences between FIIs' irrational herding and their overall herding in the stock market of emerging countries such Taiwan. This is an important issue because supervisors in the stock market and internal corporate managers of emerging countries would like to know whether FIIs' irrational herding behaviors exist.

[1] Kremer and Nautz (2013) summarize two major explanations for herd behavior: unintentional herding and intentional herding. The former is similar to rational herding, and the latter is similar to irrational herding.

[2] Hung et al. (2010) propose that, based on characteristic herding, institutional investors receive correlated signals, but these signals can be non-informational. Thus, we do not regard characteristic herding as rational herding.

Driven by institutional herding, the average liquidity level in the stock market can raise. However, institutional herding can simultaneously promote the increase in the liquidity risk of individual stocks, which can lead to the instability of stock transaction. There are fewer studies that directly explore the impact of institutional investors' herding on the stock liquidity and its risk. The turnover rate in the Taiwanese stock market is the highest among all countries (Hu,1998), and one of the main reasons behind this phenomenon can be that the herding behavior of institutional investors have increased the average liquidity level in the stock market. Furthermore, the limits in the trading regulation such as price limits and the limit in selling stocks in the stock market of emerging countries could generate asymmetric effects of buying- and selling- herding behaviors of investors in the stock market. In practice, because the total volumes of the securities that investors intend to sell are required to be smaller than the total volumes of the securities that they would like to buy in the stock market, the impact on institutional investors' stock sales is smaller than the impact on their stock purchases. In addition, the securities authorities mainly encourage investors to buy rather than sell stocks. The asymmetric effects of institutional buying herding relative to selling herding can more increase the average liquidity level. However, the asymmetric power of institutional buying herding can more expand the liquidity risk of individual stocks and more promote the instability of stock transaction.

Because there is the so little literature that directly analyzes the impact of institutional herding on stock liquidity, we first summarize the few studies on the impact of investors' trades on liquidity in the stock market. Brown and Cliff (2004) argue that net purchases by institutional investors positively reflect the extent to which these investors are optimistic about an individual stock. Both Odean (1998) and Baker and Stein (2004) propose that optimistic sentiments among investors generate high liquidity. Campbell, Grossman, and Wang (1993) offer a model in which trading volume acts as a proxy for the aggregate demand of liquidity traders. Many papers indicate that institutional investors prefer to trade in liquid stocks with higher turnovers (Falkenstein, 1996; Gompers and Metrick, 2001; Covrig et al., 2006; Chiao et al, 2010). Chiao et al (2010) propose that stock liquidity can make institutional investors quickly dispose the stocks bought by them when their stocks exhibit the unexpected direction. Hence, institutional herding, especially institutional buying herding, could promote higher liquidity in the stock market. Moreover, Kamara, Lou and Sadka (2008) empirically find that liquidity and liquidity covariance of stocks rise in parallel with an increase in institutional ownership. Cao and Petrasek (2014) denote that mutual funds tend to engage in herding behavior and correlated trading in the stock market, and thus the stocks with greater mutual fund ownership easily produce liquidity risks. The phenomenon is perhaps because some investors may be unable to convert these stocks fast without a loss of capital. Accordingly, this result implies that institutional buying herding can more significantly increase liquidity but can be more largely accompanied with the simultaneous increase in liquidity's volatility than institutional selling herding. In addition, Baker and Stein (2004) deem high liquidity to be a condition of market domination by irrational investors. Thus, we assume that the irrational buying herding of FIIs would more significantly and simultaneously expand the liquidity and liquidity's volatility of stocks than the overall buying herding of these investors. Specifically, extending Sun, Tong and Yan (2009)'s model design on the effects of liberalization in the stock market, this study adds the original and irrational buying herding measure (BHM) and selling herding measure (SHM) into the model. By this way, the third objective of this study investigates whether FIIs' overall and irrational buying herding behavior more significantly and positively influences stocks' liquidity and its volatility than their overall and irrational selling herding behaviors. Furthermore, because irrational buying herding behavior of institutional investors can more result in the instability of stock transaction, we especially analyze whether their irrational buying herding behavior more significantly increases stocks' liquidity and its risks than their overall buying herding behavior. Moreover, it is easier for the irrational

buying herding of institutional investors in industrial firms with higher liquidity to largely accelerate a stock's liquidity and its risks than their irrational selling herding. Also, we investigate whether the positive impact of FIIs' irrational buying herding in industries with high liquidity on the stock liquidity and its risks is stronger than that of their irrational selling herding.

Finally, because the business cycle is an important source of information for investment decisions, a few scholars, such as Huang, Hung, Wang and Hsieh (2010), have demonstrated that there is a significant difference between the herding behaviors exhibited by institutional investors during the bullish periods and those exhibited during the bearish periods. Since institutional irrational herding behaviors can more significantly expand in a bearish period, the effect of institutional irrational buying and selling herding on the liquidity and liquidity volatility of stocks can increase significantly during recessionary economic periods. Extending Haan and Poghosyan (2012)'s model for analyzing the effect of bank size on earning volatility from the financial crisis, we explore whether the recessionary periods strengthen the impact of FIIs' irrational buying- and selling- herding on stocks' liquidity and its risks. Specifically, adding an interaction between the recessionary periods and FIIs' irrational buying- and selling- herding in our model, the final objective of this study is to clarify whether their irrational buying- and selling- herding behaviors more significantly increase the stock liquidity and its risks during a bearish period than during a bullish period.

Our contributions include the following. First, studies rarely distinguish the rational factors and irrational portion from overall herding behaviors of institutional investors in the stock market. By extending Uchida and Nakagawa (2007)'s approach that investigates the existence of banks' irrational herding in industrial lending, we examine the existence of FIIs' irrational buying and selling herding behaviors. Second, there are few studies that directly explore the impact of the herding behavior of institutional investors on the liquidity and its risk in the stock market. However, the herding behavior of institutional investors can raise the average liquidity level of the stock market, but the institutional herding can also simultaneously stimulate the increase in the stock liquidity risk. Third, we demonstrate the impact of FIIs' irrational buying herding on increasing stocks' liquidity and its risk as compared to the impact of their overall buying herding. Finally, we demonstrate that FIIs' irrational buying and selling herding behaviors more significantly expand stocks' liquidity and its risk during recessionary periods than during expansionary periods. The remainder of this paper is organized as follows. Section 2 reports the data scope and methodology used. Section 3 discusses the related empirical results. Section 4 summarizes our conclusions.

## 2. Data and Methodology

### *2.1 Data Scope*

**F**IIs often overbuy or oversell stocks, sometimes for many days, to drive stock prices up or down. We use weekly data rather than monthly or daily data as the most appropriate measure for capturing stock liquidity and its risk and FIIs' long-run trading patterns. The raw data of stocks' liquidity in this study is the weekly individual stock turnover of companies listed on the Taiwan Stock Exchange Corporation (TSEC) between January 2003 and December 2017. Our raw data include FII buying and selling statistics during this period, and these data were further transformed into the BHM and SHM for FIIs.[3]

The data come from the Taiwan Economic Journal Data Bank. The trading numbers for FIIs were derived from each trading day and accumulated until the end of each week. If the net trading

[3] Transforming the relevant herding measures is impossible because no data exist on the buying and selling figures of FIIs prior to 2002. Also, the TSEC has the data for bid-ask spread and the imbalance in the number of shares since January 2003.

accumulation of a particular stock by one FII during a given week was positive (negative), then that FII was counted as buying (selling). Taiwan Stock Exchange (TAIEX) classifies Taiwan's listed stocks from various industries into 28 different categories. TAIEX also compiles these industrial firms' turnovers into the corresponding industrial liquidity. Because previous studies have demonstrated that institutional investors favor liquid stocks with higher turnovers (Falkenstein, 1996; Gompers and Metrick, 2011; Hotchkiss and Strickland, 2003), this paper deduces that the overall and irrational herding behaviors of FIIs are more evident for the industries with higher liquidity. FIIs' herding behaviors in the industries with higher liquidity have a greater impact on the liquidity and its volatility of overall stocks. Hence, this paper investigates whether the overall and irrational herding behaviors of FIIs in the industries with higher liquidity are more significant and whether FIIs' herding behaviors in the industries with higher liquidity are likely to significantly drive up the liquidity risks of all stocks.

### *2.2 Examining the Overall Herding of FIIs*

**T**he LSV measure of Lakonishok, Shleifer and Vishny (1992) has been widely used in the related studies of herding behavior. The LSV measure is first reported as follows:

$$HM_{i,t} = \left|P_{i,t} - E\left(P_{i,t}\right)\right| - E\left|P_{i,t} - E\left(P_{i,t}\right)\right|, \tag{1}$$

in which $P_{i,t} = B_{i,t}/\left(B_{i,t} + S_{i,t}\right)$ and $B_{i,t}\left(S_{i,t}\right)$ is the number of FIIs who buy (sell) stock i in week t. $P_{i,t}$ is the ratio of FIIs buying stock *i* in week t relative to the total number of FIIs trading, and $E\left(P_{i,t}\right)$ is the expected ratio of buyers for all traded stocks in week t. An adjustment $E\left|P_{i,t} - E\left(P_{i,t}\right)\right|$ is subtracted to control for random variation around the expected values of buyers based on the null hypothesis of no herding.[4] The adjustment has no expectation sign due to the random variation, and it is defined to sum over FIIs who are expected buyers from all participants at given week t in the stock market. Based on the assumption of no herding for a stock *i* in week *t*, $P_{i,t}$ follows a binomial distribution. Because there are a large number of firms *i* in week *t* in our sample, the binomial distribution of the LSV measure is approximated to the normal distribution. That is, we standardize the average LSV measure as a new statistic to compute the statistical significance.

Wermers (1999) divides $HM_{i,t}$ into the buying- and selling- herding categories. To investigate FIIs' herding behaviors in the two categories, this study computes the conditional herding measures with a higher or lower ratio of buyers than the average of all stocks in the specific stock-weeks as the following:

$$BHM_{i,t} = HM_{i,t}\left|P_{i,t} > E\left(P_{i,t}\right)\right. \tag{2}$$

$$SHM_{i,t} = HM_{i,t}\left|P_{i,t} < E\left(P_{i,t}\right)\right., \tag{3}$$

Where $BHM_{i,t}$ and $SHM_{i,t}$ can capture asymmetries in institutional herding into and out of stocks. The separate measurement of buying and selling herding behaviors is important for the subsequent analysis of the effects of herding on stock liquidity.

### *2.3 Examining the Irrational Herding of FIIs*

In addition to examining FIIs' overall herding, we drop the possible rational conditions for the specific industries and firms to investigate the existence of irrational herding in FIIs. Moreover, compared to the irrational loan herding of Uchida and Nakagawa (2007), we consider the more complete rational factors of FIIs' herding for industrial and firms' conditions in the stock market. Due to abundant capital and better investment capabilities by FIIs, they make trading decisions based on more varying rational indicators given the specific industrial and firm conditions in the an emerging market. Extending the procedure of irrational loan herding by Uchida and Nakagawa (2007), we use the regression of the ordinary least squares (OLS) as follows:

[4] Subtracting the adjustment overcomes the possibility of observing more variation in the buyer ratio for stocks with only a few trades.

$$P_{i,t} - E(P_{i,t}) = \alpha + \beta F_{i,t} + \varepsilon_{i,t}, \tag{4}$$

in which $F_{i,t}$ is a vector of the specific industrial and firm's control variables, which includes the industrial GDP growth rate in each TSE industry, the firm's growth rate in the operating revenue and the firm's price-earnings (PE) ratio.[5] We add the firm's growth rate in the operating revenue to consider the firm's current growth condition and add the firm's PE ratio to consider its potential growth condition for the future. That is, $\varepsilon_i$ represents the portion of FIIs' irrational herding that cannot be explained by the industrial and firm's rational factors. Hence, we can measure the degree of an FII's irrational herding by the adjusted LSV herding indicator as follows:

$$HM_{i,t}^{I} = |\varepsilon_{i,t}| - E|\varepsilon_{i,t}|. \tag{5}$$

To examine the statistical significance of the adjusted LSV herding measure, we standardize the means of adjusted LSV measures as new statistics, which also follow a standard normal distribution. If the result significantly rejects the null hypothesis of no herding, then there is irrational herding behavior by FIIs. Next, this study calculates the conditional irrational herding measures in the buying and selling directions in the specific stock-weeks as the following:

$$BHM_{i,t}^{I} = HM_{i,t}^{I} | BHM_{i,t} \tag{6}$$

$$SHM_{i,t}^{I} = HM_{i,t}^{I} | SHM_{i,t}. \tag{7}$$

### *2.4 Impact of FIIs' Overall and Irrational Herding on Liquidity and its Risk*

Extending the research design of Sun et al. (2009) and substituting into it a panel data model due to its estimation precision, we use the related variables of liquidity in the stock market as the dependent variables. To examine the possible impact of institutional herding on liquidity in the stock market, this paper further adds the original LSV or the irrational LSV measure into our model to analyze whether and how the degree of overall herding or irrational herding by FIIs affect stocks' liquidity.

The dependent variable $(Y_{i,t})$ is the proxy variables for stock liquidity of a firm i at week t in the stock market, and it is defined as a stock's turnover $(TO_{i,t})$. We use stock turnover to measure the liquidity in the stock market because the usage of turnover is not biased towards the companies with the largest market value and is fitted to measure various kinds of data regardless of higher or lower frequency (Cai et al., 2004). The bid-ask spread and order imbalance are more appropriately regarded as the illiquidity measures of high frequency such as intra-day or daily data (Li et al., 2019; Wang et al., 2012). Accordingly, due to our data with weekly frequency, the two proxies are not used to measure stock turnover in this study. The model is specified as follows.

$$TO_{i,t} = T_{i,t}/Q_{i,t} \tag{8}$$

The turnover of a stock i in the $t^{th}$ week $TO_{i,t}$ is defined as the number of shares traded divided by the number of shares outstanding for a stock i in the $t^{th}$ week, which is shown in equation (8).

$$Y_{i,t} = \alpha_{i,t-j} + \beta_1 BHM_{i,t-j} + \beta_2 SHM_{i,t-j} + \beta_3 IND_{i,t-j} + \beta_4 IND_{i,t-j} * BHM_{i,t-j} + \beta_5 IND_{i,t-j} * SHM_{i,t-j} + \gamma_1 Size_{i,t-j} + \gamma_2 Leverage_{i,t-j} + \gamma_3 ROA_{i,t-j} + \gamma_4 INS_{i,t-j} + \varepsilon_{i,t-j}, j = 0,1 \tag{9-1}$$

$$Y_{i,t} = \alpha'_{i,t-j} + \beta'_1 BHM_{i,t-j}^{I} + \beta_2' SHM_{i,t-j}^{I} + \beta_3' IND_{i,t-j} + \beta_4' IND_{i,t-j} * BHM_{i,t-j}^{I} + \beta_5' IND_{i,t-j} * SHM_{i,t-j}^{I} + \gamma_1' Size_{i,t-j} + \gamma_2' Leverage_{i,t-j} + \gamma_3' ROA_{i,t-j} + \gamma_4' INS_{i,t-j} + \varepsilon'_{i,t-j}, j = 0,1 \tag{9-2}$$

$BHM_{i,t-j}$ and $SHM_{i,t-j}$ in equation (9-1) come from the original LSV measure as equation (1), and $BHM_{i,t-j}^{I}$ and $SHM_{i,t-j}^{I}$ in equation (9-2) come from the irrational LSV measure as equation (3). Through equation (9-1) and equation (9-2), we can analyze the impact of FIIs' herding on stock liquidity. By comparing the difference of equations (9-1) and (9-2), we can confirm the possible difference between

[5] Uchida and Nakagawa (2007) confined their study to only two industrial control variables: the industrial GDP growth rate and land prices. Because land prices are not suitable to be regarded as a rational factor for investors trading in the stock market, we do not use this indicator.

the impacts of FIIs' overall and irrational herding on liquidity in the stock market. IND, measured by the industrial turnover, is included into the model to catch the impact of the industrial liquidity on individual stock liquidity. Additionally, by producing an interaction term between the industrial liquidity and FIIs' overall or irrational buying herding and selling herding, we can identify the impact of the degree of FIIs' buying-related herding and selling-related herding in the industrial firms with higher liquidity on stocks' liquidity. Other variables in our models are regarded as the control variables of a firm's typical attributes and corporate governance, including Size, Leverage, ROA, INS and IND. The control variables of a firm's typical attributes contain Size, Leverage and ROA, and that of a firm's corporate governance contains INS. Size offers a proxy for the natural log of total assets of a firm, Leverage is a firm's total assets over total liabilities, ROA is measured as a firm's return on assets, and INS represents the percentage of institutional ownership. In contrast to Sun et al.'s (2009) use of the percentage of state ownership (ST), regarded as the control variable of a firm's corporate governance, we use the ownership percentage of three major types of institutional investors as the substitute variable of a firm's corporate governance. We propose that a higher percentage of institutional ownership, which represent good corporate governance, leads to the lower stock liquidity and its volatility. This phenomenon is possibly because a higher percentage of institutional ownership produces the less liquidity risk in the market performance.

Meanwhile, because studies such as Kamara et al. (2008) demonstrate that liquidity volatility of stocks increases with greater institutional herding, we also examine whether there is the positive impact of FIIs' buying herding on stock liquidity volatility. $Std(Y_{i,t})$, the volatility of a stock's liquidity, is defined as the standard deviation of a stock's liquidity at week t, which is calculated over the preceding four weeks. Taking stock turnover as an example, the volatility of turnover for stock i in week t can be illustrated as follows:

$$Std(TO_{i,t}) = \sqrt{\frac{1}{T-1}\sum_{s=1}^{T}(TO_{i,t-s} - \frac{1}{T}\sum_{s=1}^{T}TO_{i,t-s})^2}, T = 4 \quad (10)$$

$$Std(Y_{i,t}) = \alpha_{i,t-j} + \beta_1 BHM_{i,t-j} + \beta_2 SHM_{i,t-j} + \beta_3 IND_{i,t-j} + \beta_4 IND_{i,t-j} * BHM_{i,t-j} + \beta_5 IND_{i,t-j} * SHM_{i,t-j} + \gamma_1 Size_{i,t-j} + \gamma_2 Leverage_{i,t-j} + \gamma_3 ROA_{i,t-j} + \gamma_4 INS_{i,t-j} + \varepsilon_{i,t-j}, j = 0,1 \quad (11\text{-}1)$$

$$Std(Y_{i,t}) = \alpha'_{i,t-j} + \beta_1' BHM^I_{i,t-j} + \beta_2' SHM^I_{i,t-j} + \beta_3' IND_{i,t-j} + \beta_4' IND_{i,t-j} * BHM^I_{i,t-j} + \beta_5' IND_{i,t-j} * SHM^I_{i,t-j} + \gamma_1' Size_{i,t-j} + \gamma_2' Leverage_{i,t-j} + \gamma_3' ROA_{i,t-j} + \gamma_4' INS_{i,t-j} + \varepsilon'_{i,t-j}, j = 0,1 \quad (11\text{-}2)$$

By comparing the possible difference between equations (11-1) and (11-2), this study can identify the difference in the impact of FIIs' overall and irrational herding behaviors on the volatility of stocks' liquidity. Similarly, we add IND to show the impact of the industrial liquidity on the volatility of individual stock liquidity. Also, by using an interaction term between the industrial liquidity and FIIs' buying herding and selling herding, we can clarify whether there is a larger increase in FIIs' irrational buying herding in the industries with high liquidity on the stocks' liquidity volatility than their irrational selling herding.

### *2.5 Impact of FIIs' Overall and Irrational Herding on Liquidity and its Risk during the Recessionary Economic Period*

This study subsequently extends Haan and Poghosyan (2012)'s way on the impact of bank size on earnings volatility in the crisis period to compare the impacts of FIIs' BHM and SHM during the bullish and bearish periods on liquidity in the stock market. That is, this study uses a BC formulated by the Council for Economic Planning and Development to classify bullish and bearish periods. Meanwhile, to match the data of weekly frequency in this study, we transfer the bullish and bearish periods of monthly frequency into those of weekly frequency. We measure the Bear variable as a dummy variable that takes the value of one when the bear period indicated by the Council for Economic Planning and Development occurs and zero otherwise. Specifically, we introduce an interaction term between the bear period and FIIs' overall or irrational herding to confirm the impact of their herding during the bear

period on stocks' liquidity. Our panel data models are represented as follows.

$$Y_{i,t} = \alpha_{i,t-j} + \beta_1 BHM_{i,t-j} + \beta_2 SHM_{i,t-j} + \beta_3 BHM_{i,t} * Bear_{t-j} + \beta_4 SHM_{i,t-j} * Bear_{t-j} + \beta_5 Bear_{t-j} + \gamma_1 Siz e_{i,t-j} + \gamma_2 Leverage_{i,t-j} + \gamma_3 ROA_{i,t-j} + \gamma_4 INS_{i,t-j} + \varepsilon_{i,t-j}, j = 0 \text{ or } 1 \quad (12\text{-}1)$$

$$Y_{i,t} = \alpha_{i,t-j} + \beta_1 BHM^I_{i,t-j} + \beta_2 SHM^I_{i,t-j} + \beta_3 BHM^I_{i,t-j} * Bear_{t-j} + \beta_4 SHM^I_{i,t-j} * Bear_{t-j} + \beta_5 Bear_{t-j} + \gamma_1 Size_{i,t-j} + \gamma_2 Leverage_{i,t-j} + \gamma_3 ROA_{i,t-j} + \gamma_4 INS_{i,t-j} + \varepsilon_{i,t-j}, j = 0 \text{ or } 1 \quad (12\text{-}2)$$

From equations (12-1) and (12-2), we can capture the impact of an interaction between a BC and FIIs' overall or irrational herding on the liquidity in the stock market to identify the possible difference in the impact of FIIs' overall and irrational herding on stocks' liquidity in the specific market periods. Meanwhile, by comparing the difference between (9-2) and (12-2), we can highlight the impact of an interaction between a BC and irrational herding by FIIs on stocks' liquidity. Hence, we can compare the possible difference in the impact of an interaction between a BC and FIIs' overall or irrational herding on liquidity in the stock market. Moreover, we use the same method to examine the effects of an interaction between a BC and herding by FIIs on the volatility of stocks' liquidity. The models are shown as follows.

$$Std(Y_t) = \alpha_{i,t-j} + \beta_1 BHM_{i,t} + \beta_2 SHM_{i,t-j} + \beta_3 BHM_{i,t-j} * Bear_{t-j} + \beta_4 SHM_{i,t-j} * Bear_{t-j} + \beta_5 Bear_{t-j} + \gamma_1 Size_{i,t-j} + \gamma_2 Leverage_{i,t-j} + \gamma_3 ROA_{i,t-j} + \gamma_4 INS_{i,t-j} + \varepsilon_{i,t-j}, j = 0 \text{ or } 1 \quad (13\text{-}1)$$

$$Std(Y_t) = \alpha_{i,t-j} + \beta_1 BHM^I_{i,t} + \beta_2 SHM^I_{i,t-j} + \beta_3 BHM^I_{i,t-j} * Bear_{t-j} + \beta_4 SHM^I_{i,t-j} * Bear_{t-j} + \beta_5 Bear_{t-j} + \gamma_1 Size_{i,t-j} + \gamma_2 Leverage_{i,t-j} + \gamma_3 ROA_{i,t-j} + \gamma_4 INS_{i,t-j} + \varepsilon_{i,t-j}, j = 0 \text{ or } 1 \quad (13\text{-}2)$$

# 3. Empirical Results

### *3.1 Findings of the Panel Unit Root and Basic Statistics*

**R**egardless of the panel unit root test used, all panels ($TO_{i,t}$, $BHM_{i,t}$, $SHM_{i,t}$, $BHB^I_{i,t}$, $SHM^I_{i,t}$, $IND_{i,t}$, $Size_{i,t}$, $Leverage_{i,t}$, $ROA_{i,t}$ and $INS_{i,t}$) have the stationary characteristics, which advances the estimations of the panel regressions. Our sample included 102 firms listed by the TSEC, and these samples were designed for balanced panels. Table 1 reports the summary statistics for the dependent variables, independent variables and control variables. $TO_{i,t}$ has the average stock liquidity (2.9405) and exhibits the liquidity's volatility (4.0905). Regarding FIIs' herding measure, SH$M^I$ has the highest degree of FIIs' herding (0.0895), and $SHM$ has lowest (0.0166). SH$M^I$ also exhibits the highest volatility of FIIs' herding (0.1304), and $SHM$ has the lowest volatility (0.0705). Regarding other control variables, $INS_{i,t}$ has the highest mean (21.1716), and $IND_{i,t}$ has the lowest (2.1274). $INS_{i,t}$ posts the highest volatility (17.9541), and $Size_{i,t}$ has the lowest volatility (3.3781).

**Table 1. Summary statistics**

| Panel A: Dependent variables and independent variables | | | | | |
|---|---|---|---|---|---|
| Items | $TO_{i,t}$ | $BHM_{i,t}$ | $SHM_{i,t}$ | ${BHM^I}_{i,t}$ | ${SHM^I}_{i,t}$ |
| Mean | 2.9405 | 0.0182 | 0.0166 | 0.0895 | 0.0643 |
| Median | 1.9465 | 0.0000 | 0.0000 | 0.0053 | 0.0000 |
| Std. Dev. | 4.0905 | 0.0934 | 0.0705 | 0.1304 | 0.1193 |
| Maximum | 72.9477 | 0.6861 | 0.7165 | 0.8222 | 23.7990 |
| Minimum | -0.9564 | -0.2493 | -0.2485 | 0.0000 | 0.0000 |
| Skewness | 3.7030 | 1.6826 | 1.7861 | 1.6461 | 15.5975 |
| Panel B: Control variables | | | | | |
| Items | $IND_{i,t}$ | $Size_{i,t}$ | $Leverage_{i,t}$ | $ROA_{i,t}$ | $INS_{i,t}$ |
| Mean | 2.1274 | 9.2278 | 4.1348 | 9.1058 | 21.1716 |
| Median | 0.0000 | 10.2087 | 1.9113 | 5.7600 | 20.6650 |
| Std. Dev. | 5.7260 | 3.3781 | 6.0242 | 10.7349 | 17.9541 |
| Maximum | 28.0000 | 14.7550 | 72.6355 | 79.0640 | 79.2180 |
| Minimum | 0.0000 | 0.0253 | -19.9300 | -26.7300 | 0.0000 |
| Skewness | 3.0278 | -1.7679 | 3.3139 | 2.3722 | 0.8191 |

### *3.2 Results of FIIs' Overall and Irrational Buying- and Selling- Herding*

**T**able 2 presents the average weekly BHMs and SHMs in equations (2) and (3), the respective associated Z-statistics, $\overline{BHM} - \overline{SHM}$, the associated t-statistics across all stocks and the different industry quintiles for securities with $\geq 1$, $\geq 5$, $\geq 10$ and $\geq 15$ FII traders. In Table 1, we find that the average BHM is significantly larger than the average SHM for securities with $\geq 10$ and $\geq 15$ FII traders, which is similar to the result of Kremer and Nautz (2013). The result implies that the significantly higher buying herding level of FIIs occurs in securities traded at higher activity, possibly because FIIs prefer to herd when buying stocks to actively acquire profits for stocks with FIIs' optimistic expectations. For securities with $\geq 5$ FII traders, our results show that the average BHM is slightly larger than the average SHM, but the results are not statistically significant. The result means that a non-significant, higher buying force of FIIs exists in securities traded at medium activity. However, we can see the completely contrary situation in which the average SHM is significantly larger than the average BHM for securities with $\geq 1$ FII trader. This finding most likely occurs because the securities traded by FIIs at lower activity would promote FIIs to have pessimistic expectations. Thus, FIIs focus more on selling stocks frequently to avoid losses when FIIs non-actively trade, which leads to FIIs' selling-related herd behavior on stocks with this activity.

**Table 2 The herding effect of FIIs' buying and selling stocks with different numbers of trades.**

| Number of trades by FII | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | >=1 | | >=5 | | >=10 | | >=15 | |
| | BHM | SHM | BHM | SHM | BHM | SHM | BHM | SHM |
| All | 0.003051 | 0.012977 | 0.030463 | 0.029805 | 0.048434 | 0.046104 | 0.052628 | 0.047983 |
| Z-stat | 8.2071 | 31.9708 | 57.1996 | 53.1805 | 61.8061 | 55.9661 | 31.8987 | 27.1851 |
| Sample | 132093 | 126340 | 53492 | 50547 | 22634 | 21060 | 4596 | 4257 |
| BHM-SHM | -0.00993 | | 0.000659 | | 0.00233 | | 0.004645 | |
| T-stat | -18.0579*** | | 0.852408 | | 2.05073** | | 1.924693* | |
| P-Val | 7.58E-73 | | 0.39399 | | 0.040299 | | 0.0543 | |

Notes: * represents a significance level of 90%, ** indicates a 95% significance level, *** indicates a 99% significance level.

Moreover, this paper examines the statistical significance of the difference between FIIs' buying- and selling- herding under the different industrial categories for the stocks of the different transaction activities. This research will only report the simplified results and implications of FIIs' overall herding in the industries for the sake of brevity. Findings from this research indicate that for stocks with high

and moderate trading activities, FIIs are engaged in buying herding in a majority of industries, and they are engaged in selling herding in a minority of industries. This phenomenon may occur because, for the stocks of high and moderate trading activities, FIIs prefer to herd in buying those stocks with optimistic expectations to generate profits. Therefore, with regard to a majority of the industries, the strength of FIIs' buying herding is significantly greater than that of their selling herding. However, for the stocks with low trading activity, FIIs tend to behave oppositely. That is, with regard to most industries, the strength of FIIs' selling herding is significantly higher than that of their buying herding. This phenomenon may occur because, for the stocks with low trading activity, FIIs' attention diminishes, and as such, FII shave pessimistic expectations about these stocks. In turn, this effect could lead the FIIs to pessimistically sell off these stocks to reduce losses.

The results of FIIs' unexpected herding of subtracting rational conditions in the specific industries and firms across all stocks and the adverse industries for securities with different FIIs' trading activities are reported in Table 3. Consistent with the results in Table 2, our results in Table 3 show that the average BHM is significantly larger than the average SHM for securities with $\geq 10$ and $\geq 15$ FII traders, but the average SHM is significantly larger than the average BHM for securities with $\geq 1$ FII trader. The reason behind this result is similar to the reason for FIIs' overall herding. The different results compared with Table 2 with regard to securities with $\geq 5$ FIIs' traders is that the average BHM is significantly larger than the average SHM, indicating that there is a significantly higher irrational buying force of FIIs for securities traded at medium activity levels. This inconsistent finding may occur because FIIs tend to irrationally buy stocks to actively acquire profits when FIIs trade stocks at medium activity levels, which may result from their avoiding any overreaction of profits as they trade subsequently stocks at the most optimistic expectations.

**Table 3 The irrational herding effect of FIIs' buying and selling stocks with different numbers of trades.**

| Number of trades by FII | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | >=1 | | >=5 | | >=10 | | >=15 | |
| | BHM | SHM | BHM | SHM | BHM | SHM | BHM | SHM |
| All | 0.2312 | 0.236583 | 0.153169 | 0.148859 | 0.146066 | 0.138848 | 0.141667 | 0.128775 |
| Z-stat | 264.2938 | 246.7828 | 149.555 | 141.4275 | 91.9205 | 86.7386 | 46.675 | 41.7554 |
| Sample | 36453 | 35284 | 14293 | 13829 | 5806 | 5439 | 1361 | 1259 |
| BHM-SHM | -0.00538 | | 0.00431 | | 0.007218 | | 0.012892 | |
| T-stat | -4.15276*** | | 2.935186*** | | 3.197569*** | | 2.976673*** | |
| P-Val | 3.29E-05 | | 0.003336 | | 0.00139 | | 0.002941 | |

Notes: * represents a significance level of 90%, ** indicates a 95% significance level, *** indicates a 99% significance level.

Then, this paper investigates the statistical significance of the difference between FIIs' irrational buying- and selling- herding under the different industrial categories for the stocks of different transaction activities. Again, only the simplified results and implications of FIIs' irrational herding in the industries are reported. Findings indicate that for the stocks with high and moderate trading activities, FIIs' irrational buying herding behavior is consistently and significantly larger than their irrational selling herding behavior. This phenomenon may occur because, for the stocks with moderate trading activities, FIIs will take the rational factors into consideration when they are engaged in overall herding. Thus, in a minority of industries, FIIs' selling-related herding still can be larger than their buying-related herding. After controlling for rational factors, FIIs are likely to be overly optimistic about the moderately traded stocks of the various industries. Hence, the phenomenon that FIIs' buying herding is more significant than their selling herding appears to apply in all industries. However, for stocks that are less actively traded, our findings show that FIIs' irrational selling herding behaviors in all industries are significantly higher than their irrational buying herding behaviors. This research further finds that among

the less actively traded stocks, the manufacturing industry is the specific industry in which FIIs' irrational selling herding is greater than their irrational buying herding. This phenomenon may be due to a recent surge in the Mainland Chinese manufacturing industry and a relocation of the Taiwanese manufacturing industry. Thus, it results in the possibility that when some FIIs sell off the stocks of manufacturing industries with low transaction activities, the selling behavior easily triggers other FIIs to have pessimistic expectations and irrationally engage in selling these manufacturing stocks to reduce losses.

### *3.3 Results of the Impact of FIIs' Buying- and Selling- Herding on Liquidity and its Risk*

**T**he result of the panel data estimations and Hausman test of equations (9-1), (9-2), (11-1) and (11-2) are presented in Tables 4 and 5, respectively. According to the result of the Hausman test, all of the stock liquidity measures and the volatilities of these liquidity measures are fitted with the fixed-effect model. Columns (2) and (3) refer to the impacts of FIIs' herding and irrational herding measures on stocks' liquidity or its volatility in the current week, and columns (5) and (6) refer to those in the next week. Our focus is on the coefficients of BHM and SHM (BHMI and SHMI), which capture the effects of FIIs' buying- and selling- herding (irrational buying- and selling- herding) after controlling for variables representing various firm-specific characteristics. In sum, we see that the influence of FIIs' buying- and selling- herding is larger in the current week than in the next week, suggesting that the greater effect of FIIs' herding behavior on the stocks' liquidity occurs within one week. The results of Tables 4 and 5 consistently show that FIIs' behaviors of overall buying herding and irrational buying herding more significantly increase individual stocks' turnovers and their volatilities than their behaviors of overall selling herding and irrational selling herding. One the one hand, this phenomenon indicates that the force of institutional buying herding is stronger than that of their selling herding in increasing the average liquidity in the stock market of an emerging market. On the other hand, this finding denotes that the institutional buying herding behavior more simultaneously pushes up stock liquidity risk than their selling herding behavior. Moreover, we also find that FIIs' irrational buying herding behaviors more significantly expand stocks' liquidity and its volatility than their overall buying herding behaviors. This phenomenon further highlights the force of institutional irrational buying herding after dropping the rational factors with regard to increasing market liquidity and its liquidity risk. FIIs' irrational buying herding behavior is more likely to increase the liquidity of the individual stocks but is more likely to accompany with the simultaneous increase in the liquidity risk of individual stocks.

**Table 4 The impact of FIIs' buying- and selling- herding on stocks' turnovers ($TO_{i,t}$).**

| | (9-1) | (9-2) | | (9-1) | (9-2) |
|---|---|---|---|---|---|
| Constant | | | Constant | | |
| $BHM_{i,t}/BHM^{I}_{i,t}$ | 1.8203*** | 2.0256*** | $BHM_{i,t-1}/BHM^{I}_{i,t-1}$ | 1.6015*** | 1.8203*** |
| $SHM_{i,t}/SHM^{I}_{i,t}$ | 1.6155*** | 0.4990*** | $SHM_{i,t-1}/SHM^{I}_{i,t-1}$ | 1.0985*** | 0.0228*** |
| $IND_{i,t}$ | 0.0010** | 0.0011** | $IND_{i,t-1}$ | 0.0008** | 0.0009** |
| $IND_{i,t} * BHM_{i,t}/IND_{i,t} * BHM^{I}_{i,t}$ | 0.0007** | 0.0008*** | $IND_{i,t-1} * BHM_{i,t-1}/IND_{i,t-1} * BHM^{I}_{i,t-1}$ | 0.0004 | 0.0002 |
| $IND_{i,t} * SHM_{i,t}/IND_{i,t} * SHM^{I}_{i,t}$ | -0.0009*** | -0.0001*** | $IND_{i,t-1} * SHM_{i,t-1}/IND_{i,t-1} * SHM^{I}_{i,t-1}$ | -0.0004** | -0.0001** |
| $Size_{i,t}$ | 0.3918*** | 0.5001*** | $Size_{i,t-1}$ | 0.2803*** | 0.3015*** |
| $Leverage_{i,t}$ | 0.0090 | 0.0186* | $Leverage_{i,t-1}$ | -0.00332 | -0.00386 |
| $ROA_{i,t}$ | 0.0410*** | 0.0305*** | $ROA_{i,t-1}$ | 0.0315*** | 0.0296*** |
| $INS_{i,t}$ | -0.0220*** | -0.0194*** | $INS_{i,t-1}$ | -0.0198*** | -0.0186*** |
| R-squared | 0.3135*** | 0.3190*** | R-squared | 0.2710*** | 0.2654*** |
| Hausman test | 37.9057*** | 37.0124*** | Hausman test | 33.2896*** | 31.1052*** |

Notes: * represents a significance level of 90%, ** indicates a 95% significance level, *** indicates a 99% significance level.

**Table 5 The impact of FIIs' buying- and selling- herding on volatility of stocks' turnovers ($TO_{i,t}$)**

| | (11-1) | (11-2) | | (11-1) | (11-2) |
|---|---|---|---|---|---|
| Constant | | | Constant | | |
| $BHM_{i,t}/BHM^{I}_{i,t}$ | 0.8990*** | 0.9688*** | $BHM_{i,t-1}/BHM^{I}_{i,t-1}$ | 0.7996*** | 0.8248**** |
| $SHM_{i,t}/SHM^{I}_{i,t}$ | 0.6208*** | -0.0655 | $SHM_{i,t-1}/SHM^{I}_{i,t-1}$ | 0.4522*** | -0.0726 |
| $IND_{i,t}$ | 0.0023** | 0.00334*** | $IND_{i,t-1}$ | 0.0020** | 0.0031* |
| $IND_{i,t} * BHM_{i,t}/IND_{i,t} * BHM^{I}_{i,t}$ | 0.0004*** | 0.0007*** | $IND_{i,t-1} * BHM_{i,t-1}/IND_{i,t-1} * BHM^{I}_{i,t-1}$ | 0.0002*** | 0.0003*** |
| $IND_{i,t} * SHM_{i,t}/IND_{i,t} * SHM^{I}_{i,t}$ | -0.0002** | 0.0001 | $IND_{i,t-1} * SHM_{i,t-1}/IND_{i,t-1} * SHM^{I}_{i,t-1}$ | 0.0001** | 0.0001 |
| $Size_{i,t}$ | 0.0767*** | 0.0829*** | $Size_{i,t-1}$ | 0.0815*** | 0.0854*** |
| $Leverage_{i,t}$ | 0.0016 | 0.0112* | $Leverage_{i,t-1}$ | -0.0012 | -0.0013 |
| $ROA_{i,t}$ | 0.0037*** | 0.0032*** | $ROA_{i,t-1}$ | 0.0048*** | 0.0044*** |
| $INS_{i,t}$ | -0.0118*** | -0.0110*** | $INS_{i,t-1}$ | -0.0120*** | -0.0119*** |
| R-squared | 0.2512*** | 0.2498*** | R-squared | 0.2550*** | 0.2542*** |
| Hausman test | 41.0358*** | 37.0122*** | Hausman test | 41.3540*** | 37.6502*** |

Notes: * represents a significance level of 90%, ** indicates a 95% significance level, *** indicates a 99% significance level.

Second, Tables 4 and 5 show that high liquidity industry significantly raises individual stock liquidity and its volatility. Meanwhile, FIIs' irrational buying herding in the industries with high liquidity is stronger to increase the liquidity and its volatility of individual stocks within a week than their irrational selling herding. This fact illustrates the asymmetric reinforcement of institutional irrational buying herding in the industries with higher liquidity compared with their irrational selling herding in quickly increasing the liquidity and its risk in the stock market of an emerging country. Third, in terms of the control variables of a firm's typical attributes, greater size, leverage and return on assets of firms consistently lead to larger increases in the liquidity and its volatility of the stock market. This situation is more statistically significant within a week. The positive impacts of greater size, leverage and return on assets of firms on all stock liquidity measures demonstrate that higher typical firm attributes quickly increase market liquidity. Fourth, in terms of the control variable of a firm's corporate governance, a higher percentage of institutional ownership results in a larger decrease in the liquidity and its volatility of stock market. The negative effect of a higher percentage of institutional ownership on most liquidity variables confirms that better corporate governance reduces the liquidity risk in the stock market.

In addition, to avoid the heteroscedasticity of standard errors of the coefficients in estimating the impacts of FIIs' buying- and selling- herding on stock liquidity and its risk, we also use heteroscedasticity standard error estimates to adjust these standard errors for our robustness.

Appendix Table A1 and Table A2 report the results of robustness tests that consider the heteroscedasticity corrections for the impacts of FIIs' buying- and selling- herding on stock liquidity and its volatility. Similar with the results of Tables 4 and 5, Appendix Tables A1 and A2 again show that FIIs' overall buying herding and irrational buying herding more significantly increase the liquidity and its risks of individual stocks than their overall selling herding and irrational selling herding. The results of the robustness test confirm the consistency and stability of our empirical results.

### *3.4 The Results of the Impact of FIIs' Buying and Selling Herding on Liquidity and its Risk during a Recessionary Period*

**F**inally, this study uses panel data estimations to examine whether the relationship between FIIs' herding or irrational herding and stocks' liquidity and its volatility is significantly different during a recessionary period compared with an expansionary period. Because the greater impact of FIIs' herding behavior on stocks' liquidity occurs within one week, we analyze the effects in the same week of a FIIs' herding. The results of the impact of the interaction between bearish period and FIIs' herding (or irrational

herding) on stocks' liquidity and its volatility are presented in Tables 6 and 7, respectively. Based on the results of the Hausman test, the fixed-effect model is consistently chosen in all stock liquidity measures and the volatility of these liquidity measures. Columns (2) and (3) refer to the impact of interactions between bearish periods and FIIs' herding and irrational herding measures on stocks' liquidity and its volatility.

**Table 6 The impact of FIIs' buying- and selling- herding on stocks' turnovers ($TO_{i,t}$) during recessionary economic periods**

| | (12-1) | (12-2) |
|---|---|---|
| Constant | | |
| $BHM_{i,t}/BHM_{i,t}^{I}$ | 0.4400** | 0.8396** |
| $SHM_{i,t}/SHM_{i,t}^{I}$ | 0.4129** | 0.4095* |
| $BHM_{i,t} \times Bear_t$ / $BHM_{i,t}^{I} \times Bear_t$ | 0.0724 | 0.5808** |
| $SHM_{i,t} \times Bear_t$ / $SHM_{i,t}^{I} \times Bear_t$ | 0.2884 | 0.6664* |
| $Bear_t$ | -0.4906*** | -0.5174*** |
| $Size_{i,t}$ | 0.5435*** | 0.5335*** |
| $Leverage_{i,t}$ | 0.0111*** | 0.0112*** |
| $ROA_{i,t}$ | 0.0434*** | 0.0432*** |
| $INS_{i,t}$ | -0.0089*** | -0.0090*** |
| Hausman test | 21.9663*** | 25.8284*** |
| R-squared | 0.1294 | 0.1289 |

Notes: * represents a significance level of 90%, ** indicates a 95% significance level, *** indicates a 99% significance level.

**Table 7 The impact of FIIs' buying- and selling- herding on volatility of stocks' turnovers ($TO_{i,t}$) during recessionary economic periods**

| | (13-1) | (13-2) |
|---|---|---|
| Constant | | |
| $BHM_{i,t}/BHM_{i,t}^{I}$ | -0.3235*** | -0.2435* |
| $SHM_{i,t}/SHM_{i,t}^{I}$ | 0.2211 | 0.0580 |
| $BHM_{i,t} \times Bear_t/BHM_{i,t}^{I} \times Bear_t$ | 0.2143 | 0.4002** |
| $SHM_{i,t} \times Bear_t/SHM_{i,t}^{I} \times Bear_t$ | 0.3137 | 0.4213** |
| $Bear_t$ | -0.3037*** | -0.3711*** |
| $Size_{i,t}$ | 0.0052 | 0.0090 |
| $Leverage_{i,t}$ | -0.0021 | -0.0021 |
| $ROA_{i,t}$ | 0.0088*** | 0.0088*** |
| $INS_{i,t}$ | -0.0126*** | -0.0126*** |
| Hausman test | 33.2069*** | 34.8667*** |
| R-squared | 0.1415 | 0.1412 |

Notes: * represents a significance level of 90%, ** indicates a 95% significance level, *** indicates a 99% significance level.

Our results in Tables 6 and 7 show that other variables, except the increased variables of the bearish period and the interaction term with the bearish period, do not show significant differences in stocks' liquidity and its volatility compared with the results of Tables 4 and 5. We find that the bearish periods have significant and negative effects on most of stocks' liquidity and its volatility because there is less stock trading activity for investors during recessionary economic periods compared with expansionary economic periods, which results in less liquidity and its risk in the stock market. By observing the interaction terms $\mathrm{BHM}_{i,t} * Bear_t$, $\mathrm{SHM}_{i,t} * Bear_t$, we can see that FIIs' overall buying herding and selling herding during a bearish period have insignificantly positive effects, but their irrational buying herding and selling herding have significantly positive effects on stocks' liquidity and its volatility. The

different degree of the positive impacts of FIIs' overall and irrational herding behaviors during recessionary economic periods reflect the possibility that the component of FIIs' rational herding behavior in the stock market during such periods could increase less in stocks' liquidity and its risks. However, our results show that FIIs' irrational buying and selling herding behaviors during recessionary economic periods could make stocks' liquidity and its volatility critically increase. This finding implies that FIIs' irrational buying and selling herding behaviors during an unfavorable market period could quickly increase the liquidity and its risk in the stock market.

# 4. Conclusion

**B**y extending the original and adjusted BHM and SHM measures, this study first examines whether there is significant evidence of FII's overall and irrational buying and selling herding in the Taiwanese stock market. Furthermore, we compare the differences between FIIs' irrational and overall herding behaviors because supervisors who manage institutional behavior in the stock market more prefer to clarify the existence and impact of irrational herding behavior of institutional investors. The separation is important because irrational herding behavior of institutional investors can more largely expand stock liquidity or its risks than their overall herding behavior. Our results confirm that FIIs' overall and irrational buying herding is significantly larger than their overall and irrational selling herding especially for higher activity stocks with $\geq 10$ and $\geq 15$ FIIs' traders. The main difference between the overall and irrational herding's results is found for stocks with $\geq 5$ FIIs' traders, where FIIs' irrational buying herding is significantly larger than their irrational selling herding but their overall buying and selling herding does not exist in this tendency. This finding denotes that FIIs' significant higher buying force than selling force only occurs in irrational herding rather than overall herding behavior at the medium activity level. Hence, investment supervisors should do more to manage FIIs' irrational buying herding behavior upon FIIs' higher trading activity.

More importantly, when we analyze the impact of FIIs' herding behaviors on the liquidity and its volatility in the stock market, our results consistently reveal that FIIs' overall buying herding and irrational buying herding more significantly expand stocks' turnovers and their volatilities than their overall selling herding and irrational selling herding. Hence, FIIs' buying herding behavior more increases the average liquidity level of stock market than their selling herding behavior. However, investment supervisors should more focus on controlling the force of FIIs' buying herding in simultaneously pushing up liquidity risk in the stock market than that of their selling herding. Moreover, we find that FIIs' irrational buying herding more significantly raise stocks' liquidity but also more significantly expands stocks' liquidity volatility than their overall buying herding. This phenomenon indicates that supervisors should emphasize the force of FIIs' irrational buying herding in raising liquidity risk in the stock market. In addition, we can see that the asymmetric increase of FIIs' irrational buying herding in industries with higher liquidity rapidly expands the liquidity and its volatility in the stock market. Thus, to inhibit further increases in liquidity risk in the stock market, financial authorities should discourage FIIs from following herding practices in industries with higher liquidity.

Finally, we demonstrate that FIIs' irrational buying- and selling- herding behaviors during a bearish period produce more significant increases in stocks' liquidity and its risks than their overall buying- and selling- herding behaviors. Also, FIIs' irrational buying- and selling- herding behaviors during a recessionary period more significantly increase the liquidity and its risk in the stock market than an expansionary period. This study provides a helpful reference for supervisors in the stock market of emerging countries, emphasizing that they should focus on managing FIIs' irrational buying herding behavior after dropping the rational factors, especially during the recessionary period, to reduce the liquidity risk in the stock market, which could maintain stable stock returns.

## References


Ahearne, A., Griever, W. & Warnock, F. (2004). Information costs and home bias: An analysis of US holdings of foreign equity. *Journal of International Economics, 62*, 313-336.

Baker, M. and Stein, J., (2004). Market Liquidity as a Sentiment Indicator. *Journal of Financial Markets, 7*, 271-299.

Brown, G.W. and Cliff, M.T., (2004). Investor Sentiment and the Near-term Stock Market. *Journal of Empirical Finance, 11*, 1-27.

Campbell, J.Y., Grossman, S.J. and Wang, J., (1993). Trading Volume and Serial Correlation in Stock Return. *Quarterly Journal of Economics*, 905-939.

Cao, C., Petrasek, (2014). Liquidity risk and institutional ownership. *Journal of Financial Markets, 21,* 76-97.

Cai, C.X., Hudson, R., and Keasey, K., (2004). Intra day bid-ask spreads, trading volume and volatility: recent empirical evidence from the London stock exchange. *Journal of Business Finance & Accounting, 31*(5-6), 647-676.

Chang, C., (2010). Herding and the Role of Foreign Institutions Emerging Equity Markets. *Pacific-Basin Finance Journal, 18*, 175-185.

Chiao, C.S., Chen, S.H., and Hu, J.M., (2010). Informational differences among institutional investors in an increasingly institutionalized market. *Japan and the World Economy, 22*, 118-129.

Covrig, V., Lau, S.T., and Ng, L., (2006). Do domestic and foreign fund managers have similar preferences for stock characteristics? A cross-country analysis. *Journal of International Business Studies, 37*(3), 407-429.

Demirer, R., Kutan, A.M. and Chen, C.D., (2010). Do Investors Herd in Emerging Stock Markets? Evidence from the Taiwanese Market. *Journal of Economic Behavior and Organization, 76*, 283-295.

Devenow A. and Welch, I., (1996). Rational Herding in Financial Economics. *European Economic Review, 40*, 603-615.

Falkenstein, E.G., (1996). Preferences for Stock Characteristics A Revealed by Mutual Fund Portfolio Holdings. *Journal of Finance, 51*, 111-135.

Fang, H., Lu, Y.C., Yau, H.Y. and Lee, Y.H., (2013). Impact of Nontradable Share Reform of the A-share Market on China-Related Stock Markets. *Romanian Journal of Economic Forecasting, forthcoming*.

Froot, K.A., Scharfstein, D.S. and Stein, J.C., (1992). Herd on the Street: Informational Inefficiencies in a Gompers, P.A. and Metrick, A., (2001). Institutional Investors and Equity Prices. *Quarterly Journal of Economics, 116*, 229-260.

Haan, J.de. and Poghosyan, T., (2012). Size and Earnings Volatility of US Bank Holding Companies. *Journal of Banking and Finance, 22*(1), 35-54.

Hirshleifer, D., Subrahmanyam, A. and Titman, S., (1994). Security Analysis and Trading Patterns when Some Investors Receive Information Before Others. *Journal of Finance, 49,* 1665-1698.

Hung, H.H., Hung, R.J., Wang, C.P. and Hsieh, Y.P., (2010). Does Fund Manager Herding Vary over the Business Cycle? *Applied Economics Letters, 17*, 1531-1535.

Hu, S.Y., (1998). The Effects of the Stock Transaction Tax on the Stock Market-Experiences from Asian Markets. *Pacific-Basin Finance Journal, 6*, 347-364.

Hotchkiss, E.S. and Strickland, D., (2003). Does Shareholder Composition Matter? Evidence from the Market Reaction to Corporate Earnings Announcements. *Journal of Finance, 58*, 1469-1498.

Kamara, A., Lou, X. and Sadka, R., (2008). The Divergence of Liquidity Commonality in the Cross-section. *Journal of Financial Economics, 89*, 444-466.

Kremer, S. and Nautz, D., (2013a). Causes and Consequences of Short-term Institutional Herding. *Journal of Banking and Finance, 37*(5), 1676-1686.

Lakonishok, J., Shleifer, A. and Vishny, R.W., 1992. The Impact of Institutional Trading on Stock Prices. *Journal of Financial Economics, 32*(1), 23-43.

Li, S., Zhang, T., and Li, Y., (2019). Flight-to-liquidity: Evidence from China's stock market. *Emerging Markets Review, 38*, 159-181.

Nofsinger, J.R. and Sias, R.W., (1999). Herding and Feedback Trading by Institutional and Individual Investors. *Journal of Finance, 54*(6), 2263-2295.

Scharfstein, D.S. and Stein, J.C., (1990). Herd Behavior and Investment. *American Economic Review, 80*, 765-479.

Sun, Q., Tong, W. and Yan, Y., (2009). Market Liberalization Within a Country. *Journal of Empirical Finance, 16*, 18-41.

Odean, T., (1998). Volume, Volatility, Price and Profit When All Traders are Above Average. *Journal of Finance, 53*, 1887-1934.

Uchida, H. and Nakagawa, R., (2007). Herd Behavior in the Japanese Loan Market: Evidence from Bank Panel Data. *Journal of Financial Intermediation, 16*, 555-583.

Walter, A., and Weber, F.M., (2006). Herding in the German Mutual Fund Industry. *European Financial Management, 12*(3): 375-406.

Wang, J., Wu, C., and Yu, E.S.H., (2012). Order Imbalance, Liquidity, and Returns of the U.S. Treasury Market. *Review of Pacific Basin Financial Markets and Policies, 15*(02), 1-39.

Wermers, R., (1999). Mutual Fund Herding and the Impact on Stock Prices. *Journal of Finance, 54*(2), 581-622.

**Appendix Table A1: The impact of FIIs' buying- and selling- herding on stocks' turnovers ($TO_{i,t}$) as considering the correction of heteroscedasticity.**

| | (9-1) | (9-2) | | (9-1) | (9-2) |
|---|---|---|---|---|---|
| Constant | | | Constant | | |
| $BHM_{i,t}/BHM^{I}_{i,t}$ | 0.2085*** | 0.2164*** | $BHM_{i,t-1}/BHM^{I}_{i,t-1}$ | 0.1742*** | 0.2003*** |
| $SHM_{i,t}/SHM^{I}_{i,t}$ | 0.1909*** | 0.0655*** | $SHM_{i,t-1}/SHM^{I}_{i,t-1}$ | 0.1359** | 0.0032** |
| $IND_{i,t}$ | 0.0004** | 0.0005** | $IND_{i,t-1}$ | 0.0003** | 0.0004** |
| $IND_{i,t} * BHM_{i,t}/IND_{i,t} * BHM^{I}_{i,t}$ | 0.0003** | 0.0004*** | $IND_{i,t-1} * BHM_{i,t-1}/IND_{i,t-1} * BHM^{I}_{i,t-1}$ | 0.0002 | 0.0001 |
| $IND_{i,t} * SHM_{i,t}/IND_{i,t} * SHM^{I}_{i,t}$ | -0.0005** | -0.0001** | $IND_{i,t-1} * SHM_{i,t-1}/IND_{i,t-1} * SHM^{I}_{i,t-1}$ | -0.0002** | -0.0001** |
| $Size_{i,t}$ | 0.0802*** | 1.0846*** | $Size_{i,t-1}$ | 0.0720** | 0.0754*** |
| $Leverage_{i,t}$ | 0.0034 | 0.0059* | $Leverage_{i,t-1}$ | -0.0012 | -0.0019 |
| $ROA_{i,t}$ | 0.0085** | 0.0069** | $ROA_{i,t-1}$ | 0.0076*** | 0.0058*** |
| $INS_{i,t}$ | -0.0083** | -0.0078** | $INS_{i,t-1}$ | -0.0071** | -0.0062** |
| R-squared | 0.2958*** | 0.2994*** | R-squared | 0.2588*** | 0.2592*** |
| Hausman test | 36.8205*** | 36.5412*** | Hausman test | 31.9805*** | 30.0110*** |

Notes: * represents a significance level of 90%, ** indicates a 95% significance level, *** indicates a 99% significance level.

**Appendix Table A2: The impact of FIIs' buying- and selling- herding on volatility of stocks' turnovers ($TO_{i,t}$) as considering the correction of heteroscedasticity.**

| | (11-1) | (11-2) | | (11-1) | (11-2) |
|---|---|---|---|---|---|
| Constant | | | Constant | | |
| $BHM_{i,t}/BHM^{I}_{i,t}$ | 0.0980*** | 0.1187*** | $BHM_{i,t-1}/BHM^{I}_{i,t-1}$ | 0.0895*** | 0.1001*** |
| $SHM_{i,t}/SHM^{I}_{i,t}$ | 0.0718** | -0.0398 | $SHM_{i,t-1}/SHM^{I}_{i,t-1}$ | 0.0593** | -0.0121 |
| $IND_{i,t}$ | 0.0003** | 0.0003** | $IND_{i,t-1}$ | 0.0002* | 0.0003** |
| $IND_{i,t} * BHM_{i,t}/IND_{i,t} * BHM^{I}_{i,t}$ | 0.0001** | 0.0002** | $IND_{i,t-1} * BHM_{i,t-1}/IND_{i,t-1} * BHM^{I}_{i,t-1}$ | 0.0001** | 0.0001** |
| $IND_{i,t} * SHM_{i,t}/IND_{i,t} * SHM^{I}_{i,t}$ | -0.0001** | 0.0001 | $IND_{i,t-1} * SHM_{i,t-1}/IND_{i,t-1} * SHM^{I}_{i,t-1}$ | -0.0001** | 0.0001 |
| $Size_{i,t}$ | 0.0219** | 0.0234*** | $Size_{i,t-1}$ | 0.0208*** | 0.0232*** |
| $Leverage_{i,t}$ | 0.0005 | 0.0023* | $Leverage_{i,t-1}$ | -0.0004 | -0.0005 |
| $ROA_{i,t}$ | 0.0012** | 0.0009** | $ROA_{i,t-1}$ | 0.0014** | 0.0011** |
| $INS_{i,t}$ | -0.0034** | -0.0032** | $INS_{i,t-1}$ | -0.0037** | -0.0035** |
| R-squared | 0.2103*** | 0.2198** | R-squared | 0.2106*** | 0.2163*** |
| Hausman test | 39.1305*** | 35.0128*** | Hausman test | 39.3305*** | 35.0218*** |

Notes: * represents a significance level of 90%, ** indicates a 95% significance level, *** indicates a 99% significance level.