9. INSTITUTIONAL INVESTOR SENTIMENT AND MARKET RETURNS: EVIDENCE FROM THE TAIWAN FUTURES MARKET[1]

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Abstract

This study explores the dynamic relationship between the sentiment of institutional investors and market returns in the futures market. Using data from the Taiwan futures market, the empirical results show that the dynamic relationship between the sentiment of foreign institutional investors and the futures returns is much stronger than that of the sentiment of domestic institutional investors and the futures returns. Our empirical results also display that the sentiment of foreign institutional investors Granger-causes the sentiment of domestic institutional investors, but not vice versa. Finally, the sentiment of foreign institutional investors has a larger effect on subsequent market returns and market states than that of the sentiment of domestic institutional investors. Overall, our empirical results suggest that the relationship among the institutional investor sentiment, market returns, as well as market conditions in the Taiwan futures market is dominated by the sentiment of foreign institutional investors.

Keywords: Institutional Investor Sentiment; Foreign Investors; Domestic Investors; Futures Returns; Market States.

JEL Classification: G12, G14

1. INTRODUCTION

This paper investigates the dynamic relationship between the sentiment of institutional investors and market returns in the futures market. A large volume of previous

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research has focused on the very important issue of the relationship between investor sentiment and asset returns. Previous studies have presented that the investor sentiment of the stock market has a significantly negative effect on subsequent stock returns (Baker & Wurgler, 2006; Chung, Hung, & Yeh, 2012; Baker, Wurgler, & Yuan, 2012). On the other hand, the impact of the investor sentiment of the futures market on subsequent market returns has received much attention in the literature. Using data from Commodity Futures Trading Commission (CFTC), Wang (2001) and Brown and Cliff (2004) use the trading activity of the futures market to calculate investor sentiment, and then examine the impact of the investor sentiment of the futures market on subsequent market returns. Han (2008) also employs the data from the CFTC to construct the investor sentiment of the futures market, and analyzes the how the sentiment of the futures market affects option prices.

Previous studies have used the investor sentiment of derivatives markets as the proxies of the institutional investor sentiment (see Brown & Cliff, 2004; Han, 2008). However, due to data limitations, no work can measure the institutional investor sentiment in a futures market directly, and therefore, no work has been done on the dynamic relationship between the institutional investor sentiment by various types of the futures investors and the futures returns. On July 2, 2007, the Taiwan Futures Exchange (TAIFEX) has disclosed the trading activity for the different classes of institutional investors in the futures market. Hence, this data set provides an opportunity to construct the institutional investor sentiment of the futures market and allows us to investigate the dynamic relationship between the institutional investor sentiment and the market returns in the futures market.

Following Brown and Cliff (2004), Schmeling (2009), and Corredor, Ferrer, and Santamaria (2013), this paper uses the VAR model to investigate the dynamic relationship between the institutional investor sentiment and market returns in the futures market. Previous studies have proposed two possible explanations, a mispricing correction hypothesis and market risk sentiment hypothesis, to interpret the impact of investor sentiment on subsequent market returns. The mispricing correction effect predicts that investor sentiment is negatively correlated with subsequent market returns (see Baker & Wurgler, 2006; Schmeling, 2009; Chung et al., 2012). As for the market risk sentiment hypothesis, previous studies suggest that the market risk sentiment is positively correlated to subsequent market returns (Frijns, Koellen, & Lehnert, 2008; Tse & Zhao, 2012; Lee & Chang, 2013). Additionally, Brown and Cliff (2004) propose two effects, the “bandwagon” effect and the “bargain shopper” effect, to explain the impact of market returns on subsequent investor sentiment. The bandwagon effect implies that market returns are positively related to subsequent investor sentiment. On the contrary, the bargain shopper effect predicts a negative relation between market returns and subsequent investor sentiment. We use the above competing hypotheses to explain our empirical results of the VAR model.

Our contribution to the existing literature will be two-fold. First, to the best our knowledge, this is the first study to examine the dynamic relationship among the sentiment indices of foreign as well as domestic institutional investors and the futures returns. While Brown and Cliff (2004) and Han (2008) use the data from the CFTC to construct the proxy of institutional investor sentiment for the futures market, this study can directly calculate the different types of the institutional investor sentiment in the

futures market with the data from the TAIFEX. Hence, our empirical results will deepen our understanding about the nature of the dynamic relationship between the institutional investor sentiment and market returns in the futures market. Second, whereas Brown and Cliff (2004), Schmeling (2009), and Corredor et al. (2013) only report the empirical evidence for the Granger-causality tests with regards to investor sentiment and stock returns, this paper not only reports the evidence for the Granger-causality tests but also present the results for the tests of cumulative (net) effects for the institutional investor sentiment and the market returns in the futures market. In particular, the tests of cumulative (net) effects can provide empirical results for testing our competing hypotheses. Hence, our study sheds light on the theoretical explanations for the relationship between the institutional investor sentiment and market returns in the futures market.

Our empirical results show that the dynamic relationship between the sentiment of foreign institutional investors and the futures returns is much stronger than that of the sentiment of domestic institutional investors and the futures returns. Specifically, the impact of the sentiment of foreign institutional investors on subsequent futures returns is significantly positive and is in line with the market risk sentiment hypothesis. The futures return has a significantly negative effect on the subsequent sentiment of foreign institutional investors. This finding is in support of the bargain shopper effect. Additionally, the empirical results find that the impact of the domestic institutional investor sentiment on subsequent futures returns is insignificant and vice versa. Our empirical evidence further indicates that the causality from the sentiment of foreign institutional investors to the sentiment of domestic institutional investors is much stronger than in the reverse direction. Finally, the impact of the sentiment of foreign institutional investors on subsequent market states is larger than those of the sentiment of domestic institutional investors on subsequent market states.

The remainder of the paper is organized as follows. Section 2 describes the data and presents econometric models. Section 3 reports the empirical results. Finally, concluding remarks are presented in Section 4.

2. DATA, INVESTOR SENTIMENT, AND METHODOLOGY

2.1. Data and Investor Sentiment

This paper utilizes the Taiwan Weighted Stock Index (TWSI) and the corresponding index futures contracts traded on TAIFEX for analysis. The daily futures closing prices are obtained from the TAIFEX. The trading activities for the futures market are also collected from the TAIFEX. The long and short open interests by various types of institutional investors for the futures market was provided by the TAIFEX since July 2, 2007. The open interests of institutional investors for the futures market displayed from the TAIFEX are the summation of the spot month, the next calendar month, and the next three-quarter months futures contracts for each type of institutional traders. The types of institutional investors displayed from the TAIFEX are foreign investors, mutual funds, and proprietary traders. This paper defines mutual funds and proprietary

traders as the domestic institutional investors. The sample period used in this study is from July 2, 2007 to December 11, 2013. To reduce potential expiration effects, a nearby futures contract was rolled over to the next nearest contract 1 day prior to expiration of the current contract.[5]

Following Wang (2001), this paper uses daily long and short open interests of foreign and domestic institutional investors for the futures contracts to calculate institutional investor sentiment. As such, the sentiment index of institutional investor *i* at time *t*, $SI_{i,t}$, is calculated as follows:

$$SI_{i,t} = \frac{S_{i,t} - min(S_{i,t})}{max(S_{i,t}) - min(S_{i,t})}, \; i = F \text{ or } D \tag{1}$$

where *F and D* are the foreign institutional investors and domestic institutional investors, respectively. $S_{i,t}$ is the aggregate position for investor *i* at time *t*. The max ($S_{i,t}$) and min ($S_{i,t}$) represent historical maximum and minimum aggregate position for investor *i* at time *t* over the previous 2 years (or a total of 512 trading days). In this regard, the sample period for FP_t and $SI_{i,t}$ is from July 22, 2009 to December 11, 2013. The aggregate position for investor *i* at time *t* , $S_{i,t}$, is calculated as follows:

$$S_{i,t} = \frac{OI_{i,P,t} - OI_{i,N,t}}{OI_{i,P,t} + OI_{i,N,t}}, \; i = F \text{ or } D \tag{2}$$

where $OI_{i,j,t}$ is the natural logarithm of open interest *j* in dollars for investor *i* at time *t*, *j=P* or *N*. *P* and *N* are the positive and negative open interests. The positive (negative) open interest of a futures market is the long (short) open interest.

2.2. Vector Autoregression Model

Previous studies have shown that market returns and investor sentiment may act as a system. In particular, Brown and Cliff (2004, 2005) and Schmeling (2009) use the VAR (Vector Autoregression) model to explore the relationship between stock returns and investor sentiment. Thus, this paper also employs the VAR model to study the dynamic relationship between the market returns and the sentiment of institutional investors in the futures market. The bivariate VAR is estimated as follows:[6]

$$\begin{aligned} FR_t &= \alpha_1 + \sum_{k=1}^{K} \beta_{1k} \times FR_{t-k} + \sum_{k=1}^{K} \lambda_{1k} \times DSI_{i,t-k} + \varepsilon_{FR,t} \\ DSI_{i,t} &= \alpha_2 + \sum_{k=1}^{K} \beta_{2k} \times FR_{t-k} + \sum_{k=1}^{K} \lambda_{2k} \times DSI_{i,t-k} + \varepsilon_{i,t} \end{aligned}, \; i = F \text{ or } D \tag{3}$$

[5] To rule out the expiration effects, this paper also uses the stock index returns as the proxy of market returns for our investigation. Specifically, this paper uses the spot closing prices of the TWSI for our analysis. The results reveal that the dynamic relationship between the sentiment indices of foreign and domestic institutional investors and the stock index returns is identical to those findings reported in Table 4 and Figure 1. The results are not presented here but are available upon request from the authors.

[6] Following Brown and Cliff (2004), this paper uses the difference in the institutional investor sentiment for our analysis.

where FR_t is the return of the futures market at time *t* and $DSI_{i,t}$ is the difference of the sentiment for institutional investor *i* at time *t*.[7] $\varepsilon_{FR,t}$ is the residual of the futures returns at time *t*. $\varepsilon_{i,t}$ is the residual of the difference of the sentiment for institutional investor *i* at time *t*. *F and D* are the foreign institutional investors and domestic institutional investors, respectively. To ensure that the results are robust to the chosen number of lags, this paper reports the VAR results for up to ten lags. By doing so, we can distinguish causality and predictability for short or long time horizons (see Dufour & Renault, 1998; Lee, Li, & Wang, 2010; Lee, Chien, & Liao, 2012).

In the futures return equation, the difference of the sentiment for institutional investor *i* Granger-causes the futures returns, if the null hypothesis that lagged coefficients, $\lambda_{11} = \lambda_{12} = ... = \lambda_{1k} = 0$ (*k* = 1, 2, 3,…, *K*), are zero is rejected. In the difference of the sentiment for institutional investor *i* equation, the futures return Granger-causes the difference of the sentiment for institutional investor *i*, if the null hypothesis that lagged coefficients are zero, $\beta_{21} = \beta_{22} = ... = \beta_{2k} = 0$ (*k = 1, 2, 3, …, K*), is rejected.

In addition to Granger-causality tests, this paper also examines the cumulative (net) effect of the difference of the sentiment for institutional investor *i* on the futures returns and vice versa. In the futures return equation, if the null hypothesis that the sum of the lagged coefficients ($\sum_{k=1}^{K} \lambda_{1k}$) is zero is rejected, the difference of the sentiment for institutional investor *i* has a cumulative (net) effect on the futures returns. In the difference of the sentiment for institutional investor *i* equation, if the null hypothesis that the sum of the lagged coefficients ($\sum_{k=1}^{K} \beta_{2k}$) is zero is rejected, the futures return has a cumulative (net) effect on the difference of the sentiment for institutional investor *i*. The tests on the sum of the lagged coefficients allow us to identify the dynamic net effect for the futures returns and the difference of the sentiment for institutional investor *i*.

In order to further verify the empirical results, this paper also explores the relationship among the futures returns, the sentiment of foreign institutional investors, and the sentiment of domestic institutional investors. The trivariate VAR is estimated as follows:

$$\begin{aligned} FR_t &= \alpha_1 + \sum_{k=1}^{K} \beta_{1k} \times FR_{t-k} + \sum_{k=1}^{K} \lambda_{1k} \times DSI_{F,t-k} + \sum_{k=1}^{K} \theta_{1k} \times DSI_{D,t-k} + \varepsilon_{FR,t} \\ DSI_{F,t} &= \alpha_2 + \sum_{k=1}^{K} \beta_{2k} \times FR_{t-k} + \sum_{k=1}^{K} \lambda_{2k} \times DSI_{F,t-k} + \sum_{k=1}^{K} \theta_{2k} \times DSI_{D,t-k} + \varepsilon_{F,t} \\ DSI_{D,t} &= \alpha_3 + \sum_{k=1}^{K} \beta_{3k} \times FR_{t-k} + \sum_{k=1}^{K} \lambda_{3k} \times DSI_{F,t-k} + \sum_{k=1}^{K} \theta_{3k} \times DSI_{D,t-k} + \varepsilon_{D,t} \end{aligned} \quad (4)$$

[7] The paper uses "difference in sentiment" and "change in sentiment" interchangeably to represent the variation of institutional investor sentiment.

where FR_t is the return of the futures market at time *t*. $DSI_{F,t}$ is the difference of the sentiment for foreign institutional investors at time *t*. $DSI_{D,t}$ is the difference of the sentiment for domestic institutional investors at time *t*. $\varepsilon_{FR,t}$ is the residual of the futures returns at time *t*. $\varepsilon_{F,t}$ is the residual of the difference of the sentiment for foreign institutional investors at time *t*. $\varepsilon_{D,t}$ is the residual of the difference of the sentiment for domestic institutional investors at time *t*. Similarly, the Granger-causality test and the cumulative (net) effect are used to explore the relationship among the futures returns as well as the sentiment indices of foreign and domestic institutional investors.

Although the Granger causality test and the cumulative (net) effect will suggest which variables in the model have statistically significant effects on the future values of other variables in the system, it will not be able to reveal whether unexpected changes in the value of a given variable have a positive or negative effect on the other variables in the system, or how long it would take for the unexpected impact of that variable to work its way through the system (see Lee, Huang, & Yin, 2013). To study this issue, this paper uses the GIRF (Generalized Impulse Response) technique developed by Pesaran and Shin (1998) to assess how and to what extent the unexpected shocks influence movements in the futures returns as well as the sentiment indices of foreign and domestic institutional investors over time. The advantage of the GIRF is that while the traditional impulse response functions based on the widely used Choleski factorization of VAR innovations may be sensitive to variable ordering, the GIRF technique does not depend on the VAR ordering.

2.3. Institutional Investor Sentiment and Market Conditions

Prior research suggests that sentiment contains useful information on market states (e.g., Chen, 2011; Lee & Chang, 2013). In this regard, this paper also examines the impact of institutional investor sentiment on subsequent market conditions. Following Cooper, Gutierrez, and Hameed (2004), Chen (2009), and Chuang and Susmel (2011), this study defines up- and down-market states as follows:

$$Bull_t = \begin{cases} 1, \text{if } AvgFR_t^k = \dfrac{FR_t + FR_{t-1} + \ldots + FR_{t-k}}{k} > ThR \\ 0, \text{otherwise} \end{cases} \tag{5}$$

$$Bear_t = \begin{cases} 1, \text{if } AvgFR_t^k = \dfrac{FR_t + FR_{t-1} + \ldots + FR_{t-k}}{k} < -ThR \\ 0, \text{otherwise} \end{cases} \tag{6}$$

where $Bull_t$ is the bull regime (up-market state) for the futures returns at time *t*. $Bear_t$ is the bear regime (down-market state) for the futures returns at time *t*. $AvgFR_t^k$ is the moving average of the last *k* and present values of the futures returns at time *t*. *ThR* is the threshold return. FR_t is the return of the futures market at time *t*. Then, as in Chen (2009), the probit model is estimated as follows:

$$P(Bull_{t+k}) = F(\alpha_{Bull} + \beta_{Bull} \times DSI_{F,t} + \theta_{Bull} \times DSI_{D,t}) \tag{7}$$

$$P(Bear_{t+k}) = F(\alpha_{Bear} + \beta_{Bear} \times DSI_{F,t} + \theta_{Bear} \times DSI_{D,t}) \tag{8}$$

where $DSI_{F,t}$ is the difference of the sentiment for foreign institutional investors at time *t*. $DSI_{D,t}$ is the difference of the sentiment for domestic institutional investors at time *t*.

3. EMPIRICAL RESULTS

3.1. Descriptive Statistics and Preliminary Regression Results

Table 1 provides the summary statistics and regression analysis for the futures returns and the difference in the sentiment of institutional investors. Panel A of Table 1 reports the mean, standard deviation, maximum, minimum, and ADF-test for the level and difference in market prices as well as the sentiment indices of foreign and domestic institutional investors in the futures market. Panel A of Table 1 shows that the mean value for the futures price is 7837.01. The maximum and minimum values for the futures prices are 9138.00 and 6592.00, respectively. The maximum and minimum values for the futures prices suggest that the futures market experiences the different market conditions in our sample period. Moreover, the ADF statistic for the futures prices is -2.7511, indicating that the futures prices are not stationary at the 5% level. The mean value of the futures returns is 0.0002 and the maximum and minimum values for the futures returns are 0.0435 and -0.0658, respectively. The ADF statistic for the futures returns is -23.9565 and is significant at the 1%.

For the sentiment of foreign institutional investors, the mean value is 0.4407. The ADF statistic for the sentiment of foreign institutional investors is -5.6322 and is significant at the 1% level. The mean value of the difference in the sentiment of foreign institutional investors is close to 0. The ADF statistic for the difference in the sentiment of foreign institutional investors is -22.4450 and is significant at the 1% level. As to the sentiment of domestic institutional investors, the mean value is 0.6131. The ADF statistic for the sentiment of domestic institutional investors is -4.6030 and is significant at the 1% level. The mean value of the difference in the sentiment of domestic institutional investors is -0.0002. The ADF statistic for the difference in the sentiment of domestic institutional investors is -13.1826 and is significant at the 1% level. In summary, Panel A of Table 1 shows that ADF statistics for the futures returns and the difference in the sentiment indices for foreign and domestic institutional investors are all significant at the 1% level, indicating that the futures returns and difference in the sentiment indices are stationary and can be used for following analysis.

Panel A of Table 1 also presents that the standard deviations of the difference in the sentiment indices for foreign and domestic institutional investors are 0.0655 and 0.0648, respectively. The findings of the standard deviations for the difference in the sentiment indices of institutional investors imply that the variation of the sentiment of foreign institutional investors tends to be more sensitive to the market-wide information/condition than those of domestic institutional investors.

Panel B of Table 1 reports the preliminary regression results for the impact of the sentiment of institutional investors on the futures returns. The result for the contemporaneous regression analysis reveals that the difference in the sentiment of foreign institutional investors is significantly and positively related to the futures returns. The regression coefficient for the impact of the difference in the sentiment of foreign institutional investors on the futures returns is 0.0430 and the $AdjR^2$ is 0.0601. As to the contemporaneous regression analysis with regard to domestic institutional

investors, the result also shows that the impact of the difference in the sentiment of domestic institutional investors on the futures returns is significantly positive at the 1% level. The regression coefficient for the impact of the difference in the sentiment of domestic institutional investors on the futures returns is 0.0867 and the $AdjR^2$ is 0.2425. Additionally, Panel B of Table 1 reports the impact of the difference in the sentiment indices of foreign and domestic institutional investors on subsequent futures returns. The empirical result reveals that the difference in the sentiment of foreign institutional investors significantly and positively affects subsequent futures returns. The regression coefficient for the impact of the difference in the sentiment of foreign institutional investors on subsequent futures returns is 0.0287 and the $AdjR^2$ is 0.0263. By contrast, the difference in the sentiment of domestic institutional investors has an insignificant effect on subsequent futures returns and the $AdjR^2$ is 0.0002. The results for the effect of the sentiment of institutional investors on the futures returns are unchanged even the paper simultaneously includes contemporaneous and lagged difference in the sentiment indices for foreign and domestic institutional investors, respectively, in the regression model.

In summary, for the contemporaneous regression analyses, the empirical findings of Panel B of Table 1 present that while the impact of the difference in the sentiment of foreign and domestic institutional investors on the futures returns is significantly positive at the conventional level, the effect and explanatory power for the domestic institutional investors are larger than those of foreign institutional investors. On the contrary, for the effect of the sentiment indices of institutional investors on subsequent futures returns, the empirical results show that the difference in the sentiment of foreign institutional investors has a greater effect on subsequent futures returns than those of domestic institutional investors. These findings suggest that the difference in the sentiment of foreign institutional investors contains more information with respect to market-wide risk appetite on subsequent futures returns. To further explore the dynamic relationship between the institutional investor sentiment and the market returns in the futures market, the VAR is used in this paper. The possible explanations and detailed results for the VAR model are presented in the following section.

3.2. Dynamic Relationship between Institutional Investor Sentiment and Futures Returns

In this section, this paper explores the dynamic relationship between the institutional investor sentiment and market returns in the futures market. Previous studies have proposed two possible explanations, a mispricing correction hypothesis and market risk sentiment hypothesis, to interpret the impact of investor sentiment on subsequent market returns.[8] For the mispricing correction effect, Baker and Wurgler (2006), Schmeling (2009), Chung et al. (2012), and Baker et al. (2012) show that a high investor sentiment causes asset prices to deviate from their intrinsic values. The

[8] *Wang (2001) provides evidence that large speculator sentiment forecasts price continuations. In contrast, large hedger sentiment predicts price reversals. Since the purposes of institutional investors' trading in the futures markets could be hedging, speculative, or both, it is not appropriate to explain the relation between the institutional investor sentiment and the future returns following the argument of Wang (2001).*

mispricing is corrected when the noise traders are confronted by realizations of economic fundamentals (Chung et al., 2012; Baker et al., 2012) or when the mispricing caused by noise traders is so large and arbitrageurs find the expected returns so great (Baker et al., 2012). As such, a mispricing correction effect is associated with trading activity of noise traders and predicts that investor sentiment is negatively correlated with subsequent market returns. In this regard, if the institutional investor sentiment of a futures market is associated with a mispricing correction effect, the institutional investor sentiment of a futures market is negatively related subsequent futures returns.

As for the market risk sentiment hypothesis, previous studies present that when the market risk sentiment is higher (lower), investors have a greater preference for investing in (selling) risky assets (e.g., Frijns et al., 2008; Tse & Zhao, 2012; Lee & Chang, 2013). As documented by Frijns et al. (2008), when the sentiment with regard to risk appetites is high, investors have a preference for investing in risky assets. By contrast, a low investor risk appetite sentiment results in selling risky assets. Tse and Zhao (2012) suggest that funds move globally to seek high-yielding assets and the high risky asset markets pricing behavior would reflect risk sentiment. As such, if the institutional investor sentiment of a futures market is positively correlated with the market risk sentiment, it is likely that the institutional investor sentiment of a futures market is positively associated with subsequent futures returns.

Prior research has explored how market returns affect subsequent investor sentiment. Brown and Cliff (2004), Schmeling (2009), and Corredor et al. (2013) employ the VAR model to investigate how stock returns affect subsequent investor sentiment and the empirical results show that stock returns Granger-cause investor sentiment.[9] Brown and Cliff (2004) propose two effects, the bandwagon effect and the bargain shopper effect, to explain the impact of asset returns on subsequent investor sentiment. First, for a bandwagon effect, the good (bad) returns during the period drive optimism (pessimism). The bandwagon effect implies that asset returns are positively related to subsequent investor sentiment. On the contrary, when investors see assets becoming a bargain, they see a buying opportunity and become bullish. Thus, the bargain shopper effect predicts a negative relation between asset returns and subsequent investor sentiment. Following the bandwagon hypothesis, the futures return is positively related to subsequent institutional investor sentiment. By contrast, if the bargain shopper effect holds, the futures return is negatively correlated to subsequent institutional investor sentiment.

According to above discussions and competing hypotheses, the VAR model is used to investigate the dynamic relationship between the institutional investor sentiment and market returns in the futures market. The results are presented in Tables II to IV. Whereas most of previous studies only report the empirical evidence for the Granger-causality tests (e.g., Schmeling, 2009; Corredor et al., 2013), Tables II to IV not only report the evidence for the Granger-causality tests but also present the results for the

[9] *In particular, Brown and Cliff (2004) provide evidence that large stock returns have a positive effect on subsequent investor sentiment and small stock returns are negatively correlated with subsequent investor sentiment.*

tests of cumulative (net) effects. In particular, the tests of cumulative (net) effects can provide empirical results for testing our competing hypotheses.

Table 2 reports the dynamic relationship between the difference in the sentiment of foreign institutional investors and the futures returns. Panel A of Table 2 presents the results for the Granger-causality tests. The empirical results show that there is a bi-directional Granger-causality relationship between the difference in the sentiment of foreign institutional investors and the futures returns. All the test statistics are significant at the 1% level, and the results are robust with different lags. For example, the *F*-values of causality tests for $\lambda_{11} = \lambda_{12} = ... = \lambda_{1k} = 0$ and $\beta_{21} = \beta_{22} = ... = \beta_{2k} = 0$ are 7.4550 and 6.2356, respectively, at the case of lag 5 (*k=5*), and the *F*-values are all significant at the 1% level. These empirical results are consistent with the findings of Schmeling (2009) in that sentiment depends on previous returns and that returns depend on previous sentiment movements.

Panel B of Table 2 presents the results of the sum of the coefficients test. These empirical results provide strong evidence of a positive effect of the difference in the sentiment of foreign institutional investors on subsequent futures returns, and the results are robust with different lags. For example, the regression coefficient of the lagged one period of the difference in the sentiment of foreign investor sentiment is 0.0287 and is significant at the 1% level. The sum of the coefficients, $\sum_{k=1}^{K} \lambda_{1k}$, with 10 lags is 0.0902 and is significant at the 1% level. Furthermore, Panel B of Table 2 also presents the impact of the futures returns on subsequent changes in the sentiment of foreign institutional investors. The empirical findings show that the past futures return is negatively correlated with the difference in the sentiment of foreign institutional investors, and the results are robust with different lags. For instance, the regression coefficient of the lagged one period of the futures return is -0.9152 and is significant at the 1% level. Similarly, the sum of the coefficients, $\sum_{k=1}^{K} \beta_{2k}$, with 3, 5, and 10 lags are -1.1750, -1.9335, and -2.9072, respectively, and are all significant at the 1% level. In summary, the empirical evidence for Panel B of Table 2 suggests that the impact of the difference in the foreign institutional investor sentiment on subsequent futures returns is in support of the market risk sentiment hypothesis in the short-, mid- and long-time horizons.[10] Moreover, the results for the impact of the futures returns on subsequent changes in the foreign institutional investor sentiment are consistent with the bargain shopper effect in the short-, mid- and long-time horizons.

[10] *Chuang, Lee, and Wang (2013) argue that investor optimism leads stocks to be overvalued, at least in the short run. As such, a high sentiment implies that investors feel optimistic about future price movement in the stock markets. The argument of Chuang et al. (2013) implies that investor sentiment has a positive effect on subsequent stock returns at least in a short-time horizon even investor sentiment is associated with a mispricing correction effect. Since our empirical findings show that the sentiment of foreign institutional investor positively affect subsequent futures returns in the short- and long-time horizons, we conclude that the sentiment of foreign institutional investor is more closely related to market risk sentiment.*

Table 3 displays the dynamic relationship between the difference in the sentiment of domestic institutional investors and the futures returns. Panel A of Table 3 presents the results for the Granger-causality tests. The empirical evidence shows that there is a bi-directional Granger-causality relationship between the difference in the sentiment of domestic institutional investors and the futures returns with lagged one period. The *F*-values of causality tests for $\lambda_{11} = 0$ and $\beta_{21} = 0$ are 4.0867 and 16.4553, respectively, and the *F*-values are all significant at the 5% level. For 3, 5, and 10 lags, the evidence shows that the difference in the domestic institutional investor sentiment does not Granger-cause the futures returns. The *F*-values of causality tests for $\lambda_{11} = \lambda_{12} = ... = \lambda_{1k} = 0$ with 3, 5, and 10 lags are 1.4063, 0.8808, and 1.6499, respectively, and are insignificant at the 5% level. By contrast, the empirical findings display that the futures return Granger-causes the difference in the domestic institutional investor sentiment for different lags. For instance, the *F*-values of causality tests for $\beta_{21} = \beta_{22} = ... = \beta_{2k} = 0$ with 3, 5, and 10 lags are 5.3069, 3.8691, and 2.5741, respectively, and are all significant at the 5% level. Overall, the empirical results for Panel A of Table 3 suggest that there is a bi-directional Granger-causality relationship between the difference in the sentiment of domestic institutional investors and the futures returns in a short-time horizon. Furthermore, for the mid- and long-time horizons, the futures return Granger-causes the difference in the domestic institutional investor sentiment market, but not vice versa.

Panel B of Table 3 presents the results of the sum of the coefficients test. The empirical evidence shows that the difference in the sentiment of domestic institutional investors has a significantly negative effect on subsequent futures returns in a short-time horizon. The regression coefficient of the lagged one period of the difference in the sentiment of domestic investor sentiment is -0.0123 and is significant at the 5% level. However, for the mid- and long-time horizons, the sum of the coefficients, $\sum_{k=1}^{K} \lambda_{1k}$, with 3, 5, and10 lags are -0.0142, -0.0132, and -0.0444, and are insignificant at the 5% level. Moreover, Panel B of Table 3 also presents the impact of the futures returns on subsequent changes in the sentiment of domestic institutional investors. The empirical results display that the futures return has a significantly positive effect on subsequent changes in the sentiment of domestic institutional investors in a short-time horizon. The sum of the coefficients, $\sum_{k=1}^{K} \beta_{2k}$, with 1 and 3 lags are 0.7967 and 0.6876, and are significant at the 5% level. On the contrary, for the mid- and long-time horizons, the empirical findings show that the past futures return is insignificantly correlated with the difference in the sentiment of domestic institutional investors. The sum of the coefficients, $\sum_{k=1}^{K} \beta_{2k}$, with 5 and 10 lags are 0.2627 and 0.9038, and are insignificant at the 5% level. In conclusion, the empirical evidence for Panel B of Table 3 indicates that the impact of the difference in the domestic institutional investor sentiment on subsequent futures returns is in support of a mispricing correction

hypothesis in a short-time horizon. In addition, the results for the impact of the futures returns on subsequent changes in the domestic institutional investor sentiment are in line with the bandwagon effect in a short-time horizon.

While the dynamic relationship between the sentiment of foreign and domestic institutional investors and the futures returns displayed in Tables II and III can be explained by the competing hypotheses mentioned above, the empirical evidence of Tables II and III indicates that the dynamic relationship between the foreign institutional investor sentiment and the futures returns is much stronger than that of the domestic institutional investor sentiment. In order to further verify these empirical results, this paper also explores the relationship among the futures returns, the sentiment of foreign institutional investors, and the sentiment of domestic institutional investors. The results are reported in Table 4.

Panel A of Table 4 presents the results for the Granger-causality tests. The empirical results show that there is a bi-directional Granger-causality relationship between the difference in the sentiment of foreign institutional investors and the futures returns. All the test statistics are significant at the 1% level, and the results are robust with different lags. For example, the *F*-values of causality tests for $\lambda_{11} = \lambda_{12} = ... = \lambda_{1k} = 0$ and $\beta_{21} = \beta_{22} = ... = \beta_{2k} = 0$ are 6.9074 and 6.8942, respectively, at the case of lag 5 (*k=5*), and the *F*-values are all significant at the 1% level. However, the empirical evidence show that the difference in the sentiment of domestic institutional investors does not Granger-cause the futures returns for all lags. Specifically, the *F*-values of causality tests for $\theta_{11} = \theta_{12} = ... = \theta_{1k} = 0$ with 1, 3, 5, and 10 lags are 0.1026, 0.3704, 0.3788, and 1.6304, and the *F*-values are all insignificant at the 5% level. In addition, the futures return Granger-causes the difference in the sentiment of domestic institutional investors only in the short-time horizon. The *F*-value of the causality test for $\beta_{31} = 0$ is 8.6475 and the *F*-value is significant at the 1% level. Our empirical results also display that the difference in the sentiment of foreign institutional investors Granger-causes the difference in the sentiment of domestic institutional investors in short-, mid- and long-time horizons. For example, the *F*-value of the causality test for $\lambda_{31} = \lambda_{32} = ... = \lambda_{3k} = 0$ is 2.7757 at the case of lag 5 (*k=5*), and the *F*-value is significant at the 5% level. Nevertheless, the result shows that the causality from the sentiment of domestic institutional investors to the sentiment of foreign institutional investors is not obvious. The difference in the sentiment of domestic institutional investors only Granger-cause the difference in the sentiment of foreign institutional investors at the case of lag 1 (*k=1*). The *F*-value of the causality test for $\theta_{2k} = 0$ is 3.9192 and the *F*-value is significant at the 5% level.

Panel B of Table 4 presents the results of the sum of the coefficients test. The empirical results provide strong evidence of a positive effect of the difference in the sentiment of foreign institutional investors on subsequent futures returns, and the results are robust with different lags. For example, the sum of the coefficients, $\sum_{k=1}^{K} \lambda_{1k}$, with 5 lags is 0.0650 and is significant at the 1% level. Additionally, the empirical

findings show that the past futures return is negatively correlated with the difference in the sentiment of foreign institutional investors, and the results are robust with different lags. For instance, the sum of the coefficients, $\sum_{k=1}^{K} \beta_{2k}$, with 1 and 10 lags are -1.1483 and -3.9069, respectively, and are all significant at the 1% level. As to the cumulative effects for the difference of the domestic institutional investor sentiment and the futures returns, the results show that the difference of the domestic institutional investor sentiment has insignificantly negative effects on subsequent futures returns. Specifically, the sum of the coefficients, $\sum_{k=1}^{K} \theta_{1k}$, are negative but insignificant at the 5% level for the l, 3, and 10 lags. Furthermore, the empirical evidence shows that the impact of the futures returns on subsequent changes in the domestic institutional investor sentiment is significantly positive in the short-time horizon. The regression coefficient, β_{31}, is 0.6218 and is significant at the 1% level. As for the cumulative effects for the differences in the foreign and domestic institutional investor sentiment, the results show that the changes in the foreign institutional investor sentiment have significantly positive effects on subsequent changes in the domestic institutional investor sentiment in the short-and mid-time horizons. The sum of the coefficients, $\sum_{k=1}^{K} \lambda_{3k}$, with 1, 3 and 5 lags are 0.0715, 0.2069, and 0.1640, and are significant at the 5% level. Finally, the evidence shows that the changes in the domestic institutional investor sentiment have significantly positive effects on subsequent changes in the foreign institutional investor sentiment in the short-and long-time horizons. The sum of the coefficients, $\sum_{k=1}^{K} \theta_{2k}$, with 1 and 10 lags are 0.0725 and 0.3615, and are significant at the 5% level.

As for the tests of the competing hypotheses, Panel B of Table 4 shows that the impact of the difference in the foreign institutional investor sentiment on subsequent futures returns is still in support of the market risk sentiment hypothesis in the short-, mid- and long-time horizons even we include the difference in the sentiment of domestic institutional investors in the VAR model. The results for the impact of the futures returns on subsequent changes in the foreign institutional investor sentiment are still consistent with the bargain shopper effect in the short-, mid- and long-time horizons when the difference in the sentiment of domestic institutional investors is controlled in the VAR model. However, the impact of the difference in the domestic institutional investor sentiment on subsequent futures returns is insignificant, suggesting that the sentiment of domestic institutional investors has little effect on subsequent futures returns after controlling the sentiment of foreign institutional investors in the regression model. Finally, the results for the impact of the futures returns on subsequent changes in the domestic institutional investor sentiment are in line with the bandwagon effect in a short-time horizon after controlling the difference in the sentiment of foreign institutional investors.

In summary, the results of Table 4 display that the dynamic relationship between the foreign institutional investor sentiment and the futures returns remain unchanged after controlling the domestic institutional investor sentiment in the VAR model. By contrast, the dynamic relationship between the domestic institutional investor sentiment and the futures returns becomes weaker and insignificant after controlling the foreign institutional investor sentiment in the VAR model. These findings are similar in spirit to the findings reported in Tables II and III in that the dynamic relationship between the foreign institutional investor sentiment and the futures returns is much stronger than that of the domestic institutional investor sentiment. As such, we conclude that the relationship between the institutional investor sentiment and market returns in the Taiwan futures market is dominated by the sentiment of foreign institutional investors.

Figure 1 displays the generalized impulse responses of the futures returns and sentiment indices of institutional investors.[11] A Monte Carlo simulation with 5000 replications is used to obtain the error bands and the 95% confidence level. For the effect of unexpected shocks of the institutional investor sentiment on the futures returns, the results show that an unexpected shock from the difference in the sentiment of foreign institutional investors has a significantly positive impact on the futures returns in the next trading days. However, an unexpected shock from the difference in the sentiment of domestic institutional investors has an insignificant effect on subsequent futures returns. For the effect of unexpected shocks of the futures returns on the institutional investor sentiment, the result shows that the difference in the sentiment of foreign institutional investors responds negatively to unexpected shocks from the futures returns in the following trading days. The evidence displays that the difference in the sentiment of domestic institutional investors responds positively to unexpected shocks from the futures returns in the next trading day. Overall, the result of Figure 1 is similar in spirit to the findings reported in Panel B of Table 4 in that the sentiment of foreign institutional investors has a larger effect on the futures returns than the sentiment of domestic institutional investors.

3.3. Institutional Investor Sentiment and Subsequent Market Conditions

Chen (2011) and Lee and Chang (2013) present that sentiment can be used to explained and predicted subsequent market conditions. In this regard, the paper investigates how the sentiment of foreign and domestic institutional investors affects subsequent market states in this section. If the sentiment of institutional investors is correlated with the market risk sentiment, we hypothesize that the impact of the sentiment of institutional investors on subsequent bull (bear) market states should be positive (negative). On the contrary, if the sentiment of institutional investors is associated with a mispricing correction effect, the sentiment of institutional investors has a negative (positive) effect on subsequent bull (bear) market states. The empirical results are presented in Table 5.

Panels A and B of Table 5 employ the value of 0.00 as the threshold returns (*ThR=0.00*) to identity the bull and bear regimes. For a robustness check, Panels C and D of Table 5 uses the value of 0.0025 as the threshold returns (*ThR=0.0025*) to

[11] *The number of optimal lags for the generalized impulse response functions is determined by the Akaike information criteria (AIC).*

identity the bull and bear regimes. Since the results of *ThR=0.00* are similar to those of *ThR=0.0025*, we only focus on the findings with *ThR=0.00* as in Chen (2009). Panel A of Table 5 reports the results of the bull market states with *ThR=0.00*. The evidence shows that the difference in the sentiment of foreign institutional investors has a significantly positive effect on subsequent bull market states for all time horizons. For example, the regression coefficients of β_{Bull} for the lags of 1, 3, 5 and 10 are 2.5503, 1.8775, 1.2170, and 2.0070, and all of the regression coefficients are significant at the 5% level. By contrast, the difference in the sentiment of domestic institutional investors has an insignificant effect on subsequent bull market states for all time horizons. The regression coefficients of θ_{Bull} for all lags are insignificant at the 5% level. Panel B of Table 5 reports the results of the bear market states with *ThR=0.00*. The results show that the difference in the sentiment of foreign institutional investors has a significantly negative effect on subsequent bear market states for all time horizons. For instance, the regression coefficients of β_{Bear} with 5 and 10 lags are -1.3039 and -1.9291 and are all significant at the 5% level. On the contrary, the difference in the sentiment of domestic institutional investors has an insignificant effect on subsequent bear market states for all time horizons. The regression coefficients of θ_{Bear} for all lags are insignificant at the 5% level.

In summary, the results of Table 5 present that the impact of the difference of the sentiment of foreign institutional investors on subsequent market states is much stronger than that of the difference of the sentiment of domestic institutional investors. The empirical evidence also suggests that the sentiment of foreign institutional investors is associated with the market risk sentiment. Overall, the results of Table 5 are in line with the findings displayed in Table 4.

3.4. Robustness Checks

To further check our results, we also use the previous 3 years data to calculate the sentiment indices of foreign and domestic institutional investors. Then, we re-run the dynamic relationship among the foreign institutional investor sentiment, the domestic institutional investor sentiment, and futures returns and the impact of the sentiment of foreign and domestic institutional investors on subsequent market states. The results are presented in Tables VI to VII.

Table 6 presents the results of the trivariate VAR model for the sentiment indices of foreign as well as domestic institutional investors and the futures returns with using the prior 3 years data to calculate institutional investor sentiment. Panel A of Table 6 presents the results for the Granger-causality tests. Panel B of Table 6 reports the results of the sum of the coefficients test. The empirical results of Table 6 are similar to those findings reported in Table 4. More specifically, the results for the Granger-causality tests show that there is a bi-directional Granger-causality relationship between the difference in the sentiment of foreign institutional investors and the futures returns for the short-, mid-, and long-time horizons. The *F*-values of causality tests for $\lambda_{11} = \lambda_{12} = ... = \lambda_{1k} = 0$ and $\beta_{21} = \beta_{22} = ... = \beta_{2k} = 0$ are all significant at the 1% level in the short-, mid-, and long-time horizons. The empirical evidence of the Granger-causality tests also show that the difference in the sentiment of domestic institutional investors does not Granger-cause the futures returns for all lags. The *F*-

values of causality tests for $\theta_{11} = \theta_{12} = ... = \theta_{1k} = 0$ with 1, 3, 5, and 10 lags are 0.5624, 0.3517, 0.3626, and 1.5062, and the *F*-values are all insignificant at the 5% level. In addition, the Granger-causality tests display that the futures returns Granger-cause the difference in the sentiment of domestic institutional investors only in a short-time horizon. The *F*-value of the causality test for $\beta_{31} = 0$ is 5.0037 and the *F*-value is significant at the 5% level. Finally, the result shows that the causality from the sentiment of foreign institutional investors to the sentiment of domestic institutional investors is much stronger than in the reverse direction.

As for the sum of the coefficients test, the empirical results provide strong evidence of a positive effect of the difference in the sentiment of foreign institutional investors on subsequent futures returns, and the results are robust with different lags. For example, the tests for sum of the coefficients, $\sum_{k=1}^{K} \lambda_{1k}$, are all positively significant at the 1% level. The empirical findings also show that the past futures returns are negatively correlated with the difference in the sentiment of foreign institutional investors, and the results are robust with different lags. For instance, the sum of the coefficients, $\sum_{k=1}^{K} \beta_{2k}$, are all negatively significant at the 5% level. Moreover, the results show that the difference of the domestic institutional investor sentiment has insignificant effects on subsequent futures returns. The sum of the coefficients, $\sum_{k=1}^{K} \theta_{1k}$, are all insignificant at the 5% level. In addition, the empirical evidence shows that the impact of the futures returns on subsequent changes in the domestic institutional investor sentiment is significantly positive in the short-time horizon. The regression coefficient, β_{31}, is 0.4908 and is significant at the 5% level. Finally, our empirical results indicate that the foreign institutional investor sentiment is a significantly positive predictor of the domestic institutional investor sentiment but there is no evidence of the domestic institutional investor sentiment influencing the foreign institutional investor sentiment. Overall, the cumulative effects of Table 6 show that the foreign institutional investor sentiment and the futures returns are consistent with the market risk sentiment hypothesis and the bargain shopper effect. However, the relationship between the domestic institutional investor sentiment and the futures returns is insignificant.

Figure 2 displays the generalized impulse responses of futures returns and sentiment of foreign and domestic institutional investors with using the prior 3 years data to calculate institutional investor sentiment. The empirical evidence of Figure 2 is identical to the results reported in Figure 1. The results show that an unexpected shock from the difference in the sentiment of foreign institutional investors has a significantly positive impact on the futures returns in the next trading days. However, an unexpected shock from the difference in the sentiment of domestic institutional investors has an insignificant effect on subsequent futures returns. Furthermore, the difference in the sentiment of foreign institutional investors responds negatively to unexpected shocks from the futures returns in the following trading days. Finally, the

difference in the sentiment of domestic institutional investors responds positively to unexpected shocks from the futures returns in the next trading day.

Table 7 reports the impact of sentiment of foreign and domestic institutional investors on subsequent conditions of the futures returns with using the prior 3 years data to calculate institutional investor sentiment. The evidence shows that the impact of the difference in the sentiment of foreign institutional investors on subsequent market states is larger than those of the difference in the sentiment of domestic institutional investors on subsequent market states. Specifically, the difference in the sentiment of foreign institutional investors has a significantly positive (negative) effect on subsequent bull (bear) market states. However, the impact of the difference in the sentiment of domestic institutional investors on subsequent market states is insignificant and is not clear. The results of Table 7 are identical to those findings reported in Table V.

4. Concluding Remarks

This paper examines the dynamic relationship between the institutional investor sentiment and the market returns in the futures market. Previous studies have constructed investor sentiment with the data from the stock market, and then examine how the investor sentiment of the stock market affects stock market returns (e.g., Brown & Cliff, 2004, 2005; Baker & Wurgler, 2006; Baker et al., 2012; Chung et al., 2012). Furthermore, prior literature has employed the trading activity of the futures market to calculate investor sentiment and explores the impact of the investor sentiment on the futures returns (Wang, 2001) and option prices (Han, 2008). However, to the best of our knowledge, no work has been done on the dynamic relationship between the institutional investor sentiment by various types of the investors in the futures market and the futures returns. Accordingly, the current paper attempts to fill this void.

The empirical results of Granger-causality tests show that the sentiment of foreign institutional investors Granger-causes the futures returns and vice versa. The empirical evidence of Granger-causality tests also presents that the sentiment of domestic institutional investors does not Granger-cause the futures returns. In addition, the futures return Granger-causes the sentiment of domestic institutional investors only in the short-time horizon. Finally, our empirical results show that the foreign institutional investor sentiment is a significant predictor of the domestic institutional investor sentiment but there is no evidence of the domestic institutional investor sentiment influencing the foreign institutional investor sentiment.

In addition to using the Granger-causality tests to explore the dynamic relationship between the institutional investor sentiment and the market returns in the futures market, this paper also examines the cumulative (net) effect between the sentiment for institutional investor and the futures returns. The empirical results provide strong evidence of a positive effect of the sentiment of foreign institutional investors on subsequent futures returns. This finding is in line with the market risk sentiment hypothesis (see Frijns et al. 2008; Tse & Zhao, 2012). In addition, the empirical findings also show that the past futures return is negatively correlated with the

sentiment of foreign institutional investors. This result is consistent with the bargain shopper effect (see Brown & Cliff, 2004). However, our empirical findings suggest that the cumulative effects between the domestic institutional investor sentiment and the futures returns are not obvious and insignificant. Finally, we also find that the impact of the sentiment of foreign institutional investors on subsequent market states is larger than those of the sentiment of domestic institutional investors on subsequent market states.

While previous studies show that the investor sentiment of the stock market has a negative effect on subsequent stock returns (e.g., Baker & Wurgler, 2006; Baker et al., 2012), our empirical finding suggests that the foreign investor sentiment of the futures market has a positive effect on subsequent market returns. This finding implies that whereas investor sentiment of the stock market proposed by Baker and Wurgler (2006) and Baker et al. (2012) is correlated with the trading activity of irrational investors, the foreign institutional investor sentiment of the futures market suggested in this research might tend to be related to the trading behavior of investors' risk appetite. Overall, our empirical results indicate that the dynamic relationship between the institutional investor sentiment and the market returns in the Taiwan futures market is dominated by the sentiment of foreign institutional investors. This empirical result provides useful information for practitioners in making trading decisions.

References

Baker, M. and Wurgler, J., 2006. Investor sentiment and the cross-section of stock returns. *Journal of Finance*, 61, pp. 1645-1680.

Baker, M., Wurgler, J. and Yuan, Y., 2012. Global, local, and contagious investor sentiment. *Journal of Financial Economics*, 104, pp. 272-287.

Brown, G.W. and Cliff, M.T., 2004. Investor sentiment and the near-term stock market. Journal of Empirical Finance, 11, pp. 1-27.

Brown, G.W. and Cliff, *M.T., 2005. Investor sentiment and asset valuation.* Journal of Business, 78, pp. 405-440.

Chen, S.S., 2009. Predicting the bear stock market: Macroeconomic variables as leading indicators. *Journal of Banking and Finance*, 33, pp. 211-223.

Chen, S.S., 2011. Lack of consumer confidence and stock returns. Journal of Empirical Finance, 18, pp. 225-236.

Chuang, W.I. Susmel, R., 2011. Who is the more overconfident trader? Individual vs. institutional investors. *Journal of Banking and Finance*, 35, pp. 1626-1644.

Chuang, W.I. Lee, B.S. and Wang, K.L., 2013. US and domestic market gains and Asian investors' overconfident trading behavior. *Financial Management*, forthcoming.

Chung, S.L., Hung, C.H. and Yeh, C.Y., 2012. When does investor sentiment predict stock returns? Journal of Empirical Finance, 19, pp. 217-240.

Cooper, M.J., Gutierrez, R.C. and Hameed, A., 2004. Market states and momentum. *Journal of Finance*, 59, pp. 1345-1365.

Corredor, P., Ferrer, E., Santamaria, R., 2013. Investor sentiment effect in stock markets: Stock characteristics or country-specific factors? *International Review of Economics and Finance*, 27, pp. 572-591.

Dufour, J. and Renault, E., 1998. Short run and long run causality in time series: *Theory. Econometrica*, 66, pp. 1099-1125.

Estrella, A., 1998. A new measure of fit for equations with dichotomous dependent variables. *Journal of Business and Economic Statistics*, 16, 198-205.

Frijns, B., Koellen, E. and Lehnert, T., 2008. On the determinants of portfolio choice. Journal of Economic Behavior and Organization, 66, pp. 373-386.

Han, B., 2008. Investor sentiment and option prices. *Review of Financial Studies*, 21, pp. 387-414.

Lee, B.S., Li, W. and Wang, S.S., 2010. The dynamics of individual and institutional trading on the Shanghai Stock Exchange. *Pacific-Basin Finance Journal*, 18, pp. 116-137.

Lee, H.C., Chien, C.Y. and Liao, T.H., 2012. Commonality in trading activity and futures-cash basis: Evidence from the Taiwan Futures and Stock Markets. *Journal of Futures Markets*, 32, pp. 964-994.

Lee, H.C. and Chang, S.L., 2013. Spillovers of currency carry trade returns, market risk sentiment, and U.S. market returns. *North American Journal of Economics and Finance*, 26, pp. 197-216.

Lee, C.C., Huang, W.L., Yin, C.H., 2013. The dynamic interactions among the stock,bond and insurance markets.North *American Journal of Economics and Finance*, 26, pp. 28-52.

Pesaran, H.H. and Shin, Y., 1998. Generalized impulse response analysis in linear multivariate models. *Economics Letters*, 58, pp. 17-29.

Schmeling, M., 2009. Investor sentiment and stock returns: Some international evidence. *Journal of Empirical Finance*, 16, pp. 394-408.

Tse, Y. and Zhao, L., 2012. The relationship between currency carry trades and U.S. stocks. Journal of Futures Markets, 32, pp. 252-271.

Wang, C., 2001. Investor sentiment and return predictability in agricultural futures markets. *Journal of Futures Markets*, 21, pp. 929-952.

Table 1

Descriptive Statistics and Regression Analysis for Futures Returns and the Difference in Sentiment of Institutional Investors

Panel A: Descriptive Statistics

	FP_t	FR_t	$SI_{F,t}$	$DSI_{F,t}$	$SI_{D,t}$	$DSI_{D,t}$
Mean	7837.0100	0.0002	0.4407	0.0000	0.6131	-0.0002
Std	553.8675	0.0114	0.1896	0.0655	0.2089	0.0648
Maximum	9138.0000	0.0435	0.9898	0.4146	1.0000	0.4406
Minimum	6592.0000	-0.0658	0.0000	-0.4515	0.0596	-0.2578
ADF-Test	-2.7511	-23.9565***	-5.6322***	-22.4450***	-4.6030***	-13.1826***

Panel B: Regression Analysis

	$DSI_{i,t}$, i=F			$DSI_{i,t}$, i=D		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
α	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
β	0.0430***	---	0.0443***	0.0867***	---	0.0867***
γ	---	0.0287***	0.0305***	---	-0.0058	-0.0054
$AdjR^2$	0.0601	0.0263	0.0899	0.2425	0.0002	0.2428

Note. This table reports the summary statistics on the level and difference of futures prices and institutional investor sentiment for the futures market. FP_t is the price of the futures market at time *t*. The futures price is the closing price for the futures contracts with regards to the underlying of the Taiwan Weighted Stock Index. $SI_{F,t}$ and $SI_{D,t}$ are the sentiment indices for foreign institutional investors and domestic institutional investors, respectively. FR_t is the return of the futures market at time *t*. $DSI_{F,t}$ and $DSI_{D,t}$ are the difference of $SI_{F,t}$ and $SI_{D,t}$ at time *t*. Following Wang (2001), the sentiment index of institutional investor *i* at time *t*, $SI_{i,t}$, is calculated as follows:

$$SI_{i,t} = \frac{S_{i,t} - \min(S_{i,t})}{\max(S_{i,t}) - \min(S_{i,t})}, \; i = F \text{ or } D$$

where *F and D* are the foreign institutional investors and domestic institutional investors, respectively. $S_{i,t}$ is the aggregate position for institutional investor *i* at time *t*. The max ($S_{i,t}$) and min ($S_{i,t}$) represent historical maximum and minimum aggregate position for institutional investor *i* at time *t* over the previous 2 years (or a total of 512 trading days). In this regard, the total sample period is from July 2, 2007 to December 11, 2013, the sample period for FP_t and $SI_{i,t}$ is from July 22, 2009 to December 11, 2013, and the sample period for FR_t and $DSI_{i,t}$ is from July 23, 2009 to December 11, 2013. The aggregate position for institutional investor *i* at time *t* , $S_{i,t}$, is calculated as follows:

$$S_{i,t} = \frac{OI_{i,P,t} - OI_{i,N,t}}{OI_{i,P,t} + OI_{i,N,t}}, \; i = F \text{ or } D$$

where $OI_{i,j,t}$ is the natural logarithm of open interest *j* in dollars for institutional investor *i* at time *t*, *j=P* or *N*. *P* and *N* are the positive and negative open interests. The positive (negative) open interest of a futures market is the long (short) open interest. The number of optimal lags for the ADF-test is determined by the Akaike Information Criterion (AIC). The impact of institutional investor sentiment on futures returns is estimated as follows:

$$FR_t = \alpha + \beta \times DSI_{i,t} + \gamma \times DSI_{i,t-1} + \varepsilon_t, \; i = F \text{ or } D$$

where FR_t is the return of the futures market at time *t* and $DSI_{i,t}$ is the difference of institutional investor sentiment for institutional investor *i* at time *t*. ε_t is the residual of futures returns at time *t*. Newey-West heteroskedasticity and autocorrelation consistent (HAC) standard errors are used to calculate *t*-statistics.

** , *** indicate statistical significance at the 0.05 and 0.01 levels, respectively.

Table 2

Bivariate VAR Model for Futures Returns and Sentiment of Foreign Institutional Investors

	FR_t		$DSI_{F,t}$	
	$\sum_{k=1}^{K}\beta_{1k}$	$\sum_{k=1}^{K}\lambda_{1k}$	$\sum_{k=1}^{K}\beta_{2k}$	$\sum_{k=1}^{K}\lambda_{3k}$
	Panel A: Causality test			
k=1	0.0002	28.5859***	26.7238***	0.0025
k=3	0.6390	10.9630***	7.5230***	3.3753**
k=5	0.8257	7.4550***	6.2356***	2.8500**
k=10	0.9404	3.8473***	3.8809***	1.7772
	Panel B: Sum of coefficients test			
k=1	0.0004	0.0287***	-0.9152***	-0.0015
k=3	-0.0359	0.0491***	-1.1750***	-0.1679***
k=5	-0.0493	0.0648***	-1.9335***	-0.1245
k=10	-0.0757	0.0902***	-2.9072***	-0.0623

Note. This table reports the bivariate VAR (Vector Autoregression) results for the relationship between futures returns and the sentiment of foreign institutional investors. The *F*-values for causality tests and the sum of coefficients are reported in Panels A and B, respectively. The sample period is from July 23, 2009 to December 11, 2013. The bivariate VAR is estimated as follows:

$$FR_t = \alpha_1 + \sum_{k=1}^{K}\beta_{1k} \times FR_{t-k} + \sum_{k=1}^{K}\lambda_{1k} \times DSI_{F,t-k} + \varepsilon_{FR,t}$$

$$DSI_{F,t} = \alpha_2 + \sum_{k=1}^{K}\beta_{2k} \times FR_{t-k} + \sum_{k=1}^{K}\lambda_{2k} \times DSI_{F,t-k} + \varepsilon_{F,t} \qquad k=1,\ 3,5,10$$

where FRt is the return of the futures market at time t and DSIF,t is the difference of the sentiment for foreign institutional investors at time t. εFR,t is the residual of futures returns at time t. εF,t is the residual of the difference of the sentiment for foreign institutional investors at time t.

** , *** indicate statistical significance at the 0.05 and 0.01 levels, respectively.

Table 3

Bivariate VAR Model for Futures Returns and Sentiment of Domestic Institutional Investors

	FR_t		$DSI_{D,t}$	
	$\sum_{k=1}^{K}\beta_{1k}$	$\sum_{k=1}^{K}\lambda_{1k}$	$\sum_{k=1}^{K}\beta_{2k}$	$\sum_{k=1}^{K}\lambda_{3k}$
	Panel A: Causality test			
k=1	4.7579**	4.0867**	16.4553***	4.4683**
k=3	1.7132	1.4063	5.3069***	3.9470***
k=5	1.2583	0.8808	3.8691***	2.8955**
k=10	1.7231	1.6499	2.5741***	3.9986***
	Panel B: Sum of coefficients test			
k=1	0.0757**	-0.0123**	0.7967***	-0.0730**
k=3	0.0494	-0.0142	0.6876**	-0.1899***
k=5	0.0250	-0.0132	0.2627	-0.2512***
k=10	0.0714	-0.0444	0.9038	-0.6459***

Note. This table reports the bivariate VAR (Vector Autoregression) results for the relationship between futures returns and the sentiment of domestic institutional investors. The *F*-values for causality tests and the sum of coefficients are reported in Panels A and B, respectively. The sample period is from July 23, 2009 to December 11, 2013. The bivariate VAR is estimated as follows:

$$FR_t = \alpha_1 + \sum_{k=1}^{K}\beta_{1k} \times FR_{t-k} + \sum_{k=1}^{K}\lambda_{1k} \times DSI_{D,t-k} + \varepsilon_{FR,t}$$

$$DSI_{D,t} = \alpha_2 + \sum_{k=1}^{K}\beta_{2k} \times FR_{t-k} + \sum_{k=1}^{K}\lambda_{2k} \times DSI_{D,t-k} + \varepsilon_{D,t} \qquad k=1,\ 3,5,10$$

where FR_t is the return of the futures market at time t and $DSI_{D,t}$ is the difference of the sentiment for domestic institutional investors at time t. $\varepsilon_{FR,t}$ is the residual of futures returns at time t. $\varepsilon_{D,t}$ is the residual of the difference of the sentiment for domestic institutional investors at time t.

** , *** indicate statistical significance at the 0.05 and 0.01 levels, respectively.

Table 4

Trivariate VAR Model for Futures Returns and Sentiment of Foreign and Domestic Institutional Investors

	FR_t			$DSI_{F,}$			DSI_D		
	$\sum_{k=1}^{K}\beta_{1k}$	$\sum_{k=1}^{K}\lambda_{1k}$	$\sum_{k=1}^{K}\theta_{1k}$	$\sum_{k=1}^{K}\beta_{2k}$	$\sum_{k=1}^{K}\lambda_{2k}$	$\sum_{k=1}^{K}\theta_{2k}$	$\sum_{k=1}^{K}\beta_{3k}$	$\sum_{k=1}^{K}\lambda_{3k}$	$\sum_{k=1}^{K}\theta_{3k}$
Panel A: Causality test									
k=1	0.0357	24.4904***	0.1026	29.2222***	0.3568	3.9192**	8.6475***	4.8654**	1.6483
k=3	0.1450	9.8735***	0.3704	9.2551***	2.6904**	2.1776	2.5023	4.3013***	2.4956
k=5	0.6498	6.9074***	0.3788	6.8942***	2.5564**	1.2451	1.8182	2.7757**	2.0337
k=10	1.3902	3.8071***	1.6304	4.9127***	1.8648**	1.8139	1.3023	1.8859**	3.4836***
Panel B: Sum of coefficients test									
k=1	0.0070	0.0281***	-0.0020	-1.1483***	0.0195	0.0725**	0.6218***	0.0715**	-0.0468
k=3	-0.0287	0.0484***	-0.0018	-1.4798***	-0.1418**	0.0941	0.2536	0.2069***	-0.1328**
k=5	-0.0572	0.0650***	0.0017	-2.2954***	-0.0944	0.1297	0.1677	0.1640**	-0.2163**
k=10	0.0111	0.0883***	-0.0237	-3.9069***	0.0211	0.3615**	0.9299	0.1015	-0.6209***

Note. This table reports the trivariate VAR (Vector Autoregression) results for the relationship among futures returns, the sentiment of foreign institutional investors, and the sentiment of domestic institutional investors. The *F*-values for causality tests and the sum of coefficients are reported in Panels A and B, respectively. The sample period is from July 23, 2009 to December 11, 2013. The trivariate VAR is estimated as follows:

$$FR_t = \alpha_1 + \sum_{k=1}^{K}\beta_{1k} \times FR_{t-k} + \sum_{k=1}^{K}\lambda_{1k} \times DSI_{F,t-k} + \sum_{k=1}^{K}\theta_{1k} \times DSI_{D,t-k} + \varepsilon_{FR,t}$$

$$DSI_{F,t} = \alpha_2 + \sum_{k=1}^{K}\beta_{2k} \times FR_{t-k} + \sum_{k=1}^{K}\lambda_{2k} \times DSI_{F,t-k} + \sum_{k=1}^{K}\theta_{2k} \times DSI_{D,t-k} + \varepsilon_{F,t} \quad k=1,\ 3,5,10$$

$$DSI_{D,t} = \alpha_3 + \sum_{k=1}^{K}\beta_{3k} \times FR_{t-k} + \sum_{k=1}^{K}\lambda_{3k} \times DSI_{F,t-k} + \sum_{k=1}^{K}\theta_{3k} \times DSI_{D,t-k} + \varepsilon_{D,t}$$

where FR_t is the return of the futures market at time *t*. $DSI_{F,t}$ is the difference of the sentiment for foreign institutional investors at time *t*. $DSI_{D,t}$ is the difference of the sentiment for domestic institutional investors at time *t*. $\varepsilon_{FR,t}$ is the residual of futures returns at time *t*. $\varepsilon_{F,t}$ is the residual of the difference of the sentiment for foreign institutional investors at time *t*. $\varepsilon_{D,t}$ is the residual of the difference of the sentiment for domestic institutional investors at time *t*.

, * indicate statistical significance at the 0.05 and 0.01 levels, respectively.

Table 5

Impact of Sentiment of Foreign and Domestic Institutional Investors on Subsequent Conditions of Futures Returns

Panel A: Bull regime, ThR=0				
	α_{Bull}	β_{Bull}	θ_{Bull}	pseudo R^2
k=1	0.0856**	2.5503***	-1.0444	0.0217
k=3	0.0993***	1.8775***	-0.0657	0.0097
k=5	0.1644***	1.2170**	0.4294	0.0041
k=10	0.1064***	2.0070***	-0.9673	0.0147
Panel B: Bear regime, ThR=0				
	α_{Bear}	β_{Bear}	θ_{Bear}	pseudo R^2
k=1	-0.0973**	-2.5535***	1.0564	0.0218
k=3	-0.1039***	-1.8549***	0.0753	0.0095
k=5	-0.1691***	-1.3039**	-0.5262	0.0048
k=10	-0.1133***	-1.9291***	0.9642	0.0138
Panel C: Bull regime, ThR=0.0025				
	α_{Bull}	β_{Bull}	θ_{Bull}	pseudo R^2
k=1	-0.2588***	3.0829***	-1.8124***	0.0356
k=3	-0.3508***	1.8271***	-1.0151	0.0126
k=5	-0.4616***	2.5775***	-0.2551	0.0165
k=10	-0.6315***	2.0721***	-0.9228	0.0136
Panel D: Bear regime, ThR=0.0025				
	α_{Bear}	β_{Bear}	θ_{Bear}	pseudo R^2
k=1	-0.3633***	-1.9785***	-0.0041	0.0100
k=3	-0.5518***	-1.9800***	-0.7320	0.0098
k=5	-0.5982***	-1.8159***	-0.3482	0.0077
k=10	-0.8760***	-0.7415	-0.0048	0.0011

Note. This table reports the results for the impact of the sentiment of foreign and domestic institutional investors on subsequent conditions of futures returns. The results for bull and bear regimes with different threshold returns are reported in Panels A to D. The probit model as suggested by Chen (2009) is used for our analysis. The sample period is from July 23, 2009 to December 11, 2013. The probit model is estimated as follows:

$$P(Bull_{t+k}) = F(\alpha_{Bull} + \beta_{Bull} \times DSI_{F,t} + \theta_{Bull} \times DSI_{D,t})$$

$$P(Bear_{t+k}) = F(\alpha_{Bear} + \beta_{Bear} \times DSI_{F,t} + \theta_{Bear} \times DSI_{D,t})$$

where $DSI_{F,t}$ is the difference of the sentiment for foreign institutional investors at time *t*. $DSI_{D,t}$ is the difference of the sentiment for domestic institutional investors at time *t*. $Bull_t$ is the bull regime (up-market state) for futures returns at time *t*. $Bear_t$ is the bear regime (down-market state) for futures returns at time *t*. $Bull_t$ and $Bear_t$ are defined as follows:

$$Bull_t = \begin{cases} 1, \text{if } AvgFR_t^k = \dfrac{FR_t + FR_{t-1} + ... + FR_{t-k}}{k} > ThR \\ 0, \text{otherwise} \end{cases}$$

$$Bear_t = \begin{cases} 1, \text{if } AvgFR_t^k = \dfrac{FR_t + FR_{t-1} + ... + FR_{t-k}}{k} < -ThR \\ 0, \text{otherwise} \end{cases}$$

where $AvgFR_t^k$ is the moving average of the last *k* and present values of futures returns at time *t*. *ThR* is the threshold return. FR_t is the return of the futures market at time *t*. To measure the in-sample fit, the pseudo R^2 developed by Estrella (1998) is used in the current study.

, * indicate statistical significance at the 0.05 and 0.01 levels, respectively.

Table 6

Robust Analysis with Prior 3 Years Data to Calculate Sentiment: Trivariate VAR Model for Futures Returns and Sentiment of Foreign and Domestic Institutional Investors

	FR_t			$DSI_{F,}$			DSI_D		
	$\sum_{k=1}^{K}\beta_{1k}$	$\sum_{k=1}^{K}\lambda_{1k}$	$\sum_{k=1}^{K}\theta_{1k}$	$\sum_{k=1}^{K}\beta_{2k}$	$\sum_{k=1}^{K}\lambda_{2k}$	$\sum_{k=1}^{K}\theta_{2k}$	$\sum_{k=1}^{K}\beta_{3k}$	$\sum_{k=1}^{K}\lambda_{3k}$	$\sum_{k=1}^{K}\theta_{3k}$
Panel A: Causality test									
k=1	0.0085	18.3049***	0.5624	16.1585***	0.0002	0.5810	5.0037**	5.9405**	0.8465
k=3	0.0629	6.8450***	0.3517	4.2700***	2.9331**	1.2310	1.3347	3.2797**	1.2796
k=5	0.9434	4.7106***	0.3626	3.2519***	2.1713	0.6746	1.3454	2.7865**	1.5162
k=10	2.0005**	2.5540***	1.5062	2.5671***	1.5264	1.2795	1.0379	1.6557	2.7045***
Panel B: Sum of coefficients test									
k=1	0.0038	0.0289***	-0.0057	-0.9367***	-0.0006**	0.0325	0.4908**	0.0877**	-0.0369
k=3	-0.0268	0.0459***	-0.0039	-0.9241**	-0.1824**	0.0520	0.1837	0.1989***	-0.1096
k=5	-0.0614	0.0628***	-0.0095	-1.5383***	-0.1720	0.0635	0.1974	0.1545	-0.2151**
k=10	-0.0528	0.0867***	-0.0214	-3.0484***	-0.0197	0.3083	0.7288	0.0767	-0.5690***

Note. This table reports the trivariate VAR (Vector Autoregression) results for the relationship among futures returns, the sentiment of foreign institutional investors, and the sentiment of domestic institutional investors. The *F*-values for causality tests and the sum of coefficients are reported in Panels A and B, respectively. The previous 3 years data are used to calculate $SI_{i,t}$. As such, the sample period is from July 30, 2010 to December 11, 2013. The trivariate VAR is estimated as follows:

$$FR_t = \alpha_1 + \sum_{k=1}^{K}\beta_{1k} \times FR_{t-k} + \sum_{k=1}^{K}\lambda_{1k} \times DSI_{F,t-k} + \sum_{k=1}^{K}\theta_{1k} \times DSI_{D,t-k} + \varepsilon_{FR,t}$$

$$DSI_{F,t} = \alpha_2 + \sum_{k=1}^{K}\beta_{2k} \times FR_{t-k} + \sum_{k=1}^{K}\lambda_{2k} \times DSI_{F,t-k} + \sum_{k=1}^{K}\theta_{2k} \times DSI_{D,t-k} + \varepsilon_{F,t} \quad k=1, 3,5,10$$

$$DSI_{D,t} = \alpha_3 + \sum_{k=1}^{K}\beta_{3k} \times FR_{t-k} + \sum_{k=1}^{K}\lambda_{3k} \times DSI_{F,t-k} + \sum_{k=1}^{K}\theta_{3k} \times DSI_{D,t-k} + \varepsilon_{D,t}$$

where FR_t is the return of the futures market at time *t*. $DSI_{F,t}$ is the difference of the sentiment for foreign institutional investors at time *t*. $DSI_{D,t}$ is the difference of the sentiment for domestic institutional investors at time *t*. $\varepsilon_{FR,t}$ is the residual of futures returns at time *t*. $\varepsilon_{F,t}$ is the residual of the difference of the sentiment for foreign institutional investors at time *t*. $\varepsilon_{D,t}$ is the residual of the difference of the sentiment for domestic institutional investors at time *t*.

, * indicate statistical significance at the 0.05 and 0.01 levels, respectively.

Table 7

Robust Analysis with Prior 3 Years Data to Calculate Sentiment: Impact of Sentiment of Fore

ign and Domestic Institutional Investors on Subsequent Conditions of Futures Returns

Panel A: Bull regime				
	α_{Bull}	β_{Bull}	θ_{Bull}	pseudo R^2
k=1	0.0700	2.9745***	-1.6821**	0.0298
k=3	0.0754	1.7403**	0.3098	0.0072
k=5	0.1450***	1.0204	0.3765	0.0025
k=10	0.0508	2.1224***	-1.2370	0.0160
Panel B: Bear regime				
	α_{Bear}	β_{Bear}	θ_{Bear}	pseudo R^2
k=1	-0.0853	-2.9755***	1.7002**	0.0300
k=3	-0.0754	-1.7403**	-0.3098	0.0072
k=5	-0.1481***	-1.1622	-0.5195	0.0034
k=10	-0.0569	-2.0254***	1.2371	0.0150
Panel C: Bull regime, ThR=0.0025				
	α_{Bull}	β_{Bull}	θ_{Bull}	pseudo R^2
k=1	-0.2710***	3.4321***	-2.6418***	0.0460
k=3	-0.4232***	1.6755**	-0.8624	0.0090
k=5	-0.5438***	2.8013***	-0.1223	0.0166
k=10	-0.6967***	2.0122***	-0.5609	0.0100
Panel D: Bear regime, ThR=0.0025				
	α_{Bear}	β_{Bear}	θ_{Bear}	pseudo R^2
k=1	-0.3611***	-2.2073***	0.7000	0.0131
k=3	-0.5591***	-1.9361**	-0.9044	0.0085
k=5	-0.5990***	-1.7960**	0.1099	0.0069
k=10	-0.8999***	-1.0320	0.0163	0.0019

Note. This table reports the results for the impact of the sentiment of foreign and domestic institutional investors on subsequent conditions of futures returns. The results for bull and bear regimes with different threshold returns are reported in Panels A to D. The probit model as suggested by Chen (2009) is used for our analysis. The previous 3 years data are used to calculate $SI_{i,t}$. As such, the sample period is from July 30, 2010 to December 11, 2013. The probit model is estimated as follows:

$$P(Bull_{t+k}) = F(\alpha_{Bull} + \beta_{Bull} \times DSI_{F,t} + \theta_{Bull} \times DSI_{D,t})$$

$$P(Bear_{t+k}) = F(\alpha_{Bear} + \beta_{Bear} \times DSI_{F,t} + \theta_{Bear} \times DSI_{D,t})$$

where $DSI_{F,t}$ is the difference of the sentiment for foreign institutional investors at time *t*. $DSI_{D,t}$ is the difference of the sentiment for domestic institutional investors at time *t*. $Bull_t$ is the bull regime (up-market state) for futures returns at time *t*. $Bear_t$ is the bear regime (down-market state) for futures returns at time *t*. $Bull_t$ and $Bear_t$ are defined as follows:

$$Bull_t = \begin{cases} 1, \text{if } AvgFR_t^k = \dfrac{FR_t + FR_{t-1} + ... + FR_{t-k}}{k} > ThR \\ 0, \text{otherwise} \end{cases}$$

$$Bear_t = \begin{cases} 1, \text{if } AvgFR_t^k = \dfrac{FR_t + FR_{t-1} + ... + FR_{t-k}}{k} < -ThR \\ 0, \text{otherwise} \end{cases}$$

where $AvgFR_t^k$ is the moving average of the last *k* and present values of futures returns at time *t*. *ThR* is the threshold return. FR_t is the return of the futures market at time *t*. To measure the in-sample fit, the pseudo R^2 developed by Estrella (1998) is used in the current study.

** , *** indicate statistical significance at the 0.05 and 0.01 levels, respectively.

Figure 1

Generalized impulse responses of futures returns, sentiment of foreign institutional inve

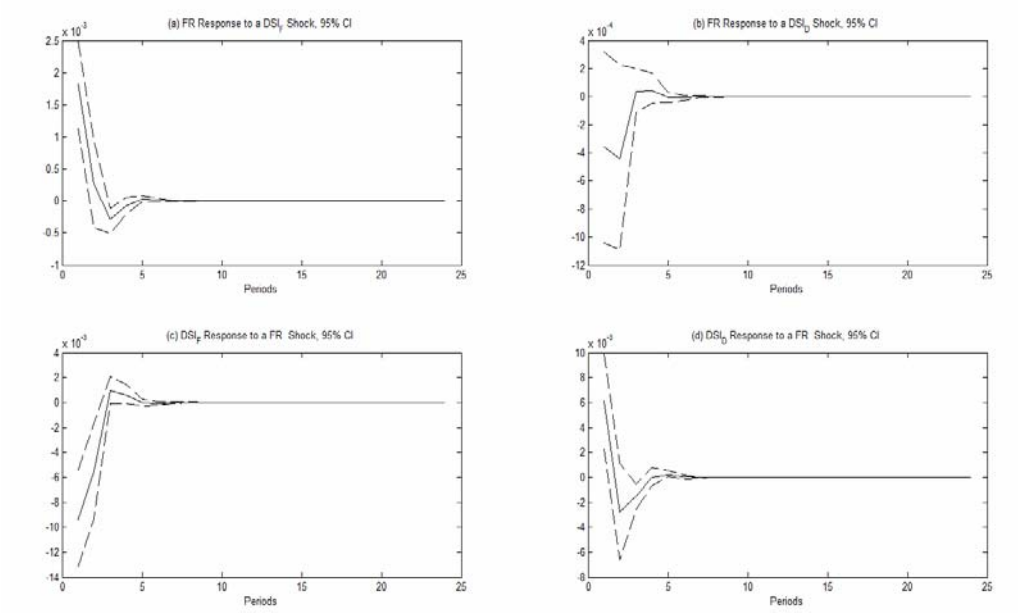

Figure 2

Generalized impulse responses of futures returns and sentiment of foreign and domestic institutional investors, using prior 3 years data to calculate sentiment