PANOECONOMICUS, 2015, Vol. 62, Issue 3, pp. 361-383
Received: 12 February 2014; Accepted: 15 October 2014.

UDC 005:336.76(529)
DOI: 10.2298/PAN1503361Y
Original scientific paper

Tzu-Yi Yang

Department of Business and Management,
Ming Chi University of Technology,
New Taipei City,
Taiwan

✉ tyyang@mail.mcut.edu.tw

Yu-Tai Yang

Department of Aeronautical and Opto-Mechatronic Engineering,
Vanung University,
Zhongli City,
Taiwan

✉ yaung5629@yahoo.com.tw

A Study on the Asymmetry of the News Aspect of the Stock Market: Evidence from Three Institutional Investors in the Taiwan Stock Market

Summary: This paper uses daily data to investigate the behavior of institutional investors in Taiwan's stock market. We adopted TGARCH and EGARCH models to test various news. We found that, for the entire sample, a significant clustering phenomenon exists in the investment behavior of three institutional investors, and the impact due to a change of news content shows significant asymmetry and leverage effects. That is, the impact of bad news from the market is stronger than that of good news. In addition, an asymmetric phenomenon can also be seen for the international news aspect as responded to by foreign institutional investors. This phenomenon is more significant than those of the dealers and institutional trust investors. Moreover, the asymmetric phenomenon as responded to by the dealers for domestic news is more significant than those of foreign investors and institutional trust investors.

Key words: Market volatility, Financial information and policy announcement, TGARCH, EGARCH.

JEL: B25, C22, F33, G01.

All stock markets are quite sensitive in any country. That is, all kinds of news aspects and policy aspects will be reflected in the value of the stock market. In some cases, this could lead to fluctuations in the stock price of the company. For example, the infringement lawsuit between Apple and High Tech Computer (HTC) has resulted in the thought from the investors that the sales channel of HTC products in the USA might be blocked and the sales profit might decline. Hence, a huge fluctuation in the stock price of HTC was seen, and such news is sufficient to let the stock price of HTC fluctuate continuously for a period of time. Domestic and international policy and news might sometimes generate fluctuations in the stock price of a specific industry or area. For example, Economic Cooperation Framework Agreement (ECFA) has a positive influence on China-concept stocks, and the financial stock has the most sensitive response to it. Hence, the major content of the first stage of ECFA is based on the financial industry. Recently, Apple has announced the development of large size smart phone, which is named iPhone 6. Once this news is released, lots of investors in the stock market buy the stocks of suppliers related to iPhone 6; however, the

actual product is still in the R&D or production stage and is not launched into the market, but such news can make the stock price rise. Another example is that the Israel-Palestine war has created important and linked impacts on related international stock markets; meanwhile, it also affects the investment behavior and persistence of investors in the stock market. All of the above has proven that the stock price has a very sensitive neural system. Hence, be it the government or enterprise, they all have to be very cautious in making decisions. In another part, different news aspects have different levels of fluctuation impact. Some last for one to several days, and some last continuously for a long period of time. Hence, they have different influences on the stock market. Moreover, lots of reasons might cause fluctuation in the stock market, but most of them are expectations about news and policies.

Henryk Gurgul and Tomasz Wójtowicz (2014) have performed a study on the impact made by macroeconomic news announced by the USA on the stock markets of new alliance countries in Europe. It was verified that at the first moment after the announcement of the news, there will be a response in the stock price for large-scale enterprises. However, for small-scale enterprises, although the return on stock is later than that of large-scale enterprises, the stock price reaction continues for a longer time. In addition, Roohollah Zare, M. Azali, and Muzafar Shan Habibullah (2013) have inspected unsymmetrical reactions caused by financial policy in the stock markets of Indonesia, Singapore, Malaysia, Philippines and Thailand, and they thought that financial policies have a longer influence on bear markets than on bull markets. Therefore, it is clear that the stock market is quite sensitive to the news. In addition, the stock market has an anticipatory effect on the news. In other words, it will respond to the value and strength of the news in advance, which is especially true for Taiwan due to its high perceptive strength regarding the changes in international society. Therefore, there is a very high correlation between the news and the investment environment. In addition, we thought that announcements made by the Ministry of Finance would affect the economic and local balance of this country. Moreover, the influence on investment behavior from policy usually lasts longer than that from the news. Therefore, we believe that policy announcements can change investors' behavior, and this is the main objective of this research, to study the influence on the investment environment from news and policy announcements.

If most of the investment in the stock market of a country is simply from individual investors, then studies on the return and fluctuation in the stock market become very simple. For example, the previous stock market in mainland China was divided into stock A and stock B, which clearly limits the investor's identity. The fluctuation in such a stock market can be explained as the investment behavior of the individual investors. That is, if the stock market is studied this way, then the fluctuation will be much simpler. However, stiffness phenomena will be seen in such a market, and the liquidity of the stock market will be questionable. However, the stock market in a general country is not divided into specific markets for specific investors. Hence, the study of the fluctuation of such a stock market will be more difficult and challenging. Therefore, the free market point of view is taken in this study to analyze the fluctuation sensitivity from different investor combinations on the stock market news. Meanwhile, different time series models are used to study if differences or

specific phenomena exist in the response to stock market news from different institutional investors.

1. Related Literature Survey

The investor combination in the stock markets of most countries includes foreign investors, dealers, investment trusts and retail investors, and the transaction methods are very diversified. However, depending on the level of development of a country and the level of transparency of the stock market, the proportions of the different investors will be affected. For example, the stock market in the USA is quite efficient. Hence, most investors would like to have their capital be managed by professional managers for their benefit. Hence, the stock market is composed of mostly institutional investors. This is because the stock market information in such a country is quite transparent. The investors cannot use the news to get extra investment return. That is, the probability of insider trading is greatly reduced. By contrast, Taiwan's stock market is a half efficient market. Retail investors occupy a larger proportion than they do in the stock market of the USA. Because the information is not transparent, insider information still exists in this market. Moreover, because investors can use insider news to get extra profit, investors in such a market thus are more sensitive in terms of the response and impact caused by stock market news. Hence, it is interesting to know whether such behavior from the retail investors in the stock market influences the decisions and behavior of the stock operations of three institutional investors in the stock market.

Stock price fluctuations change with time and with factors such as economic level, national income, liquidity of the monetary supply, interest rates, governmental policy, and expectations from investors. All these factors are called news aspects. Hence, the spread of the news usually changes the investment behavior of investors, and in most cases, it changes the return of the investors. Expectations from investors usually make stock prices respond to real situations in advance. This characteristic of the stock market has attracted interest from numerous scholars. Therefore, a variety of scholars and experts with viewpoints from multiple professional fields have stepped in to study investors' responses to stock market news.

1.1 Study of Related Time Series Models

Mostly, when scholars are investigating fluctuations in the stock market, time series models are adopted. Because stock price fluctuations and investment returns are highly related to the duration of the fluctuation, different time series models have been taken for their studies. For example, Robert F. Engle (1982) thought that the traditional econometric model adopted prediction variables in certain fixed periods of time. Thus, a new random process was introduced, which was called the autoregressive conditional heteroscedastic (ARCH) process. Moreover, after verification was done on inflation in England, it was found that for time-varying variables, the results are more accurate when this method is adopted compared to the results obtained from the traditional OLS method.

Engle and Victor K. Ng (1993) have used all kinds of time sequence models to study the fluctuation created by news in the stock market, and it was found from their

results that the exponential general autoregressive conditional heteroscedastic (EGARCH) model could capture the fluctuations created by most asymmetric news. The authors have used the entire stock market value together with different news aspects. For example, there is good news and bad news to investigate what series method is suitable for making the correct response in such a market situation. However, the disadvantage is that the authors did not consider specific behaviors or combinations of investors for investment in the stock market, yet the authors did classify the news aspects. Giampiero M. Gallo and Barbara Pacini (2000) have adopted the stock market of the USA as a target and applied the general autoregressive conditional heteroscedastic (GARCH) and EGARCH models to investigate research topics such as future profit. The conclusions were that the ARCH model can display the continuous characteristics of the prices several days prior to different opening prices and closing prices. However, the authors did not consider the structural issues created by news aspect on stock prices, which might lead to error. Similarly, Kuan-Min Wang and Hung-Cheng Lai (2014) have applied the EGARCH model and daily data to perform a related study on the stock markets of Japan, Singapore and USA. However, what is different is that the focus of the authors was switched to the level of contagiousness among stock markets. Using the EGARCH model, it is clear that stronger risk contagiousness levels are seen between the stock markets of Indonesia and mainland China. However, the risk contagiousness level between the stock markets of the USA and mainland China is quite low. R. Rabemananjara and Jean-Michel Zakoian (1993) have applied threshold ARCH models (TARCH) to verify the asymmetry in the stock market of France. The authors have provided a more general method, which allows nonlinear fluctuation and periodic behavior in the stock market. There are fluctuations with different positive impacts and negative impacts, and these impacts have different sizes. The results show that the TARCH model can better display the nonlinear behavior of stock markets, but the GARCH model fails. Therefore, numerous nonlinear phenomena exist in the stock market. However, if an inappropriate method is used, the results will be inaccurate. Although TARCH considers nonlinearity in stock market fluctuations, there are still some issues not yet considered. Hence, some scholars continue to use other methods for the verification of real results.

For example, Engle and Ng (1993) have used data from the stock market in Japan to compare the suitability of ARCH series models. The results showed that the threshold GARCH (TGARCH) model has the best explanatory power for fluctuations from asymmetry in the stock market. Ludger Hentschel (1995) considered symmetric and asymmetric fluctuation together, and the GARCH model was used to study daily data from the stock market in the USA. Banamber Mishra and Matiur Rahman (2010) have applied a dynamic model to study the correlation between profit and fluctuation in the stock market. These authors thought that when there were significant increases in the fluctuation of the stock market created by positive and negative information impacts, the market's efficiency and liquidity would be reduced. The authors have applied the TGARCH-M model to predict the impacts created by good news and bad news on the stock market. The authors considered the structural issues created by different news types on the stock market for two different markets. Because Japan is a developed country, and India is a developing emergent country,

there might be asymmetric issues that exist between these two samples. From the studies mentioned above as performed by several scholars on the fluctuations generated by time, it can be found that if the data is structured as a time series, then when inspecting topics such as self-relevancy, length of time, heterogeneity and symmetry, the adoption of the research method should be very cautious. Because the main focus of this article is the sensitivity to news and policy of institutional investors, regarding the method adopted, it was concluded that EGARCH and TGARCH are more suitable for the current research objectives. This is because in the data we have used, asymmetric correlations might exist.

1.2 The Influence on the Behavior in the Stock Market due to News Aspects

Some scholars have used stock prices and/or transaction fluctuation to co-study the economic index and other investment tools. This is because fluctuation represents investment effectiveness or the level of the index. For example, G. William Schwert (1989) analyzed the correlations among stock price fluctuation, real macroeconomic fluctuation, economic activity, financial leverage and stock transaction activity, and it was found that a positive correlation exists between financial leverage and fluctuation. In an economic recession period, the change on the return from a stock investment will be higher than that in other periods. In the meantime, the author also found that it was difficult to explain the fluctuation in stock prices with a single stock evaluation model. Richard T. Baillie and Ramon P. Degennaro (1990) thought that most of the asset pricing models see the expected return and risk of a stock investment portfolio as positive. This is usually caused by variations in asset pricing. In the meantime, the author suggested that investors should consider other risk assessments as more important than the variation of the investment portfolio. From the scholars' empirical analysis results mentioned above, it can be seen that the stock market factor will affect numerous facets. It is also the leading index of the economic status of a country. Hence, it constitutes a very sensitive neural system for the responses to the research of economic phenomena and for the reflection of living standards, wealth, income, and people's expectations.

In addition, Mishra and Rahman (2010) have applied the TGARCH model to study the dynamic relations of the fluctuation in investment returns from the stock markets in India and Japan. It was found from their study that the stock markets of India and Japan are continuously impacted by good news and bad news, and fluctuation in investment returns continues in these two countries. Obviously, good news has more influence on the stock market of India, whereas bad news has more influence on the stock market of Japan. Therefore, no matter if it is positive news or negative news, it all has a very strong influence on the returns and fluctuations of investment returns in the stock market. Carlos Aguiar de Medeiros (2011) followed the standard political economy to study Latin American structuralism and discussed the mutual influence created by standardized international economic policy on institutions and economic structure. Moreover, the author also thought that overall policy affects dynamic exchange rates, inflation, output and stabilization funds, etc. The view points of these scholars have inspired the motives of this research to study if

there is any significant influence from different news sources and government policies on the investment behavior of investors.

Adrian Claudiu Filip, Ioan-Ovidiu Spatacean, and Paula Nistor (2012), George J. Jiang, Eirini Konstantinidi, and George Skiadopoulos (2012), and P. S. M. Nizer and Julio C. Nievola (2012), all scholars, have found that market news, no matter if it is of financial or non-financial nature, or if the news is announced periodically or non-periodically, or if it is social or political news, it all affects investment behavior in the capital and financial markets. Therefore, starting from the researchers' perspective, the sources of news will continuously be divided into more detail. Meanwhile, the influences of different characteristics of news sources on the investment behavior of institutional investors will also be studied. Such studies focus on the behavior changes of investors caused by anticipatory investment mental status from the news.

2. Data Source and Model Design

2.1 Data Source and Analysis

The main theme of this paper is to study the influence of an institutional investor's behavior on Taiwan's stock market, and the data are sourced from the Taiwan Economic Journal (TEJ). TEJ has as its main job to compile a thorough collection of data such as Taiwan's macroeconomic data, information on companies with stocks listed in the regular stock market or OTC (over-the-counter) stock market, corporate governance, risk management and funds. The data are mainly provided to domestic and foreign scholars, research institutes, colleges and universities for research on Taiwan's economy and financial situation. In recent years, TEJ has collected data from the financial markets of the greater China area, namely Taiwan, Hong Kong and mainland China. In addition, data collected from financial markets in Asian areas such as Thailand, Korea, Singapore, Philippines and Malaysia provide relevant information for the making of verified, consistent and timely decisions.

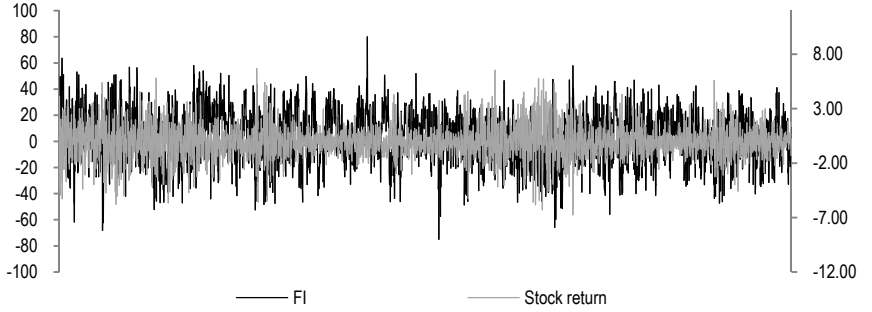
In this research, the percentage rise and fall of the TSE index in Taiwan's stock market and the daily transaction value from foreign investors, dealers and investment trusts are collected. The data collection period is from January 02, 2001 to October 31, 2012 for a data sample of up to 2,936. The results of the data analysis revealed that investors in Taiwan's stock market are still mostly retail investors. From the data collected for a period of 12 years, it was found that the average transaction value from the three institutional investors occupies approximately 28% of the total transaction value. Hence, it is clear that approximately 72% of the transactions are from retail investors. Whether or not the investment behavior of these retail investors will be affected by the few institutional investors is the main research topic in this paper. In addition, it was found in this research that the average transaction value from foreign investors accounts for approximately 21% of the total transaction value, and the average transaction value from investment trusts accounts for approximately 4% of the total transaction value. However, the average transaction value from dealers accounts for only approximately 3% of the total transaction value. Hence, the bold hypothesis is made that the investment behavior of foreign investors might af-

fect the investment behavior of other investors in the stock market. Therefore, in Figure 1, the correlation between the fluctuation in investment returns in the stock market and the fluctuation in the transaction value of the three institutional investors is provided. This is an attempt to understand if the institutional investors are the major factor affecting the fluctuation in the stock market. Observing Figure 1 to Figure 3, it can be seen from the net buy/net sell fluctuations of the daily in and out action in the stock market by three institutional investors that the investment behavior of investment trusts and dealers is more similar, but the net buy/net sell behavior of foreign investors is more independent. For example, on July 2005 when the Taiwanese government launched the new system of the Labor Pension Act, it resulted in daily net sales from dealers and investment trusts for a long period of time. However, the foreign institutional investor chose to stand on the net buy side at that moment. Next, in August 2007, right before the occurrence of the subprime mortgage crisis in the USA, the net buy/net sell position was just the opposite. This says that different attributes of institutional investors have different interpretations of different news. In addition, during the research period, the stock market was also affected by numerous news aspects; for example, Taiwan joining the World Trade Organization (WTO), the SARS crisis, the European debt crisis, and certain major policies such as major economic initiatives, taxation reform, a dual rise in gasoline and electricity and the taxation of stock income. Hence, it is interesting to know if the investment behavior of the three institutional investors in the stock market would change. The research focus is put on daily data and the behavioral changes in the stock market in a short period of time, which is an attempt to understand the investment behavior of three institutional investors and their response time to events. Moreover, we also collected major policy changes made by the government during this period of time from related government organizations. To the stock market, some of these policies are positive news, but some are negative news, and some information is domestic whereas some is foreign. Hence, this information was used to investigate the causes of fluctuations in different layers of the stock market, and the results are shown in Table 1. Although the scale of the stock market in Taiwan does not make it an international index, yet Taiwan is a developing country, and it is also an important country among newly emergent markets and among South Asian countries. Hence, it occupies an important role in the newly emergent markets like Singapore, Hong Kong and Korea. Therefore, it is worth studying further.

2.2 Explanation of Variables

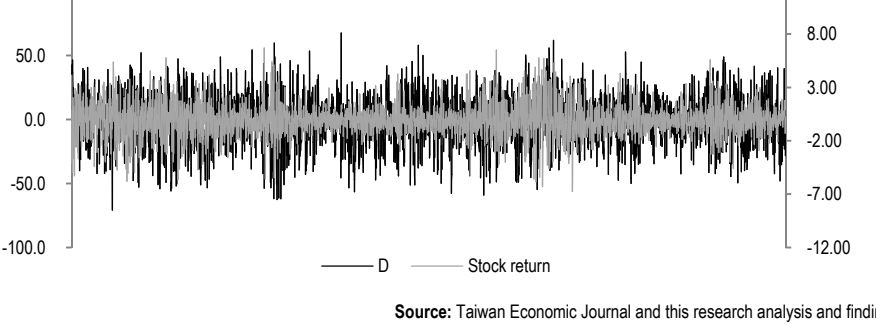
Based on the research objective of this study, the daily data from Taiwan's stock market was collected as the dependent variable of this research model. Based on the daily closing index, the stock price return rate of that day was then calculated. In addition, time series related analyses were made on three institutional investors in the stock market regarding the transaction value at the closing time each day accompanied with news aspects during the research period. Such analyses are an attempt to find out the investment behavior and sensitivity of three institutional investors to news aspects. All the news listed in Table 2 did occur in the research period, and of course, some news will be put into the empirical results for co-investigation.

If the responses of investors to the news and their expectations are consistent, then the fluctuation in the stock market will be high. For example, on April 05, 2012 when the Ministry of Finance held a forum for the stock income tax, the expectations generated from investors made the stock price fall. In addition, in 2005 when Taiwan's government launched a new Labor Pension Act, it did not cause much fluctuation in the stock price due to different expectations from investors. Therefore, the investment behavior of the three institutional investors and all kinds of news sources in Taiwan were proposed to perform sensitivity verification of the stock market.



Source: Taiwan Economic Journal[1] and this research analysis and findings.

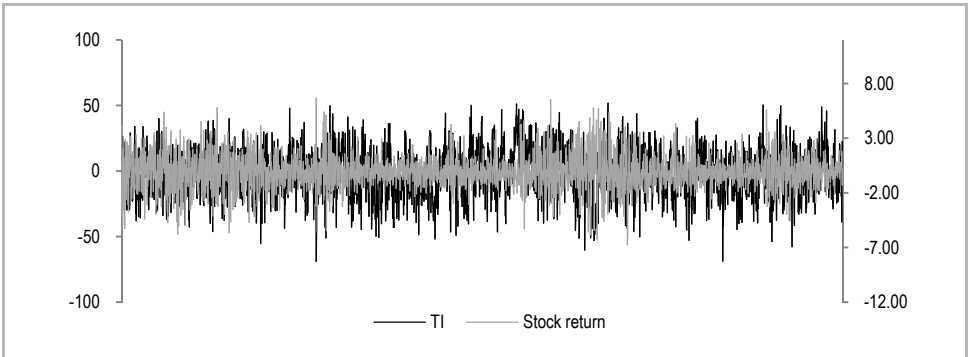
Figure 1 Correlation between Buy/Sell Transaction Differential of Foreign Investors and the Investment Return of Stock



Source: Taiwan Economic Journal and this research analysis and findings.

Figure 2 Correlation between Buy/Sell Transaction Differential of Dealers and the Investment Return of Stock

[1] **Taiwan Economic Journal (TEJ).** 2014. Taiwan Economic Journal Database. http://www.finasia.biz/ensite/Database/tabid/92/language/en-US/Default.aspx (accessed February 10, 2014).



Source: Taiwan Economic Journal and this research analysis and findings.

Figure 3 Correlation between Buy/Sell Transaction Differential of Investment Trusts and the Investment Return of Stock

Table 1 Annals of Major Events Occurring in Taiwan and International Society

Date	Content of event
September 11th, 2001	911 terrorism attack event occurred in USA.
January 1st, 2002	Taiwan's formal entry into WTO.
November 24th, 2003	The implementation of a 5 year 500 billion NT dollar plan was announced by the Taiwanese government.
April 30th, 2004	International oil price rises above 40 US dollars.
July 1st, 2005	The implementation of new Labor Pension Act was launched in Taiwan.
August 10th, 2007	The subprime mortgage crisis occurred in USA.
June 30th, 2008	Taiwan's opening for investment from mainland China.
April 15th, 2009	A consumption ticket was first issued in Taiwan.
June 29th, 2010	Formal signing of ECFA between Taiwan and mainland China.
June 1st, 2011	Luxury tax launched in Taiwan.
April 2nd, 2012	Dual rise in gasoline and electricity occurred in Taiwan.
April 5th, 2012	Forum for stock income tax was held by Taiwan's Ministry of Finance.

Note: ECFA stands for Economic Cooperation Framework Agreement, which is a bilateral economic and trade agreement between Taiwan and mainland China. The dual rise in gasoline and electricity in Taiwan refers to an average rise in gasoline price of approximately 10.7% on April 02 and on April 12 an electricity rate increase in the range of approximately 16%~35%. The timing of occurrence of the events in the table can be divided into two types, one being the actual occurrence timing of the event, which is the most accurate one; examples include the 911 terrorism attack event in the USA, Taiwan's formal entry into the WTO, the implementation of the new Labor Pension Act in Taiwan, Taiwan's opening for investment from mainland China, the first consumption ticket issued in Taiwan, formal signing of the ECFA between Taiwan and mainland China, launch of a luxury tax in Taiwan and the forum for stock income tax held by Taiwan's Ministry of Finance. The other type is the timing of the news presented in newspapers or in the news media, including the implementation of the 5 year 500 billion NT dollar plan by the Taiwanese government, the international oil price increase above 40 US dollars, the subprime mortgage crisis in the USA and the dual rise in gasoline and electricity in Taiwan.

Source: This research management.

2.3 Model Design for Empirical Verification

Because the data include time and the ordering of events during the research period, a time factor and the influence of events were also considered. Because good news and bad news always go together in the stock market, the impact on stock prices from domestic and foreign news and from financial and non-financial news is asymmetric. Hence, the exponential GARCH EGARCH model as proposed by Daniel B. Nelson (1991) and the threshold GARCH and TGARCH models as proposed by Zakoian (1994) were adopted. If an asymmetric model for the fluctuation in the stock market is not adopted, then the empirical fluctuation results will deviate. Because the above-mentioned scholars have used the GARCH and TGARCH models to perform (respectively) studies on the stock markets of the USA and Japan, and it was found that asymmetric effects exist in the investment returns of the stock market, triggering the idea of this research on whether such phenomena and their correlations can be used to study the influences of different types of news on investment behavior, therefore we try to make use of such correlations to design a model of the impact of news on the stock market into Equations (2) and (4), and it is hoped that some results can be acquired.

Of course, basic verification will also be done on the data. This includes descriptive statistical analysis, stationary analysis, a white noise test and structural analysis. Then, the EGARCH and TGARCH models will be used to analyze the fluctuations in the stock market. First, the EGARCH model as proposed by Nelson (1991) was adopted in this research, and the model is as below:

Table 2 Variable Definitions

Variable	Code	Definition
The ratio of stock return (SR)	Stock_r	We proxy stock_r as a dependent variable to calculate the percentage of change of stock return, and the estimation formula is: $(\text{Stock}_t - \text{stock}_{t-1}/\text{tock}_{t-1}) \times 100.$
Transaction value of stock from foreign investors (FI)	Stock_turnover_F	The percentage of stock bought/sold daily by foreign investors relative to the daily transaction value. The estimation formula is: $(\text{Stock\_BV}_{F.t} - \text{Stock\_SV}_{F,t}/\text{Stock\_BV}_{F,t} + \text{Stock\_SV}_{F,t}) \times 100.$
Transaction value of stock from investment trusts (IT)	Stock_turnover_I	The percentage of stock bought/sold daily by investment trusts relative to the daily transaction value. The estimation formula is: $(\text{Stock\_BV}_{I.t} - \text{Stock\_SV}_{I,t}/\text{Stock\_BV}_{I,t} + \text{Stock\_SV}_{I,t}) \times 100.$
Transaction value of stock from dealers (Dealer)	Stock_turnover_D	The percentage of stock bought/sold daily by dealers relative to the daily transaction value. The estimation formula is: $(\text{Stock\_BV}_{D.t} - \text{Stock\_SV}_{D,t}/\text{Stock\_BV}_{D,t} + \text{Stock\_SV}_{D,t}) \times 100.$

Note: Stock_BV in the table denotes the daily net purchase of the stock, Stock_SV denotes the daily net sales of the stock, F denotes Foreign Investor, I denotes Investment Trust, and D denotes Dealer. SR is the ratio of stock return, FI shows the transaction value of stock from foreign investors, IT shows the transaction value in stock from investment trusts.

Source: This research management.

Condition average formula:

$$\gamma_t = a_0 + \sum_{i=t}^{m} a_i r_{t-1} + \sum_{j=1}^{n} b_t \varepsilon_{t-j}^2, \quad \varepsilon_t|\sigma_{t-1} \sim N(0,h). \tag{1}$$

Condition variance formula:

$$\ln(h_t) = \alpha_0 + \sum_{i=1}^{q} \left(\gamma_i \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \alpha_i \left(\frac{|\varepsilon_{t-i}|}{\sqrt{h_{t-i}}} - E\frac{|\varepsilon_{t-i}|}{\sqrt{h_{t-i}}} \right) \right) + \sum_{j=1}^{p} \beta_i \ln(h_{t-1}), \tag{2}$$

where $\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} > 0$ denotes positive news in the stock market and $\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} < 0$ denotes negative news in the stock market. When the coefficient is $\gamma_i = 0$, it means that a symmetric relation exists between positive news and negative news in the market. When the coefficient is $\gamma_i < 0$, it means that the impact on the stock market from bad news is greater than the impact from good news. Hence, an asymmetric relation exists. α and β represent the correlation coefficients of the variables; if the coefficients reach significance, it means that the fluctuation of the shareholding ratio of the investment institution has clustering properties, and *i* here represents the data in period *i*. Here daily data is used to study the frequency of the fluctuation in the stock market, and the main reason is: If the fluctuation in the stock market is investigated using a shorter frequency, then the verified research results cannot change the investment behavior and investment portfolios of the general investors and investment institutions in time. However, if the research frequency is too long, then the real value of the news aspect cannot be captured.

Next in this research, another asymmetric model, TGARCH, was used for comparison and for empirical verification, and the model is as follows:

Condition average formula:

$$\gamma_t = a_0 + \sum_{i=t}^{m} a_i r_{t-1} + \sum_{j=1}^{n} b_t \varepsilon_{t-j}, \quad \varepsilon_t|\sigma_{t-1} \sim N(0,h). \tag{3}$$

Condition variance formula:

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon^2{}_{t-1} + T\varepsilon_{t-1}^2 D_{t-1} + \sum_{j=1}^{p} \beta_j h_{t-j}. \tag{4}$$

Here D_{t-1} represents the virtual variable of market information ($D_{t-1} = 1$ means that the market reflects good news or domestic news, $D_{t-1} = 0$ means bad news or foreign news). In addition, in this research, news is divided into domestic and foreign news, and the main objective is to investigate the fluctuation in the domestic stock market and the connection to the international market. α_i represents the influence of the non-conditional fluctuation of the previous term on the conditional variance of the current term; β_j represents the influence of the conditional variance of the previous term on the conditional variance of the current term, and here *i* represents the data in period *i*.

T is the estimation coefficient. When *T* is positive, it means that bad news has a stronger impact on the stock market than good news.

Finally, in Equations (2) and (4), the investor identities are added respectively; for example, foreign investors, investment trusts and dealers. The main objective is to observe which investors or investment institutions deduce good investment behavior from the news in the stock market. In order to get correct results smoothly, be-

fore a regression test is performed in this study, some basic tests are done to ensure the correctness of the data. These processes will be described in detail in the next section.

3. Empirical Results and Analysis

Before performing the analysis, analyses and tests have to be done on the structure of the data in this research to ensure that when the data are analyzed, judgment errors will not be generated in the research results. Because the data generating process (DGP) of time series data is usually related to the data a few terms ago, the variable of the current term will be affected by the variable of the past term. Hence, if DGP does not meet stationary characteristics, then the correctness and predictive capability of the estimated results will have serious problems. Therefore, before empirical verification was done on the data, the augmented Dickey-Fuller unit root test (ADF) was adopted, and it revealed that the DGP stability test results for this research all significantly refute the unit root null hypothesis. In other words, the data do not possess unit root characteristics. In addition, a residual auto-correlation (Q) test was also adopted, and the results show that the null hypothesis tested without auto-correlation cannot be refuted. Finally, the results are in Table 3.

Table 3 Summary Statistics of ADF, PP, SBC and ARMA

Market/Investors	ADF	Adjusted R^2	AIC	SBC	ARMA
SR	-51.269***	0.000	3.593	3.599	(1,1)
FI	-20.054***	0.310	8.474	8.483	(3,1)
IT	-19.120***	0.264	8.357	8.363	(2,1)
DI	-36.491***	0.145	8.705	8.711	(2,1)

Note: ADF is the *t*-statistic for the augmented Dickey-Fuller test, SBC is the Schwarz Bayesian information criterion and AIC is the Akaike information criterion. ***, ** and * indicate significance at α = 1, 5 and 10%, respectively. SR, FI, IT and D are the same as in Table 2.

Source: This research management.

From the data on the three institutional investors and stock investment returns collected from Taiwan for this study, after all of the above tests and analyses, it can be ensured that our subsequent empirical analysis results will better reflect actual investment behavior. In addition, for the data structure and events, in the last section some good news and bad news and some domestic events and foreign events have been collected. Hence, it is an interesting question whether dramatic differences in the source and/or characteristics of the news would affect the investment behavior of the three institutional investors. Because the influence of good and bad news on condition variance has asymmetric characteristics, asymmetric TGARCH and EGARCH models were adopted to solve the asymmetry issue. However, in actual application, this study first tried to use the mobile CHOW test to judge the time point of the structural change, the method proposed by Bruce E. Hansen (2001).

From the results of mobile CHOW and CUSUM tests, it can be seen that foreign investors have the strongest sensitivity to the news. However, from the CHOW test result, it can be seen that different institutional investors have different responses

to different news. For example, during the research period, foreign investors had the highest sensitivity to the subprime mortgage crisis in the USA, but investment trusts and dealers had higher sensitivity to domestic news such as the government opening to investment from mainland China, the price of gasoline and welfare policy. Adoption of the mobile CHOW and CUSUM test methodologies revealed that the investment behavior of the different institutional investors during the research period was not necessarily continuous. From Figure 4 to Figure 6, it can be very clearly seen that the investment behavior of each institutional investor shows multiple structural change. Hence, if only the time series model was considered for the verification, it would have created deviation in the results considering the generation of structural deviation by news on research results when the research period is too long. Hence, it was decided that empirical analysis would be done in EGARCH and TGARCH for the different sample frequencies.

In addition, an interesting insight taken from these figures is that the institutional investors are the most sensitive in their predictive investment behavior, whereas the general investor cannot catch this message. Among them, foreign investors are more sensitive to this. For example, before the occurrence of the subprime mortgage crisis in the USA and before the dual rise in gasoline and electricity as well as the taxation of stock income, foreign investors usually made the predicted investment behavior. Of course, other institutional investors such as investment trusts and dealers all display such behavior. However, these behaviors are thought of as herding behavior in the market instead of as predicted investment behavior. Moreover, the entire predicted investment behavior of the three institutional investors could be seen during the latter half of the research period and after the implementation of all kinds of new taxation systems by the government, which can be seen from Figure 4 to Figure 7. In addition, the 9/11 terrorism attack, which occurred in 2001 in the USA, was a burst event that could not be expected by the three institutional investors. However, since it did not occur domestically, its influence on the investment behavior of the domestic stock market was thus shorter, and consistency is not seen among all the institutional investors.

According to the good and bad news collected domestically and overseas in Table 1 and after excluding the influence on the stock market of the terrorism attack in the USA, the research period has been divided into the entire period and four sub-periods. These include the first sub-period from January 02, 2001 to April 29, 2004. In this period, Taiwan's stock market experienced Taiwan joining the WTO and an economic stimulus program of 500 billion NT dollars for a period of five years launched by the Taiwan government. The period from April 30, 2004 to June 29, 2008 is the second sub-period; events occurring in this period include the rise of the international oil price to 40 US dollars per barrel, the launching of a new Labor Pension Act by the Taiwanese government, and the occurrence of the subprime mortgage crisis in the USA. The period from June 30, 2008 to May 31, 2011 is the third sub-period; events occurring in this sub-period include the opening of mainland China's investment into Taiwan, the issuance of consumption tickets, and the formal signing of the ECFA between the Taiwanese government and that of mainland China. The period from June 01, 2011 to October 31, 2012 is the fourth sub-period;

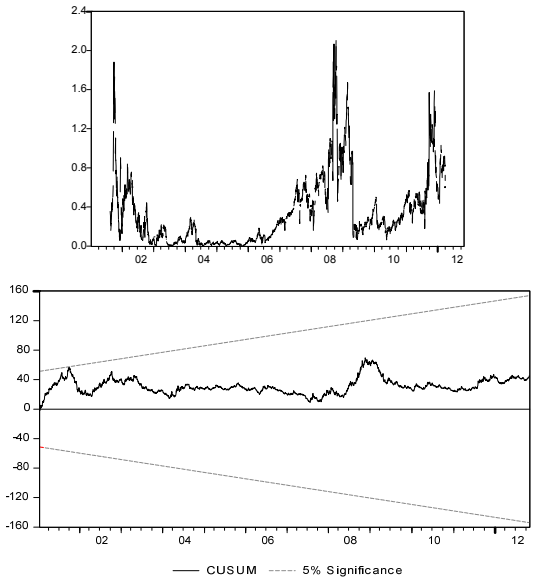
events occurring in this sub-period include topics such as implementation of a luxury tax, the dual rise in gasoline and electricity and the income tax launched by Taiwan's government. In our classification, some news has a positive impact on the stock market, some has negative impact, some news is domestic and some news is foreign. These types of news are helpful to us in analyzing the sensitivity of the fluctuations of the stock market to the news.

Next, this research used the TGARCH and EGARCH asymmetric models to further investigate the investment and decision-making behavior of the three institutional investors. Of course, first the layers of the GARCH(p, q) model have to be decided until the ARCH effect is deleted. ARCH-LM and Q^2 tests are frequently used by most scholars in testing if autocorrelation and/or heterogeneous variance exist in the data. However, in this research, the ARCH-LM and Q^2 tests were used to quantitatively test the ARCH effect. Moreover, the layers of the model (p, q) were chosen according to the results, and the test results are summarized in Table 4.

Continuing from the layers chosen in Table 4, EGARCH and TGARCH asymmetric leverage effect models were adopted to perform empirical analyses of the effects of news on investment behavior in the stock market for the entire sample. It was thought in this research that due to differences in background, risk taking capability and degree of policy implementation among the three institutional investors, they tend to take different investment strategy approaches based on the news, and this was also one of our goals to understand. From the entire sample in Table 5 it can be clearly seen that for GARCH, no matter if it is investment return in the stock market or the stock transaction value of foreign investors, dealers and investment trusts, it usually has high fluctuation and clustering phenomena in the entire sample period. However, whether the fluctuation and clustering phenomena created by the three institutional investors regarding stock news have consistency might be the next topic to be verified. In Table 5 it is also shown that for the three institutional investors the EGARCH coefficient $\gamma < 0$ and the TGARCH coefficient $T > 0$, and the values show very significant results. That is, among the news aspects, bad news usually creates more fluctuation in the stock market than good news, and this also proves the existence of asymmetry and leverage in Taiwan's stock market.

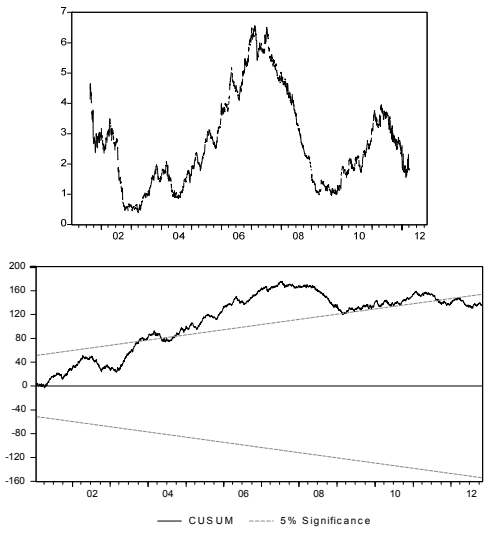
The main focus of this research is on the investment behavior of the three institutional investors because changes in the news aspect usually affect their investment behavior. Hence, the research period was divided into four sub-periods. The first sub-period is from January 02, 2001 to April 29, 2004. In this period, the EGARCH empirical model results are significantly difference from the TGARCH empirical model results. From the EGARCH model, it can be seen that the three institutional investors still show significant clustering regarding news aspect fluctuations, but the fluctuation clustering phenomenon in TGARCH is less significant. In addition, in this period of time, the three institutional investors showed significant sensitivity to the news aspect, and the fluctuation from bad news was higher than that from good news. That is, bad news was retained longer in this period of time, and an asymmetric phenomenon of $\gamma < 0$ was generated. In addition, although it is true for $T > 0$, the phenomenon was usually not significant. Only the dealers showed significance. For the EGARCH model, although Taiwan joined WTO in that period and had become a member country of WTO, it still did not bring significant economic effectiveness to Taiwan. Instead, the 9/11 terrorism attack event showed in-time and

continuous influences on the investment behavior of the three institutional investors, and the empirical results are as shown in Table 6.



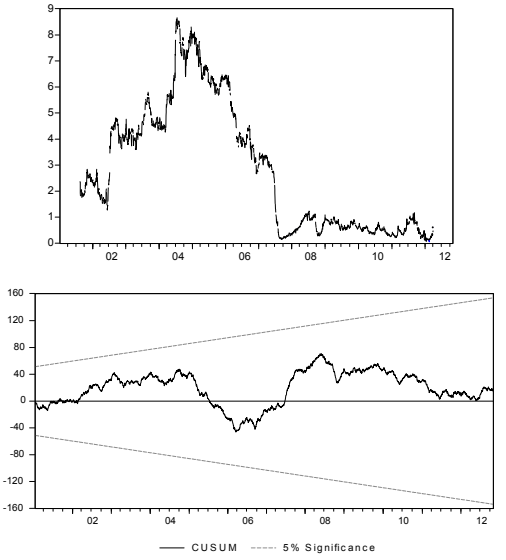
Source: The analysis result of this research.

Figure 4 Variation Chart of the Return Rate of Stock Prices (CHOW and CUSUM)



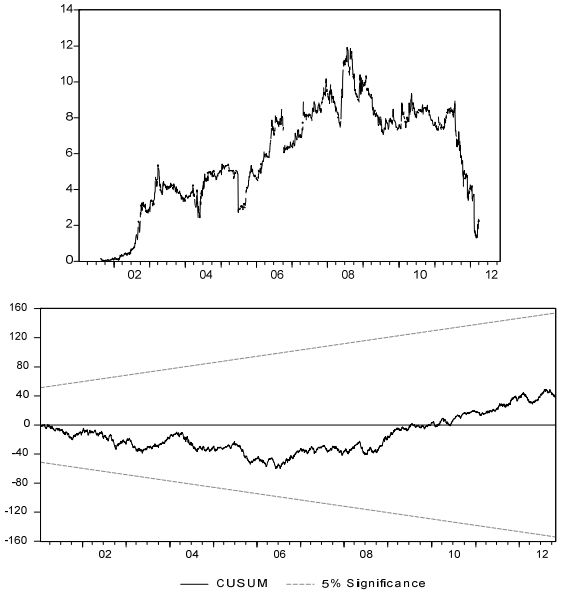
Source: The analysis result of this research.

Figure 5 Variation Chart of the Total Stock Transaction Value on the Current Day by Foreign Investors (CHOW and CUSUM)



Source: The analysis result of this research.

Figure 6 Variation Chart of the Total Stock Transaction Value on the Current Day by Investment Trusts (CHOW and CUSUM)



Source: The analysis result of this research.

Figure 7 Variation Chart of the Total Stock Transaction Value on the Current Day by Dealers (CHOW and CUSUM)

Table 4 Summary Statistics of LM and ARCH-LM Tests for Three Legal Entities in Taiwan's Stock Market

Legal entity	ARCH-LM	GARCH	ARCH-LM	EGARCH	SBC	ARCH-LM	TGARCH	SBC	ARCH-LM
SR	2.046	(2,0)	0.985	(2,0,1)	3.565	2.33	(2,0,1)	3.554	1.078
FI	1.38*	(1,1)	0.67	(1,1,1)	8.481	0.69	(0,1,1)	3.384	0.68
D	2.25	(1,1)	0.95	(1,1,1)	8.686	0.92	(1,1,1)	8.686	0.92
IT	1.29	(1,1)	0.97	(0,2,1)	8.384	0.99	(0,2,1)	8.384	0.97

Note: LM and ARCH-LM are *F*-statistics. SR, FI, IT and D are the same as in Table 2.

Source: This research management.

Table 7, shows that TGARCH can better display the clustering effect of the investment behavior than EGARCH, but both methods show consistent effect of $\gamma < 0$ and $T > 0$ for asymmetry of good and bad news. However, the asymmetry of good and bad news for investment funds is not significant. This is because some investment trusts might be consigned for stock operations by the government. They sometimes have to consider economic stability factors. Hence, they sometimes tend to operate the stock in the reverse direction, which dilutes the asymmetric effect. Because in this period of time Taiwan's stock market experienced a rise in international oil prices and the launching of a new Labor Pension Act system, the operation costs of enterprise increased as did inflation. However, the most serious case identified in this research was the subprime mortgage crisis that occurred in the USA which affected the global financial system. At that moment, the overall performance of the global stock market was not good. Hence, news fluctuations generated asymmetric influences, and foreign investors and dealers showed the most sensitive responses to such news.

In the third research sub-period in Table 8, it was found that both EGARCH and TGARCH show significant clustering phenomena. However, it was also found in this period that Taiwan's government would like the stock market to keep rising through its continuous release of good news to the stock market, for example the opening of mainland China's capital to investment in Taiwan, Taiwan's first release of consumption tickets to stimulate consumption and the formal signing of agreements such as ECFA. It is believed that such good news in principle will make the impact from good news stronger than the impact from bad news. However, the empirical result says otherwise. In this research period, it was found that $\gamma < 0$ and $T > 0$, so the positive and negative directions are still the same, but what differs is the coefficient shows the phenomenon to be insignificant. This is because the government's stimulus project could not totally solve the global economic recession and the continuous burning of the European debt crisis.

In the last sub-period in Table 9, it was found that the Taiwanese government launched a luxury tax, there was a dual rise in gasoline and electricity and the forum for stock income tax was about to be implemented. All these policies had a clustering effect on the investment behavior of the three institutional investors. However, when the impact of news aspect fluctuations was investigated, it was found that the investment behavior of the three institutional investors was not affected more by bad news. This is because this is a domestic affair of each country, and at that moment, the

economy was in a boom stage in foreign countries. Hence, the capital flow was quite loose. Although it had effects on the investment behavior of domestic institutional investors, compared to the international situation, the influence of domestic policy seems to be temporary. At this moment, the investment behavior response of the institutional investor due to bad news was not necessarily stronger than the impact brought about by good news in international society.

Anyway, the main objective of this research was to see if the investment behavior of the three institutional investors changed or if clustering behavior existed in the three institutional investors after the acquisition of news or after predicting the news. It was found that no matter if in the entire period or in the sub-period, such phenomena exists, but the significance of the impact of the news depends on the strength, category and timing of the news. However, speaking broadly, the impact brought about by international news was stronger than the impact brought about by domestic news, and the fluctuation caused by bad news was higher than that caused by good news.

4. Conclusion

The main objective of the investor is to get the maximum profit under the lowest risk. No matter if it is an institutional investor, a government or an individual, they all have the same objective, and that is the main reason they invest so much capital into the investment target. In this research, time series EGARCH and TGARCH models were used to investigate the investment behavior of institutional investors in response to news in the stock market, and the most important thing affecting this investment behavior is expectation of the news and the response speed. Hence, in this research, through these two methods, the asymmetry of the news aspects and the leverage effect were studied. The empirical results from the entire sample show that α and β each have values with significance levels higher than 5%, which means that clustering exists between the stock investment return and the fluctuation of the shareholding percentage of the investing institution. In addition, from the range sample of Table 5 it can be seen that the impact from bad news on investment institutions in Taiwan's stock market is larger than the impact from good news, and the effect of bad news continues longer than that of good news. Moreover, because the empirical result was $\gamma < 0$ and $T > 0$ in the empirical result, this study concludes that news has an asymmetric influence on the investment behavior of investment institutions. Furthermore, in the period from 2001 to 2004, it can be seen that the impact of bad news on the investment behavior was still higher than that of good news. In addition, the same phenomena also exist in the empirical results in the other sub-periods, which proves that investment institutions are more sensitive to bad news.

In this research, from the figures and the empirical results we also found that among the three institutional investors, foreign investors were the most sensitive to the impact of the news. The consistent trend between their investment behavior and stock fluctuations can be observed in Figure 4 and Figure 5. With respect to the clustering phenomenon, in Figures 4 and 5 it can be seen that such a phenomenon exists at the time when the investment return from the stock market starts to rise and the shareholding percentage of the foreign investor has changed in the previous period.

Therefore, Taiwan's investment institutions and individuals, when doing stock market investments, will refer to the investment behavior of foreign investors. In addition, sometimes governmental departments will make decisions based on foreign investors' behavior. Moreover, the behavior of institutional investors is also a pretty good target to aim for. In addition to the comparison between Table 6 and Table 4, the rest of the empirical results are all the same as those of foreign investors. However, the dealers are the most sensitive to the impact of domestic news. In addition, an asymmetric relation exists in the fluctuation caused by the news. Investment trusts, as found in this research, are the group that is most difficult to control because they have an asymmetric relation to the impact of the news. In addition, they sometimes might have a responsibility to fulfill the government's policy with an investment decision. Therefore, the trend of fluctuation in Figure 6 is quite different from those of the other two institutional investors.

However, this research is a study focused on the investment behavior of the institutional investor in the stock market, with the main objective to understand factors affecting the investment decisions and considerations of different institutional investors. Because different institutional investors usually respond differently to different news, when something is expected to occur or things have already occurred in international society, an investor can refer to the behavioral model of foreign investors to reduce their loss to its minimum and to enhance their profit to its maximum. For domestic events, investors can refer to the investment mode of dealers because clustering and leverage effects exist in the investment behavior of these institutional investors.

References

Baillie, Richard T., and Ramon P. Degennaro. 1990. "Stock Returns and Volatility." *Journal of Financial and Quantitative Analysis*, 25(2): 203-214.

De Medeiros, Carlos Aguiar. 2011. "The Political Economy of the Rise and Decline of Developmental States." *Panoeconomicus*, 58(1): 43-56.

Engle, Robert F. 1982. "Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation." *Econometrica*, 50(4): 987-1007.

Engle, Robert F., and Victor K. Ng. 1993. "Measuring and Testing the Impact of News on Volatility." *Journal of Finance*, 48(5): 1749-1778.

Filip, Adrian Claudiu, Ioan-Ovidiu Spatacean, and Paula Nistor. 2012. "The Impact of Non-Financial Reporting on Stock Markets in Emerging Economies." *Procidia Economics and Finance*, 3: 781-785.

Gallo, Giampiero M., and Barbara Pacini. 2000. "The Effects of Trading Activity on Market Volatility." *European Journal of Finance*, 6(2): 163-175.

Gurgul, Henryk, and Tomasz Wójtowicz. 2014. "The Impact of US Macroeconomic News on the Polish Stock Market: The Importance of Company Size to Information Flow." *Central European Journal of Operations Research*, 22(4): 795-817.

Hansen, Bruce E. 2001. "The New Econometrics of Structural Change: Dating Breaks in U.S. Labour Productivity." *Journal of Economic Perspectives*, 15(4): 117-128.

Hentschel, Ludger. 1995. "All in the Family Nesting Symmetric and GARCH Models." *Journal of Financial Economics*, 39(1): 71-104.

Jiang, George J., Eirini Konstantinidi, and George Skiadopoulos. 2012. "Volatility Spillovers and the Effect of News Announcements." *Journal of Banking and Finance*, 36(8): 2260-2273.

Mishra, Banamber, and Matiur Rahman. 2010. "Dynamics of Stock Market Return Volatility: Evidence from the Daily Data of India and Japan." *The International Business and Economics Research Journal*, 9(5): 79-83.

Nelson, Daniel B. 1991. "Conditional Heteroskedasticity in Asset Returns: A New Approach." *Econometrica*, 59(2): 347-370.

Nizer, P. S. M., and Julio C. Nievola. 2012. "Predicting Published News Effect in the Brazilian Stock Market." *Expert Systems with Applications*, 39(12): 10674-10680.

Rabemananjara, R., and Jean-Michel Zakoian. 1993. "Threshold Arch Models and Asymmetries in Volatility." *Journal of Applied Econometrics*, 8(1): 31-49.

Schwert, G. William. 1989. "Why Does Stock Market Volatility Change over Time?" *Journal of Finance*, 44(5): 1115-1153.

Wang, Kuan-Min, and Hung-Cheng Lai. 2014. "Which Global Stock Indices Trigger Stronger Contagion Risk in the Vietnamese Stock Market? Evidence Using a Bivariate Analysis." *Panoeconomicus*, 60(4): 473-497.

Zakoian, Jean-Michel. 1994. "Threshold Heteroskedastic Models." *Journal of Economic Dynamic and Control*, 18(5): 931-955.

Zare, Roohollah, M. Azali, and Muzafar Shan Habibullah. 2013. "Policy and Stock Market Volatility in the ASEAN5: Asymmetries over Bull and Bear Markets." *Procedia Economics and Finance*, 7: 18-27.

Appendix

Table 5 GARCH, EGARCH and TGARCH for Three Institutional Investors of Taiwan for a Whole Period

Model	Legal entity	Order	a_0	a_1	a_2	a_3	b_1	α_0	α_1	β_1	β_2	γ/T	SBC	Obv. no
ARMA-EGARCH	SR	(1,1)	-0.015	0.471***			-0.433***	0.373	0.135***	0.079***		0.325***	3.565	2936
		(1,1,1)	(0.265)	(0.000)			(0.000)	(0.000)	(0.000)	(0.000)		(0.000)		
	FI	(3,1)	0.068	1.326***	-0.297***	-0.062***	-0.873***	0.043	0.038***	0.986***		-0.013***	8.481	2935
		(1,1,1)	(0.160)	(0.000)	(0.000)	(0.003)	(0.000)	(0.111)	(0.001)	(0.000)		(0.019)		
	D	(2,1)	-0.177	1.069***	-0.225***		-0.717***	0.142	0.098***	0.962***		-0.038***	8.686	2936
		(1,1,1)	(0.107)	(0.000)	(0.000)		(0.000)	(0.003)	(0.000)	(0.000)		(0.000)		
	IT	(2,0)	-0.917	0.485***	0.040***			2.614		1.466***	-0.939***	-0.017**	8.384	2936
		(0,2,1)	(0.001)	(0.000)	(0.023)			(0.000)		(0.000)	(0.000)	(0.046)		
ARMA-TGARCH	SR	(1,1)	-0.005	0.867***			-0.870***	1.440	0.189***	0.227***		-0.145***	3.384	2936
		(1,1,1)	(0.133)	(0.000)			(0.000)	(0.000)	(0.000)	(0.000)		(0.000)		
	FI	(3,1)	0.066	1.330***	-0.303***	-0.060***	-0.873***	3.264		0.975***		0.023***	8.478	2935
		(0,1,1)	(0.162)	(0.000)	(0.000)	(0.004)	(0.000)	(0.009)		(0.000)		(0.000)		
	D	(2,1)	-0.165	1.059***	-0.219***		-0.707***	10.411	0.018***	0.927**		0.048***	8.686	2936
		(1,1,1)	(0.150)	(0.000)	(0.000)		(0.000)	(0.000)	(0.040)	(0.000)		(0.000)		
	IT	(2,0)	-0.903	0.486***	0.039**			11.042		1.879***	-0.925***	0.0050*	8.384	2936
		(0,2,1)	(0.002)	(0.000)	(0.027)			(0.000)		(0.000)	(0.000)	(0.093)		

Notes: The *p*-value is shown in brackets for ARMA-EGARCH and ARMA-TGARCH. γ and *T* are coefficients for ARMA-EGARCH and ARMA-TGARCH. ***, ** and * indicate significance at α = 1, 5 and 10%, respectively. SR, FI, IT and D are the same as in Table 2.

Source: The analysis result of this research.

Table 6 GARCH, EGARCH and TGARCH for Three Institutional Investors in Taiwan in the Period of 02 January 2001 - 29 April 2004

Model	Legal entity	Order	a_0	a_1	a_2	b_1	α_0	a_1	a_2	β_1	β_2	β_3	γ/T	SBC	Obv. no
ARMA-EGARCH	SR	(1,1)	-0.012	0.799***		-0.785***	-0.022	0.035***		2.596***	-2.524***	0.922***	0.011***	3.853	818
		(1,3,1)	0.451	(0.000)		(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)		
	FI	(2,0)	2.113	0.464***	0.120***		0.658			2.054***	-2.017***	0.850***	-0.014**	8.731	818
		(0,3,1)	0.001	(0.000)	(0.000)		(0.141)			(0.000)	(0.000)	(0.000)	(0.046)		
	D	(1,0)	-0.806	0.455***			0.477	-0.201**	0.207**	0.917***			-0.085***	8.740	819
		(2,1,1)	(0.216)	(0.000)			(0.024)	(0.042)	(0.042)	(0.000)			(0.005)		
	IT	(2,0)	-0.889	0.505***	-0.087**		2.859***			1.424***	-0.960***		-0.027*	8.239	818
		(0,2,1)	0.091	(0.000)	(0.011)		(0.000)			(0.000)	(0.000)		(0.074)		
ARMA-TGARCH	SR	(1,1)	-0.004	0.870***		-0.855***	0.030**	0.055***		2.228***	-1.995***	0.722***	-0.038***	3.869	818
		(1,1,1)	0.597	(0.000)		(0.000)	(0.023)	(0.000)		(0.000)	(0.000)	(0.000)	(0.008)		
	FI	(2,0)	2.182	0.465***	0.115***		196.792			0.874	-0.381	-0.088	0.054	8.742	818
		(0,3,1)	(0.001)	(0.000)	(0.000)		(0.041)			(0.164)	(0.675)	(0.864)	(0.135)		
	D	(1,0)	-0.326	0.512***			7.847	-0.115***	0.062***	1.000***			0.058***	8.729	819
		(2,1,1)	(0.495)	(0.000)			(0.001)	(0.000)	(0.009)	(0.000)			(0.000)		
	IT	(2,0)	-1.002	0.501***	-0.084**		117.396			1.436***	-0.990***		-0.000	8.243	818
		(0,2,1)	0.054	(0.000)	(0.013)		(0.000)			(0.000)	(0.000)		(0.909)		

Notes: The *p*-value is shown in brackets for ARMA-EGARCH and ARMA-TGARCH. γ and *T* are coefficients for ARMA-EGARCH and ARMA-TGARCH. ***, ** and * indicate significance at α = 1, 5 and 10%, respectively. SR, FI, IT and D are the same as in Table 2.

Source: The analysis result of this research.

Table 7 GARCH, EGARCH and TGARCH for Three Institutional Investors in Taiwan in the Period 29 April 2004 - 29 June 2008

Model	Legal entity	Order	a_0	a_1	a_2	b_1	α_0	a_1	a_2	a_3	β_1	β_2	γ/T	SBC	Obv. no
ARMA-EGARCH	SR	(1,1)	-0.007	0.858***		-0.874***	-0.008	0.194***	0.291***				0.068**	3.228	1032
		(2,0,1)	(0.217)	(0.000)		(0.000)	(0.883)	(0.000)	(0.000)				(0.012)		
	FI	(2,1)	0.270	1.272***	-0.336***	-0.777***	5.123				1.059***	-0.997***	-0.015***	8.360	1032
		(0,2,1)	(0.041)	(0.000)	(0.000)	(0.000)	(0.000)				(0.000)	(0.000)	(0.000)		
	D	(1,0)	-1.635	0.419***			0.118	0.179***	-0.193**	0.115	0.966***		-0.034*	8.753	1032
		(3,1,1)	(0.005)	(0.000)			(0.142)	(0.000)	(0.030)	(0.142)	(0.000)		(0.066)		
	IT	(2,1)	-0.022	1.313***	-0.341***	-0.881***	2.325				0.269	0.315	-0.016	8.501	1032
		(0,2,1)	(0.724)	(0.000)	(0.000)	(0.000)	(0.604)				(0.914)	(0.872)	(0.687)		
ARMA-TGARCH	SR	(1,1)	-0.008	0.854***		-0.858***	0.929	0.271***	0.206***				-0.160***	3.197	1032
		(2,0,1)	(0.184)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)				(0.003)		
	FI	(2,1)	0.344	1.203***	-0.289***	-0.706***	1.883				1.898***	-0.908***	0.004**	8.361	1032
		(0,2,1)	(0.066)	(0.000)	(0.000)	(0.000)	(0.011)				(0.000)	(0.000)	(0.039)		
	D	(1,0)	-1.528	0.429***			11.425	0.045***	-0.133***	0.098***	0.920***		0.075***	8.750	1032
		(3,1,1)	(0.008)	(0.000)			(0.011)	(0.001)	(0.000)	(0.000)	(0.000)		(0.001)		
	IT	(2,1)	-0.022	1.314***	-0.341***	-0.882***	20.891				1.832***	-0.912***	0.008	8.497	1032
		(0,2,1)	(0.721)	(0.000)	(0.000)	(0.000)	(0.000)				(0.000)	(0.0000	(0.307)		

Notes: The *p*-value is shown in brackets for ARMA-EGARCH and ARMA-TGARCH. γ and *T* are coefficient for ARMA-EGARCH and ARMA-TGARCH. ***, ** and * indicate significance at α = 1, 5 and 10%, respectively. SR, FI, IT and D are the same as in Table 2.

Source: The analysis result of this research.

Table 8 GARCH, EGARCH and TGARCH for Three Institutional Investors in Taiwan in the Period 30 June 2008 - 31 May 2011

Model	Legal entity	Order	a_0	a_1	a_2	b_1	α_0	a_1	a_2	β_1	γ/T	SBC	Obv. no
ARMA-EGARCH	SR	(2,1)	-0.019	-0.867***	0.125***	0.954***	0.259	0.334***	0.405***		0.158***	3.701	729
		(2,0,1)	(0.844)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)		
	FI	(2,1)	-0.025	1.187***	-0.267***	-0.749***	8.796	-0.143**		-0.547	-0.042	8.522	729
		(1,1,1)	(0.873)	(0.000)	(0.000)	(0.000)	(0.000)	(0.045)		(0.083)	(0.279)		
	D	(1,0)	0.611	0.300***			-0.004	0.100***		0.986***	-0.012	8.512	729
		(1,1,1)	(0.326)	(0.000)			(0.946)	(0.002)		(0.000)	(0.477)		
	IT	(2,1)	-0.212	1.299***	-0.355***	-0.814***	0.162			0.970***	-5.82E-05	8.360	729
		(0,1,1)	(0.222)	(0.000)	(0.000)	(0.000)	(0.007)			(0.000)	(0.990)		
ARMA-TGARCH	SR	(2,1)	-0.034	0.738***	-0.178***	-0.707***	1.230	0.434***	0.296***		-0.331***	3.682	729
		(2,0,1)	(0.023)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.002)		
	FI	(2,1)	-0.021	1.204***	-0.283***	-0.741***	9.320	-0.011		0.948***	0.059***	8.514	729
		(1,1,1)	(0.891)	(0.000)	(0.000)	(0.000)	(0.099)	(0.493)		(0.000)	(0.040)		
	D	(1,0)	0.614	0.292***			5.550	0.044**		0.932***	0.007	8.517	729
		(1,1,1)	(0.323)	(0.000)			(0.179)	(0.031)		(0.000)	(0.758)		
	IT	(2,1)	-0.212	1.299***	-0.354***	-0.813***	9.401			0.958***	-0.001	8.360	729
		(0,1,1)	(0.221)	(0.000)	(0.000)	(0.000)	(0.008)			(0.000)	(0.936)		

Notes: The *p*-value is shown in brackets for ARMA-EGARCH and ARMA-TGARCH. γ and *T* are coefficients for ARMA-EGARCH and ARMA-TGARCH. ***, ** and * indicate significance at α = 1, 5 and 10%, respectively. SR, FI, IT and D are the same as in Table 2.

Source: The analysis result of this research.

Table 9 GARCH, EGARCH and TGARCH for Three Institutional Investors in Taiwan in the Period 01 June 2011 - 31 October 2012

Model	Legal entity	Order	a_0	a_1	b_1	α_0	a_1	β_1	β_2	γ/T	SBC	Obv. no
ARMA-EGARCH	SR	(1,1)	0.029	0.674**	-0.616*	-0.042	0.069*			0.130***	3.274	357
		(1,0,1)	(0.379)	(0.043)	(0.089)	(0.184)	(0.079)			(0.000)		
	FI	(1,1)	-0.676	0.784***	-0.495***	9.240		0.953***		0.019	8.412	357
		(0,1,1)	(0.131)	(0.000)	(0.000)	(0.235)		(0.000)		(0.310)		
	D	(1,1)	0.066	0.720***	-0.593***	17.723		0.957***		-0.004	8.854	357
		(0,1,1)	(0.878)	(0.000)	(0.001)	(0.253)		(0.000)		(0.859)		
	IT	(1,0)	-1.048	0.464***		22.357***		-1.969***	-1.001***	0.007**	8.342	357
		(0,2,1)	(0.201)	(0.000)		(0.000)		(0.000)	(0.000)	(0.024)		
ARMA-TGARCH	SR	(1,1)	0.049	0.041	0.825**	0.094	0.515**			-0.181***	3.376	357
		(1,0,1)	(0.697)	(0.983)	(0.022)	(0.153)	(0.018)			(0.004)		
	FI	(1,1)	-0.556	0.798***	-0.517***	6.221		-0.133		-0.067	8.425	357
		(0,1,1)	(0.203)	(0.000)	(0.000)	(0.290)		(0.901)		(0.405)		
	D	(1,1)	0.052	0.701***	-0.570***	0.310		0.948***		0.014	8.851	357
		(0,1,1)	(0.908)	(0.000)	(0.002)	(0.153)		(0.000)		(0.561)		
	IT	(1,0)	-0.893	0.468***		14.397***		1.955***	-1.007***	0.001	8.512	357
		(0,2,1)	(0.293)	(0.000)		(0.000)		(0.000)	(0.000)	(0.241)		

Notes: The *p*-value is shown in brackets for ARMA-EGARCH and ARMA-TGARCH. γ and *T* are coefficients for ARMA-EGARCH and ARMA-TGARCH. ***, ** and * indicate significance at α = 1, 5 and 10%, respectively. SR, FI, IT and D are the same as in Table 2.

Source: The analysis result of this research.

THIS PAGE INTENTIONALLY LEFT BLANK