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外資政策對台灣股市報酬率與波動性影響之結構性變遷分析

The Structural Change of Stock Returns and Volatility Subsequent to the Deregulation for Foreign Investment in Taiwan Markets

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摘要:過去文獻鮮少探討開放外資投資限制之後，外資的行為對股市的增額影響。本文採用結構性變遷的 GARCH 模型捕捉民國九十二台灣全面開放外資前後，台灣股市報酬率與波動性的轉變，本研究主題為：一、政府開放外資後，外資買（賣）超對台灣股票報酬率的影響是否產生結構性變化。二、比較政府開放外資前後，台灣股市波動性的差異。三、針對外國證券投資與外國直接投資比重高的公司，探討政府全面開放外資投資後，該公司外資買（賣）超對其報酬率或波動性的影響，並和其他外資投資比重低的公司加以分析比較差異之處。

本研究中模型配適度的檢定證實結構性變遷 GARCH 模型的解釋能力較傳統模型為佳，該結構性變遷模型實證結果顯示外資買賣超影響台灣股市報酬率，而在政府全面放寬外資管制之後，外資交易行為對股市報酬率影響程度呈現結構性下降的趨勢；研究結果隱含台灣投資人會參酌外資的投資策略作投資，而當台灣證券市場投資環境更為開放時，外資進入台灣股市交易頻繁，外資買賣行為對投資大眾指標意義下降，故外資交易行為對台灣股市邊際影響力因而隨之縮小。尤其，外人證券投資與外人直接投資比重高的股

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票群組股價波動性隨著放寬外資限制制度而顯著縮小，本研究結果隱含開放外資來台從事證券投資可穩定台灣證券交易市場，由於新興國家（例如中國大陸）仍管制外國人到其資本市場從事外人證券投資，該實證研究可作為這些政府開放證券市場的政策參考。

關鍵詞：動能假說；資訊效果假說；GARCH 模型；結構性變遷；買賣超；機構投資

Abstract : Since 2003, Taiwan has relaxed the restrictions for foreign investment and permitted foreign investors to freely invest in Taiwan stock markets. The purpose behind enacting this policy was the belief that foreign investors could promote Taiwan investors to come up with sound investment strategies through greater awareness of the fundamental information of public companies. However, previous studies did not meticulously investigate the incremental impact of foreign behavior on market returns nor did they look into the volatility many years after the deregulation. Hence, the purpose of this paper is to compare the effect of foreign buy-sell difference on the stock returns and the volatility prior and subsequent to Taiwan's deregulation of the foreign investment. The aims of the research are to examine whether structural change is present in both stock returns and volatility in the Taiwanese markets after the restriction relaxed. First, this paper explores whether foreign buy-sell difference is positively related to stock returns in the Taiwan Stock Exchange. Second, this article examines whether smaller correlation exists between foreign buy-sell difference and stock returns after the lifting of foreign portfolio investment. In addition, we analyze whether volatility significantly decreases after the foreign investment restriction has relaxed. The results show that foreign buy-sell difference is positively related to stock returns in the Taiwan Stock Exchange. This suggests that foreign institutions may lead Taiwanese investors to buy or sell Taiwanese stocks, which may in turn affect the demand for Taiwanese stocks. Such relations declined after the lifting of foreign investment limit, suggesting that the influence of foreign investment strategies on investment decisions of many Taiwanese investors mitigated after foreign investment restrictions were relaxed. Furthermore, the long-term volatility substantially decreased for firms with larger foreign

ownership, which points out the stabilization of stock markets during post-deregulation periods.

Keywords: Buy-Sell difference; Structural change; CARCH model; Institutional investors; Momentum hypothesis; Information effect hypothesis

1. Introduction

Since 1990, Taiwan has gradually relaxed the restrictions for foreign investment and permitted foreign investors to freely invest in Taiwan stock markets. In 1990, regulations that limited Qualified Foreign Institutional Investments (QFII) were still in place. For instance, the ownership ratio for individual firms was limited to 5% while the total shares of QFII were controlled to a maximum of 10%. It was only until 2003, did the Executive Yuan pass the "Regulations Governing Securities Investment by Overseas Chinese and Foreign Investors" amendment and abolished the restrictions to QFII, allowing an open market for foreign investments to enter into Taiwan. From then, foreign institution investments do not need to attain government authorization to exchange in the stock market; they could finally purchase their stocks directly from Taiwan's stock exchange. As a result, the transfer of foreign investment into Taiwan has progressively grown over the years. In 2006, foreign investment amounted to an accumulated value of 120,121 million US dollars. In 1994, the market value of listed companies with foreign investments amounted to merely 3,774 million US dollars, but by August 2006 it had already increased to 155,224 million US dollars. Furthermore, the accumulated foreign investment in Taiwan Stock exchange grew from 1.54% of the overall market value in 1994 to 33% in August 2006. These figures evidently show that there has been a change in Taiwan's stock market investor structure after the relaxation of foreign investment policies. Thus, the behavior of foreign investment and its influence on Taiwan's stock market is an important issue.

The motivation behind establishing a free capital market is firstly, for globalization, namely, for Taiwan to join the World Trade Organization (WTO); and secondly to raise the number of qualified foreign investors investing in

Taiwan's stock market. Individual investors stand for the majority of investments in Taiwan's stock market. This raises governmental concerns, as the government is worried that there may be a lack in qualified investors roaming the stock market. Foreign investors are mostly composed of institutional investors, who have the professional skill and time to gather and analyze a firm's basic information. Thus, if Taiwan is able to attract foreign investor, it may as a result stimulate and encourage its investors in implementing investment strategies.

Studies have been done on the restrictions on foreign investments and their influence on the stock market (Bailey and Jagtiani, 1994; Bailey, Chung, and Kang, 1999; Hargis, 2002; Tsai, and Li, 2004). According to Boner-Neal et al. (1990), the relaxing of foreign investment regulations may cause the premium of closed-end country funds to decrease. Although these researches discuss about the open markets influence on the stock market, they do not probe into the investment behavior of the national incremental effort on stock returns. For this reason, this research uses the GARCH structural model to investigate whether the open market effectively lowers the volatility of Taiwan's stock market and whether there is any influence on Taiwan's stock returns.

According to Warther (1995) and Edelen and Warner (2001), as the unexpected cash inflow increase for stock mutual funds, so cash inflow into stock market increases and inspire the stock returns. Furthermore, the liquidity effect hypothesis (e.g. Scholes, 1972), price pressure hypothesis (e.g. Shleifer, 1986) and information effect hypothesis (e.g. Close, 1975) interpret the influence of the institutional investor's large scale, abnormal transaction volume on other investor's institution strategy and consequently cause an substantial elevations in stock returns. Table 1 depicts the three major institutional investors (foreign institution, dealer and mutual fund) in Taiwan's stock market. From the table, foreign institution holds for the largest amount of the total market value and has increased from a 19.52% in 2001 (pre-restriction relaxation period) to 33.40% in 2006 (post-restriction relaxation period). It can be seen that the influence of foreign transactions on Taiwan's stock returns and volatility can not be ignored.

Table 1

Market Value Proportion of Foreign Institution, Dealer and Mutual Fund in Taiwan Stock Exchange

	Foreign institution (%)	Mutual fund (%)	Dealer (%)
90	19.52	1.64	0.27
91	16.88	1.79	0.35
92	22.89	1.93	0.36
93	23.24	1.85	0.41
94	31.90	1.65	0.39
95	33.40	1.20	0.27

Source：*Taiwan Economic Journal* (*TEJ*) database

In addition, according to the momentum hypothesis proposed by Lakonishok, Shleifer, and Vishny (1992), Cooper, Gutierrez, and Hameed (2004), and George and Hwang (2004), foreign investors play the role of "news watcher" since they have the ability to gather and analyze information. On the other hand, the general individual investors in Taiwan take the foreign investors investment strategies and use it as a source for their own investment direction. Therefore, when foreign investor's buy-sell difference is positive, Taiwan investors will consider buying in those stocks, resulting in an increase in demand of the stock. This in turn increases the stock return. Similarly, if the buy-sell difference is negative, then it will result in a drop of stock returns. In other words, foreign investors are expected to lead individual investment strategies. Since Taiwan loosened the foreign investment restrictions, the leading influence of foreign investors on local individual investors is likely to change. It is in our interest to investigate whether foreign investment restriction relaxations will cause structural changes in foreign investors' leading positions after Taiwan relaxes foreign investment restrictions. Particularly, the estimation of the relations between stock returns and foreign investment may be biased when ignoring the foreign restriction factors. Thus, owing to two reasons mentioned above, this study proposes to utilize the GARCH structural change model to investigate the difference between the stock returns before and after the deregulation of foreign investments. The first purpose of this paper is to investigate whether foreign

investment restriction relaxations will cause structural changes in foreign investors' leading roles after Taiwan relaxes foreign investment restrictions.

In addition to causing a structural change to the stock returns, foreign investment restriction relaxation may also stimulate a change to the volatility of Taiwan's stock market. According to De Long et al. (1990) and Cutler, Poterba, and Summers (1990), "news watchers" may prompt "momentum traders" to follow news watchers' lead, and buy in more stock thus causing the so-called "momentum strategy". These "news watchers" are then able to sell their stock at a higher price in the following time period. Under the "momentum strategy" the "news watchers" may disregard the firm's performance and yet benefit from their investments, thus becoming "rational spectators". From the point of view of the momentum hypothesis, once the amount of "rational spectator" increases the volatility will in turn increase.

However, from the perspective of information asymmetry, a free market may enable individual investors to gain access to research reports of foreign institutional investors and as a result construct their own investment strategies. El-Gazzar (1998) and Tsai and Li (2004) report that international media focuses on firms with higher foreign investment ownership. This means that the public is more easily able to access the information concerning firms with higher foreign ownership. Foreign institutional investors are more likely to utilize professional skills and devote time into gathering and analyzing data. As such, once a firm has high foreign investment ownership the market will release more of its information. This will not only decrease information asymmetry between investors and the firm but also decrease stock volatility. From this perspective, restriction loosening has the positive effect of stabilizing the stock market. Whether market deregulations enhance or stabilize the market volatility has long been a critical issue in academic fields. Thus, our second research aim is to use a dummy variable to capture and see if there is a difference in Taiwan's stock volatility pre- and post market deregulation.

The stock exchange behavior depends on the foreign ownership. Foreign institutions investing in Taiwan may be one of two types: foreign portfolio investment (FPI) or foreign direct investment (FDI). FDI investors refer to the

investors who bring money into Taiwan by setting up factories, recruit local employees and engage in production and manufacturing activities. As such investors of this type will not exit or withdraw their capital from Taiwan easily. In most cases, FDI investors are often the major shareholders who take a keen interest in running the business. Based on Company Law[2] and the Securities Exchange Act[3], there are regulations that major shareholders have to abide when buying or selling their stock. These regulations prohibit FDI investors from engaging in short-term stock trading on the share of their firm while promoting long-run stock investment. FDI investors prefer involving long-term investment in Taiwanese firms.

By contrast, the priority of FPI investors is to obtain the benefits from Taiwan's stock. Thus, they are very sensitive to Taiwan's overall economic indicators, namely interest and exchange rates, so they prefer short-term security trading. FPI investors prefer short-term security trading. Local Taiwan investors can follow FPI investors' short-term trading strategies more often than they follow FDI investors' long-term ones since FDI investors do not trade as frequently as FPI investors do. Fluctuations are likely to be caused by this short-term trading strategy. Hence, it is worthwhile in examining the relationship between foreign investment behaviors with that of stock returns and volatility. The third purpose of this paper focuses our investigation on companies with high FDI and FPI to see whether their investment behavior has any different influence

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[2] Article 197 of Company Act regulates "each director shall, after having been elected, declare to the competent authority the number and amount of the shares of the company being held by him/her at the time when he/she is elected. In case a director of a company whose shares are issued to the public that has transferred, during the term of office as a director, more than one half of the company's shares being held by him/her at the time he/she is elected, he/she shall, ipso facto, be discharged from the office of director." According to article 197 of Company Act, each director reduces short-term trading on the share of the company in order to obey this article and stabilize their positions.

[3] Article 157 of Securities and Exchange Act regulates "In the event that any director, supervisor, managerial officer, or shareholder holding more than ten percent of the shares of a company sells the listed securities within six months after its acquisition, or repurchase the securities within six months after its sale, the company shall claim for the disgorgement of any profit realized from the sale and purchase." The regulations reduce the short-term trading for the director, supervisor, managerial officer, or shareholder holding more than ten percent of the shares of a company.

on Taiwan's stock returns and volatility.

The purposes of this research can be stated in twofold. First, this paper investigates whether foreign investment restriction relaxations will cause structural changes in foreign investors' leading roles after Taiwan relaxes foreign investment restrictions. We employ the structural change GARCH model to detect the structural declining relations between Taiwan's stock return and foreign trading, after the deregulation of foreign investment in Taiwan. Second, this article uses a dummy variable to capture and see if there is a difference in Taiwan's stock volatility pre- and post market deregulation. From our research, the results of the goodness of fit demonstrated that the structural change GARCH model exhibited superior analysis compared to that of the conventional GARCH model. We also find that a market deregulation will reduce the significance of foreign investors as trading indicators for local investors, as local investors are less inclined to stake their investment according to foreign trading practices. In addition, companies with high foreign shareholding ratios show a decline in stock volatility. This suggests that companies with high proportions of FPI and FDI have reduced the information asymmetry between outsider investors and firms particularly after foreign investment restrictions relaxations. Hence, the stock volatility drops substantially during the post-deregulation periods. Market deregulations are proven to be favorable to stabilize the firm's stock volatility.

2. Research Hypothesis

2.1 Relationship Between Foreign Investor Trading Behavior and Stock Returns

According to Scholes (1972) liquidity effect hypothesis, as opposed to the general individual investors' huge dealings, institutional investors deal in massive amounts that will influence the markets stock return value. In addition, according to Shleifer (1986) price pressure hypothesis, the law of supply and demand states that large- volume trading of institutional investors will result in price change; in other words institutional investments has a fair impact on the market's stock

return. If the buy-sell difference of institutional investors is positive, individual investors will take into account its investment strategy and buy stock; the demand in stock will increase and so will the return on equity. On the other, if institutional investors' buy-sell difference is negative, the demand in stock will decrease, and so will the return on equity.

Furthermore, Arbel, Carvell, and Strebel (1983) and Brous and Kini (1994) also pointed out that institutional investors have a rich source of information; they have professionals that collect and analyze data to prepare investment strategies. Hence, according to scholars in support of information effect hypothesis, institutional investors are more objective and rational than average investors. Therefore, when market investors notice abnormal or unusually large transactions of institutional investors, this usually implies important investments and causes market investors to reevaluate their investment strategy; stock prices (stock returns) will thus be affected.

Scholars of momentum hypothesis (such as Lakonishok, Shleifer, and Vishny, 1992; Chan and Lakonishok, 1993; Daniel, Hirshleifer, and Subrahmanyam, 1998; Hong and Stein, 1999) pointed out that there are two types of investors in the market: "news watchers" and "momentum traders". "News watchers" act and trade in accordance to the firm's fundamental information, while "momentum traders", who neither gather nor analyze data concerning the firm's operation, may only follow investment strategies set by "news watchers", i.e. institutional investors. "Momentum traders" are said to gain profit in their investments through the momentum strategy (Jegadeesh and Titman, 1993 ; Rouwenhorst, 1998 ; Jegadeesh and Titman, 2001 ; Lui, Strong, and Xu, 1999). Following from the momentum hypothesis, institutional investors possess the ability to collect and analyze data, playing the role of news watchers; individual investors then observe their investment strategies and use their (news watchers') investment policies to determine the direction of investment. Hence, the buy-sell difference of foreign institutional investors is likely to positively related to the market stock returns. Based on the above theoretical basis, we put forth our first hypothesis:

H1: There is a positive relationship between the buy-sell difference of foreign institutional investors and the market's stock returns.

2.2 The Effect of Foreign Trading Behaviors on Stock Returns After Market Deregulation

As of October 2 in 2003, the Executive Yuan passed the amendments of "Regulations Governing Securities Investment by Overseas Chinese and Foreign Investors". This enabled foreign institutional investors to trade in Taiwanese stock market without the government's approval. In 2006, the number of registered foreign investment in Taiwan's stock market raised up to 2,294 cases. By the end of March in 2007, the total value of foreign investment in Taiwan's stock market accounted for 31% of the total market value. It is clear that the proportion of individual investors, who mostly operate short-term security trading, has reduced; while the proportion of institutional investors, who mostly operate long-term security trading, has increased. There is no doubt that the investor's structure has changed in Taiwan's stock market as result of the governmental deregulation policy. In the past, scholars (such as, Bailey and Jagtiani, 1994; Bailey, Chung, and Kang, 1999; Hargis, 2002; Tsai, and Li, 2004) have studied the impact of deregulation on foreign investment in the stock market. Boner-Neal et al. (1990) found that during the initiating period when foreign trade controls were said to be relaxed, closed-country fund premiums shrank.

During the implementation period of qualified foreign institutional investment before October 2, 2003, Taiwan only approved qualified foreign institutional investors (QFIIs) to engage in the investment in Taiwan stock markets under specific regulations. There are strict controls that monitor foreign investment accounts and capital remittance. For instance, all capital gains and dividends of foreign investors had to be audited before they could be converted from new Taiwan dollars to foreign currency. As a result, foreign investment institutes investing in Taiwan will make the best use of their professional investment analysis. Thus, the foreign investors' trading behaviors will provide as a trading strategy reference point for other investors. The impact of foreign institutional trading on local individual investor ("momentum traders") strategy is

obvious. However, after the government abolished restrictions on foreign investment, large volumes of foreign capital flowed into Taiwan. The possible outcome is that the marginal influence of the increased foreign institutional trading activities on local individual investors is likely to decrease. In addition, Taiwan's listed companies may set up subsidiary companies overseas and remit their funds back to the local parent companies, thus causing "fake foreign investment". This generates a false impression of foreign investment. As such, general individual investors no longer take foreign investments to act as significant indicators, as they did prior to market deregulation. The impact of foreign institutional trading on Taiwan stock returns is reduced; the relations between the foreign institutional investor behaviors and the market's stock returns decline. From the above, the following hypothesis is established:

H2: After the deregulation of foreign investment, the relationship between the buy-sell difference of foreign institutional investors and the market's stock returns decline.

Foreign investment in Taiwan enterprises may be categorized into two categories: FPI and FDI. The main aim of FPI is to profit from the investment in Taiwan's capital market. Once investors (usually institutional investors) locate a potential investment opportunity, there will be an influx of funds. However, once their expected profits are realized, these foreign investors will instantly withdraw their capital out of the Taiwan stock exchange. Such FPIs are said to have rapid flow and depend on the current local economic status. For instance, interest rates, investment environment, policies and regional stability are factors that may cause FPI to decide to retain or take away their capital in Taiwan stock markets. Thus, FPI capital flows are often referred to as 'Hot Money". Enterprises with a high proportion of FPI are profit-oriented, their stock prices are very sensitive to macroeconomic factors and their investment strategy is a good investment indicator for Taiwan's individual investors. In other words, the trading behaviors of FPIs ("news watchers") can be regarded as significant trading indicators to local Taiwan individual investors ("momentum traders"). However, after Taiwan opened its stock markets, an increasing number of FPIs have flowed into Taiwan

and trades are now done much more frequently. This decreased the information asymmetry between firms and outside investors, especially for firms with high FPI holdings. The FPI's leading position is no longer as apparent in post-deregulation period as it is in pre-deregulation period. The marginal impact of FPI trading on Taiwan stock returns has substantially been reduced; the relationship between FPI behaviors and the market's stock returns has dramatically declined. Focusing on firms with high FPI, our research devises the third hypothesis:

H3: After the deregulation of foreign investment, the impact of foreign institutional buy-sell difference on stock returns is reduced for firms with high FPI holdings.

Foreign direct investors (FDI) refer to foreign firms that invest in Taiwan's fixed assets (e.g. factories, land, transportation devises) and set up factories in Taiwan. Because most FDI investors are large shareholders or hold manger positions, they are able to obtain private insider information easily. Therefore, the trading behaviors of FDIs ("news watchers") can be regarded as significant trading indicators to local Taiwan individual investors ("momentum traders"). Deregulation of foreign investment reduced information asymmetry between the firm and its investors because more FDI investors provided information. The marginal influence of FDI trading activities on the firm's return rate is thus reduced. Hence, we formulated our fourth hypothesis:

H4: After the deregulation of foreign investment, the impact of foreign institutional buy-sell difference on stock returns is reduced for firms with high FDI holdings.

2.3 The Effect of Foreign Trading Behaviors on Stock Volatility After Market Deregulation

According to Froot et al. (2001) research findings, foreign investors have the tendency to implement the momentum strategy. When there is a large amount of foreign funds flowing in, it is predictable that, in the near future, the local stock

market will yield positive returns. This type of scenario may be seen particularly in emerging markets. Research findings by Harris and Pisedtasalasai (2006) reveal that foreign investors in emerging Asian markets prefer to implement the momentum strategy, simply because foreign investors have obvious short-term impacts on local stock markets. On the other hand, according to El-Gazzar (1998) as well as Tsai and Li (2004), international media is more likely to report messages concerning companies with a high proportion of foreign institutional investors. The information release decreases information asymmetry between firms and outside investors. After the government abolished restrictions on foreign trade, foreign investors allowed foreign institutions to more smoothly engage in FDIs and FPIs in Taiwan. The increasing number of foreign institutional trading in Taiwan enables general individual investors to gain access to firm's information more readily because institutional investor will seek professional skills to gather or analyze data related to the firm and release those messages. This reduces information asymmetry between the enterprise and its investors, thus creating a more stable market with low stock volatility. This leads to our fifth hypothesis:

H5: After the deregulation of foreign investment, the stock volatility of Taiwan stock exchange will decrease.

Once Taiwan relaxes foreign investment restrictions, the market will release fair amounts of information regarding enterprises with high proportions of FPI. This will not only reduce information asymmetry between the firm and its investors, but also prevent trading behaviors such as "herding" in the market and thus decrease stock volatility. Focusing on firms with high proportions of FPI, we formulated the sixth hypothesis:

H6: After the deregulation of foreign investment, the stock volatility of firms with high proportions of FPI will decrease.

Foreign direct investors (FDI) refer to foreign firms that invest in Taiwan's fixed assets (e.g. factories, land, transportation devises) and set up factories in Taiwan. FDI investors are less sensitive to interest rates and exchange rates. As

such, they will not bring in capitals to Taiwan or take away their funds out of Taiwan merely because of short-term changes in interest rates or temporary environmental changes. In addition, most FDI investors are often the major shareholders who take a keen interest in running the business. Under Company Law and the Securities Exchange Act, the regulations prohibit FDI investors from engaging in short-term stock trading on the shares of their firm. FDI investors prefer long-term investment in Taiwanese firms, as a result the increasing FDI proportion in Taiwan markets decrease stock volatility. Additionally, the deregulation of foreign investment increases the FDI proportion in Taiwan, so the stock volatility is further reduced. This forms our next hypothesis:

H7: After the deregulation of foreign investment, the stock volatility of firms with high proportions of FDI will decrease.

3. Data and Sample

We focus on listed firms in Taiwanese Stock Exchange (TSE) to explore the impact of foreign investor buy-sell difference on the stock returns and volatility. Since the daily institutional investor buy-sell difference is composed of the buy-sell difference of foreign institutional investors, dealers and mutual funds, this study simultaneously takes into account the impact of the three types of institutional investors' behaviors. This paper selects the rate of returns and the variations of stock returns from Taiwan Stock Exchange (TSE) weighted indices. Because nearly 70% of foreign investment capitals invest in Taiwanese electronics firms, the Taiwanese Electronics Industry weighted indices is also investigated in this study. In this article, Taiwan Stock Exchange (TSE) weighted indices and Taiwanese Electronics Industry weighted indices are collected from the *Taiwan Economic Journal* (TEJ) database. In addition, the TEJ database was also the source for the institutional investor data. Such institutional investor data includes buy-sell difference from foreign institutions, mutual fund and dealers. Taiwan Stock Exchange (TSE) weighted indices range from August 1st, 1995 to March 30th, 2007, while Taiwanese Electronics Industry weighted indices range

from December 12th, 2000 to March 30th, 2007 since the Taiwanese Electronics Industry weighted indices are only available from the beginning of December 12th in 2000.

In addition, this study further divides foreign investment into FPI and FDI to explore the impact of their behaviors on stock markets. Three groups of stocks are chosen according to the foreign investment amount in this research: FPI, FDI, and control sample group. The three groups are chosen only from Taiwanese electronics firms because the majority of foreign investors invest in electronics firms. Besides, the electronics firms with capital smaller than 300 million are deleted because the stock prices of these small firms are easily manipulated by investors. Next, the firms are classified into the three groups in keeping with the following criteria: The firms whose foreign market value ratio is over 1% are selected. Foreign market value ratio refers to the foreign ownership market value of underlying securities for the individual firm deflated by total foreign ownership market values across all firms in the Taiwan Stock Exchange. Among these firms whose foreign ownership market value ratio is over 1%, firms are classified as the "FPI group" only if its average QFII ownership from 1995 to 2001 accounts for 50% of the foreign ownership. On the other hand, firms are only classified as the "FDI group" [4] if its average QFII ownership during the period does not account for 50% of the foreign ownership. Finally, the firms whose foreign market value ratio is under 1% are classified as "control sample group".

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[4] With regard to FPI (foreign portfolio investment), QFIIs can trade through the Taiwan Stock Exchange (TSE) and thus acquire direct ownership of Taiwanese firms. With regard to FDI (foreign direct investment), foreign institutions gain approval from the Taiwan government to bring in capital and the technological know-how to construct factories, employ staff, and operate production in Taiwan. The FDI ownership is not the QFII ownership through Taiwan stock exchange (TSE). For example, Philip corp. is the main FDI investors and its FDI ownership accounts for 25.49% of the total ownership for Taiwan Semiconductor Manufacturing Corp. (TSMC) before 1995. After TSMC is listed in TSE in 1995, the average QFII ownership only accounts for 9.82%, which is smaller than the foreign ownership through FDIs. Therefore, TSMC belongs to the "FDI group" in this research.

In this paper, the data concerning stock returns and buy-sell difference from foreign investors, mutual fund and dealers of these three groups are applied since all firms in these three groups are listed in the sample. Thus, the three groups range from July 23th, 2001 to March 30th, 2007.

4. Methodology

4.1 GARCH Model

Initially, we used the Froot and Rogoff (1995) Augmented Dickey-Fuller (ADF) tests[5] to check whether the two series of the rate of returns from Taiwanese stock exchange indices and Taiwanese Electronics Industry weighted indices, were unit roots, I(1). Next, the GARCH model was constructed. The conventional time-series model assumed the constant conditional variance, which implied that risk did not vary with time. However, Engle (1982) proposed the Autoregressive Conditional Heteroscedasticity (ARCH) model to quantify the risk and uncertainty. Bollerselev, Chou, and Kroner (1992) further illustrated that the GARCH (Generalized Autoregressive Conditional Heteroscedasticity) model could reliably explain the financial time-series and upgrade the model's explanatory power. For this reason, this article chooses GARCH (1,1) model to examine the relations between foreign institutional buy-sell difference and stock returns as equation (1):

$$R_{i,t} = \alpha_0 + \alpha_1 F_{i,t-1} + \alpha_2 B_{i,t-1} + \alpha_3 I_{i,t-1} + \varepsilon_{i,t}, \quad (1)$$

$$\varepsilon_{i,t} \sim N(0, h_{i,t}),$$

$$h_{i,t} = \omega_0 + \omega_1 \varepsilon_{i,t-1}^2 + \omega_2 h_{i,t-1}, \text{ i=}TSE, TSEE,$$

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[5] Augmented Dickey-Fuller unit root tests:

One unit root-- $\Delta x_t = \xi_1 + \zeta_1 x_{t-1} + \sum_{i=1}^{k} \zeta_{1,i} \Delta x_{t-i} + \varepsilon_{1,t}$

Two unit roots-- $\Delta^2 x_t = \xi_2 + \zeta_2 \Delta x_{t-1} + \sum_{i=1}^{k} \zeta_{2,i} \Delta^2 x_{t-i} + \varepsilon_{2,t}$

x denotes the rates of stock returns. We examine the hypothesis of ζ_1=0 and ζ_2=0 in the regression listed. Lag length K is chosen in the criteria of AIC minimization.

where $R_{TSE,t}$ and $R_{TSEE,t}$ are Taiwan Stock Exchange index (i=*TSE)* stock returns and Taiwan Stock Exchange electronics industry index (i=*TSEE)* stock returns, respectively, on the *t*th day. $F_{TSE,t-1}$ and $F_{TSEE,t-1}$ are foreign institutional buy-sell difference deflated by market values for Taiwan Stock Exchange listed firms and electronics firms listed in Taiwan Stock Exchange, respectively, on the *t-1*th day. $B_{TSE,t-1}$ and $B_{TSEE,t-1}$ are dealer buy-sell difference deflated by market values for Taiwan Stock Exchange listed firms and electronics firms listed in Taiwan Stock Exchange, respectively, on the *t-1*th day. $I_{TSE,t-1}$ and $I_{TSEE,t-1}$ are mutual fund buy-sell difference deflated by market values for Taiwan Stock Exchange listed firms and electronics firms listed in Taiwan Stock Exchange, respectively, on the *t-1*th day.

Institutional investors are composed of foreign institutional investors, mutual fund and dealers, so we take account of the trading behaviors from institutional investors, mutual fund and dealers in equation (1). If the buying orders are more (less) than the selling orders, the phenomenon is defined as possessing a positive (negative) buy-sell difference, namely, a buy-sell surplus (deficit). Because the buy-sell difference of foreign institutions is disclosed everyday, individual investors can follow their trading strategies on a daily bases. Hence, equation (1) regresses the stock return rates on these three types of institutional trading behaviors at the previous day to investigate the impact of institutional trading on returns and volatility in Taiwan Stock Exchange. In equations (1), coefficients α_1, α_2, α_3 denote the previous day's marginal effect of the buy-sell difference on stock returns for the foreign institution, the dealer, and the mutual fund, respectively. If the coefficients α_1, α_2, α_3 are positive, it implies that the foreign institution's, dealer's and mutual fund's trading behavior for the day before enhanced stock returns. This paper employs the Taiwan stock exchange listed firms and electronics firms listed in Taiwan Stock Exchange to run regression (1). T-statistics is employed to examine whether the coefficients α_1, α_2, α_3 are significantly positive, so we can compare the impact of these three kinds of institutional investors on stock returns. Particularly, this article can confirm the hypothesis $H_{10}: \alpha_1 = 0$ to see whether foreign institutional investor's strategy is indeed critical to Taiwan's stock returns.

4.2 Structural Change GARCH Model

4.2.1 Structural Change Analysis of Stock Returns

Studies have been done on the influence of institutional investors' capital flows into stock market on the market returns (Warther, 1995; Froot, O'Connell, and Seasholes, 2001; Edlelen and Warner, 2001). However, they do not probe into the market deregulation, which leads to the relation changes between market returns and foreign institutional investors' capital flows. If the market deregulation is ignored in the model, the estimation of coefficients will be biased. For this reason, this research uses the structural change GARCH model to investigate whether the open market effectively lowers stock volatility of the Taiwan's stock market and whether there is any change to Taiwan's stock returns.

To incorporate the structural change caused by the market deregulation, we use dummy variables to divide our time line into two periods, namely, pre-deregulation and post-deregulation periods. The dummy can capture the difference in stock returns and volatility between pre-deregulation and post-deregulation periods. We modified equation (1) as equation (2):

$$R_{i,t} = \beta_0 + \beta_1 F_{i,t-1} + \beta_2 (F_{i,t-1} \times D_{i,t}) + \beta_3 B_{i,t-1} + \beta_4 I_{i,t-1} + \varepsilon_{i,t}, \quad (2)$$

$$\varepsilon_{i,t} \sim N(0, h_{i,t}),$$

$$h_{i,t} = \gamma_0 + \gamma_1 \varepsilon_{i,t-1}^2 + \gamma_2 h_{i,t-1} + \gamma_3 (\varepsilon_{i,t-1}^2 \times D_{i,t}) + \gamma_4 (h_{i,t-1} \times D_{i,t}),$$

i=*TSE, TSEE,*

where $D_{i,t} = 1$ if the data is during post-deregulation period (period before Oct. 1, 2003); $D_{i,t} = 0$ if the data is during pre-deregulation period (period after Oct. 2, 2003). In equation (2), the slope of the foreign institutional buy-sell difference is β_1 in pre-deregulation periods, but becomes $(\beta_1 + \beta_2)$ in post-deregulation periods. This paper uses the t-statistic to examine the hypothesis $H_{20} : \beta_2 = 0$ to investigate the incremental effect of the deregulation on the relations between buy-sell difference and market stock returns. If the coefficient β_2 is negative, it suggests that the foreign institutional influence on stock returns declines as the market opens for

foreigners. In addition, to investigate the foreign institutional effect on stock returns, this paper uses the t-statistic to examine whether foreign institutional investor affect Taiwan stock returns before market deregulation, namely, $H_0 : \beta_1 = 0$. Also, Wald statistics is used to examine whether foreign institutional investor affect Taiwan stock returns after market deregulation, namely, $H_0 : \beta_1 + \beta_2 = 0$.

4.2.2 Structural Change Analysis of Volatility

To incorporate the volatility structural change caused by the market deregulation, we use dummy variables to divide the timeline into two periods, pre-deregulation and post-deregulation periods in the variance equation of structural change GARCH model. Hence, the dummy variable can capture the difference in volatility between pre-deregulation and post-deregulation periods. In the variance equation, if the coefficients γ_3 and γ_4 are negative, it suggests that the short-term and long-term volatility declined, respectively. This paper use the t-statistic to examine the hypothesis $H_{50} : \gamma_3 = 0$ and $H_{50} : \gamma_4 = 0$ to investigate the incremental effect of market deregulations on the volatility.

4.2.3 Goodness of Fit Test

This paper employs a model's likelihood ratios. It compares the goodness-of-fit of the structural change GARCH model (model 2) with the conventional GARCH model (model 1). The likelihood ratio is stated as equation (3):

$$D = -2\log(\frac{L_0}{L_m}) = -2(\log L_0 - \log L_m), \quad (3)$$

where L_0 is the likelihood function values of GARCH model (model 1); L_m is the likelihood function values of structural change GARCH model (model 2). The likelihood ratio D can be converted into χ^2 distribution, so this article can employ χ^2 statistics in which the degree of freedom is the parameter number. If the χ^2 statistics test results significantly reject the null hypothesis, it suggests that the structural change GARCH model (model 2) contain incremental explanatory power and that it performs better than the conventional GARCH model (model 1).

4.3 Analyzing the difference in stock returns and volatility of firm with differential foreign investment characteristics

After the deregulation of foreign trade, the proportions of foreign institutional investors have increased in the Taiwan stock market. The market will also release more information regarding companies with high proportions of foreign investment. However, it is found that although more information has been released, information is also merely targeted to firms with higher FDI and FPI holding. Information from mutual funds and dealers remain scarce. It seems that Taiwan's open market has singularly benefited the firms with high proportions of foreign investment.

For the aforementioned reasons, we extend our investigation by dividing the sample companies into three categories: firms with high FPI proportions (FPI group), firms with high FDI proportions (FDI group) and firms with little foreign investment (control sample group). The weighted average rate of stock return is calculated for each group and this article runs the equation (2) with the three groups (i= FPI group, FDI group, and control sample group) to compare the stock return changes between pre-deregulation and post-deregulation periods to examine the third and fourth hypothesis. In addition, we further test whether the coefficients γ_3 and γ_4 in the variance equation are negative for the three groups firms to examine the sixth and seventh hypothesis.

5. Empirical Results

5.1 Results of GARCH Regression Model

From our sample, the average buy-sell difference for foreign investment is positive. This means that within the time of our investigation, there was an average surplus in foreign investment in Taiwan stock market. Particularly, after the deregulation policy, foreign investment has continued to supply funds to Taiwan markets. However, it was found that dealers and mutual funds fell short of the supply funds to Taiwan markets. Daily average buy-sell difference is negative for dealers and mutual funds.

In addition, before the deregulation policy, the average daily buy-sell difference of foreign investment was a surplus of NT 602 million dollars. Meanwhile, once the government opened up the market, the average daily buy-sell difference of foreign institutions increased to NT 1,893 million dollars. These figures indicate that the deregulation policy had a positive effect of encouraging foreign investment. Similarly, the average daily buy-sell difference of dealers went from a negative value of NT 14 million dollars before market deregulation to a positive buy-sell difference of NT19 million dollars after market deregulation. This shows the positive capital inflow effect of the open market. However, the average daily buy-sell differences of mutual funds show a different story. It ranges from a negative buy-sell difference of NT 75 million dollars to a negative buy-sell difference of NT 180 million dollars.

Observing the stock market from the time-series point of view, it was noticed that no matter in which point in time, after the deregulation policy, the standard deviation of foreign institutions were significantly greater than those of dealers and mutual funds. This is possibly caused by the "hot money" characteristic of foreign investments, whereby international funds will flow rapidly from one market to the next. Thus, the opening of the market only sped up the currency flow and increased the standard deviation of foreign investments.

The Augmented Dickey Fuller (ADF) Test results showed that the variables were stable; we then ran GARCH regression analysis. The regression results of the Taiwan Stock Exchange index returns and Taiwan Stock Exchange electronic industry index returns on the three institutional investors' trading behavior are listed in Table 2. From Table 2, it is seen that the coefficients of foreign institutional buy-sell difference and those of mutual funds are 2.7983 (α_1) and 4.7209 (α_3) , respectively. The T-statistic shows that the coefficient of buy-sell difference (α_1) is significantly positive at 1% level for foreign institutional investors and the coefficient of buy-sell difference(α_3)is significantly positive at 5% level for mutual funds. This means that the buy-sell difference of foreign institutions and mutual funds have a positive effect on stock returns. The findings suggest that if there is a surplus in the buy-sell difference of foreign institutions and mutual funds, general individual investors tend to follow their trading

strategies to buy more stocks, thus increasing the demand and raising stock returns. Inversely, if foreign institutional buy-sell difference was to have a negative value, general individual investors are inclined to sell their stocks, resulting in an increase in supply and a decrease in stock returns. The above analysis results support hypothesis 1 (H1).

Table 2
Results of GARCH Regression

$$R_{i,t} = \alpha_0 + \alpha_1 F_{i,t-1} + \alpha_2 B_{i,t-1} + \alpha_3 I_{i,t-1} + \varepsilon_{i,t},$$
$$\varepsilon_{i,t} \sim N(0, h_{i,t}), \quad (1)$$
$$h_{i,t} = \omega_0 + \omega_1 \varepsilon_{i,t-1}^2 + \omega_2 h_{i,t-1}.$$

Dependant variable	Taiwan Stock Exchange index returns		Taiwan Stock Exchange electronics industry index returns	
	Coefficient	T-statistics	Coefficient	T-statistics
$F_{i,t-1}$	2.7983	5.3720***	1.7838	3.7097***
$B_{i,t-1}$	2.9727	0.9330	0.2178	0.0547
$I_{i,t-1}$	4.7209	2.2163**	7.5149	2.7997***
Interpret (α_0)	0.0384	1.6470	0.0368	0.9526
Interpret (ω_0)	0.0253	4.2447***	0.0206	2.5466**
$\varepsilon_{i,t-1}^2$	0.0746	11.2233***	0.0531	6.8103***
$h_{i,t-1}$	0.9157	126.7220***	0.9401	111.1559***

Notes: *Significant at the 10 percent level. **Significant at the 5 percent level. ***Significant at the 1 percent level.

From the GARCH regression results, the coefficient of mutual funds' buy-sell difference ($\alpha_3 = 4.7209$) is greater than those of foreign institutions' ($\alpha_1 = 2.7983$). These findings imply that mutual funds have more a significant influence on Taiwan's Stock Exchange Index stock returns than foreign investors. Furthermore, dealers are perceived to be insignificantly positive with Taiwan Stock Exchange Index stock returns.[6] The reason for this may be owing to the

[6] Although the coefficient of dealer α_2 is larger than the coefficient of foreign investment α_1,

fact that from 2001 to 2006 the proportion of foreign institutional investors were between 16.88% and 33.40%, but no more than 0.5% for dealers. As such, the trading behaviors of dealers would merely hold limited influence on stock returns, so the coefficient of buy-sell difference for dealers is insignificant.

From the regression results of Taiwan Stock Exchange electronic industry index stock returns on the three institutional investors' buy-sell difference as depicted in Table 2, the coefficient of foreign investors, dealers and mutual funds are 1.7838, 0.2178 and 7.5149 respectively. The T-statistic shows that the coefficient of foreign investments buy-sell difference (α_1) and that of mutual funds (α_3) are significantly positive at 1% level. This means that the buy-sell difference of foreign investments and mutual funds have a positive relationship with stock returns of the electronics industry. This in turn implies that if there is a buy-sell surplus of foreign investments and mutual funds in Taiwan Stock Exchange electronics industry stocks, then general individual investors will follow their investment strategy and buy electronics stocks, thus increasing the demand of stock in the electronics industry and raising its stock returns. Conversely, if foreign investments' buy-sell difference was to be negative in the electronics industry, general individual investors would sell their electronics stocks, resulting in an increase in electronics industry stock supply and a decrease in stock returns of electronics stocks. From the above analysis, hypothesis 1 (H1) is supported.

In addition, for both Taiwan Stock Exchange Index and Electronic Industry Index, the coefficient of mutual fund institutional investors' buy-sell difference is always greater (α_3) than those of foreign investors (α_1) as well. The reason behind this could be because mutual fund investors and their related-party members periodically release their analysis of Taiwan stock trends to the media, allowing their investment strategies to become one of the leading indicators to Taiwan's general investors. The trading behavior of mutual fund investors is hence directly related to stock trends. Furthermore, dealers are observed to have a

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the standard deviation of the coefficient α_2 is also much greater than that of the coefficient α_1. As a result, the coefficient α_2 is still insignificant.

much lower average buy-sell difference in our sample. The extent of dealers' influence on Taiwan Stock Exchange Index and Taiwan Stock Exchange Electronics Industry Index is substantially minor compared to the other two major institutional investors. Thus, we concluded the unobvious relations between dealer's trading behavior and stock returns.

5.2 Results of the Structural Change GARCH Model

5.2.1 Structural Change Analysis of Stock Returns

This research investigated the structural change in stock returns and volatility for five major groups when the government enacted the deregulation policy in 2003. The five major groups include firms in Taiwan Stock Exchange, electronics firms in Taiwan Stock Exchange, firms with high FPI proportions, firms with high FDI proportions, and firms with little foreign investment (control sample firms). The structural change GARCH regression results are displayed in Table 3. The results of the Taiwan Stock Exchange index stock returns and Taiwan Electronic Industry index stock returns, from Table 3, show the coefficients of the interaction terms $(F_{i,t-1} \times D_t)$ between foreign investments' buy-sell difference and the dummy variable are negatively related to stock returns. After the markets opened, the influence of foreign investment buy-sell difference on stock returns diminished. This supports our fourth hypothesis (H4): after the deregulation of foreign investment, the impact of foreign trading activities on stock returns is reduced in firms high in FDI.

Table 3 depicts the results of the Wald statistics. After the policy deregulation, the coefficient of foreign investors' buy-sell difference on the Taiwan Stock Exchange Index and Electronic Industry were 1.9561[7] and 1.5125[8] respectively. Wald Statistic exhibits the two coefficients significantly positive at 5% level. From our research findings, we observed that despite the fact that market deregulation may reduce the impact of foreign investments on stock returns; however, there remains significant impact of foreign institutional buy-sell

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[7] $\beta_1 + \beta_2$ =6.5406-4.5845=1.9561

[8] $\beta_1 + \beta_2$ =3.4166-1.9041=1.5125

difference on the Taiwan's stock returns. If there is a buy-sell surplus, local

Table 3
Results of Structural Change GARCH Regression

$$R_{i,t} = \beta_0 + \beta_1 F_{i,t-1} + \beta_2 (F_{i,t-1} \times D_{i,t}) + \beta_3 B_{i,t-1} + \beta_4 I_{i,t-1} + \varepsilon_{i,t},$$
$$\varepsilon_{i,t} \sim N(0, h_{i,t}), \qquad (2)$$
$$h_{i,t} = \gamma_0 + \gamma_1 \varepsilon_{i,t-1}^2 + \gamma_2 h_{i,t-1} + \gamma_3 (\varepsilon_{i,t-1}^2 \times D_{i,t}) + \gamma_4 (h_{i,t-1} \times D_{i,t}).$$

Dependant variable	Taiwan Stock Exchange index returns		Taiwan Stock Exchange electronics industry index returns	
	Coefficient	T-statistics	Coefficient	T-statistics
$F_{i,t-1}$	6.5406	5.1481***	3.4166	2.3642**
$(F_{i,t-1} \times D_t)$	-4.5845	-3.2102***	-1.9041	-1.2336
$B_{i,t-1}$	2.6983	0.8576	0.6512	0.1633
$I_{i,t-1}$	3.6006	1.6233	6.4790	2.3441**
Interpret (β_0)	0.0341	1.4519	0.0310	0.7905
Interpret (γ_0)	0.0382	4.6672***	0.0393	3.1719***
$\varepsilon_{i,t-1}^2$	0.0802	8.6327***	0.0479	3.3718***
$h_{i,t-1}$	0.9077	95.5978***	0.9431	64.7170***
$(\varepsilon_{i,t-1}^2 \times D_{i,t})$	-0.0172	-1.3251	0.0038	0.2413
$(h_{i,t-1} \times D_{i,t})$	-0.0032	-0.2923	-0.0161	-1.2925
Goodness-of-fit results				
Likelihood ratio	23.54***		12.44***	
Wald statistics				
$H_0 : \beta_1 + \beta_2 = 0$	1.9561		1.5125	
Chi-square (χ^2)	7.4357***		6.4737**	

Notes: *Significant at the 10 percent level. **Significant at the 5 percent level. ***Significant at the 1 percent level.

demand (and supply) for Taiwan stock will still increase and stock returns

continue to soar. In short, foreign investment strategies remain a significant indicator in Taiwan markets even after market deregulations.

The research results from Taiwan Stock Exchange Index and Electronic Industry Index imply that before the markets opened, during the regulation period, the amount of foreign investments were scarce. As a result, foreign institutional (news watchers') trading behaviors became significantly meaningful to Taiwan's local investors (momentum traders). However, after the deregulation went through, not only did the amount of foreign investments dramatically increased, but momentum traders were able to access information through other channels. In addition, in order to make a company seem successful, some firms may try to create a false image of high foreign investment by manipulating buying their stocks from their own branch offices abroad. As such, trading behaviors of foreign institutions (news watchers) are no longer critical indicator in the eyes of Taiwan's local investors (momentum traders). This, inadvertently, decreases the influence of foreign investors' buy-sell difference on stock returns.

5.2.2 Structural Change Analysis of Stock Volatility

From Table 3, after the deregulation, the Taiwan Stock Exchange volatility regression results show that variables γ_3 and γ_4 are no longer dominant. This indicates that, in contrast to our hypothesis 5 (H5), after the government allowed open markets there were no drastic changes to the stock return volatility. The results are different from Ou (1994) findings that restriction relaxations of foreign investment decrease the stock volatility. The possible reason behind this could be because the market releases relatively more information merely concerning firms with high ratios of institutional investors; as such information asymmetry is deceased. However, although the deregulation policy enabled more foreign investors to invest in Taiwan stock, increase information flow and decrease information asymmetry, these information are generally confined to firms with higher foreign investment. However, since a minority of Taiwanese firms is involved in foreign investment, the government's effort in opening up the market brings little effect to companies. We are then unable to solely judge the deregulation effect on market volatility using the above information alone on

whether or not the deregulation has indeed decreased stock return volatility. In the following section of our research, we propose to extend our investigation by dividing the sample companies into three categories: firms with high FPI proportions, firms with high FDI proportions and firms with little foreign investment (control sample firms) in the section 5.3.

5.2.3 Goodness-Of-Fit Results

Our investigation compares the goodness-of-fit between the structural change GARCH model (model 2) and the conventional GARCH model (model 1). Table 3 depicts the results of the likelihood ratios. From Table 3, the chi-square results reject the null hypothesis. The results suggest that structural change GARCH model reveals better prediction outcomes; it has the superior ability of explaining the stock returns and volatility.

5.3 Return and Volatility Analysis of Firms With Differential Foreign Investment Characteristics

Table 4 depicts the structural change GARCH regression results of the three types of institutional investors' trading behavior, according to the three firm categories mentioned above i.e. firms with high FPI proportions (FPI group), firms with high FDI proportions (FDI group) and firms with little foreign investment (control sample group). From table 4, the coefficient β_1 is significantly greater than zero for FPI sub-sample firms. This means that before the government allowed open markets, firms with high proportions of FPI had a positive relationship between buy-sell differences and stock return rates. However, after the deregulation policy, the Wald statistic test showed that the ($\beta_1 + \beta_2$) results were not prominent, pointing to the fact that the buy-sell difference's influence on stock return rates are diminishing. These results support hypothesis 3 (H3) which states that: after the deregulation of foreign investment, the impact of foreign trade on stock returns is reduced for firms high in FPI.

Also, from the data on table 4, we found that the coefficient β_1 of firms with high proportions of FDI were significantly greater than zero as well. Before the government allowed open markets, firms with high proportions of FDI had a

positive relationship between foreign institutional buy-sell difference and stock returns. However, after the deregulation policy, the coefficient β_2 was significantly negative. In addition, the Wald statistics test showed that the ($\beta_1 + \beta_2$) results were not as prominent, indicating that the buy-sell

Table 4
Regression Results of Firms With Differentia Investment Characteristics

$$R_{i,t} = \beta_0 + \beta_1 F_{i,t-1} + \beta_2 (F_{i,t-1} \times D_{i,t}) + \beta_3 B_{i,t-1} + \beta_4 I_{i,t-1} + \varepsilon_{i,t},$$
$$\varepsilon_{i,t} \sim N(0, h_{i,t}), \qquad (2)$$
$$h_{i,t} = \gamma_0 + \gamma_1 \varepsilon_{i,t-1}^2 + \gamma_2 h_{i,t-1} + \gamma_3 (\varepsilon_{i,t-1}^2 \times D_{i,t}) + \gamma_4 (h_{i,t-1} \times D_{i,t}).$$

Sample	FPI		FDI		Control	
	Coefficient	T-statistics	Coefficient	T-statistics	Coefficient	T-statistics
$F_{i,t-1}$	15.4721	2.0383**	3.8546	2.0718**	14.2502	0.5920
$(F_{i,t-1} \times D_t)$	-9.5109	-1.1400	-3.9415	-1.9046**	-7.4448	-0.3023
$B_{i,t-1}$	11.4209	0.3967	32.9939	2.3000**	7.0132	0.9553
$I_{i,t-1}$	21.4229	1.1611	8.6048	0.8712	10.4222	2.6351***
Interpret (β_0)	0.0757	2.0375**	0.1113	*2.4851**	0.1306	2.7847***
Interpret (γ_0)	0.0278	4.1546***	0.0464	*2.9951**	0.0873	3.4475***
ε_{t-1}^2	0.0194	2.2116**	0.0264	2.0992**	0.0551	3.0670***
$h_{i,t-1}$	0.9704	102.0832***	0.9633	69.5641***	0.9312	49.7734***
$\varepsilon_{t-1}^2 \times D_{i,t}$	0.0300	3.0448***	0.0127	0.9048	-0.0017	-0.0958
$(h_{i,t-1} \times D_{i,t})$	-0.0352	-4.0021***	-0.0225	-1.6711*	-0.0176	-1.2663
Wald statistics						
$H_0 : \beta_1 + \beta_2 = 0$	5.9612		-0.0869		6.8054	
Chi-square (χ^2)	2.3144		0.0086		1.6689	

Notes: *Significant at the 10 percent level. **Significant at the 5 percent level. ***Significant at the 1 percent level.

difference's influence on stock return rates were diminishing after market

deregulations. These results support hypothesis 4 (H4) which states that: after the deregulation of foreign investment, the impact of foreign trade on stock returns is reduced in firms with higher FDI holdings

The control group in table 4 depicts an insignificant β_1, which implies the negligible relations between foreign institutional behaviors and Taiwan stock returns. Furthermore, the Wald statistics test also showed $(\beta_1+\beta_2)$ as not prominent. After the deregulation of foreign investment policies, the buy-sell difference of foreign investment did not contain incremental effect on Taiwan stock returns. Neither before nor after the market opened, had foreign institutional buy-sell difference contained effect on stock return rates. This finding is unique to previous descriptions of firms with high FDI and FPI, which implies that regulation policies on foreign investment yield great impact on firms high in FDI and FPI. On the contrary, companies with relatively low foreign investment seem not to have perceptible influence. Consistent with the results proposed by Chang (1999) and Wu (2005), foreign buy-sell difference is more influential on stock returns for firms with greater foreign holdings than those with lower ones.

On the whole, table 4 supports hypothesis 3 and 4. However, we must be careful of over simplifying; the results acquired from the structural change GARCH regression analysis do not, directly and solely, point out the fact that deregulation of trade policies lesson the role of firms high in FDI and FPI as market indicators. In fact, the receding role of FDI and FPI firms in the market could be as a result of the free market flow. Under the free market, once foreign investors have free access to Taiwan markets, foreign investment funds are more likely to trade according to business cycle. For instance, foreign investors sell their shares at high values to gain profit, and buy-in shares when the stock sales fall to take advantage of low stock prices. Therefore, overall speaking, changes in foreign investments decreased their relationship with Taiwan stock returns.

In regards to stock volatility, coefficient γ_3 and γ_4 in Table 4 captures the short-term and long-run volatility, respectively. Firms with high FPI have coefficient γ_4 significantly negative. This implies that after markets were opened, long-term stock return volatility declines dramatically. Similarly, firms high in FDI had a negative coefficient γ_4 value. After the government

deregulated foreign trade policies, foreign institutional trading behavior increases dramatically. According to El-Gazzar (1998) as well as Tsai and Li (2004), even international media is more likely to report messages concerning companies with a high proportion of foreign institutional investors. The information release also decreases information asymmetry between firms and outside investors. Hence, long-term stock return volatility drops substantially after market deregulation. On the other hand, both coefficient γ_3 and γ_4 were not prominent in the control group, implying that there were no signs of increased volatility after deregulation. Our research found that, once markets were opened, long-run stock return volatility decreased for firms high in FPI and FDI, but had no such effect for firms low in foreign investment.

In contrast to the FDI group, the coefficient γ_3 is significantly positive for FPI group firms and suggests the increasing short-term stock return volatility after market deregulation. FPI are sensitive to exchange rates or interest rates. After foreigners can freely trade in Taiwan Stock Exchange, these frequent trading increase the short-term stock return volatility. On the other hand, because FDI's trading strategies is not as sensitive to macroeconomics status as FPI's trading ones, the short-term stock return volatility does not rise after market deregulations. To sum up the aforementioned results, the long-term stock return volatility decreases after market deregulation, while the short-run stock return volatility does not. The results do not strongly support hypotheses H6 and H7.

6. Conclusions

After the government implemented the deregulation of foreign trade in 2003, the amount of foreign investment in the Taiwan Stock Exchange has grown over the years. Our research constructed the structural change GARCH regression model to capture the effect of foreign institutional trading behaviors on the Taiwan Stock Exchange. According to our research finding, there is a positive relationship between stock return rates and the trading behavior of foreign investments and mutual fund, consistent with our hypothesis. It is found that when foreign investors attain a positive buy-sell difference, general individual investors

(momentum traders) follow their investment strategy and buy in stocks, which increase stock return rates. Conversely, if there is a negative buy-sell difference, momentum traders will follow and sell their stocks, decreasing stock return rates. It is as if foreign investors are the ones who lead the rise and fall of Taiwan's stock market trend. Once a particular stock is recognized by institutional investors as having potential, the public recognizes this positive outlook and invests into it as well. As such, foreign institutional investor's research reports are taken by the public as important stock indicators.

In addition, after market deregulation, there is a structural declining trend between foreign institutional behaviors and stock return rates. In other words, when foreign investment depict some buy-sell difference in Taiwan stock, the extent of individual's demand for Taiwan stock will shrink. As a result, the increasing magnitude of stock return rates subsequent to market deregulation is not as large as that of stock return rates prior to market deregulation. With an open market, foreign investors are able to freely flow into or flow out of the Taiwan market, and make use of their professional skills. Therefore, the marginal effect of foreign institutional trades on general individuals declines. Furthermore, we found that the deregulation did not affect the Taiwan Stock Exchange nor did it affect the electronic industry index's volatility; however, the long-run volatility of firms with high proportions of FPI and FDI were decreased. It was also found that stock volatility of firms could only be stabilized in firms that contained high ratios of foreign investment.

From the above descriptions, there are two capital market management implications to this research: first, after the deregulation, foreign trading behaviors have reduced the impact on stock return rates. Second, open markets stabilized the long-run stock price volatility of firms with higher foreign investments. Since there remain several emerging countries (for example, China) that regulate foreign investors entrance into their country to engage in FPI, this research may offer as a reference for them in deciding about open markets. So far, we have focused on the impact of market deregulations on Taiwan stock markets. However, stock markets and future markets may be affected each other. The interactions between these two markets should be simultaneously considered in further research.

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7. References

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