國 立 交 通 大 學

財 務 金 融 研 究 所

碩 士 論 文

市場自由化政策對中國大陸 A、B 股報酬、風險與相關性之影響

The Effects of Market Liberalizations on Return, Risk, and Co-movement of China's A- and B-Share Stock Markets

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中 華 民 國 九 十 五 年 六 月

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財務金融研究所碩士班

碩士論文

A Thesis

Submitted to Graduate Institute of Finance
National Chiao Tung University
in partial Fulfillment of the Requirements
for the Degree of
Master of Science
in
Finance

June 2006

Hsinchu, Taiwan, Republic of China

中華民國九十五年六月

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2006 年 6 月

摘要

本篇論文探討 2001 年 2 月的 B 股開放以及 2002 年 11 月的核准申請 QFII 兩項主要股市開放政策對中國大陸 A 股及 B 股股票市場的影響。我們預期在市場開放政策實施之後，股票市場的風險會降低而且 A 股 B 股兩市場間的互動也會更為頻繁。本研究藉由四個不同的面向來檢驗自由化政策的效果。首先，探討政策的宣告效果；其次，比較股票折價的變化情形；再來，分析 A 股與 B 股兩市場間的共整合關係；最後，探究兩股票市場的波動度有何轉變。實證結果顯示 B 股開放政策對中國大陸 A、B 股票市場的風險、報酬以及相關性都有顯著的影響，但是 QFII 的核准卻沒有明顯的效果。我們推論中國政府的干預或是 QFII 在 A 股市場所能扮演的角色可能是導致此一現象的主要原因。

關鍵字:股票市場、自由化政策、報酬、共整合、波動度

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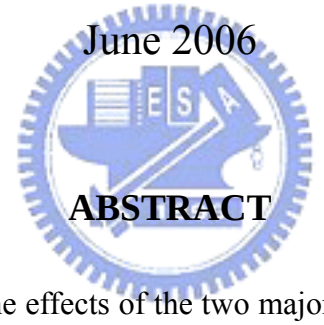
June 2006



ABSTRACT

This paper investigates the effects of the two major market liberalization policies, the opening of the B-share market in February 2001 and the approval of the QFII scheme in November 2002, on price behavior of China's A- and B-share markets. We expect the risk of stock markets will decrease and the two markets will interact with each other more frequently after the implement of market liberalizations. We examine the effects of market liberalizations by four different points of view. First, the announcement effects of two liberalization policies; second, the change of mean price discount; third, the cointegartion relationship between the A- and B-share stock markets; final, the volatility pattern of the A- and B-share stock markets. The empirical results show that the opening of the B-share market has significant influence on the return, risk, and co-movement relationship of the A- and B-share stock market while the QFII scheme does not have obvious impacts. We infer this phenomenon may result from the government's interference or the role QFII can play in the China's A-share stock market.

Keywords: stock markets; market liberalization; return; cointegartion; volatility

致謝辭

兩年的研究所生涯轉眼間就結束了，兩年的光陰或許不是很長的一段過程，但是卻留下了許多難以忘懷的回憶，真的很高興有機會能夠就讀交大財金所。

首先，要感謝我的指導教授陳達新老師，於研究期間常給予指導並適時提供意見，亦在生涯規劃上給予我寶貴的意見。此外也感謝口試委員劉祥熹教授、謝文良教授以及鍾惠民教授，在口試時提供寶貴的意見與經驗，使本篇論文能夠更臻於完善。

再來感謝陳君達老師、吳志強學長與尚育在程式方面的協助，讓我的論文能夠順利完成。此外，由衷感謝好友慧妤、小素、小倢、怡文、柏鈞、家農以及一群難得的好同學們陪我度過研究所的生涯。不論是互相討論學業、互相分享心情或是一起出遊玩樂，對我而言都是難忘且十分珍惜的回憶，是你們讓我的生活除了論文撰寫之外，能夠如此多彩多姿，這份情誼我會永遠銘記於心，也祝福大家未來有良好的發展。

最後，我要特別感謝我的父母，不辭辛勞栽培我完成大學與研究所的學業沒有你們的支持，今天我就無法有這樣的成果，謹以此論文獻給養育我長大的雙親。

呂忠穎 謹誌於

交通大學財務金融研究所

民國九十五年六月

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The Effects of Market Liberalizations on the Return, Risk, and Co-movement of China's A- and B-Share Stock Markets

1. Introduction

The world was shocked by China's unanticipated announcement of its Renminbi appreciation on July 21, 2005. Although the impact of this policy is still being debated, it could be viewed as a first step toward a floating exchange rate system, which will be very different from China's previous fixed exchange rate regime. Nevertheless, this surprising policy was not the first step to liberalize the market taken by China. The two most important stock market liberalization reforms have been the opening of the B-share market to local Chinese with foreign-currency accounts and the approval of a scheme to allow Qualified Foreign Institutional Investors (QFIIs) in the A-share market. The former reform was announced on February 19, 2001 and became effective on February 28, 2001, while the latter was announced on November 7, 2002 and took effect on December 1, 2002. With China's accession to the World Trade Organization (WTO) in 2002, the barriers to foreign trade and investment have been abolished and China's capital and equity markets have gradually opened. There is no doubt that more efforts will be made to integrate the stock markets in the near future.

China's financial markets have attracted the attention of investors due to the rapid economic growth that has taken place over the last decade. Since 1992, the average annual economic growth rate has surpassed 10%. Even during the period of the Asian financial crisis, China's economic growth rates were impressive and much higher than the average growth rates for the world economy. Spurred on by this continued economic growth, China's stock markets have become bigger and bigger. According to the annual statistics released by the World Federation of Exchange

(WFE), the ratio of China's stock market capitalization to its GDP was about 36.3% in 2003.[1] The market capitalization of China's stock market in 2004 was the third largest in Asia, next only to that of Japan and Taiwan.[2] There were also in total 1,169 listed companies in China in 2004, which was more than the corresponding number in Taiwan, and, in addition, China also had the largest number of investor accounts ─ over 80 million ─ in the world. We expect that China's stock markets will play an increasingly important role in global stock markets.

However, China's stock markets have become a hot issue not only because of their importance but also because of their uniqueness. These distinguishing features make it difficult to automatically extend the research results of other countries to China. Bailey, Chung, and Kang (1999) even explicitly argue that China's market is a strange case and also one of the most difficult markets to describe. There are many classes of common shares in China and the two most important classes are A-shares and B-shares. Although shares that are similar to A- and B-shares are traded in other countries, the pricing behavior in China's A- and B-share markets is quite unusual. The A-shares are denominated in the local currency, that is, in Renminbi, and can only be owned and traded by individuals and legal persons in the People's Republic of China (PRC). The B-shares are denominated in foreign currency and can only be traded and owned by foreigners, including the residents of Hong Kong, Macau, and Taiwan. Because A-shares cannot be freely converted to B-shares, and vice versa, the A-share market and the B-share market are basically viewed as segmented markets. However, liberalization and globalization are the mega trends in world financial markets, and emerging markets, including those of China, are no exception. Moreover, the IMF and the World Bank are also encouraging developing countries to

[1] See http://www.world-exchanges.org. China's stock markets include the Shanghai Stock Exchange and the Shenzhen Stock Exchange.
[2] Sources: *World Development Indicators 2004*, World Bank.

open up their financial markets in order to achieve economic growth and financial stability. Under this global atmosphere, the effect of market liberalization has become a key issue not only for academics, but also for participants.

In this paper, we wish to examine whether China's stock markets, i.e. the A-share market and the B-share market, have become more stable and more closely integrated following the implementation of two important market liberalization policies. We also intend to explore the impacts of these two polices on these stock markets. To this end, we will divide our overall sample into three sub-periods, namely, the period before the announcement of the opening of the B-share market to local Chinese, the period after the opening but before the approval of the QFII scheme in the A-share market, and the period after the approval of that scheme. The first thing we would like to do is to explore whether the two markets have abnormal stock returns before and/or after the announcement of the two events based on the event study method. We can examine the investors' expectations regarding the effects of these liberalization policies and see if there is any information leakage.

There also exists a huge price discount for B-shares relative to A-shares. Because A-shares cannot be freely converted to B-shares, and vice versa, the price disparity in the two markets cannot be reduced by arbitrage activities. We therefore expect that the price disparity will become smaller as the two markets become more closely integrated following the implementation of the stock market liberalization policies. In addition, the stock prices themselves may contain some information or patterns that the stock returns cannot convey. Thus we will use the vector error correction model (VECM) to explore the possible change in the relationship between the stock prices in the two markets. We believe that there exists an apparent co-movement relationship between the stock prices in the A-share market and those in the B-share market. The phenomenon of a large price disparity would be also

mitigated if market integration were found to become stronger after a series of market liberalization policies take effect.

Finally, we will examine whether the A-share market and the B-share market become more stable after these two policies are implemented. In order to examine the level of financial stability, we use volatility, i.e. the standard deviation, of the two stock markets as a benchmark. In our research, we will employ a bivariate generalized autoregressive conditional heteroskedastic model (bivariate GARCH) to investigate the changes in volatility during the three sample periods. After the market liberalization policies take effect, the two markets will interact with each other more frequently, and thus the two markets will operate more efficiently. We would thus expect to find that the pattern of volatility between the A- and B-shares is closer in the last of the three sample periods.

The main contribution of our paper is to divide the overall sample into three sub-periods based on these two important liberalization events and then to comprehensively study the respective impacts of the two policies on the A-share and B-share markets. Previous studies explore the effect of the two liberalization policies separately, but we will discuss them jointly. As mentioned earlier, we will examine the announcement effects, the price discount, the co-movement relationship, and the changes in the volatility of the two markets for the different sample periods. We believe that the experience we have gained from China's stock markets could serve as a good example to demonstrate the benefits of market liberalization to other developing economies and could also have important policy implications.

The remainder of this paper is organized as follows. A brief history of China's stock market is presented in Section 2. Section 3 consists of a literature review, and Section 4 describes the data and presents the initial analysis. Section 5 details an event study on the financial impact of market liberalization. Section 6 gives a

comparison of the B-share price discounts in different periods. Section 7 presents the cointegration analysis, and Section 8 the empirical results of the bivariate GARCH model. Finally, Section 9 summarizes and concludes the paper.

2. A Brief History of China's Stock Market

The first equity issue in China took place in 1984 when a department store issued shares to its employees. After that, an increasing number of state-owned enterprises (SOEs) were privatized as a result of selling shares to their own employees or to other companies and SOEs. However, there was no stock market at that time and stock trading was still prohibited. The first stock exchange in the history of the People's Republic of China, the Shanghai Stock Exchange (SHSE), opened on November 26, 1990, to be followed by the Shenzhen Stock Exchange (SZSE) on April 11, 1991.

Listed companies in China may actually issue five different types of shares: A-shares, B-shares, state shares, legal shares, and overseas shares. A-shares are equivalent to ordinary equity shares as they are generally accepted in other equity markets. They are denominated in Renminbi and may only be traded by Chinese citizens. B-shares are ordinary shares denominated in Renminbi but traded in foreign currencies. Holders of B-shares have the same rights and bear the same obligations as holders of A-shares. The distinction between A-shares and B-shares is that B-shares have been restricted to foreign investors (before February 19, 2001), and that quotes and dividends are in foreign currency. The state shares are held by the government through a designated government agency, and the legal shares (restricted institutional shares) are held by legal persons that are enterprises or economic entities other than individuals. The state shares and the legal shares cannot be listed on the two official exchanges, but very thin volumes are traded over the counter based on the Security Trading and Automatic Quote System (STAQS) and the National Electronic

Trading System (NETS). Since 1993, Chinese firms have also been permitted to list shares overseas. H-shares refer to those listed in Hong Kong, S-shares to those listed in Singapore, and L-shares to those listed in London. N-shares listed on the New York Stock Exchange take the form of IPOs or American Depository Receipts (ADR) and were first issued in September 1992.

After A-shares received approval to be traded on the SHSE, the Chinese government hoped not only to prevent foreign investors from influencing the prices of A-shares, but also to satisfy the demand for foreign capital on the part of domestic companies. Because the Renminbi is not freely exchangeable, the China government established the B-share market for foreign investors in February 1992. B-shares are denominated in Hong Kong and United States dollars on the Shenzhen Stock Exchange and the Shanghai Stock Exchange, respectively. B-shares were only traded and owned by foreigners, including the residents of Hong Kong, Macau, and Taiwan before February 19, 2001. The A-share market and the B-share market are thus viewed as segmented because A-shares cannot be freely converted to B-shares, and vice versa.

In contrast to the active trading activity and liquidity of the A-share market, the B-share market is never active, and there is a huge discount of B-share prices relative to A-shares. This discount in relation to B-shares increased from 25% in 1993 to 86% in 2001 prior to the first liberalization action, i.e. when the A-share market was opened to local Chinese residents, at which point the B-share market was considered to be practically dead. One of the most important reasons for this phenomenon was that the market participants were limited to foreign investors. Besides that, foreign investors were able to invest in China by buying Chinese shares listed overseas, for example, H-shares and N-shares, or by buying the shares of multinational companies with significant exposure to China. The Chinese government resorted to many

measures to revitalize the B-share market, such as lowering the trading stamp duty on B-shares, allowing non-state-owned enterprises to issue B-shares, establishing B-shares funds, and so on. Unfortunately, these policies were not effective, and that is the reason why the China Securities Regulatory Commission (CSRC) and the State Administration of Foreign Exchange (SAFE) announced the first important market liberalization policy on February 19, 2001. Starting from February 28, 2001, Chinese nationals with an existing foreign currency deposit account with a domestic commercial bank would be able to trade B-shares on the SHSE and SZSE. Those who opened an account after February 19, 2001 would be allowed to trade after June 1, 2001. The B-share market was closed for a week after the announcement, and reopened on February 28, 2001.

Following its accession to the WTO, China has had to gradually remove the barriers to foreign trade and investment. The major reform after the opening of the B-share market was the long-awaited Qualified Foreign Institutional Investors (QFII) scheme, announced on November 7, 2002 and made effective on December 1, 2002. This new policy allows qualified foreign investors to invest in the A-share market, which previously was exclusively reserved for domestic investors. By means of the QFII scheme, China's government has not only facilitated the inflow of foreign capital and professional knowledge into its financial market, but has also minimized any possible negative effects that may have arisen due to the inflows of foreign capital.

3. Literature Review

There are many studies that have focused on the relationship between market segmentation and stock prices in emerging markets. For instance, Domowitz, Glen, and Madhavan (1997) examined the relationship induced by ownership restrictions in

Mexico. The restrictions on equity ownership in Mexico and China are very much alike because in both countries there are multiple classes of stock shares that differentiate between domestic and foreign investors. Significant stock price premiums are documented for unrestricted shares that have only been opened to foreign investors and in their study they argue that the stock price premium reflects the relative scarcity of unrestricted shares. In other stock markets with partial segmentation between domestic and foreign investors through dual classes of shares, the foreign class shares are generally sold at a premium, but in China the B-shares are generally traded at a discount.[3] Chakravarty, Sarkar, and Wu (1998) have thus tried to explain the sources of different kinds of price behavior for the A-shares and the B-shares and have argued that the price discount results from the information asymmetry between foreign investors and domestic investors. Foreign investors are less able to acquire and assess information regarding China's companies, relative to domestic investors, due to language barriers, different accounting standards, and a lack of reliable information about the economy and companies in China.

On the other hand, Chui and Kwok (1998) pointed out that foreign investors receive news about China faster than domestic investors because of the information barriers within China. The rational investors that buy and sell A-shares should make trading decisions based on the previous price movements of the B-shares. As a result, the returns on the B-shares lead the returns on the A-shares. However, Chen, Lee, and Rui (2001) did not support this information hypothesis because their empirical results showed that there is no casual relationship between the returns (volatility) in relation to the A-shares and the returns (volatility) in relation to the B-shares during the sample period from 1992 to 1997.

[3] For example, Loderer and Jacobs (1995) found that Nestle's foreign-held voting bearer stocks were selling for about twice the price of the domestically-held registered shares when, on November 17, 1998, Nestle's board decided to allow foreign investors to hold registered shares.

The liquidity hypothesis provides another explanation for the price discounts related to the B-shares. According to this hypothesis, the price discounts are caused by the B-shares' lower liquidity and higher transaction costs. Amihud and Mendelson (1986) noted that illiquid stocks should have higher expected returns and should be priced lower to compensate investors for the increased trading costs. Chen, Lee, and Rui (2001) supported this hypothesis with their panel data analysis results, which showed that the significant price discounts were primarily due to the illiquidity of the B-share market.

The differential risk hypothesis also provides an explanation for the price discounts related to the B-shares. This hypothesis argues that domestic investors and foreign investors have different degrees of risk aversion because the domestic stock market is highly speculative. The speculative behavior of Chinese investors may push up the prices of A-shares. If this hypothesis were true, there ought to be a positive relationship between the price discounts and this risk level. However, Chen, Lee, and Rui (2001), who used the variance of returns as a proxy for the risk level, did not support this hypothesis.

In addition to the studies on the differences in price behavior between the A-share market and the B-share market, the volatility of China's stock market is also an important issue for academics and investors. Su and Fleisher (1998) argued that the volatility of China's stock market returns is high relative to developed markets. From their empirical results, they argued that the variance of stock market excess returns is time-varying, mildly persistent and is influenced by government market support and liberalization policies. They also found that volatility decreased after the announcement of market liberalization policies in July 1994 and that the volatility of the A-share market and the B-share market were different. Since the A-shares and the B-shares have the same ownership rights and claims to future cash flows, the

sources of the differences in volatility across China's stock markets have become an interesting issue. Su and Fleisher (1999) stated that the differences in volatility between the A-shares and the B-shares were related to the differences in the intensity of news announcements and the differences in the way that such news is incorporated into trading decisions. Besides that, they found that there exists a positive relationship between the time-series of the price discounts and the differences in the volatility-related expected intensity of information flows.

He, Wu, and Chen (2002) tried to find another explanation for the disparity in the volatility of the A-shares and the B-shares. The microstructure theory developed by Kyle (1985) and Easley, Kiefer, O'Hara, and Paperman (1996) suggests that volatility is related to asymmetric information. According to this theory, higher volatility is caused by a higher degree of information asymmetry and increased participation on the part of informed traders in the market, which in turn lead to higher trading costs. The empirical results of He, Wu, and Chen (2002) indicated that the higher volatility of the B-shares is attributable to the higher market-making costs faced by foreign investors and they argued that the volatility disparity between the two markets will disappear when controlling for informed trading and other trading costs.

Earlier studies treated the A-share market and the B-share market as two segmented markets because of the investment restrictions in China. After the market liberalization policies were implemented, the two markets were able to interact with each other more frequently and to impact the two markets. Henry (2000) argued that the equity price indexes of emerging countries experienced abnormal returns before the implementation of the initial stock market liberalization. His results supported the prediction of the international asset-pricing model that market liberalization policies may reduce the country's cost of equity by sharing risk between the domestic and foreign investors. Chiu, Lee, and Chen (2005) investigated the impact of the

opening of the B-share market on local Chinese with foreign-currency accounts. Their empirical results showed that, after allowing domestic investors to invest in the B-share market, the volatility transmission process had speeded up and the persistence of the impact had been shortened. They argued that the market liberalization impacted not only the A-share market but also the B-share market.

4. Data and Initial Analysis

The data that we use in our study comprise the time series of daily closing prices and indices on the Shanghai Stock Exchange and the Shenzhen Stock Exchange that are obtained from the Taiwan Economic Journal (TEJ) database. In the first part of our empirical test, our event study employs stock indices returns of the SHSE and SZSE A-share markets and the stock indices returns of the SHSE and SZSE B-share markets from 30 trading days before to 30 trading days after the event days, namely, February 28, 2001 and November 7, 2002. The objective of the event study is to investigate the announcement and valuation impacts of these two new liberalization policies on China's stock markets overall.

The second part of our empirical test is to compare the B-share price discounts for different sample periods. The objective of the comparison is to investigate whether the price disparity becomes smaller after the market liberalization. The third part of the test examines the extent of the market integration and which market is more important in the price discovery process. The data series begins on October 6, 1992 and ends on September 30, 2005. The whole data set series is then divided into three unequal sub-periods to present the periods before and after the market liberalization policies took place. Data from October 6, 1992 to February 19, 2001 represent the first period; the second period is represented by the data from February 28, 2001 to November 6, 2002; and the third period is represented by the data from

November 7, 2002 to September 30, 2005. This study focuses not only on the effect on the stock prices of opening the B-share market to local Chinese residents, but also on the effect of the subsequent market liberalization policy, i.e. the QFII scheme that became effective on December 1, 2002. The daily stock returns, $R_{i,t}$, for stock exchange i are measured by the log difference between the closing price indexes:

$$R_{i,t} = 100 \times [\ln(P_{i,t}) - \ln(P_{i,t-1})]. \quad (1)$$

The final part of the empirical test is to explore the inter-market information links. The return correlation of the two markets is a measure of the information link between the two markets. We use daily data for the whole sample period from October 6, 1992 to September 30, 2005 and set up two event dummies in order to capture possible changes in the correlation structure during the liberalization process.

Before we enter into detailed analyses, we examine the A-share and B-share daily market indices over our sample period to obtain a general view of the market situation both before and after the two market liberalization policies. In Figure 1 the solid lines plot the A-share market indices and the relevant Y-axis is the one on the left. The dashed lines plot the B-share market indices and the relevant Y-axis is on the right. It can be seen that the opening up of the B-share market affected only the B-share market indices, while the announcement of the QFII scheme affected the A-share market.

The descriptive statistics of the A-share and B-share returns within the two exchanges are presented through Panel A to Panel D in Table 1. This table lists the mean, maximum, minimum, standard deviation, skewness, kurtosis, and the Jarque-Bera normality test. Lee, Chen, and Rui (2001) argued that the distribution of Chinese stock returns exhibits the following characteristics: leptokurtosis, skewness, and volatility clustering. Our descriptive results in Table 1 exhibit the

same properties. From the Jarque-Bera statistics, skewness, and kurtosis, we know that the hypothesis of a normal distribution is strongly rejected for all four data series. During the first period, the SHSE and SZSE Class A-share returns have higher standard deviations than the SHSE and SZSE Class B-share returns. However, during the next two periods, the A-share returns have lower standard deviations than the B-share returns on both stock exchanges. It is also worth noting that the mean A-share returns are negative during the next two periods in both stock exchanges, but that only the SHSE Class B-share returns are negative in the final period. Further analysis will be performed in the sections that follow.

5. Event Study on the Financial Impact of Market Liberalization

We use event-study methodology to analyze the announcement and valuation impacts of the new liberalization policies on China's stock prices. The purpose of an event study is to examine the behavior of stock prices both before and after an important event such as regulatory changes, the announcement of a dividend payment or a merger, etc. and is a standard approach adopted in research in economics and finance (Binder, 1998). Furthermore, Merton (1987) argues that, other things being equal, an increase in the size of a company's investor base will reduce the investors' expected returns, and hence the market price of the firm's stocks will rise. So if there is buying pressure due to the opening of the B-share market to local Chinese investors or the opening of the A-share market to QFIIs and there is no information leakage, we believe that the stock price will immediately increase according to the theoretical model developed by Merton. In addition, stock prices should fully and instantaneously reflect all available information at any time in an efficient market and therefore a change in the market liberalization policy should only have a temporary impact on the stock markets.

To conduct an event study, each of the event day, estimation window, event window, and estimation model must be determined. We measure the market's reaction to the policy announcement on February 19, 2001 by calculating the abnormal returns of the SHSE A-share market index, the SZHE A-share market index, the SHSE B-share market index, and the SZHE B-share market index, around the 61-day event window (t=-30, t=+30). The abnormal return (AR) during the event window for stock market index i on day t is defined as:

$$\mathrm{AR}_{i,t} = R_{i,t} - R_{m,i} . \qquad (2)$$

where $R_{i,t}$ is the return on stock market index i on day t, and $R_{m,i}$ is the average return of stock market index i during the estimation period. The average returns of the stock market indices are estimated based on the mean-adjusted model of a 100-day estimation window by calculating the average return for the period from 130 trading days before the event day to 31 trading days before the event day. It is worth noting that our event day is defined as February 28, 2001, which was the first trading day after the markets were suspended following the government's announcement. It is not February 19, 2001 because the news was publicly released after trading hours on that day. Besides that, we define the next event day as November 7, 2002, which was the announcement day. We also calculate the cumulative abnormal return (CAR) for each stock market index i, for the period from 30 trading days before the event day to 30 days after.

The results for the event study are presented in Table 2 and Table 3. Panel A in Table 2 and Table 3 examines the A-share market response around the event day and Panel B in Table 2 and Table 3 examines the B-share market response around the event day. We do not observe any significant market response before the event day either on the SHSE or the SZSE. In order to save space, Table 2 and Table 3 contain

the daily average abnormal returns for $t = -10,...,+10$. From Table 2, for the pre-event-day period, the Z-statistics are all statistically insignificant and it seems that no information regarding the policy change was leaked out to the market before the announcement was officially made. The Chinese government has successfully kept the information regarding these policy liberalizations completely secret and there has been no evidence of information leakage. However, the stock indices have risen dramatically on and after t=0 as investors have expected that there will be an increased demand for Class B-shares in the near future. Panel B in Table 2 shows that the significantly positive AARs have continued to rise for four trading days (t =0, t =3) on the SHSE and for five trading days (t =0, t =4) on the SZSE. As argued by Jegadeesh and Titman (1993), who found that stock prices usually experience short-term reversal, there are price reversals on $t = 5$ on both exchanges, and the AARs are negatively significant. Moreover, significant abnormal returns reappear on $t = 7$ in the case of the SHSE, and on $t = 7$ and $t = 8$ in the case of the SZSE. To sum up, the event study results show that, first, the investors have not anticipated the information contained in the market liberalization announcement, and, second, the policy contains positive signals in relation to the B-share market.

From Panel A in Table 3, we find that for the whole event period (t=-10 to t=10) there is no abnormal return in the A-share market. We believe this phenomenon indicates that information was not leaked before the government's announcement of its open market policy. It also means that investors do not anticipate that the QFII scheme will give rise to increased demand for the A-shares and/or the QFII cannot have a significant influence on the A-share market in the immediate future. It is worth noting that the B-share market of the SHSE also exhibits a similar price pattern to that mentioned above, and so we may state that the QFII scheme has a certain price impact on the B-share market. In general, we learn from the event study results that

investors have expected the information contained in the government's open market announcement, and the open market policy contains information that is of negative value to the A-share market.

6. The Price Discount Between A- and B-Shares

The most notable puzzle is the Class B-share discount relative to the Class A-shares. In other stock markets with partial segmentation between domestic and foreign investors through dual classes of shares, the foreign class shares are generally sold at a premium, but in China the Class B-shares are generally traded at a discount, sometimes by as much as 70% (see Chen and Su (1998)).

In this section we would like to examine whether the price discounts have been mitigated after the implementation of the two market liberalization policies. The B-share price discount is defined as:

$$\text{Price Discount} = \left(P_B - P_A\right) \Big/ P_B . \tag{3}$$

We examine paired firms that issued both A- and B-shares during our sample period from September 30, 1998 to September 30, 2005. The first sample period extends from September 30, 1998 to February 19, 2001, the second sample period from February 28, 2001 to November 6, 2002, and the final period is represented by the data from November 7, 2002 to September 30, 2005. The sample period starts on September 30, 1998 because before that time the number of companies listed in the B-share market was too small to compute meaningful price discounts. Among the paired firms, 40 pairs of stocks were traded on the Shanghai Stock Exchange (SHSE) and 42 were traded on the Shenzhen Stock Exchange (SZSE), respectively.

Form the empirical results of Table 4, we learn that before the market liberalization policies take place, there exists a huge price discount for the B-shares

relative to the A-shares. After the opening of the B-share market, the price discount decreases significantly indicating that the two markets become more closely integrated with each other following the market's opening. However, the price discount does not fall after the announcement of the QFII scheme. The reason for this result may be that the QFIIs' invested capital is small relative to the whole of the stock market capital and thus they cannot have a significant impact on the price of the A-shares.

7. Cointegration Analysis

7.1 Information Criteria and Unit Root Tests

Level data, such as the time series of the stock price, are usually non-stationary, and thus before we proceed with cointegration analysis, we have to perform unit root tests for all stock indices. We employ the Augmented Dickey-Fuller test to examine whether each stock index series contains a unit root. In order to proceed with the ADF test, we first of all have to choose the optimal lag length, which we do by means of the two most popular information criteria which are Akaike's (1974) information criterion (AIC) and Schwarz's (1978) Bayesian information criterion (SBIC). Based on the AIC and SBIC, we finally choose ten as our optimal lag length.

From the results of Table 5, regardless of whether the 1%, 5% or10% critical value, we cannot reject the null hypothesis that the level data, which are the stock price indices, contain unit roots. However, the results of the unit root tests for the difference values of the stock indices show that the null hypothesis has been rejected at every significance level. From the results of the ADF test, we learn that all of the stock indices are I(1) series and perform the cointegration test as the next step.

7.2 Johansen Cointegration Test and Cointegration Analysis

Because the announcement of the market liberalization policies may influence

the cointegration relationships between the A- and B-share stock markets, the overall data set is divided into three unequal sub-periods to represent the periods both before and after the market liberalization policies were implemented prior to proceeding with the cointegration analysis. The data from October 6, 1992 to February 19, 2001 represent the first period, the second period is represented by the data from February 28, 2001 to November 6, 2002, and the final period is represented by the data from November 7, 2002 to September 30, 2005. In addition, we also perform cointegration analysis for whole sample period to compare the estimation results for the three different periods.

In order to employ the Johansen test, we construct a vector error correction model that takes the following form:

$$\Delta \mathrm{P}_t = \Pi \mathrm{P}_{t-k} + \Gamma_1 \Delta \mathrm{P}_{t-1} + \Gamma_2 \Delta \mathrm{P}_{t-2} + \ldots + \Gamma_{k-1} \Delta \mathrm{P}_{t-(k-1)} + u_t, \tag{4}$$

where

$$\Pi = \left(\sum_{j=1}^{k} \beta_i \right) - I_g \text{ and } \Gamma_i = \left(\sum_{j=1}^{i} \beta_j \right) - I_g .$$

P_t is the stock index at time t, P_{t-i} is the lagged level term, and $\Delta \mathrm{P}_{t-i}$ represents the lagged differences. The Johansen test is centered on an examination of the Π matrix, which can be interpreted as a long-run coefficient matrix. The test for cointegration between the Ps is calculated by looking at the rank of the Π matrix via its eigenvalues. There are two test statistics for cointegration based on the Johansen approach, which are formulated as:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{g} \ln\left(1 - \hat{\lambda}_i\right), \tag{5}$$

and

$$\lambda_{\max}\left(r, r+1\right) = -T \ln\left(1 - \hat{\lambda}_{r+1}\right). \tag{6}$$

If the test statistic is greater than the critical value from Johansen's tables, we can

reject the null hypothesis that there are r cointegrating vectors in favor of the alternative that there are $r+1$ (for λ_{trace}) or more than r (for $\lambda_{\max}$) such vectors.

Table 6 represents the empirical results of the Johansen test for the full sample period, the period before the opening of the B-share stock market, the period after the opening of the B-share market but before the announcement of the QFII scheme and the period after the announcement of the QFII scheme. According to the results for the full sample period, we cannot reject the null hypothesis of no cointegrating vectors (corresponding to Π having a zero rank) for both the Shanghai Stock Exchange (SHSE) and the Shenzhen Stock Exchange (SZSE) at the 10% significance level based on the two test statistics. Because this null is not rejected, it can be concluded that there are no cointegrating vectors between the A-share stock indices and the B-share stock indices.

Before the opening of the B-share market, the result of the first sample period in Table 6 shows that the null hypothesis of no cointegrating relationships between the A-share market and the B-share market cannot be rejected at the 10% significance level whether for the SHSE or the SZSE. In the period after the opening of the B-share market but before the announcement of the QFII scheme, the second sample period's results, as shown in Table 6, demonstrate that the null hypothesis is rejected at the 10% significance level for both the SHSE and the SZSE, indicating that there are long-run relationships between the A-shares and the B-shares in this sample period. In the final sample period, the null hypothesis cannot be rejected at 10% significance level either for the SHSE or the SZSE, and thus we argue that there are no cointegration relationships between the A-share stock indices and the B-share stock indices.

For the period prior to the opening of the B-share market, the empirical results of the Johansen test in this paper are similar to the results of previous studies. These

results indicate that the A-share stock indices and the B-share stock indices do not exhibit a co-movement relationship in the long run. Investors cannot predict the trend of the A-share (the B-share) stock indices from the stock indices of the B-shares (the A-shares).

After the first market liberalization policy was implemented, local Chinese with an existing foreign currency deposit account with a domestic commercial bank could buy the A-shares and the B-shares at the same time, and thus the restrictions on arbitrage trading disappeared. The price difference between the A- and B-shares would thus have become smaller theoretically, and so we expect that the cointegration relationship between the A-share market and the B-share market would be stronger than before. According to the results of the Johansen test, there are cointegration relationships between the A-share market and the B-share market for the SHSE and the SZSE and this phenomenon confirms the theoretical expectation.

It is also worth noticing that the cointegration relationships disappear in the third sample period based on the results of the Johansen test. This phenomenon conflicts with our initial expectation because the relationships should become stronger in the final sample period as the result of a higher degree of market liberalization. After the announcement of the QFII scheme, foreign investors were able to invest in the A-share stock market just like Chinese nationals were able to invest in the B-share market after the opening of the B-share market. The interactions between the two stock markets should become more frequent following the implementation of the two market liberalization policies and this is the reason why we argue that the cointegration relationships should become stronger than before.

We suspect that this “abnormality” could be attributed to the announcement made by the China Securities Regulatory Commission (CSRC) regarding selling state shares to the public in the A-share market on June 12, 2001. After this policy was

implemented, the supply of stocks rose suddenly, but the demand for stocks decreased because investors feared that, as non-tradable stocks entered the market, the market balance between supply and demand would be destabilized, with the result that banks also rapidly withdrew their funds from the stock market. Because the demand for funds (that is, the supply of stocks) was greater than the supply of funds (that is, the demand for stocks), the stock prices of the A-shares fell sharply.[4] While the A-share market was a bear market, prices in the B-share market did not fall as dramatically as the A-share market, and thus the different price behavior of the two markets caused the cointegration relationship to disappear in the final sample period. The other reason was that although the QFIIs could invest in the A-shares after the market liberalization policy was implemented, the foreign invested capital was still small relative to the whole of the A-share stock market.[5] So the QFII scheme had only a limited influence on the price behavior of the A-shares and that is the reason why the two markets did not become more closely integrated after the QFII scheme was announced.

8. The Bivariate GARCH Model

In order to justify the use of the GARCH model, we should test whether ARCH-effects are present in the residuals. A test for determining whether ARCH-effects are present in the residuals of an estimated model can be conducted by taking the following steps. First, we run any postulated linear regression and save the residuals, $\hat{\varepsilon}_t$. Second, we square the residuals and regress them on q own lags to test for ARCH of order q, i.e. we run the regression:

[4] This is the so-called "state-owned-enterprise privatization" of the early 2000s which caused China's A-share market to almost collapse.
[5] The implementation day of the QFII scheme was December 1, 2002, but the first application was made on May 23, 2003 by UBS Limited.

$$\hat{\varepsilon}_t^2 = \gamma_0 + \gamma_1 \hat{\varepsilon}_{t-1}^2 + \gamma_2 \hat{\varepsilon}_{t-2}^2 + ... + \gamma_q \hat{\varepsilon}_{t-q}^2 + \nu_t ,$$

where ν_t is an error term. We can obtain R^2 from this regression. Third, the test statistic is defined as TR^2 (the number of observations multiplied by the coefficient of multiple correlation) from the last regression, and is distributed as a $\chi^2(q)$. Finally, the null and alternative hypotheses are

$H_0 : \gamma_1 = 0$, $\gamma_2 = 0$, $\gamma_3 = 0$, …, and $\gamma_q = 0$;

$H_1 : \gamma_1 \neq 0$ or $\gamma_2 \neq 0$ or $\gamma_3 \neq 0$ …or $\gamma_q \neq 0$.

Thus, the test is one of a joint null hypothesis that all q lags of the squared residuals have coefficient values that are not significantly different from zero. If the value of the test statistic is greater than the critical value from the χ^2 distribution, then the null hypothesis is rejected. The test can also be thought of as a test for autocorrelation in the squared residuals. As well as testing the residuals of an estimated model, the ARCH test is frequently applied to raw returns data. We test whether the ARCH effects are present in the returns of the A- and B-share markets and find that the null hypotheses are rejected in both stock markets. So the use of the GARCH model is justified by the results.

Following Karolyi and Stulz's (1996) approach, this paper processes the following bivariate AR(1)-GARCH(1,1) model with a constant conditional correlation formulation in regard to the A-share stock indices and B-share stock indices. Daily data for the whole sample period from October 6, 1992 to September 30, 2005 are employed in the regression. This study uses two event dummies to capture possible changes in the volatility structure in the liberalization process:

$$R_{a,t} = \alpha_{a1} + \alpha_{a2} R_{a,t-1} + \alpha_{a3} R_{b,t-1} + \alpha_{a4} D_1 + \alpha_{a5} D_2 + \varepsilon_{a,t} , \quad (7)$$

$$R_{b,t} = \alpha_{b1} + \alpha_{b2} R_{b,t-1} + \alpha_{b3} R_{a,t-1} + \alpha_{b4} D_1 + \alpha_{b5} D_2 + \varepsilon_{b,t} , \quad (8)$$

$$h_{aa,t} = \beta_{a0} + \beta_{a1} h_{aa,t-1} + \beta_{a2} \varepsilon^2_{a,t-1} + \beta_{a3} \varepsilon^2_{b,t-1} + \beta_{a4} D_1 \varepsilon^2_{a,t-1} + \beta_{a5} D_1 \varepsilon^2_{b,t-1} + \beta_{a6} D_2 \varepsilon^2_{a,t-1} + \beta_{a7} D_2 \varepsilon^2_{b,t-1}, \quad (9)$$

$$h_{bb,t} = \beta_{b0} + \beta_{b1} h_{bb,t-1} + \beta_{b2} \varepsilon^2_{a,t-1} + \beta_{b3} \varepsilon^2_{b,t-1} + \beta_{b4} D_1 \varepsilon^2_{a,t-1} + \beta_{b5} D_1 \varepsilon^2_{b,t-1} + \beta_{b6} D_2 \varepsilon^2_{a,t-1} + \beta_{b7} D_2 \varepsilon^2_{b,t-1}, \quad (10)$$

$$h_{ab,t} = \rho_{ab} \sqrt{(h_{aa,t} h_{bb,t})} . \quad (11)$$

where R_a and R_b are the returns on the A-share stock indices and B-share stock indices, respectively. The conditional variance, h_t, is composed of the lagged squared errors ε^2_{t-1} in the return process and the lagged conditional variance, h_{t-1}. D_1 and D_2 are the two event dummies and D_1 takes the value of one from February 28, 2001 to November 6, 2002, and zero otherwise, while D_2 takes the value of one from November 7, 2002 to September 30, 2005, and zero otherwise.

In the mean equations, i.e. Equation (7) and Equation (8), coefficient $\alpha_{i,2}$ measures the effect of the last period return on the A-shares (B-shares) on this period's return on the A-shares (B-shares) and coefficient $\alpha_{i,3}$ measures the effect of last period's return on the other market. $\alpha_{i,4}$ and $\alpha_{i,5}$ measure whether the return on the A-shares (the B-shares) exhibit a structural change after the opening of the B-share market or the approval of the QFII scheme, respectively. In the conditional variance equation, i.e. Equation (9) and Equation (10), coefficient $\beta_{i,1}$ captures the impact of the last period's conditional variance and $\beta_{i,2}$ ($\beta_{i,3}$) captures the impact of the last period's squared error for the A-share market (B-share market) on the current period's conditional variance, respectively. The coefficients $\beta_{i,4}$ to $\beta_{i,7}$ measure the effects of the market liberalization policies on China's stock market volatility

using the cross terms of D_i and $\varepsilon_{i,t-1}^2$. If these coefficients are statistically significant, then the market liberalization policies have had an effect on China's stock market volatility. In the conditional variance equation, i.e. Equation (11), ρ_{ab} measures the correlation between the A-share market and the B-share market. The coefficient does not change during the overall sample period because we assume that this model is characterized by constant conditional correlation. Given the information link, the above formulation allows the information, which is presented by the unconditional volatility in the variance equation, ε^2, to affect the other market.

The estimation results of this model are presented in Table 7. From the coefficients of the lagged terms in the mean equations of the Shanghai Sample, we find that the last period returns of the A- and B-shares both play important roles in the determination of the current period return of the A-share market, while only the lagged return of the B-shares influences the current period return of the B-share market. However, in the Shenzhen Sample, the coefficients are contrary to those of the Shanghai Sample. Only the lagged return of the A-shares influences the current period return of the A-share market while the last period returns of the A- and B-share markets are both important in the determination of the current period return of the B-share market. From the coefficients of the dummy variables, we know that the openness of the B-share market has an impact on the return of the Shanghai Stock Exchange (SHSE) B-Shares and the return of the Shenzhen Stock Exchange (SZSE) A-Shares, while the approval of the QFII scheme only has an influence on the return of the SZSE B-shares.

The parameters in the variance equations give rise to some interesting phenomena. For the SHSE, $D_1 * \varepsilon_{1,t-1}^2$ has a coefficient of -0.0903 (t-value = -5. 29) in the A-share market and $D_1 * \varepsilon_{2,t-1}^2$ has a coefficient -0.0908 (t-value = -3.60) in the

B-share market. This means that the unconditional volatility of the A- and B-shares decreases after the opening of the B-share market in the case of the SHSE. $D_2 * \varepsilon_{1,t-1}^2$ has a coefficient of -0.3527 (t-value = -15.36) in the A-share market and $D_2 * \varepsilon_{2,t-1}^2$ has a coefficient -0.1751 (t-value = -11.48) in the B-share market. These findings show that the volatilities of the A-shares and the B-shares keep on decreasing after the announcement of the QFII scheme. In the case of the SZSE, we can find similar results.

The results in relation to the cross-market influence are important for understanding the flows of information across markets. In the case of the SHSE, for Ra regressions, $\varepsilon_{2,t-1}^2$ has a coefficient of 0.0910 with a t-value of 179.11, which is significant at the 1% significance level. This means that the volatility of the B-shares has a strong and positive effect on the volatility of the A-shares on the next day before the opening of the B-share market. After the market liberalizations, the effect changes. $D_1 * \varepsilon_{2,t-1}^2$ has a coefficient of -0.0904 with a t-value of -169.83 and $D_2 * \varepsilon_{2,t-1}^2$ has a coefficient of 0.004 with a t-value of 0.96. Thus we know that the B-share volatility has a negative impact on the A-share volatility after the first liberalization policy is implemented, but then tends to reverse afterwards. In the SZSE, the estimation results for the Ra regressions are opposite to those of the SHSE. These findings indicate that the volatility of the B-shares does not have an effect on the volatility of the A-shares the next day before the opening up of the B-share market and has a negative impact on the volatility of the A-shares after the approval of the QFII scheme.

In the SHSE, for the R_b regressions, $\varepsilon_{1,t-1}^2$ has a coefficient of 0.0006 with a t-value of 1.13, which is not significant at any significant level. This means that the

A-share volatility does not have an effect on the volatility of the B-shares the next day before the opening up of the B-share market, but this situation changes after the market liberalization policy is implemented. $D_1 * \varepsilon_{1,t-1}^2$ has a coefficient of 0.1366 with a t-value of 23.83 and $D_2 * \varepsilon_{1,t-1}^2$ has a coefficient of 0.0180 with a t-value of 1.20. This means that the A-share volatility begins to have a positive impact on the B-share volatility after the opening of the B-share market, but then tends to reverse. We find similar results for the R_b regressions in the SZSE. Finally, we focus on the correlation coefficients. The correlation coefficients are 0.5076 (the t-value being 40.75) and 0.4842 (the t-value being 33.43) in the SHSE and SZSE, respectively. This means that the A-share market and the B-share market are indeed highly correlated.

9. Summary & Conclusions

In recent years, China's economy has experienced rapid economic growth and much wealth has been accumulated. Along with the continuous economic growth, China's stock market has become bigger and now plays an important role in Asia. However, China's stock market has experienced major structural changes over the past few years. This paper has empirically examined the effects of opening the B-share market in February 2001 and of approving the QFII scheme in November 2002.

We used the time series of daily closing prices and indices for the SHSE and SZSE that were obtained from the Taiwan Economic Journal (TEJ) database for the period from October 6, 1992 to September 30, 2005. By applying an event study methodology, we found that investors did not anticipate the openness of the B-share market and that this policy had a positive effect on the B-share market. However,

investors expected the information contained in the announcement regarding the QFII scheme and the policy had a negative impact on the A-share market.

By comparing the price discounts between different sample periods, we found that the price disparity was indeed mitigated after the first market reforms but did not change significantly after the second liberalization policy. We observed a similar phenomenon in terms of the empirical results obtained from the cointegration analysis. There was a strong co-movement relationship between the A- and B-shares after the opening of the B-share market but this relationship disappeared after the application of the QFII scheme. The reason for this abnormality was that although market liberalizations enhanced the interaction between the two markets, the government's interference caused the price behavior of the A-share market to be different from that of the B-share market. Another possible reason is that the amount of capital which QFIIs could inject into the market was too small to have an impact on the stock price, and thus the price disparity was not mitigated further.

The estimation results of the bivariate GARCH model indicated that the unconditional volatility of the A- and B-shares decreased after the market liberalizations, and the volatility pattern between the A- and B-shares caused the markets to interact more closely after the opening of the B-share market. Just as we observed in the cointegration analysis, we also found that the interaction did not change significantly after the approval of the QFII scheme.

From the results of the different empirical methodologies, we have provided evidence in support of our expectation that the A-share market and the B-share market will become more stable and more closely integrated following the implementation of the two important market liberalization policies referred to above. It is beneficial for developing countries to open their financial markets, but the effects of liberalization may be neutralized by the interference of government. China's government should

exercise caution when interfering in its stock markets in order to achieve its original objective of market liberalization.

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Table 1 Descriptive Statistics for the Stock Returns

This table contains descriptive statistics of the stock returns of the A- and B-shares for the Shanghai Stock Exchange (SHSE) and the Shenzhen Stock Exchange (SZSE), respectively. Our sample is divided into three sub-periods. The full sample period extends from October 6, 1992 to September 30, 2005. The first sample period covers data from October 6, 1992 to February 19, 2001, the second sample period extends from February 28, 2001 to November 6, 2002, and the final period covers data from November 7, 2002 to September 30, 2005.

Panel A. Shanghai Stock Exchange Class A Shares

	6/10/1992-18/2/2001	19/2/2001-6/11/2002	7/11/2002-30/9/2005
Mean(%)	0.0512	-0.0571	-0.0411
Maximum(%)	30.8523	9.3998	7.9013
Minimum(%)	-18.4271	-6.5053	-3.9600
Standard Error	3.0807	1.4882	1.3012
Skewness	1.5639	1.0048	0.7628
Kurtosis	18.1561	9.0817	2.6444
Jarque-Bera	29134.2736	1492.4029	273.7831

Panel B. Shanghai Stock Exchange Class B Shares

	6/10/1992-18/2/2001	19/2/2001-6/11/2002	7/11/2002-30/9/2005
Mean(%)	0.01339	0.1255	-0.0981
Maximum(%)	12.1837	9.4530	6.9654
Minimum(%)	-13.0846	-10.2917	-8.7675
Standard Error	2.2948	2.6321	1.5951
Skewness	0.4150	0.3679	0.1272
Kurtosis	4.4965	3.6066	4.3543
Jarque-Bera	1794.5698	233.7125	558.8481

(Continued)

Panel C. Shenzhen Stock Exchange Class A Shares			
	6/10/1992-18/2/2001	19/2/2001-6/11/2002	7/11/2002-30/9/2005
Mean(%)	0.0399	-0.0667	-0.0699
Maximum(%)	29.5777	9.2401	7.6513
Minimum(%)	-19.6323	-6.7445	-5.1548
Standard Error	2.7970	1.5811	1.3643
Skewness	0.9170	0.7682	0.4621
Kurtosis(Exc)	14.2286	7.5211	1.8672
Jarque-Bera	17425.8332	1016.5004	127.5023
Panel D. Shenzhen Stock Exchange Class B Shares			
	6/10/1992-18/2/2001	19/2/2001-6/11/2002	7/11/2002-30/9/2005
Mean(%)	-0.0061	0.1218	0.0103
Maximum(%)	13.7983	9.3976	7.7990
Minimum(%)	-16.6994	-9.5776	-6.5973
Standard Error	2.3024	2.9044	1.5950
Skewness	0.3558	0.3309	0.1512
Kurtosis(Exc)	8.4421	2.4173	2.5102
Jarque-Bera	6076.9031	108.3513	187.7801

Table 2 Stock Average Abnormal Returns Surrounding February 28, 2001

This table presents the abnormal returns surrounding the event day, i.e. February 28, 2001. The abnormal return is computed as the difference between the observed and expected returns. The expected return is the average market return during the estimation period. The Z-statistics test the null hypothesis that the average abnormal returns are equal to zero.

Panel A: The A-share market

	Shanghai Stock Exchange		Shenzhen Stock Exchange	
Day	AAR(%)	Z(AAR)	AAR(%)	Z(AAR)
-10	-0.06%	-0.063	0.06%	0.061
-9	-0.89%	-0.967	-0.89%	-0.95
-8	-0.28%	-0.303	-0.22%	-0.237
-7	1.25%	1.362	0.94%	0.997
-6	-0.77%	-0.836	-0.70%	-0.748
-5	-2.33%	-2.534 *	-2.84%	-3.025 **
-4	-0.14%	-0.15	-0.49%	-0.525
-3	1.50%	1.634	1.30%	1.38
-2	0.92%	1.003	1.30%	1.38
-1	0.35%	0.383	0.46%	0.486
0	-0.30%	-0.325	-0.31%	-0.333
1	0.15%	0.165	0.48%	0.508
2	0.86%	0.938	0.90%	0.954
3	-0.23%	-0.248	-0.27%	-0.291
4	0.18%	0.198	-0.02%	-0.025
5	0.15%	0.165	0.23%	0.242
6	0.46%	0.503	0.59%	0.625
7	0.39%	0.426	0.67%	0.71
8	-0.07%	-0.074	0.17%	0.178
9	-0.70%	-0.76	-0.77%	-0.823
10	0.93%	1.014	0.88%	0.933

The symbols *, **, and *** denote statistical significance at the 5%, 1% and 0.1% levels, respectively, using a two-tailed test.

(Continued)

Panel B: The B-share market

	Shanghai Stock Exchange		Shenzhen Stock Exchange	
Day	AAR(%)	Z(AAR)	AAR(%)	Z(AAR)
-10	0.90%	0.299	0.13%	0.063
-9	-0.59%	-0.195	-0.09%	-0.043
-8	0.69%	0.23	0.29%	0.144
-7	3.23%	1.071	1.60%	0.803
-6	-0.28%	-0.092	-0.14%	-0.068
-5	-0.28%	-0.092	-0.14%	-0.068
-4	-0.28%	-0.092	-0.14%	-0.068
-3	-0.28%	-0.092	-0.14%	-0.068
-2	-0.28%	-0.092	-0.14%	-0.068
-1	-0.28%	-0.092	-0.14%	-0.068
0	9.14%	3.030 **	9.12%	4.591 ***
1	9.17%	3.040 **	9.17%	4.616 ***
2	9.14%	3.030 **	9.15%	4.606 ***
3	9.16%	3.036 **	9.17%	4.616 ***
4	4.66%	1.545	9.17%	4.616 ***
5	-7.14%	-2.365 *	-3.41%	-1.715
6	-0.03%	-0.009	5.33%	2.682
7	6.76%	2.241 *	7.56%	3.805 ***
8	4.36%	1.446	6.46%	3.251 **
9	-1.83%	-0.606	-0.40%	-0.199
10	2.28%	0.756	5.05%	2.541 *

The symbols*, **, and *** denote statistical significance at the 5%, 1% and 0.1% levels, respectively, using a two-tailed test.

Table 3 Stock Average Abnormal Returns Surrounding November 7, 2002

This table presents the abnormal returns surrounding the event day, i.e. November 7, 2002. The abnormal return is computed as the difference between the observed and expected returns. The expected return is the average market return during the estimation period. The Z-statistics test the null hypothesis that the average abnormal returns are equal to zero.

Panel A: The A-share market

	Shanghai Stock Exchange		Shenzhen Stock Exchange	
Day	AAR(%)	Z(AAR)	AAR(%)	Z(AAR)
-10	-0.80%	0.054	-0.85%	-0.574
-9	-0.99%	-0.562	-1.14%	-0.77
-8	-1.12%	-0.697	-1.49%	-1.007
-7	0.54%	-0.789	0.60%	0.407
-6	-0.06%	0.387	-0.03%	-0.019
-5	-0.14%	-0.038	-0.04%	-0.026
-4	0.24%	-0.095	0.17%	0.116
-3	1.38%	0.174	1.50%	1.016
-2	1.71%	0.982	1.59%	1.077
-1	-0.36%	1.216	-0.53%	-0.358
0	0.13%	-0.251	-0.10%	-0.067
1	-2.06%	0.097	-2.67%	-1.805
2	-1.17%	-1.455	-1.07%	-0.723
3	-1.19%	-0.825	-2.31%	-1.562
4	0.31%	-0.839	0.45%	0.306
5	-2.00%	0.224	-2.17%	-1.467
6	0.20%	-1.413	0.43%	0.292
7	-0.85%	0.146	-1.18%	-0.797
8	0.73%	-0.598	0.87%	0.59
9	-2.48%	0.522	-2.72%	-1.839
10	-2.47%	-1.753	-3.32%	-2.245 *

The symbols*, **, and *** denote statistical significance at the 5%, 1% and 0.1% levels, respectively, using a two-tailed test.

(Continued)

Panel B: The B-share market				
	Shanghai Stock Exchange		Shenzhen Stock Exchange	
Day	AAR(%)	Z(AAR)	AAR(%)	Z(AAR)
-10	-0.68%	-0.478	-1.01%	-0.596
-9	-4.13%	-2.916 **	-2.27%	-1.338
-8	-2.93%	-2.068 *	-3.43%	-2.021 *
-7	0.97%	0.688	0.91%	0.535
-6	-0.34%	-0.238	-0.72%	-0.425
-5	-0.02%	-0.012	0.12%	0.07
-4	-0.37%	-0.259	-0.28%	-0.166
-3	1.93%	1.366	2.00%	1.177
-2	2.33%	1.649	2.34%	1.377
-1	-0.03%	-0.019	-0.50%	-0.295
0	-0.76%	-0.535	-0.73%	-0.431
1	-3.13%	-2.209 *	-3.59%	-2.116 *
2	-1.22%	-0.86	-2.34%	-1.379
3	-3.45%	-2.435 *	-3.09%	-1.821
4	0.76%	0.539	1.08%	0.635
5	-1.93%	-1.361	-1.85%	-1.091
6	0.65%	0.462	1.36%	0.8
7	-0.48%	-0.337	-0.60%	-0.354
8	2.07%	1.465	1.85%	1.089
9	-3.90%	-2.753 **	-1.55%	-0.914
10	-3.54%	-2.499 *	-2.07%	-1.22

The symbols*, **, and *** denote statistical significance at the 5%, 1% and 0.1% levels, respectively, using a two-tailed test.

Table 4 Comparisons of the B-share Price Discounts

This table presents the differences between the B-share price discounts for the three sample periods. The first sample period is covers data from September 30, 1998 to February 19, 2001, the second sample period extends from February 28, 2001 to November 6, 2002 and the third period covers data from November 7, 2002 to September 30, 2005.

Panel A: SHSE		
First Period Mean Discount	Second Period Mean Discount	Mean Difference
-6.3156	-1.0299	5.2857***
		(-14.6467)
Second Period Mean Discount	Third Period Mean Discount	Mean Difference
-1.0299	-1.1442	-0.1143
		(0.9179)
Panel B: SZSE		
First Period Mean Discount	Second Period Mean Discount	Mean Difference
-4.1403	-0.9312	3.2091***
		(-13.2455)
Second Period Mean Discount	Third Period Mean Discount	Mean Difference
-0.9312	-0.8232	0.1081
		(-1.5377)

The symbols*, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a one-tailed test.

Table 5 Unit Root Tests: ADF Test

This table presents the results of the unit root tests. We employed the ADF test to determine whether there were unit roots in the series.

Level data	τ	**K**	**Difference value**	τ	**K**
SHSE A shares	-2.408	10	SHSE A shares	-18.017	10
SHSE B shares	-1.769	10	SHSE B shares	-15.621	10
SZSE A shares	-1.529	10	SZSE A shares	-20.508	10
SZSE B shares	-1.505	10	SZSE B shares	-18.519	10

Note: k is the lag length and is chosen on the basis of the minimum AIC or SIC. τ is the test statistic. Critical values: 1%= -3.435 5%= -2.863 10%= -2.568

Table 6 Johansen Cointegration Test

Note: L-max and Trace are two test statistics under Johansen's approach, that is, $\lambda_{\max}$ and λ_{trace}, respectively. L-max90 and Trace90 are the 10% critical values of the two test statistics. The full sample period is from October 6, 1992 to September 30, 2005. The first sample period covers the data from October 6, 1992 to February 19, 2001, the second sample period extends from February 28, 2001 to November 6, 2002, and the final period covers the data from November 7, 2002 to September 30, 2005.

Panel A: Shanghai Stock Exchange

Full Sample Period: 6/10/1992-30/09/2005						
Eigenv.	L-max	Trace	H0: r	p-r	L-max90	Trace90
0.0022	6.92	10.41	0	2	10.6	13.31
0.0011	3.49	3.49	1	1	2.71	2.71
First Sample Period: 6/10/1992-18/2/2001						
Eigenv.	L-max	Trace	H0: r	p-r	L-max90	Trace90
0.0026	5.32	7.98	0	2	10.6	13.31
0.0013	2.67	2.67	1	1	2.71	2.71
Second Sample Period: 19/2/2001-6/11/2002						
Eigenv.	L-max	Trace	H0: r	p-r	L-max90	Trace90
0.0585	24.37	26.76	0	2	10.6	13.31
0.0059	2.38	2.38	1	1	2.71	2.71
Final Sample Period: 7/11/2002-30/9/2005						
Eigenv.	L-max	Trace	H0: r	p-r	L-max90	Trace90
0.0083	5.82	6.65	0	2	10.6	13.31
0.0012	0.83	0.83	1	1	2.71	2.71

(Continued)

Panel B Shenzhen Stock Exchange

Full Sample Period: 6/10/1992-30/09/2005						
Eigenv.	L-max	Trace	H0: r	p-r	L-max90	Trace90
0.0016	4.89	8.74	0	2	10.6	13.31
0.0012	3.85	3.85	1	1	2.71	2.71
First Sample Period: 6/10/1992-18/2/2001						
Eigenv.	L-max	Trace	H0: r	p-r	L-max90	Trace90
0.0031	6.35	7.91	0	2	10.6	13.31
0.0008	1.56	1.56	1	1	2.71	2.71
Second Sample Period: 19/2/2001-6/11/2002						
Eigenv.	L-max	Trace	H0: r	p-r	L-max90	Trace90
0.1411	62.07	63.86	0	2	10.6	13.31
0.0044	1.79	1.79	1	1	2.71	2.71
Final Sample Period: 7/11/2002-30/9/2005						
Eigenv.	L-max	Trace	H0: r	p-r	L-max90	Trace90
0.0085	5.97	6.96	0	2	10.6	13.31
0.0014	0.99	0.99	1	1	2.71	2.71

Table 7 Bivariate GARCH Estimation

This table presents the results of the bivariate GARCH for the following model:

$$R_{a,t} = \alpha_{a1} + \alpha_{a2} R_{a,t-1} + \alpha_{a3} R_{b,t-1} + \alpha_{a4} D_1 + \alpha_{a5} D_2 + \varepsilon_{a,t},$$

$$R_{b,t} = \alpha_{b1} + \alpha_{b2} R_{b,t-1} + \alpha_{b3} R_{a,t-1} + \alpha_{b4} D_1 + \alpha_{b5} D_2 + \varepsilon_{b,t},$$

$$h_{aa,t} = \beta_{a0} + \beta_{a1} h_{aa,t-1} + \beta_{a2} \varepsilon^2_{a,t-1} + \beta_{a3} \varepsilon^2_{b,t-1} + \beta_{a4} D_1 \varepsilon^2_{a,t-1} + \beta_{a5} D_1 \varepsilon^2_{b,t-1} + \beta_{a6} D_2 \varepsilon^2_{a,t-1} + \beta_{a7} D_2 \varepsilon^2_{b,t-1},$$

$$h_{bb,t} = \beta_{b0} + \beta_{b1} h_{bb,t-1} + \beta_{b2} \varepsilon^2_{a,t-1} + \beta_{b3} \varepsilon^2_{b,t-1} + \beta_{b4} D_1 \varepsilon^2_{a,t-1} + \beta_{b5} D_1 \varepsilon^2_{b,t-1} + \beta_{b6} D_2 \varepsilon^2_{a,t-1} + \beta_{b7} D_2 \varepsilon^2_{b,t-1},$$

$$h_{ab,t} = \rho_{ab} \sqrt{(h_{aa,t} h_{bb,t})}.$$

R_a and R_b are the returns on the A-share stock indices and B-share stock indices, respectively. The unconditional volatility in the variance equation in one market is allowed to affect the other market. The variable $\varepsilon^2_{1,t-1}$ in the table stands for the A-share market lagged volatility and the variable $\varepsilon^2_{2,t-1}$ stands for the B-share volatility. D_1 and D_2 are two event dummies. D_1 takes on the value of one from February 28, 2001 to November 6, 2002, and a value of zero otherwise; while D_2 takes on the value of one from November 7, 2002 to September 30, 2005, and a value of zero otherwise.

	Shanghai Stock Exchange		**Shenzhen Stock Exchange**	
	R_a	R_b	R_a	R_b
Mean Equation				
constant	-0.1079 **	-0.0937 ***	0.0476	-0.1132 ***
	(-2.7655)	(-2.6960)	(1.1902)	(-3.3017)
$R_{a,t-1}$	0.0902 ***	0.0129	0.0485 **	0.0312 ***
	(4.0036)	(1.2776)	(2.1617)	(2.8659)
$R_{b,t-1}$	-0.0424 ***	0.1157 ***	-0.0145	0.0991 ***
	(-2.8976)	(5.9178)	(-1.1728)	(4.6009)
D_1	0.0629	0.1464 *	-0.0898 *	0.1029
	(1.0308)	(1.5731)	(-1.4370)	(1.0661)
D_2	0.0553	0.0335	-0.1158	0.1323 **
	(0.9470)	(0.5977)	(-1.8778)	(2.0493)

(Continued)

Volatility Equation

constant	0.1420 ***	0.2321 ***	0.0620 ***	0.4078 ***
	(7.1084)	(8.5481)	(5.3335)	(8.6822)
h_{t-1}	0.6816 ***	0.7210 ***	0.8521 ***	0.6530 ***
	(58.4342)	(57.5737)	(149.1327)	(25.4892)
$\varepsilon_{1,t-1}^2$	0.4538 ***	0.0006	0.2007 ***	0.0008
	(19.2354)	(1.1261)	(19.9621)	(1.1140)
$\varepsilon_{2,t-1}^2$	0.0910 ***	0.3150 ***	0.0015	0.3362 ***
	(179.1083)	(23.8293)	(1.5348)	(9.1711)
$D_1 * \varepsilon_{1,t-1}^2$	-0.0903 ***	0.1366 ***	-0.0733 ***	0.1848 ***
	(-5.2944)	(3.6045)	(-6.5744)	(3.3082)
$D_1 * \varepsilon_{2,t-1}^2$	-0.0904 ***	-0.0908 ***	-0.0011	-0.0804 **
	(-169.8346)	(-3.6007)	(-1.1173)	(-2.4265)
$D_2 * \varepsilon_{1,t-1}^2$	-0.3527 ***	0.0180	-0.1201 ***	0.0212
	(-15.3597)	(1.2031)	(-9.8522)	(1.3066)
$D_2 * \varepsilon_{2,t-1}^2$	0.004	-0.1751 ***	-0.0115 ***	-0.2140 ***
	(0.9556)	(-11.4795)	(1.9677)	(-7.0529)
ρ	0.5076 ***		0.4842 ***	
	(40.7465)		(33.4333)	

The symbols*, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a two-tailed test.

Figure 1 Market Index

The solid lines plot the A-share market indices and the relevant Y-axis is the one on the left. The dashed lines plot the B-share market indices and the relevant Y-axis is on the right.