Market Liberalization within a Country

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September 2004

Abstract

China's B-share market, which used to be restricted to foreign investors, was partially opened up in February 2001 to Chinese local investors. We take this as a controlled experiment in cross-border trading on a small scale. We find mild but positive effects on the B-share market after liberalization, with higher volumes, lower levels of volatility, lower bid-ask spreads, and more liquidity after liberalization. Between A- and B-shares, price disparities narrowed; the correlation and the cointegration relationship became stronger; and the flow of information became more balanced. More new individual investors entered into the B-share market without crowding out existing institutional investors. Overall, the liberalization measure has helped to improve the quality of the B-share market and our results lend no support to the popular saying that liberalization does nothing but help the existing foreign shareholders to cash out.

Keywords: Partial liberalization, Cross-market trading, Market quality, Market segmentation, China

JEL classification: G14; G15

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1. Introduction

The integration of financial markets is a part of today's mega trend of globalization. Cross-border listings and trading activities have increased dramatically in the past decade. This has stirred up great interest in academics to study the costs and benefits of market liberalization. These studies typically involve cross-sectional analyses of countries undergoing liberalization. This paper takes the novel approach of examining market liberalization within a country. As such, many intervening factors can be automatically controlled for and we can focus on how a "pure" lifting of trade barriers impacts cross-market trading and how markets are affected.

The development we are examining is the opening up of the B-share market in China to local investors in 2001. Chinese companies can issue both A-class and B-class shares with identical features. However, due to foreign exchange controls, only local Chinese were permitted to invest in A-shares and only foreigners were allowed to invest in B-shares. Thus, the two classes of shares used to be completely segmented. However, the B-share market experienced only light trading and was viewed as being practically dead. Aiming to revitalize the market, the Chinese government announced on February 19, 2001 that the B-share market would open up to local Chinese with foreign-currency accounts in Chinese banks. The policy was implemented 10 days later.

This development can be viewed as a controlled experiment in cross-border trading on a small scale. It controls for all legal, political, social, economic, even firm-level differences across the two markets. It experiments with the lifting of the trade barrier on order flow dynamics through time to see how this affects the quality and, hence, the development of the two markets.

Our investigation contributes to the literature on cross-border trading by shedding light on the fundamental issue of financial market integration: Does liberalization benefit all markets or does it benefit only one at the expense of others? Is partial liberalization better than no liberalization when other factors are controlled? In view of the fact that the IMF and World Bank typically advise developing economies to open up their financial markets, our study is also of practical relevance.

We look at a year before and a year after the liberalization event and do a relatively comprehensive study. Our results generally show that the B-share market has exhibited higher volumes, lower volatility, lower returns, lower bid-ask spreads, and more liquidity after liberalization. In addition, the returns, volumes, volatility, spreads, and liquidity of the B-share market have been tending to converge with those of the A-share market. In fact, after the liberalization, the price disparities between A- and B-shares have narrowed; and the return correlation and the cointegrating relationship between the two markets have become stronger and tighter. The flow of information between the two markets has also become more balanced.

Interestingly, although the price disparity between A- and B-shares shrank after liberalization, as just mentioned, stocks with a *relatively* bigger disparity before liberalization remained with a relatively bigger disparity after liberalization. If the original B-share investors had been cashing out when the market opened up to A-share investors, this would not be the case. Also, based on the aggregate data, we observed a surge in the number of individual investor accounts entering the B-share markets both in Shanghai and Shenzhen following liberalization. However, we also observed a mild increase in the number of individual investors entering the A-share market after liberalization. Hence, there is no sign that the increase in the number of investors in the B-share market had switched from the A-share market or that they have crowded out the existing institutional investors in the B-share markets of the two exchanges.

These results indicate that opening up the B-share market has benefited the B-share market without adversely affecting the A-share market. Also, there is no evidence that foreign investors have systematically abandoned the B-share market, leaving only Chinese investors trading in two partially segmented markets. All in all, China's experience supports the view that the liberalization of stock markets lead to improvements in the quality of the markets in general. The fact that such improvements are limited in China is probably due to the partial nature of the liberalization. The paper proceeds as follows. A brief history of the Chinese equity market is presented in Section 2. Data and methodology are given in Section 3. The results are discussed in Section 4. Section 5 concludes the paper.

2. A Brief History of Chinese Equity Issues

The first equity issue in China was in 1984 when a department store in Beijing issued its shares to the employees of the store. In the following few years, more state-owned enterprises (SOEs) were "incorporated" through the selling of shares to their own employees or to other share companies and SOEs. Stock trading was prohibited, but black markets emerged in several large cities. As a result, the State Council decided in 1989 to establish two national stock exchanges. The Shanghai Stock Exchange (SHSE) was inaugurated in December 19, 1990 and the Shenzhen Stock Exchange (SZSE) opened in April 1991.

A company may issue five different types of shares in China, but only A-class shares and B-class shares are tradable. A-shares are equivalent to ordinary equity shares as generally accepted in other equity markets. They are exclusively available to Chinese citizens and domestic institutions. When a company makes its initial public offering (IPO), tradable shares are required to account for no less than 25% of total outstanding shares.

B-shares are issued to attract foreign capital. The first B-class shares were available to the outside world when Shanghai Vacuum Electron issued RMB420 million (around US$67 million net of issuing costs) worth of shares at a P-E ratio of 17.44. The shares began trading on

February 21, 1992. Since the RMB is not convertible under the capital account, B-shares are traded in either U.S. dollars (in the SHSE) or Hong Kong dollars (in the SZSE).[1] B-shares can only be subscribed by, and traded among, foreign investors. Also, firms can only choose to list their B-shares in either the SHSE or the SZSE, but not in both.[2]

Unlike the A-share market, the B-share market is never active, and B-share prices have been trading at a discount to their corresponding A-share prices since the early days. In fact, the B-share discount increased from about 25% in 1993 to 86% right before liberalization. Various measures have been introduced by the Chinese government to vitalize the market, such as lowering the trading stamp duty on B-shares, allowing non-state-owned firms to issue B-shares, establishing joint B-share funds, and so forth. However, these measures have not been very effective. Then, on February 19, 2001, the China Securities Regulatory Commission (CSRC) and the State Administration of Foreign Exchange Bureau (SAFE) announced that, starting from February 28, 2001, Chinese nationals with existing foreign currency deposit accounts with a domestic commercial bank would be allowed to trade B-shares in the SHSE and SZSE. Those who opened a foreign currency deposit account with a domestic bank after February 19 would be only allowed to trade from June 1, 2001 onwards. The B-share market was closed for a week after the announcement, and resumed trading on February 28th.

3. Data and Methodology

We examine paired firms. A total of 86 firms issued both A-class and B-class shares at the end of 2000; however, only 83 pairs have enough trading data during our sample period from February 5, 2000 to June 15, 2002. Among them, 41 pairs of stocks trade on the Shanghai Stock Exchange (SHSE) and 42 trade on the Shenzhen Stock Exchange (SZSE). We divided our sample period into three sub-periods. The pre-liberalization period indicates the period on or before February 4, 2001, while the post-liberalization period indicates the period on or after June 16, 2001. The days in between belong to the liberalization period. Singling out this sub-period of liberalization is also important for our more long-term analyses on the lasting impact of the liberalization policy, because this is a transitional period during which both the A-share and B-share markets could be expected to be quite volatile. Including this period into the post-liberalization period will likely contaminate the analyses. We mainly use daily data from the Taiwan Economic Journal (TEJ) database.

[1] B-shares are still denominated in RMB nominally, but quoted and traded in USD or HKD.
[2] There are also *H-shares*, which have been listed in Hong Kong since 1993. *N-shares* listed on the New York Stock Exchange are in the form of IPOs or American Depository Receipts (ADRs). N-shares were first issued in September 1992 but the market is very thin. To limit foreign ownership, the Chinese government has allowed no more than 49% of a company's convertible shares to be B, H, or N shares until very recently. See the appendix for the number of listed companies in China.

We focus on six basic market variables, namely stock return, trading volume, return volatility, price premium, liquidity, and bid-ask spread as measures of market quality. Stock return is the logarithmic difference in daily stock prices. Trading volume is the number of shares traded divided by the total number of outstanding tradable shares. Return volatility is the standard deviation of daily returns. The B-share price premium is defined as $(P_B - P_A)/P_A$. The liquidity (or rather illiquidity) measure is the no-trading ratio, which is the ratio of trading days with zero volume over the total number of trading days of the sample period. The idea is that if a stock is more liquid, it will have fewer no-trading days. [3] The bid-ask spread is defined as (Ask - Bid)/(Ask + Bid)½, where the bidding and asking prices are the daily closing bid and ask quotes, respectively.

Our first set of tests is based on the two-tailed Wilcoxon rank-sum test and the t-test to detect possible changes in the median and mean, respectively, of the six impact variables across the sub-sample periods. If the partial liberalization has improved the quality of a market, there will be an increase in trading volume and liquidity; and a decrease in volatility, spread, and stock return. In addition, the price differences between the A- and B-share markets should be narrower. Since these changes in the A-share and B-share markets occurred simultaneously and are likely to be related, we also run cross-sectional, seemingly unrelated regressions with some control variables to control for firm-specific characteristics, as follows:

$$\Delta Y_{a,i} = \alpha_o + \alpha_1 Size_{a,i} + \alpha_2 Leverage_{a,i} + \alpha_3 ROA_{a,i} + \alpha_4 ST_{a,i} + \alpha_5 RS_{a,i} + \alpha_6 SHSE + \varepsilon_{a,i}$$
$$\Delta Y_{b,i} = \beta_o + \beta_1 Size_{b,i} + \beta_2 Leverage_{b,i} + \beta_3 ROA_{b,i} + \beta_4 ST_{b,i} + \beta_5 RS_{b,i} + \beta_6 SHSE + \varepsilon_{b,i} \qquad (1)$$

$\Delta Y_{a,i}$ ($\Delta Y_{b,i}$) is the change in the relevant variables such as stock return, trading volume, and so forth of firm i in the A-share (B-share) market across the pre and post sub-periods. Specifically, ΔY is the difference in the average values of Y between the post-liberalization period (i.e., June 16, 2001 to June 15, 2002) and the pre-liberalization period (i.e., February 5, 2000 to February 4, 2001) The key firm features that we want to control for are firm size, capital structure, earnings ability, ownership structure, relative supply, and so forth. Size is the natural log of total assets. Capital structure is captured by firm leverage; the ratio of total liabilities over total assets; and the relative B-share supply, RS, which is the ratio of outstanding tradable B-shares to outstanding tradable A-shares. ROA, the return on assets, reflects the earning power of the firm. ST is the percentage of state ownership in the firm. The features captured by these two variables may directly affect the interest of investors in the stock. SHSE is a dummy variable taking a

[3] Using no-trading days, Lesmond, Ogden, and Trzcinka (1999) constructed a limited dependent variable model to measure transaction costs, which has been found to be superior to other frequently used measures.

value of 1 if a firm is listed in the Shanghai Stock Exchange, and zero otherwise. All independent variables except SHSE are the three-year average values in 1998-2000.

Our second set of tests is to look into the inter-market information links. An overall measure of the information link between the two markets is the return correlation of the two markets. We use Karolyi and Stulz's (1996) approach and run the following bivariate GARCH model with a constant conditional correlation formulation on A-share stocks and B-share stocks in aggregate. Daily data for the whole sample period from February 5, 2000 to June 15, 2002 are used in the regression. We put in two event dummies to capture possible changes in the correlation structure in the liberalization process:

$$
\begin{aligned}
R_{a,t} &= \alpha_{ao} + \alpha_{a1} R_{a,t-1} + \alpha_{a2} D_1 + \alpha_{a3} D_2 + \varepsilon_{a,t} \\
R_{b,t} &= \alpha_{bo} + \alpha_{b1} R_{b,t-1} + \alpha_{b2} D_1 + \alpha_{b3} D_2 + \varepsilon_{b,t} \\
h_{aa,t} &= \beta_{ao} + \beta_{a1} h_{aa,t-1} + \beta_{a2} \varepsilon^2_{a,t-1} + \beta_{a3} \varepsilon^2_{b,t-1} \\
&\quad + \beta_{a4} D_1 \varepsilon^2_{a,t-1} + \beta_{a5} D_1 \varepsilon^2_{b,t-1} + \beta_{a6} D_2 \varepsilon^2_{a,t-1} + \beta_{a7} D_2 \varepsilon^2_{b,t-1} \\
h_{bb,t} &= \beta_{bo} + \beta_{b1} h_{bb,t-1} + \beta_{b2} \varepsilon^2_{a,t-1} + \beta_{b3} D_1 \varepsilon^2_{b,t-1} \\
&\quad + \beta_{b4} D_1 \varepsilon^2_{a,t-1} + \beta_{b5} D_1 \varepsilon^2_{b,t-1} + \beta_{b6} D_2 \varepsilon^2_{a,t-1} + \beta_{b7} D_2 \varepsilon^2_{b,t-1} \\
h_{ab,t} &= [\rho_{ab,o} + \rho_{ab,1} D_1 + \rho_{ab,2} D_2] \sqrt{(h_{aa,t} h_{bb,t})}
\end{aligned}
\tag{2}
$$

R_a (R_b) is the return of the equally weighted *portfolio* of all A (B) stocks in the matched sample. Given the information link, the above formulation allows the information, as proxied by the unconditional volatility in the variance equations, ε^2, to affect the other market. D_1 and D_2 are the two event dummies. D_1 takes the value of one from February 5, 2001 onwards, and zero otherwise; while D_2 takes the value of one from June 16, 2001 onwards, and zero otherwise. If the two markets have become more integrated, $\rho_{ab,2}$ is expected to be significantly positive.

Although the above formulation explicitly examines the extent of market integration, it is not clear, but important to investigate, which market is more important in the price discovery process. In other words, it is important to know, given two markets, if informed traders would trade essentially in one market (the argument of winners take all) or in both markets (the argument of splitting the trade to hide their identities). We follow Hasbrouck (1995) and Eun and Sabherwal (2003) in using the vector error-correction model (VECM) to make our investigation. The model appears as follows:

$$
\Delta P^a_t = \alpha^a_o + \alpha^a_1 (P^a_{t-1} + \beta * P^b_{t-1}) + \sum_{i=1}^{q} \beta_i (\Delta P^a_{t-1}) + \sum_{i=1}^{q} \gamma_i (\Delta P^b_{t-1}) + \varepsilon^a_t
$$

$$\Delta P_t^b = \alpha_o^b + \alpha_1^b (P_{t-1}^a + \beta * P_{t-1}^b) + \sum_{i=1}^{q} \beta_i (\Delta P_{t-1}^a) + \sum_{i=1}^{q} \gamma_i (\Delta P_{t-1}^b) + \varepsilon_t^b \quad (3)$$

By the nature of the cointegrating relationship, α_1^a and α_1^b have opposite signs. If the absolute value of α_1^a (i.e., $|\alpha_1^a|$) is greater than α_1^b, the B-share market has a bigger impact on A-share prices than the A-share market. This means that the B-share market places a more important role in terms of price discovery. This is because the error-correction term is a deviation from the long-run equilibrium of A-share and B-share prices. It exerts a pulling force on the share prices to converge back to the long-run cointegrating relationship. Such adjustments are captured by the coefficients of the error-correction term, α_1^a and α_1^b (and that is why they bear opposite signs). If $|\alpha_1^a|$ is greater than α_1^b, the deviation leads to more changes in the prices of the A-shares than the B-shares. That is to say, the correction is done more through an adjustment in the prices of the A-shares than the B-shares. This will occur if new information is incorporated in the B-share market first to cause a temporary deviation in the prices of the A-shares and B-shares from their long-run cointegrating relationship, which should be (-1, 1). The above regression is repeated for each firm in our sample in both the pre- and post periods.

We follow Eun and Sabherwal (2003) and use the error-correction coefficients of Equation (3) to construct variable X, which equals to $|\alpha_1^a|/(|\alpha_1^a| + \alpha_1^b)$, and run the following regression:

$$\ln\left(\frac{X}{1-X}\right) = \mu_o + \mu_1 \text{Spread} + \mu_2 \text{Volume} + \mu_3 \text{Cap} + \varepsilon \quad (4)$$

The dependent variable essentially gives the relative magnitude of $|\alpha_1^a|$ and α_1^b. If the dependent variable has a value close to zero, the two alpha values are of similar magnitude. If its value is positive (negative), $|\alpha_1^a|$ will be greater (smaller) than α_1^b. All independent variables are ratios of the daily averages of the A-share value and B-share value for each firm in the post-liberalization period. "Spread" is the B-share bid-ask spread relative to the A-share spread. "Volume" is the B-share trading volume relative to the A-share trading volume, and "Cap" is the B-share market capitalization relative to the A-share market capitalization.[4] . With such a setting, the regression examines which market quality factors would affect the relative importance of price discovery in the A-share and B-share markets. For instance, if μ_1 is

[4] We do not put in volatility and the liquidity variables because both are highly correlated with the trading volume ratio.

significantly positive, then a higher bid-ask spread in the B-share market relative to the A-share market will lead to a bigger $|\alpha_1^a|$ relative to α_1^b. This, as explained above, means that the B-share market has a bigger impact on A-share prices.

4. Empirical Results

Before we enter into detailed analyses, we examine the aggregate A-share and B-share monthly market indices and the monthly market trading volume (in shares) over our sample period to obtain a general view of the market situation before and after the opening up of the B-share market.[5]

(Insert Figure 1 Here)

In Figure 1A the bold lines plot the A-share market indices and the relevant Y-axis is the one on the left. The thin lines plot the B-share market indices and the relevant Y-axis is the one on the right. The solid lines are for the Shanghai market indices and the dotted lines are for the Shenzhen market indices. It can be seen that the opening up of the B-share market affected only the B-share market indices; the A-share market indices remained roughly stable over the sample period. There seems to have been some leakages of information or speculation on market liberalization since mid-2000, as both the Shanghai and Shenzhen B-market indices began to rise gradually and steadily since then. However, the two market indices started to retreat after reaching their peaks simultaneously in May, but stayed much higher than before liberalization.

The plot in Figure 1B on trading volume shows roughly the same picture. Trading volumes in both the Shanghai and Shenzhen B-share markets, represented by the thin solid line and thin dotted line, respectively, shot up when the B-share market opened up; but subsequently declined to only slightly higher than the original trading level of the pre-liberalization period. On the other hand, trading volumes in the Shanghai and Shenzhen A-share markets, represented by the bold solid line and bold dotted line, respectively, tended to show a mild reduction during the liberalization period compared with the pre- and post-liberalization periods.[6]

It is interesting that in Figure 1C the number of transactions in the Shanghai B-share and Shenzhen B-share markets shows a much clearer increase after liberalization than the trading volumes shown in Panel B, although their patterns are similar. One possible explanation for this is that the opening up of the B-share market attracted mainly small individuals rather than large institutional local investors. Individuals trade frequently but in small quantities. The

[5] The data are from the CEIC DRI database of McGraw-Hill, not from our matched A-B sample pairs.
[6] The trading volume in dollar value shows a similar picture but we do not report the figures here to save space.

plot for foreign currency deposits in Panel D seems to be consistent with the conjecture. While the enterprise deposit does not show a clear, discernable pattern, the residential deposit shows a strong upward trend but slows down in the early months of 2000, the period when the B-share market opened up.

The preliminary sketch shows that the opening up of the B-share market has brought mild benefits to the B-market in the form of higher prices, more transactions and larger trading volumes. We now move on to more a rigorous examination of the issue.

4.1 Wilcoxon Tests

We compare the mean and median A-share and B-share figures of the six variables we are interested in over the three periods; i.e., the period before, during, and after the opening up of the B-share market to Chinese local investors in February 2001. The results are presented in Table 1.[7]

(Insert Table 1 Here)

The first row shows the comparison of return. For the 83 A-share stocks, the median and mean daily returns before liberalization (i.e., from February 5, 2000 to February 4, 2001) were 0.22% and 0.28%, respectively. The corresponding 83 B-share stocks had median and mean returns of 0.34% and 0.36%, respectively. During the period of liberalization (i.e., from February 5, 2001 to June 15, 2001), the A-share median (mean) return was 0.09% (0.10%), while the B-share median (mean) return was 1.21% (1.26%). That is to say, the A-share median (mean) return *dropped* by 0.13% (0.18%), while the B-share median (mean) return *rose* by 0.86% (0.89%) upon liberalization. The Wilcoxon tests indicate that such changes in return are significant at the 5% level.[8] The sub-column of "+ve/-ve ratio" under the major column of "During - Before" also indicates that only 23 of 83 A-share stocks showed an increase in return during the liberalization period. A big contrast is that all 83 B-share stocks showed an increase in return during the liberalization period.

However, the stock prices of both A- and B-shares declined in the post-liberalization period from June 16, 2001 to June 15, 2002. As such, the return in this period is the lowest among the three sub-sample periods. For instance, comparing the returns in the pre-liberalization period with those of the post-liberalization period, the change for the A-share stocks is around -0.35% (the "After - Before" column). This means that the daily return after liberalization is 0.35% lower than before liberalization. Only one stock has a higher return in the post-liberalization period. For the returns on B-share stocks, the drop is even more drastic. The

[7] We only report the full-sample results to save space. The results for the Shanghai and Shenzhen sub-samples are similar and plotted in Figure 2. The complete tables are available upon request.

median and mean return changes are –0.50% and –0.55%, respectively. The changes are all statistically significant at the 5% level. Also, not a single B-share stock has a return in the post-liberalization period higher than in the pre-liberalization period.

The opening up of the B-share market to Chinese local investors has led to lower returns in the A-share market but higher returns in the B-share market. Furthermore, after the opening up, both the A-share and B-share markets have had negative returns. Notice that the difference in return between the A-shares and B-shares is smaller in the post-liberalization period than in the pre-liberalization period.

The Wilcoxon test on the changes in volume across periods in Table 1 indicates that the drops in A- share volume are of statistical significance at the 5% level. The situation in the B-share market was different. There was a significant jump in trading volume during the liberalization period. In the "During - Before" column of Table 1A, the median and mean volume increases were around 3 percent, with a 5% statistical significance. In fact, all 83 stocks showed an increase in volume during this period. However, such an increase could not be sustained, and the volume of all 83 stocks dropped in the post-liberalization period. Yet, when comparing the trading volume in this period with that in the pre-liberalization period, there was still a significant increase of 0.27 percent in the median value and 0.16 percent in the mean value. Also, 61 firms had a higher trading volume in the post-liberalization period than in the pre-liberalization period. Given all of these, we argue that the liberalization process has helped to activate the B-share market.

A-share stocks showed a lower volatility and B-share stocks showed a higher volatility during the liberalization period. Interestingly, A-share stocks resumed the same level of volatility in the post-liberalization period as in the pre-liberalization period, but B-share stocks became significantly less volatile. In the "After - Before" column of Table 1, the median difference in volatility for B-shares was –0.41, and the mean difference was –0.32. Both have a statistical significance of 5%.[9] This is a sign of an improvement in the quality of the market. Notice that the median drop in A-share volatility was 0.10 and that this is only marginally significant at the 10% level. Also, the median values of A-share and B-share volatility were 2.75 and 3.29, respectively, before the liberalization; but became 2.64 and 2.88, respectively, after the liberalization. The difference in volatility between A- and B-shares was smaller after the liberalization than before.

[8] Since the t-test results for mean changes led to a similar inference on statistical significance as the Wilcoxon test results for median changes, we discuss only the Wilcoxon test to save space.

[9] It is worth-mentioning that in their study of emerging markets, Bekaert and Harvey (1997, 2000) found no evidence that liberalization increases volatility, while Kim and Singal (2000) found a decrease in volatility after a year of liberalization.

The bid-ask spread was reduced, especially for B-share stocks, when the B-share market opened up. Table 1 shows that the A-share spread was reduced by 3 basis points, but that the B-share spread was drastically reduced by 96 basis points ("During - Before" column), and that both reductions bear a statistical significance of 5%. However, the A-share spread widened back to 0.0019 in the post-liberalization period, a figure larger than before the liberalization. The B-share spread, however, showed no significant change in the post-liberalization period. That is to say, the quality of the B-share market did improve after liberalization. Again, the spreads in the A- and B-shares became much more similar after than before liberalization.

The illiquidity shows a pattern similar to the spread in that the major drop was in the B-share stocks during the period of liberalization. It is conceivable that when the B-share trading volume surged with the opening up of the market, the stocks had fewer days of no trading. Indeed, in the "During - Before" column in Table 1, the median illiquidity figure showed a big drop of 0.07 and the mean figure dropped even more, by 0.08. Such a reduction in the number of no-trading days occurred across the board for all 83 B-share stocks. It is true that the no-trading figure rebounded a little in the post-liberalization period; but when compared with the pre-liberalization figure, it was still a drop of 0.06, which is statistically significant at the 5% level (the "After - Before" column). Notice that there were no significant changes in the no-trading figure of A-share stocks across the three time periods. This is further evidence that the improvement in quality in the B-share market did not come at the expense of the A-share market. On the other hand, the no-trading figures of A- and B-shares are much more comparable now than before liberalization.

There was, as expected, a dramatic narrowing in the price gap between A-share and the B-share prices when the B-share market opened up. Although this narrowing of the price gap tended to stabilize in the post-liberalization period, our Wilcoxon test (not reported here) shows that the gap was still significantly narrower in this period than in the liberalization period.

Before concluding, we put the contrasts in a SUR setting and control for some key firm characteristics as in Equation (1). Specifically, we compare the situation between the pre-and post-liberalization periods, and present the results in Table 2.[10]

(Insert Table 2 Here)

The focus is on the regression intercepts, which capture the changes in the variables in question after controlling for firm characteristics. Consistent with the univariate comparisons, there was a significant drop in return for both A-share and B-share stocks, the coefficients being –0.88 (t-value of –3.90) and –3.29 (t-value being –9.59), respectively. For trading volume, only

B-share stocks showed an increase in trading volume, of 0.008, which is marginally significant at the 10% level. Volatility tended to drop for both A-share and B-share stocks after liberalization, but without statistical significance. For the bid-ask spread and illiquidity, only B-share stocks showed a significant reduction. The spread dropped by 0.026 with a t-value of –5.60 and the illiquidity measure dropped by 0.18 with a t-value of –5.04. Both t-values are statistically significant at the 5% level. The price premium (discount) increased (decreased) by 0.46 after liberalization with a highly significant t-value of 5.65. Notice that, in general, the opening up of the B-share market has had a more significant impact on B-share stocks than on A-share stocks.

Two control variables worth mentioning are firm size and the exchange dummy. Firm size enters positively into the return change regressions of both A-share and B-share stocks with t-values of 3.42 and 5.02, respectively. Since the intercepts are negative, the positive coefficients for "Size" mean that firms of a larger size experienced a smaller drop in return after liberalization. For the volume change regressions, only the "Size" coefficient of B-share stocks is significant, with a t-value of –1.75. This suggests that larger firms have had less of an *increase* in volume than smaller firms. On the other hand, firm size enters positively into the spread and illiquidity change regressions of only B-share stocks, with a t-value of 4.28 and 3.81, respectively. This means that smaller firms have experienced more improvements in bid-ask spread and illiquidity than larger firms. All of this seems to indicate that smaller firms benefited more when the B-share market opened up. One possible reason for this is that the liberalization policy attracted individual local investors to the B-share market. We will come back to this point later.

The exchange dummy, SHSE, carries positive coefficients on return; and premium change regressions and negative coefficients on the volatility change, spread change, and illiquidity change regressions of the B-share stocks, all with statistical significance. Hence, the liberalization policy has tended to have a bigger impact on the Shanghai market than on the Shenzhen market. This seems to confirm the view that the regulation of the Shenzhen market was looser than of the Shanghai market, and that many domestic investors with foreign currencies were already participating in the B-share market even before the partial liberalization.

The results so far suggest that the opening up of the B-share market to Chinese local investors has led to mild improvements in the quality of the B-share market through an increase in trading volume and liquidity, and a decrease volatility and bid-ask spread. Also, the price gap between A- and B-share prices has been reduced but not eliminated. Such a reduction in the price gap actually reflects the continuous presence of foreign investors in the B-share market. If, taking the extreme case, all of the original foreign investors had been "replaced" by Chinese

[10] Since our focus in on the consequential impact, the results of the comparison between the pre-

local investors, it would be hard to explain why Chinese investors would stay in the A-share market, paying systematically higher prices for all stocks that have both A-shares and B-shares. We will come back to this point later.

4.2 Cross-market Linkage

Our next set of investigations is to examine possible changes in information linkage across the two markets. The examination, based on a simple bivariate GARCH(1, 1) formulation, is presented in Table 3.

(Insert Table 3 Here)

The first major column shows the results of portfolios A and B formed from equally weighted A-share and B-share returns, respectively. Consistent with the previous results, the first dummy variable "D1" in the mean equation shows that there was an increase in the B-share return when the B-share market opened up. The second dummy variable "D2" shows a decrease in the B-share return in the post-liberalization period.

The focus lies on the correlation coefficients. The correlation coefficient of 0.66 with a t-value of 20.46 suggests that the A-share and B-share markets were highly correlated before liberalization, as expected. Interestingly, the correlation was reduced during liberalization, as captured by the interactive dummy "ρ*D1". The coefficient is –0.18 with a t-value of –2.04, which is statistically significant at the 5% level. This was not expected, but is conceivable, as this period was particularly volatile. Investors jumped on to the B-share market to take advantage of perceived "under-priced" stocks. Such price pressure was unique to the B-share market and, hence, tended to weaken the information-based linkage between the two markets. Once the situation stabilized and Chinese investors were in both the A-share and B-share markets, the linkage between the two markets strengthened, as revealed by the coefficient of the second interactive dummy variable, "ρ*D2," which captures the post-liberalization period. The coefficient is 0.27 with a t-value of 2.98, which is statistically significant at the 1% level. Notice that the correlation coefficient has a net increase of 0.08 (= 0.270 – 0.189) from the pre-liberalization period to the post-liberalization period.

A similar situation occurred in the Shanghai sub-group and the Shenzhen sub-group, as shown in the second and the third major columns, respectively. Although the liberalization effect was much stronger in the Shanghai group than in the Shenzhen group as shown in Tables 2 and 3, the correlation coefficient had a bigger fluctuation in Shenzhen than in Shanghai. The correlation coefficient dropped by 0.24 in Shenzhen but by 0.17 in Shanghai during the liberalization period, and rebounded by 0.31 in Shenzhen and by 0.27 in Shanghai in the post-

liberalization and the liberalization periods are not reported to save space, but are available upon request.

liberalization period. Notice that the t-values of such changes are all significant. There was a net increase in the value of the post-liberalization correlation coefficient for the Shanghai group (0.1 = -0.17 + 0.27) and the Shenzhen group (0.07 = -0.24 + 0.31).

The parameters in the variance equations also show interesting features. For the overall sample, "D1* $\varepsilon^2_{i,t-1}$" has a coefficient of –0.19 (t-value being –2.33) and 0.01 (t-value being 1.66) in the A-share and B-share portfolio equations, respectively. This means that the (unconditional) volatility of A-shares dropped during the liberalization period, while the volatility of B-shares increased. "D2* $\varepsilon^2_{i,t-1}$" has a coefficient of 0.18 (t-value being 2.29) in the A-share portfolio equation and –0.11 (t-value being –1.32) in the B-share portfolio equation. This means the A-share volatility rebounded while the B-share volatility declined in the post-liberalization period. This consistent with what we observed in Table 3.

Such changes in volatility across various stages of liberalization are more salient in the Shenzhen stocks than in the Shanghai ones, as the coefficients of the interactive dummies of the latter group show a general lack of statistical significance. But for the Shenzhen group, the interactive dummies, "D1* $\varepsilon^2_{i,t-1}$" and "D2* $\varepsilon^2_{i,t-1}$," have coefficients of -0.26 (t-value of -9.64) and 0.23 (t-value of 8.36), respectively, in the Shenzhen A-share portfolio equation; and have coefficients of 0.005 (t-value of 0.33) and -0.13 (t-value of -8.17) in the Shenzhen B-share portfolio equation, respectively.

The results on cross-market influence are important for understanding flows of information across markets. Back to the full-sample results, for R_a regressions, "$\varepsilon^2_{j,t-1}$" has a coefficient of –0.009 with a t-value of –2.96, which is significant at the 1% level. This means that, prior to the opening up of the B-share market, the B-share volatility had a strong, negative influence on the next-day A-share volatility. When the market opened up, the impact was the other way around. "D1* $\varepsilon^2_{j,t-1}$" has a coefficient of 0.01 (t-value being 1.84), and "D2* $\varepsilon^2_{j,t-1}$" has a coefficient of -0.11 (t-value being -1.29). This means that B-share volatility began to have a positive impact on A-share volatility during the period of liberalization, but then tended to reverse afterwards. There is a similar spillover effect in volatility from the A-share market to the B-share market.

For the Shanghai sub-group, no significant changes were shown in cross-market volatility spillovers when the B-share market opened up, as the coefficients of the four interactive event dummies do not enter significantly into the regression. Significant effects occur only in the Shenzhen sub-group. When the B-share market opened up, the flow of information across the two markets increased, and the magnitude of the impact was especially strong from the A-market to the B-market. The interactive dummy, "D1* $\varepsilon^2_{j,t-1}$," has coefficients

of 0.01 (t-value of 1.78) and 0.03 (t-value of 5.11) in the A-share and B-share portfolio equations, respectively. In the post-liberalization period, "D2* $\varepsilon^2_{j,t-1}$" had coefficients of -0.13 (t-value of -2.18) in the A-share equation, and 0.009 (t-value of 1.20) in the B-share equations. This means that the impact of B-share volatility on the A-share market declined, while the impact of A-share volatility on the B-share volatility stayed strong after liberalization. All in all, the opening up of the B-share market facilitated flows of information across the two markets in the form of more spillover in volatility from one market to the other, especially in the case of the Shenzhen stocks.

To further investigate the information linkages between the A-share and B-share market, we examined the cointegrating relationship of the A-share and B-share prices before and after the liberalization periods. Many authors (e.g. Yang, 2003) have examined cointegration relationship between A- and B-share indices and found that the indices are not cointegrated. We use Johansen's test (1991, 1995) on 83 pairs of A-share and B-share prices for both the pre-liberalization and post-liberalization periods. We applied the 5% critical value reported by Osterwald-Lenum (1992) on the Johansen trace statistics to determine whether a cointegrating relationship exists. We present only a summary of the results in Table 4.

(Insert Table 4 Here)

The first major column of Panel A shows that there were only 13 pairs of Shanghai stocks and 14 pairs of Shenzhen stocks with a cointegrating relationship in the pre-liberalization period. However, after liberalization, the number of cointegrating pairs jumped to 28 for the Shanghai group and to 33 for the Shenzhen group. This clearly indicates that before the B-share market opened up, the A-share and B-share prices of many firm pairs moved according to the same set of information. However, as the B-share market began to open up, the information flowed more effectively across the two markets and many more firm pairs started moving together. More Shenzhen than Shanghai stocks have a cointegrating relationship both before and after the liberalization.

The second major column of Panel A presents the estimated normalized cointegrating vectors (the "β" value in Equation (3)) averaged in various percentiles over the two periods of liberalization. Since only 13 pairs of Shanghai stocks and 14 pairs of Shenzhen stocks in the pre-liberalization period were cointegrated, we provide only the median value of the normalized vectors. For the 13 Shanghai pairs, the figure is -2.22 and for the 14 Shenzhen pairs, it is -1.31. Notice that the theoretical cointegrating vector should be (1, -1), as A-share and B-share stocks are two classes of shares with equal rights that are issued by the same company. As the actual vectors are different, the A-shares and B-shares are priced differently. This is especially the case for the Shanghai stocks. Yet, after liberalization, the median value of the cointegrating vector

for the Shanghai stocks dropped to –1.50 and that for the Shenzhen stock dropped to –1.11. Hence, the long-run price relationship between the A-share and B-share stocks became tighter after the opening up of the B-share market. Further evidence for this is the fact that the range of the cointegrating values was relatively tight, from –2.10 and –1.49 of the 5th percentile to –0.89 and –0.88 of the 95th percentile for the Shanghai and Shenzhen groups, respectively. Again, the A-share and B-share price relationship was tighter for Shenzhen firms.

The last major column of Panel A shows the coefficients of the error-correction term in the VECM (the "α" value in Equation (3)) averaged in various percentiles over the two periods of liberalization. Again, we only present the median values in the pre-liberalization period due to the small number of cointegrated firms. The median values of the coefficients of the error-correction term for the Shanghai A-share and B-share groups are – 0.0013 and 0.0015, respectively. This means that the relative impact on the A-share and B-share markets was similar. This was not the case for the Shenzhen stocks. The A-share coefficient is –0.0026, whereas the B-share coefficient is 0.0005. Since the absolute value of the A-share coefficient is much larger than the value of the B-share coefficient, the impact of the B-share prices was larger on the A-share prices than vice versa.

However, the situation changed after the opening up of the B-share market. In the post-liberalization period, the median values of the coefficients of the error-correction term for the Shanghai A-share and B-share groups are – 0.0098 and 0.0171, respectively. The B-share coefficient is now larger than the absolute value of the A-share coefficient. Hence, the A-share market has had a bigger impact on the B-share market than the other way round. For the Shenzhen stocks, the A-share coefficient is –0.0185 and the B-share coefficient is 0.0156. Although the A-share coefficient is still larger in absolute value, the difference in value between the two coefficients is much less than before liberalization. This also indicates that the impact of the A-share market is relatively larger than before.

The result seems to be counter-intuitive. When the B-share market opened up and attracted more order flows, its role in the price discovery process should have been enhanced rather than reduced. One plausible explanation is that, after liberalization, the B-share market attracted mainly Chinese investors without subsequently drawing in more foreign investors. Given the fact that A-share and B-share stocks were trading at grossly different prices before liberalization, investors in the two markets (i.e., Chinese investors in the A-share market and foreign investors in the B-share market) had quite different pricing formulas for the stocks, for whatever reasons. When Chinese investors moved into the B-share market, they traded according to the A-share pricing formula, so that the influence of the A-share market on the B-share market was enhanced. In other words, B-share prices that used to be not very responsive to the price movements of A-shares before liberalization (due to different pricing formulas and/or information sets of foreign investors) now become more responsive to A-share price

movements, due to the presence of the Chinese investors in the B-share market after liberalization.

Table 4B shows the regression results of Equation (4). As can be seen, only the relative market capitalization enters significantly into the regression. The coefficient is 3.73 with a t-value of 3.25, which is significant at the 1% level. Recall that the dependent variable is essentially the ratio of the error-correction coefficients, $|\alpha_1^a|$ and α_1^b. A positive coefficient means that if the market capitalization of B-shares relative to A-shares is larger, the relative value of α_1^a becomes larger. In other words, the larger size of the market helps it to reveal price information.[11]

Overall, the GARCH and cointegration results suggest that opening up the B-share market does improve information linkages between the A-share and B-share markets, although only to a limited extent.

4.3 Investor Changes

The opening up of the B-share market attracted Chinese local investors and there was a concern that foreign investors would take this opportunity to sell their portfolio holdings to local investors and cash out from the market. Although the limitation of our data prevents us from testing this conjecture directly, we tried to take an indirect approach by looking at the possible linkages in price premiums before and after liberalization. Specifically, we want to see if the magnitude of the price gap before liberalization has any relationship with the price gap after liberalization. The idea behind such an investigation is as follows. Although the price gap phenomenon is not fully understood, it has to be jointly determined by A-share and B-share investors.[12] When the B-share market opens up to A-share investors and *if* the original B-share investors abandon the market, the B-share market will then be predominantly occupied by Chinese local investors who will then determine the price gap, if any. Unless we assume that Chinese local investors and foreign investors are sharing the same pricing model on Chinese stocks, the price gap defined by Chinese and foreign investors in the pre-liberalization period should be quite different from the price gap defined by only Chinese investors in the post-liberalization period.

On the other hand, if foreign investors largely stay in the B-share market; or if even more foreign investors are attracted into the market because more traders are coming into the market, the price gap after liberalization will still be jointly determined by Chinese and foreign

[11] We did not run separate regressions for Shanghai stocks and Shenzhen stocks because the sample sizes are too small.

[12] See Bailey (1994), Sun and Tong (2000), Chen et al. (2001), Mei et al. (2003), Karolyi and Li (2003), Chan et al. (2003) and their references to studies of market segmentation and price disparities in general.

investors. In this case, the price gaps before and after liberalization will be positively related. We therefore set up the following cross-sectional regression equation:

$$\begin{aligned} Prem_{i,post} = \beta_o + \beta_1 Prem_{i,pre} + \beta_2 RV_{i,pre} + \beta_3 RD_{i,pre} + \beta_4 RSpd_{i,pre} + \beta_5 RS_{i,pre} \\ + \beta_6 SHSE_{i,pre} + \beta_7 Size_{i,pre} + \beta_8 Lev_{i,pre} + \beta_8 ROA_{i,pre} + \varepsilon \end{aligned} \quad (5)$$

All variables are cross-time averages for stock i in the pre-liberalization period *except* for the dependent variable, $Prem_{i,post}$, which is the average price premium of stock i in the *post-liberalization* period. Stock i's price premium is denoted as "$Prem_{i.}$" "RV_i" is its B-share trading volume relative to its A-share trading volume. "RD" is its B-share return volatility relative to its A-share return volatility. "$RSpd_i$" is its B-share spread relative to its A-share spread. "RS_i" is its B-share supply relative to its a-share supply. "SHSE" takes the value of one if it is listed on the Shanghai Stock Exchange and zero otherwise. "Lev_i" is its leverage; "$Size_i$" is its firm size; and "ROA_i" is its return on assets. The focus is on the coefficient β_1. If B-share investors were no longer influential in the pricing of B-shares because they had abandoned the market, β_1 would not be statistically significant. However, the regression result in Panel A of Table 5 shows that β_1 is significantly positive.

(Insert Table 5 Here)

The coefficient of $Prem_{pre}$ is 0.98 with a t-value of 5.26 (the first column of Panel A) when three control variables are put in the regression; and is 1.15 with a t-value of 4.10 (the second column of Panel B) when more control variables are put in. Notice that the regression constant is significantly positive (0.28 in the first column and 0.57 in the second column). Recall that the price premium is measured as $(P_B - P_A)/P_A$ and, hence, is negative in value. The regression results indicate that price premiums tend to decline in a parallel fashion across the stocks after liberalization. That means the *relative* price disparities across stocks remain intact after liberalization. This is consistent with the view that foreign investors still have an influence on the pricing of B-shares after liberalization.

As for the control variables, it can be seen that when the relative (B-share) volume and volatility are higher before liberalization, the post-liberalization price premium tends to be larger (or the discount is *smaller)*. More active B-share trading means less of a discount in the price of B-shares. On the other hand, a greater supply of B-shares leads to a greater discount in the price of B-shares. All of this is consistent with the findings of Sun and Tong (2000) and Chen et al. (2001), among others.

Panel B of Table 5 reports the results of replacing the dependent variable of Equation (5) with the percentage change in the premium, defined as the change in the premium before and

after liberalization divided by the premium before liberalization. By doing so, we directly examine how the pre-liberalization premium relates to the magnitude of the change in the premium. The results are surprising. The coefficient of $Prem_{pre}$ carries a negative sign. Notice that the dependent variable has a negative value because the numerator is positive (as the post-liberalization premium is larger (less negative) than the pre-liberalization premium), whereas the denominator is negative by construct. Hence, the negative coefficient indicates that stocks that showed a greater disparity in price before liberalization tend to show *less* of a percentage reduction in price gap after liberalization. This is surprising because when the B-share market opened up to A-share investors, such investors should have invested more on those stocks that were mispriced (underpriced from their perspective) the most, to obtain full "arbitrage" profits. If that had been the case, stocks with a larger price disparity before liberalization should have had a greater reduction in percentage discount after liberalization.

One possible explanation for this is that when Chinese investors entered the B-share market when it opened up, foreign investors did not react uniformly across the stocks. If they wanted to sell, they would sell those stocks they viewed as the worst according to their pricing model. These stocks were discounted the most. On the other hand, if foreign investors wanted to increase their holdings of B-share stocks due to the improvement in the liquidity and conditions of the market, they would consider these heavily discounted stocks last. In either case, stocks with a large price disparity before liberalization would face heavier selling pressure or lighter buying pressure from the foreign investors. This might explain why these stocks showed a smaller percentage reduction in their price gap after liberalization. This is simply a conjecture, but is consistent with the view that foreign investors did not abandon the B-share market in general.

The monthly plot of the number of investment accounts opened in the A-share and B-share markets through our sample period in Figure 2 also shows partial support for our conjecture.[13]

(Insert Figure 2 Here)

In Panel A, the bold solid and dotted lines represent the number of accounts in the Shanghai and Shenzhen A-share markets, respectively. The thin solid and dotted lines represent the number of accounts in the Shanghai and Shenzhen B-share markets, respectively. It can be seen that when the B-share markets opened up around February 2001, the number of *individual* accounts in the B-share markets shot up, especially in the Shanghai B-share market. These accounts may be opened by individual Chinese or foreign investors. Since the B-share market was always open to the latter group of investors, the sudden rise in numbers more likely came

[13] The data come from the CEIC DRI database of McGraw-Hill.

from the former group of investors. This is consistent with our cointegrating results in Table 4A that opening up the B-share market makes B-share prices more responsive to A-share price movements due to the presence of Chinese investors in the B-share market. Recall that for the post-liberalization period, the absolute, median values of the coefficients of the error-correction term for the Shanghai A-share/B-share groups and the Shenzhen A-share/B-share groups are 0.0098/0.0171 and 0.0185/0.0156, respectively. As the Shanghai ratio is much smaller than the Shenzhen ratio, the price of B-shares is more responsive to movements in the price of A-shares in the Shanghai market than in the Shenzhen market. This is consistent with the above observation that more new individual accounts were opened in the Shanghai B-share market than in the Shenzhen B-share market. However, these investors do not seem to have switched from the A-share markets, as the number of individual A-share accounts (the bold lines) rose steadily through time.

There were no particular changes in the number of *institutional* accounts, local and foreign, around the period of liberalization. The number rose steadily through time, as shown in Panel B. There is no sign that foreign institutional investors left the B-share markets (and closed their accounts) after the markets were opened up to Chinese local investors, as all lines moved up steadily over time. As mentioned before, the reduction in the price gap between A- and B-shares shown in Table 1 also indirectly indicates the continuous presence of foreign investors in the B-share market.

5. Conclusion

China's B-share market, which used to be restricted to foreign investors, was opened up in February 2001 to Chinese local investors. We regard the development as a controlled experiment in cross-border trading on a small scale. Our study controlled for all legal, political, social, economic, and even firm-level differences across the two markets; and experimented with the effects of lifting the trade barrier on order flow dynamics through time. We examined how that, in turn, affected the quality and, hence, the development of the two markets. We found some mild but positive results for the B-share market. The period after liberalization saw higher trading volumes, lower volatility, lower bid-ask spreads, and more liquidity. All of these variables also tended to converge with those of the A-share market. Furthermore, price disparities between A- and B-shares narrowed, the return correlation became higher, and the cointegrating relationship stronger and tighter. The flow of information between the two markets also became more balanced. We also found some indirect evidence that is consistent with the view that Chinese individual investors entered the B-share markets after liberalization. There was no sign that these investors came from the A-share market or that they crowded out existing institutional investors in the B-share markets.

Overall, the liberalization measure has helped to improve the quality of the B-share market, and this has not come at the expense of the A-share market. Yet the improvements are quite limited, and there is no sign that many foreign investors were subsequently attracted into the B-share market. The lackluster B-share market is said to be due to illiquidity. Our results show that allowing local investors to enter the B-share market to boost up its liquidity does little to solve the problem. The fact that there is still a gap in price between A- and B-shares after liberalization hints at the fundamental unattractiveness of Chinese stocks to foreign investors. The Chinese government has made a major effort to tackle the issue by attempting to enhance the quality of corporate governance in China. Its latest initiatives have been the issuing of the Code of Corporate Governance for Listed Companies in China on January 7, 2001 and the tentative Code of Corporate Governance for Securities Companies in China on December 15, 2003.

As for the A-share market, the recent implementation of the Qualified Foreign Institutional Investors (QFII) scheme in China is perceived as being a potentially useful and stronger push to improve the quality of China's stock markets.[14] The scheme allows qualified foreign institutions to bring in foreign currencies and convert them to *renminbi* to invest in the A-share stock market, as well as in the bond market. The hope is that opening up the markets to foreign institutional investors will boost the confidence of investors and bring in fresh liquidity from overseas. Furthermore, QFII will help in the push for more market transparency and better corporate governance. It will be very interesting to see how this scheme of opening up the A-share market to foreign investors complements the liberalization policy of opening up the B-share market to Chinese local investors to raise the vigor and quality of China's stock markets.

[14] The scheme was designed by SAFE and announced by the CSRC on November 5, 2002.

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Table 1
Univariate Tests

This table presents, in various samples, the number of observations, the mean and median values of daily average stock return, trading volumes, illiquidity, volatility, and price discounts of B-shares relative to their corresponding A-shares in relation to the events permitting Chinese nationals to buy B-shares using their foreign currency deposits. The pre-announcement period is from February 5, 2000 to February 4, 2001; the period marked "during" is from February 5, 2001 (10 trading days before the first event) to June 15, 2001 (10 trading days after the last event); while the post-event period is from June 16, 2001 to June 15, 2002. B-share prices have been converted to RMB using the relevant daily exchange rate before calculating their returns, bid-ask spreads and premiums. The B-share premium is $(P_B-P_A)/P_A$. The volatility is proxied by the standard deviation of the daily returns in the relevant period. The volume is the number of shares traded divided by the number of shares outstanding. The bid-ask spread is the daily closing ask price minus the bid price divided by the average of the bid and ask price. The illiquidity is proxied by the percentage of zero return days, which was derived by dividing the number of trading days with a zero return by the total number of trading days in the relevant period. The t-test and Wilcoxon Z-test have been employed to test for any significant changes in the mean and median of these variables between any two periods, respectively. The number of positive versus negative changes in median and mean is also shown in the table.

Variable	Sample	Obs	Median (Mean) Before	Median (Mean) During	Median (Mean) After	Median (Mean) Change	+ve/-ve ratio	Median (Mean) Change	+ve/-ve ratio
						During - Before		After - Before	
Return	A-share	83	0.2294	0.0994	-0.1238	-0.1300**	23/60	-0.3532**	1/82
			(0.2896)	(0.1029)	(-0.1211)	(-0.1867)**		(-0.4106)**	
	B-share	83	0.3473	1.2167	-0.1607	0.8694**	83/0	-0.5080**	0/83
			(0.3652)	(1.2622)	(-0.1922)	(0.8970)**		(-0.5574)**	
Volume	A-share	83	0.0285	0.0154	0.0101	-0.0131**	12/71	-0.0184**	1/82
			(0.0305)	(0.0184)	(0.0111)	(-0.0121)**		(-0.0194)**	
	B-share	83	0.0051	0.0372	0.0078	0.0321**	83/0	0.0027**	61/22
			(0.0058)	(0.0378)	(0.0074)	(0.0319)**		(0.0016)**	
Volatility	A-share	83	2.7524	2.0705	2.6431	-0.6819**	9/74	-0.1093*	40/43
			(2.9612)	(2.1389)	(2.6530)	(-0.8223)**		(-0.3082)	
	B-share	83	3.2927	4.3409	2.8802	1.0482**	81/2	-0.4125**	14/69
			(3.2956)	(4.3609)	(2.9724)	(1.0653)**		(-0.3232)**	
Bid-ask Spread	A-share	83	0.0017	0.0014	0.0019	-0.0003**	19/64	0.0002**	58/23
			(0.0018)	(0.0015)	(0.0020)	(-0.0003)**		(0.0002)**	
	B-share	83	0.0126	0.0030	0.0033	-0.0096**	0/83	-0.0093**	0/83
			(0.0134)	(0.00365)	(0.0037)	(-0.0099)**		(-0.0098)**	
Illiquidity	A-share	82	0.0214	0.0213	0.0211	0.0009	42/41	-0.0003	40/43
			(0.0198)	(0.0222)	(0.0210)	(0.0014)		(0.0012)	
	B-share	83	0.1026	0.0238	0.0380	-0.0788**	0/83	-0.0646**	3/80
			(0.1072)	(0.0260)	(0.0389)	(-0.0812)**		(-0.0683)**	
Premium	B-share	83	-0.8017	-0.4884	-0.4659	0.3133**	83/0	0.3358**	83/0
			(-0.7944)	(-0.4919)	(-0.4505)	(0.3025)**		(0.3439)**	

**(*) denotes significance at the 5(10) percent level.

Table 2
Seemingly Unrelated Regression

This table reports the results of the regression analysis for variations in the difference of average return, volume, volatility, illiquidity, bid-ask spread, and premium (or discount) before and after the events surrounding the partial liberalization of B-share firms. The whole sample spans from February 5, 2000 to June 15, 2002 and is further divided into three sub-periods: (1) The pre-announcement period from February 5, 2000 to February 4, 2001, (2) the event period from February 5, 2001 (10 trading days before the first event) to June 15, 2001 (10 trading days after the second event), and (3) the post-event period from June 16, 2001 to June 15, 2002. The B-share prices have been converted to RMB using the relevant daily exchange rate before calculating their returns, R; bid-ask spread, Bidask; and Premium, Prem. The B-share premium is $(P_B-P_A)/P_A$. The volatility, S, is proxied by the standard deviation of the returns in the relevant period. The volume, V, is the number of shares traded, divided by the number of shares outstanding. The bid-ask spread is proxied by the daily closing ask price minus the bid price divided by the average of the bid and ask price. The illiquidity, Illiq, is proxied by the number of zero return days as a percentage of total trading days during the relevant period. The first event difference is the difference between the event period average and the pre-announcement period average, i.e., the event period average – the pre-announcement average; while the second event difference is that between the post-event period average and the pre-announcement average; i.e., the post period average – the pre-announcement average. All independent variables except the exchange dummy SHSE are the three-year average of the period 1998-2000. Size is proxied by the natural log of the total assets; Leverage is the ratio of total liabilities over total assets; ROA is the return on assets; relative supply, Rel Sup, is the ratio of outstanding tradable B-shares to outstanding tradable A-shares; and ST is the level of state ownership. SHSE takes 1 if a firm is listed in the Shanghai Stock Exchange, and zero otherwise. t-statistics are in parentheses.

	ΔR_{a2}	ΔR_{b2}	ΔV_{a2}	ΔV_{b2}	ΔS_{a2}	ΔS_{b2}	$\Delta Bidask_{a2}$	$\Delta Bidask_{b2}$	$\Delta Illiq_{a2}$	$\Delta Illiq_{h2}$	$\Delta Prem_b$
Constant	-0.8859 (-3.908)**	-3.292 (-9.595)**	-0.0271 (-1.012)	0.0084 (1.966)*	-0.0043 (-0.002)	-0.9875 (-0.676)	-0.0004 (-0.433)	-0.0260 (-5.605)**	-0.0043 (-0.224)	-0.1872 (-5.047)**	0.4679 (5.655)**
Size	0.0591 (3.421)**	0.1314 (5.021)**	0.0008 (0.434)	-0.0005 (-1.757)*	-0.0092 (-0.050)	0.0392 (0.896)	0.0001 (0.863)	0.0015 (4.289)**	0.0012 (0.807)	0.0108 (3.819)**	-0.0085 (-1.389)
Leverage	-0.0611 (-0.610)	-0.0318 (0.210)	-0.0001 (-0.015)	0.0041 (2.188)**	-0.0239 (-0.022)	-0.1641 (-0.648)	0.0001 (0.031)	-0.0047 (-2.269)**	-0.0088 (-1.052)	-0.0012 (-0.076)	0.0055 (0.119)
ROA	-0.1953 (-1.203)	1.2281 (4.997)**	-0.0115 (-0.600)	0.0107 (3.494)**	-2.5217 (-1.476)	-3.6838 (-8.975)**	-0.0001 (-0.162)	0.0072 (2.080)**	-0. 0261 (-1.912)*	0.0489 (1.841)*	0.0143 (0.274)
ST	-0.0011 (-1.446)	-0.0021 (-1.784)*	-0.0001 (-1.572)	-0.0000 (-1.363)	-0.0082 (-0.982)	-0.0013 (-0.673)	-0.0001 (-0.947)	0.0001 (0.095)	1.09E-05 (0.161)	-2.03E-05 (-0.155)	8.88E-05 (0.222)
Rel. Sup.	-0.0195 (-2.331)**	-0.0150 (0.012)	-0.0001 (-0.106)	-0.0000 (-0.241)	-0.0060 (-0.068)	-0.0366 (-1.726)*	0.0001 (-0.302)	-0.0001 (-0.849)	-0.0012 (-1.635)	-0.0026 (-1.920)*	-0.0165 (-4.129)**
SHSE	-0.0255 (-0.651)	0.3772 (6.342)**	0.0026 (0.568)	-0.0009 (-1.217)	0.3028 (0.732)	-0.4372 (-4.401)**	-0.0002 (-1.263)	-0.0032 (-4.020)**	-0.0061 (-1.853)*	-0.0384 (-5.979)**	0.0593 (2.888)**
Obs.	166		166		166		166		166		83
Adj. R^2	0.9002		0.3361		0.0305		0.8220		0.7685		0.1899

**(*) denotes significance at the 5(10) percent level.

Note: Including industry dummies in the regressions giving qualitatively the same results. We do not report these results to save space. However, they are available upon request.

Table 3
Bivariate GARCH Estimation

This table presents the results of the bi-variate GARCH of the following model:

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

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

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

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

$$h_{ab,t} = [\rho_{ab,o} + \rho_{ab,1}D_1 + \rho_{ab,2}D_2]\sqrt{(h_{aa,t}h_{bb,t})}$$

R_a (R_b) is the return of the equally weighted portfolio of all A (B) stocks in the matched sample. The unconditional volatility in the variance equation, ε^2, in one market is allowed to affect the other market. The variable "$\varepsilon^2_{i,t-1}$" in the table stands for own-market lagged volatility, so that for the "R_a column (R_b column)" it stands for the "$\varepsilon^2_{a,t-1}$ ($\varepsilon^2_{b,t-1}$)" term in the GARCH equation above. The variable "$\varepsilon^2_{j,t-1}$" in the table stands for cross-market lagged volatility, so that for the "R_a column (R_b column)" it stands for the "$\varepsilon^2_{b,t-1}$ ($\varepsilon^2_{a,t-1}$)" term in the GARCH equation. D_1 and D_2 are the two event dummies. D_1 takes the value of one from February 5, 2001 onwards, and zero otherwise; while D_2 takes the value of one from June 16, 2001 onwards, and zero otherwise.

	Full Sample		Shanghai Sample		Shenzhen Sample	
	R_a	R_b	R_a	R_b	R_a	R_b
Constant	0.0865	0.2188	0.0959	0.2925	0.1053	0.1508
	(1.5816)	(2.1102)**	(1.3327)	(2.0897)**	(2.3816)**	(1.9365)*
AR(1)	0.1294	0.1160	0.0993	0.1154	0.1507	0.1403
	(3.1190)***	(2.9144)***	(2.4217)**	(2.6599)***	(4.7578)***	(4.7056)***
AR(2)	-0.0421	-0.0333	-0.0353	-0.0361	-0.0403	-0.0619
	(-1.2268)	(-1.0109)	(-1.0526)	(-0.9658)	(-1.6001)	(-2.2591)**
D1	0.1539	0.8551	0.2227	0.7389	0.0370	1.0322
	(1.3208)	(2.5029)**	(1.7153)*	(2.3571)*	(0.6547)	(10.2634)***
D2	-0.2176	-0.9732	-0.2784	-0.8685	-0.1705	-1.1945
	(-1.6264)	(-2.8256)***	(-2.0287)**	(-2.8399)***	(-2.3724)**	(-11.0049)***
Constant	0.1658	0.6905	0.2419	0.8074	0.1319	1.1547
	(3.3143)***	(4.1316)****	(2.7859)****	(4.1990)***	(4.0935)***	(6.8137)***
h_{t-1}	0.7974	0.7423	0.7695	0.6645	0.8353	0.7070
	(17.4907)***	(17.2530)***	(16.4538)***	(14.0165)***	(33.1431)***	(23.3091)***
$\varepsilon^2_{i,t-1}$	0.1487	0.1436	0.1403	0.2252	0.1186	0.3199
	(3.0396)***	(3.6182)***	(2.8159)***	(4.3150)***	(4.5766)***	(7.7603)***
$D1*\varepsilon^2_{i,t-1}$	-0.1946	0.0954	-0.0580	-0.0077	-0.2668	0.0055
	(-2.3351)**	(1.8903)*	(-0.9496)	(-0.1968)	(-9.6458)***	(0.3338)
$D2*\varepsilon^2_{i,t-1}$	0.1833	-0.0142	0.0900	0.0336	0.2341	-0.1334
	(2.2947)**	(-0.2819)	(1.2452)	(0.8535)	(8.3679)***	(-8.1708)***
$\varepsilon^2_{j,t-1}$	-0.0093	0.1377	-0.0080	0.1959	-0.0042	-0.1752
	(-2.9677)***	(1.5262)	(-2.0102)**	(1.8711)*	(-2.3891)**	(-4.6736)***
$D1*\varepsilon^2_{j,t-1}$	0.0114	0.0163	0.0007	0.0148	0.0117	0.0324
	(1.8460)*	(1.6631)*	(0.1667)	(1.2923)	(1.7820)*	(5.1125)***
$D2*\varepsilon^2_{j,t-1}$	-0.1142	-0.1164	-0.0936	-0.0226	-0.1308	0.0094
	(-1.2966)	(-1.3209)	(-1.5654)	(-0.9626)	(-2.1864)**	(1.2080)
ρ	0.6663		0.6015		0.6850	
	(20.4633)***		(19.9107)***		(39.8416)***	
ρ*D1	-0.1897		-0.1786		-0.2469	
	(-2.0478)**		(-1.9100)*		(-12.9677)***	
ρ*D2	0.2708		0.2774		0.3134	
	(2.9823)***		(3.0860)***		(15.8749)***	
Function	-1040.557		-1132.018		-1063.6198	
Obs.	544	544	544	544	544	544
Chi-Sq(1)	5.3492**	0.9773	2.1094	1.2333	5.5824**	1.2515
Q(12)	18.4026**	15.7223*	13.0018	11.9701	18.1774**	16.1554*
Q(24)	30.4167*	27.8119	29.0561	20.7675	34.1043**	29.0443*

*,**,*** denote significance at the 10, 5, and 1 percent levels, respectively.

Table 4
Cointegration Estimations

Panel A. Estimated Values of Alpha and Beta

The "alpha" and "beta" estimates come from the following VECM:

$$\Delta P_t^a = \alpha_o^a + \alpha_1^a (P_{t-1}^a + \beta * P_{t-1}^b) + \sum_{i=1}^{q} \beta_i (\Delta P_{t-1}^a) + \sum_{i=1}^{q} \gamma_i (\Delta P_{t-1}^b) + \varepsilon_t^a$$

$$\Delta P_t^b = \alpha_o^b + \alpha_1^b (P_{t-1}^a + \beta * P_{t-1}^b) + \sum_{i=1}^{q} \beta_i (\Delta P_{t-1}^a) + \sum_{i=1}^{q} \gamma_i (\Delta P_{t-1}^b) + \varepsilon_t^b$$

"Alpha" is the coefficient of the error-correction term. Hence, α_1^a and α_1^b are the coefficients of the error-correction term in the equations of the change in A-share prices, ΔP_a, and the change in B-share prices, ΔP_b, respectively. "Beta" is the cointegrating vector between A-share and B-share prices.

	No. of Coint Firms			Beta Value		Alpha Value			
	SHSE	SZSE	Percentile	SH	SZ	SHA	SHB	SZA	SZB
Pre	13	14	50%	-2.2207	-1.3130	-0.0013	0.0015	-0.0026	0.0005
Post	28	33	5%	-2.1000	-1.4952	-0.0305	0.0097	-0.0795	0.0516
			25%	-1.6858	-1.2723	-0.0135	0.0145	-0.0248	0.0094
			50%	-1.5054	-1.1125	-0.0098	0.0171	-0.0185	0.0156
			75%	-1.1945	-0.9593	-0.0051	0.0214	-0.0132	0.0193
			95%	-0.8969	-0.8852	-0.0037	0.0266	-0.0072	0.0231

Panel B. Regression on Alpha Ratio of Cointegrating Pairs

The regression model is as follows:

$$\ln\left(\frac{X}{1-X}\right) = \alpha_o + \alpha_1 \text{Spread} + \alpha_2 \text{Volume} + \alpha_3 \text{Cap} + \varepsilon$$

X in the dependent variable is equal to $|\alpha_1^a|/(|\alpha_1^a| + \alpha_1^b)$, where α_1^a and α_1^b are defined as in Panel A above. "Spread" is the B-share bid-ask spread relative to the A-share spread. "Volume" is the B-share trading volume relative to the A-share trading volume, and "Cap" is the B-share market capitalization relative to the A-share market capitalization.

	Combined	SHSE	SZSE
Intercept	-0.2400	-5.7852	1.1124
	(-0.1557)	(-2.9561)***	(0.8114)
Spread (B) / Spread (A)	-0.1626	-0.5659	-0.1690
	(-0.8654)	(-1.4836)	(-1.0559)
Volume (B) / Volume (A)	-0.2025	-0.0391	-0.3422
	(-1.0363)	(-0.1257)	(-1.9126)*
MV (B) / MV(A)	1.2275	7.6558	-0.4850
	(0.6956)	(2.5313)***	(-0.3038)
SHSE	-0.8062		
	(-1.6092)		
Observations	62	28	33
Adjusted R-squared	0.1619	0.0855	0.1098

*,**,*** denote significance at the 10, 5, and 1 percent levels, respectively.

Table 5

Cross-sectional Regression Results on Price Premium

This table reports the results of the regression analysis on price premium before and after the events surrounding the partial liberalization of B-share firms.

$$Prem_{i,post} = \beta_o + \beta_1 Prem_{i,pre} + \beta_2 RV_{i,pre} + \beta_3 RD_{i,pre} + \beta_4 RSpd_{i,pre} + \beta_5 RS_{i,pre} + \beta_6 SHSE_{i,pre} + \beta_7 Size_{i,pre} + \beta_8 Lev_{i,pre} + \beta_8 ROA_{i,pre} + \varepsilon$$

The whole sample spans from February 5, 2000 to June 15, 2002. The pre-liberalization period spans from February 5, 2000 to February 4, 2001, and the post-liberalization period spans from June 16, 2001 to June 15, 2002. The event period from February 5, 2001 (10 trading days before the first event) to June 15, 2001 (10 trading days after the second event) is excluded. The B-share prices have been converted to RMB using the relevant daily exchange rate. The price premium, Prem, is $(P_B-P_A)/P_A$. $Prem_{i,post}$ is the average price premium of Stock i across the post-liberalization period. $Prem_{i,pre}$ is the average price premium of Stock i across the pre-liberalization period. Trading volume is the number of shares traded, divided by the number of shares outstanding; and relative volume is the B-share volume over the A-share volume. Return volatility is proxied by the standard deviation of the returns in the relevant period. Relative volatility is the B-share volatility over the A-share volatility. Relative Supply is the ratio of outstanding tradable B-shares to outstanding tradable A-shares. Size is proxied by the natural log of total assets; Leverage is the ratio of total liabilities over total assets; and ROA is the return on assets. SHSE takes 1 if a firm is listed in the Shanghai Stock Exchange, and zero otherwise. t-statistics are in parentheses. All independent variables, with the exception of the exchange dummy SHSE, are the three-year average of the period 1998-2000.

	Panel A		Panel B	
	$Prem_{i,post}$	$Prem_{i,post}$	$\Delta Prem / Prem_{i,pre}$	$\Delta Prem / Prem_{i,pre}$
C	0.2266	0.4929	-0.7633	-1.1251
	(1.7065)*	(1.4905)	(-4.1479)***	(-2.7827)***
$Prem_{i,pre}$	0.9537	1.1242	-0.5550	-0.7648
	(5.4947)***	(3.9555)***	(-2.2628)**	(-2.1324)**
$RV_{i,pre}$ (Relative Volume)	0.1360	0.1430	-0.1752	-0.1879
	(2.4565)**	(2.4540)**	(-2.4812)**	(-2.5373)**
$RD_{i,pre}$ (Relative Volatility)	0.0328	0.0334	-0.0438	-0.0410
	(1.1707)	(1.2028)	(-1.1379)	(-1.0299)
$RSpd_{i,pre}$ (Relative Spread)	0.0045	0.0039	-0.0064	-0.0051
	(1.4805)	(1.2615)	(-1.5350)	(-1.1997)
$RS_{i,pre}$ (Relative Supply)	-0.0154	-0.0135	0.0189	0.0158
	(-4.0296)***	(-3.0222)***	(3.8703)***	(2.7840)***
$SHSE_{i,pre}$	0.0352	0.0320	-0.0489	-0.0448
	(1.8323)*	(1.6198)	(-1.8834)*	(-1.7168)*
$Size_{i,pre}$		-0.0107		0.0152
		(-1.0410)		(1.3016)
$Leverage_{i,pre}$		0.0083		-0.0296
		(0.1645)		(-0.4652)
$ROA_{i,pre}$		0.0002		-0.0108
		(0.5329)		(-0.1674)
Observation	83	83	83	83
Adjusted R-squared	0.5722	0.5632	0.3881	0.3756

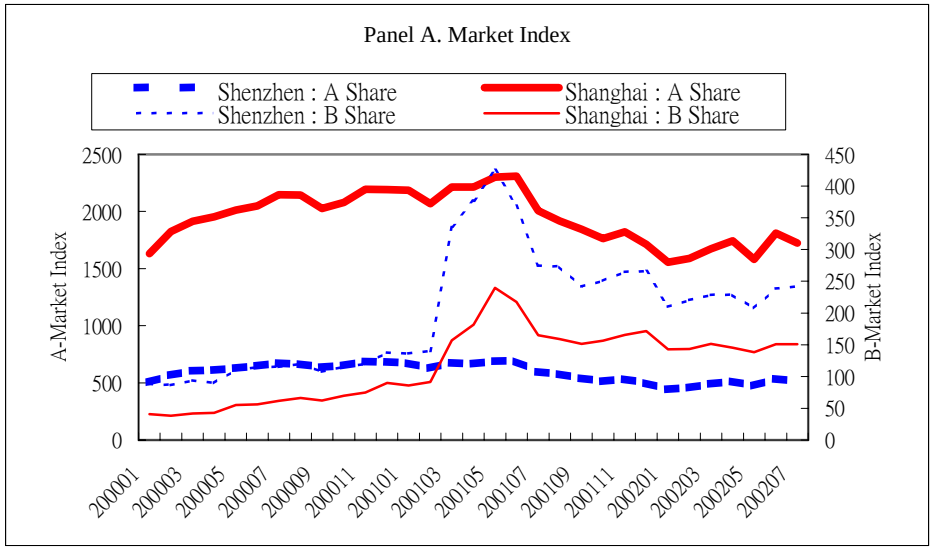
*, **, *** denote significance at the 10, 5, and 1 percent levels, respectively.

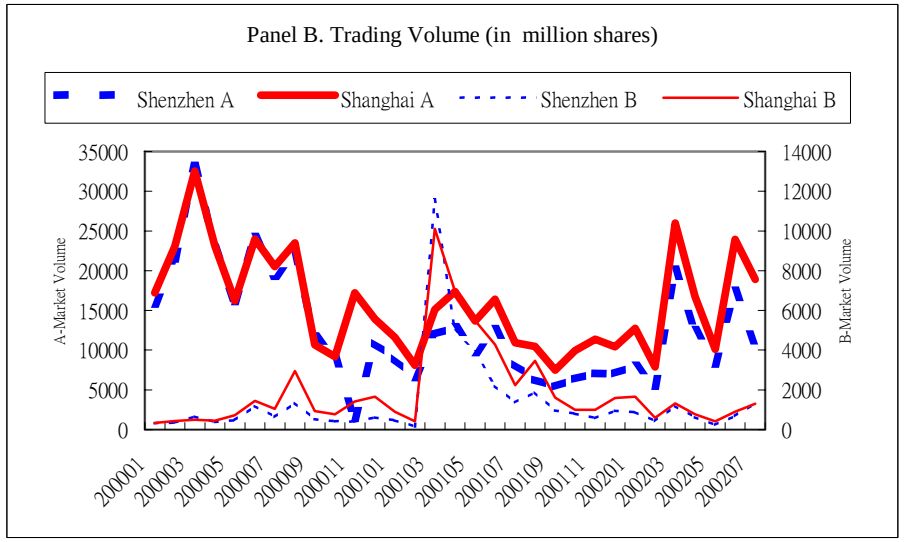
Appendix.

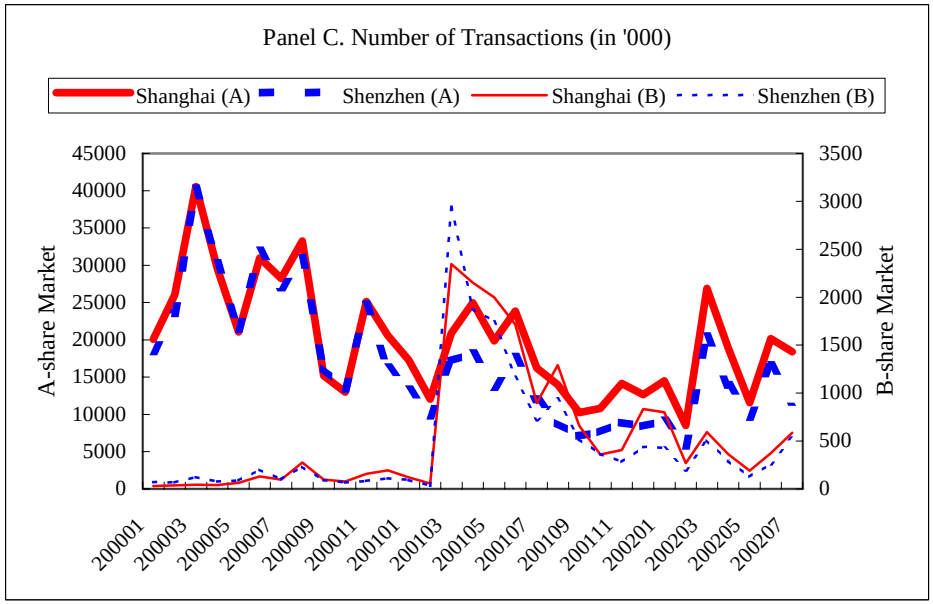
Number of Listed Companies in China
(1993 – 2002)

	Shanghai			Shenzhen			China (Total)			Hong Kong
	A-share	B-share	A_B pairs	A-share	B-share	A_B pairs	A-share	B-share	A_B pairs	H-share
1992	33	9	9	24	9	9	57	18	18	0
1993	101	21	21	76	20	19	76	41	40	6
1994	169	33	32	118	25	22	287	58	54	15
1995	184	36	32	127	34	26	311	70	58	18
1996	287	42	35	227	43	34	514	85	69	25
1997	372	50	41	348	51	35	720	101	76	42
1998	425	52	42	400	54	38	825	106	80	43
1999	471	54	42	450	54	40	921	108	82	46
2000	559	55	43	499	58	43	1058	113	86	52
2001	636	54	43	494	56	45	1130	110	88	60
2002	705	54	45	494	57	45	1199	111	90	75

Figure 1. Market Index and Trading Volume (Jan 2000 – June 2003)







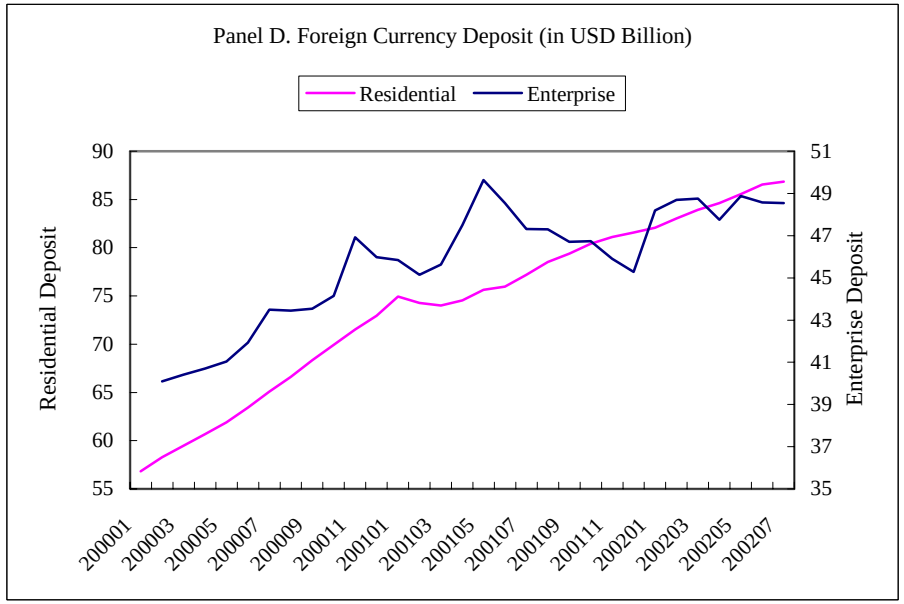


Figure 2. Number of Investors through Time (Jan 2000 – June 2002)