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How Well do Prices Converge in Anticipation of Capital Control Liberalization? Evidence from a Chinese Reform

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Abstract

This paper analyzes the effects of a pilot program that enables cross-market investment between Hong Kong and Shanghai's stock exchanges. Among the companies that are concurrently listed in both markets, the announcement of the program causes the price disparity between shares in both markets to reduce by an average of 16.6 percent within the same day of announcement. The price convergence is directly proportional to the magnitude of preexisting price disparity. Despite the large institutional differences between both markets, the prices converge symmetrically via initial share price increases in the market that traded the stock at a relative discount. The results suggest that capital control plays an important role in explaining the disparity of equity prices between markets.

JEL CLASSIFICATION: O16, F32

Keywords: Capital account liberalization, Chinese reform, law of one price, dual-listed shares, natural experiment

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1 Introduction

The capital account of China has remained relatively closed since economic reform started in the late 1970s. As of 2012, China accounted for 11 percent of the world's total exports, but less than 3 percent of the world's total holdings of cross-border assets and liabilities. The central bank of China has recently begun ambitious attempts to liberalize its financial and foreign exchange system. The liberalization of capital control plays an integral role in the country's reform agenda.[1]

This paper adds to the literature on the effects of capital account liberalization by analyzing a natural experiment that involves a recent financial reform in China. On April 10, 2014, China announced a pilot program that enables cross-market investment between Hong Kong and Shanghai's stock markets. Hong Kong investors are allowed to invest in the Shanghai market, with an overall quota of 250 billion yuan (40.3 billion USD). Investors in Mainland China who have at least 500,000 yuan (80,645 USD) in securities or cash are allowed to invest in the Hong Kong market, with an overall quota of 300 billion yuan (48.4 billion USD).[2] The above quotas represent 2 and 1.6 percent of the total market capitalization in the Shanghai and Hong Kong stock exchanges, respectively. The pilot program represents a significant step towards the liberalization of capital control. Previously, cross-border investment in stock markets between Mainland China and the rest of the world predominantly relied on Qualified Foreign Institutional Investor (QFII) and Qualified Domestic Institutional Investor (QDII) programs, which are limited to selected institutional investors only.[3] The pilot program is similar in size to QFII and QDII programs, and it is scheduled to be launched in six months.

The announcement of the pilot program provides a natural experiment setting that allows us to investigate how the anticipated relaxation of capital control can affect equity prices in both financial markets. Since equity prices are inversely related to the cost of (equity) capital, the analysis has broad economic implications – the cost of capital is an important determinant

[1] Prasad and Wei (2007) document the evolution of China's capital control and the composition of capital inflows in detail.

[2] The daily quotas in the Shanghai and Hong Kong markets are 10.5 and 13 billion yuan, respectively.

[3] Individuals in Mainland China were generally forbidden to transfer more than 50,000 US dollars in or out of the border per year. The QFII program, which started in 2002, allows foreign institutional investors to invest in Mainland China's stock markets. The QDII program, which started in 2006, allows institutional investors in Mainland China to invest in stock markets abroad. The total quotas for QFII and QDII have increased gradually since they were launched. As of 2014, the total quotas for QFII and QDII have reached 53.5 and 86.5 billion US dollars, respectively.

of investment activity in the economy, and can exert influences on wider aspects of economic welfare (Henry (2007)). By exploiting a unique feature of the Mainland and Hong Kong equity markets, this study also provides new evidence on how well the law of one price holds under the liberalization. The pilot program stipulates that cross-market investment is solely restricted to designated stocks in both markets. These include constituents of major indices, and shares of companies that are concurrently listed in both markets.[4] A unique feature of both markets is that there were as many as 84 companies that were concurrently listed in the Mainland and Hong Kong markets.[5] The shares issued in the Mainland market are called A-shares, while the shares issued in the Hong Kong market are called H-shares. The shares of these companies are *dual-listed* – although A-shares and H-shares are non-fungible and are traded in their respective stock exchanges only, both types of shares have the same dividend and voting rights. If the announcement of the pilot program has an immediate effect, it should ubiquitously narrow the price disparities between A-shares and H-shares of all dual-listed companies following the announcement. In addition, if the law of one price is the main driving force, the convergence should be proportional to the magnitude of the preexisting price disparity between A-shares and H-shares of the company just prior to the announcement.

Dual-listed shares play an increasingly important role in the Mainland and Hong Kong markets. In 2014, the market capitalization of dual-listed A-shares and H-shares constitutes 50 and 18 percent of the total market capitalization of the Mainland and Hong Kong markets, respectively. It is widely documented that large price disparities often exist between dual-listed A-shares and H-shares. For instance, just before the announcement of the program, one-third of the dual-listed companies had A-shares that were at least 50 percent more expensive than H-shares. The analysis has wide implications not only for financial markets but also cross-border capital movements in general. The results are also interesting because both

[4]The indices include the Shanghai Stock Exchange 180 Index, Shanghai Stock Exchange 380 Index, Hang Seng Composite LargeCap Index, and Hang Seng Composite MidCap Index. After including concurrently-listed companies, many of which are also constituents of the above indices, there are around 500 stocks in the Shanghai market and 250 stocks in the Hong Kong market that meet the eligibility criteria. They constitute around 50 and 15 percent of the total number of listed companies, respectively.

[5]The Mainland market has two stock exchanges (Shanghai and Shenzhen). Companies may list in either the Shanghai or Shenzhen market. Among the 84 companies, 68 are listed in the Shanghai market and 16 are listed in the Shenzhen market. The data and results section discuss in detail how the companies listed in the Shenzhen market are handled.

the Hong Kong and Mainland markets are ranked among the largest 10 stock exchanges in the world, and there is a strong asymmetry in institutional characteristics and the degree of openness between both markets.

The regression analysis is primarily focused on micro-level and cross-sectional implications on price disparities. The methodology resembles a quasi-experimental design, in which the policy effect is identified by a news shock that generate heterogeneous effects on price convergence shortly after the announcement. In the baseline analysis, data on closing prices of A-shares and H-shares of dual-listed companies are obtained for the day of announcement and up to two days before announcement. The pre-announcement data suggests that in all companies, the price disparity between A-shares and H-shares is almost invariant on a daily basis. However, on the day of announcement, the price disparities narrowed by an average of 13.5 percent among companies whose H-shares were at a discount to A-shares, and 25 percent among companies whose H-shares were at a premium to A-shares. Moreover, the model closely predicts that the magnitude of price convergence of each H-A pair of shares is directly proportional to its preexisting degree of price disparity. These effects are very large considering the small scale of the pilot program relative to the size of both markets. The effects persist after controlling for other factors and analyzing data from a longer time horizon. The results suggest that investors anticipate further liberalization of capital control above and beyond the current scale of the pilot program.

Further analysis reveals that the price convergence is primarily driven by initial share price increases in the market that trades the stock at a relative discount. If H-shares of a firm were cheaper than its A-shares just prior to the announcement, the price of H-shares will move up but the price of A-shares will remain largely unchanged. By contrast, if H-shares were more expensive than A-shares, the price of A-shares will move up but the price of H-shares will remain largely unchanged. Among companies with large preexisting price disparities, this implies significant share price increases in one of the markets; for instance, if H-shares were one-third cheaper than A-shares, the price of H-shares will be predicted to increase by around 10 percent. This finding is surprising because the Mainland and Hong Kong markets are different in numerous institutional aspects, and yet the price movements are symmetric. The initial stock market responses seem to suggest that the equilibrium price of dual-listed shares can be closer to the H-share or A-share price, whichever is higher.

This paper proceeds as follows. Section 2 discusses the relationship of this paper with the literature. Section 3 provides a brief summary of the data. Section 4 presents the empirical model and results. Section 5 summarizes the findings and discusses possible explanations. Additional tables are provided in Supplemental Material (Chan (2014)) and the Appendix.

2 Relationship with the Literature

Capital account liberalization has remained a controversial policy issue, as the literature has generally found mixed evidence regarding its importance in the development of emerging market economies (e.g., Kose et al. (2009), Prasad and Rajan (2008)). While the results are mixed regarding the effects on economic growth, there is a larger consensus that such liberalizations can improve investment in the host country by lowering the cost of capital and financing constraints (e.g., Henry (2007)).[6] For instance, Harrison et al. (2004) and Forbes (2007) find that restrictions on capital account transactions can negatively affect firms' financing constraints. Gallindo et al. (2007) find that the allocative efficiency of investment funds increases after financial liberalization.[7] Using data on stock market liberalization in multiple emerging countries, Henry (2000) find that liberalizing countries experience abnormal stock returns at the aggregate index level several months prior to the actual implementation of stock market liberalizations. He argues that the results are consistent with theoretical predictions that the cost of (equity) capital will become lower due to risk sharing between domestic and foreign agents.[8]

A challenge that underlies the above studies is that capital account liberalization policies are difficult to measure, and they are often accompanied by economic reforms and other con-

[6]For instance, in a regression analysis involving equity market liberalizations in different countries, Bekaert et al. (2001) find that equity market liberalizations can lead to increased economic growth. Using a calibrated neoclassical model, Gourinchas and Jeanne (2006) find small welfare gains when an emerging market economy switches from financial autarky to perfect capital mobility.

[7]Harrison et al. (2004) use cross-country time-series data on restrictions on international transactions and capital flows. Forbes (2007) studies Chilean capital account restrictions (*encaje*) in the 1990s. Gallindo et al. (2007) use data on a variety of measures of liberalization across countries. The above studies use firm-level data from Worldscope database for regression analysis.

[8]In segmented markets, the price of risk in the local market is higher than the global price of risk due to the lack of diversification. Upon liberalization, the local price of risk will fall, which is accompanied by a fall in the equity premium (e.g., Gultekin et al. (1989)). For instance, international investors will value shares in the local market because they offer diversification benefits to them. Holding expected future cash flows constant, this will translate into a reduction in the cost of equity capital (as reflected by a lower dividend yield), and a corresponding upward reevaluation of stock prices. The lower cost of equity capital will channel through the economy and result in a broader impact on economic welfare.

current changes which are hard to fully control for. Differences in findings across studies may depend on differences in country coverage, sample periods, and indicators of liberalization (Eichengreen (2001), Edison et al. (2002)). Henry (2007) discusses the policy-experiment approach on the topic; however, natural experiments that can provide clean identification of the effects of liberalization policies remain quite rare. An exception is Chari and Henry (2004), who study stock market liberalizations which allow foreigners to purchase *selected* stocks in the local stock market.[9] Difference-in-differences methods are used to disentangle the effects of the liberalizations on investible versus non-investible firms. They find that the average stock price revaluation (for investible firms) that can be explained by improved risk-sharing is around 3.4 percent within one month following the liberalization.

Another literature that is related to this study revolves around the law of one price in financial markets. Lamont and Thaler (2003) summarize various event studies such as twin shares (e.g., Froot and Dabora (1999), Rosenthal and Young (1990)) and corporate spinoffs (e.g., Lamont and Thaler (2003)). They conclude that violation of the law is quite prevalent. Possible explanations include short sale constraints, and the risk of arbitraging due to the presence of "noise traders" (e.g., DeLong et al. (1990)). However, large price disparities between H-shares and A-shares are not surprising because the Mainland and Hong Kong markets have been segmented and they differ in numerous dimensions. The related literature is therefore focused on explaining the pattern and dynamics of preexisting price disparities. For instance, using weekly index-level data, Seasholes and Liu (2011) find that order imbalances can explain some of the changes in the price disparity between H-shares and A-shares. Liu and Seasholes (2011) analyze a quasi-experiment in which the short-sale ban is lifted for some Mainland stocks but not others. They find some preliminary evidence that the policy may help narrow the price disparity by enabling hedging by arbitrageurs.

This study combines the above two strands of literature by analyzing a natural experiment that can provide clean identification of the effects of equity market liberalization. The study does not focus on explaining the preexisting patterns of price disparities between A-shares and H-shares; instead it attempts to measure how well the liberalization can remove such price disparities. With more than 80 firms that are dual-listed in both markets, the

[9] In Forbes (2007), the imposition of Chilean capital control is universal, and the analysis is a before-and-after design.

evidence is constructed at the micro-level. The announcement of the pilot program is largely unanticipated, and there is only a six-month waiting period prior to implementation. The pilot program is unique as it liberalizes capital flow between two markets only. In addition, the news shock was sufficiently large such that the resulting sharp movement in prices allows the analysis to be conducted in a quasi-experimental setting using outcomes just before and after the announcement.[10]

3 Data

The raw data set consists of 84 companies which were concurrently listed in the Mainland and Hong Kong markets as of April 2014. The analysis sample consists of 81 companies after excluding one company which suspended trading during the sample period, and two broker firms whose businesses can benefit directly from the pilot program.[11] A complete list of companies is available in Supplemental Material. For each company, the key variables are the closing prices of its H-shares and A-shares on April 8, April 9, and April 10. In the analysis, both prices are expressed in Hong Kong dollars.[12] For firm i on day t, denote the closing price of its H-shares in the Hong Kong market and A-shares in the Mainland market by P_{Hit} and P_{Ait}, respectively. The *HA premium*, denoted by y_{it}, is defined as follows:

$$y_{it} \equiv \frac{P_{Hit}}{P_{Ait}} - 1. \tag{1}$$

A positive HA premium indicates that the price of H-shares is more expensive than A-shares; by contrast, a negative HA premium indicates that the price of H-shares is less expensive than A-shares.[13] Appendix Figure 1 plots the empirical distribution of the HA premium on April 9, which is one day before announcement. The average HA premium is -0.18, which implies that on average, a firm's H-shares are traded at a 18% discount to A-shares. There are 59

[10] We also analyze the effects over a longer horizon (weeks). See the Results section for more details.

[11] The stock codes in the Hong Kong market are 0317, 6030, and 6837.

[12] One Hong Kong dollar is approximately 0.129 US dollars. The price of A-shares is converted from Yuan into Hong Kong dollars using the concurrent exchange rate. One Hong Kong dollar is approximately 0.794 Yuan.

[13] In the literature, the price disparity is often expressed as an *AH premium* which is $P_{Ait}/P_{Hit} \times 100\%$. I define the price disparity as equation (1) instead because there are many companies whose H-shares are traded at a deep discount to A-shares. The empirical distribution of price disparities will be far less skewed if equation (1) is used.

companies whose H-shares are traded at a discount to A-shares. While there are 14 companies whose H-shares are traded at more than 50% discount to A-shares (i.e., $y_{it} \leq -0.5$), there is only one company whose H-shares are traded at more than 50% premium to A-shares (i.e., $y_{it} \geq 0.5$).

Summary statistics of the 81 dual-listed companies are provided in Table I. The first three rows of the Table summarize basic company characteristics on April 9. In the Hong Kong market, the average market capitalization is 51.2 billion Hong Kong dollars (6.6 billion USD), and the average dividend yield is 2.7 percent. Among the 74 companies which have a well-defined price-earnings ratio, the average is 22.1. The empirical distributions of market capitalization and price-earnings ratio are skewed, as the median values are only 9.7 billion HKD and 12.2, respectively.

Around midday on April 10, the pilot program, which was called "Shanghai-Hong Kong Stock Connect," was announced via a joint statement issued by the China Securities Regulatory Commission and the Securities and Futures Commissions of Hong Kong. As was evident from intraday prices (not shown), share prices of dual-listed companies, especially the ones with large preexisting price disparities, reacted strongly to the announcement.

Table I summarizes the HA premia of the dual-listed companies between April 8 and April 10. The average HA premium remained almost identical between April 8 and April 9. On April 10, the average HA premium narrowed by 1.2 percentage points from -0.179 to -0.167. A more striking comparison is that among companies with *negative* preexisting HA premium (on April 9), the average HA premium increased by 4 percentage points from -0.328 to -0.288; among companies with *positive* preexisting HA premium, the average HA premium reduced by 6.3 percentage points from 0.219 to 0.156. The above results indicate that the price disparity between H-shares and A-shares narrowed substantially upon the announcement of the pilot program.

Table I also summarizes the daily stock returns of H-shares and A-shares of dual-listed companies in the Hong Kong and Mainland markets on April 9 and April 10. On April 9, the price of H-shares in the Hong Kong market increased by an average of 0.31 percent, and the price of A-shares in the Mainland market increased by an average of 0.28 percent.[14] By

[14]The Hang Seng Index closed at 22596, 22843, and 23186 on April 8, April 9, and April 10, respectively. The Shanghai Stock Exchange Composite Index closed at 2098, 2105, and 2134, respectively.

contrast, on April 10, the price of H-shares in the Hong Kong market increased by an average of 7.64 percent, and the price of A-shares in the Mainland market increased by an average of 2.12 percent. Therefore, as a whole, the prices of both H-shares and A-shares of dual-listed companies reacted positively to the announcement.

The exact price responses depend on whether the company had a negative or positive preexisting HA premium. For instance, among companies with negative preexisting HA premium, the price of H-shares in the Hong Kong market increased by an average of 10.61 percent, and the price of A-shares in the Mainland market increased by merely 1.11 percent. Among companies with positive preexisting HA premium, the price of H-shares in the Hong Kong market reduced by an average of 0.30 percent, and the price of A-shares in the Mainland market increased by 4.82 percent.

4 Empirical Model and Results

To analyze the effect of the policy announcement, the following analytical framework is first considered:

$$\Delta y_{it} = \alpha + \beta y_{i,t-1} + \epsilon_{it}, \tag{2}$$

where

$$\Delta y_{it} \equiv y_{it} - y_{i,t-1}. \tag{3}$$

The dependent variable Δy_{it} denotes the difference in the HA premium of firm i between day t and day $t-1$. Denote the day of announcement by T, one day before announcement by $T-1$, and so on. Extensions of the above specification will be discussed later in this section.

Pre-Announcement Period. Consider two consecutive days before the announcement of the pilot program. A sufficient condition for the pre-announcement period to be considered as a control environment is that the HA premia of all firms in the sample should be very

similar between day $T-1$ and $T-2$, that is, $\Delta y_{i,T-1} \approx 0$ for all i.[15] Then, if there is a systematic change in the HA premia of all firms in the sample between day $T-1$ and T, we can attribute the change to the announcement of the pilot program.[16]

Figure 1a plots the HA premium of each firm on day $T-1$ versus the premium on day $T-2$. The data points align very well to the 45 degree line, which implies that the HA premia of all firms barely change between day $T-1$ and $T-2$. This is not surprising because in the absence of major institutional changes, the HA premium should be stable at least in the short run.

The invariability of the HA premium between day $T-1$ and $T-2$ is formally examined via equation (2). Column 1 of Table II reports estimates of the regression of $\Delta y_{i,T-1}$ on $y_{i,T-2}$. As expected, the intercept (α) and slope (β) coefficients are almost zero and are far from being statistically significant at the 10 percent level. In addition, the standard error of the regression, which is an estimate of the standard error of the error term $\epsilon_{i,T-1}$, is very small at 0.014. This implies that the HA premia of all firms remain roughly the same between day $T-1$ and $T-2$. There is very little dynamics in the premium between day $T-1$ and $T-2$.

Effect of News Announcement on Price Disparities. Now consider the day of news announcement (i.e., day T) and one day before the announcement (i.e., day $T-1$). If investors anticipate that the prices of H-shares and A-shares will converge, the news announcement should bring the HA premium closer to zero on day T. In particular, the premium should go up among firms with initial negative premium, and it should go down among firms with initial positive premium.

[15] To see this, consider a more general model which uses a difference-in-differences design and a panel dataset of two periods (t=T-1 or T):

$$\Delta y_{it} = \gamma_1 + \alpha \mathbf{1}\{t_i = T\} + \gamma_2 y_{i,t-1} + \beta \mathbf{1}\{t_i = T\} y_{i,t-1} + \mu_i + \epsilon_{it}, \tag{4}$$

where $\mathbf{1}\{t_i = T\}$ is an indicator variable that equals to 1 if the observation for firm i is in period T, and equal to zero otherwise; μ_i is the fixed effect for firm i. The main parameters of interest are α and β. If $\Delta y_{i,T-1} = 0$ for all i, we will have $\gamma_1 = \gamma_2 = \mu_i = 0$. Therefore, the model will reduce to a cross-sectional model in period T:

$$\Delta y_{iT} = \alpha + \beta y_{i,T-1} + \epsilon_{iT}, \tag{5}$$

which is the same as equation (2).

[16] The identification strategy requires that there are no other news on day T that narrows the HA premia of all firms in the same systematic manner. It is unlikely that such news exist.

Figure 1b plots the HA premium of each firm on day T versus the premium on day $T-1$. The data points form a strong positive relationship that is *flatter* than the 45 degree line, which implies that the HA premia of firms become closer to zero on day T. The deviation from the 45 degree line is too large to be explained by preexisting dynamics or random perturbation; for instance, the sample standard deviation of Δy_{iT} is 0.06, which is at least four times as large as the sample standard deviation of $\Delta y_{i,T-1}$ (which is 0.014).

The relationship is formally estimated and is reported in Column 2 of Table II, which comes from the regression of Δy_{iT} on $y_{i,T-1}$ (equation (2)). The slope coefficient is -0.168, and it is statistically significant at the 1 percent level. The negative slope coefficient suggests that firms with higher initial HA premium are subject to a larger reduction in the premium upon the news announcement.

Column 3 of Table II extends equation (2) with the following piecewise linear specification:

$$\Delta y_{iT} = \alpha_1 + \alpha_2 \mathbf{1}\{y_{i,T-1} > 0\} + \beta_1 y_{i,T-1} + \beta_2 \mathbf{1}\{y_{i,T-1} > 0\} y_{i,T-1} + \epsilon_{iT}, \tag{6}$$

where $\mathbf{1}\{y_{i,T-1} > 0\}$ is an indicator variable that equals 1 if $y_{i,T-1} > 0$, and equals zero otherwise. The model allows for a break in the intercept, and it allows the slope to differ depending on the sign of the preexisting HA premium. The results show that both the intercept coefficient (α_1) and differential intercept coefficient (α_2) are close to zero and statistically insignificant. Therefore, if the H-shares and A-shares of a firm had the same price before the announcement, the model predicts that no change in the premium will occur after the announcement. The slope coefficient (β_1) and differential slope coefficient (β_2) are -0.113 and -0.252, respectively, and both are statistically significant at the 1 percent level. The sample regression line is plotted in Figure 2, which also contains actual values from the data.

Both Figure 2 and the regression estimates indicate that the HA premium goes up among firms with negative preexisting premium, and it goes down among firms with positive preexisting premium. This is consistent with how the policy is predicted to narrow price disparities. Moreover, the absolute size of the adjustment depends on the sign of the initial HA premium – among firms with negative preexisting HA premium, the adjustment is larger by 1.13 percentage points per each 10-percentage-point reduction in the initial premium; by contrast, among firms with positive preexisting HA premium, the adjustment is larger by 0.113+0.252

= 3.65 percentage points per each 10-percentage-point increase in the initial premium.

Based on the sample regression line, it can be shown that upon the news announcement, the HA premium narrowed by an average of 13.5 percent among firms with negative preexisting premium, and the HA premium narrowed by an average of 25 percent among firms with positive preexisting premium. Among all firms, the HA premium narrowed by an average of 16.6 percent.

Is the Convergence Driven by Price Changes in Hong Kong or Mainland? The last two columns of Table II examine whether the change in the HA premium was mainly due to price changes in the Hong Kong market or the Mainland market.[17] Column 4 of Table II reports estimates of the regression which has the same regressors as equation (6), but uses the difference in the natural logarithm of the price in the Hong Kong market between day T and $T-1$ (i.e., $\Delta \ln P_{HiT} \equiv \ln P_{HiT} - \ln P_{Hi,T-1}$) as the dependent variable. Therefore, the dependent variable captures the relative price change of H-shares between day T and $T-1$. The sample regression line and the actual values in the data are given in Figure 3a.

The results suggest that only firms with a negative preexisting HA premium are subject to price increases in the Hong Kong market. The regression estimates suggest that among these firms, the price increase of H-shares is larger by 3.01 percent per each 10-percentage-point reduction in the initial HA premium. This can translate to a large price revaluation; for instance, if H-shares were one-third cheaper than A-shares, the predicted price increase of H-shares will be 10 percent within the same day of announcement. Surprisingly, firms with positive preexisting HA premium do not experience price reductions in the Hong Kong market; although their H-shares are more expensive than A-shares, the prices of H-shares remain largely unchanged upon the news announcement.

Column 5 of Table II has a similar specification to Column 4, but uses the difference in the natural logarithm of the price in the Mainland market between day T and $T-1$ (i.e., $\Delta \ln P_{AiT} \equiv \ln P_{AiT} - \ln P_{Ai,T-1}$) as the dependent variable.[18] Therefore, the dependent variable captures the relative price change of A-shares between day T and $T-1$. The sample

[17] In both columns, firms whose H-share price increased by more than 35 percent are excluded from the sample. There are four such firms in the sample.

[18] In the Mainland market, a stock will suspend trading for the rest of the day if the price increases by more than 10 percent. There are three such stocks in the sample.

regression line and the actual values in the data are given in Figure 3b.

The most striking result is that the pattern in Figure 3b is a mirror image of Figure 3a. Only firms with positive preexisting HA premium are subject to significant price increases in the Mainland market. Moreover, among these firms, the price increase is larger by 0.09 + 2.19 = 2.28 percent per each 10-percentage-point increase in the initial HA premium. By contrast, firms with negative preexisting HA premium are not subject to share price reductions in the Mainland market.

The above results are striking as they indicate that the price disparity between both markets diminishes primarily through stock price increases in the market that trades the stock at a relative discount. If the initial HA premium is negative, the price of H-shares in the Hong Kong market will move up but the price of A-shares in the Mainland market will remain largely unchanged. Similarly, if the initial HA premium is positive, the price of A-shares in the Mainland market will move up but the price of H-shares in the Hong Kong market will remain largely unchanged. This finding is surprising because the Hong Kong and Mainland markets are different in numerous institutional aspects, and yet the price movements are symmetric.[19] The initial stock market responses also seem to suggest that the equilibrium price of dual-listed shares can be closer to the H-share or A-share price, whichever is higher.

Sensitivity Analysis. The results above indicate that the size of the preexisting HA premium is a strong factor of price movements of dual-listed shares upon the policy announcement. Table III examines whether the effect of the policy announcement also depends on other factors. In the table, the set of regressors in equation (6) is expanded to include the natural logarithm of market capitalization of firm i in the Hong Kong market on day $T-1$ (in billion Hong Kong dollars), the firm's dividend yield (in percent), and the interactions of both regressors with the initial HA premium. In particular, if the interaction terms are statistically significant, this will imply that other factors play a role in reinforcing or dampening price convergence. The model is estimated using: (1) the full sample; (2) a subsample

[19] One institutional difference is short-sale constraints, which are less significant in the Hong Kong market than in the Mainland market. However, if short-sale constraints are nonsubstantial in the Hong Kong market, the price of H-shares should drop upon the news announcement if H-shares was trading at an initial premium to A-shares. Further discussion is provided at the end of this section.

consisting of firms with positive dividend yield only; (3) a subsample consisting of firms with a market capitalization of at least one billion HKD in the Hong Kong market; (4) a subsample consisting of firms concurrently listed in the Shanghai (instead of Shenzhen) and Hong Kong markets.

In all four regressions, the additional regressors are all statistically insignificant at the 10 percent level. This implies that the size of the preexisting price disparity is the predominant factor in driving price convergence upon the news announcement. In addition, the effects remain quantitatively similar to Table II – the intercept coefficients (α_1, α_2) are close to zero, and the slope coefficients for the preexisting HA premium (β_1, β_2) are similar in size to Table II. In particular, results from regression (4) indicate that firms listed in the Shenzhen market are also subject to the same price convergence even though the Shenzhen market is not involved in the pilot program. This suggests that investors anticipate liberalization of capital control to take place in the Shenzhen market as well.

Effects over a Longer Time Horizon. Data from a longer horizon is used for examining whether the price disparity continues to narrow beyond the day of announcement. Table IV reports the estimation results based on data from three weeks after the announcement (April 30).[20] Column 1 of Table IV uses the difference in HA premium between April 30 and April 9 as the dependent variable (i.e., $y_{i,T+21} - y_{i,T-1}$). The results are quantitatively similar to Column 3 of Table II, which suggests that the policy causes a sharp adjustment in the HA premium on the first day of announcement, but the price disparity does not narrow further subsequently. Interestingly, while the actual degree of price convergence (up to April 30) are more dispersed around the sample regression line among firms with negative preexisting HA premium, the model still closely predicts the degree of price convergence among firms with positive preexisting HA premium (Appendix Figure 2).

Columns 2 to 5 of Table IV investigate whether the price convergence up to April 30 is driven by price changes in the Hong Kong market or the Mainland market. In Columns 2 and 3, the difference in the log price of H-shares between April 30 and April 9 is used as the dependent variable (i.e., $\ln P_{Hi,T+21} - \ln P_{Hi,T-1}$).[21] Estimates from linear and piecewise

[20] Results from a shorter horizon, e.g., two weeks after the announcement, are qualitatively similar and not reported. The results are available upon request.

[21] The measure is normalized with respect to changes in the Hang Seng Index, which dropped by 4.5 percent

linear specifications are reported.

The results indicate that H-shares in the Hong Kong market are still subject to larger price increases if they were initially traded at a deeper discount to A-shares. This is consistent with findings in Table II. However, unlike Table II, firms with positive preexisting HA premium are subject to *reductions* in the H-share price (see also Appendix Figure 3a). Therefore, if H-shares were initially traded at a premium to A-shares, the price of H-shares will not react instantly upon the announcement but may eventually move down as time progresses.

Results regarding the Mainland market are reported in Columns 4 and 5, which use the difference in the log price of A-shares between April 30 and April 9 as the dependent variable (i.e., $\ln P_{Ai,T+21} - \ln P_{Ai,T-1}$).[22] Estimates from linear and piecewise linear specifications are reported. Contrary to Table II, the results suggest a weak positive relationship between the preexisting HA premium and A-share price movement. In addition, a significant number of firms with negative preexisting HA premium are subject to price reductions in A-shares (Appendix Figure 3b).

To summarize, the above findings indicate that the price disparity between H-shares and A-shares does not narrow further beyond the day of announcement. Although the HA premium does not change subsequently, prices of H-shares and A-shares evolve over time, and they may move down to various degrees if the shares were initially traded at a premium to the other market.

5 Summary and Discussion

This paper uses a recent pilot program in China to analyze the effects of capital control liberalization on two important equity markets. The pilot program, which partially liberalizes capital flow between Hong Kong and Shanghai stock exchanges, allow the effects to be measured in a natural experiment setting at a microeconomic level. Since dual-listed shares are prevalent in both markets and have identical dividend and voting rights, they are ideal for isolating the effects of capital control on segmentation and price disparities between both markets. The results have wide implications as capital account liberalization is often

during the period.

[22]The measure is normalized with respect to changes in the SSE Composite Index, which dropped by 5 percent during the period.

associated with financial crises and instability in emerging markets (e.g., Prasad and Rajan (2008)). This study also provides micro-level evidence that is much needed for understanding the link between capital account liberalizations and improved allocative efficiency, which are closely related to the cost of capital in the economy and economic development.

The following findings are established. The announcement of the pilot program caused a sharp reduction in the price disparity of dual-listed shares between the Hong Kong and Mainland markets. As a whole, the price disparity narrowed by an average of 16.6 percent within the same day of announcement. Moreover, among dual-listed firms whose shares in the Hong Kong market were traded at a premium to shares in the Mainland market, the price disparity narrowed by 25 percent. For other firms, the price disparity narrowed by 13.5 percent. The price disparity did not narrow further over time according to data from up to three weeks after the announcement. The price convergence was initially triggered by a pure upward revaluation of share prices; however, as time progresses, price convergence began to consist of both upward and downward revaluations of share prices.

The price convergence was notable given the relatively small size of the pilot program. This indicates that investors anticipate capital control liberalization that is above and beyond the current scale of the program. In this regard, the results may represent a lower bound of the total effect of capital control in China. When other potential future policies start to unwind and their uncertainties removed, further reductions in price disparities should be expected. The results also suggest that the implementation (or announcement) of a policy may have large repercussions, as it may change agents' expectations regarding the trajectory of further policy developments. If such expectations are neglected in the analysis, we may form a biased estimate of the effects of the initial policy. Both considerations are potentially important for emerging markets, where policy development is subject to a substantial degree of uncertainty.

The initial upward revaluation of share prices is somewhat surprising given that H-shares and A-shares of dual-listed firms have identical dividend and voting rights. This phenomenon is unlikely to be caused by risk-sharing between agents in Mainland and foreign markets; for instance, for Hong Kong investors, there is little extra diversification benefit by holding A-shares in the Mainland market as they are highly correlated with H-shares in the Hong Kong market. The observed symmetry in price movements is also interesting, as the Mainland and

Hong Kong markets are very different institutionally. For instance, if share prices in the Hong Kong market are determined internationally, they should remain relatively stable upon the policy announcement. Alternatively, if short sale constraints are less substantial in the Hong Kong market, prices of H-shares should have a larger tendency to drop if they were traded at an initial premium to A-shares in the Mainland market. The data finds mixed evidence regarding both hypotheses.

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TABLE I

SUMMARY STATISTICS[a]

	Mean	Std. dev.
Full sample:		
HK Market capitalization (in billion HKD)	51.176	162.057
Price-earnings ratio[b]	22.077	34.159
Dividend yield (%)	2.703	2.416
HA premium[c]		
April 8, 2014	-0.180	0.318
April 9, 2014	-0.179	0.319
April 10, 2014	-0.167	0.267
Daily return		
April 9, 2014, Hong Kong market (%)	0.314	1.541
April 10, 2014, Hong Kong market (%)	7.643	11.483
April 9, 2014, Mainland market (%)	0.283	1.019
April 10, 2014, Mainland market (%)	2.120	2.673
Stocks with Negative HA premium on April 9, 2014: [d]		
HA premium		
April 8, 2014	-0.327	0.229
April 9, 2014	-0.328	0.228
April 10, 2014	-0.288	0.203
Daily return		
April 9, 2014, Hong Kong market (%)	0.203	1.659
April 10, 2014, Hong Kong market (%)	10.607	12.146
April 9, 2014, Mainland market (%)	0.329	1.035
April 10, 2014, Mainland market (%)	1.113	1.348
Stocks with positive HA premium on April 9, 2014: [e]		
HA premium		
April 8, 2014	0.213	0.133
April 9, 2014	0.219	0.130
April 10, 2014	0.156	0.085
Daily return		
April 9, 2014, Hong Kong market (%)	0.612	1.150
April 10, 2014, Hong Kong market (%)	-0.304	2.007
April 9, 2014, Mainland market (%)	0.159	0.988
April 10, 2014, Mainland market (%)	4.820	3.421

a There are 81 companies in the sample.

b Stocks with positive earnings in the most recent financial year only (N=74).

c The formula is P_H/P_A - 1. Both H-share and A-share prices are expressed in Hong Kong dollars. A positive premium implies that H-shares are more expensive. A negative premium implies that A-shares are more expensive.

d There are 59 stocks in this category.

e There are 22 stocks in this categoy.

TABLE II

MAIN RESULTS[a]

Dependent variable:	$\Delta y_{i,T-1}$	Δy_{iT}	Δy_{iT}	$\Delta \ln P_{HiT}$	$\Delta \ln P_{AiT}$
	(1)	(2)	(3)	(4)	(5)
Intercept	0.001	-0.018 ***	0.003	-0.013 **	0.119 ***
	(0.002)	(0.003)	(0.005)	(0.006)	(0.003)
$y_{i,T-2}$	0.002				
	(0.005)				
$y_{i,T-1}$		-0.168 ***	-0.113 ***	-0.301 ***	0.009
		(0.009)	(0.011)	(0.018)	(0.008)
$1\{y_{i,T-1}>0\}$			0.014	0.016	-0.015 **
			(0.010)	(0.012)	(0.006)
$y_{i,T-1} \times 1\{y_{i,T-1}>0\}$			-0.252 ***	0.272 ***	0.219 ***
			(0.035)	(0.046)	(0.023)
R-squared	0.002	0.807	0.894	0.859	0.789
Standard error of regression	0.014	0.026	0.020	0.025	0.012
Number of observations	81	81	81	77	77

a The HA premium of firm i on day t is denoted by y_{it}. The difference in HA premium of firm i between day t and t-1 is denoted by Δy_{it}. The closing share prices of firm i on day t in the Hong Kong and Mainland markets are denoted by P_{Hit} and P_{Ait}, respectively. The subscript T denotes April 10, 2014. Standard errors are given in parentheses. *, Significant at the 10 percent level; **, significant at the 5 percent level; ***, significant at the 1 percent level.

TABLE III

SENSITIVITY ANALYSIS: PRICE CONVERGENCE IS DUE TO PREEXISTING PRICE DISPARITY

Dependent variable: Δy_{iT}	(1)	(2)	(3)	(4)
Intercept	-0.007	-0.005	-0.011	-0.100
	(0.008)	(0.010)	(0.008)	(0.009)
$y_{i,T-1}$	-0.134 ***	-0.139 ***	-0.163 ***	-0.139 ***
	(0.169)	(0.023)	(0.025)	(0.018)
$1\{y_{i,T-1}>0\}$	0.018	0.018	0.017	0.018
	(0.013)	(0.013)	(0.013)	(0.012)
$y_{i,T-1} \times 1\{y_{i,T-1}>0\}$	-0.205 ***	-0.196 ***	-0.198 ***	-0.168 ***
	(0.046)	(0.050)	(0.046)	(0.048)
ln(market capitalization)	0.003	0.003	0.003	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
ln(market capitalization) $\times$ $y_{i,T-1}$	-0.008	-0.011	0.000	-0.010
	(0.006)	(0.007)	(0.009)	(0.007)
Dividend yield (percent)	-0.007	-0.001	-0.001	-0.007
	(0.001)	(0.001)	(0.001)	(0.001)
Dividend yield (percent) $\times$ $y_{i,T-1}$	0.001	0.003	0.002	0.000
	(0.004)	(0.005)	(0.005)	(0.004)
R-squared	0.901	0.908	0.900	0.906
Standard error of regression	0.020	0.020	0.019	0.018
Sample used	Full sample	Firms with positive dividend yield	Firms with at least HK$1b market capitalization in HK market	Firms that are listed in Shanghai and HK markets
Number of observations	81	65	72	65

a The HA premium of firm i on day t is denoted by y_{it}. The difference in HA premium of firm i between day t and t-1 is denoted by Δy_{it}. The subscript T denotes April 10, 2014. Standard errors are given in parentheses. *, Significant at the 10 percent level; **, significant at the 5 percent level; ***, significant at the 1 percent level.

TABLE IV

THREE WEEKS AFTER ANNOUNCEMENT: PRICE DISPARITY
DOES NOT NARROW FURTHER, BUT SHARE PRICES MAY EVOLVE DIFFERENTLY[a]

Dependent variable:	$y_{i,T+21} - y_{i,T-1}$	$\ln P_{Hi,T+21} - \ln P_{Hi,T-1}$	$\ln P_{Hi,T+21} - \ln P_{Hi,T-1}$	$\ln P_{Ai,T+21} - \ln P_{Ai,T-1}$	$\ln P_{Ai,T+21} - \ln P_{Ai,T-1}$
	(1)	(2)	(3)	(4)	(5)
Intercept	-0.004	-0.022 ***	-0.048 ***	0.005	-0.019
	(0.009)	(0.007)	(0.013)	(0.006)	(0.012)
$y_{i,T-1}$	-0.089 ***	-0.163 ***	-0.236 ***	0.056 ***	-0.008
	(0.022)	(0.022)	(0.038)	(0.019)	(0.033)
$1\{y_{i,T-1}>0\}$	-0.002		0.043		0.033
	(0.019)		(0.027)		(0.023)
$y_{i,T-1} \times 1\{y_{i,T-1}>0\}$	-0.261 ***		0.062		0.075
	(0.069)		(0.100)		(0.087)
R-squared	0.688	0.423	0.464	0.104	0.167
Standard error of regression	0.039	0.056	0.055	0.049	0.048
Number of observations	81	77	77	77	77

a The HA premium of firm i on day t is denoted by y_{it}. The closing prices of firm i on day t in the Hong Kong and Mainland markets are denoted by P_{Hit} and P_{Ait}, respectively. The subscript T+21 denotes April 30, 2014; T-1 denotes April 9, 2014. Standard errors are given in parentheses. *, Significant at the 10 percent level; **, significant at the 5 percent level; ***, significant at the 1 percent level.

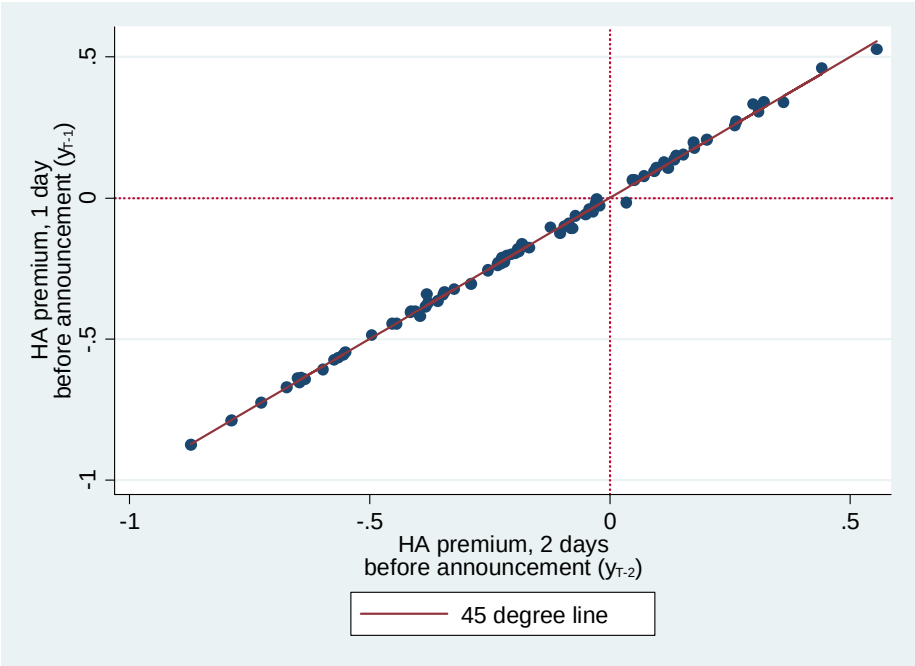


FIGURE 1(a). -- Price Disparity between H-shares and A-shares Remained Stable during the Pre-Announcement Period.

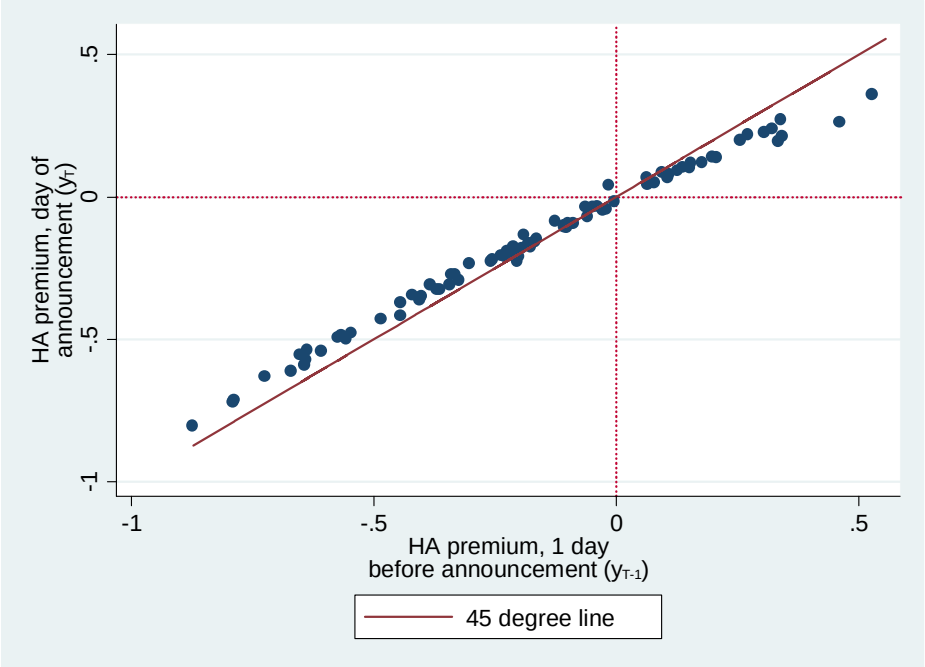


FIGURE 1(b). -- Price Disparity between H-shares and A-shares Narrowed upon Announcement of the Pilot Program.

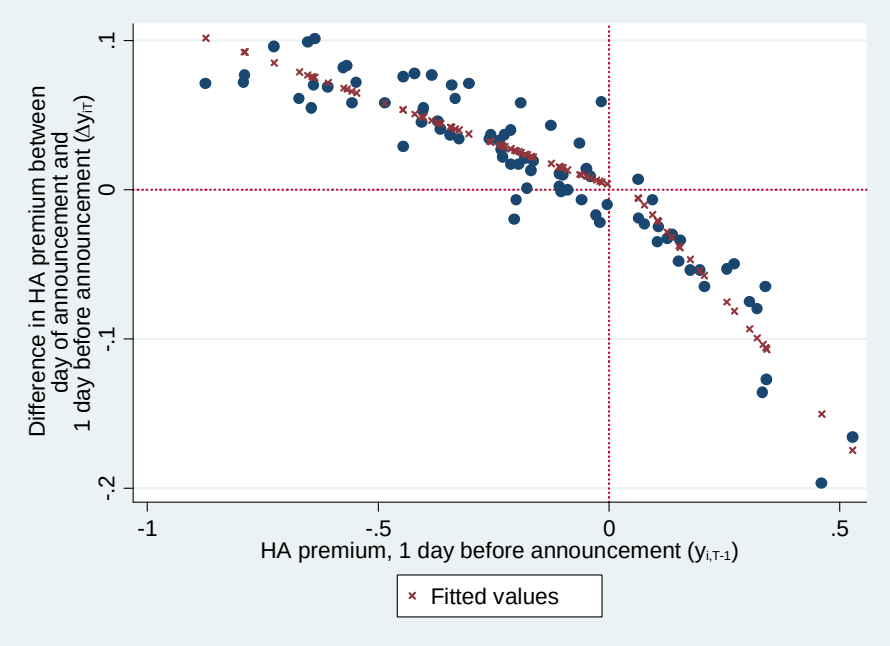


FIGURE 2. -- Price Convergence is Directly Proportional to Preexisting Price Disparity.

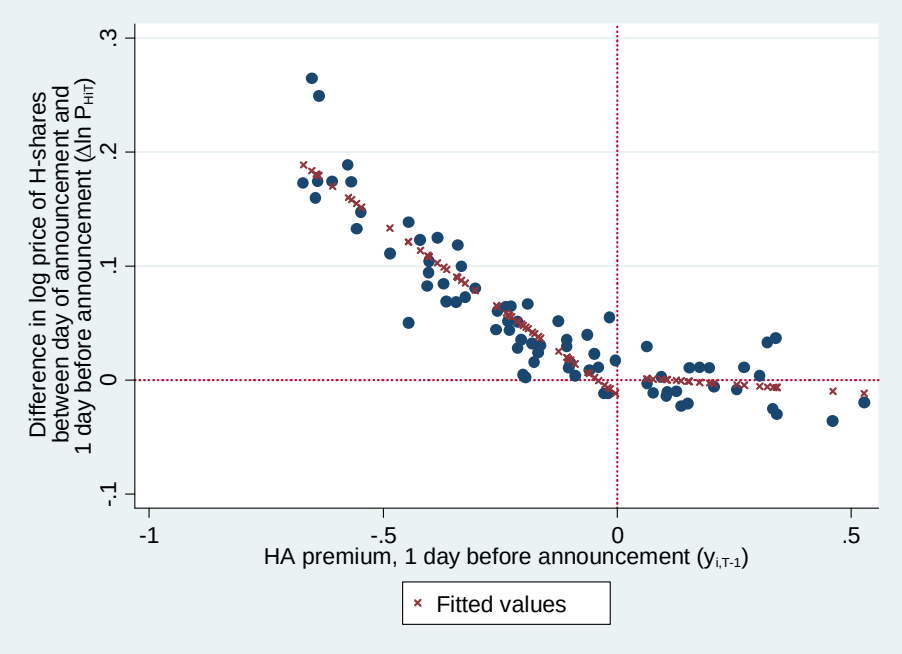


FIGURE 3(a). -- Effect on H-Share Price as a Function of Preexisting Price Disparity.

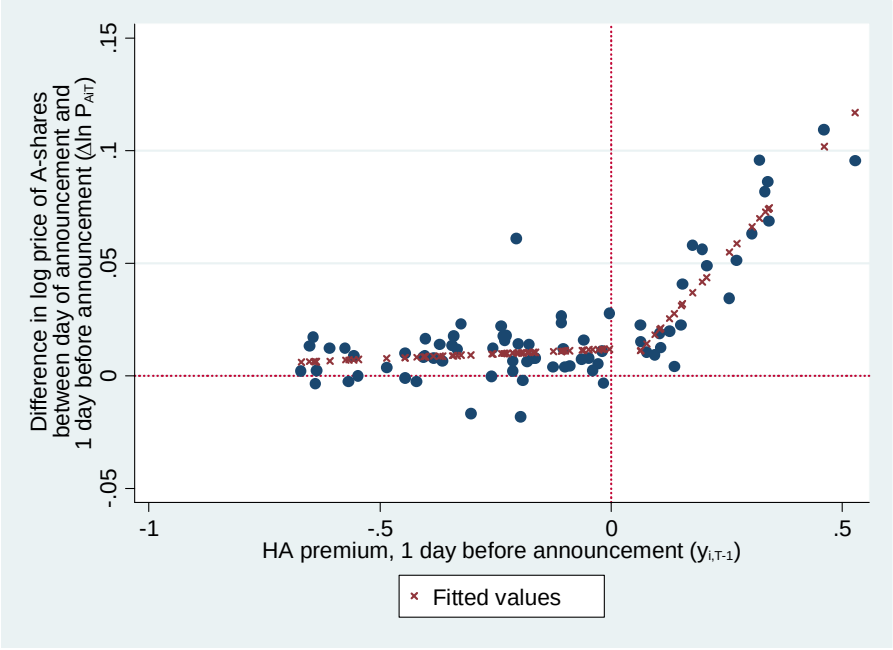
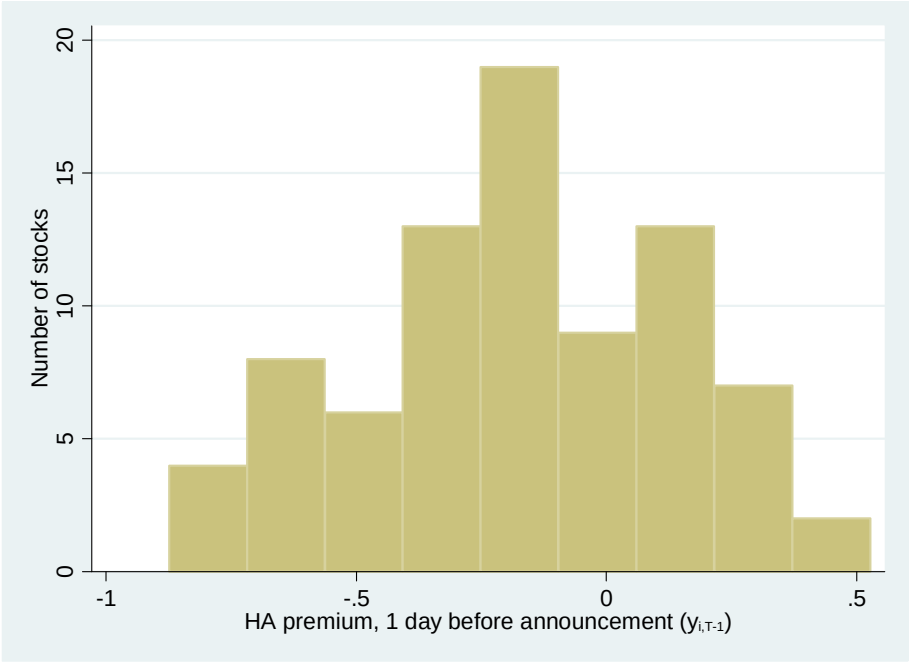
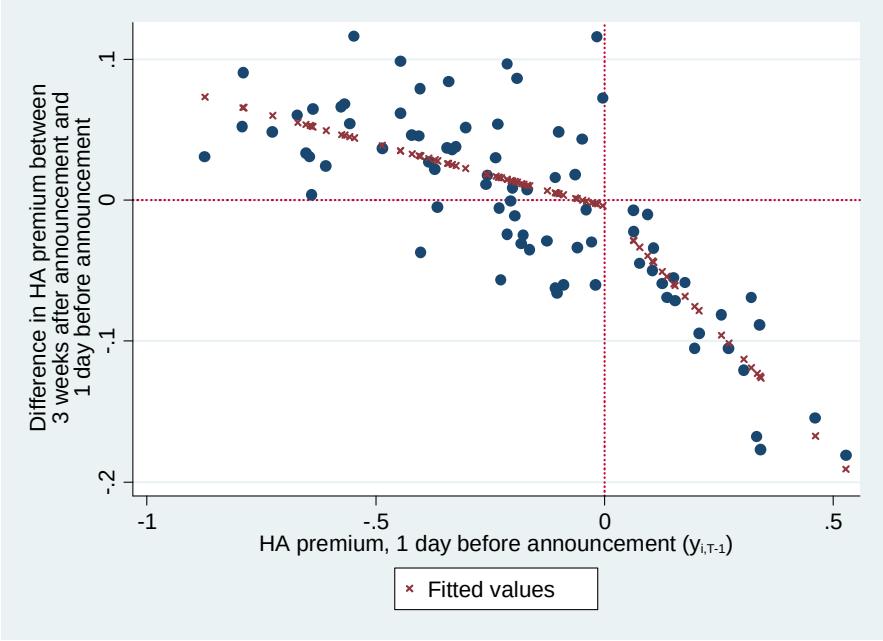


FIGURE 3(b). -- Effect on A-Share Price as a Function of Preexisting Price Disparity.

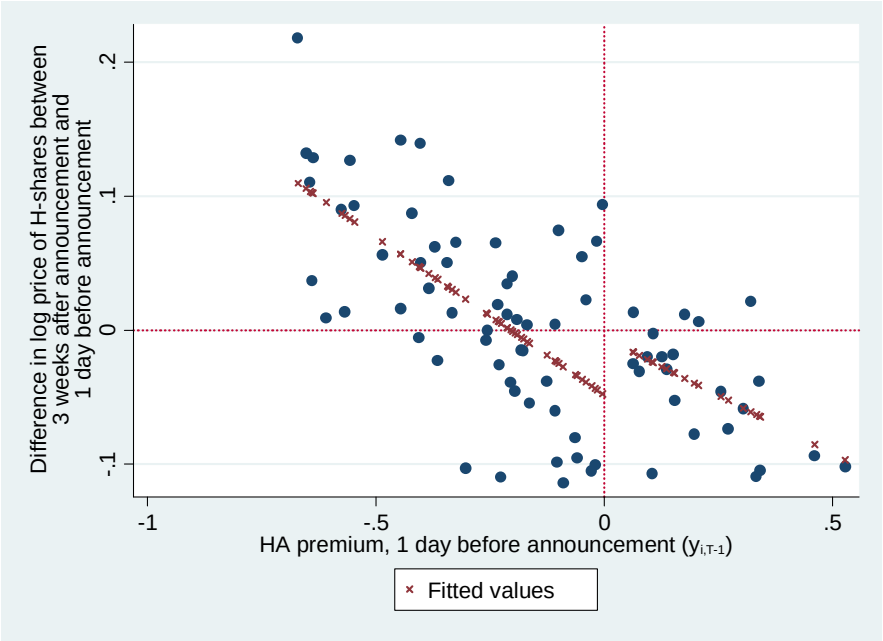
APPENDIX FIGURES



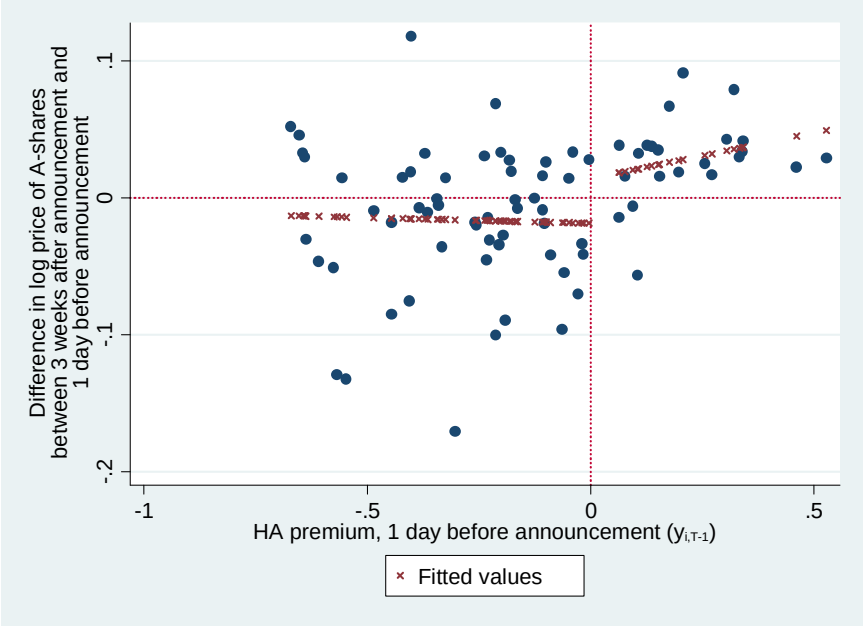
Appendix Figure 1. -- Empirical Distribution of Price Disparity Prior to Program Announcement.



Appendix Figure 2. -- Price Convergence at Three Weeks after Announcement.



Appendix Figure 3(a). -- Effect on H-Share Price at Three Weeks after Announcement.



Appendix Figure 3(b). -- Effect on A-Share Price at Three Weeks after Announcement.