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Mark K. Chan & Simon Kwok

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Marc K. Chan
University of Technology, Sydney

Simon Kwok
The University of Sydney *

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Abstract

We use longitudinal data on stock prices of cross-listed firms to investigate abnormal systematic changes in the price disparity of cross-listed stocks between the Hong Kong and Shanghai exchanges from 2002 to 2014. We identify a liberalization policy that generated an unprecedented abrupt convergence in price disparity. The policy, known as *Shanghai-Hong Kong Stock Connect*, serves to lower the capital control barrier of cross-market investment between both markets. In a quasi-experimental setup, we find that the announcement of the policy caused the price disparity between cross-listed shares in both markets to reduce by one-sixth. The magnitude of the effect was the largest since 2002, and was seven standard deviations away from the historical average. We also find that the convergence was asymmetric, and the convergence was driven by an upward revaluation of share prices.

JEL CLASSIFICATION: F36, G18

Keywords: Capital account liberalization, Chinese financial market, law of one price, cross-listed shares, natural experiment

*Chan: Economics Discipline Group, University of Technology Sydney, PO Box 123, Broadway NSW 2007 Australia; Email: marc.chan@uts.edu.au. Kwok: School of Economics, Merewether Building, The University of Sydney, NSW 2006 Australia; Email: simon.kwok@sydney.edu.au.

1 Introduction

Although the capital account of China has remained relatively closed since economic reform started in the late 1970s, the country's reform agenda has recently included ambitious plans to liberalize its financial system. The liberalization of capital control can lead to substantial revaluation of equity prices in the Chinese financial market. Since equity prices are inversely related to the cost of (equity) capital, liberalization can exert influences on wider aspects of economic welfare (Henry (2007)). The prevalence of cross-listed firms, which constitute a sizable proportion of the total market capitalization, has also made the China's financial market a particularly interesting object of study. These firms are concurrently listed on mainland and Hong Kong markets (as *A-shares* and *H-shares*, respectively), and their widely varying price disparities have been one of the most interesting puzzles in the Chinese financial market. The cross-listed firms provide a natural experiment setting that allows researchers to evaluate the impact of capital account liberalization on financial markets.

Using longitudinal data on stock prices of cross-listed firms, we investigate whether there were abnormal systematic changes in the price disparity of cross-listed stocks between the Hong Kong and Shanghai markets during the period from 2002 to 2014. From the data we identify a liberalization policy that generated an unprecedented abrupt reduction in price disparity. The policy, known as *Shanghai-Hong Kong Stock Connect*, serves to lower the capital control barrier of cross-market investment between Hong Kong and Shanghai's stock markets. In a quasi-experimental setup, we find that the announcement of the policy caused the price disparity between cross-listed shares in both markets to reduce by an average of one-sixth. The magnitude of the effect was the largest since 2002, and was seven standard deviations away from the historical average. Interestingly, we also find that the price disparity tended to reduce more among firms whose H-shares were traded at a premium to A-shares. In addition, the reduction in price disparity was primarily driven by an upward revaluation of share prices.

The next section further discusses the motivation of our paper and its relationship with the literature. Section 3 presents evidence from longitudinal data regarding the overall pattern of changes in price disparity from 2002 to 2014, and potential anomalies. Section 4 provides a brief summary of the policy background related to *Shanghai-Hong Kong Stock Connect*.

Section 5 presents further analysis on the effect of the policy, and section 6 concludes.

2 Related 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)).[1]. 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.[2]

A major 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 concurrent 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)). 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. A possible exception is Chari and Henry (2004), who study stock market liberalizations which allow foreigners to purchase *selected* stocks in the local stock market. Difference-in-differences methods are used to disentangle the effects of the liberalizations on investible versus non-investible firms. They find that the average

[1]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

[2]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.

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. However, investible firms often differ greatly from non-investible firms in various dimensions, and governments may endogenously select firms to be investible internationally.

Another literature that is related to this study revolves around the law of one price in financial markets.[3] In the literature of Chinese financial markets, Bailey (1994) did a pioneering study on the price disparity between A and B shares, but both types of shares are listed in the Mainland market. By contrast, 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 of preexisting price disparities, and a subset of the literature also discusses the relationship between price disparities and earlier episodes of capital account liberalization (e.g., Su et al. (2007), Cai et al. (2011), Seasholes and Liu (2011), Choi et al. (2013), Doukas and Wang (2014)). These studies usually focus on either the cross-sectional and time-series evidence, and very few consider both perspectives of the problem.

3 Pattern of Changes in Price Disparity, 2002-2014

To form our preliminary analysis, we obtain a longitudinal sample of cross-listed stocks on each day from January 4, 2002 to September 2, 2014. For each firm that has been concurrently listed in the Shanghai and Hong Kong markets during the sample period, we collect the daily dividend-adjusted closing prices of its A-shares (in the Shanghai market) and H-shares (in the Hong Kong market).[4] The prices are expressed in Hong Kong dollars using the contemporaneous exchange rate between the Hong Kong dollar and Chinese Yuan. Denote firm i's A-share price on day t by P_{Ait}, and its H-share price by P_{Hit}. The HA

[3] For instance, 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)). These studies usually focus only on one pair of twin shares because of their rarity in markets. The authors 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)).

[4] At the beginning of the sample period there were 14 cross-listed firms. The number of cross-listed firms grew slowly to 20 in late 2005, increased sharply to around 40 in 2008, and then increased gradually to 60 in 2014.

premium, denoted by y_{it}, is defined as a measure of price disparity 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.

We are primarily interested in the average change of price disparity across all cross-listed firms for each day in the sample period. To weed out firm-level idiosyncratic shocks, the following simple analytical framework is considered:

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

where $\Delta y_{it} \equiv y_{it} - y_{i,t-1}$ represents the change in the HA premium of firm i between day t and day $t-1$. The regression coefficient β_t represents the average change in the level of HA premium today for a given level of HA premium on the previous day; it could thus be interpreted as the average speed of HA premium adjustment among the cross-listed firms on day t. In particular, if there is systematic convergence in HA premium across firms on day t as opposed to day $t-1$, the slope coefficient β_t will be negative. We perform a separate regression in equation (2) for each day in the sample period, and the estimate of β_t is plotted in Figure 1.[5] The grey region in the figure denotes the 95-percent confidence region for β_t.

Figure 1 shows that the coefficient estimates for β_t generally lie within the region between -0.1 and +0.1, with a very small number of exceptions. The coefficient estimate is subject to more variation between 2002 and 2008, which is partly due to a smaller number of cross-listed firms during that period. Interestingly, an unusually large negative spike occurs on April 10, 2014. The coefficient estimate is seven standard deviations from the sample mean (-0.0021).

Figure 2 plots the t-statistic for β_t, which is defined as the ratio between the coefficient estimate and its standard error. The t-statistic adjusts for the effect of sample size and estimation error. While the earlier spikes have diminished in size, the large negative spike in

[5] Our estimates are robust to outliers. In addition to the normal procedure of inspection, for each day in the sample period we remove potential outliers using the method of inter-quartile range (1.5 × IQR rule) on $y_{i,t-1}$.

2014 stands out even more, with a t-statistic of -17. Figure 3 plots the R-squared measure for equation (2). The R-squared on April 10, 2014 is 0.84, which is consistent with a systematic change in the price disparity across all firms, and a large negative t-statistic. By contrast, the R-squared measures for other days in the sample period are generally lower than 0.6, and tend to be rather low in recent years.

The next two figures present further evidence on the changes in price disparity between 2002 and 2014. Figure 4 plots the coefficient estimates of β_t versus the values of the t-statistic. As expected, the coefficient estimates and the t-statistics are positively correlated. The estimation result for April 10, 2014 is given by the far outlier on the lower left of the graph, which indicates an abnormal and significant reduction in the price disparity. Figure 5 plots the estimates of α_t versus β_t. While almost all the points form a cluster along the 45-degree line, the point that corresponds to April 10, 2014 is given by the outlier on the left side of cluster, with an intercept coefficient estimate that is close to zero.

From Figures 1 and 2, the time series plots of β_t estimates and the t-statistics show that the speed of HA premium adjustment fluctuates frequently over time. It is remarkable that fluctuations of a similar degree tend to cluster over different time periods. In particular, more pronounced premium adjustments tend to occur around crisis or recession periods, while smaller adjustments are observed over normal periods. To investigate the time-series patterns further, we fit a GARCH (1,1) model as follows:

$$\beta_t = \mu + \sigma_t u_t, \qquad \sigma_t^2 = \omega + a\beta_{t-1}^2 + b\sigma_{t-1}^2, \tag{3}$$

where u_t is an innovation with mean zero and variance 1. We estimate the model for the time series of β_t estimates and t-statistics, respectively, and the results are reported in Table I. Indeed, we found a strong GARCH effect on the speed of HA premium adjustment parameter. This result confirms that the HA premium adjustment dynamics are highly persistent over time. Against the persistently quiet backdrop in the preceding period, the sharp spike in the β_t estimate (and its t-statistic) on April 10, 2014 looks all the more peculiar.

4 Policy Background

Before investigating the data further, we present a summary of the policy background that is related to the empirical results. On April 10, 2014, China announced a pilot program, known as *Shanghai-Hong Kong Stock Connect*, 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). The above quotas represent 2 and 1.6 percent of the total market capitalization in the Shanghai and Hong Kong stock exchanges, respectively. The daily quotas in the Shanghai and Hong Kong markets are 10.5 and 13 billion yuan, respectively, and represent approximately one-fifth of the daily turnover in each market.

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.[6] The pilot program is similar in size to QFII and QDII programs, and it was scheduled to be launched in six months. It 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.[7]

Both 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 prevalence of cross-listed firms provides a natural experiment setting that allows us to investigate how the program can affect equity

[6]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.

[7]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.

prices in both financial markets. Cross-listed shares play an increasingly important role in the Mainland and Hong Kong markets. In 2014, the market capitalization of cross-listed A-shares and H-shares constitutes 50 and 18 percent of the total market capitalization of the Mainland and Hong Kong markets, respectively. 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. However, it is widely documented that large price disparities often exist between cross-listed A-shares and H-shares. For instance, in early 2014, one-third of the cross-listed companies had A-shares that were at least 50 percent more expensive than H-shares. 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 cross-listed companies following the announcement. In addition, the degree of convergence should be proportional to the magnitude of the preexisting price disparity between A-shares and H-shares.

5 Further Investigation on the Data

Was the unusual change in the price disparity on April 10, 2014 an artifact of the data? We first present summary statistics of the 84 companies that were concurrently listed in the Mainland and Hong Kong markets as of April 2014.[8] The analysis sample consists of 81 companies after excluding one firm which suspended trading during the sample period, and two broker firms whose businesses can benefit directly from the pilot program. For each firm, the key variables are the closing prices of its H-shares and A-shares on April 8, April 9, and April 10. Both prices are expressed in Hong Kong dollars. The average HA premium on April 9 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 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, there is only one firm whose H-shares are traded at more than 50% premium to A-shares.

Summary statistics of the 81 cross-listed companies are provided in Table II. The first

[8]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. In the baseline analysis below, we include cross-listed firms from both markets. We also carry out the analysis excluding firms listed in the Shenzhen market, but the results are very similar (see sensitivity analysis below).

three rows of the table summarize basic firm 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 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 cross-listed companies, especially the ones with large preexisting price disparities, reacted strongly to the announcement. The table also summarizes the HA premia of the cross-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 II also summarizes the daily stock returns of H-shares and A-shares of cross-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.[9] By 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 cross-listed companies reacted positively to the announcement. The exact price responses depend on whether the firm 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

[9]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.

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.

The empirical approach that we pursue below resembles a quasi-experimental design. To motivate the discussion, consider a longitudinal data set that includes up to T days before the announcement of the pilot program. Denote the first period of the sample by $t = 0$, and denote the day of announcement by T. Consider the following difference-in-differences model:

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

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. In this difference-in-differences set up, the pre-announcement period represents the benchmark control environment. The day of announcement consists of firms with heterogeneous treatment, where the preexisting price disparity just before the announcement ($y_{i,T-1}$) represents the strength of the treatment. The key parameters of interest are the differential intercept and slope parameters α and β, respectively, which identify the effect of the policy announcement. In particular, we expect α to be close to zero and, in particular, β to be negative.

It can readily be shown that if $|\Delta y_{it}| << |\Delta y_{iT}|$ for $t \neq T$, the parameters γ_1 and γ_2 will be close to zero, which implies that the model can be simplified to the following form:

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

Since the time-series evidence strongly supports this assumption, we will adopt the above equation as the main empirical specification in practice. To illustrate the validity of the assumption, we apply the above specification to the pre-announcement period as a "placebo." For instance, consider Figure 6, which plots the HA premium of each firm on day $T-1$ (April 9, 2014) versus the premium on day $T-2$ (April 8, 2014). 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 $T-2$. The relative invariability of the HA premium between day $T-1$ and

$T-2$ is formally examined in Column 1 of Table III, which reports estimates of the "placebo 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 statistically insignificant. In addition, the standard error of the regression, which is an estimate of the standard deviation 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 $T-2$.

Effect of Policy Announcement on Price Disparities. 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 policy 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. The relationship is formally estimated and reported in Column 2 of Table III, 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 III 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 significant 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 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 $1.13 + 2.52 = 3.65$ percentage points per each 10-percentage-point increase in the initial premium. Figure 7 plots the sample regression line and the data, which depict the systematic convergence in the price disparity. From the estimation results 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 III examine whether the change in the HA premium was mainly due to price changes in the Hong Kong market or the Mainland market.[10] Column 4 of Table III 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 8a.

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

[10] 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.

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 III 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. Therefore, the dependent variable captures the relative price change of A-shares between day T and $T-1$. The sample regression line and the actual values in the data are given in Figure 8b.

The most striking result is that the pattern in Figure 8b is a mirror image of Figure 8a. 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.[11]

Sensitivity Analysis. The results above indicate that the size of the preexisting HA premium is a strong determinant of price movements of cross-listed shares upon the policy announcement. Table IV 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

[11] 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.

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 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 excluding firms concurrently listed in the Shenzhen and Hong Kong markets.[12]

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 III – 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 III. 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.

6 Summary and Discussion

In this paper, we used longitudinal data on stock prices of cross-listed firms to investigate whether there were abnormal systematic changes in the price disparity of cross-listed stocks between the Hong Kong and Shanghai markets during the period from 2002 to 2014. We identified a recent liberalization policy that generated an unprecedented abrupt reduction in price disparity. The pilot program, which partially liberalized capital flow between Hong Kong and Shanghai stock exchanges, allowed the effects of capital control liberalization to be measured in a natural experiment setting. Since cross-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. We found that the policy announcement caused the price disparity between cross-listed shares in both markets to reduce by one-sixth. This study provides further micro-level evidence that is

[12] In a separate paper which focuses on price dynamics (Chan and Kwok (2014)), we also consider a longer time period after the policy announcement.

much needed for understanding the link between capital account liberalizations and improved allocative efficiency.

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 interesting given that H-shares and A-shares of cross-listed firms have identical dividend and voting rights. This is consistent with the "cost-of-capital" hypothesis, which is related to investors' expectation of a lower cost of equity capital on both sides of the market. The phenomenon is related to risk-sharing behavior between agents in Mainland and foreign markets; for instance, for Hong Kong investors, there is extra diversification benefit by holding A-shares in the Mainland market as they are imperfectly 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.

References

Bailey, W. (1994): "Risk and Return in China's New Stock Markets: Some Preliminary Evidence." *Pacific-Basin Finance Journal*, 2, 243–260.

Cai, C. X., P. B. McGuinness, and Z. Qi (2011): "The Pricing Dynamics of Cross-Listed Securities: The Case of Chinese A- and H-shares," *Journal of Banking and Finance*, 35, 2123–2136.

Chan, M. K. and S. Kwok (2014): "Capital Account Liberalization and Dynamic Price Discovery: Evidence from Chinese Cross-Listed Stocks," University of Sydney School of Economics Working Paper Series 2014-8.

Chari, A. and P. Henry (2004): "Risk-Sharing and Asset Prices: Evidence from a Natural Experiment," *Journal of Finance*, 59, 1295–1324.

Choi, O. T., H. Wong, C. K. F. Yiu, and M. Yu (2013): "In Depth Analysis of the Dually Listed Companies in Hong Kong and China Stock Markets Prior and Posterior to the Global Financial Turmoil," *International Journal of Economics and Finance*, 5, 100–110.

DeLong, J., A. Shleifer, L. Summers, and R. Waldmann (1990): "Noise Trader Risk in Financial Markets," *Journal of Political Economy*, 98, 703–38.

Doukas, J. A. and L. Wang (2014): "Does the bonding effect matter in a more integrated capital market world?" *Journal of International Money and Finance*, 47, 162–184.

Eichengreen, B. (2001): "Capital Account Liberalization: What Do Cross-Country Studies Tell Us?" *World Bank Economic Review*, 15, 341–365.

Forbes, K. J. (2007): "One Cost of the Chilean Capital Controls: Increased Financial Constraints for Smaller Traded Firms," *Journal of International Economics*, 71, 294–323.

Froot, K. and E. Dabora (1999): "How are Stock Prices Affected by the Location of Trade?" *Journal of Financial Economics*, 53, 189–216.

Gallindo, A., F. Schiantarelli, and A. Weiss (2007): "Does Financial Liberalization Improve the Allocation of Investment? Micro Evidence from Developing Countries," *Journal of Development Economics*, 83, 562–587.

Gultekin, M., B. Gultekin, and A. Penati (1989): "Capital Controls and International Capital Market Segmentation: The Evidence from the Japanese and American Stock Markets," *Journal of Finance*, 44, 849–869.

Harrison, A., I. Love, and M. McMillan (2004): "Global Capital Flows and Financing Constraints," *Journal of Development Economics*, 75, 269–301.

Henry, P. (2000): "Stock Market Liberalization, Economic Reform, and Emerging Market Equity Prices," *Journal of Finance*, 55, 529–564.

——— (2007): "Capital Account Liberalization: Theory, Evidence, and Speculation," *Journal of Economic Literature*, 45, 887–935.

Kose, M. A., E. Prasad, K. S. Rogoff, and S. Wei (2009): "Financial Globalization: A Reappraisal," *IMF Staff Papers*, 56, 8–62.

Lamont, O. and R. Thaler (2003): "Anomalies: The Law of One Price in Financial Markets," *Journal of Economic Perspectives*, 17, 191–202.

Prasad, E. and R. Rajan (2008): "A Pragmatic Approach to Capital Account Liberalization," *Journal of Economic Perspectives*, 22, 149–172.

Rosenthal, L. and C. Young (1990): "The Seemingly Anomalous Price Behavior of Royal Dutch/Shell and Unilever N.V./PLC," *Journal of Financial Economics*, 26, 123–41.

Seasholes, M. and C. Liu (2011): "Trading Imbalances and the Law of One Price," *Economics Letters*, 112, 132–134.

Su, Q., T. T.-L. Chong, and I. K.-M. Yan (2007): "On the convergence of the Chinese and Hong Kong stock markets: a cointegration analysis of the A and H shares," *Applied Financial Economics*, 17, 1349–1357.

TABLE I

GARCH MODEL ON CONVERGENCE IN PRICE DISPARITY[a]

Time series:	Estimates of β_t (1)	T-statistics of β_t (2)
μ	-0.002 ***	-0.193 ***
	(0.000)	(0.033)
ω	1×10^{-5} ***	0.013 **
	(1.02×10^{-6})	(0.006)
a	0.096 ***	0.018 ***
	(0.009)	(0.004)
b	0.892 ***	0.979 ***
	(0.008)	(0.005)

a A GARCH(1,1) model

$$\beta_t = \mu + \sigma_t u_t, \sigma_t^2 = \omega + a\beta_{t-1}^2 + b\sigma_{t-1}^2$$

is estimated on the coefficient estimates and the t-statistics of $\beta_{t.}$ Here β_t is defined as the slope coefficient of the regression in equation (2) on day t. 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 II

SELECTED SUMMARY STATISTICS[a]

	Mean	Std. dev.
Sample in April 2014:		
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 III

MAIN REGRESSION RESULTS[a]

	Placebo	Linear	Piecewise Linear	HK Market	Shanghai Market
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

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 IV
SENSITIVITY ANALYSIS

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	All firms	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

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.

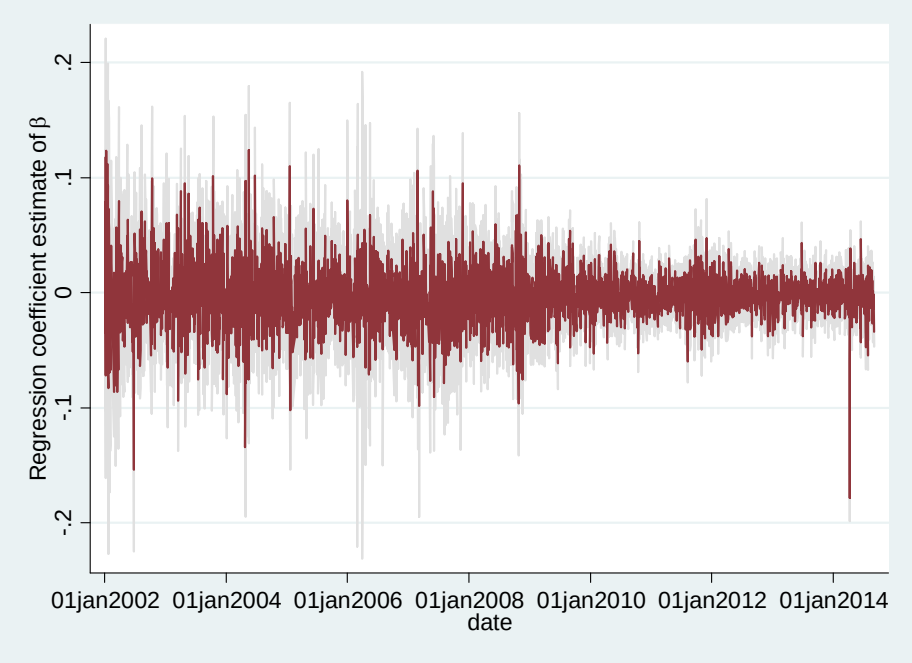

FIGURE 1. -- Time series plot of the slope coefficient estimate and its 95% confidence interval (in grey) in 2002/1 – 2014/8.

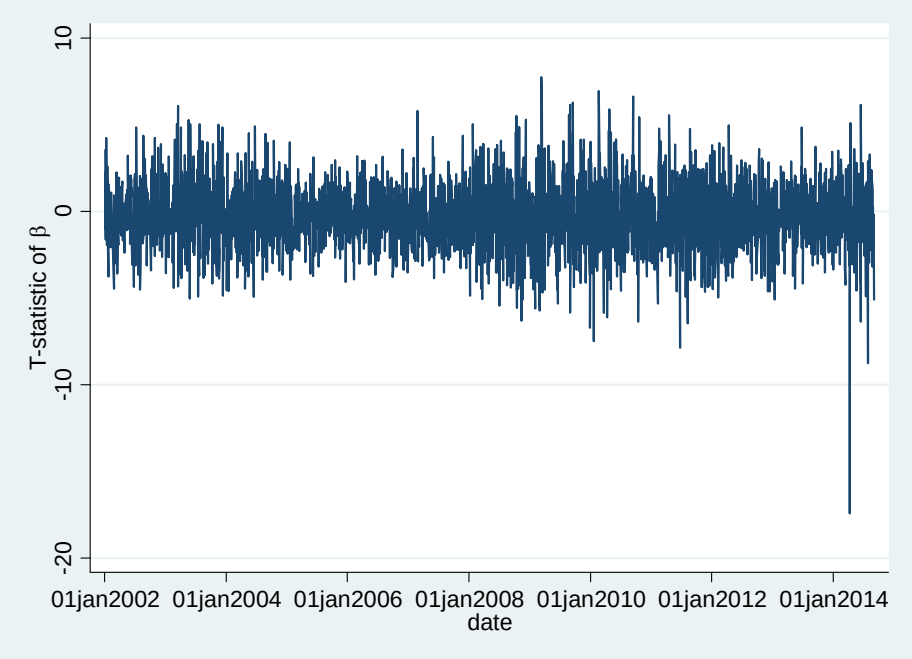

FIGURE 2. -- Time series plot of the t-statistic of the slope coefficient estimate in 2002/1 – 2014/8.

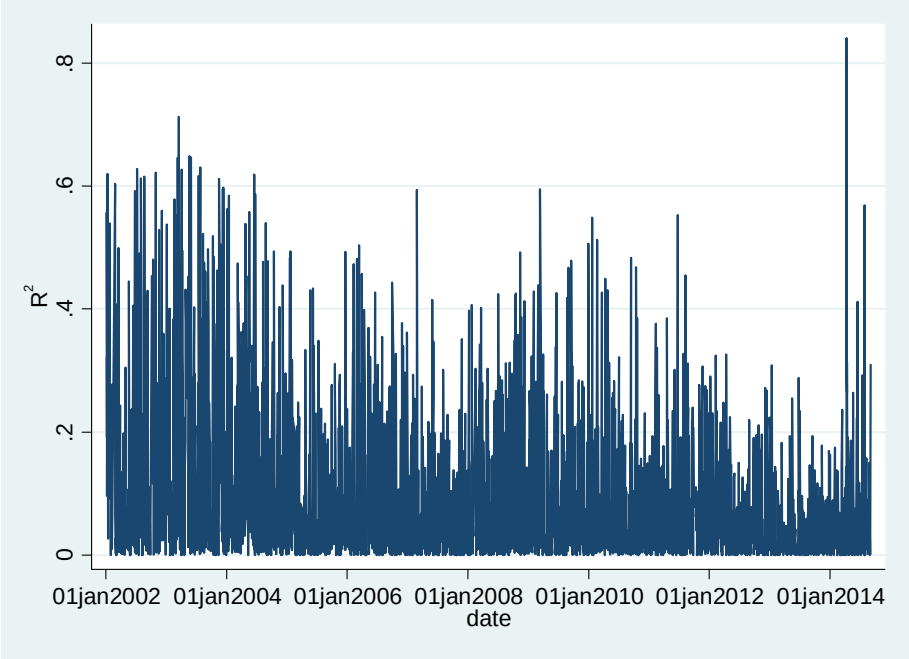

FIGURE 3. -- Time series plot of R-squared in 2002/1 – 2014/8.

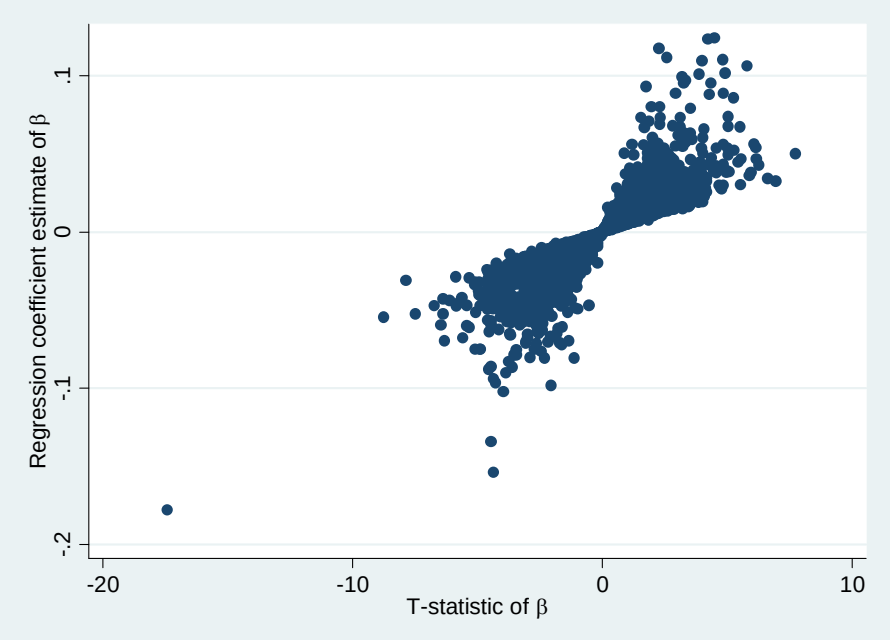

FIGURE 4. -- Scatter plot of the slope coefficient estimate and its t-statistic in 2002/1 – 2014/8.

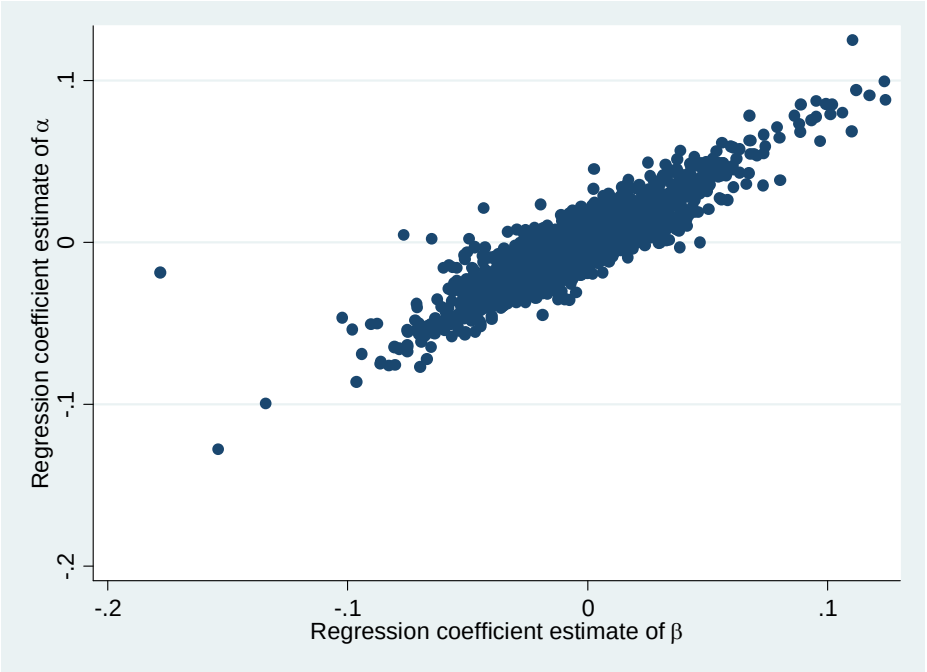

FIGURE 5. -- Scatter plot of the intercept and slope coefficient estimates in 2002/1 – 2014/8.

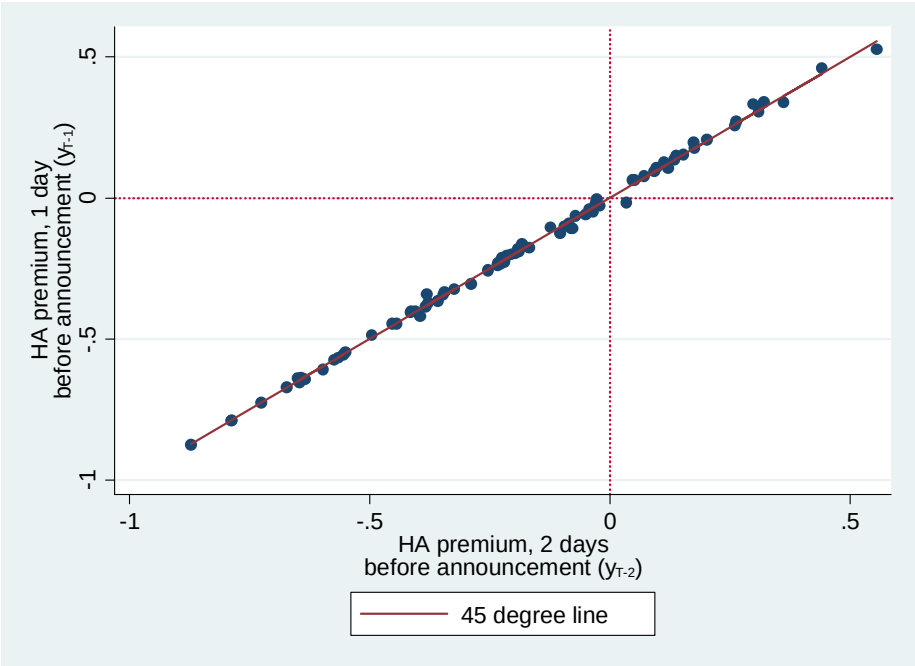

FIGURE 6. – Price Disparity Just Before Policy Announcement.

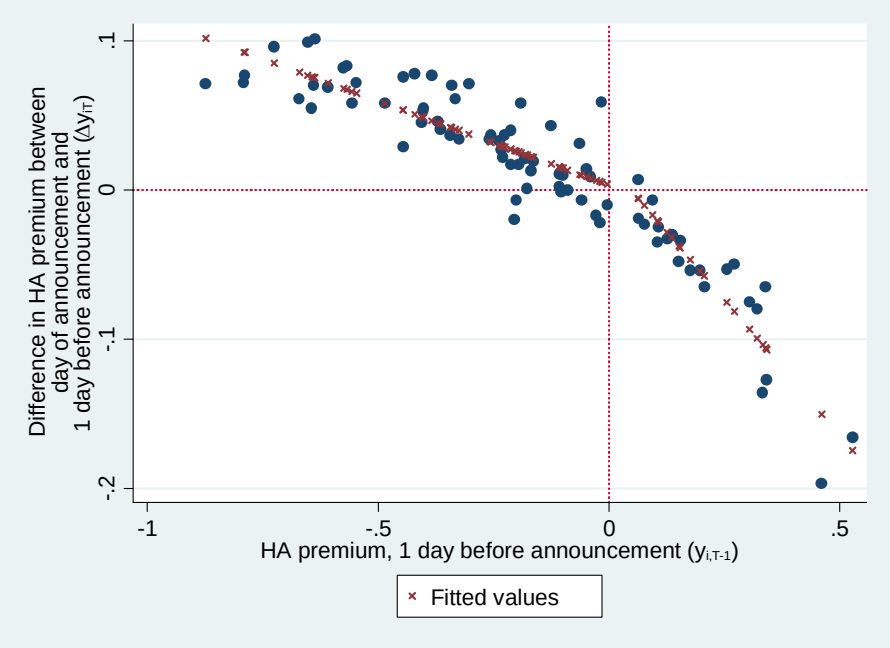

FIGURE 7. – Convergence in Price Disparity Upon Policy Announcement.

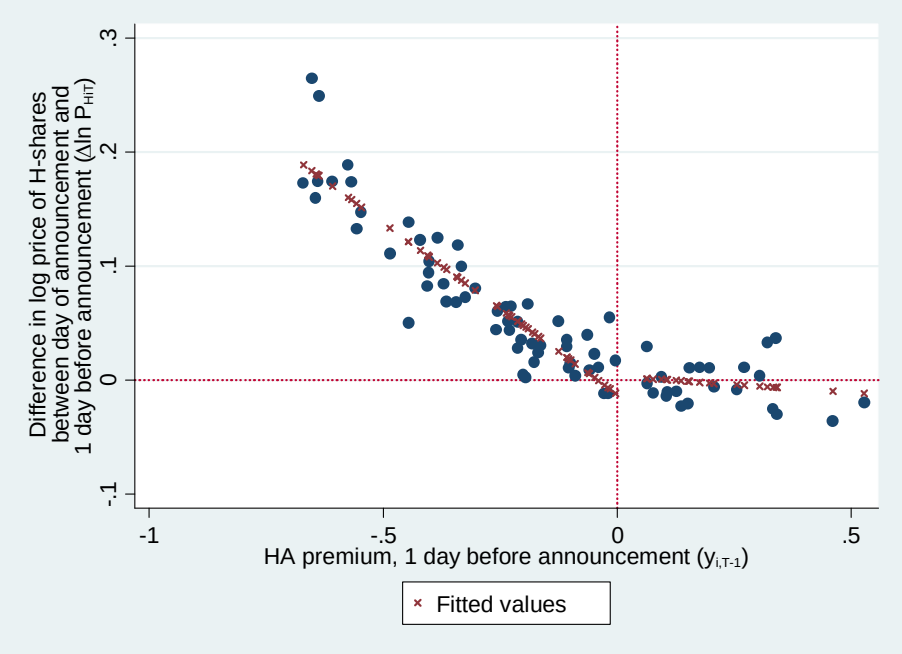

FIGURE 8(a). -- Effect on H-Share Price as a Function of Preexisting Price Disparity.

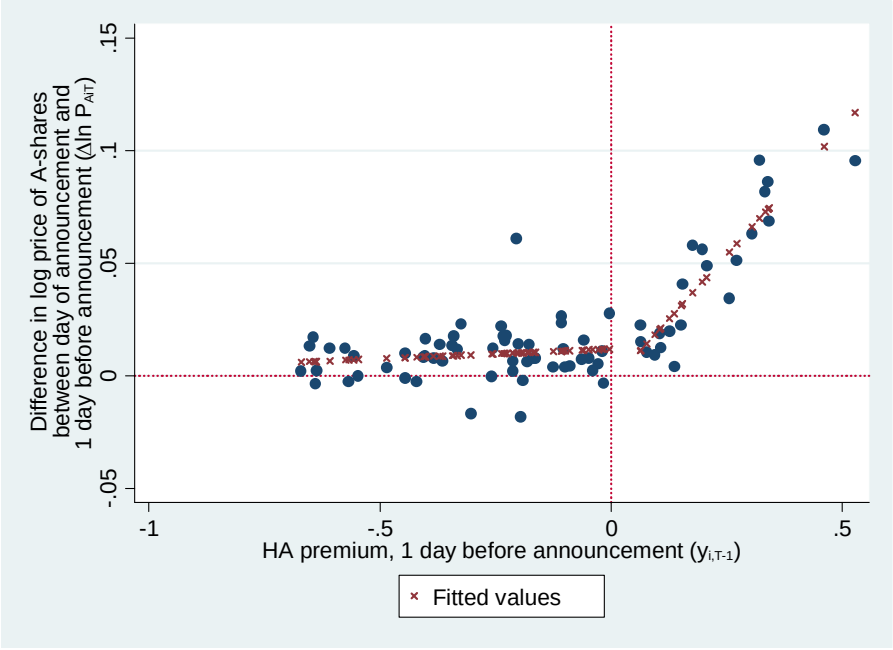

FIGURE 8(b). -- Effect on A-Share Price as a Function of Preexisting Price Disparity.