Portfolio Constraints and Asset Prices: Evidence from the Shanghai-Hong Kong Stock Connect Program*

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Abstract

This paper studies the Shanghai-Hong Kong stock market connect program, which creates the second largest stock exchange in the world. Compared to propensity-score-matched unconnected stocks, connected stocks in Shanghai experience a value appreciation of 2.4% (17 billion USD) over the seven-day announcement window and a significant positive abnormal turnover right after the program becomes effective. More importantly, both the value appreciation and abnormal stock turnover increase with stocks' Shanghai market beta. Our findings are consistent with the theoretical prediction that Hong Kong investors will tilt toward high Shanghai-beta stocks when they are constrained to invest in the Shanghai stock market.

Keywords: Market liberalization, Portfolio constraints, Betting against beta
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1 Introduction

Market liberalizations are usually associated with restrictive constraints. For example, foreign investors are only allowed to invest in a subset of domestic stocks. In addition, foreign investors may also face limits on the capital or shares they can invest in local stocks. Portfolio constraints can have substantial impact on the valuation of local stocks beyond the standard asset pricing models without market frictions. However, we only have limited understanding on how these portfolio constraints may affect asset prices and investors' trading behavior in the domestic market.

In this paper, we study the effect of portfolio constraints on asset prices using an important event - the Shanghai-Hong Kong Stock Connect Program. The program connects the Shanghai and Hong Kong stock exchanges by allowing Hong Kong investors to directly trade Shanghai-listed shares (called "northbound trading"),[1] and qualified mainland Chinese investors to trade Hong Kong-listed shares (called "southbound trading").[2] This event is viewed as one of the most important steps toward the open-up of Chinese financial market. The tie-up of the two markets constituents a market exceeding $7 trillion USD in total size and makes the second largest equity market in the world.

The program imposes two major restrictions that make the connection deviate from a perfect integration. First, only a designated list of stocks is available to trade for investors from the other exchange (which we will refer to as "connected stocks"). Second and more importantly, the cross-border trading is subject to a restrictive daily and aggregate quota. In other words, Hong Kong investors can only invest limited amount of capital in Shanghai stocks. Such setup enables us to investigate two important issues. First, by comparing the connected and unconnected stocks, we identify the valuation effect of the connection between the two markets. Using a propensity score matching method, we find that the value of connected stocks increases by 2.4% on average in the seven-day announcement window compared to matched unconnected stocks, which translates into 17 billion USD in market capitalization.

Second, we uncover an important implication of portfolio constraints on asset prices and investor trading behavior. The capital constraints imposed by the connect program is more likely to bind for Hong Kong investors since the access to Chinese domestic market has long been under strict government control while access to Hong Kong market is relatively free. Therefore, our studies on portfolio constraints mainly focus on the Shanghai connect stocks.

[1]Since Hong Kong has an open financial market, the program essentially allows all Hong Kong and overseas investors to trade Shanghai-listed shares.

[2]Mainland investors are required to have at least 500,000 RMB in their investment and cash accounts to be qualified to trade eligible Hong Kong stocks.

We find that high beta (with respect to the Shanghai market) stocks experience significantly higher value appreciation during program announcement than low beta stocks. Stocks with one more beta experience 5% more returns in the seven-day announcement window. High beta stocks also experience higher abnormal turnover after program commencement than low beta stocks. Our results are consistent with the theoretical prediction that Hong Kong investors tilt their portfolio toward high beta stocks when they face constraints on the capital they can invest in the Shanghai stock market, which leads to higher valuation and trading demand for those high beta stocks.

Our paper is closely linked to several strands of literature. First, it contributes to the literature that studies the effect of demand shocks on asset price. A number of empirical studies suggest that the demand curve of stocks slopes down. Previous studies on the change of index constitutions show that stock prices increase (decrease) after a index inclusion (deletion). The recent theoretical work done by Petajisto (2009) suggests that the demand curve for individual stocks could be steep if the prices are set by two separate classes of investors instead of a representative agent. Our results provide evidence that the demand effect plays an important role in stock revaluation when markets integrate.

Second, our paper is closely related to the literature on financial market liberalization and integration. Most of the papers in the literature examine the revaluation from the perspective of risk-sharing between domestic and foreign investors. For example, Chari and Henry (2004) study stock market liberalization in 11 international markets and find stocks experience significant revaluations after the liberalization. They show that firm-specific revaluations are proportional to the change in systematic risk and on average systematic risk decreases by 6.8 percentage points. Our results suggest that risk-sharing cannot fully explain the cross-sectional variation in stock revaluation, while the demand effect has a substantial impact on asset prices when the market integration is constrained.

Third, our paper contributes to the literature on asset pricing with portfolio constraints. For example, Brunnermeier and Pedersen (2009) and Frazzini and Pedersen (2014) study the effect of leverage constraints on asset prices. They suggest that when investors face binding leverage (margin) constraints, they optimally deviate from holding the market portfolio and tilt their portfolio towards riskier assets with higher market beta. Our paper is in the similar spirit and extends previous studies by investigating the asset pricing implication when investors are restricted in the capital they can invest. We show that when foreign investors have constrained exposure to the domestic stock market during market integration, they tend to overweight stocks that have high sensitivity to that market.

The reminder of the paper is organized as follows. Section 2 introduces the institutional background. Section 3 provides the literature review. Section 4 develops the hypothesis.

Section 5 discusses the empirical results. Section 6 discusses alternative hypotheses and performs additional tests. Section 7 concludes.

2 Institutional Background

The idea of the program was first brought up by the Binhai New Area of Tianjin Provinces of China and Bank of China in as early as 2007, but the regulators then decided to postpone the program indefinitely. It was until 7 years later on Apr 10, 2014 that the program was finally formally announced by Chinese Premier Li Keqiang at the Boao Forum in the Chinese province of Hainan. The program was estimated to take about 6 months to launch but delayed to be finally approved on Nov 10, 2014 and launched on Nov 17, 2014.

This program will allow mainland Chinese and Hong Kong investors to trade directly an eligible list of stocks in each other's market through local securities companies.[3] The program was viewed as a major step forward for opening up China's capital markets to more international investment and as a part of the financial reform undergoing in China nowadays.

Before the launch of the program, Chinese financial regulators have mostly restricted foreign investment into the country's stock markets. One alternative channel is through the US dollar denominated shares or B-shares market. However, the B-shares market has stopped to issue any new stocks since 2001 and is thinly traded. Another alternative channel is to participate in the China's Qualified Foreign Institutional Investor (QFII and RMB-QFII) programs. However, the program has a limited quota and is only accessible to selected and government-approved foreign institutions.

Investors in mainland China are also restricted in participating in the overseas capital markets. Individuals cannot buy foreign stocks directly and face a quota in the amount of money they can exchange into foreign currencies and transfer in or out of border each year (usually, 50,000 US dollar per year).[4] The Qualified Domestic Institutional Investor (QDII) program is also limited in amount and open to selected institutions only.[5] Unlike QFII and QDII, Shanghai-Hong Kong Stock Connect are accessible to both individual and institutional investors. Specially, all Hong Kong and overseas investors are allowed to trade eligible shares listed in Shanghai. Mainland investors need to have 500,000 RMB in their investment and cash accounts to be qualified to trade eligible Hong Kong shares.

[3]Hong Kong investors also refer to other foreign investors who trade through Hong Kong securities companies.

[4]Some wealthy Chinese citizens are able to open security accounts in Hong Kong, or other oversea countries, but this option is far from accessible to the majority of individual investors.

[5]The QFII and QDII started in 2002 and 2006 respectively, and have gradually grown to a size of 66 and 89 billion USD in Nov 2014. RMB-QFII started in 2011 and has a size of 298 billion RMB in Nov 2014.

Eligible shares are generally made up of the broadly representative large-cap stocks and mid-cap stocks with high growth and established earnings records. Specifically, eligible stocks on the Shanghai stock exchanges include all constituent stocks of the SSE 180 Index and SSE 380 Index, and stocks that are dual-listed in Hong Kong, excluding stocks that are either not traded in RMB, or included in the exchange's 'risk alert board' - generally stocks are in the process of delisting and running the risk of being delisted; eligible stocks on the Hong Kong stock exchange include the constituent stocks of the Hang Seng Composite Large Cap Index and Hang Seng Composite Mid Cap Index and stocks that dual-listed in Shanghai, excluding stocks that are not traded in Hong Kong dollars . On the first day of trading, there are 568 and 268 eligible stocks in Shanghai and Hong Kong exchanges, which accounts for 58% and 69% of total market cap in each market.[6]

Trading is subject to a daily and aggregate quota. The daily quota for the net buy values of cross-border trades is 13 billion RMB for Shanghai shares and 10.5 billion RMB for Hong Kong shares, which represents approximately one-fifth of the daily turnover in each market. The aggregate quota is 300 billion RMB for Shanghai shares and 250 billion for Hong Kong shares, represent 2% of total market capitalization and is similar in size as QFII and QDII programs. Shorting selling is not allowed in the program.

On the first day of the program, the entire allowable quota of trading of Shanghai shares was consumed two hours before the close of the market. However, trading of Shanghai shares is less active and only 17% quota is used. One possible reason is that the requirement of 500,000 RMB might prohibit potential small retial investors in mainland to participate in the Hong Kong market.

3 Literature Review

Our paper is closely linked to several strands of literature. First, it adds to the studies on the effect of demand shocks on asset price. A number of empirical studies have documented abnormal returns associated with index redefinition and conclude that demand curve for these assets slopes down. Examination of changes in the constituents of S&P 500 show inclusions (exclusions) increase (decrease) stock prices (Garry and Goetzmann (1986), Harris and Gurel (1986), Shleifer (1986), Dillon and Johnson (1991), Beneish and Whaley (1996), Lynch and Mendenhall (1997), and Hedge and McDermott (2003)). Similar results are also documented for Russell indices (Onayev and Zdorovtsov (2008)), Toronto stock exchange 300 index (Kaul, Mehrotra, and Morck (912)), Nikkei 225 index (Greenwood (2005)) and

[6]For the detailed list of eligible stocks, please refer to: http://www.hkex.com.hk/eng/market/sec_tradinfra /chinaconnect/Eligiblestock.htm.

MSCI country indices (Chakrabarti et al. (2005)). In addition, it has been shown that arbitrage risk affects the slope of demand curves (Wurgler and Zhuravskaya (2002)). While most of works in the literature are empirical, Petajisto (2009) propose a theory of financial intermediary that is able to produce the both the right sign and magnitude of the slope of demand curve. Another group of papers studying the effect of demand shocks examines institutional trades and show unusual large demand can move asset prices (for example, Goetzmann and Massa (2002), Coval and Stafford (2007)). While this literature has focused so far on index redefinitions and institutional trades, our article is the first to show that the demand effect could potentially play an important role in stock revaluation when markets integrate.

Second, our paper is also related to the literature that assesses the impact of financial market liberalization and integration. Empirical studies have shown that market liberalization leads to decreases in the cost of capital and significant stock revaluations. For example, Bekaert and Harvey (2000) examine 20 emerging markets and show that after capital market liberalization the cost of capital decreases between 5 and 75 basis points. Errunza and Miller (2000) examine individual firms and document a significant decline of 42% in the cost of capital using a sample of 126 firms from 32 countries. Henry (2000) show a country's equity price experience positive abnormal returns prior to the implementation of its initial stock market liberalization. Liberalization can also affect risk and volatility of individual stocks. Gultekin, Gultekin, and Penati (1989) find price of risk in Japanese and US equity market converged after the enactment of Japanese foreign exchange and foreign trade control law. Huang and Yang (2000) examine 10 emerging markets and find increased accessibility of international investors leads to an increase in stock price volatility. Chari and Henry (2004) studies stock market liberalization in 11 international markets and find stocks experience significant revaluation and a decrease in systematic risk after the liberalization. Most of the papers in the literature examine the revaluation from the perspective of risk-sharing between domestic and foreign investors. Our results suggest that demand effect could dominate risk-sharing effect in explaining the cross-sectional variation in stock revaluation when the market integration is constrained.

Third, our paper connects to a broader literature on portfolio constraints. The portfolio constraint we study in this paper is most related to the leverage constraint studied in Brunnermeier and Pedersen (2009), Frazzini and Pedersen (2014) and Rytchkov (2014). Their models predict that when facing leverage constraint investors will hold more higher-beta securities in order to minimize the diversification loss. Our paper extends their studies by showing when investors have constrained exposure to a certain market factor during market integration, they tend to tilt their holdings toward stocks which has high

sensitivity to that market.

A related literature studies the effect of international investment barriers on stock prices. Barriers to international investment may take many forms. Black (1974) and Stulz (1981) study the investment barrier in the form of a proportion taxation associated with holding foreign securities. Errunza and Losq (1985) consider the type of barrier that restricts a class of investors from trading in a subset of securities. They develop an international asset pricing model under such barrier and show the securities inaccessible to a subset of investors command a "super" risk premium. Eun and Janakiramanan (1986) and Hietala (1989) studies ownership restrictions imposed on either foreign or domestic investors and show there may exist a two-tier pricing rule for these restricted securities. The constraint we consider is most similar to that in Eun and Janakiramanan (1986) but distinct in that the barrier in Eun and Janakiramanan (1986) is imposed on individual stock level while the constraint we study is imposed on the portfolio level. This distinct feature enables us to study the portfolio allocation problem within the restricted stocks.

Last but not the least, our paper contributes to a growing body of literature on Chinese equity market. Chinese stock market began operation in 1991 with eight stocks and have been presented an amazing growth in terms of trading volume and market capitalization. Cakici, Chan, and Topyan (2015) provide a comprehensive analysis of cross-sectional stock return predictability in China and document several differences from the US market. There are also a couple of papers studying dual-listed shares traded on Mainland Chinese stocks exchanges and Hong Kong stock exchanges. For example, Andrade, Bian, and Burch (2013) studies Chinese stock market bubbles using the dual-listed shares in Hong Kong as a benchmark. Seasholes and Liu (2011) examine price and trading dynamics of the dual-listed shares in Mainland China and Hong Kong. To our knowledge, our paper is among the first to understand the implications of the Shanghai-Hong Kong stock connect program, which is seen as an important step to open up the Chinese capital markets and strength its international impact.

4 Hypothesis Development

Upon the startup of the SH-HK stock connect program, connected Shanghai stocks enter into the opportunity set of Hong Kong investors. As long as these new assets are not redundant or dominated by existing assets, Hong Kong investors will shift positive amount of wealth toward these stocks to achieve the new optimal portfolio. This shift would provide diversification benefits and particularly increase the ever-lacking China exposure for Hong Kong investors. If the demand curve is download-sloping as shown in Shleifer

(1986) among others, the anticipated increase of demand from Hong Kong investors will lead to an appreciation in price of connected stocks upon program announcement. Therefore we develop our first hypothesis.

Hypothesis 1: *Upon the announcement of the SH-HK stock connect program, connected stocks experience significant higher (abnormal) returns than unconnected stocks of similar characteristics.*

When there is a portfolio constraint imposed on the total amount of capital that can be invested into these newly-added Shanghai listed stocks, investors may not be able to achieve their first-best portfolio allocation. In this case, we hypothesize that investors would distribute more of their quota on stocks with high Shanghai market beta.[7] The intuition is similar to that in Frazzini and Pedersen (2014) where investors are constrained from borrowing and therefore tilt toward high beta stocks to increase their risk exposure. In our setup, Hong Kong investors tilt toward high beta stocks in order to increase their exposure to China stock market and minimize diversification loss under restrictive capital constraints. If our hypothesis is true, we expect to observe a larger increase in demand and price for high beta stocks. Below we establish our hypothesis 2 and 3.

Hypothesis 2: *Under portfolio constraints, connected stocks with high Shanghai beta will experience a higher value appreciation than those with low Shanghai beta.*

Although the price effect should take place on announcement, the actual trading from Hong Kong investors could only happen after the program becomes effective. If Hong Kong investors indeed demand more of those high beta stocks in the Shanghai Stock Exchange, we should expect Hong Kong investors to buy more of those stocks right after the commencement of the program, which is reflected in the abnormal trading activities.

Hypothesis 3: *The demand of Hong Kong investors for Shanghai stocks will lead to abnormal turnover of the connected Shanghai stocks right after the commencement of the program. More importantly, Hong Kong investors demand more of high Shanghai-beta stocks and therefore high Shanghai-beta stocks will have higher abnormal turnover than low Shanghai-beta stocks.*

[7] We offer a parsimonious model in the appendix to illustrate the intuition.

5 Empirical Results

5.1 Data and Summary Statistics

We start with 541 stocks listed in the Shanghai Stock Exchange (SSE) that can be traded by Hong Kong and foreign investors through the northbound trading service. Among the 541 stocks, only 520 stocks have valid return data in October, 2014. We match the 520 connected SSE stocks with unconnected SSE stocks with a propensity-score matched procedure. We implement this procedure by first estimating a logit regression to model the probability of being a treatment firm using firm characteristics (including firm size ($SIZE$), book-to-market ratio (BM), return-on-assets (ROA), leverage (LEV), and China market beta ($BETA\_CH$)) at the end of October 2014. We then match each treatment firm to the control firms using the nearest neighbor matching technique (with replacement, and caliper is set at 0.25*standard error of propensity score). This procedure results in a final sample of 448 treatment (connected) firms with valid control (unconnected) firms. We further require that the treatment firms and their control firms have valid return data within three day window (-1,1) of the announcement event on Nov 10, 2014. This requirement further reduces our final sample to 416 treatment firms with their propensity-score matched control firms.

Table 1 summarizes the characteristics of our sample of connected stocks. These stocks are generally large and matured. On average a sample stock has a market cap of 9.157 billion yuan ($e^{16.031}/10^6$), a book-to-market ratio of 0.624, a ROA of 0.049, and a leverage of 0.199. These connected stocks have much higher sensitivity with respect to Shanghai market index than Hong Kong market index; they have on average a $BETA\_CH$ of 1.217 and a $BETA\_HK$ of 0.496. The average total volatility ($TVOL$) and idiosyncratic volatility with respect to the Shanghai market ($IVOL\_SH$) of connected stocks are 0.349 and 0.299, respectively. Our sample stocks are liquid stocks, with an average turnover ($TURNOVER$) of 0.016 and Amihud (2002) illiquidity measure ($AMIHUD$) of 0.029 ($\times 10^{-8}$). Connected stocks on average experience 2.6% return during the one month before the program announcement in October, 2014. Among our sample stocks, 69% are state-owned enterprises.

Table 2 compares the main characteristics of the connected stocks and their propensity-score-matched unconnected (control) stocks. The tests show that there are no significant differences in $SIZE$, BM, ROA, LEV, $BETA\_CH$, $TURNOVER$, and RET_1_1 between connected stocks and the matched stocks.

5.2 Abnormal Return around Program Announcement

5.2.1 The Aggregate Valuation Effect

In this section, we test our Hypothesis 1 by examining the abnormal returns of connected stocks and their propensity-score-matched PS-matched) unconnected stocks during the program announcement. Because connected stocks could be different from the universe of all unconnected stocks, the abnormal returns of connected stocks during the program announcement may not only reflect the connection effect but also reflect differences between the connected stocks and the rest of the market. In order to address the endogeneity problem, we match the connected stocks with unconnected stocks based on their major stock characteristics. Later on in the regression analysis, we also control for additional firm characteristics.

In the univariate analysis, we calculate the cumulative excess and abnormal returns (CAR) for connected stocks and PS-matched non-connected stocks during the event window. We report the average CAR for the two groups and test whether the CARs are significantly different. In Table 3 Panel A, we study the event window from day -1 to day 1. Consistent with our Hypothesis 1, we observe that the connected stocks experience 1.5% more cumulative excess returns (CR) than the matched non-connected stocks in the 3-day period with a t-statistic of 4.81. The difference in cumulative abnormal return based on the market model ($CAR1$) is 1.7% with a t-statistic of 5.30. The difference in cumulative abnormal return based on the Fama-French three factor model ($CAR2$) decreases to 0.7% with a t-statistic of 2.32. In Table 3 Panel B and C, we extend the event window to be (-2,+2) and (-3,+3) and find the difference in CAR grows larger and become more significant. Specifically, the market-model adjusted CAR are 2.2% and 2.7% with t-statistics of 5.84 and 5.83, respectively. The Fama-French 3-factor model adjusted CAR are 1.4% and 1.9% with t-statistics of 4.17 and 6.54, respectively. As a robustness check, we exclude AH dual-listed stocks from the sample and repeat the analysis. We find the results are qualitatively the same.

To help understand the announcement effect of the connection program on stock prices more closely, we plot the CAR over the event-window (-20,+20) in Figure 1. It is evident that at the first few days of the event window, connected stocks and unconnected ones generate almost the same level of returns and their cumulative returns are largely indistinguishable. This result assures us that the treatment and control groups are well-matched and there is no significant return difference between the two groups. Starting from around one week prior to the event, the two lines begin to diverge, suggesting that there could be an information leakage about the announcement of the program. The difference in CAR between connected

and matched unconnected stocks grows to the maximum three days after the event and flattens out afterwards. The result suggests that the effect of the program announcement is incorporated into the prices in a reasonably fast speed. More importantly, no signs of return reversal at the end of (-20,+20) window are observed, suggesting that the value effect could be permanent for those connected stocks.

To rule out the possibility that differences in firm characteristics might drive the return difference between connected and matched non-connected stocks around the event window, we conduct the following regression analysis:

$$CAR_i = a_0 + a_1 CONNECT_i + \boldsymbol{b z_{i,t-1}} + \varepsilon_{i,t}, \tag{1}$$

where the dependent variable CAR_i represents cumulative return (CR, in %), cumulative abnormal return based on the market model (CAR1, in %), and cumulative abnormal return based on the Fama-French three factor model (CAR2, in %) during the announcement window (-3,3), respectively. $CONNECT_i$ is a dummy variable, which equals one if the firm is included in the Northbound trading service and zero otherwise. $\boldsymbol{z_{i,t-1}}$ is a vector of control variables whose information is publicly available before the program announcement, including market capitalization ($SIZE$), book-to-market equity ratio (BM), return-on-assets (ROA), leverage (LEV), idiosyncratic volatility with respect to a China market model ($IVOL\_CH$), Amihud illiquidity measure ($AMIHUD$), and average daily turnover ($TURNOVER$). Our sample includes connected stocks and their PS-matched unconnected counterparts. A connected stock is required to have a valid PS-matched stock to be included in our sample.

The results are reported in Table 4. We first conduct the regression of CAR on the connected dummy alone without any controls. The result is essentially the same as that in the portfolio analysis. The coefficient on the connection dummy is 2.367, 2.679, and 1.871 for CR, $CAR1$, and $CAR2$, respectively, suggesting that connected stocks experience around 2-3% more cumulative abnormal return than the PS-matched unconnected stocks. Next, we include a set of control variables into the regression, including firm size, B/M ratio, ROA, leverage, $BETA\_CH$, $IVOL\_CH$, Amihud illiquidity and share turnover. The magnitude of the coefficient on the connection dummy sightly decreases but remains both economically and statistically significant.

In sum, during the seven-day window around the program announcement, connected stocks experience an average value appreciation of 2.4% compared with their unconnected counterparts, which translates to more than 20 billion USD in market value. One potential explanation for the value appreciation is the demand effect of Hong Kong investors. When

demand-curve is downward sloping, high demand of foreign investors after market integration could push up the equilibrium asset prices and have a permanent positive effect on stock valuation. An alternative explanation for the revaluation is the risk-sharing effect. The change in expected return is proportional to the change in covariance. If the covariance between the connected stocks and the integrated market is lower than the covariance between the connected stock and the local market, connected stocks will experience a decrease in expected return and an increase in stock prices. We provide evidence supporting the demand effect under portfolio constraints in the following section.

5.2.2 Revaluation in the Cross Section and the Beta Effect

In this section, we investigate the cross-sectional variation of the announcement effect on stock valuation and test our Hypothesis 2. Theoretical models such as Frazzini and Pedersen (2014) suggest that when investors face certain portfolio constraints such as leverage constraints so that they cannot gain optimal exposure to certain risk factors, they would overweigh stocks with high sensitivity (or beta) with respect to that factor. In the case of market integration under restrictive capital control, foreign investors are constrained in the capital they are allowed to invest in local stocks and therefore cannot achieve optimal exposure to the local capital market. In this case, we should expect to observe the behavior of "betting against beta" in the similar spirit as in Frazzini and Pedersen (2014). In other words, foreign investors demand more of those stocks that have high beta with respect to the local stock market. Such high demand for high beta stocks leads to higher valuation of those high beta stocks relative to low beta stocks.

We extend regression (1) by adding an interaction term between the connected dummy and a stock's Shanghai beta (beta with respect to the Shanghai stock market, $BETA\_CH$):

$$CAR_i = a_0 + a_1 CONNECT_i + a_2 CONNECT_i * BETA\_CH_i + a_3 BETA\_CH_i + \boldsymbol{bz_{i,t}} + \varepsilon_{i,t}, \tag{2}$$

where $BETA\_CH_i$ is firm beta with respect to the China market. The results are reported in Table 5. Consistent with our Hypothesis 2, we find a positive and statistically significant coefficient on the interaction term, suggesting that the positive announcement effect on stock prices is more pronounced for stocks with high $BETA\_CH$ than those with low $BETA\_CH$. The coefficient on the interaction term is close to 5, which means that one unit increase in a connected stock's Shanghai beta will lead to a 5% increase in its cumulative abnormal return during the seven-day announcement window. The magnitude is economically large and statistically significant at 1% level for all specifications. This finding remains strong and

significant after controlling for a set of firm characteristics.

In order to rule out the possibility that the beta effect is not due to the interaction between the connect dummy and other firm characteristics, we add a number of additional interaction terms into the regression, including the interaction between the connect dummy and $SIZE$, BM, ROA, LEV, $IVOL\_CH$, $AMIHUD$, $TURNOVER$, and a stock's beta with respect to the Hong Kong stock market ($BETA\_HK$). It is evident that the interaction effect between connect and $BETA\_CH$ remains strong and significant after we add the interaction term between the connect dummy and any other firm characteristics. And none of the other interaction terms has a significant coefficient.

Taken together, portfolio constraints play an important role in determining the stock revaluation during the announcement of Shanghai-Hong Kong connect program. It is expected by the market that Hong Kong investors will overweigh high Shanghai-beta stocks because they face restrictive capital constraints in investing in the Shanghai stock market. Therefore, high Shanghai-beta stocks experience significantly higher value appreciation than low Shanghai-beta stocks upon program annoucement. Our results provide a vivid example that capital constraints, similar to leverage constraints, can also induce investors to "bet against betas".

5.3 Abnormal Turnover around Program Commencement

The Shanghai-Hong Kong connect program became effective on Nov 17th, one week after the announcement. Hong Kong investors expected to buy in Shanghai-listed stocks after the open-up of the Shanghai stock market. Figure 2 plots the usage of daily quota for the program. Northbound trading refers to Hong Kong investors' net purchase of Shanghai-listed shares. Southbound trading refers to mainland Chinese investors' trading of Hong Kong-listed shares. We observe that northbound trading is quite active with an average usage of about 30-40% over first 14 days. In particular, on the first day, the quota was completely consumed up, suggesting that the portfolio constraint is indeed binding. At the same time, southbound trading is quite inactive. One possible reason is that only mainland Chinese investors with at least 500,000 RMB in their accounts can participate in the program. This filters out 95% of individual investors and the rest who are qualified are likely to be wealthy ones, who are less constrained in investing abroad beforehand.

The demand of Hong Kong investors for Shanghai stocks should be reflected in the abnormal turnover of connected Shanghai stocks. We perform the following regression analysis for the abnormal turnovers of connected stocked and their PS-matched

unconnected stocks:

$$Y_i = a_0 + a_1 CONNECT_i + \boldsymbol{bz_{i,t}} + \varepsilon_{i,t}, \tag{3}$$

where Y_i represents abnormal turnover of firm i in the first seven-day window (0,6) right after the connection between the Shanghai Stock Exchange and the Hong Kong Stock Exchange. We use two measures for abnormal turnover. One is $TURNOVER\_AB1$, which is defined as the average daily turnover during the event window minus average daily turnover in the most recent month. The other one is $TURNOVER\_AB2$, which is defined as the average daily turnover during the event window minus average daily turnover in the most recent month divided by average daily turnover in the most recent month. The results are reported in Table 7. The coefficient on the connect dummy is around 3 when the dependent variables is $TURNOVER\_AB1$ ($\times 10^3$), which suggests that connected stocks experience 0.3 percentage points increase in their daily turnover (compared with unconnected stocks) during the seven-day window right after the program commencement. The coefficient on the connect dummy is close to 0.1 when the dependent variables is $TURNOVER\_AB2$, which suggests that the daily turnover of connected stocks increases by 10% on average (compared with unconnected stocks) over the seven-day window right after the program commencement. Our results confirm that connected stocks indeed experience abnormal turnover right after the program commencement.

Next, we investigate the abnormal turnover of connected stocks in the cross section. When Hong Kong investors face capital constraints, they can only invest very limited amount in Shanghai stocks and therefore are potentially under-exposed to the Shanghai local market. In this case, they should demand more of high Shanghai-beta stocks than low Shanghai-beta stocks. Therefore, high Shanghai-beta stocks should experience higher abnormal turnover than low Shanghai-beta stocks. We introduce an interaction term between the connect dummy and $BETA\_CH$ in regression (3) of abnormal turnover.

$$Y_i = a_0 + a_1 CONNECT_i + a_2 CONNECT_i * BETA\_CH_i + a_3 BETA\_CH_i + \boldsymbol{bz_{i,t}} + \varepsilon_{i,t}, \tag{4}$$

The results are reported in Table 7. We find that the interaction term is significantly positive, suggesting that abnormal turnover is significantly higher for high $BETA\_CH$ stocks than low $BETA\_CH$ stocks. The coefficient is close to 7 for $TURNOVER\_AB1$, which means that one unit increase in a stock's Shanghai beta will lead to 0.7 percentage points increase in a stock's average daily turnover (compared with unconnected stocks) over the seven-days window right after the commencement of the connect program. The coefficient is close to

0.3 for $TURNOVER\_AB2$, which suggests that one unit increase in a stock's Shanghai beta will lead to 30% increase in a stock's average daily turnover (compared with unconnected stocks) over the seven-day window right after the commencement of the connect program. These results confirm that Hong Kong investors indeed demand more of high $BETA\_CH$ stocks as seen from the abnormal turnover after the program commencement.

In Table 8, we add interactions of the connect dummy with a list of firm characteristics that may potentially affect the stock turnover. We show that none of these interaction terms matter and interactive effect between connect and $BETA\_CH$ remains economically and statistically significant across all the regressions.

Taken together, we provide supporting evidence for our Hypothesis 3. After the commencement of the Shanghai-Hong Kong connect program, connected stocks experience significantly higher abnormal turnover than unconnected stocks with similar characteristics due to the demand of Hong Kong investors. More importantly, high Shanghai-beta stocks experience significantly higher abnormal turnover than low Shanghai-beta stocks, which provides direct evidence that Hong Kong investors indeed demand more of high Shanghai-beta stocks than low Shanghai-beta stocks. Our results confirm the theoretical prediction that Hong Kong investors overweigh high Shanghai-beta stocks when they face restrictive capital constraints and limited exposure to the Shanghai local stock market.

5.4 Placebo Tests

In all our previous tests, we match connected stocks with unconnected stocks based on their major firm characteristics. However, differences in returns around program announcement and abnormal turnovers around program commencement might be driven by differences in unobserved stock characteristics among these two groups of stocks. In that case, such differences could be persistent and do not depend on the specific event time *per se*.

In order to control for the unobserved differences between connected and unconnected stocks that could drive the pattern of returns and turnover observed, we implement a placebo test. Specifically, we consider a list of random dates before and after the event and repeat the analysis of Table 5-8 on these dates. If there are some unobserved factors other than the connect program that drive the relation we document, we would expect to observe similar relations in some of those random dates as well.

We report the results of our placebo tests in Table 9. We find that the effects of the connect dummy and the interaction between the connect dummy and $BETA\_CH$ completely disappear on those randomly chosen dates for both returns (Panel A) and abnormal turnovers (Panel B and C). On any of the six dates, which are at least two weeks away from the

event, none of the coefficients on the connect dummy are significant, which suggests that the connected stocks and matched unconnected stocks have indistinguishable returns and turnovers during any time outside the event window. Moreover, none of the coefficients on the interaction between the connect dummy and $BETA\_CH$ are significant for both returns and turnover, confirming that the "betting against beta" effect only magnifies itself during stock revaluation after the announcement of the connect program due to the demand of Hong Kong investors. This placebo test assures us that the relation we document is not driven by the fixed heterogeneities between connected and unconnected stocks.

6 Alternative explanations and Additional Tests

6.1 Risk Sharing

Our results suggest that the demand of Hong Kong investors plays an important role in the revaluation of connected Shanghai stocks. However, revaluation could also happen due to the risk-sharing effect as suggested by, for example, Chari and Henry (2004). Under market integration, stocks will be revaluated based on its covariance with the a new market portfolio. [8] The revaluation of stocks upon program announcement can reflect the change in expected return, which should be proportional in the change in covariances.

We test the risk-sharing effect by introducing an interaction term between the connect dummy and $DIFCOV$ into the regression of cumulative abnormal return. $DIFCOV$ equals the difference between a stock's covariance with the Shanghai market and its covariance with the Hong Kong market. $DIFCOV$ is used as a proxy for the change in a stock's covariance and therefore a proxy for the change in a stock's expected return due to the risk-sharing effect. We report the results in Table 10. The coefficient on the interaction term between the connect dummy and $DIFCOV$ is insignificant irrespective whether we control for the interaction between the connect dummy and $BETA\_CH$.

It is worth mentioning that the risk-sharing explanation does not have any direct prediction on the abnormal turnover of connected stocks upon program commencement. However, in order to rule out the possibility that the beta effect on abnormal turnover is due to the change in covariances, we also include an interaction term between $CONNECT$ and $DIFCOV$ into the regression of abnormal turnover. The results are reported in Table

[8] Under complete liberalization, domestic stocks will be revaluated based its covariance with the new integrated market. Under market segmentation, for example, foreign (local) investors are only allowed to invest in limited number of connected local (foreign) stocks, the domestic connected stocks will be revaluated based on its covariance with the post-liberalization portfolio held by foreign investors and the domestic unconnected stocks will be revaluated based on its covariance with the post-liberalization portfolio held by domestic investors.

10. It is evident that the coefficient on the interaction term between $CONNECT$ and $DIFCOV$ becomes insignificant after we control for the interaction between $CONNECT$ and $BETA\_CH$, while the coefficient on the interaction between $CONNECT$ and $BETA\_CH$ remains economically and statistically significant.

Taken together, the risk-sharing effect cannot explain the stock revaluation in the cross section during the program announcement. It also cannot explain the abnormal turnover of high Shanghai-beta stocks right after the program commencement. Our results suggest that the demand effect under portfolio constraints dominates the risk-sharing effect in explaining the cross-sectional stock revaluation and abnormal turnover in the event of the Shanghai-Hong Kong stock connect.

6.2 Revaluation and Turnover in the Hong Kong Market

So far, our studies mainly focus on the valuation of Shanghai stocks during the Shanghai-Hong Kong stock connect program. As we have argued earlier, this is due to two major reasons. First, while the Hong Kong stock market is a relatively open market to foreign investors, Shanghai stock market is largely a closed market before the connect program. Therefore, we would expect the connection between the two markets to have a stronger impact on Shanghai stocks than Hong Kong stocks. Second, while Hong Kong investors face restricted constraints in investing in Shanghai local stock market, mainland investors face much less constraints in investing in stocks abroad. This fact can be seen from the quota used by both groups of investors. While the daily quota for buying Shanghai stocks is used up by Hong Kong investors on the first day upon program commencement, only less than 20% of the quota for buying Hong Kong stocks is used by mainland investors. Therefore, the effect of portfolio constraints on asset prices is likely to be stronger for Shanghai stocks.

Nonetheless, we perform similar analysis for Hong Kong stocks (See online appendix). There are two major results. First, connected Hong Kong stocks experience more value appreciation during program announcements and higher abnormal turnover during program commencement than PS-matched unconnected stocks. However, the magnitude of the value appreciation is smaller and less significant than that of the Shanghai stocks. Second, the interaction between the connect dummy and a stock's Hong Kong beta is insignificant in both the regressions of cumulative abnormal return and abnormal turnover. Our results suggest that since the portfolio constraints on investing abroad is less likely to bind for mainland investors, the beta effect is much weaker for the Hong Kong stocks.

7 Conclusion

Portfolio constraints have a significant impact on asset prices, which is not captured by the frictionless asset pricing models. While a number of theoretical models study asset pricing implications under portfolio constraints, empirical evidence that can clearly identify the effect is scarce. In this paper, we study the Shanghai-Hong Kong stock connect program, which impose strict restriction on the capital that Hong Kong investors can invest in the Shanghai stock market. This unique event enables us to test the asset pricing implications of portfolio constraints in the context of large-scale market integrations.

We find that connected stocks experience significant value appreciation compared to unconnected stocks with similar firm characteristics. More importantly, the revaluation of connected stocks exhibit substantial cross-sectional heterogeneity. Shanghai stocks with higher market beta experience significantly higher value appreciation than low beta stocks. Our results are consistent with the theoretical predictions of portfolio choices under capital constraints, which suggests that Hong Kong investors should overweigh high beta stocks if they are constrained in the capital that they can invest in the Shanghai stock market. We provide additional evidence that high beta stocks experience higher abnormal turnover right after the commencement of the program than low beta stocks, confirming that Hong Kong investors indeed demand more of high beta stocks than low beta stocks.

Stock revaluation after market integration may also be explained by risk-sharing effect. Change in expected returns should be proportional to the change in covariances. We test the covariance effect and find that our results cannot be fully explained by the change in expected return due to risk sharing. Our paper suggests that when a market undergoes limited liberalization with restrictive capital control, the demand effect under portfolio constraints may dominate the risk-sharing effects.

Appendix A Definition of Variables

SIZE Natural logarithm of the market capitalization (in thousand).

BM Book-to-market equity ratio, defined as book value of equity divided by market value of equity.

ROA Return-on-Assets, defined as net income divided by total assets.

LEV Leverage, defined as the sum of short-term debt and long-term debt divided by total assets.

BETA_CH China Market Beta, which is estimated from a market model (the China market return) based on past 12-month daily returns.

TVOL Total volatility, defined as (annualized) standard deviation of daily stock returns in the past 12 months.

IVOL_CH Idiosyncratic volatility, defined as (annualized) standard deviation of the daily return residual from a China market model in the past 12 months.

BETA_HK Hong Kong Market Beta, which is estimated from a market model (the Hong Kong market return) based on past 12-month daily returns.

TURNOVER Average daily turnover over the past 12 months ($\times 10^3$). Daily turnover is defined as daily trading volume (in shares) divided by total tradable shares outstanding.

AMIHUD Amihud illiquidity measure calculated from daily return and trading volume in the past 12 months ($\times 10^{-8}$).

RET_1_1 Monthly stock return in month $t-1$.

SOE A dummy variable that equals one if the firm is a state-owned enterprise and zero otherwise.

Appendix B A Simple Model: Connection between Two Markets under Portfolio Constraints

In this section, we develop a parsimonious model to illustrate how the portfolio constraint considered in the paper affects investors' demand. We consider a two-period economy with two markets and three assets that at $t = 0$ investors choose portfolios, and at $t = 1$ when the assets in these portfolios pay off.

To match with our empirical setup, we simply call the two markets Hong Kong and Shanghai and denote them as "h" and "s" respectively. We assume that in the Hong Kong market, there is only one security(can be regarded as market portfolio) that pays out $\tilde{r_h}$ at time 1, in which $\tilde{r_h} \sim N(\mu_h, \sigma_h)$; and in the Shanghai market, there are two securities that pay out $\beta_H \tilde{r_s}$ and $\beta_L \tilde{r_s}$ respectively, in which $\tilde{r_s} \sim N(\mu_s, \sigma_s)$ and $\beta_H > \beta_L > 0$.

There is one representative investor with CARA utility function $E[U(\tilde{W})] = -E[exp(-\lambda \tilde{W})]$ who allocates his wealth across the three assets to maximize his expected utility.

To save notations, we denote $\beta_b = b\beta_H + (1-b)\beta_L$, $V_h = \sigma_h^2$, $V_s = \sigma_s^2$, $Cov_{hs} = Cov(\tilde{r_h}, \tilde{r_s})$.

The representative investor's terminating wealth can be expressed as $\tilde{W} = a\tilde{r_h} + (1-a)(b\beta_H \tilde{r_s} + (1-b)\beta_L \tilde{r_s}) = a\tilde{r_h} + (1-a)\beta_b \tilde{r_s}$. And his objective function $Obj = -exp(-E[\lambda \tilde{W}] + \frac{1}{2} Var[\lambda \tilde{W}]) = -exp(-\lambda[a\mu_h + (1-a)\beta_b \mu_s] + \frac{1}{2}\lambda^2 [a^2 V_h + (1-a)^2 \beta_b^2 V_s + 2a(1-a)\beta_b Cov_{hs}])$

First order conditions w.r.t. a is

$FOC_a = Const_a \times (\mu_h - \beta_b \mu_s - \lambda[aV_h + (a-1)\beta_b^2 V_s + (1-2a)\beta_b Cov_{hs}])$

First order conditions w.r.t. b is

$FOC_b = Const_b \times ((1-a)(\beta_H - \beta_L)[\mu_s - \lambda(1-a)\beta_b V_s - \lambda a Cov_{hs}])$

where $Const_a$ and $Const_b$ are positive constants.

Proposition I

In a unconstrained economy, the investor's optimal holdings will be

$a_u^* = \frac{\mu_h V_s - \mu_s Cov_{hs}}{\lambda(V_h V_s - Cov_{hs}^2)}$

$b_u^* = (\frac{\mu_s V_h - \mu_h Cov_{hs}}{\lambda(V_h V_s - Cov_{hs}^2) - \mu_h V_s + \mu_s Cov_{hs}} - \beta_L)/(\beta_H - \beta_L)$

We put restrictions on the parameter space so that optimal holdings a_u^*, b_u^* will both be between $(0, 1)$, i.e. representative investor take longs position in all the three securities.

Proposition II

Consider a constrained economy where $a > \frac{\mu_h V_s - \mu_s Cov_{hs}}{\lambda(V_h V_s - Cov_{hs}^2)}$, i.e. the representative investor can constrained to invest less than $(1-a)$ in the Shanghai market,

If $\mu_s > \lambda Cov_{hs}$, then the investor's optimal holdings $b_c^* > b_u^*$, i.e. the representative

investor will demand more high beta Shanghai stocks in the constrained economy than that in the unconstrained economy.

Proposition II formalize our intuition in the paper that when an investor is constrained to under-invest in one market, he would be inclined to demand more high beta stocks in that market.

Proof of Proposition II

To prove proposition II, we simply need to verify $FOC_b|_{b_u^*} > 0$ and $SOC_b < 0$ when $a > \frac{\mu_h V_s - \mu_s Cov_{hs}}{\lambda(V_h V_s - Cov_{hs}^2)}$ and $\mu_s > \lambda Cov_{hs}$.

Step 1) Prove $FOC_b|_{b_u^*} > 0$

$FOC_b = Const_b \times (1-a)(\beta_H - \beta_L)[\mu_s - \lambda(1-a)\beta_b V_s - \lambda a Cov_{hs}]$

By assumption, the term $(1-a)(\beta_H - \beta_L)$ is positive, so we only need to consider the term in the bracket,

Rearrange the term, $\mu_s - \lambda(1-a)\beta_b V_s - \lambda a Cov_{hs} = \mu_s - \lambda\beta_b V_s + \lambda a(\beta_b V_s - Cov_{vs})$

One can easily verify $\mu_s - \lambda\beta_b V_s + \lambda a(\beta_b V_s - Cov_{vs})|_{a_u^*, b_u^*} = 0$ so now we just need to show $\beta_b V_s - Cov_{vs}|_{b_u^*} > 0$

Through some algebra, we have $\beta_b V_s - Cov_{vs}|_{b_u^*} = \frac{(V_h V_s - Cov_{hs}^2)(\mu_s - \lambda Cov_{hs})}{\lambda(V_h V_s - Cov_{hs}^2) - \mu_h V_s + \mu_s Cov_{hs}}$

The denominator is positive from the the assumption that $a_u^* < 1$

Step 2) Prove $SOC_b < 0$

$SOC_b = -\lambda(1-a)^2(\beta_H - \beta_L)^2 V_s < 0$

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Table 1. Summary Statistics

This table reports the time-series averages of the number, mean, standard deviation, minimum, 25th percentile, median, 75th percentile, and maximum of firm characteristics, including natural log of market capitalization in thousand yuan ($SIZE$), book-to-market equity ratio (BM), return-on-assets (ROA), leverage (LEV), beta with respect to the China market ($BETA\_CH$), total volatility ($TVOL$), idiosyncratic volatility with respect to a China market model ($IVOL\_CH$), beta with respect to the Hong Kong market ($BETA\_HK$), average daily turnover in the past one year ($TURNOVER$), Amihud illiquidity measure in the past one year ($AMIHUD$), past one-month return (RET_1_1), a dummy variable that equals one if the firm is a state-owned enterprise and zero otherwise (SOE). See Appendix A for the definition of variables. All variables are winsorized at the 1% and 99% levels. The sample include all connected firms that have a valid propensity-score matched firm.

VAR	N	MEAN	STDDEV	MIN	P25	P50	P75	MAX
SIZE	416	16.031	0.783	14.470	15.474	15.918	16.461	18.271
BM	416	0.624	0.397	0.089	0.349	0.532	0.794	2.113
ROA	416	0.049	0.039	-0.052	0.022	0.041	0.070	0.200
LEV	416	0.199	0.152	0.000	0.054	0.194	0.307	0.689
BETA_CH	416	1.217	0.257	0.550	1.060	1.205	1.381	1.849
TVOL	416	0.349	0.080	0.195	0.291	0.339	0.401	0.613
IVOL_CH	416	0.299	0.082	0.154	0.236	0.293	0.354	0.564
BETA_HK	416	0.496	0.190	0.030	0.383	0.487	0.603	1.055
TURNOVER	416	0.016	0.011	0.002	0.009	0.014	0.021	0.064
AMIHUD	416	0.029	0.023	0.003	0.014	0.023	0.039	0.129
RET_1_1	416	0.026	0.085	-0.110	-0.027	0.008	0.060	0.518
SOE	408	0.679	0.467	0.000	0.000	1.000	1.000	1.000

Table 2. Firm Characteristics for Connected Firms and Propensity-Score-Matched Unconnected Firms

This table presents the main firm characteristics for connected (treatment) firms and their propensity-score-matched unconnected (control) firms. We implement the propensity-score-matched procedure by first estimating a logit regression to model the probability of being a treatment firm using firm size ($SIZE$), book-to-market ratio (BM), return-on-assets (ROA), leverage (LEV), and China market beta ($BETA\_CH$) at the end of October 2014. We then match each treatment firm to the control firms using the nearest neighbor matching technique (with replacement, and caliper set at 0.25*standard error of propensity score). Our final sample include 416 connected firms and their corresponding propensity-score-matched unconnected firms, which also have valid return data within three day window (-1,1) of the announcement event on Nov 10, 2014.

	Connected	Unconnected	Dif	t-statistics
SIZE	16.031	15.948	0.084	1.598
BM	0.624	0.590	0.035	1.231
ROA	0.049	0.044	0.004	1.388
LEV	0.199	0.206	-0.007	-0.620
BETA_CH	1.217	1.228	-0.010	-0.575
TURNOVER	0.016	0.017	-0.001	-0.648
RET_1_1	0.026	0.023	0.003	0.531

Table 3. Portfolio Analysis for Announcement Returns of Connected Stocks and Propensity-Score-Matched Unconnected Stocks

This table reports the average cumulative return (CR, in %), cumulative abnormal return based on the market model (CAR1, in %), and cumulative abnormal return based on the Fama-French three factor model (CAR2, in %) of connected stocks and their propensity-score-matched unconnected stocks during the announcement of the connection between the Shanghai Stock Exchange and the Hong Kong Stock Exchange. Panel A, Panel B, and Panel C report the returns for the event window (-1,1), (-2,2), and (-3,3), respectively.

	Matched sample			Matched sample ex AH		
	Con	Non-Con	Diff	Con	Non-Con	Diff
Panel A. Event Window (-1,1)						
CR (-1,1)	-1.700	-3.200	1.500	-1.900	-3.300	1.400
	(-7.57)	(-14.79)	(4.81)	(-8.27)	(-14.85)	(4.38)
	416	416		382	382	
Car1(-1,1)	-3.000	-4.700	1.700	-3.300	-4.800	1.500
	(-13.14)	(-20.83)	(5.30)	(-13.75)	(-20.67)	(4.49)
	416	416		382	382	
Car2(-1,1)	-0.900	-1.600	0.700	-0.900	-1.500	0.600
	(-4.06)	(-7.79)	(2.32)	(-3.89)	(-7.23)	(1.93)
	416	416		382	382	
Panel B. Event Window (-2,2)						
CR (-2,2)	0.800	-1.000	1.800	0.600	-1.100	1.700
	(3.03)	(-4.23)	(5.08)	(2.32)	(-4.55)	(4.80)
	412	412		378	378	
Car1(-2,2)	-2.100	-4.300	2.200	-2.300	-4.400	2.100
	(-7.74)	(-16.44)	(5.84)	(-8.17)	(-16.22)	(5.37)
	412	412		378	378	
Car2(-2,2)	-0.500	-1.900	1.400	-0.600	-1.900	1.300
	(-2.04)	(-8.27)	(4.17)	(-2.05)	(-7.83)	(3.42)
	412	412		378	378	
Panel C. Event Window (-3,3)						
CR (-3,3)	0.000	-2.400	2.400	-0.100	-2.600	2.500
	(-0.06)	(-7.79)	(7.79)	(-0.44)	(-8.14)	(6.36)
	409	409		375	375	
Car1(-3,3)	-1.900	-4.600	2.700	-2.000	-4.800	2.800
	(-5.85)	(-13.94)	(5.83)	(-6.07)	(-14.04)	(5.90)
	409	409		375	375	
Car2(-3,3)	0.000	-1.900	1.900	0.000	-2.000	2.000
	(-0.11)	(-6.54)	(6.54)	(0.06)	(-6.49)	(6.49)
	409	409		375	375	

Table 4. Regression Analysis for Announcement Returns of Connected Stocks and Propensity-Score-Matched Unconnected Stocks

This table reports the regression analysis for the announcement returns of connected stocked and propensity-score-matched unconnected stocks:

$$CAR_i = a_0 + a_1 CONNECT_i + \boldsymbol{bz_{i,t}} + \varepsilon_{i,t},$$

where CAR_i represents cumulative return (CR, in %), cumulative abnormal return based on the market model (CAR1, in %), and cumulative abnormal return based on the Fama-French three factor model (CAR2, in %) during the announcement window (-3,3), respectively. $CONNECT_i$ is a dummy variable, which equals one if the firm is included in the Northbound trading service and zero otherwise. Control variables $\boldsymbol{z_{i,t}}$ include market capitalization ($SIZE$), book-to-market equity ratio (BM), return-on-assets (ROA), leverage (LEV), beta with respect to the China market ($BETA\_CH$), idiosyncratic volatility with respect to a China market model ($IVOL\_CH$), beta with respect to the Hong Kong market ($BETA\_HK$), Amihud illiquidity measure ($AMIHUD$), and turnover ($TURNOVER$). Corresponding t-statistics based on robust standard errors clustered at the firm level are reported in parentheses.

	CR(-3,3)		Car1(-3,3)		Car2(-3,3)	
CONNECT	2.367	1.718	2.679	1.749	1.871	1.416
	(5.45)	(4.09)	(5.86)	(4.08)	(4.47)	(3.38)
SIZE		1.750		1.323		0.205
		(4.24)		(3.13)		(0.50)
BM		0.075		-0.398		-1.985
		(0.13)		(-0.68)		(-3.34)
ROA		-3.218		0.448		2.116
		(-0.61)		(0.08)		(0.41)
LEV		1.017		0.899		-0.252
		(0.69)		(0.60)		(-0.17)
BETA_CH		1.300		1.225		1.767
		(1.33)		(1.19)		(1.80)
IVOL_CH		-21.907		-26.654		-14.366
		(-6.26)		(-7.38)		(-4.16)
AMIHUD		10.219		-11.958		-14.758
		(0.92)		(-1.08)		(-1.29)
TURNOVER		0.007		-0.026		-0.015
		(0.26)		(-0.95)		(-0.56)
CONSTANT	-2.386	-25.306	-4.557	-17.517	-1.904	-0.714
	(-7.80)	(-3.76)	(-13.96)	(-2.56)	(-6.55)	(-0.11)
Adj.R2	0.034	0.148	0.039	0.199	0.023	0.067
Obs.	818	818	818	818	818	818

Table 5. Announcement Returns and the Effect of Betting against Beta

This table reports the results from the following regression:

$$CAR_i = a_0 + a_1 CONNECT_i + a_2 CONNECT_i * BETA\_CH_i + a_3 BETA\_CH_i + \boldsymbol{b z_{i,t}} + \varepsilon_{i,t},$$

where CAR_i represents cumulative return (CR, in %), cumulative abnormal return based on the market model (CAR1, in %), and cumulative abnormal return based on the Fama-French three factor model (CAR2, in %) during the announcement window (-3,3), respectively. $CONNECT_i$ is a dummy variable, which equals one if the firm is included in the Northbound trading service and zero otherwise. $BETA\_CH_i$ is firm beta with respect to the China market. Control variables $\boldsymbol{z_{i,t}}$ include market capitalization ($SIZE$), book-to-market equity ratio (BM), return-on-assets (ROA), leverage (LEV), idiosyncratic volatility with respect to a China market model ($IVOL\_CH$), Amihud illiquidity measure ($AMIHUD$), and turnover ($TURNOVER$). The sample include connected stocked and their propensity-score-matched unconnected stocks. Corresponding t-statistics based on robust standard errors clustered at the firm level are reported in parentheses.

	CR(-3,3)		Car1(-3,3)		Car2(-3,3)	
CONNECT	-4.050	-5.191	-4.025	-5.665	-3.656	-4.713
	(-1.98)	(-2.60)	(-1.88)	(-2.74)	(-1.79)	(-2.35)
*CONNECT*BETA_CH*	5.230	5.634	5.458	6.046	4.522	4.999
	(3.08)	(3.44)	(3.07)	(3.56)	(2.71)	(3.05)
BETA_CH	-3.776	-1.499	-4.525	-1.779	-1.558	-0.717
	(-3.33)	(-1.25)	(-3.84)	(-1.42)	(-1.38)	(-0.57)
SIZE		1.756		1.330		0.210
		(4.32)		(3.23)		(0.52)
BM		-0.015		-0.495		-2.065
		(-0.03)		(-0.84)		(-3.46)
ROA		-3.952		-0.339		1.465
		(-0.75)		(-0.06)		(0.29)
LEV		0.992		0.873		-0.274
		(0.68)		(0.59)		(-0.19)
IVOL_CH		-22.436		-27.221		-14.835
		(-6.47)		(-7.59)		(-4.33)
AMIHUD		9.494		-12.736		-15.401
		(0.87)		(-1.19)		(-1.37)
TURNOVER		0.009		-0.024		-0.013
		(0.35)		(-0.88)		(-0.50)
CONSTANT	2.261	-21.704	1.012	-13.652	0.014	2.481
	(1.62)	(-3.28)	(0.69)	(-2.06)	(0.01)	(0.38)
Adj.R2	0.045	0.160	0.053	0.212	0.030	0.078
Obs.	818	818	818	818	818	818

Table 6. Announcement Returns and the Effect of Betting against Beta: Robustness Check

This table reports the robustness checks for the effect of connection and China market beta on the announcement returns in the regression analysis. The dependent variable is the cumulative abnormal return based on the Fama-French three factor model (CAR2, in %) during the announcement window (-3,3). Control variables include market capitalization ($SIZE$), book-to-market equity ratio (BM), return-on-assets (ROA), leverage (LEV), beta with respect to the China market ($BETA\_CH$), idiosyncratic volatility with respect to a China market model ($IVOL\_CH$), Amihud illiquidity measure ($AMIHUD$), turnover ($TURNOVER$), and beta with respect to the Hong Kong market ($BETA\_HK$). The sample include connected stocked and their propensity-score-matched unconnected stocks. Corresponding t-statistics based on robust standard errors clustered at the firm level are reported in parentheses.

	Car2(-3,3)							
CONNECT	-9.519	-4.231	-4.080	-4.817	-5.159	-3.562	-4.791	-4.553
	(-1.07)	(-1.91)	(-1.92)	(-2.29)	(-2.48)	(-1.75)	(-2.37)	(-2.29)
*CONNECT*BETA_CH*	4.964	4.815	4.769	4.956	4.634	4.607	5.733	4.448
	(3.00)	(2.92)	(2.90)	(3.04)	(2.59)	(2.85)	(3.07)	(2.25)
*CONNECT*SIZE*	0.302							
	(0.59)							
*CONNECT*BM*		-0.460						
		(-0.45)						
*CONNECT*ROA*			-7.890					
			(-0.95)					
*CONNECT*LEV*				0.669				
				(0.26)				
*CONNECT*IVOL_CH*					2.790			
					(0.51)			
*CONNECT*AMIHUD*						-21.564		
						(-1.44)		
*CONNECT*TURNOVER*							-0.052	
							(-1.29)	
*CONNECT*BETA_HK*								1.014
								(0.36)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R2	0.077	0.077	0.078	0.077	0.077	0.079	0.079	0.077
Obs.	818	818	818	818	818	818	818	818

Table 7. Abnormal Turnover, Connection, and the Beta Effect

This table reports the regression analysis of the abnormal turnovers of connected stocked and propensity-score-matched unconnected stocks:

$$Y_i = a_0 + a_1 CONNECT_i + \boldsymbol{bz_{i,t}} + \varepsilon_{i,t},$$
$$Y_i = a_0 + a_1 CONNECT_i + a_2 CONNECT_i * BETA\_CH_i + a_3 BETA\_CH_i + \boldsymbol{bz_{i,t}} + \varepsilon_{i,t},$$

where Y_i represents abnormal turnover of firm i in the first three-day window (0,2) after the connection between the Shanghai Stock Exchange and the Hong Kong Stock Exchange. We use two measures for abnormal turnover. One is $TURNOVER\_AB1$, which is defined as the average daily turnover during the event window minus average daily turnover in the most recent month. The other one is $TURNOVER\_AB2$, which is defined as the average daily turnover during the event window minus average daily turnover in the most recent month divided by average daily turnover in the most recent month. $CONNECT_i$ is a dummy variable, which equals one if the firm is included in the Northbound trading service and zero otherwise. $BETA\_CH_i$ is firm beta with respect to the China market. Control variables $\boldsymbol{z_{i,t}}$ include market capitalization ($SIZE$), book-to-market equity ratio (BM), return-on-assets (ROA), leverage (LEV), idiosyncratic volatility with respect to a China market model ($IVOL\_CH$), and Amihud illiquidity measure ($AMIHUD$). Corresponding t-statistics based on robust standard errors clustered at the firm level are reported in parentheses.

	TURNOVER_AB1				TURNOVER_AB2			
CONNECT	3.193	2.015	-5.513	-7.741	0.164	0.118	-0.214	-0.303
	(3.34)	(2.12)	(-1.24)	(-1.77)	(4.23)	(2.98)	(-1.22)	(-1.73)
*CONNECT*BETA_CH*			7.094	7.955			0.309	0.344
			(1.90)	(2.19)			(2.20)	(2.47)
BETA_CH		-0.861	-7.082	-4.779		0.040	-0.166	-0.129
		(-0.45)	(-2.96)	(-2.03)		(0.52)	(-1.90)	(-1.44)
SIZE		2.768		2.724		0.118		0.116
		(3.61)		(3.60)		(3.84)		(3.81)
BM		-1.059		-1.176		-0.014		-0.019
		(-0.71)		(-0.79)		(-0.25)		(-0.33)
ROA		-10.732		-11.706		-0.495		-0.537
		(-0.88)		(-0.96)		(-0.91)		(-0.99)
LEV		-3.132		-3.158		-0.108		-0.109
		(-0.93)		(-0.95)		(-0.75)		(-0.76)
IVOL_CH		-493.592		-503.527		-12.843		-13.272
		(-4.22)		(-4.30)		(-2.97)		(-3.04)
AMIHUD		-7.879		-10.361		-1.610		-1.717
		(-0.33)		(-0.43)		(-2.06)		(-2.20)
CONSTANT	-6.080	-36.945	2.611	-31.025	-0.183	-1.731	0.020	-1.475
	(-9.80)	(-2.70)	(0.91)	(-2.28)	(-7.61)	(-3.20)	(0.17)	(-2.74)
Adj.R2	0.012	0.066	0.019	0.071	0.020	0.068	0.023	0.074
Obs.	818	818	818	818	818	818	818	818

Table 8. Abnormal Turnover, Connection, and the Beta Effect: Robustness Check

This table reports the robustness checks for the effect of connection and China market beta on the abnormal turnovers in the regression analysis. The dependent variable is the abnormal returns during the first three trading days after the connection between the Shanghai stock Exchange and the Hong Kong Stock Exchange. We use two measures for abnormal turnover. One is $TURNOVER\_AB1$, which is defined as the average daily turnover during the event window minus average daily turnover in the most recent month. The other one is $TURNOVER\_AB2$, which is defined as the average daily turnover during the event window minus average daily turnover in the most recent month divided by average daily turnover in the most recent month. Control variables include market capitalization ($SIZE$), book-to-market equity ratio (BM), return-on-assets (ROA), leverage (LEV), beta with respect to the China market ($BETA\_CH$), idiosyncratic volatility with respect to a China market model ($IVOL\_CH$), Amihud illiquidity measure ($AMIHUD$), and beta with respect to the Hong Kong market ($BETA\_HK$). The sample include connected stocked and their propensity-score-matched unconnected stocks. Corresponding t-statistics based on robust standard errors clustered at the firm level are reported in parentheses.

	TURNOVER_AB1							TURNOVER_AB2						
CONNECT	2.808	-6.722	-5.504	-6.222	-8.386	-7.501	-7.672	-1.558	-0.230	-0.300	-0.183	-0.307	-0.199	-0.268
	(0.15)	(-1.53)	(-1.20)	(-1.35)	(-1.61)	(-1.59)	(-1.75)	(-1.93)	(-1.27)	(-1.60)	(-0.96)	(-1.53)	(-1.07)	(-1.53)
*CONNECT*BETA_CH*	7.305	7.327	7.026	7.155	6.827	7.518	11.070	0.334	0.308	0.323	0.291	0.302	0.295	0.253
	(2.00)	(2.05)	(1.92)	(1.95)	(1.85)	(2.04)	(2.37)	(2.38)	(2.23)	(2.30)	(2.06)	(2.09)	(2.11)	(1.43)
*CONNECT*SIZE*	-0.616							0.079						
	(-0.57)							(1.63)						
*CONNECT*BM*		-0.586							-0.055					
		(-0.26)							(-0.62)					
*CONNECT*ROA*			-25.843							0.353				
			(-1.31)							(0.40)				
*CONNECT*LEV*				-3.228							-0.305			
				(-0.58)							(-1.28)			
*CONNECT*IVOL_CH*					97.865							2.507		
					(0.47)							(0.33)		
*CONNECT*AMIHUD*						5.896							-1.585	
						(0.19)							(-1.24)	
*CONNECT*BETA_HK*							-8.225							0.146
							(-1.17)							(0.61)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R2	0.074	0.074	0.076	0.074	0.074	0.074	0.076	0.082	0.080	0.080	0.081	0.080	0.081	0.080
Obs.	818	818	818	818	818	818	818	818	818	818	818	818	818	818

Table 9. Placebo Tests: Announcement Return and abnormal turnover

This table reports the placebo tests for the announcement return and abnormal turnover analysis. We choose three pseudo trading dates (22 Dec 2014, 15 Dec 2014, and 8 Dec 2014) after the event month and three dates before the event month (20 Oct 2014, 13 Oct 2014, and 29 Sep 2014). We choose trading Mondays as our pseudo dates to mimic the actual event dates and minimize overlapping observations. Panel A, B, and C report the regression analysis for $CAR2(-3,3)$, $TURNOVER\_AB1(0,2)$, and $TURNOVER\_AB2(0,2)$, respectively. Control variables include market capitalization ($SIZE$), book-to-market equity ratio (BM), return-on-assets (ROA), leverage (LEV), beta with respect to the China market ($BETA\_CH$), idiosyncratic volatility with respect to a China market model ($IVOL\_CH$), Amihud illiquidity measure ($AMIHUD$), turnover ($TURNOVER$), and beta with respect to the Hong Kong market ($BETA\_HK$). Corresponding t-statistics based on robust standard errors clustered at the firm level are reported in parentheses.

Panel A. Dependent variable = CAR2(-3,3)

	22-Dec-14		15-Dec-14		8-Dec-14		20-Oct-14		13-Oct-14		29-Sep-14	
CONNECT	0.567	-0.032	0.421	-3.484	0.204	-3.527	-0.435	0.321	-0.208	-3.520	-0.055	0.773
	(1.06)	(-0.01)	(0.79)	(-1.40)	(0.30)	(-1.06)	(-1.12)	(0.16)	(-0.49)	(-1.76)	(-0.16)	(0.54)
*CONNECT*BETA_CH*		0.502		3.271		3.123		-0.613		2.680		-0.684
		(0.23)		(1.57)		(1.12)		(-0.38)		(1.75)		(-0.61)
BETA_CH	-2.577	-0.798	-0.702	-7.186	-0.801	-6.128	-0.594	3.648	-0.539	-2.695	-0.942	-1.607
	(-4.42)	(-0.48)	(-1.47)	(-4.77)	(-1.15)	(-3.08)	(-1.34)	(2.96)	(-1.08)	(-2.09)	(-3.00)	(-1.68)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R2	0.025	0.024	0.083	0.085	0.099	0.099	0.075	0.074	0.053	0.055	0.123	0.122
Obs.	766	766	774	774	774	774	800	800	780	780	788	788

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Panel B. Dependent variable = TURNOVER_AB1(0,2)

	22-Dec-14		15-Dec-14		8-Dec-14		20-Oct-14		13-Oct-14		29-Sep-14	
CONNECT	-0.776	1.908	0.709	1.366	1.385	3.336	-0.715	-6.089	-1.661	-5.059	-0.442	0.365
	(-0.72)	(0.37)	(0.70)	(0.31)	(1.03)	(0.55)	(-0.71)	(-1.16)	(-2.04)	(-1.36)	(-0.46)	(0.08)
*CONNECT*BETA_CH*		-2.257		-0.552		-1.637		4.318		2.726		-0.667
		(-0.53)		(-0.15)		(-0.31)		(1.02)		(0.90)		(-0.17)
BETA_CH	-7.579	-6.489	0.680	0.951	4.847	5.644	-5.234	-7.464	-1.684	-3.090	2.548	2.883
	(-3.46)	(-2.56)	(0.36)	(0.40)	(1.86)	(1.62)	(-2.12)	(-2.42)	(-0.99)	(-1.33)	(1.24)	(0.98)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R2	0.091	0.090	0.035	0.034	0.111	0.110	0.081	0.082	0.097	0.097	0.069	0.068
Obs.	787	787	804	804	797	797	822	822	831	831	792	792

Panel C. Dependent variable = $TURNOVER\_AB2(0,2)$

	22-Dec-14		15-Dec-14		8-Dec-14		20-Oct-14		13-Oct-14		29-Sep-14	
CONNECT	-0.032	0.009	-0.003	0.056	0.010	0.057	-0.007	-0.047	-0.073	-0.195	-0.010	0.202
	(-0.69)	(0.04)	(-0.06)	(0.29)	(0.18)	(0.21)	(-0.19)	(-0.26)	(-2.05)	(-1.17)	(-0.22)	(1.07)
*CONNECT*BETA_CH*		-0.034		-0.050		-0.040		0.033		0.098		-0.175
		(-0.19)		(-0.32)		(-0.17)		(0.24)		(0.77)		(-1.16)
BETA_CH	-0.427	-0.411	-0.229	-0.205	-0.236	-0.216	-0.254	-0.271	-0.046	-0.097	-0.005	0.083
	(-4.45)	(-3.86)	(-2.81)	(-1.89)	(-2.02)	(-1.27)	(-3.23)	(-2.54)	(-0.68)	(-0.95)	(-0.06)	(0.75)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R2	0.149	0.148	0.045	0.044	0.092	0.091	0.025	0.024	0.046	0.045	0.046	0.046
Obs.	787	787	804	804	797	797	822	822	831	831	792	792

Table 10. Alternative Explanation: Risk Sharing

Panel A, B, and C report the regression analysis for $CAR2(-3,3)$, $TURNOVER\_AB1(0,6)$, and $TURNOVER\_AB2(0,6)$, respectively. Control variables include market capitalization ($SIZE$), book-to-market equity ratio (BM), return-on-assets (ROA), leverage (LEV), beta with respect to the China market ($BETA\_CH$), idiosyncratic volatility with respect to a China market model ($IVOL\_CH$), Amihud illiquidity measure ($AMIHUD$), and turnover ($TURNOVER$). Corresponding t-statistics based on robust standard errors clustered at the firm level are reported in parentheses.

	CAR2(-3,3)		TURNOVER_AB1(0,6)		TURNOVER_AB2(0,6)	
CONNECT	-0.106	-2.798	-6.595	-8.555	-0.220	-0.443
	(-0.07)	(-1.42)	(-1.80)	(-1.97)	(-1.31)	(-2.26)
*CONNECT*DIFCOV*	2.538	-4.023	13.410	5.242	0.518	-0.139
	(1.14)	(-1.12)	(2.28)	(0.58)	(2.01)	(-0.37)
DIFCOV	-0.472	-0.706	-11.168	-21.578	-0.370	-0.730
	(-0.30)	(-0.31)	(-2.71)	(-3.59)	(-2.12)	(-3.04)
*CONNECT*BETA_CH*		5.636		5.776		0.522
		(2.18)		(2.00)		(2.21)
BETA_CH		0.118		9.897		0.340
		(0.07)		(2.72)		(2.47)
SIZE	0.347	0.149	-0.272	-0.901	0.106	0.073
	(0.85)	(0.37)	(-0.31)	(-1.10)	(2.60)	(1.93)
BM	-2.137	-2.283	-0.831	-1.358	-0.055	-0.080
	(-3.68)	(-3.92)	(-0.55)	(-0.89)	(-0.88)	(-1.27)
ROA	-2.001	-0.037	-34.661	-24.153	-1.544	-1.067
	(-0.41)	(-0.01)	(-2.57)	(-1.79)	(-2.64)	(-1.85)
LEV	-1.155	-0.783	-6.847	-5.368	-0.175	-0.102
	(-0.80)	(-0.54)	(-1.77)	(-1.39)	(-1.02)	(-0.60)
IVOL_CH	-13.104	-12.053	-269.107	-192.959	-19.042	-15.706
	(-3.73)	(-3.49)	(-1.93)	(-1.39)	(-3.28)	(-2.71)
AMIHUD	-11.307	-11.992	-65.974	-59.630	-1.550	-1.349
	(-1.04)	(-1.10)	(-2.71)	(-2.51)	(-1.48)	(-1.26)
TURNOVER	-0.011	-0.025	-0.124	-0.182	0.000	-0.002
	(-0.39)	(-0.88)	(-1.19)	(-1.77)	(0.08)	(-0.68)
CONSTANT	-0.719	2.266	23.172	26.678	-0.838	-0.554
	(-0.11)	(0.34)	(1.57)	(1.90)	(-1.29)	(-0.88)
Adj.R2	0.064	0.075	0.053	0.074	0.069	0.096
Obs.	812	812	828	828	828	828

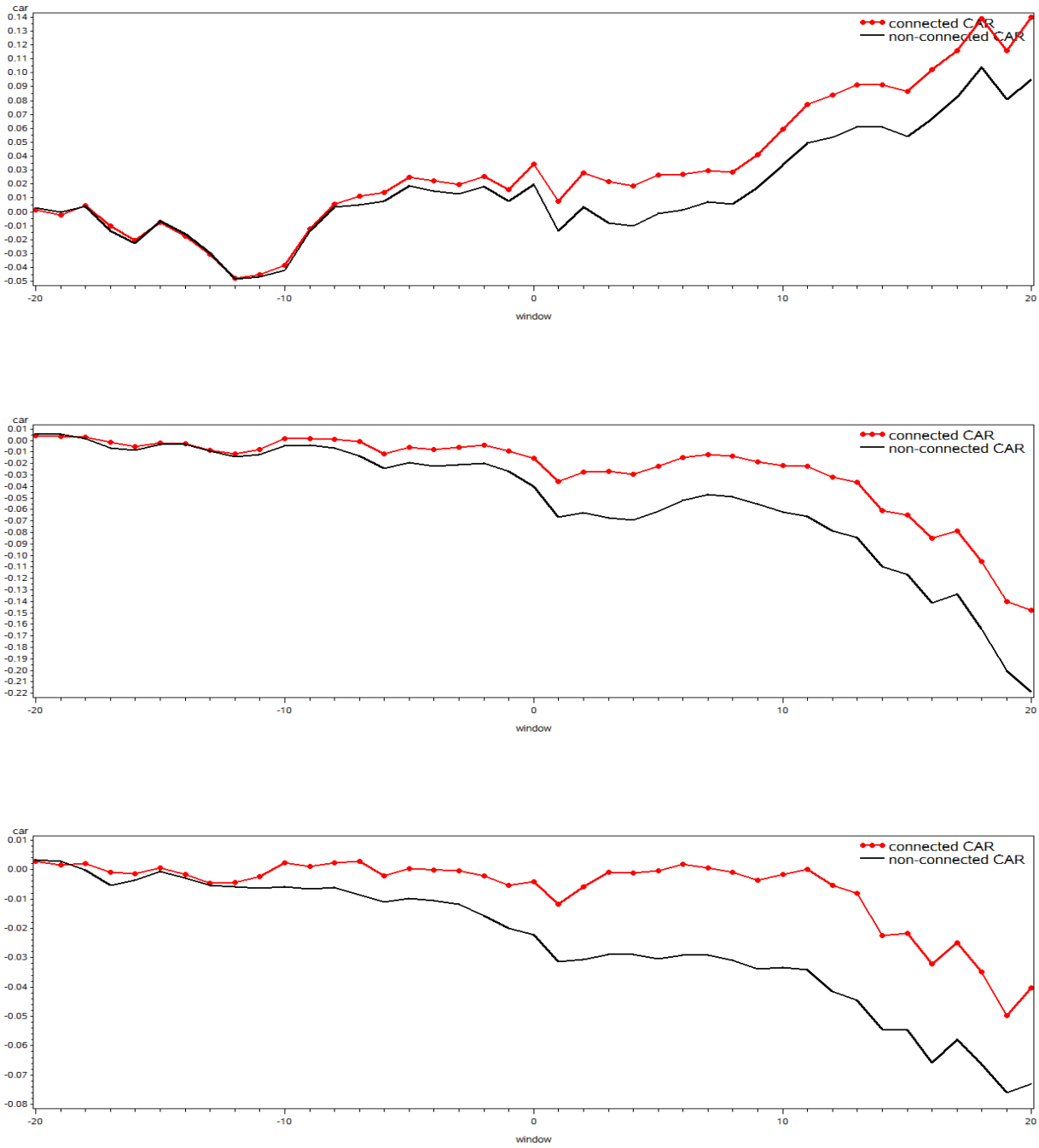

Figure 1. Cumulative Return (Abnormal Return) around the Announcement Window for Connected Firms and Their Propensity-Score-Matched Unconnected Firms
This figure presents the (1a) cumulative return, (1b) cumulative abnormal return based on the market model, and (1c) cumulative abnormal return based on the Fama-French three factor model around the announcement window from -20 to 20 for connected firms and their propensity-score-matched unconnected firms, respectively.

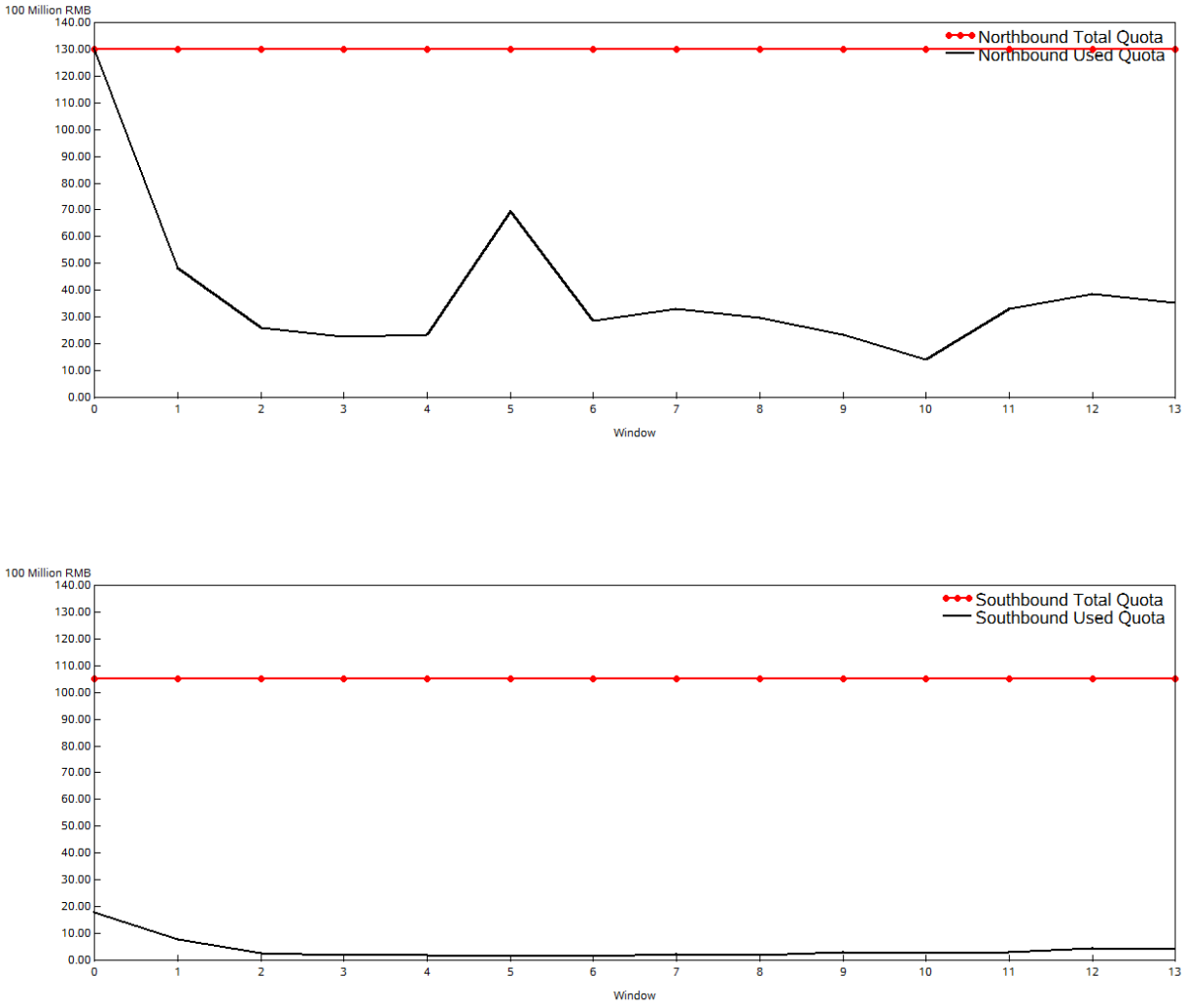

Figure 2. Daily Total Quota and Used Quota for Northbound and Southbound Service after the Connection

This figure presents the daily total quota and used quota for (2a) Northbound and (2b) Southbound service within 14 days after the connection between the Shanghai Stock Exchange and the Hong Kong Stock Exchange.