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How does the exchange-rate regime affect dual-listed share price parity? Evidence from China's A- and H-share markets

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Abstract:

This paper examines the impact of exchange-rate regime change on the price disparity of China's dual-listed stocks. We use four years of synchronous intraday data of 26 pairs of dual-listed RMB-denominated A-shares and their corresponding HKD-denominated H-shares. The sample period covers the 2005 and 2008 changes in the exchange rate regime. During that time, the Chinese authorities strictly prohibited short selling of stocks and tightly regulated capital flows. In contrast to the existing general findings, we find that the law of one price can be strengthened for dual-listed stocks (DLSs) in segmented capital markets under a flexible exchange rate regime; the disparity between the DLSs is reduced under the managed float compared to the pegged regime. Moreover, we find that the magnitude of the H-share discount is positively related to the expected RMB appreciation under managed float; however, under the pegged regime the relationship is negative.

Keywords:

H-share discount; Dual-listed stocks; Market segmentation; Quasi arbitrage; Alternate exchange rate regime

1. Introduction

Common stocks issued by the same company and carrying identical rights traded in multiple exchanges must obey the Law of One Price (LOP) to preclude arbitrage in a globally perfect capital market. However, in the third quarter of 2022, even after the implementation of various measures to ease intermarket access between the Chinese mainland and Hong Kong since the introduction of Hong Kong dollar (HKD) denominated H-shares in 1993, Renminbi (RMB) denominated A-shares listed on the Shanghai and Shenzhen exchanges are still priced at an average premium of over 40 % above the dual-listed H-shares. This is a strong indication that there are significant obstacles to conducting arbitrage between the dual-listed A- and H-shares.

Exchange rate risk can be an important hurdle against intermarket arbitrage; however, studies on the direct relationship between such risk and price disparity of dual-listed stocks (DLSs) are contaminated by an endogeneity problem as exchange rate movements directly affect the value ratio of the stock pair (e.g., [Zhao, 2010](#); [Ye and Hutson, 2011](#)). This paper bypasses the endogeneity issue by examining how, and to what extent, exogenous exchange-rate regime changes affect the price disparity.

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The study is facilitated by two clearly-defined official policy changes in the RMB exchange rate regime in 2005 and 2008. The first regime change took effect on 21 July 2005 when the U.S. dollar (USD) peg was replaced by a managed float; the second change, on 1 July 2008, largely amounted to a return to the former regime by introducing a closely monitored soft peg again with the USD. Since 1983, the HKD has been linked to the USD by the Hong Kong authorities through a currency board system, and variations in the price of the RMB vis-à-vis USD have directly affected the relative value of A-H stock pairs.

The paper has two main objectives: firstly, the study assesses how, and to what extent, the changes in the exchange rate regime affect the relative price of dual-listed A- and H-shares. In particular, we test whether the 2005 change allowed traders to buy the significantly discounted H-shares to speculate on RMB appreciation, which could have increased the intensity of arbitrage and reduced the H-share discount. Conversely, the research determines the extent to which the 2008 change to the soft dollar peg discouraged currency speculation, which is expected to have reduced the intensity of arbitrage and raised the H-share discount. Secondly, the paper tests how, and to what extent, market- and firm-specific factors, including exchange rate risk and expectations, liquidity constraints against traders, information asymmetry, and short-selling restrictions differences between the China markets (i.e., Shanghai Stock Exchange and Shenzhen Stock Exchange) and the Hong Kong Exchanges (HKEX), affect the relative valuation of the dual-listed stocks.

The segmented market features essential to this research are enhanced by the prevailing regulatory conditions surrounding the study period; particularly, during that time, China exercises tight control on capital flows and carries out strict prohibitions on stock short-selling. The tight control on capital flows deters direct speculation on RMB exchange rates; whilst the latter restriction prevents short A – long H stock arbitrage, the natural trading strategy since H-shares have been priced at a significant discount relative to the A-shares. International investors however have unlimited access to the H-shares market, which make the stocks a convenient financial instrument to express their views on the future RMB exchange rates and the valuation of A- and H-shares.

The high and persistent H-share discount is in stark contrast with the premium of foreign over local shares documented by [Hietala \(1989\)](#), [Bailey and Jagtiani \(1994\)](#) and [Domowitz, Glen, and Madhavan \(1997\)](#) in Finland, Thailand, and Mexico, respectively. Previous literature has put forward six major explanations of this puzzle. First, information asymmetry, between local (China mainland residents) and foreign investors, has been found to affect the relative valuation of DLSs. [Chakravarty, Sarkar, and Wu \(1998\)](#) and [Chan, Menkveld, and Yang \(2008\)](#) provide evidence that local investors possess an information advantage on the value of A-shares, while [Chui and Kwok \(1998\)](#) conclude that information barriers on the Chinese mainland are a source of an information disadvantage.

Second, capital controls in the home market may limit the extent of diversification into overseas assets of domestic investors; as a result, as championed by [Eun and Janakiraman \(1986\)](#), such investors are forced to overweigh local shares in their portfolios; a phenomenon which can be mirrored by a lower level of risk aversion and a higher price of local than foreign shares. Their proposition is supported by a number of studies such as [Ma \(1996\)](#), [Sun and Tong \(2000\)](#) and [Chan and Kwok \(2005\)](#). Besides, [Wang and Xu \(2004\)](#), [Li, Yan, and Greco \(2006\)](#) and [Burdekin and Redfern \(2009\)](#) document that market-specific risk factors and investor sentiment affect the H-shares discount.

Third, the relative liquidity between the A- and H-share markets affects the price disparity ([Amihud and Mendelson, 1986](#); [Wang and Xu, 2004](#)). Consistent with the trading-cost hypothesis, [Lee \(2009\)](#) finds that the percentage differences in both the quoted spread and depth between A- and H-shares have significant explanatory power on the H-share discount.

Fourth, the bubble component of asset prices, magnified by short-sales restrictions and the dominance of individual investors, can be reflected in a large trading volume and high price volatility ([Scheinkman et al., 2003](#)). [Mei, Scheinkman, and Xiong \(2009\)](#) find that trading caused by investors' differential speculative motives between A- and B-shares explains 20 % of the cross-sectional variation in the B-share discount.¹

Heterogeneous beliefs and uncertainties in various pricing parameters constitute another explanation of the price disparity between A- and H-shares when riskless arbitrage mechanisms are disrupted. Following [Merton's \(1974\)](#) insight that common stock is a *de facto* call option on the underlying asset of a company, [Chung, Hui, and Li \(2013\)](#) show that, within a Bayesian framework, parameter uncertainty is a robust determining factor of A-H share price discrepancies. This result leads to their conclusion that the price disparity persists when investors in segmented markets have different estimates of the pricing parameters.

Finally, foreign investors may require a higher expected return for bearing exchange-rate risk, which depresses foreign-listed share prices compared to Chinese-mainland-listed ones ([Fernald and Rogers, 2002](#)). However, since exchange rate risk is two-sided, empirical findings are also mixed with respect to that proposition. Specifically, a positive relationship between the expected appreciation and the magnitude of H-share discount is found both during periods with rigid RMB exchange rates ([Wang and Xu, 2004](#); [Arquette, Brown and Burdekin, 2008](#); [Burdekin et al, 2009](#)) and with flexible exchange rates ([Eichler, 2011](#)). Our empirical study will shed light on the relative merits of these possible explanations of the H-share discount.

The paper carries out four major tests. The first test assesses whether the price disparity between A- and H-shares is greater under the managed float than under the USD peg. The second test is motivated by the fact that riskless arbitrage is a sufficient, though not a necessary, condition to drive a perfect correlation between dual-listed stock returns, because quasi-arbitrage can strengthen this correlation. This second test examines whether the correlation between A- and H-

¹ B-shares are priced and traded in USD and HKD in SSE and SZSE, respectively. They are accessible to foreign investors.

shares is lower under the USD peg than during the managed-floating regime. The third test examines the proposition that an increase in the expected RMB appreciation prompts purchases of H-shares and reduces the discount, and vice versa. The motivation for this test is that H-shares can be used, especially during the flexible exchange-rate regime, as a double bet on both the RMB appreciation and a decrease in the H-share discount. The fourth set of tests assesses to what extent firm- and market-specific factors affect the discount under the different exchange rate regimes.

To facilitate a direct comparison of the prices of 26 dual-listed shares, the study uses intraday second-by-second bid-ask quote and transactions data during the two hours of overlapping trading sessions in the Chinese mainland and Hong Kong markets between 2004 and 2009, a period encompassing the two changes in exchange rate regimes. The use of intraday data eliminates the potential distortion of asynchronous prices and legging risk on the test results.

The study first finds that the switch from USD peg to managed float in 2005 significantly decreased the H-share discount; whilst the reversal of the exchange rate regime in 2008 significantly increased the discount. This result supports the study's proposition that overseas investors use H-shares as an instrument to speculate on the change in the relative valuation of A- and H-share prices and the future RMB appreciation, bypassing China's strict controls on capital flows. This first result is strengthened by our finding that the switch to a managed float significantly increased the correlation of the returns of the DLSs. Our second finding shows that the relationship between the change in the expected RMB exchange rate and the H-share discount changes sign between different exchange rate regimes; under the managed float the relationship is positive, but it is negative under the pegged exchange rate regime.

Our empirical results provide support to some of the existing explanations of the H-share discount. Among these explanations the findings of the study favor the asymmetric information and relative liquidity hypotheses. The robustness tests imply that the above results are qualitatively invariant with respect to changes in the length of the sample period surrounding the regime change, and that the announcement dates of the regime changes do correspond to significant structural breaks in the time series of individual H-share discounts.

The paper contributes to the literature on the determinants of the relative price between dual-listed stocks. Most importantly, the study provides significant evidence that, in a market subject to capital controls and prohibition against short-selling, a flexible exchange rate regime can encourage quasi-arbitrage to foster the alignment between the prices of dual-listed stocks. In contrast to the important findings of [de Jong, Rosenthal, and van Dijk \(2009\)](#), [Fernald and Rogers \(2002\)](#), and [Wang and Xu \(2004\)](#), that exchange-rate risk widens the price gap between local and foreign shares, the paper also confirms the widely recognized proposition that idiosyncratic market factors can significantly affect the relative valuation of dual-listed stocks when the channel for conducting riskless arbitrage is blocked. These results lead to our conjecture that price parity between dual-listed stocks can be enhanced when restrictions are lifted on capital flows and short-selling of stocks, and cross-settlement between markets is allowed.

The value added of this paper has two extra dimensions. First, the extent studies generally find a positive relationship between the expected RMB appreciation and the magnitude of the H-share discount; however, these studies ignore the changes in exchange rate regimes covered by their samples ([Arquette et al, 2008](#); [Burdekin and Redfern, 2009](#); [Eichler, 2011](#)); an exception is [Hua, Huang, and Jiang \(2022\)](#) who examine the impact on the valuation of A-shares of the two RMB exchange rate regime changes to managed floating in 2005 and 2010, but mainly focus on international trade channels. Our paper examines the effects of changes to and from managed floating and focuses on financial channels. Second, most existing work uses low frequency data (weekly for [Arquette et al., 2008](#); and monthly for [Burdekin and Redfern, 2009](#), as well as [Eichler, 2011](#); and [Hua et al., 2022](#)). Even papers using daily frequencies ([Hua et al., 2022](#)), abstract from the fact that the daily opening and closing times differ between the Chinese mainland and Hong Kong markets, while we consider only the two overlapping trading hours between these exchanges.

The paper is organized as follows: after Section 1, the introduction, Section 2 presents the background of the study. We describe the data and methodology in Section 3, summarize and interpret the empirical findings in Section 4, and conduct robustness checks in Section 5. Section 6 concludes and draws the policy implications of the findings.

2. Background of the study

In a frictionless global market, when the price in RMB of a HKD denominated H-share dual-listed on the HKEX is below the price of its corresponding A-share traded on the Shanghai Stock Exchange (SSE), one may sell short the A-share on SSE for RMB, simultaneously exchange the proceeds for HKD, buy the corresponding H-share on HKEX, and exchange the H-share into A-share to cover the short stock position undertaken on SSE. If the arbitrage is unimpeded, then the process will continue until the A- and H-share prices are at par in the same currency. Conversely, if the price in HKD of an RMB denominated A-share listed on SSE is above its corresponding H-share dual-listed on HKEX, then reverse the direction of the arbitrage trades by first selling short the H-share on HKEX, exchange the proceeds for RMB, and buy the corresponding A-share on SSE to cover the short position undertaken on HKEX.

The expectation that A and H stock pairs should obey the law of one price is due to the confusion between a DLS and a cross-listed stock (CLS). The listing on 26 November 2019 of Alibaba on HKEX is a cross-listing, following its debut on the New York Stock Exchange (NYSE) in the form of an American Depositary Receipt (ADR). The ADR and the stock listed on HKEX are mutually fungible, an important feature that allows for cross-settlement and direct arbitrage if there is a parallel trading session between the two exchanges. Despite the absence of a parallel trading session between the two markets, as

the HKEX cash market closes hours before the NYSE opens, the closing price of the stock in New York was only about 1.5 % above its first day closing price in Hong Kong.² Gagnon and Karolyi (2010) document, at a global level, the mechanics of arbitrage in cross-listed stocks and show that deviations between the prices of cross-listed stocks are typically below 1 %, which suggests that intermarket arbitrage has been highly effective in keeping the prices of CLSs near parity. Conversely, at its debut in Shanghai on 16 July 2020, the opening price of the A-share of Semiconductor Manufacturing International Corporation (SMICs) was about 168 % above its corresponding H-share dual-listed in Hong Kong.³

Observations of persistent and substantial price deviations between DLSs is not a phenomenon unique to the China markets because these shares represent corporate entities, though with identical rights, and are registered under different legal frameworks of the jurisdictions where the stocks are listed; an institutional feature that effectively prohibits cross-settlement and riskless intermarket arbitrage. As the prohibition against cross-settlement bars direct arbitrage between DLSs, arbitrageurs are exposed to divergence and non-convergence risks in conducting quasi arbitrage; the former risk produces immediate losses while the latter amplifies the adverse impact of capital constraints and position limits against arbitrage (Brennan and Schwartz, 1990; Shleifer and Vishny, 1997; Pedro and Saretto, 2009). De Jong, et al. (2009) found significant price deviations, ranging from 5 % to 40 %, for 12 companies dual-listed in the U.K., U.S., and European countries for the period 1980 to 2002, and showed cases where the prices of DLSs take nine years to converge. Last but not the least, exchange rate risk deters quasi-arbitrage, particularly for DLSs listed in markets without a parallel trading session (de Jong et al., 2009; Fernald and Rogers, 2002; Wang and Xu, 2004).

The various institutional obstacles against direct or pure arbitrage between DLSs provide an ideal experimental setting for examining how, and to what extent, factors, including idiosyncratic stock characteristics, investor sentiment, heterogeneous belief, information asymmetry, and liquidity effects influence the relative valuation between dual-listed stocks. Particularly, for the A- and H-shares dual-listed in the China and Hong Kong markets, capital flows were restricted, and short-selling of A-shares was prohibited during the period under investigation.⁴ This prohibition further segments the markets and allows the paper to explore the extent to which the market's expectation of future exchange rates under different exchange rate regimes affects the relative valuation of DLSs.

3. Data and methodology

3.1. Data

This study examines the synchronous prices of A- and H-shares during the overlapping trading hours between Chinese mainland exchanges (SSE and SZSE) and HKEX in the morning (10:00–11:30 am Beijing Time) and afternoon (14:30–15:00p.m. Beijing Time) sessions.⁵ Time-stamped second-by-second intraday transactions and bid-ask quote data of 26 pairs of dual listed A- and H-shares for the period 2004 to 2009 are obtained from the CSMAR Corporation and HKEX.⁶ Daily exchange rate data of the USD/RMB and HKD/RMB are also retrieved from the CSMAR database; and the daily data of the 12-month non-deliverable USD vis-à-vis RMB forward contract (NDF) price are retrieved from Bloomberg Terminals.

During the overall sample period, both A- and H-shares are traded on electronic platforms via open-limit order books, an important market feature that eliminates the potential distortions due to stale prices and uncertain bid-ask bounce problems in measuring the relative prices. Moreover, before March 2010, the China Securities Regulatory Commission (CSRC) strictly prohibited short selling of stocks listed on both Shanghai and Shenzhen Stock Exchanges. The prohibition against short-selling eliminated short A – long H pure arbitrage; an important characteristic of the study period that allows the paper to focus on factors that affect the intensity of quasi-arbitrage which in turn influences the price disparity between the markets.

The study excludes the following observations: (1) data for trades at zero price or zero volume; (2) observations with A-share trades hitting the price limit of +/-10 %; (3) quotes with bid-ask spreads lower than or equal to zero, or depth equal to zero; and (4) the first and last five minutes of each trading session, in order to avoid the potential distortion due to the chaotic and strategic trades right after the opening, and shortly before the closing, of either market. Table 1 provides a summary of company names, stock codes, and listing dates of the stock pairs included in the sample.

² Alibaba closes at HKD187.60 on 26 November 2019 its first trading day on HKEX and the ADR closes at USD194.7 on NYSE; since 1 ADR is equivalent to 8 shares of the stock listed on HKEX and the price of USD was around HKD7.8288, the HKD price per share embedded in the ADR was around 190.53 representing a deviation of about 1.5% of the stock's price in Hong Kong relative to the ADR price. However, even if there is a parallel trading session between the two markets CLSs arbitrage is not risk-free because the conversion between ADRs and the corresponding local shares cannot be completed instantaneously (Grammig and Schlag (2005)).

³ The H-share of the Semiconductor Manufacturing International Corporation (SMICs) registered in Hong Kong and traded on HKEX was dual-listed on the Shanghai Tech-Focused Star Market on 16 July 2020. The opening price was RMB95 (around HKD105.4 at the then exchange rate of 0.90138 RMB per HKD) on the first trading day but the parallel traded H-share was priced at HKD39.3.

⁴ Only from March 2010 did the China Securities Regulatory Commission (CSRC) begin to allow less than 100 stocks to be sold short on the Shanghai and Shenzhen Stock Exchanges.

⁵ Beijing, Shanghai, Shenzhen, and Hong Kong share a common time zone.

⁶ There were 28 dual listed A- and H-shares but the data for two H-shares are incomplete and therefore excluded from the analysis. These two stocks are Hisense Kelon Electrical Holdings Company Limited and Luoyang Glass Company Limited before July 2009.

Table 1
Listing Information of the Sample of Dual-Listed A-H Stock Pairs.

A-share code	H-share code	Stock name	A-share listing date	H-share listing date
000585	00,042	Northeast Electric Dev@	12/13/1995	7/6/1995
000666	00,350	Jingwei Textile Machinery@	12/10/1996	2/2/1996
000756	00,719	Shandong Xinhua Pharm@	8/6/1997	12/31/1996
000898	00,347	Angang Steel@	12/25/1997	7/24/1997
600011	00,902	Huaneng Power Int'l	12/6/2001	1/21/1998
600012	00,995	Anhui Expressway	1/7/2003	11/13/1996
600026	01,138	China Shipping Development	5/23/2002	11/11/1994
600028	00,386	China Petro & Chemical	8/8/2001	10/19/2000
600029	01,055	China Southern Airlines	7/25/2003	7/31/1997
600115	00,670	China Eastern Airlines	11/5/1997	2/5/1997
600188	01,171	Yanzhou Coal Mining	7/1/1998	4/1/1998
600332	00,874	Guangzhou Pharm	2/6/2001	10/30/1997
600362	00,358	Jiangxi Copper	1/11/2002	6/12/1997
600377	00,177	Jiangsu Expressway	1/16/2001	6/27/1997
600548	00,548	Shenzhen Expressway	12/25/2001	3/12/1997
600585	00,914	Anhui Conch Cement	2/7/2002	10/21/1997
600600	00,168	Tsingtao Brewery	8/27/1993	7/15/1993
600685	00,317	Guangzhou Shipyard Int'l	10/28/1993	8/6/1993
600688	00,338	Sinopec Shanghai Petrochem	11/8/1993	7/26/1993
600775	00,553	Nanjing Panda Electric	11/18/1996	5/2/1996
600806	00,300	Kunming Machine Tool	1/3/1994	12/7/1993
600808	00,323	Maanshan Iron & Steel	1/6/1994	11/3/1993
600860	00,187	Beiren Printing Machinery	5/6/1994	8/6/1993
600874	01,065	Tianjin Capital Envir Protection	6/30/1995	5/17/1994
600875	01,072	Dongfang Electric Corp	10/10/1995	6/6/1994
600876	01,108	Luoyang Glass	10/31/1995	7/8/1994

Stocks marked by @ are dual-listed in Shenzhen Stock Exchange and Hong Kong Stock Exchange; unmarked stocks are dual-listed in Shanghai Stock Exchange and Hong Kong Stock Exchange (HKEx). H-shares are traded in HKD on HKEx and A-shares are traded in RMB on the two stock exchange in China Mainland.

The H-share discount ($SD.H_t$) for a dual-listed stock is calculated as follows:

$$SD.H_t = \frac{P_t^A - (P_t^H S_t^{RMB/HKD})}{P_t^A} \quad (1)$$

where P_t^A and P_t^H are respectively the average price of A- and H-shares over the two hours of overlapping trading sessions between SSE/SZE and HKEX. The daily morning fixing spot rate $S_t^{RMB/HKD}$ is used for converting the H-share price to RMB.⁷

Following Chan, et al. (2008), the price impact is calculated as follows:⁸

$$P_t - P_{t-1} = \gamma Q_t V_t + \varphi(Q_t - Q_{t-1}) + e_t \quad (2)$$

where P_t is the intraday transaction price at time t ; γ is the price impact parameter, Q_t is +1 if the trade is buyer-initiated and -1 if the trade is seller-initiated, following the algorithm of Lee and Ready (1991); V_t represents trade size; and φ denotes the gross-profit component associated with an order. If domestic investors in the A-share market are better informed than foreign investors in the corresponding H-share market, then the price impact in the A-share market should be larger than in the corresponding H-share market, and the difference in price impact between the A- and H-shares should be positively correlated with the H-share discount.

Following Arquette, et al. (2008) and Burdekin and Redfern (2009), the 3-month RMB NDF price will be used to estimate the actual forward premium (AFP) to proxy for the market's expectation on future RMB movements:

$$AFP = 1 - \frac{F_t}{S_t^{RMB/USD}} \quad (3)$$

where F_t is the RMB NDF rate versus the US dollar; and $S_t^{RMB/USD}$ is the daily spot exchange rate of the RMB against the USD. In an efficient market, the forward premium only reflects the interest rate differential. However, the interest rates' market is segmented because the Chinese mainland's capital account is tightly regulated, which inhibits interest rate arbitrage. Hence, the forward premium largely reflects long-term exchange rate expectations. First, we will estimate the implied forward premium IFP_t of RMB based on the interest rate differential, i.e.,

⁷ Our measure of the H-share discount is mostly positive, while in most studies the metric is mostly negative, which can lead to some confusion in interpreting the regression results.

⁸ Using a trade's price impact as a measure of information asymmetry was suggested by Kyle (1985), Glosten (1987) and Glosten and Harris (1988).

$$IFP_t = 1 - \frac{S_t^{RMB/USD} * (CNibor_t - Libor_t) * 90/360}{S_t^{RMB/USD}} \quad (4)$$

Then the proxy for RMB appreciation or depreciation $EERC_t$ will be estimated as the actual forward premium (AFF) minus the implied forward premium (IFP), as follows:

$$EERC_t = \frac{S_t^{RMB/USD} * (CNibor_t - Libor_t) * 90/360 - F_t}{S_t^{RMB/USD}} \quad (5)$$

where $CNibor_t$ is the 3-month China interbank offered rate, collected from the People's Bank of China; and $Libor_t$ is the 3-month London interbank offered rate.

Following [Li, et al. \(2006\)](#), the discount between indexes of Chinese mainland and Hong Kong markets will be used as a proxy for the market-specific factor. Since it has been widely documented that the Hong Kong market is more exposed to global factors (particularly the US market) than the Chinese mainland market,⁹ we will use the discount between the indexes of the Chinese mainland and either the Hong Kong or the US market as the second market-specific factor. These two index-discount (ID) proxies are defined as follows:

$$ID_t^{CN\&HK} = 1 - \frac{HSI_t/HSI_0}{MCI_t/MCI_0} \quad (6)$$

$$ID_t^{CN\&US} = 1 - \frac{SP500I_t/SP500I_0}{MCI_t/MCI_0} \quad (7)$$

where HSI_t is the daily closing price of the Hang Seng Stock Index converted to RMB; MCI_t is the daily closing price of the Chinese mainland stock index that tracks the price movement of A-shares listed on SSE and SZSE; and $SP500I_t$ is the daily closing price of the Standard & Poor's 500 converted to RMB. Both index prices are scaled by their beginning-of-sample prices. We expect the H-share discount to be positively associated with the index discounts.

The liquidity of a stock listed on the China or Hong Kong market will be measured by the stock's turnover ratio (TR):

$$TR = \ln\left(1 + \frac{AV}{NS}\right) \quad (8)$$

Where AV is the average volume, and NS is the outstanding number of shares.

Since the relative economic cost for institutional investors is substantially lower for analyzing a large firm than for a small one, following [Karolyi and Li, \(2003\)](#), and [Chan, et al. \(2008\)](#), we use the market capitalization of A- and H-shares as a measure of the level of information asymmetry. The market capitalization (MC) of a stock is defined as:

$$MC = NS \times CPD \quad (9)$$

where NS is the number of shares outstanding; and CPD the daily closing price.

Following [Naidu and Rozeff \(1994\)](#) and [Lee \(2009\)](#), we will measure the daily volatility of an individual stock by a modified-range estimator (intraday range: IR) as below:¹⁰

$$IR_t = \frac{HP_t - LP_t}{(HP_t + LP_t)/2} \quad (10)$$

where HP_t and LP_t are the highest and lowest traded prices on day t during the overlapping trading sessions.

We postulate that the H-share discount should be positively related to the stock risk of A-shares and negatively related to the stock risk of H-shares. Following [Chan et al. \(2008\)](#), and [Karolyi and Li \(2003\)](#), we will also use momentum as another stock-risk proxy.

The correlations will be calculated in the following way: first, we will calculate the average of the price of A- and the corresponding H-share prices, taken every 5 min during the 2-hour overlapping trading interval between the SSE/SZSE and HKEX. After converting the H-share price into RMB, we will calculate the A- and H- shares' daily returns using the average prices to estimate the correlations.

When a change in correlation from period 1 to period 2 between market A and market B is accompanied by a change in volatility across these two periods, the Pearson correlation should be corrected for the volatility change, following the argument of [Forbes and Rigobon \(2002\)](#). Denote the change in volatility between the two periods by d for market A, then.

$$d = [(\sigma_{A1} / \sigma_{A2}) - 1]$$

where σ_{A1} is the volatility of market A in period 1, and σ_{A2} is the volatility of market A in period 2.

⁹ [Wang and Xu \(2004\)](#) show that H-shares exhibit significant exposure to both the Hong Kong (foreign) and China (local) markets; whilst A-shares exhibit only significant exposure to the China (local) market.

¹⁰ The range volatility measure is not adjusted for the opening and closing prices between the two-hour overlapping sessions because the overlapping trading sessions were in the middle of the afternoon sessions of both Hong Kong and the Chinese mainland exchanges.

The Forbes-Rigobon corrected correlation is computed as:

$$\rho_{FR} = \frac{\rho}{\sqrt{1 + d[1 - (\rho)^2]}}$$

with ρ_{FR} the correlation in period 2 corrected for the change in the volatility of market A between periods 1 and 2, and ρ the Pearson correlation observed during period 2.

3.2. Methodology

We divide the overall sample into the following four 18-month sub-periods for testing the impact of an exchange rate regime change on the price disparity: Period 1: 2 January 2004–21 July 21, 2005 represents the pegged (to USD) exchange rate regime before the change to a managed floating regime on 22 July 2005; period 2: 22 July 2005–31 December 2006 represents the managed floating period following the 2005 regime change; period 3: 1 January 2007–30 June 2008 corresponds to the managed floating regime before the switch to a soft-peg (against USD); finally, period 4: 1 July 2008 – 31 December 2009, represents the period following the second regime change. In an Appendix, we reduce the 18-month subperiods to 6-month subperiods surrounding the two effective dates of the regime change to examine the robustness of the results.

To compare the impact of asymmetric-information, liquidity-condition, speculative-behavior and stock-risk factors on the H-share discount, before and after the two RMB exchange-rate regime switches in July 2005 and in July 2008, we will follow the intuition and the model of [Chan, et al. \(2008\)](#), and employ a cross-sectional regression method. We will estimate the following bivariate (Eq. (11)) and multivariate (Eq.(12)) models:

$$\text{Model I : } SD.H_i = a_1 + b_1 X_i + e_i \quad (11)$$

$$SD.H_i = a_1 + b_1 DFI_i^{A-H} + b_2 T_i^A + b_3 T_i^H + b_4 NT_i^A + b_5 NT_i^H + b_6 MC_i^A + b_7 MC_i^H + b_8 M_i^A + e_i \quad (12)$$

where X_i is the chosen independent variable (for firm i), which can include either: DPI_i^{A-H} : the difference of price impact between A- and H-shares as the proxy for asymmetric information; T_i^A and T_i^H : the turnover ratio of A- and H-shares, and NT_i^A and NT_i^H : the number of trades of A- and H-shares as the proxies for liquidity- condition and speculative-trading factors; MC_i^A and MC_i^H : the market capitalization of A- and H-shares, as another proxy for the asymmetric information factor; and M_i^A : the momentum of A-shares, as the proxy for the stock-risk factor. In order to control for the possible collinearity problem, the collinearity diagnostic test is applied.¹¹

In model I, we considered testing the significance of our cross-sectional proxies for asymmetric- information, liquidity-condition, speculative-behavior and different-risk hypotheses in a cross-sectional model. But, with such model, we would not be able to control for some time-series factors, such as the expected exchange rate change, which may bias the significance of the idiosyncratic factors. Therefore, we will employ a panel data analysis in order to examine both the cross-sectional and time series factors. We will estimate the following multivariate model:

Model II:

$$SD.H_{i,t} = a_1 + b_1 DumSSR + b_2 EERC_t + b_3 ID_t^{CN-HK} + b_4 ID_t^{CN-US} + b_5 ST_{i,t}^A + b_6 ST_{i,t}^H + b_7 NT_{i,t}^A + b_8 NT_{i,t}^H + b_9 SR_{i,t}^A + b_{10} SR_{i,t}^H + b_{11} MC_{i,t}^A + b_{12} MC_{i,t}^H + b_{13} Lag.SD.H_{i,n} + e_{i,t} \quad (13)$$

where i is the firm's index, and t represents the time index. In case we have a large value of the Hausman statistic, which argues in favor of a fixed-effects model, this panel data estimation will be based on the one-factor fixed effects model. [Li, et al. \(2006\)](#) and [Burdekin and Redfern \(2009\)](#) employ a similar panel method to examine the Chinese foreign discount. We will take the lag of the H-share discount to control for the autocorrelation of the dependent variable as in [Chan and Kwok \(2005\)](#), [Li, et al. \(2006\)](#), or [Burdekin and Redfern \(2009\)](#).¹²

First, to identify the effect of short-selling restrictions on the H-share discount, a dummy variable $DumSSR$ will be used, which equals 1 when H-share returns (during the overlapping trading session of A- and H-shares) are negative and 0 otherwise. The dummy variable indicates situations when the short sale constraint in the A-share market is binding. Second, we will add two new testing variables, i.e., the discount between Chinese mainland and Hong Kong indexes (ID_t^{CN-HK}) and the discount between the indexes of the Chinese mainland and the US (ID_t^{CN-US}). Furthermore, in preliminary empirical work, we tried to estimate the price impact for every sample day in order to get the daily price impact data; however such a coefficient was insignificant for most sample days. Thus, we will exclude it in model II (Eq. (13)), but we will keep the market capitalization as our information-asymmetry proxy. Finally, we will change our different-risk proxy ($SR_{i,t}^A$ and $SR_{i,t}^H$), removing the momentum due to its insignificance in the cross-sectional analysis below, and replacing it with the range of A- and H-shares.

¹¹ The results are available upon request.

¹² Here, we add the first lag (i.e., $n = t - 1$), selected on the basis of the Bayesian Schwartz information criterion.

For the robustness test, with an unbalanced panel we cannot carry out a structural break test. Accordingly, we will implement the [Bai and Perron \(1998, 2003\)](#) multiple structural break test on each individual equation in the system of equations (13).

4. Empirical results and interpretations

This section first provides descriptive statistics for the H-share discount for the overall sample and the four subperiods, and tests how an exchange rate regime change affects the discount; second, we compute the correlation coefficients between A- and corresponding H-share returns over the four subperiods and test for the effects of regime changes on the correlations; third, following [Chan et al. \(2008\)](#), we employ a cross-sectional regression with measures of the level of asymmetric information, liquidity conditions, risk appetites, and differential risks; and finally, a panel-data analysis is used to examine simultaneously the cross-sectional and time series factors of the H-share discount, to complement the cross-sectional analysis.

4.1. Exchange rate regime and the discount

The Hang Seng AH Index Series (“China AH Series”), which was launched on 9 July 2007, measures the absolute price premium (or discount) of dual-listed A- and H-shares according to the free-float adjusted market-capitalization-weighted average premium (or discount) of the A-share versus H-share prices.

[Table 2](#) shows the average H-share discount surrounding the two changes in exchange rate regime. All average H-share discounts are significantly positive during the pegged exchange rate regime before the 2005 regime change, while three H-shares were priced at a significant premium after the 2005 regime change. The median discounts show similar results. The average H-share discount for all, except one, stock are significantly lower after than before the switch from USD peg to managed float in 2005; the overall average decline in the discount amounts to over 16.8 %. We also find that all of the average H-share discounts immediately before the 2008 regime change were significantly positive; the average median discounts show consistent results. The change in average discounts is significantly positive except for 6 out of the 26 stock pairs after the 2008 reversal in exchange rate regime from managed float to USD peg. On average, the H-share discount increased by 5 %.

4.2. Exchange rate regime and returns correlation

[Table 3](#) summarizes the individual and average returns correlations between A- and the corresponding H-shares before and after the change in the exchange rate regime. The post-regime-change correlations are adjusted for volatility change using the Forbes-Rigobon method.

Panel A of [Table 3](#) shows that, with only a few exceptions, the correlations between A- and H-returns are significantly positive for the four subperiods. The 2005 switch to the manage float strengthened the Pearson (Forbes-Rigobon volatility-adjusted) correlations between A- and H-share returns for 24 out of the 26 stocks in the sample; moreover, the average of the correlations increased by 19.18 % (33.7 %), a difference which is significant at the 1 % level. Most remarkably, the correlations of three stocks turned from negative to significantly positive after the reform. On the other hand, the return to the pegged regime in 2008, far from reducing, rather increased, the correlation between A- and H-shares, by 9.67 % (8.4 %), and only 6 stocks experienced a significant decline; all the changes in correlations are significant at the 1 % (5 %) level. Panel B provides the test results of the difference in the means of pre-regime-change Pearson correlation and either the post-regime-change Pearson correlation (unadjusted for volatility change) or the correlation adjusted for the change in volatility via the Forbes-Rigobon approach.

The significant increase in correlation for nearly the entire sample of stock pairs following the 2005 change is highly consistent with the large drop (by 16.8 % on average) in the H-share discount after that date. However, the increase in the H-share discount only amounts to 5 % on average after the 2008 return to the pegged regime, a result consistent with the observed change in the correlations.

Therefore the changes in the correlations following the 2005 reform are consistent with our conjecture that H-shares are used as an instrument to speculate in the RMB exchange rate. This result is thus in contrast with the conventional wisdom that an increase in exchange rate volatility impedes dual-listed stock arbitrage which results in a widening price disparity of the DLSs. Indeed, we find that exchange rate volatility can stimulate the intensity of intermarket arbitrage in dual-listed stocks, and consequently tighten the correlation, and reduce the price disparity.

[Fig. 1](#) plots the direction of exchange rate expectations for the spot, 3, 6, and 12-month forward exchange rates of the USD vis-a-vis the RMB, based on the NDF market for the sample period. The RMB had been selling at a forward premium against the US dollar until October 2008. The NDF prices indicate that the market expected an appreciation of the RMB throughout most of the sample period, except from 26 September 2008 to 30 March 2009.

[Table 4](#) reports and compares the mean and median of key variables for the overall period and the four subperiods. As a proxy for asymmetric-information, the average differential price impact coefficient between A- and H-share markets (in RMB 1/10,000 per 1,000 shares)¹³ is positive for all subperiods; an indication of lower market depth of the A- than the H-share mar-

¹³ In 1/10,000 yuan per 1,000 shares.

Table 2

H-share discounts before and after the 2005 and 2008 changes in exchange rate regime.

A-share code#	Mean discount	Mean discount	Diff. in means	Mean discount	Mean discount	Diff. in means
	<i>Pre-2005 reform</i>	<i>Post-2005 Reform</i>	<i>Pre-2005 reform minus Post-2005 Reform</i>	<i>Pre-2008 reform</i>	<i>Post-2008 reform</i>	<i>Post-2008 reform minus Pre-2008 Reform</i>
	<i>Pegged to USD</i>	<i>Managed float</i>	<i>Managed float</i>	<i>Pegged to USD</i>		
000585	0.731***	0.705***	0.027***	0.673***	0.712***	0.039***
000666	0.545***	0.404***	0.141***	0.576***	0.750***	0.174***
000756	0.671***	0.598***	0.073***	0.662***	0.720***	0.058***
000898	0.213***	-0.140***	0.353***	0.161***	0.090***	-0.071
600011	0.206***	-0.041***	0.247***	0.356***	0.392***	0.036***
600012	0.350***	0.062***	0.288***	0.234***	0.279***	0.045***
600026	0.298***	0.026***	0.272***	0.271***	0.271***	0.000
600028	0.274***	0.151***	0.123***	0.446***	0.482***	0.036***
600029	0.302***	0.167***	0.135***	0.555***	0.653***	0.098***
600115	0.595***	0.511***	0.083***	0.613***	0.709***	0.096***
600188	0.232***	0.092***	0.140***	0.319***	0.452***	0.134***
600332	0.631***	0.399***	0.232***	0.528***	0.618***	0.090***
600362	0.313***	0.246***	0.067***	0.546***	0.591***	0.045***
600377	0.408***	0.176***	0.232***	0.189***	0.127***	-0.061***
600548	0.452***	0.111***	0.341***	0.340***	0.466***	0.126***
600585	0.045***	-0.062***	0.108***	0.130***	-0.072***	-0.202***
600600	0.121***	0.027***	0.094***	0.278***	0.224***	-0.054***
600685	0.613***	0.344***	0.269***	0.328***	0.503***	0.175***
600688	0.388***	0.255***	0.133***	0.641***	0.703***	0.061***
600775	0.758***	0.690***	0.068***	0.699***	0.796***	0.097***
600806	0.720***	0.583***	0.137***	0.495***	0.609***	0.115***
600808	0.294***	0.019***	0.275***	0.337***	0.254***	-0.083***
600860	0.519***	0.526***	-0.008	0.663***	0.779***	0.116***
600871	0.609***	0.480***	0.130***	0.720***	0.792***	0.073***
600874	0.521***	0.448***	0.073***	0.601***	0.756***	0.155***
600875	0.568***	0.220***	0.349***	0.322***	0.343***	0.021
			MeanDiff.			Mean Diff.
			0.1684*** (8.24)			0.0507***(-2.93)

This Table shows the average H-share discount surrounding the two changes in exchange rate regimes. The H-share discount is calculated by the daily average of the two hours of overlapping trading sessions between the Hong Kong Stock Exchange and Shanghai/Shenzhen Stock Exchange. The discount is denominated in the (RMB) price of A-share and calculated by first converting the HKD price to RMB for H-shares using the daily spot RMB/HKD exchange rate.

Statistical significance of 1 %, 5 %, and 10 % are indicated by ***, **, and *, respectively.

#please refer to Table 1 for the stock code of the corresponding H-share.

ket.¹⁴ The mean differential price impact significantly declined over time; hence, the differentials are significantly lower, at the 5 % level, following each reform.

Momentum, our proxy for stock risk, is positive in all sub-periods, except for the pre-2005 reform period, showing that A-share investors are more risk tolerant than H-share investors. Another stock-risk proxy, the (range) volatilities, is similar between A- and H-shares before the pre-2008 reform period. Subsequently, the volatility became higher for H- than for A-shares.

The index discount between the Chinese mainland and Hong Kong is negative before the 2005 reform, implying that the Hong Kong index increased more quickly than the Chinese mainland index. After that reform, a reversal took place since the index discount CN-HK became positive. The index discount between the Chinese mainland and the US was positive during all sub-periods, which indicates that the Chinese mainland stock index increased more quickly than the US stock index.

The bottom part of the table shows that over each of the four 18-month windows, the market expected the RMB to appreciate. Most importantly, the expected RMB exchange rate rises after the 2005 regime change but falls after the 2008 reform. Moreover, the volatility measured by the returns standard deviation of the RMB/USD exchange rate was higher under the managed float than under the pegged regimes.

In summary, the shrinkage of the H-share discount, after the July 2005 reform, was accompanied by: (i) a reduction in asymmetric information (i.e., a rise in the market capitalization of A-shares and/or a fall in the price impact differential) between the A- and H-share markets; (ii) a fall in the expected rate of appreciation of RMB; (iii) a decrease of the index discounts, both CN-HK and CN-US; and (iv) an increase of momentum.

¹⁴ The decreases in the differences between the price impact of A- and H-share markets from the pre-2005 to post-2005 reform periods and from the pre-2008 to post-2008 reform periods are both significantly different from zero at the 5% significance level, based on the *t*-test.

Table 3

Correlations of A- and H daily stock returns before and after the 2005 and 2008 changes in foreign exchange regimes.

Panel A: Pearson and Forbes-Rigobon (volatility adjusted) correlation of daily returns of A- and H-shares							
A-share code#	2004–2009	Pre-2005 reform	Post-2005 Reform		Pre-2008 reform	Post-2008 reform	
		Pegged to USD	Managed float		Managed float	Pegged to USD	
		Pearson correlation	Pearson correlation	Forbes-Rigobon	Pearson correlation	Pearson correlation	Forbes-Rigobon
000585	0.492***	0.224***	0.295***	0.294***	0.533***	0.594***	0.571***
000666	0.35***	0.024	0.13*	0.262***	0.432***	0.579***	0.536***
000756	0.364***	0.217***	0.219**	0.393***	0.352***	0.544***	0.597***
000898	0.52***	0.268***	0.655***	0.781***	0.553***	0.608***	0.524***
600011	0.146***	-0.028	-0.008	-0.026	0.257***	0.371***	0.304***
600012	0.189***	0.071	0.212***	0.199***	0.215***	0.235***	0.192***
600026	0.46***	0.265***	0.23***	0.363***	0.355***	0.644***	0.481***
600028	0.282***	-0.096**	0.439***	0.776***	0.498***	0.458***	0.425***
600029	0.367***	0.093*	0.483***	0.655***	0.402***	0.432***	0.439***
600115	0.525***	0.152**	0.477***	0.573***	0.684***	0.424***	0.509***
600188	0.311***	0.231***	0.152**	0.467***	0.353***	0.612***	0.502***
600332	0.184***	0.065	0.183**	0.615***	0.331***	0.562***	0.544***
600362	0.557***	0.331***	0.621***	0.534***	0.552***	0.619***	0.573***
600377	0.178***	0.187***	0.023	0.091	0.282***	0.24***	0.242***
600548	0.16***	0.071	0.067	0.13*	0.283***	0.185***	0.209***
600585	0.474***	0.255***	0.679***	0.905***	0.548***	0.696***	0.683***
600600	0.184***	-0.052	0.528***	0.905***	0.388***	0.324***	0.374***
600685	0.225***	0.072	0.401***	0.887***	0.433***	0.582***	0.614***
600688	0.235***	-0.046	0.538***	0.869***	0.35***	0.491***	0.519***
600775	0.489***	0.444***	0.547***	0.527***	0.408***	0.586***	0.652***
600806	0.411***	0.343***	0.326***	0.348***	0.332***	0.594***	0.641***
600808	0.354***	0.101*	0.323***	0.55***	0.381***	0.583***	0.464***
600860	0.414***	0.044	0.45***	0.622***	0.403***	0.582***	0.533***
600871	0.502***	0.19***	0.462***	0.408***	0.577***	0.614***	0.581***
600874	0.385***	0.265***	0.222***	0.252***	0.369***	0.554***	0.582***
600875	0.382***	0.279***	0.3***	0.342***	0.407***	0.482***	0.569***
Mean	0.352	0.153	0.344	0.489	0.411	0.508	0.494
Min	0.146	-0.096	-0.008	-0.025	0.215	0.185	0.191
Max	0.557	0.444	0.679	0.904	0.684	0.696	0.683
Lower Quartile	0.225	0.065	0.212	0.294	0.35	0.432	0.436
Median	0.366	0.169	0.325	0.497	0.395	0.57	0.528
Upper Quartile	0.474	0.265	0.483	0.655	0.498	0.594	0.58

Panel B: T-test results of the difference between mean correlations before and after the 2005 and 2008 regime changes

Pre-2005 reform - Post-2005 reform	Pre-2005 reform mean Pearson correlation - Forbes-Rigobon Post-2005 reform mean correlation	Pre-2008 reform mean Pearson correlation - Post-2008 reform mean Pearson correlation	Pre-2008 reform mean Pearson correlation - Post-2008 reform mean Pearson correlation
-0.1918 (-4.51)***	-0.337 (-5.39)***	-0.0967 (-3.87)***	-0.084 (-3.61)**

The Pearson's correlations are calculated in the following way: first, we calculate the 5-minute average price of A and the corresponding H shares taken every 5 min during the 2-hour overlapping trading interval between the China and Hong Kong markets with the H-share price converted into RMB; then calculate the A and H shares daily returns to estimate the correlations. The following Forbes-Rigobon correlation is also used to adjust for the change in volatility in the period after a regime change. The adjusted correlation is computed as follows:

$$\rho_{FR} = \frac{\rho}{\sqrt{1+d[1-(\rho)^2]}}$$

Where ρ_{FR} the correlation in period 2 corrected for the change in the volatility of market A between periods 1 and 2, ρ the Pearson correlation observed during period 2 and $d = [(sA1 / sA2) - 1]$; where sA1 is the volatility of market A in period 1, and sA2 is the volatility of market A in period 2.

Panel A summarizes the average correlations between A and the corresponding H shares before and after the change the foreign exchange rate regime. The post regime change correlations are adjusted for volatility change using the Forbes-Rigobon method.

Panel B provides the test results of the difference in the means between pre-regime and post-regime correlations.

Statistical significance of 1 %, 5 %, and 10 % are indicated by ***, **, and *, respectively.

#please refer to Table 1 for the stock code of the corresponding H-share

The rise in the discount after the return to a soft peg in 2008 was associated with: (i) the rise in the expected rate of RMB appreciation; (ii) the increase of the index discounts, both CN-HK and CN-US; (iii) the increase of trading activity in the A- and H-share markets; (iv) the decrease of momentum; and (v) the increase of A- and H-share market ranges.

Table 5 reports the Spearman correlations coefficients of the explanatory variables employed in the cross-sectional analysis. Stocks that exhibit higher information asymmetry between A- and H-share markets enjoyed higher risk in the A-share market. Large size A-share firms had also a larger market capitalization in the H-share market, exhibited a smaller turnover in the A-share market, and experienced a larger H-share number of trades. Our findings show that a highly liquid A-share was associated with a highly liquid H-share for large cap stocks, and the turnover ratio was significantly positively correlated with the number of deals in all markets.

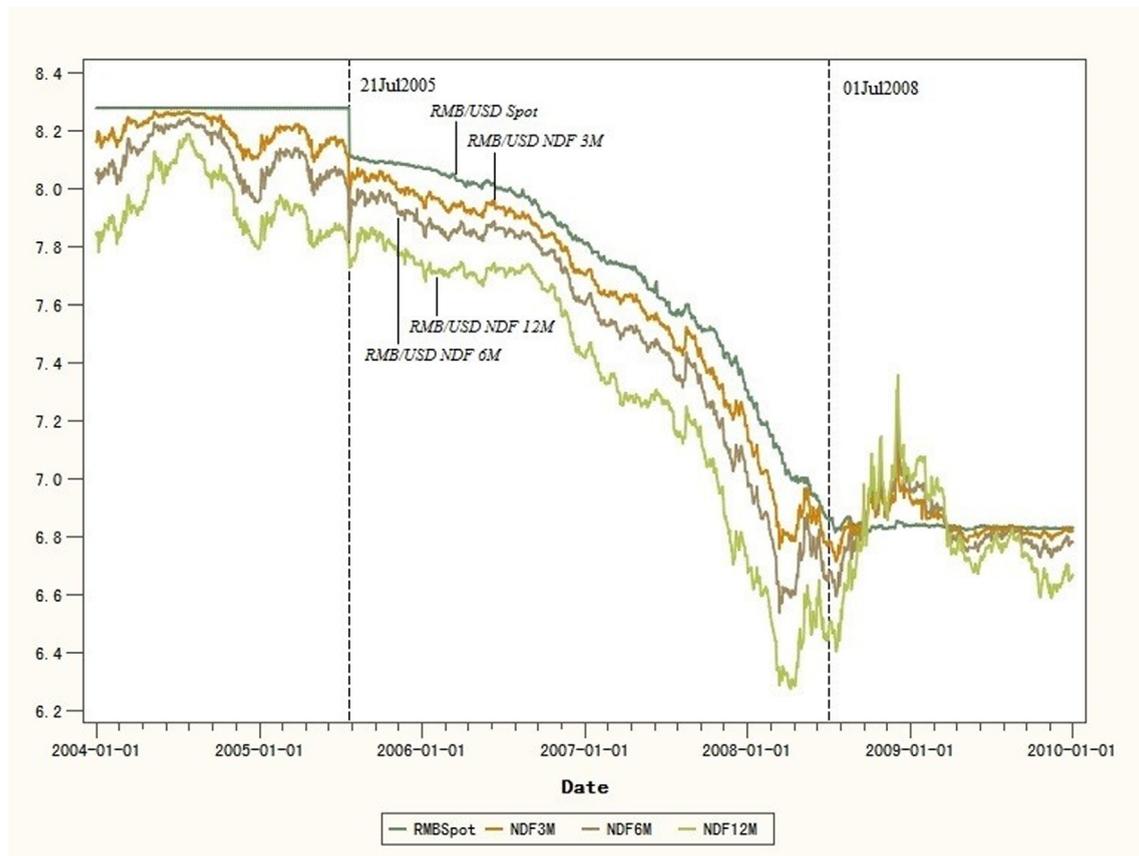


Fig. 1. Spot and forward exchange rates of the US dollar to RMB on the Non-Deliverable Forward market for 2004–2009.

Table 4

Summary statistics of the mean and median of key variables for the periods before and after the two changes in exchange rate regime.

	Pre-2005 reform		Post-2005 reform		Pre-2008 reform		Post-2008 reform	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Price of A-shares	6.477	5.542	5.749	5.422	18.879	11.797	11.431	6.958
Price of H-shares (RMB)	3.768	3.021	4.453	3.933	11.414	6.434	6.875	3.506
Diff. Price impact A-H ^a	2.594	2.316	1.364	0.777	2.543	1.398	0.891	0.722
Market capitalization of A-shares ^b	2055	1121	8848	2937	69,243	17,668	46,468	12,063
Market capitalization of H-shares ^b	5164	2257	6556	2540	13,985	7264	9842	3931
Turnover of A-shares	0.013	0.013	0.015	0.013	0.011	0.008	0.011	0.012
Turnover of H-shares	0.009	0.008	0.008	0.008	0.012	0.010	0.012	0.011
Number of trades of A-shares	343	248	447	303	1210	824	1057	722
Number of trades of H-shares	140	76	151	73	446	213	537	333
Momentum ^c	-0.607	-0.653	0.522	0.454	0.245	0.199	0.260	0.200
Range of A-shares	0.025	0.025	0.027	0.026	0.042	0.042	0.035	0.034
Range of H-shares	0.025	0.026	0.025	0.025	0.041	0.041	0.044	0.043
Discount of index of MC and HK	-0.165	-0.176	-0.315	-0.310	0.240	0.243	0.163	0.167
Discount of index of MC and US	0.858	0.860	0.848	0.844	0.933	0.934	0.923	0.928
Expect. RMB/USD change	-0.530***	-0.510	-1.206***	-1.264	-1.122***	-1.300	-0.338***	-0.277
Yearly Std Dev of RMB/USD	0.0004*	0.0002	0.0105**	0.0086	0.0169***	0.0165	0.0111***	0.0061
High-Low range of RMB/USD	0.0005***	0.0001	0.0051***	0.0035	0.0087***	0.0077	0.0077***	0.0065

Pre-2005 reform period: February 1, 2004 to July 21, 2005; Post-2005 reform period: July 22, 2005 to December 31, 2006 Pre-2008 reform period: January 1, 2007 to June 31, 2008; post-2008 reform period: July 1, 2008 to December 31, 2009 The metrics represent the two-hour overlapping trading session during the four sample periods between the Shanghai/Shenzhen and Hong Kong Markets. Statistical significance levels (F-test) of 10 %, 5 %, and 1 % are indicated by ***, **, and *, respectively.

^a In 1/10,000 yuan per 1,000 shares. For all 26 dual-listed stocks, the PI is significant. ^b In millions yuan. ^c The cumulative A-share return is used as a proxy for the momentum variable.

Table 6 summarizes the results of cross-sectional regressions before and after the exchange-rate regime reform on 21 July 2005. Panel A reports the results over the pre-2005 reform period. Columns (1) to (5) present the results of the bivariate regressions, and column (6) shows the results of the multivariate regressions. The difference in price impact between the A- and H-share markets is always significant, both with and without the control variables. Further, the market capitalization of A-shares has significantly consistent effects on the H-share discount in the bivariate as well as in the multivariate regressions. This effect of the magnitude of capitalization implies that larger firms exhibit smaller discounts, a finding in support of the information-asymmetry hypothesis – the relative cost of collecting information is substantially lower for large firms from the perspective of institutional investors (Chan, et al. 2008). The number of trades of H-shares is also significant in the bivariate and multivariate regressions, implying that the higher the liquidity of the H-share market the smaller the H-share discount.

In Panel B, we report the cross-sectional regression results over the post-2005 reform period. The impact of asymmetric information on the H-share discount disappears after the switch to a managed-floating regime. Only the turnover of A-shares is significant with a consistent sign in both bivariate and multivariate regressions, implying that the higher the turnover of the A-share market, the larger speculative trading.

The above regression analysis (via Model I) is repeated over the periods before and after the return to managed float in July 2008. Panel A of **Table 7** shows the cross-sectional regression results over the pre-2008 reform period. Only A-share market's turnover has a significantly consistent effect on the H-share discount in bivariate and multivariate regressions, which confirms that domestic speculative trading plays a dominant role in the H-share discount in this period.

Panel B of **Table 7** reports the cross-sectional regression results over the post-2008 reform period. In the bivariate and multivariate regressions, the A-share turnover and the market capitalization of A- and H-shares are both consistently significant. The significance of A-share turnover shows the role of speculative trading in driving the H-share discount. Market capitalization of the A-share and H-share markets has opposite effects, the former positive and the latter negative, respectively inconsistent and consistent with the information-asymmetry hypothesis. We observe that the information asymmetry is almost significant at 10 % (with a t-value: 1.65); thus we would expect that after the reversion to a fixed exchange rate regime, the information asymmetry could affect the H-share discount, though with a very low significance.

Table 8 summarizes the multivariate regressions for every subperiod. Overall, the H-share discount was influenced by asymmetric information and liquidity conditions before, but not after, the switch to a managed-floating regime of July 2005. We suggest that this exchange-rate regime switch reduced, or even canceled out, the impact of information asymmetry on the H-share discount. This shrinkage of asymmetric information between A- and H-share markets may not be related only to the exchange-rate regime reform of July 2005. Other components of Chinese *de jure* financial liberalization (such as the split-share reform of April 2005) could also have reduced the asymmetric information between these two markets. However, in the current study, we cannot identify exactly which reform drove this shrinkage of asymmetric information on the H-share discount.

Under the managed-floating exchange rate, the H-share discount is mostly influenced by domestic speculative trading. After the return to a fixed exchange-rate regime of July 2008, the speculative trading of A-shares remains dominant in the determination of the H-share discount. In addition, the negative effect of the H-share market capitalization on the H-share discount implies that the H-shares have a smaller discount for large firms than for small firms, due to lower information costs after the return to the fixed exchange rate regime.

Table 9 summarizes the panel regressions results from 2004 to 2009. Consistent with our expectations, the coefficient of the prohibition-against-short-selling dummy indicates that a drop in the H-share price is generally associated with a widening of the gap between the values of the DLs. Our findings confirm that, under the floating exchange rate regime, there is a significant positive relationship between the change in the expected RMB appreciation and the magnitude of the H-share discount; however, under the pegged exchange rate regime, we find a negative relationship (prior to 2005 and after 2008). This negative relationship under the pegged regime can be attributed to the rise in the expected appreciation in the 18 months prior to July 2005 accompanied by a fall in the H-share discount. After 2008 the negative relationship corresponds to the rise in expected RMB appreciation generated by the widely anticipated return to a soft peg. In the light of these results, the positive relationship found by most existing empirical work seems to be due to the dominance of the floating regime in their sample period. We also tested model II using the actual forward premium (as in Arquette et al., 2008; Burdekin et al. 2009; Eichler 2011) as the RMB expected appreciation proxy, and we obtain similar results.¹⁵

Cross-country index discounts have contrasted effects; the linkage of the index discount between the Chinese mainland and Hong Kong (i.e., index discount CN-HK) and the H-share discount is significantly positive during all sub-periods, which is consistent with the market-specific-conditions hypothesis that the H-share discount is highly related to A-share market indices. In contrast, the linkage of the H-share discount and the index discount between China and the US (i.e., index discount CN-US) is insignificant for all sub-periods except after the return to a pegged exchange rate regime in July 2008, but the negative effect on the H-share discount is then inconsistent with our expectations.

After controlling for the impact of the expected-exchange-rate-change and market-specific conditions on the H-share discount, the coefficients of the turnover ratios of A- and H-shares are significantly positively and negatively related to the H-

¹⁵ The results are not reported here to conserve space, they are available upon request.

Table 5
Spearman rank correlation for explanatory variables.

	Market cap. ^{Ab}	Market cap. ^{H b}	Turnover ^A	Turnover ^H	Nb. of trades ^A	Nb. of trades ^H	Momentum
Diff. Price impact A-H ^a	-0.143	-0.085	0.136	-0.088	-0.233	-0.138	0.429**
Market cap. of A-shares ^b		0.784***	-0.378*	0.032	0.062	0.691**	-0.064
Market cap. of H-shares ^b			-0.457***	0.048	0.030	0.740**	0.004
Turnover of A-shares				0.261	-0.001	-0.422**	0.370*
Turnover of H-shares					0.443**	0.446***	0.251
Number of trades of A-shares						0.151	0.083
Number of trades of H-shares							0.098

Notes: This table presents the correlations among cross-sectional explanatory variables. All variables are calculated based on the period of 2004–2009.

*/**/*** Significant at the 90%/95%/99% level.

^aIn 1/10,000 yuan per 1,000 shares. ^bIn millions yuan

Table 6
Cross-sectional regression analysis of the H-share discount before and after the Chinese exchange rate reform of July 2005 (Model I).

Panel A: Regression analysis of the H-share discount before the Chinese exchange rate system reform. (Pre-2005 reform period: 02/01/2004–07/21/2005)						
Model I	(1)	(2)	(3)	(4)	(5)	(6)
Diff. Price impact A-H ^a	0.046** (2.44)	-8.739**				0.048** (2.13)
Market cap. of A-shares ^c		(-2.32)				-22.806*** (-4.84)
Market cap. of H-shares ^c		1.238 (1.33)				4.967*** (5.11)
Turnover of A-shares			11.445 (0.93)			-20.516 (-1.65)
Turnover of H-shares			-17.055*	0.936 (0.22)		22.712** (2.23)
Number of trades of A-shares ^b			(-1.90)			30.844*** (4.05)
Number of trades of H-shares ^b				-9.300**		-24.335***
				(-2.57)		(-5.01)
Momentum					-0.128	-0.165** (-2.37)
					(-1.09)	
Intercept	0.318***	0.437*** (3.20)	0.543*** (6.58)	0.553*** (11.01)	0.359*** (4.40)	0.062 (0.47)
	(5.23)					
F-stat	0.02	0.18	0.01	0.01	0.29	0.00
Adj. R ²	0.17	0.06	0.30	0.25	0.01	0.71
Panel B: Regression analysis of the H-share discount after the Chinese exchange rate system reform. (Post-2005 reform period: 07/22/2005–12/31/2006)						
Model I	(1)	(2)	(3)	(4)	(5)	(6)
Diff. Price impact A-H ^a	0.016 (0.55)					-0.024 (-0.90)
Market cap. of A-shares ^c		-2.240* (-1.84)				-0.113 (-0.09)
Market cap. of H-shares ^c		2.254 (1.48)				0.732 (0.39)
Turnover of A-shares			20.013*** (3.37)			21.410*** (3.19)
Turnover of H-shares			-15.529* (-1.73)	-8.409 (-1.70)		8.540 (0.47)
Number of trades of A-shares ^b						-12.141** (-2.88)
Number of trades of H-shares ^b				1.115 (0.27)		-3.165 (-0.39)
Momentum					-0.049 (-0.52)	-0.079 (-0.98)
Intercept	0.248*** (3.88)	0.097 (0.99)	0.537*** (4.06)	0.321*** (6.33)	0.296*** (4.24)	0.371** (2.69)
F-stat	0.59	0.01	0.08	0.08	0.61	0.01
Adj. R ²	0.00	0.28	0.13	0.13	0.00	0.46

This table summarizes the results of cross-sectional regressions before and after the exchange rate reform of July 2005 with model I (Eqs. (11) and (12)). We calculate the PI (price impact coefficient) by following the model of Chan et al. (2008), which is used as one of our proxy of information asymmetry. The PI diff. is defined as the difference in price impact coefficient of A- and H-shares. We employ the Market cap. as a measure of information asymmetry, and also a liquidity and speculative trading proxy, which is defined as the number of shares outstanding multiplied by the average daily closing price. We take turnover as our proxy of liquidity and speculative hypotheses, which is defined as the logarithm of sum of 1 and daily volume divided by number of shares outstanding. We use Nb. trades (Number of trades) as another measure of liquidity and speculative hypotheses. We employ Momentum as the proxy of the stock risk hypothesis. We use the A-share cumulative returns as our momentum variable. The t-value reports in (...). */**/*** Significant at the 90%/95%/99% level.

^a In 1/10,000 yuan per 1,000 shares. ^bPer 10,000 trades. ^c In 1,000,000 yuan.

share discount, respectively, during all sub-periods, which is consistent with the liquidity-condition hypothesis (Wang and Xu 2004; Li, et al., 2006; Lee 2009).

The relationship between the number of trades in A-shares and the H-share discount is only significant over the post-2005 (at the 1% level) and post-2008 reform periods (at the 10% level). These results support the view that domestic speculative trading plays a role in the H-share discount.

The measures of liquidity and speculation intensity both have a greater effect on the H-share discount during the post-2005 period than during other sub-periods. This is in line with Beltratti, Bortolotti, and Caccavaio (2016), who show that the

Table 7

Cross-sectional regression analysis of the H-share discount before and after the re-peg of the RMB against the US dollar (Model I).

Panel A: Regression analysis of the H-share discount before the 2008 regime change in July 2008. (Pre-2008 reform period: 01/01/2007–06/30/2008)						
Model I	(1)	(2)	(3)	(4)	(5)	(6)
Diff. Price impact A-H ^a	-0.010 (-0.98)					0.007 (0.69)
Market capitalization of A-shares ^c		0.200** (2.47)				0.148 (1.48)
Market capitalization of H-shares ^c		-1.594** (-2.64)				-1.276 (-1.33)
Turnover of A-shares			14.309*** (3.53)			14.248** (2.77)
Turnover of H-shares			4.151 (0.71)			2.270 (0.22)
Number of trades of A-shares ^b				0.201 (0.08)		0.578 (0.25)
Number of trades of H-shares ^b				-0.319 (-0.30)		1.175 (0.53)
Momentum					-0.086 (-0.98)	-0.080 (-0.92)
Intercept	0.482*** (10.60)	0.253*** (3.82)	0.456*** (2.89)	0.541*** (11.63)	0.469*** (11.84)	0.252 (1.38)
F-stat	0.34	0.00	0.94	0.04	0.34	0.01
Adj. R ²	0.00	0.41	-0.08	0.17	0.00	0.44
Panel B: Regression analysis of the H-share discount after the re-peg of the RMB against the US dollar in July 2008. (Post-2008 reform period: 07/01/2008–12/31/2009)						
Model I	(1)	(2)	(3)	(4)	(5)	(6)
Diff. Price impact A-H ^a	0.074 (1.21)	0.416*** (3.10)				0.096 (1.65)
Market capitalization of A-shares ^c						0.428** (2.81)
Market capitalization of H-shares ^c		-3.155*** (-3.32)				-3.602** (-2.76)
Turnover of A-shares			24.783*** (4.14)			18.149* (1.86)
Turnover of H-shares			-5.976 (-0.88)			-17.699 (-1.22)
Number of trades of A-shares ^b				-0.895 (-0.26)		4.078 (1.03)
Number of trades of H-shares ^b				-0.845 (-0.74)		1.816 (0.80)
Momentum					0.268 (1.67)	0.135 (0.75)
Intercept	0.434*** (5.96)	0.290** (2.80)	0.606*** (3.04)	0.618*** (11.33)	0.606*** (3.04)	0.164 (0.70)
F-stat	0.24	0.00	0.37	0.01	0.37	0.01
Adj. R ²	0.02	0.38	0.00	0.27	0.00	0.47

This table summarizes the results of the cross-sectional regressions before and after the re-peg of the RMB against the US dollar in July 2008 with model I (Eqs. (11) and (12)). We calculate the PI (price impact coefficient) by following the model of Chan et al. (2008), which is used as one of our proxy of information asymmetry. The PI diff. is defined as the difference in price impact coefficient of A- and H-shares. We employ the Market cap. as a measure of information asymmetry, and also a liquidity and speculative trading proxy, which is defined as the number of shares outstanding multiplied by the average daily closing price. We take turnover as our proxy of liquidity and speculative hypotheses, which is defined as the logarithm of sum of 1 and daily volume divided by number of shares outstanding. We use Nb. trades (Number of trades) as another measure of liquidity and speculative hypotheses. We employ Momentum as the proxy of the stock risk hypothesis. We use the A-share cumulative returns as our momentum variable. The t-value reports in (...). ***/**/* Significant at the 90%/95%/99% level.

^aIn 1/10,000 yuan per 1,000 shares. ^bPer 10,000 trades. ^cIn 1,000,000 yuan.

Table 8

Summary of multivariate regressions.

Summary of multivariate regressions results over four sub-periods.				
Model I	Pre-2005	Post-2005	Pre-2008	Post-2008
Diff. Price impact A-H ^a	0.048** (2.13)	-0.024 (-0.90)	0.007 (0.69)	0.096 (1.65)
Market capitalization of A-shares ^c	-2.281*** (-4.84)	-0.113 (-0.09)	0.148 (1.48)	0.428** (2.81)
Market capitalization of H-shares ^c	4.967*** (5.11)	0.732 (0.39)	-1.276 (-1.33)	-3.602** (-2.76)
Turnover of A-shares	-20.516 (-1.65)	21.410*** (3.19)	14.248** (2.77)	18.149* (1.86)
Turnover of H-shares	22.712** (2.23)	8.540 (0.47)	2.270 (0.22)	-17.699 (-1.22)
Number of trades of A-shares ^b	30.844*** (4.05)	-12.141** (-2.88)	0.578 (0.25)	4.078 (1.03)
Number of trades of H-shares ^b	-24.335*** (-5.01)	-3.165 (-0.39)	1.175 (0.53)	1.816 (0.80)
Momentum	-0.165** (-2.37)	-0.079 (-0.98)	-0.080 (-0.92)	0.135 (0.75)
Intercept	0.062 (0.47)	0.371** (2.69)	0.252 (1.38)	0.164 (0.70)
F-stat	0.00	0.01	0.01	0.01
Adj. R ²	0.71	0.46	0.44	0.47

This table summarizes the results of the cross-sectional regressions over the period from 2004 to 2009 with model I ((12)). We calculate the PI (price impact coefficient) by following the model of Chan et al. (2008), which is used as one of our proxy of information asymmetry. The PI diff. is defined as the difference in price impact coefficient of A- and H-shares. We employ the Market cap. as a measure of information asymmetry, and also a liquidity and speculative trading proxy, which is defined as the number of shares outstanding multiplied by the average daily closing price. We take turnover as our proxy of liquidity and speculative hypotheses, which is defined as the logarithm of sum of 1 and daily volume divided by number of shares outstanding. We use Nb. trades (Number of trades) as another measure of liquidity and speculative hypotheses. We employ Momentum as the proxy of the stock risk hypothesis. We use the A-share cumulative returns as our momentum variable. The t-value reports in (...). ***/**/* Significant at the 90%/95%/99% level.

^aIn 1/10,000 yuan per 1,000 shares. ^bPer 10,000 trades. ^cIn 1,000,000 yuan.

Table 9

Panel-data analysis of the H-share discount before and after the Chinese exchange rate reforms (Model II).

	Pre-2005 reform	Post-2005 reform	Pre-2008 reform	Post-2008 reform
short-sale restrictions	0.004*** (8.62)	0.004*** (7.10)	0.004*** (6.47)	0.005*** (10.19)
Expected exchange rate change	-0.024*** (-6.02)	0.034*** (8.59)	0.012*** (9.42)	-0.006*** (-4.04)
Index discount CN-HK	0.046*** (7.36)	0.022*** (2.79)	0.025*** (3.72)	0.065*** (13.13)
Index discount CN-US	-0.026 (-0.48)	0.017 (0.33)	0.106* (1.87)	-0.309*** (-7.33)
Turnover of A-shares	0.162*** (7.94)	0.288*** (12.80)	0.269*** (8.59)	0.158*** (5.57)
Turnover of H-shares	-0.158*** (-5.66)	-0.361*** (-9.08)	-0.239*** (-9.39)	-0.183*** (-7.22)
Number of trades of A-shares ^a	-0.007 (-1.28)	0.025*** (3.31)	0.003 (0.94)	0.005* (1.69)
Number of trades of H-shares ^a	0.002 (0.10)	0.028 (1.53)	0.003 (0.42)	-0.013** (-1.97)
Range of A-shares	-0.090*** (-5.45)	-0.040** (-2.04)	-0.110*** (-8.77)	0.009 (0.69)
Range of H-shares	0.027** (2.29)	-0.020 (-1.61)	0.002 (0.26)	-0.015** (-2.00)
Market capitalization of A-shares ^b	0.373*** (6.92)	-0.000 (-0.28)	0.008*** (9.92)	0.011*** (10.01)
Market capitalization of H-shares ^b	-0.308*** (-13.65)	0.014 (1.04)	-0.087*** (-9.56)	-0.074*** (-10.60)
H-share discount en t-1	0.948*** (305.79)	0.953*** (320.17)	0.931*** (247.19)	0.936*** (296.54)
Intercept	0.044 (0.89)	0.042 (0.91)	-0.064 (-1.24)	0.292*** (7.53)
Fixed effects	Yes	Yes	Yes	Yes
Observations	346	318	343	347
F-stat	0.00	0.00	0.00	0.00
Adj R ²	0.99	0.99	0.99	0.99

This table reports the panel regression results before and after the Chinese exchange rate reform of July 2005 and the re-peg of the RMB against the US dollar of July 2008 with model II (Eq. (13)). The pre-2005 reform period is from 02/01/2004 to 07/21/2005 and the post-2005 reform is from 07/22/2005 to 12/31/2006. The pre-2008 reform period is from 01/01/2007 to 06/31/2008, and the post-2008 reform period is from 07/01/2008 to 12/31/2009. The t-value reports in (...). ***/**/* Significant at the 90%/95%/99% level.^aPer 10,000 trades.^bIn millions yuan.

split-share reform of 2005 successfully increased firm's liquidity and performance, especially for stocks with less attractive characteristics.

For the differential-stock-risk factor two results go against our expectations. The A-share range is significantly negative during all sub-periods, except for the post-2008 reform period, while the H-share range is significant only before the reform of July 2005 with a wrong sign. The information asymmetry using the A-share market capitalization as a proxy has a significant positive impact on the H-share discount during all sub-periods except for the post-2005 reform period; such a positive relationship is inconsistent with the sign expected under the information-asymmetry hypothesis. Over the same three sub-periods, the H-share market capitalization has a significant negative impact on the H-share discount, implying that the larger H-share firms the smaller the discount, due to lower information costs. Under the fixed exchange rate regime prior to July 2005, the market capitalizations of A- and H-shares both have the largest effect in absolute value on the H-share discount; after that date, their impacts on the H-share discount decreases over time. This is consistent with our cross-sectional finding that asymmetric information plays a role on the H-share discount, especially before July 2005.

To summarize, both idiosyncratic factors have a strong impact on the H-share discount after the switch to a managed float, except for asymmetric information and the index discount between China and Hong Kong.¹⁶ Moreover, the return to a fixed exchange-rate regime of July 2008 does not increase the impact of these idiosyncratic factors on the H-share discount. Thus, we suggest that the relaxation of exchange rate management does not encourage arbitrage (or the LOP condition) between the A- and H-share markets and introduces an extra exchange rate risk to the arbitrageurs.

5. Robustness checks

1 The above analysis has been conducted on the assumption that the impact of the exchange rate regime change is felt at the implementation, or effective date, of the new policy. To check for the robustness of the results, we first perform a break test to examine whether significant changes occur around the implementation date. Then we further explore the robustness of results with respect to a change in the length of the event window.

5.1. Break date test

In an efficient market, the stock prices could have incorporated the market's expectation on RMB appreciation as astute traders rebalance their portfolio prior to the announcement of the policy change. In order to check if the official announcement dates (21 July 2005 and 1 July 2008) of exchange rate regime change correspond to significant breaks in the relationship between the individual H-share discounts and their drivers, we use the structural break test of Bai and Perron (1998, 2003) for each individual equation in the regression system (13).¹⁷ The results, reported in Table 10, show that the two break dates of the H-share discount in the 26 stock samples are statistically significant, except for those 2 stocks (000585 and 600775) for which such a test is not feasible since they have no observations until 26 October 2005, and 12 September 2005, respectively, and only the 2008 break can be tested.

¹⁶ The cross-sectional analysis examines whether other financial reforms adopted during the sample period affect the impact of asymmetric information on the discount.

¹⁷ We thank the anonymous referees for highlighting the importance of this point.

Table 10

Test for multiple breaks in the H-share discount equations at known break dates.

H0: No breaks vs. H1: 2 breaks - Bai & Perron (1998, 2003)					
A-share code#	observation	W(tau)	p-value(F)	Break Date(s)	
000585	1053	-	-		3-Jul-08
000666	1110	12.20***	0.00	22-Jul-05	2-Jul-08
000756	1065	12.15***	0.00	22-Jul-05	2-Jul-08
000898	1283	20.28***	0.00	22-Jul-05	2-Jul-08
600011	1284	41.69***	0.00	22-Jul-05	2-Jul-08
600012	1279	18.93***	0.00	22-Jul-05	2-Jul-08
600026	1289	25.65***	0.00	22-Jul-05	2-Jul-08
600028	1296	19.57***	0.00	22-Jul-05	2-Jul-08
600029	1254	13.16***	0.00	22-Jul-05	2-Jul-08
600115	1147	9.00***	0.00	22-Jul-05	2-Jul-08
600188	1284	17.48***	0.00	22-Jul-05	2-Jul-08
600332	1273	10.67***	0.00	22-Jul-05	2-Jul-08
600362	1269	14.19***	0.00	22-Jul-05	2-Jul-08
600377	1269	24.87***	0.00	22-Jul-05	2-Jul-08
600548	1285	14.05***	0.00	22-Jul-05	2-Jul-08
600585	1279	23.42***	0.00	22-Jul-05	2-Jul-08
600600	1263	12.33***	0.00	22-Jul-05	2-Jul-08
600685	1261	7.61***	0.00	22-Jul-05	2-Jul-08
600688	1281	15.67***	0.00	22-Jul-05	2-Jul-08
600775	1053	-	-		3-Jul-08
600806	989	6.78***	0.00	22-Jul-05	2-Jul-08
600808	1285	14.52***	0.00	22-Jul-05	2-Jul-08
600860	1069	9.70***	0.00	22-Jul-05	2-Jul-08
600871	1256	7.66***	0.00	22-Jul-05	2-Jul-08
600874	1265	11.96***	0.00	22-Jul-05	3-Jul-08
600875	1249	7.96***	0.00	22-Jul-05	2-Jul-08

This table reports the results of the structural break test of Bai (1998, 2003) for each of our 26 stock in individual equations of system (13).

Statistical significance of 1 %, 5 %, and 10 % are indicated by ***, **, and *, respectively.

#please refer to Table 1 for the stock code of the corresponding H-share

Table 11

Panel data analysis of the H-share discount before and after the Chinese exchange rate reforms (windows of +/- 6 months).

	Pre-2005 reform	Post-2005 reform	Pre-2008 reform	Post-2008 reform
Short-sale restrictions	0.001 (1.56)	0.003*** (4.29)	0.004*** (5.49)	0.007*** (6.62)
Expected exchange rate change	-0.003 (-0.19)	0.020*** (3.14)	0.014*** (3.10)	-0.011*** (-3.90)
Index discount CN-HK	0.093*** (4.87)	0.113*** (5.18)	0.030** (2.00)	0.125*** (11.12)
Index discount CN-US	-0.334** (-2.38)	-0.508*** (-3.73)	0.224 (1.54)	-0.524*** (-6.32)
Turnover of A-shares	0.277*** (5.31)	0.352*** (9.61)	0.271*** (4.25)	0.102 (1.11)
Turnover of H-shares	-0.101 (-1.59)	-0.346*** (-5.99)	-0.031 (-0.34)	0.014 (0.18)
Number of trades of A-shares ^a	0.029 (1.04)	0.006 (0.22)	0.010** (2.30)	0.000 (0.02)
Number of trades of H-shares ^a	0.014 (0.35)	-0.009 (-0.29)	-0.008 (-0.49)	-0.067*** (-3.40)
Range of A-shares	-0.176*** (-5.81)	-0.086** (-2.56)	-0.123*** (-6.97)	0.029 (1.17)
Range of H-shares	-0.010 (-0.38)	0.016 (1.11)	-0.011 (-0.65)	-0.015 (-1.28)
Market capitalization of A-shares ^b	2.630*** (12.63)	-0.293*** (-5.42)	0.007*** (5.51)	0.039*** (8.52)
Market capitalization of H-shares ^b	-1.082*** (-15.02)	-0.070** (-2.11)	-0.083*** (-5.04)	-0.198*** (-10.24)
H-share discount en t-1	0.846*** (94.50)	0.883*** (121.77)	0.910*** (128.89)	0.876*** (118.54)
Intercept	0.361*** (2.97)	0.528*** (4.19)	-0.166 (-1.28)	0.493*** (6.55)
Fixed effects	Yes	Yes	Yes	Yes
Observations	106	116	113	117
F-stat	0.00	0.00	0.00	0.00
Adj. R ²	0.99	0.99	0.99	0.99

This table reports the panel regression results before and after the Chinese exchange rate reform of July 2005 and the re-peg of the RMB against the US dollar of July 2008 with model II (Eq. (13)). The t-value reports in (...). */**/** Significant at the 90%/95%/99% level.^aPer 10,000 trades.^bIn millions yuan.

5.2. Short-window analysis

To check for the consistency of our results, we re-examine Model II (Eq.(13)) over a shorter window of 6 months¹⁸ before and after the exchange rate reforms of 21 July 2005 and 1 July 2008. The robustness results are reported in Table 11. Confirming¹⁸ We could not use a shorter window than six months due to the associated insufficient data.

our results using the long (original) window, the relationship between the H-share discount and expected RMB appreciation is significantly positive during the two sub-periods under the managed float. Before the 2005 reform, the negative relationship becomes insignificant after we shorten the window to 6 months, a result attributable to the stabilization of expected RMB appreciation during the two quarters before the 2005 reform of the exchange rate regime. However, after the re-peg of the RMB against the USD, it remains negative.

The index discount CN-HK has a larger effect on the H-share discount than with the long window; its effect increases both from the pre- to post-2005 and from the pre- to post-2008 reform periods. The Index discount CN-US is significantly negative in all sub-periods except for the pre-2008 reform period, but this negative effect is not consistent with its expected sign.

The effect on the H-share discount of the turnover of A-shares is significantly positive during all sub-periods until the reversal to the USD peg in 2008, while the H-share turnover significantly affects the discount only before the 2005 regime change. Moreover, the effect of liquidity drops significantly following the 2005 regime change. The coefficient of the number of trades of the A-share market is significant before the 2008 reform, while the coefficient of the number of trades of the H-share market becomes significant after that same reform.

The results on the H-share discount with respect to A-share market volatility is robust to the change in the length of the window. However, the absolute impact on the discount of market capitalization is larger with the shorter window, a result which provides incremental evidence that asymmetric information is an important determinant of the H-share discount in the early periods.

6. Conclusion

This study avoids the innate endogeneity problem in studying the impact of exchange rate changes on the price disparity of dual-listed stocks by examining how, and to what extent, the two exogenous changes in exchange rate regimes implemented by the Chinese government in 2005 and 2008 affected the disparity between the A- and H-share prices.

The paper finds that H-shares have been traded at a significant discount throughout the overall sample period. The H-share discount decreased after the 2005 switch to a flexible exchange rate regime while the 2008 reversal of the regime increased the discount. Our findings show that, under a flexible exchange rate regime, when short selling is prohibited in the stock market, capital controls are strictly enforced, and traders expect the local currency (RMB) to appreciate, overseas investors use the foreign (H-) shares to establish proxy positions in local currency and equity stocks. Moreover, idiosyncratic market factors, including information asymmetry, differential market liquidity and risk-preference (a la clientele effect), have a significantly reduced impact on the relative stock prices under a flexible (compared to a fixed) exchange rate regime; an indication that unique market and clientele factors can have a significant impact on the no-arbitrage pricing relationship only when hurdles against direct arbitrage are binding, but the effects of such idiosyncratic factors can be dampened by quasi-arbitrage activities.

These results lead to our conjecture that price parity between dual-listed stocks can be enhanced when restrictions are lifted on capital flows and short-selling of stocks, and cross settlement between markets, are allowed. Conversely, the price disparity between A- and H-shares, or in general the Chinese mainland and Hong Kong stock markets, can be reduced if the H-shares are converted to Hong Kong Depository Receipts against the corresponding A-shares and/or the A-shares are converted to China Depository Receipts against the corresponding H-shares, such that the corresponding stocks in the two markets are exchangeable. Further research can be done to examine how, when, and to what extent the lifting of short-selling restrictions in 2010 affected the price disparity. Moreover, since late 2014, the Stock Connect program between Chinese mainland and Hong Kong exchanges has been expanded to include more stocks and to allow for higher turnover quota. Finally, on 4 July 2022, the Connect program has admitted Exchange Traded Funds in the system. Hence, future study can examine whether, when, and to what extent the deepening of the Connect program reduces the relative valuation gap between the two markets, particularly the A- and H-shares.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- Amihud, Y., Mendelson, H., 1986. Asset Pricing and the Bid-Ask Spread. *J. Financ. Econ.* 17 (2), 223–249.
- Arquette, G.C., Brown Jr, W.O., Burdekin, R.C.K., 2008. US ADR and Hong Kong H-Share Discounts of Shanghai-Listed Firms. *J. Bank. Finance* 32 (9), 1916–1927.
- Bai, J., Perron, P., 1998. Estimating and Testing Linear Models With Multiple Structural Changes. *Econometrica* 66, 47–78.
- Bai, J., Perron, P., 2003. Computation and Analysis of Multiple Structural Change Models. *J. Appl. Econom.* 18 (1), 1–22.
- Bailey, W., Jagtiani, J., 1994. Foreign ownership restrictions and stock prices in the Thai capital market. *J. Financ. Econ.* 36 (1), 57–87.
- Beltratti, A., Bortolotti, B., Caccavaio, M., 2016. Stock Market Efficiency in China: Evidence from the Split-Share Reform. *Quart. Rev. Econ. Finan.* 60 (C), 125–137.
- Brennan, M., Schwartz, E.S., 1990. Arbitrage in Stock Index Futures. *J. Bus.* 63 (1), 7–31.
- Burdekin, R.C.K., Redfern, L., 2009. Sentiment Effects on Chinese Share Prices and Savings Deposits: The Post-2003 Experience. *China Econ. Rev.* 20 (2), 246–261.

- Chakravarty, S., Sarkar, A., Wu, L., 1998. Information Asymmetry, Market Segmentation and the Pricing of Cross-Listed Shares: Theory and Evidence from Chinese A and B Shares. *J. Int. Finan. Mark., Inst. Money* 8 (3–4), 325–356.
- Chan, K., Kwok, J.K.H., 2005. Market Segmentation and Share Price Premium. *J. Emerg. Mark. Finan.* 4 (1), 43–61.
- Chan, K., Menkveld, A.J., Yang, Z., 2008. Information Asymmetry and Asset Prices: Evidence from the China Foreign Share Discount. *J. Finan.* 63 (1), 159–196.
- Chui, A.C.W., Kwok, C., 1998. Cross-Autocorrelation between A-Shares and B-Shares in the Chinese Stock Market. *J. Finan. Res.* 21, 333–353.
- Chung, T.-K., Hui, C.-H., Li, K.-F., 2013. Explaining Share Price Disparity with Parameter Uncertainty: Evidence from Chinese A- and H-Shares. *J. Bank. Finance* 37 (3), 1073–1083.
- De Jong, A., Rosenthal, L., Van Dijk, M.A., 2009. The Risk and Return of Arbitrage in Dual-Listed Companies. *Rev. Finan.* 13, 495–520.
- Domowitz, I., Glen, J., Madhavan, A., 1997. Market Segmentation and Stock Prices: Evidence from an Emerging Market. *J. Finan.* 52 (3), 1059–1085.
- Eichler, S., 2011. Exchange Rate Expectations and the Pricing of Chinese Cross-Listed Stocks. *J. Bank. Finance* 35 (2), 443–455.
- Eun, C.S., Janakiramanan, S., 1986. A Model of International Asset Pricing with a Constraint on the Foreign Equity Ownership. *J. Finan.* 41 (4), 897–914.
- Fernald, J., Rogers, J.H., 2002. Puzzles in the Chinese Stock Market. *Rev. Econ. Stat.* 84 (3), 416–432.
- Forbes, K.J., Rigobon, R., 2002. No Contagion, Only Interdependence: Measuring Stock Market Comovements. *J. Finan.* 57 (5), 2223–2261.
- Gagnon, L., Karolyi, G.A., 2010. Multi-Market Trading and Arbitrage. *J. Financ. Econ.* 97 (1), 53–80.
- Glosten, L.R., 1987. Components of the Bid-Ask Spread and the Statistical Properties of Transaction Prices. *J. Finan.* 42 (5), 1293–1307.
- Glosten, L.R., Harris, L.E., 1988. Estimating the Components of the Bid/Ask Spread. *J. Financ. Econ.* 21 (1), 123–142.
- Hua, X., Wei, H., Jiang, Y., 2022. Controlled Currency Regime and Pricing of Exchange Rate Risk: Evidence from China. *J. Account., Audit. Finan.* 37 (1), 39–76.
- Grammig, J.M., Schlag, C., 2005. Internationally Cross-Listed Stock Prices during Overlapping Trading Hours: Price Discovery and Exchange Rate Effects. *J. Emp. Finan.* 12 (1), 139–164.
- Hietala, P.T., 1989. Asset Pricing in Partially Segmented Markets. *J. Finan.* 44 (3), 697–718.
- Karolyi, G. A., Li, L., 2003. A Resolution of the Chinese Discount Puzzle. *Dice Center Working Paper 2003-34*. <http://ssrn.com/abstract=482487>.
- Kyle, A.S., 1985. Continuous Auctions and Insider Trading. *Econometrica* 53 (6), 1315–1335.
- Lee, C.M.C., Ready, M.J., 1991. Inferring Trade Direction from Intraday Data. *J. Finan.* 46 (2), 733–746.
- Lee, H.-W., 2009. The Price Premium of China A-Shares over Hong Kong H-Shares: A Further Visit of the Liquidity Hypothesis. *Asia-Pacific J. Finan. Stud.* 38 (5), 657–694.
- Li, Y., Yan, D., Greco, J., 2006. Market Segmentation and Price Differentials Between A-Shares and H Shares in the Chinese Stock Markets. *J. Multinat. Finan. Manage.* 16 (3), 232–248.
- Ma, X., 1996. Capital Controls, Market Segmentation and Stock Prices: Evidence from the Chinese Stock Market. *Pacific-Basin Finan. J.* 4 (2–3), 219–239.
- Mei, J., Scheinkman, J.A., Xiong, W., 2009. Speculative Trading and Stock Prices: Evidence from Chinese A-B Share Premia. *Ann. Econ. Finan.* 10 (2), 225–255.
- Merton, R.C., 1974. On the Pricing of Corporate Debt: The Risk Structure of Interest Rates. *J. Finan.* 29 (2), 449–470.
- Naidu, G.N., Rozeff, M.S., 1994. Volume, Volatility, Liquidity and Efficiency of the Singapore Stock Exchange Before and After Automation. *Pacific-Basin Finan. J.* 2 (1), 23–42.
- Pedro, S.A., Saretto, A., 2009. Option Strategies: Good Deals and Margin Calls. *J. Finan. Mark.* 12 (3), 391–417.
- Scheinkman, J.A., Wei, X., 2003. Overconfidence and Speculative Bubbles. *J. Polit. Econ.* 111 (6), 1183–1219.
- Shleifer, A., Vishny, R.W., 1997. The Limits of Arbitrage. *J. Finan.* 52 (1), 35–55.
- Sun, Q., Tong, W.H.S., 2000. The Effect of Market Segmentation on Stock Prices: The China Syndrome. *J. Bank. Finance* 24 (12), 1875–1902.
- Wang, F., Xu, Y., 2004. What Determines Chinese Stock Returns? *Finan. Anal. J.* 60 (6), 65–77.
- Ye, M., Hutson, E., 2011. Managed Exchange Rates, Dual Listing and Foreign Exchange Exposure: The Experience of Chinese banks around the Financial Crisis. *J. Asia Pacific Econ.* 16 (3), 393–421.
- Zhao, H., 2010. Dynamic Relationship between Exchange Rate and Stock Price: Evidence from China. *Res. Int. Bus. Financ.* 24 (2), 103–112.