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Article *in* Journal of Banking & Finance · September 2008

DOI: 10.1016/j.jbankfin.2007.12.019

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US ADR and Hong Kong H-share discounts of Shanghai-listed firms ☆

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Received 7 July 2007; accepted 13 December 2007
Available online 1 January 2008

Abstract

This paper examines the differential between the share prices of Chinese securities traded on their home market of Shanghai versus prices observed offshore in New York and Hong Kong. The discounts attached to Chinese securities, whether trading as ADRs on the NYSE or as H-shares on the Hong Kong market, appear to have been significantly influenced by changes in both exchange rate expectations and investor sentiment during 1998–2006. Expected exchange rate changes alone account for approximately 40% of the total variation in each case. This is combined with large cross-sectional variation, however, reflecting additional significant market-wide and company-specific sentiment effects.

JEL classification: G14; G15

Keywords: China; ADR; Share prices; Sentiment; Shanghai; Hong Kong

1. Introduction

An American Depository Receipt (ADR) is equivalent to a specified number of shares of a security trading in its home market. In theory, the price of an ADR should reflect the value of the underlying security in its home market and the exchange rate between the home currency and the US dollar. In practice the ADR price may deviate from parity and sell at either a discount or a premium to the value of the underlying asset. Arbitrage conditions imply that prices of the ADR and the underlying security diverge solely due to exchange rate expectations and the transaction costs associated with conversion of the ADR. While capital controls could drive a wedge between the ADR price and domestic currency price, even the extreme ADR discounts seen during the 2001–2002 Argentinean case – peaking above 50% – implied an average expected devaluation of the Argentinean peso against the US dollar that quite closely matched the actual official devaluation (Auguste et al., 2006). Expected exchange rate changes also appear to have been a significant influence on the discount attached to Chinese ADRs, with heightened expectations of renminbi revaluation being accompanied by shrinking ADR discounts for Chinese shares as investors anticipated a more valuable renminbi.

There have been numerous studies documenting that, when the same or equivalent securities trade in multiple markets, the law of one price is often violated (Rosenthal and Young, 1990; Froot and Dabora, 1999; Chan et al., 2003). Variations in sentiment across the different markets represent one possible source of the price differentials. Kim et al. (2000), in examining the determinants of ADR price movements, report that in addition to movements in the

☆ An earlier version of this paper was presented at the Western Economic Association meetings in San Diego, California, June 29–July 2, 2006. The authors thank session participants and two anonymous referees for helpful comments. This paper was reviewed and accepted while Prof. Giorgio Szego was the Managing Editor of the *Journal of Banking and Finance* and by the past Editorial Board.
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doi:10.1016/j.jbankfin.2007.12.019

underlying shares and exchange rates the prices are also influenced by US market movements. Possible US market sentiment effects on ADRs from a range of countries are considered by Suh (2003), who identifies a significant impact on the ADR prices of several companies from mainland China. Wei (2000) and Wang and Jiang (2004) also suggest that market sentiment may be an important factor explaining the differences in the prices of cross-listed domestic "A" shares and Hong Kong listed "H" shares. At the individual firm level, Wang and Jiang (2004, p. 1295) find that H-shares "behave more like Hong Kong stocks than mainland Chinese stocks" but "retain significant exposure to their domestic market".[1] In this paper, we examine price differentials between Shanghai A-shares and both US ADRs and Hong Kong H-shares to determine whether measures of market sentiment can explain the price differential across markets that remains after controlling for exchange rates.[2]

While not new, the idea that investor sentiment can influence asset prices and returns has recently received more attention in the finance literature. Earlier studies using closed end fund discounts as a sentiment measure yielded mixed results (Lee et al., 1991; Chen et al., 1993; Swaminathan, 1996; Elton et al., 1998; Neal and Wheatley, 1998). While investors undoubtedly have periods of being overly optimistic and overly pessimistic about the future prospects for asset returns, the question is whether such swings in investor sentiment are strong enough to be reflected in asset prices (see, for example, Brown and Cliff, 2004, 2005; Baker and Wurgler, 2006). If investor sentiment does affect asset prices and investor sentiment varies across countries, then one would expect that price differentials across countries for the same asset could reflect such differences in investor sentiment across trading locations.

Our empirical work uses a panel data approach to examine the extent to which expected exchange rate changes and market sentiment measures explain price differentials between Chinese shares traded in Shanghai versus shares of the same mainland Chinese companies traded in New York and Hong Kong. We calculate the difference between the actual ADR or H-share price and the value of the underlying securities in their home market and divide this number by the value of the underlying securities in the home market. The ADR (or H-share) discount measures the extent to which the shares listed abroad trade below the values attached to the same securities in the home market. We model this discount as a function of both expected exchange rate changes and measures of investor sentiment. For the Chinese stocks in question, the primary difference in liquidity and transactions costs should lie across, and not within, markets. One would expect that, if ADR and H-share discounts were solely due to exchange rate effects and not differences in sentiment, then the degree of price differences across securities would be similar. As shown below, this is not the case in practice.

We are able to control for company-specific sentiment effects, as well as market-wide effects, in our panel analysis. For example, if investors in the United States are more (less) optimistic than investors in China about the future prospects of equities, then we may observe all ADRs selling at a premium (discount) to the underlying Chinese securities. However, even if overall market sentiment is similar in the two countries, then investor sentiment about specific firms or industries could still lead to differences in prices across the two countries. Should US investors be optimistic about the prospects for technology firms, say, while Chinese investors were more optimistic about the prospect for industrial material firms, then we may see technology ADRs selling at a premium while industrial material ADRs sell at a discount relative to the underlying Chinese asset. There has also been considerable speculation about exchange rate revisions as reflected in movements in the forward exchange market over our post-1998 sample period. This paper offers a first attempt to separate out the effects of exchange rates and sentiment factors and isolate the significant explanatory power that may be attributed to varying market sentiment levels.

2. Data and properties of the sample

Our sample comprises 30 Chinese companies with data series available from Bloomberg. All 30 companies have A-share listings on the Shanghai stock exchange plus corresponding H-share listings in Hong Kong. Eleven of the companies also have NYSE ADR listings during our sample period.[3] Although mainland China has a stock exchange in Shenzhen as well as Shanghai, the Shanghai market is far larger, accounting for approximately 80% of total mainland China stock market capitalization in 2006. Overall mainland China stock market capitalization actually increased considerably in 2006, reaching 8.9 trillion renminbi ($US 1.14 trillion) for Shanghai and Shenzhen combined. This represented just over 40% of China's 2006 GDP, up from less than 18% of GDP in 2005.[4] In this

[1] The importance of the Hong Kong market to mainland Chinese shares is also confirmed in Kutan and Zhou's (2006) analysis of Chinese shares traded on the New York Stock Exchange (NYSE). The greater influence of the Hong Kong stock market on ADR returns is combined with significant effects of the US "host" market and the local Shanghai market, however.

[2] We focus on weekly data rather than daily, or intra-day, data (cf. Grammig et al., 2005; Pascual et al., 2006), as we believe that sentiment effects may otherwise be confounded by exchange rate noise and other very short-term volatility. This still leaves a time gap between the US and Chinese markets, however. (See Chong and Su, 2006; Su and Chong, 2007 for high frequency analysis of cointegration between A- and H-shares, and ADRs and H-shares, respectively.)

[3] A 12th company, Tianjin Capital Environmental Protection Company also has an ADR listing but there are only three observations so the company is not included in the ADR sample.

[4] The development of mainland China stock exchanges, and their relationship with Hong Kong, is described in detail in Burdekin (2008, Chapter 8).

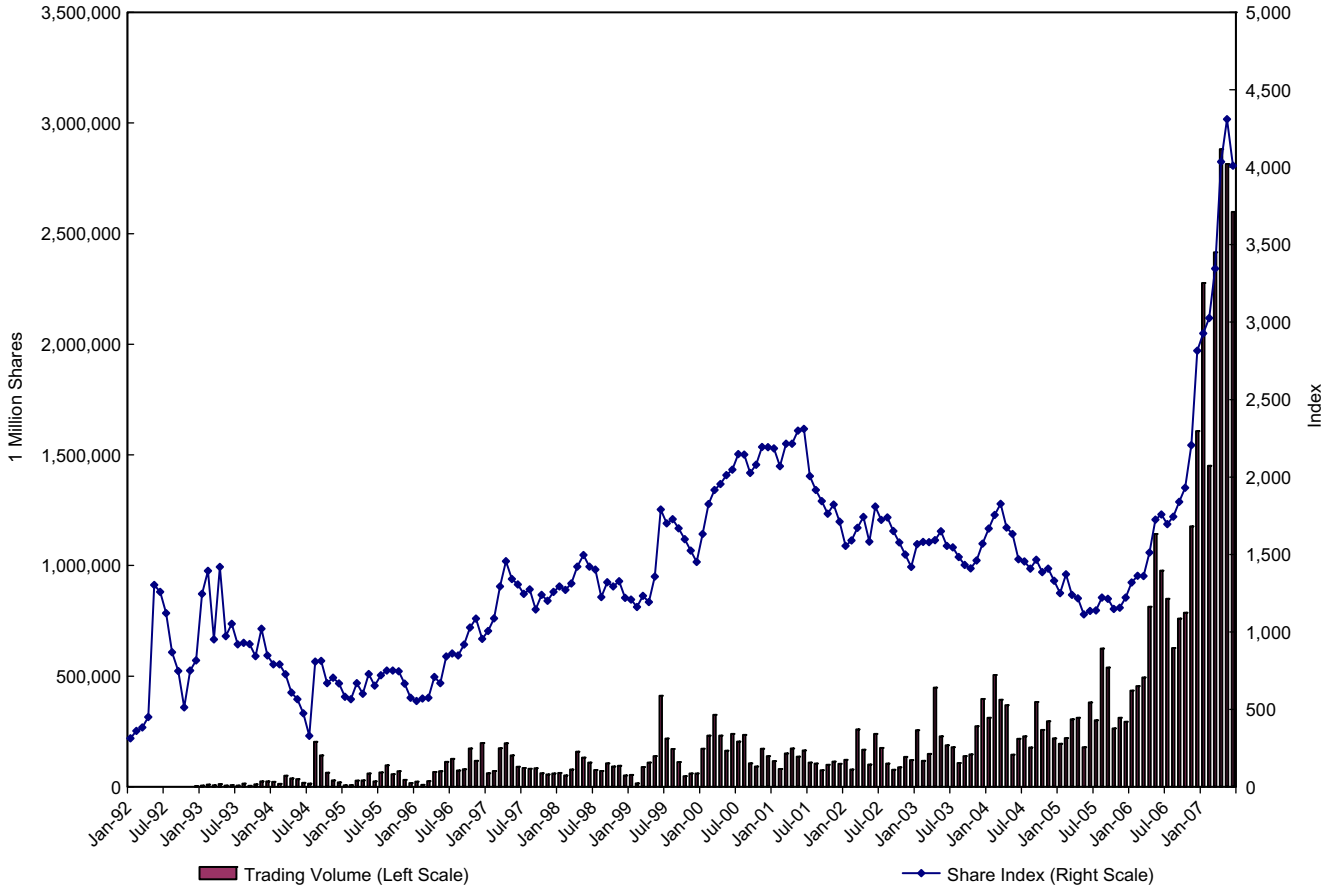

Fig. 1. Shanghai "A" share index prices and trading volumes, January 1992–June 2007.

paper, we focus on the more liquid A-shares that were sold to domestic residents rather than the B-shares that were originally available only to foreigners.[5] It seems that sentiment effects may have helped drive a wedge between A-share and B-share prices in the past, just as we point to such effects in helping account for different trading prices across the Shanghai, New York and Hong Kong markets. Ma (1996, p. 229), for example, suggests that the tendency for B-share prices to remain substantially lower than A-shares of the same company reflected not just liquidity issues but is also consistent with the mainland Chinese investors being "risk-lovers who want to make money in the short run".[6]

As shown in Fig. 1, the Shanghai A-share index has exhibited many sharp ups and downs but actually ended up registering no net gains between its inaugural (full) year of 1992 and 2005. Indeed, the Shanghai index value of 1303 in May 1992 was higher than the December 2005 value of 1221. Even prior to the strong advance that began at the end of 2005, local share prices nevertheless tended to be substantially higher than the prices for which these same securities traded in New York or Hong Kong (Fig. 2). The discounts in these offshore markets ranged between approximately 70% and 95% over the December 1998–December 2001 period, for example. The discounts then tended to tighten over the 2001–2006 period, with the ADR and H-share discounts both temporarily falling below 10% in early 2006. In the empirical analysis below, we show how expectations of renminbi appreciations against both the US dollar and the Hong Kong dollar – in combination with sentiment effects – help account for these narrowing discounts.

Variations in market sentiment undoubtedly complicate the relationship between A-shares and their corresponding ADR and H-share values – as reflected also in the persistent discount of foreign-held B-shares relative to locally-held A-shares noted earlier. There is also the issue of capital controls, with Chinese restrictions on capital outflows potentially pushing up the relative price of domestic listings insofar as domestic investors are prevented from

[5] Later policy changes have removed the strict separation between the "A" and "B" share markets. The purchase of B-shares by domestic individuals was legalized in February 2001, while limited foreign investor entry into the A-share market was approved in December 2002. Correlations between A-shares and B-shares increased sharply after the February 2001 opening up of the B-share market, rising above 65% for both Shanghai and Shenzhen over the 2001–2003 period compared to a less than 30% correlation earlier on (Chiu et al., 2005, p. 278).

[6] Wang et al. (2004, p. 439) find that greater volatility in A-shares relative to B-shares persisted over the August 1994–July 2000 period – with A-shares revealing a consistently stronger tendency to overreact to both good and bad news.

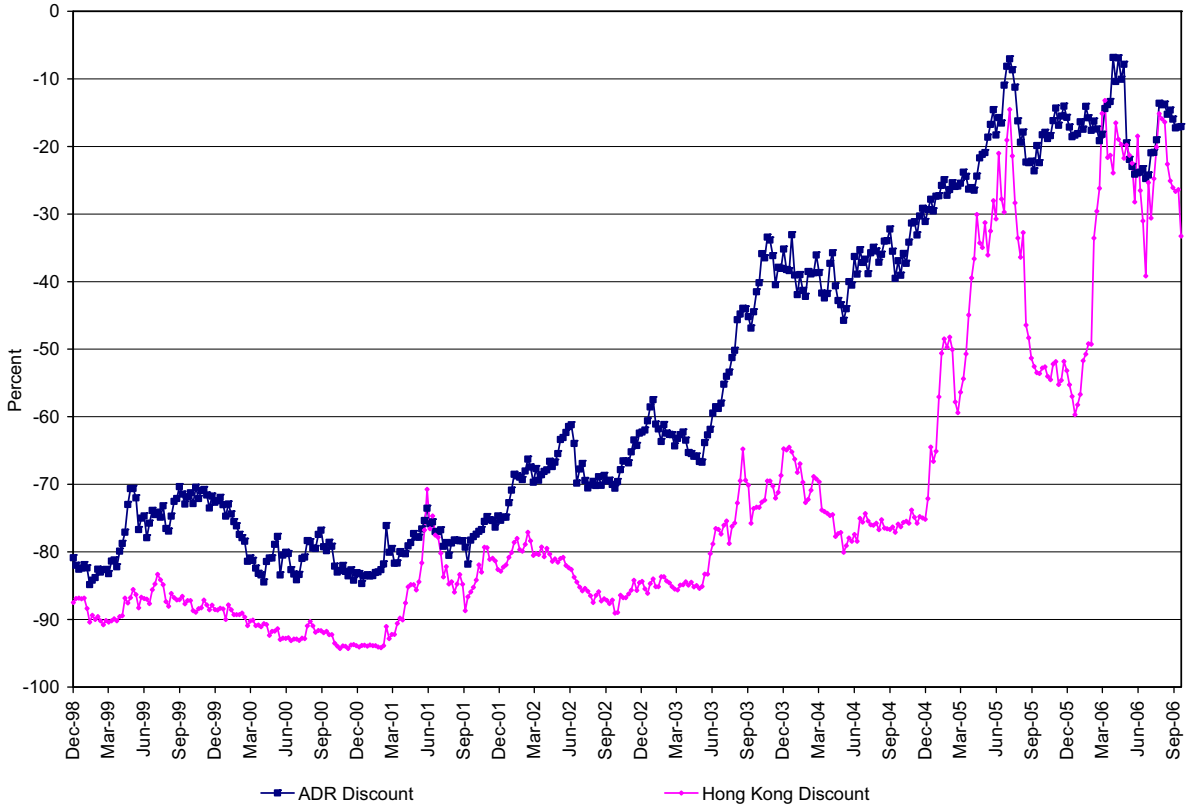

Fig. 2. ADR discounts versus H-share discounts, December 1998–September 2006.

placing funds abroad.[7] Girardin and Liu (2007, p. 368) suggest that capital controls have not precluded an "internationalization" of the strategy adopted by Chinese investors, however, and suggest that"[c]apital flight is already used by Chinese residents to buy shares in Hong Kong, including IPOs of Mainland firms listed in Hong Kong".[8]

Our full sample period runs from December 1998 to September 2006. Table 1 lists the individual companies along with the relevant period for which the company's data is included in our sample. We calculate the ADR discount[9] with respect to the NYSE listings as

$$\text{ADR discount} = [(\text{ADR Price} - \text{Implied ADR Price})/\text{Implied ADR Price}], \quad (1)$$

where the Implied ADR Price = [Price in Renminbi/(Renminbi/Dollar)] * ADR Conversion ratio. We similarly define the H-share discount to reflect the differences in the actual and implied prices of securities cross-listed in mainland China and Hong Kong.

Even in a world without arbitrage opportunities, the ADR discount would differ from zero due to transaction costs and expected changes in exchange rates. Table 2 reports summary statistics for the NYSE ADR discount and the Hong Kong H-share discount as well as the additional variables used in the regression models. The expected exchange rate change is the predicted change in exchange rates embodied in the 12-month renminbi non-deliverable forward contract rate versus the US dollar (which, in turn, implies similar expected moves against the Hong Kong dollar given Hong Kong's currency board that guarantees convertibility into US dollars at a fixed exchange rate).[10] Many of the variables like the ADR discount are company

[7] Restrictions on capital outflows have been combined with pervasive restrictions on inflows of capital into mainland China – with limited officially-sanctioned foreign purchases of Shanghai A-shares being permitted only since the end of 2002. It is possible that such purchases were augmented by illegal inflows of funds entering China's stock markets *en masse* in 2006–2007, prompting the State Administration of Foreign Exchange to strengthen controls and penalize both local and foreign banks for rules violations (see, for example, Xin, 2007). Such illegal inflows probably played a much lesser role over the bulk of our 1998–2006 sample period, however.

[8] Although more widespread purchases would, of course, be expected if existing impediments were alleviated or removed – and the August 20, 2007 announcement of a possible pilot program that would, for the first time, allow individual mainland Chinese investors to directly trade Hong Kong stocks was accompanied by both a strong rise in the Hong Kong market and downward pressure on the H-share discount (Batson, 2007).

[9] Although ADRs generally trade at a discount to the implied price over our sample period, there is, of course, no reason why the ADR cannot trade at a premium, and in some cases premiums do actually arise in the sample.

[10] This forward market for renminbi is "non-deliverable" in the sense that settlement must be made in cash only owing to the non-convertibility of China's capital account. Nevertheless, settlements reflect the difference between the forward rate and the actual future spot rate when the contract matures just as with other currency forward markets. Moreover, the non-deliverable market is quite liquid, with daily volumes that reached $US600 million by late 2003 (Fung et al., 2004).

Table 1
Companies included in the sample

Company name	ADR	ADR	H-Share	H-Share
	Data begins	Data ends	Data begins	Data ends
Angang New Steel Co	October 17, 2003	September 29, 2006	December 11, 1998	September 29, 2006
Anhui Conch Cement Co. Ltd.			February 8, 2002	September 29, 2006
Anhui Expressway			January 10, 2003	September 29, 2006
Beiren Printing Machinery			December 11, 1998	September 29, 2006
China Eastern Airlines Co.	December 11, 1998	September 29, 2006	December 11, 1998	September 29, 2006
China Petroleum and Chemical	August 10, 2001	September 29, 2006	August 10, 2001	September 29, 2006
China Shipping Development			May 24, 2002	September 29, 2006
China Southern Airlines Co.	July 25, 2003	September 29, 2006	July 25, 2003	September 29, 2006
Dongfang Electrical Machine			December 11, 1998	September 29, 2006
Guangdong Kelon Elec Hld			July 16, 1999	September 29, 2006
Guangzhou Pharmaceuticals			February 9, 2001	September 29, 2006
Guangzhou Shipyard Intl Co.			December 11, 1998	September 29, 2006
Huadian Power Intl Corp.			February 4, 2005	September 29, 2006
Huaneng Power Intr	December 7, 2001	September 29, 2006	December 7, 2001	September 29, 2006
Jiangsu Expressway Co. Ltd.	January 31, 2003	September 29, 2006	January 19, 2001	September 29, 2006
Jiangxi Copper Co. Ltd.	November 14, 2003	September 29, 2006	January 11, 2002	September 29, 2006
Jiaoda Kunji High-Tech Co.			December 11, 1998	September 29, 2006
Jilin Chemical Indus Co.	December 11, 1998	September 30, 2005	December 11, 1998	September 30, 2005
Jingwei Textile Machinery			December 11, 1998	September 29, 2006
Luoyang Glass Company Ltd.			December 11, 1998	September 29, 2006
Maanshan Iron and Steel			December 11, 1998	September 29, 2006
Nanjing Panda Elec Co. Ltd.			December 11, 1998	September 29, 2006
Shandong Xinhua Pharm Co.			December 11, 1998	September 29, 2006
Shenzhen Expressway Co. Ltd.			December 28, 2001	September 29, 2006
Sinopec Shanghai Petrochem	December 11, 1998	September 29, 2006	December 11, 1998	September 29, 2006
Sinopec Yizheng Chemical Fib			December 11, 1998	September 29, 2006
Tianjin Capital Environ			December 11, 1998	September 29, 2006
Tsingtao Brewery Co. Ltd.	December 11, 1998	September 29, 2006	December 11, 1998	September 29, 2006
Yanzhou Coal Mining Co.	December 11, 1998	September 29, 2006	December 11, 1998	September 29, 2006
ZTE Corp			December 10, 2004	September 29, 2006

Table 2
Summary statistics for weekly variables for NYSE ADR and Hong Kong samples

	Observations	Mean	Std. Dev.	Minimum	Maximum
Panel A: China–US ADR sample					
ADR discount	3,174	−0.4754	0.2938	−0.937	0.323
Expected exchange rate change	408	0.0008	0.0424	−0.0586	0.1365
Relative market P/E ratios	408	1.3626	0.3381	0.7006	2.4409
Relative company P/E ratios (natural log of P/Es)	3063	1.025	0.2478	0.4393	1.8856
Market capitalization (in millions renminbi)	2279	56.182	99.013	5.3147	584.95
Annual dividend (in renminbi)	2779	9.2150	8.6510	0.0000	50.019
Panel B: China–Hong Kong sample					
Hong Kong discount	9886	−0.5961	0.2823	−0.9765	0.3761
Expected exchange rate change	408	0.0010	0.0396	−0.0512	0.1113
Relative market P/E ratios	261	3.0034	1.4093	1.5353	6.3344
Relative company P/E ratios	8716	1.0687	0.2475	0.4394	2.3508
Market capitalization (in millions renminbi)	6987	26.701	66.502	0.5977	584.95
Annual dividend (in renminbi)	6987	8.5140	13.0350	0.0000	163.04
Panel C: Data from September 29, 2006					
ADR discount	10	−0.1708	0.2194	−0.5490	0.1520
Hong Kong discount	29	−0.2788	0.2706	−0.7235	0.1500

and time specific variables while other variables like the expected exchange rate change are only time, and not company, specific so they have fewer observations. The relative market P/E ratio reflects the price-earnings ratio of the Shanghai A-share Total Stock Index divided by either the S&P 500 price-earnings ratio or the Hang Seng China Enterprises Index price-earnings ratio. The relative company P/E ratio is the company's price-earnings ratio

Fig. 3. Expected change in the renminbi exchange rate, December 1998–September 2006.

divided by the price-earnings ratio of the Shanghai A-share Total Stock Index and the market capitalization variable is measured in renminbi.

There is not only substantial variation across time in the discount but also considerable differences across companies at any given point in time. Even though the fluctuations in the average discount may be consistent with changing exchange rate expectations, transactions costs and exchange rate expectation factors alone cannot plausibly explain the large differences across companies. For example, the data for our last observation point of September 29, 2006 show the actual NYSE ADR price to vary from as little as 45.1% of the implied ADR price to as high as 115.2% of the implied ADR price on that date – with the actual discount ranging from −54.9% to +15.2% (Table 2, Panel C). Meanwhile, the H-share discount ranges from −72.4% to 115.0% of the implied value on that same date. Such wide ranges suggest that some additional factor, such as investor sentiment, may be at work. Given the wide disparity in price differentials across companies, it is likely there are some company-specific differences in sentiment as well as overall market sentiment effects.

The variation across companies is nevertheless combined with an important role for expected exchange rate effects in explaining movements in the average discount over the sample. The sharp declines in the average ADR discount and H-share discount shown in Fig. 2 primarily occur after expectations of renminbi appreciation were first revealed in the non-deliverable forward market on November 13, 2002. As shown in Fig. 3, the implied expected appreciation against the US dollar peaks around 5% in mid-2005 before declining slightly after the actual 2% appreciation imposed by the Chinese authorities on July 21, 2005.[11] The rising revaluation pressure in the second half of 2003, in particular, appears to be accompanied by a sharp drawdown in the ADR discount.[12] The close association between the rising exchange rate expectations implied by the forward market and the shrinking ADR discount is consistent with increased demand for renminbi-denominated Chinese stocks at times when investors expect exchange rate gains that would translate these renminbi values into larger US dollar amounts. This link appears to have been clearly recognized by market participants. For example, Mike Donnelly, vice president and senior portfolio manager with American Century, summarizes the potential benefits from a rising Chinese currency as follows:

[11] See Burdekin (2008, Chapters 1 and 2) on the pressures for Chinese currency revaluation and the role played by the weakening US dollar.

[12] Zhang (2004, Chapter 18) reviews the myriad factors influencing the forward contract price over the 2002–2004 period as well as offering extensive details on the workings of the contract.

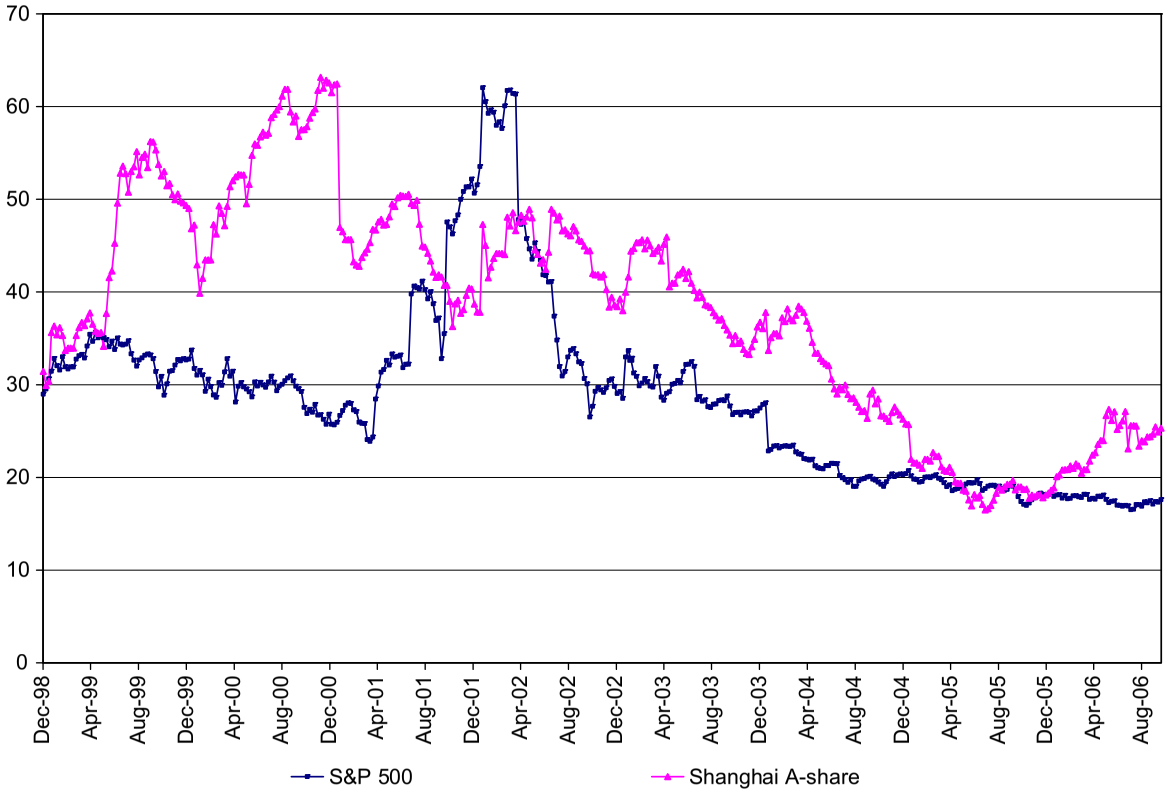

Fig. 4. *P*/*E* ratios for the S&P 500 and Shanghai A-share total stock index, 1998–2006.

Fig. 5. *P*/*E* ratios for the Hang Seng China enterprises index and Shanghai A-share total stock index, 2001–2006.

> If you have an ADR, it's going to be the local price times the exchange rate. If the exchange rate appreciates ... the value of the investment does too.[13]

The raw data suggest that exchange rate expectations provide an important, albeit incomplete, explanation of the price variation across countries.

Figs. 4 and 5 provides some details on the relative differences in price-earnings ratios across mainland China, the United States and Hong Kong. As discussed below we use the ratio of the price-earnings values as a proxy for differences in investor sentiment across countries. Fig. 4 reveals that both the Shanghai and New York markets experience increases in price-earnings ratios in the late 1990s as each market surged upward. The ratio peaks for the Shanghai market earlier than it does for the US market, however, and the price-earnings ratio in the United States has a much sharper peak in 2002 – when earnings dropped more rapidly than prices for S&P 500 companies in the aftermath of the technology bubble. Otherwise, while the Shanghai index generally trades at a higher price-earnings ratio than the US market, the spread between the two markets is clearly not constant across time but subject to significant short-run deviations. The price-earnings ratio in Shanghai actually fell below that of the S&P 500 for short periods of time in 2001–2002 and during 2005, both episodes when overall Shanghai share price performance was relatively weak (see Fig. 1) and Shanghai market sentiment was likely depressed.

Fig. 5 depicts the relative differences in price-earnings ratios between our Hong Kong and Shanghai market indices over the shorter available 2001–2006 sample period. As with Fig. 4, the declining average price-earning ratio attached to "A" shares after 2001 brings about increased convergence with the price-earnings ratio in the offshore market. The gap with the price-earnings ratio of the Hang Seng China Enterprises Index steadily declines from over 30 in 2001–2002 to less then ten during 2005.[14] From mid-2005 through the end of our sample, the price-earnings ratios in both Shanghai and Hong Kong trend upward and the spread widens slightly. Unlike the preceding comparison with the S&P 500, there is no time period for which the Shanghai price-earnings ratio falls below the equivalent Hong Kong ratio. But, as in Fig. 4, convergence between the price-earnings ratio occurs at those times when Shanghai market performance was weak.

3. Model and results

We employ a cross-sectional panel approach to examine the extent to which variations in the ADR discount across companies at different points in time are related to exchange rate expectations and measures of market sentiment. The full model is as follows:

$$\begin{aligned}\text{ADR\_discount}_{it} &= \alpha_0 + \beta_1 \text{Expected\_Exchange\_Rate\_Change}_t \\ &\quad + \beta_2 \text{Market\_Sentiment}_t + \beta_3 \text{Company\_Sentiment}_{it} \\ &\quad + \beta_4 \text{Market\_Capitilization}_{it} + \beta_5 \text{Dividend}_{it} + \varepsilon_{it}, \end{aligned} \quad (2)$$

where the expected_exchange_rate_change is the predicted change in exchange rates implied by the 12-month renminbi non-deliverable forward contract rate.[15]

Ideally, we would like to have measures of US investors' views and Shanghai investors' views toward the future prospects of their respective overall markets as well as their views towards specific companies. Instead we have to rely on proxies for market and company sentiment. Our market sentiment measure reflects the relative market-wide price-earnings ratios across the two countries measured as the price-earnings ratio on the Shanghai A-share Total Stock Index divided by the price-earnings ratio on the S&P 500 Index. If the Shanghai price-earnings ratio is higher than that in the United States then this should indicate more positive market sentiment in mainland China and the ADR should sell at a lower relative price than its Shanghai counterpart resulting in a more negative ADR discount. As noted earlier, relatively lower Shanghai price-earnings ratio do seem to have closely coincided with periods of market weakness – at which times it seems reasonable to infer that investor sentiment was depressed as well.

The company sentiment variable is measured by the (one period) lagged natural log of each individual company's price-earnings ratio relative to the natural log of the overall market-wide price-earnings ratio in Shanghai. In using one period lagged values, we avoid having the contemporaneous stock price on both sides of the regression equation. While the firms in our sample do not have negative earnings, there are several instances of near-zero earnings that produce very high company P/E ratios. We use the ratio of the natural log of the company P/E ratio to the natural log of the market P/E ratio to minimize the impact of the large P/Es that result from small earnings values.[16] If the company's price-earnings ratio is high relative to the overall Shanghai market, then it may suggest local Chinese sentiment toward this security is high. If US investors do not have a similarly high level of sentiment toward the security, then the ADR should sell at a lower relative price than its Chinese counterpart resulting in a more negative ADR discount. We also include the market

[13] As quoted in Wise (2006).

[14] The relatively low price-earnings seen for the Hong Kong index reflect the fact that the data are for only the Chinese Enterprise Sub-Index and not for the Hang Seng as a whole.

[15] Similar results are obtained if we use the current exchange rate, the weekly change in exchange rates, or expected changes using shorter duration futures contracts.

[16] Were the sample to include firms with negative earnings, one would have to use alternative measures of company sentiment such as price-to-book or price-to-sale ratios that would still have positive values. Experimentation with various other measures of market sentiment, including price-to-book ratios, price-to-sales ratios and dividend yields, yielded results similar to those obtained using the price-earnings ratio.

Table 3
Relationship between ADR discounts, exchange rates and market sentiment

	Dependent variable: ADR discount									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Expected exchange	−5.135*	−4.909*	−4.890*	−4.781*	−6.310*	−4.112*	−3.933*	−4.414*	−4.287*	−5.930*
Rate change	(0.567)	(0.571)	(0.558)	(0.552)	(0.877)	(0.751)	(0.750)	(0.827)	(0.825)	(0.874)
Market sentiment		−0.121*		−0.069**	−0.033		−0.105*		−0.082**	−0.046
		(0.015)		(0.034)	(0.026)		(0.021)		(0.027)	(0.026)
Company sentiment			−0.389*	−0.378*	−0.220**			−0.244**	−0.225**	−0.154**
			(0.115)	(0.117)	(0.073)			(0.103)	(0.099)	(0.053)
Market cap (in billions)					−0.004					0.176
					(0.112)					(0.288)
Dividend					0.014*					0.013*
					(0.003)					(0.001)
Constant	−0.531*	−0.368*	−0.132	−0.051	−0.431*	−0.520*	−0.378*	−0.275**	−0.185**	−0.475*
	(0.040)	(0.045)	(0.116)	(0.111)	(0.105)	(0.008)	(0.028)	(0.102)	(0.095)	(0.067)
Company-specific fixed effects	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	3174	3174	3063	3063	2779	3174	3174	3063	3063	2779
R^2	0.459	0.475	0.576	0.581	0.756	0.687	0.698	0.719	0.726	0.830

We estimate the following model: ADR discount$_{it} = \alpha_0 + \beta_1$Expected_Exchange_Rate_Change$_t + \beta_2$Market Sentiment$_t + \beta_3$Company Sentiment$_{it} + \beta_4$Market Capitalization$_{it} + \beta_5$ Dividend$_{it} + \varepsilon_{it}$, where the expected exchange rate change is measured as the predicted change in exchange rates over the next 12 months as measured by the 12-month futures rate. The market sentiment measure is the ratio of the Shanghai A-Share Index P/E ratio to the S&P 500 P/E ratio at time t. The company sentiment measure is the one period lag of the natural log of the ratio of company i's P/E ratio to the natural log of the Shanghai A-Share Index P/E ratio at time t. Market capitalization is measured in local currency at time t. All models are estimated using weekly data. Robust standard errors clustered by company are in parentheses; **significant at 5%; *significant at 1%.

capitalization of the firm. We expect that on average larger companies will have lower trading costs, more cross country information and fewer barriers to arbitrage – resulting in the ADR discount approaching zero as companies become larger. Finally, we include the annual dividend.

Different tax structures could factor into the ADR and H-share discounts attached to the Chinese firms we examine. Individuals in mainland China face a 20% tax rate on dividend income and 0% tax rate on capital gains (Lau and Wang, 2003; Milonas et al., 2006).[17] Insofar as this tax structure results in dividends being taxed more relative to capital gains in China than in the United States, higher dividend paying stocks would be expected to sell at less of a premium in China than the United States because they are less attractive for tax purposes. In addition, while A-share purchasers would most likely be individual investors subject to taxes, insofar as ADR investors utilize tax exempt accounts or tax exempt institutions, this would only reinforce the relative attractiveness of dividends in the United States.[18] Meanwhile, Hong Kong investors have traditionally faced no taxation on either capital gains or on dividends. Although – under the terms of the Double Tax Agreement signed on August 21, 2006 – Hong Kong residents face a 10% withholding tax rate on most dividends paid by mainland Chinese companies, this would still leave dividend payments more tax-advantaged for Hong Kong investors than for mainland Chinese investors.

Table 3 presents the results of employing our model to explain the ADR discount in New York with and without allowance for company-specific fixed effects. The negative coefficients indicate that the variables in question have the effect of making the ADR discount bigger, i.e., more negative. Column (1) indicates that expected exchange rate changes do, in fact, play an important role in determining the discount, explaining over 40% of the total variation on their own. The impact of expected exchange rate movements remains both statistically and economically significant as we add additional explanatory variables.

Columns (2)–(4) allow for sentiment effects in addition to exchange rate expectations. The market sentiment and company sentiment measures are each significantly related to the ADR discount, whether included alone or together. The higher the relative market sentiment in Shanghai, the more the price of the ADR is discounted relative to the Shanghai price. US investors in ADRs, not being immediately subject to such a Chinese-specific effect, allow prices to differ by more across the two markets in this case. Similarly, when Shanghai investors drive up the market price of an individual company relative to other local Chinese companies, that company's ADR price lags behind. Again, if the sentiment change is local in origin, the effect is not seen to spill over to US holders of the same

[17] In some instances taxes on dividends may have been less than 20% especially prior to 1999. Milonas et al. (2006) discuss these circumstances but, in general, capital gains received more favorable tax treatment than dividends for individual investors in China over our sample period.

[18] On the other hand, the flat tax rate of 20% imposed on dividends in China would have been, for many US investors, lower than the tax rates implied by the taxation of dividends as ordinary income that applied over much of our sample period. This complicates the overall effects of the taxation structure on the relative attractiveness of dividend-paying stocks in the two countries as Chinese investors may often have enjoyed more favorable treatment of both dividends *and* capital gains than their US counterparts.

security. These findings suggest that differences in investor sentiment across the two markets help to explain the price differentials across the two markets as suggested in past studies.

In column (5) we add to the model the market capitalization of the firm in local currency with the expectation that larger firms have less price discrepancy across markets. The market capitalization coefficient is not significantly different from zero, however. We also include the annual dividend paid by the firm with the expectation that this impact will be positive to the extent that differential tax effects make dividend-paying stocks relatively more attractive to US investors, thereby shrinking the discount. This last variable is, in fact, positive and significant. Although both sentiment variables remain negatively related to the discount, the coefficient on the market sentiment measure drops in magnitude and is no longer significant. The company-specific sentiment variable is not similarly affected, however. Meanwhile, columns (6)–(10) show the estimates that result after we control for company fixed effects. These findings are generally similar to before except that the coefficient on the relative company sentiment measure becomes smaller under allowance for fixed effects. This is not surprising given that it is a company-specific measure of sentiment.[19]

Our empirical approach also allows us to quantify the implied sentiment and exchange rate effects. The coefficient on the exchange rate variable in the full specification (Table 3 column (5)) is −6.310. With a one standard deviation change in the expected exchange rate change being 0.0424, a one standard deviation movement in the expected exchange rate would change the ADR discount by 0.2675. Thus, if the renminbi was expected to appreciate by 0.0424 less, then the ADR discount would increase from its mean value of −0.4754 to −0.7429. This is very much consistent with prior findings that expected exchange rate changes explain a large portion of the deviation in share prices across international markets. Whereas our overall market sentiment variable is not statistically significant, and has a small coefficient implying that a one standard deviation move in this variable would change the ADR discount by only 0.0112, relative company sentiment effects are seen to be both economically and statistically significant. A one standard deviation (0.2478) movement in the relative company sentiment measure (ratio of the natural logs of the company to market P/E ratios) would change the ADR discount by 0.0545 given the coefficient of −0.220. This would represent one-fifth of the impact of exchange rate expectations.

In Table 4 we estimate a similar model for the differences in prices of securities that are cross-listed securities on the Shanghai and Hong Kong markets. The sample period in this case is reduced to October 2001–September 2006 as we do not have earlier data on Hong Kong price-earnings ratios. As with the ADR discount, exchange rate expectations alone explain more than 40% of the total variation in the H-share discount. But, when we add our market sentiment measure, the coefficient on the exchange rate drops roughly by half. The primary reason for this is the degree of linkage between the two overall markets. While US–China exchange rates matter to the US market, the relationship is not nearly as important as exchange rates between mainland China and Hong Kong are to the Hong Kong market. As a result, the relative price-earnings ratio of the two markets is more highly correlated with exchange rates. Otherwise, the results, both with and without allowance for fixed effects, are very similar to those of Table 3. All variables are significant at the 5% level or better except for market capitalization. Unlike, the ADR regressions, the market sentiment measure remains statistically significant in the full model specification incorporating market capitalization and dividends.

The economic significance of the sentiment measures relative to the exchange rate variable, as well as their statistical significance, is much stronger for the H-share discount than for the ADR discount. The coefficient on the exchange rate variable in the full specification for the H-share discount (Table 4 column (5)) is −2.816. A one standard deviation change in the expected exchange rate change (0.0396) would change the discount by 0.1151. The overall market sentiment variable has a statistically significant coefficient, whose value implies that a one standard deviation movement in this variable alone would change the discount by 0.1170. In addition, a one standard deviation (0.2478) change in the relative company sentiment measure would change the H-share discount by 0.0936 given the coefficient of −0.378. The independent impact of each of the sentiment measures is of broadly similar magnitude to that of the suggested exchange rate effects, therefore. This implies that the combined impact of both sentiment measures, pushing in the same direction, would easily outweigh the impact of expected exchange rate changes. Indeed, a one standard deviation decrease in both the relative market P/E ratio and ratio of the log of the company to market P/E ratio would lower the H-share discount from −0.5961 to −0.3855.

[19] In addition to considering the effects of allowing for fixed effects by company, every model estimated in this paper has the standard errors clustered by company. These clustered standard errors control for correlation in the residuals for a given firm across time periods. Our results may still be subject to a time effect given that the residuals of a particular time period may be correlated across different firms. The use of explanatory variables (i.e., expected change in exchange rate and market sentiment measures) that are constant across all firms on the same date precludes us from clustering standard error by both company and date simultaneously or from controlling for company and time fixed effects. Nevertheless, we have examined the effects of re-estimating all of the models with only White-corrected standard errors, and with standard errors clustered by time period, in addition to the reported results with standard errors clustered by company. When clustered by time period, the standard errors are not much larger than the basic White-corrected standard errors, suggesting that the time effect is relatively small. When clustered by company, however, the standard errors are much larger than the White-corrected standard errors, suggesting that the company effects are of more importance. For this reason, we focus on standard errors clustered by company.

Table 4
Relationship between the Hong Kong discounts, exchange rates and market sentiment

	Dependent variable: H-share discount									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Expected exchange	−5.326*	−2.344*	−5.208*	−2.170*	−2.816*	−4.468*	−2.285*	−4.991*	−2.167*	−2.508*
Rate change	(0.478)	(0.455)	(0.415)	(0.475)	(0.459)	(0.452)	(0.482)	(0.476)	(0.458)	(0.438)
Market sentiment		−0.108*		−0.101*	−0.083*		−0.098*		−0.098*	−0.087*
		(0.011)		(0.009)	(0.009)		(0.011)		(0.010)	(0.009)
Company sentiment			−0.421*	−0.465*	−0.378*			−0.271*	−0.249*	−0.242*
			(0.053)	(0.051)	(0.062)			(0.061)	(0.058)	(0.053)
Market cap (in billions)					0.271					0.002
					(0.160)					(0.269)
Dividend					0.006*					0.004**
					(0.002)					(0.001)
Constant	−0.625*	−0.243*	−0.170**	0.233*	0.014	−0.620*	−0.269*	−0.327*	−0.002	−0.080
	(0.024)	(0.057)	(0.062)	(0.076)	(0.101)	(0.002)	(0.036)	(0.065)	(0.075)	(0.073)
Company-specific fixed effects	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	9886	7192	8716	6990	6987	9886	7192	8716	6990	6987
R^2	0.402	0.432	0.517	0.597	0.685	0.660	0.789	0.696	0.807	0.830

We estimate the following model: H-Share discount$_{it} = \alpha_0 + \beta_1$Expected_Exchange_Rate_Change$_t + \beta_2$Market Sentiment$_t + \beta_3$Company Sentiment$_{it} + \beta_4$Market Capitalization$_{it} + \beta_5$Dividend$_{it} + \varepsilon_{it}$, where the expected exchange rate change is measured as the predicted change in exchange rates over the next 12 months as measured by the 12-month futures rate. The market sentiment measure is the ratio of the Shanghai A-Share Index P/E ratio to the Hang Seng China Enterprises Index P/E ratio at time t. The company sentiment measure is the ratio of company i's P/E ratio to the Shanghai A-Share Index P/E ratio at time t. Market capitalization is measured in local currency at time t. All models are estimated using weekly data.
Robust standard errors clustered by company are in parentheses; **significant at 5%; *significant at 1%.

Shanghai A-shares and Hong Kong H-shares both represent the same ownership stake in the same company with the same rights. However, the shares are not currently convertible from one type to the other. Meanwhile, the US ADRs represent equity ownership in shares of the underlying H-shares. The H-shares underlying the ADR shares are held in a custodial account normally managed by a US financial institution and the ADR shares can be converted into the underlying H-shares with all of the rights associated with the H-shares. The actual conversion will necessarily involve some transaction costs, however, and these costs may vary across individual ADRs. The inability to convert ADRs or H-shares into A-shares limits the profits to be made from conversion. An alternative strategy would be to take a long position in the security that has the lower value and a short position in the one that has the higher value. For most of the firms in our sample this would imply shorting the Chinese security and being long the ADRs or H-shares.[20] The problem is that China does not allow securities lending, thereby effectively preventing short sales.

In the case where the ADR or H-shares trade at a premium to the A-shares, then foreign investors who have successfully registered to trade A-shares could take long A-share positions and short equivalent ADR or H-share positions in an attempt to lock in the price spread as profit assuming the prices will converge. However, such investors still bear the risk of exchange rates movements offsetting these gains unless they incur the additional cost of hedging the exchange rate risk. Any Chinese government moves to lift investment restrictions by allowing mainland Chinese investors to purchase H-shares directly would create the possibility of similar arbitrage opportunities by local Chinese investors. It would also be interesting to see whether investors in ADRs and H-shares might use the information contained in the prices of individual A-shares to make improved trading decisions. One avenue for future research would be to examine how current A-share premiums may relate to future H-share performance in order to assess whether or not the market and company sentiment measures contain valuable information about future market movements.

4. Conclusions

The discounts attached to Chinese securities, whether trading as ADRs on the NYSE or as H-shares on the Hong Kong market, appear to have been significantly influenced by both changing exchange rate expectations and differences in investor sentiment over the 1998–2006 period. Expected exchange rate changes alone account for approximately 40% of the total variation in each case. The considerable exchange-rate related variation in the average ADR and Hong Kong discounts across time almost pales alongside the extreme variation across companies, however. Our analysis suggests that this cross-sectional variation can be at least partly explained by additional market-specific and company-specific sentiment effects. If, for example, rising local sentiment makes investors in Shanghai willing to

[20] Cheng (2007, p. C3) also points to unusually large gains enjoyed by H-shares in the run up to new follow-on listings in Shanghai, with the A-shares potentially providing a "sort of value target for the H-shares".

pay more for the same predicted earnings, or more for a specific company relative to other Chinese firms, any failure of foreign investors to follow suit implies a rise in the ADR discount. Our results show that such factors exerted significant and consistent effects on the discount attached to both NYSE and Hong Kong listings. These conclusions are generally maintained under additional allowance for market capitalization, dividend payments, and company fixed effects in our regression analysis.

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