

# **The Role of Liquidity in International Cross-Listing Effects: The Case of Chinese H and N Shares**

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*This study analyzes the role of liquidity in cross-listing and examines the causality between liquidity and price disparity for Chinese stocks traded in both Hong Kong (H shares) and New York (N shares). The advantage of analyzing the same set of stocks in two liquid markets is that it reduces effects of other confounding factors. Liquidity generally improves after listing for the H share market. The H shares have higher liquidity and lower short-term returns. Causality between price disparity and liquidity runs both ways, consistent with our expectation. The Hong Kong market is more active in response to arbitrage opportunities.*

## **INTRODUCTION**

Several studies examine the effects of international cross-listing (see for example Foerster and Karolyi, 1999 and 2000, Doidge, Karolyi, Lins, Miller and Stulz, 2009, and the review paper by Karolyi, 2006). These studies document short-term non-negative, albeit small, abnormal returns after listing in a foreign location, which compares favorably to negative returns that are typically associated with domestic seasoned offers. The results imply that there are benefits of international cross-listing, but sources of gains are not exactly clear. The literature generally views that the potential benefits include greater investor recognition, corporate governance improvements, facilitation of information collection and analysis, and enhanced liquidity, although long-run returns are on average negative and vary substantially across stocks (Foerster and Karolyi, 1999). In this paper, we focus on the role of liquidity on cross-listing effects using a set of Chinese stocks that are listed in both Hong Kong (H Shares) and New York (N Shares).

There are two major reasons why limiting the sample to these Chinese H and N shares might be useful and interesting. First, as stated above, factors affecting cross-listing decisions are many, and empirically it might be difficult to control for these factors. In the studies mentioned above, returns or accounting data of cross-listed firms are compared to those of matching firms and/or to the market in general. This matching procedure might introduce potential measurement errors in that an appropriate matching firm may be hard to identify, and this is true especially for a foreign firm whose home financial environment is quite different from the country where it is cross-listed. Gagnon and Karolyi (2010) acknowledge this being a major difficulty in examining arbitrage opportunities across countries. By analyzing a set of firms listed in two liquid markets, these complications are likely less severe and there is

no need for matching stocks. The liquidity of both the H and N share markets are high but vary considerably across firms, thus the two markets are suitable for analyzing the role of liquidity. Furthermore, the two markets are subject to few trading restrictions, which further reduce the influence of other complicating factors. For example, short selling that is essential in arbitrage is allowed and practiced in both markets (Bris, Goetzmann, and Zhu, 2004). As another example, both markets do not exercise capital control.

The second reason to look at this sample is due to sample size considerations. In recent years, Chinese firms have increasingly chosen to be listed in foreign markets, probably due to the rapid growth in economy and the relaxation of regulations. Out of these, there are a nontrivial number of Chinese firms listed in both markets. This allows an adequate sample size and fairly recent data.

Using the sample of Chinese firms listed in both Hong Kong and the U.S., we examine the role of liquidity in international cross-listing returns. We hypothesize that stocks listed in a more liquid market have lower return, since their liquidity risk is lower. Moreover, the causality between liquidity and arbitrage opportunities between the two markets is analyzed here.

The remainder of the paper is organized as follows. The next section reviews the related literature and formulates the hypotheses. Section 3 describes the data and methodology. Section 4 presents the empirical results, and section 5 offers concluding remarks.

## RELATED LITERATURE AND HYPOTHESES

Many theoretical or empirical studies show that liquidity is an important pricing factor (see, for example, Amihud and Mendelson, 1986, and Acharya and Pedersen, 2005). Our first hypothesis is based on these studies. Specifically, *Hypothesis 1* is:

*Investors in the more liquid market face lower liquidity risk, thus require lower returns.*

The U.S. market generally is considered as very liquid. However, using accounting and analyst information, Yang and Lau (2006) conclude that a Hong Kong listing on average improves the “information environment” more than that in the U.S.<sup>1</sup> They reach this conclusion because they find that investment sensitivity to cash flow is lower for Chinese firms elected to list in Hong Kong than those in the U.S. If a firm’s investments are not sensitive to cash flows, it can be interpreted as evidence that the firm is facing little financial constraint.<sup>2</sup> The improvement in information environment should encourage active trading and increase liquidity. Which market attracts greater liquidity for these Chinese stocks largely is an empirical issue. Our hypothesis is sufficiently general that it does not depend on which market attracts more liquidity. If listing does enhance information environment, it should affect liquidity and stock returns; this is an issue this study attempts to address.

Additionally, the market microstructure literature generally finds an inverse relation between liquidity and price volatility (see, for example, Stoll, 2000). Therefore, we expect that the more liquid market will have lower volatility, holding other things constant. Examining volatility might also have implications for the importance of liquidity trading or noise trading. French and Roll (1986) find that stock price volatility is much higher during trading hours than in non-trading periods. They suggest that this can be explained by either greater amount of noise trading or trading based on private information during trading periods. However, they acknowledge the difficulty in empirically separating the two. The trading hours in Hong Kong coincide with the business hours of the Chinese firms, and trading times in the U.S. and Hong Kong markets do not overlap. Therefore, information production could concentrate in the H share market because of this geographic proximity. To the extent that this argument is true, a large portion of stock price volatility in the N share market can be primarily attributed to noise trading. Stated differently, if noise trading is unimportant, the volatility of N shares is expected to be lower than that of H shares.

Our second hypothesis is related to arbitrage opportunities between the two markets. In perfect markets, the prices of the same stock in two markets should be the same, after adjusting for exchange rate. If they were not, arbitrage opportunities arise. As mentioned earlier, both markets are fairly liquid and

largely free of trading restrictions, and barriers to arbitrage are few. We expect liquidity plays a role in arbitraging. Specifically, our *Hypothesis II* is:

*The relations between liquidity and price disparity should run two ways.*

Low liquidity could result in frequent occurrence of substantial price difference, but large price disparity attracts arbitrageurs, so causality arguably runs two ways. A complication is that because trading times of the two markets do not overlap, arbitraging the price difference is not entirely riskless. Nevertheless, if a deviation from price parity is sufficiently large, some arbitrage activities should follow.

The related literature on the causality between liquidity and arbitrage opportunities is, surprisingly, few. Gagnon and Karolyi (2010) present a comprehensive study of deviations from price parity between home and cross-listed markets, although they do not examine the causality. They find that the deviations are sometimes quite substantial and the evidence is consistent with “habitat-based explanations” (Barberis and Shleifer, 2003). Numerous cross-listed stocks in many countries are examined in their study. They state that “However, the breath of our cross-sectional analysis with the complexity of rules and regulations around the world and the relatively coarse horizon of analysis preclude any definitive conclusion.” Here we are comparing two relatively liquid markets on the same set of stocks based in one home country, so potential complications arguably are less. Regarding causality between liquidity and arbitrage opportunities, to the authors’ knowledge, the only existing study is Roll, Schwartz and Subrahmanyam (2007). In that study, they examine the causality between NYSE cash/futures basis and aggregate NYSE market liquidity as measured by spreads. They find evidence of two-way Granger causality between short-term absolute basis and spreads. Therefore, they conclude that market liquidity enhances pricing efficiency.

## DATA AND METHODOLOGY

Because listing might not immediately result in high liquidity and because cross-listed Chinese companies generally have short history, our analysis focuses on the short to intermediate terms: specifically one month, three months, six months, one year, and two years.

The primary data source is Yahoo finance in both the U.S. (including both NYSE and NASDAQ) and Hong Kong, supplemented by data available from exchange and firm websites. From these sites we obtain daily open, high, low, closing prices, and trading volume for each stock. The sample of listed stocks ends in 2006. As of 2006, the number of Chinese firms listed in both markets is 33; however, of these stocks, only 22 have available post-listing data of more than two years. Table 1 gives the list of these 22 companies in the chronological order of their listing dates in the U.S. markets. The bundling ratio in the table represents the number of ADR shares equivalent to one share of the underlying stock in the home country.

To test Hypotheses I, we examine the relation between liquidity and actual returns. The U.S. dollar trading volume is used as a measure of liquidity (equals to the product of trading volume and stock price per share converted into U.S. dollars).

For Hypothesis II, the relation between pricing disparity and liquidity is examined, where pricing disparity is computed as the absolute value of (H share’s closing price – N share open price) of the same calendar date (Hong Kong close is ahead of New York open of the same calendar date by 5.5 hours during non DST) and adjusted for the exchange rate. To this end, we examine Granger (1969) causality between daily price disparity and liquidity, separately for each market. Analyzing causality separately for each market serves another purpose: it has the potential to identify which market tends to have more active traders. For instance, if the hypothesized relation holds in only one market, it suggests that traders in the other market relatively are less active.

**TABLE 1**  
**CHINESE COMPANIES' STOCKS LISTED IN BOTH HONG KONG (HKSE)**  
**AND U.S. MARKETS (NYSE AND NASDAQ) AS OF THE END OF 2006**

Firm Name	U. S. Market		Hong Kong Market		Bundling Ratio
	Ticker	Date	Ticker	Date	
Brilliance China Automotive	CBA	10/9/1992	1114.HK	10/18/1999	1/100
Sinopec Shanghai Petrochemical	SHI	7/26/1993	0338.HK	7/26/1993	1/100
Huaneng Power International Inc.	HNP	10/6/1994	0902.HK	1/20/1998	1/40
Guangshen Railway Co. Ltd.	GSH	5/13/1996	0525.HK	5/13/1996	1/50
China Eastern Airlines Co.	CEA	2/4/1997	0670.HK	2/5/1997	1/100
China Southern Airlines Co.	ZNH	7/15/1997	1055.HK	7/16/1997	1/50
China Mobile(HK) Ltd.	CHL	10/22/1997	0941.HK	10/23/1997	1/5
Yangzhou Coal Mining Co.	YZC	3/31/1998	1171.HK	4/1/1998	1/50
HSBC Holdings. Plc.	HBC	7/16/1999	0005.HK	3/21/1997	1/5
City Telecom HK	CTEL	11/3/1999	1137.HK	6/6/1997	1/20
Petro China Company Ltd.	PTR	4/6/2000	0857.HK	4/7/2000	1/100
China Unicom	CHU	6/23/2000	0762.HK	6/22/2000	1/10
China Petroleum & Chemical Co.	SNP	10/19/2000	0386.HK	10/19/2000	1/100
China National Offshore Oil	CEO	2/27/2001	0883.HK	2/28/2001	1/100
Aluminum Corp. of China Ltd.	ACH	12/11/2001	2600.HK	12/12/2001	1/25
China Telecom Corporation Ltd.	CHA	12/13/2002	0728.HK	11/15/2002	1/100
China Life Insurance Co.	LFC	12/17/2003	2628.HK	12/18/2003	1/40
Tom Online Inc.	TOMO	3/11/2004	8282.HK	3/11/2004	1/80
Semiconductor Manu. Int'l	SMI	3/17/2004	0981.HK	3/18/2004	1/50
China Netcom	CN	11/16/2004	8071.HK	11/17/2004	1/20
Air China Ltd.	AICAF.PK	7/11/2006	0753.HK	12/15/2004	1/20
Angang Steel Co Ltd.	ANGGY.PK	11/28/2006	0347.HK	7/24/1997	1/40

## EMPIRICAL RESULTS

### Testing Hypothesis I: The Relations Between Liquidity and Returns

The summary statistics of variables used in this study are shown in Table 2. The return is computed as  $(S_t - S_{t-1})/S_{t-1}$ , where  $S_t$  is the stock price adjusted for dividends at day  $t$ . The U. S. dollar trading volume is adjusted for stock split, exchange rate and the bundling ratio of ADRs to the underlying stock. Table 2 shows that the market with greater liquidity in terms of dollar trading volume is the H market, which we interpret as evidence consistent with Yang and Lau (2006)'s conclusion that information production is greater in Hong Kong for these cross-listed stocks. The arithmetic average daily raw return is lower in the H share market than the N shares. This is consistent with Hypothesis I that returns are expected to be lower for a more liquid market, and the difference in returns is statistically significant based on the t test and the sign-rank test. However, using market-adjusted returns (a stock return – respective market return), Hong Kong has on average greater return though significant so only for median returns. Therefore, the initial evidence regarding the hypothesis is inconclusive. Nevertheless, it should be noted that most studies examining the relation between returns and liquidity employ buy-and-hold returns that are probably more relevant for long-term traders. Hence a following analysis utilizes buy-and-hold returns (instead of daily average returns here).

**TABLE 2**  
**SUMMARY STATISTICS**

This table presents the mean, median, and standard deviation of variables used in the study. It compares 22 Chinese stocks traded in both Hong Kong (H) and U.S. (N) markets during the two-year period after listing. These variables include daily returns, daily returns adjusted by the respective market return (H share return-Hong Kong market return and N share return-U.S. market return), liquidity measure (daily volume in U.S. dollars) and the price disparity (the absolute difference between H share's stock price and N share's stock price). The symbols \*\*\*, \*\*, and \* indicate the significance of the difference in means (t test) or medians (sign-rank test) between the two markets at the 1%, 5%, and 10% levels, respectively.

		<b>Mean</b>	<b>Median</b>	<b>Std Dev</b>
Raw Return (in %)	N	0.129	0.000	2.814
	H	0.005	0.000	2.488
	H-N	-0.125*	-0.003**	
Market-Adjusted Return (in %)	N	0.066	-0.045	2.838
	H	0.075	0.061	2.702
	H-N	0.009	0.064*	
Trading Volume (in billions of US\$)	N	0.005	0.001	0.010
	H	1.224	0.365	2.647
	H-N	1.219***	0.363	
Price Disparity (in US\$)	H-N	5.304	1.075	9.198

Regarding the relation between liquidity and volatility, the evidence indicates a negative relation between volatility and our measure of liquidity. Measured by either the standard deviation of raw returns or market-adjusted returns, H share market is associated with lower volatility. It is consistent with prior literature that documents a negative relation between volatility and liquidity. If the H market is more informative (Yang and Lau, 2006), the high volatility in the N share market implies that the level of noise trading is high in the N share market. The absolute price disparity has a median value of roughly \$1. Compared to the median stock price of about \$20 (not shown in the table), the price disparity seems sufficiently large to attract arbitrageurs, at least for those enjoying low trading costs.

Table 3 compares buy-and-hold returns (BHR) and liquidity in the two markets over various time lengths. The notable results are as follows. First, returns vary substantially across holding periods and across markets. Short-term returns, especially after adjusting for market returns, tend to be low, in agreement with the conclusion of most literature on cross-listings that the valuation effects of these listing are small.

**TABLE 3**  
**COMPARISON OF BUY-AND-HOLD (BHR) RETURNS AND LIQUIDITY**

This table compares the H and N share markets in terms of raw and market-adjusted buy-and-hold returns (BHRs) and liquidity (measured by U.S. dollar trading volume). It shows the 1-month, 3-month, 6-month, 1-year and 2-year BHR returns and liquidity of both H and N share markets after cross-listing. The symbols \*\*\*, \*\*, and \* indicate the significance of the difference in means (t test) or medians (sign-rank test) between the two markets at the 1%, 5%, and 10% levels, respectively.

Period	N	Mkt	Raw Return (in %)			Market-Adjusted BHR (in %)			Trading Volume (in \$billions)		
			Mean	Median	Std Dev	Mean	Median	Std Dev	Mean	Median	Std Dev
1-Month	2 2	N	2.779	1.007	8.158	0.289	0.240	1.396	0.004	0.003	0.006
	2 2	H	1.036	-1.148	9.521	-0.000	0.047	2.058	1.004	0.278	1.621
	2 2	H-N	-1.744*	-1.505***		-0.300	-0.284		1.000***	0.274***	
3-Month	2 2	N	5.207	-2.664	31.18 0	1.574	0.577	3.646	0.004	0.002	0.008
	2 2	H	0.872	-2.911	9.521	-0.338	-0.308	1.530	1.109	0.398	1.772
	2 2	H-N	-4.335	-0.178***		-1.912**	-0.662***		1.105***	0.395	
6-Month	2 2	N	21.964	15.120	47.62 6	0.456	0.654	0.763	0.003	0.001	0.006
	2 2	H	23.066	11.902	51.69 2	0.011	0.083	1.535	1.776	0.447	2.925
	2 2	H-N	1.103	-1.304***		-0.446	-0.330***		1.772***	0.445	
1-Year	2 2	N	29.825	21.238	61.02 7	0.408	0.320	1.353	0.005	0.002	0.009
	2 2	H	23.389	9.184	61.82 1	0.275	0.278	1.429	1.048	0.326	1.518
	2 2	H-N	-6.437	-2.248		-0.133	-0.074***		1.043***	0.324	
2-Year	2 2	N	73.660	40.941	142.9 88	-1.213	-0.053	7.106	0.011	0.002	0.018
	2 2	H	81.254	53.310	114.3 56	2.161	2.161	3.061	1.574	0.354	2.627
	2 2	H-N	7.594	0.246**		3.374*	2.339		1.563**	0.337	

Second, trading volume tends to increase during the first 6 months after listing in the H share market, but for the N market trading volume does not increase until the longer term. These results suggest that listing generally attracts liquidity and visibility, but it does not occur in a uniform fashion for all markets. Third and most importantly for this study, for 1-month and 3-month returns, N share returns are greater than those of H shares, consistent with the existence of a liquidity premium. However, in the longer terms the evidence regarding return difference between the two markets lacks a systematic pattern. A regression analysis that controls for price volatility should provide a clearer picture concerning the relation between liquidity and returns. Table 4 presents the results of this regression analysis, where the dependent variable is the ratio of the two markets' returns (measured by either raw BHR return or market-adjusted BHR return), and the explanatory variables are the ratios of the two markets' liquidity and volatility. To check for the robustness of results, the same regression is performed for various time intervals. As shown in the table, the results here are also less than robust in terms of holding periods, but are consistent with those in Table 3. Specifically, for 1-month and 3-month holding periods, the relation between liquidity and return is significantly negative, regardless whether raw return or market-adjusted return is used. This is consistent with our hypothesis. Again, the evidence in the long term is mixed. A potential explanation for this finding may be the tendency for asset prices to experience reversal in the long term. In addition, Foerster and Karolyi (1999) find long-run returns for cross-listed issues vary substantially across stocks.

**TABLE 4**  
**REGRESSION OF RETURN RATIO (H/N) OF THE TWO MARKETS ON LIQUIDITY RATIO AND VARIANCE RATIO**

This table presents the estimated regression coefficients and p values (in parentheses). The notations \*\*\*, \*\* and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable	Period	N	Intercept	Coefficients		Adj R <sup>2</sup>
				H Liq / N Liq	H SD / N SD	
Raw Return H/N	1-Month	22	-3.796 (0.284)	-0.000** (0.004)	0.024* (0.097)	0.145
	3- Month	22	4.694 (0.485)	-0.000* (0.085)	0.119 (0.482)	0.056
	6- Month	22	0.834 (0.296)	-0.000 (0.154)	-0.031 (0.253)	0.023
	1-Year	22	0.436 (0.306)	-0.000* (0.067)	0.164* (0.083)	0.062
	2-Year	22	0.388 (0.644)	0.000 (0.176)	-0.147 (0.702)	0.047
Market-Adjusted Return H/N	1-Month	22	0.008 (0.151)	-0.001** (0.011)	0.001 (0.201)	0.008
	3- Month	22	-0.371 (0.172)	-0.000*** (0.000)	0.035** (0.037)	0.229
	6- Month	22	-1.949 (0.844)	-0.000 (0.821)	0.129* (0.084)	0.098
	1-Year	22	2.178 (0.518)	-0.001*** (0.002)	0.246** (0.042)	0.037
	2-Year	22	-2.508 (0.596)	0.001 (0.159)	0.329 (0.883)	0.143

## Testing Hypotheses II: Causality of Price Disparity and Liquidity

We proceed to examine lead-lag relations between price disparity and liquidity. Based on the vector auto-regressive model, for each stock, a causality test is performed between two of the following: N share trading volume, H share trading volume, and absolute price disparity. For the sake of brevity, Table 5 displays only the relations that are found to be significant and their p values. As the table shows, there is evidence that trading of the two markets affect each other and that causality between trading and price disparity runs both ways, although the results are not overwhelming. As the summary at the bottom indicates, there are more cases where price disparity causes trading in H shares than it causes trading in the N share market. This suggests that Hong Kong investors are relatively more active in terms of the

**TABLE 5**  
**GRANGER-CAUSALITY AMONG H SHARE VOLUME, N SHARE VOLUME,**  
**AND PRICE DISPARITY**

<b>Reject the null hypotheses:</b>			
<b>independent variable(s) does not "Granger cause" the dependent variable.</b>			
<b>Ticker</b>	<b>Ind. Var.</b>	<b>Dep. Var.</b>	<b>p value</b>
CBA/1114	N share volume & Price Disparity	H share volume	0.000
"	H share volume	Price Disparity	0.087
SHI/0338	Price Disparity	H share volume	0.005
"	N share volume	Price Disparity	0.002
HNP/0902	H share volume	N share volume	0.003
GSH/0525	N share volume & Price Disparity	H share volume	0.000
CEA/0670	N share volume	H share volume	0.000
ZNH/1055	H share volume	N share volume	0.002
CHL/0941	Price Disparity	H share volume	0.002
YZC/1171	N share & H share volume	Price Disparity	0.000
HBC/0005	Price Disparity	H share volume	0.001
"	H share volume & Price Disparity	N share volume	0.001
CTEL/1137	H share volume	Price Disparity	0.000
PTR/0857	H share volume	N share volume	0.005
CHU/0762	N share volume & Price Disparity	H share volume	0.000
"	Price Disparity	N share volume	0.001
SNP/0386	H share volume	N share volume	0.009
CEO/0883	Price Disparity	H share volume	0.002
ACH/2600	H share volume	Price Disparity	0.015
CHA/0728	N share volume & Price Disparity	H share volume	0.001
LFC/2628	N share & H share volume	Price Disparity	0.041
"	H share volume & Price Disparity	N share volume	0.000
"	N share volume & Price Disparity	H share volume	0.002
TOMO/8282	H share volume	Price Disparity	0.014
SMI/0981	N share & H share volume	Price Disparity	0.002
"	N share volume & Price Disparity	H share volume	0.001
CN/8071	H share volume	Price Disparity	0.000
AIC/0753	H share volume	N share volume	0.002
ANGGY/0347	H share volume	N share volume	0.000



## SUMMARY

Cause	Effect	The Number of Significant Cases
Price Disparity	H share volume	10
H share volume	N share volume	8
H share volume	Price Disparity	8
N share volume	H share volume	7
N share volume	Price Disparity	4
Price Disparity	N share volume	3

response to arbitrage opportunities. However, trading in Hong Kong often causes price disparity, implying that the H market might sometimes overreact to disparity. The less active response of N share investors seems to reinforce the previous conjecture that the N share market is not the main market for information production. Nevertheless, both markets influence each other; that is, trading of H shares affects that of N shares and vice versa.

## CONCLUSION

In this paper, we present an analysis of the role of liquidity in cross-listing effects and examine the causality between liquidity and price disparity in the market for Chinese H and N shares. The primary results are the following. Liquidity generally improves over time, suggesting that one of the benefits of cross-listing is improved liquidity. However, liquidity improvement comes slower in the N share market. The H share market has higher liquidity and lower short-term returns compared to the N share market, although the results are not robust in longer time intervals. A regression analysis confirms a negative relation between returns and liquidity in the short term. We conclude that the results are partially consistent with the existence of a liquidity premium. Stated differently, expected returns are lower in the more liquid market, which in this case is the Hong Kong market. Regarding volatility, the results indicate that the N share market exhibits slightly higher volatility than that of H shares, which implies considerable noise trading in the N share market if the market is not more informative. Granger Causality tests finds evidence that the causality between price disparity and liquidity runs both ways, consistent with our expectation that liquidity plays a role in price discovery. Moreover, evidence suggests that the Hong Kong market is relatively more active in response to arbitrage opportunities.

## ENDNOTES

1. Other literature suggests that the location of listing matters. For example, Miller (1999) finds stock price reactions depend on listing location and Lang, Lins, and Miller (2003) find evidence that a listing in the U.S. on average enjoys more analyst coverage than in other markets. Henderson, Jegadeesh, and Weisbach (2006) examine factors influencing international financing alternatives and locations.

2. The approach is first used by Fazzari, Hubbard and Petersen (1988). Xu and Fung (2002) examine the information transmission between H and N shares; they find evidence implying that the H market plays a bigger role in information transmission whereas the N market appears to induce bigger effects on volatility transmission.

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