INTERNATIONAL JOURNAL OF BUSINESS, 6(2), 2001 ISSN:1083-4346

Short-term Dynamic Transmission and Long-term Foreign Share Discount: Evidence from the Chinese Stock Markets

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ABSTRACT

This study concerns the information transmission between Chinese A and B share classes, and the discount effect of B shares. We first examine the short-run dynamic transmission of information flow between A and B shares using a bivariate GARCH framework that jointly models the first and second moment of stock returns from both share classes. We find that there are significant positive return transmissions and volatility spillovers across Chinese A and B shares, and that the information flow transmissions from B to A shares are stronger than the transmissions from A to B shares. However, empirical results show that cross-market volatility spillover effects are still much weaker than the A B share own-market volatility spillover effects, suggesting that A and B share prices may be driven by different underlying forces. We then formulate an empirical model to investigate the financial determinants of long-term foreign B share price discount. Our results show a significant negative relationship between B share percentage price discount and company annual earnings, suggesting that foreign investors tend to react more strongly to weakness in the listed company's ability to generate earnings. Company ownership structure and capital structure are also found to have significant relationship with the B share price discount.

JEL: G12, G14, G15

Keywords: Information Transmission; Bivariate GARCH; Earnings; Chinese Stock Market; Market Segmentation

I. INTRODUCTION

As part of its continuing efforts to develop a socialist market economy, China opened the Shanghai Stock Exchange (SHSE) in December 1990 and the Shenzhen Stock Exchange (SZSE) in July 1991. Both exchanges operate in a continuous auction environment with computerized matching system, and stocks are prohibited from cross listing on both exchanges. Upon approval by the State, Chinese companies can issue two types of shares at SHSE or SZSE to raise equity capital: "A" shares are owned and traded by Chinese domestic investors, and "B" shares are owned and traded by foreign investors in US dollars at SHSE or HK dollars at SZSE[1]. Serious market fragmentation is a distinct feature of the emerging Chinese equity market, although in principle, creating a hierarchy of share classes goes against the equality of ownership within a corporation.

In recent years, the segmentation of the Chinese stock markets has attracted a great deal of research interests from financial economists. Most of the research effort so far has focused on the linkage and interactions of A and B share markets in terms of the conditional first moment of the distribution of returns. For example, Chui and Kwok (1998) applied a Simultaneous Equation framework to examine the mean transmission between A and B share returns, and found that first moment return transmissions exist from B share to A share and, to a lesser extent, from A share to B share. These studies ignored, however, the heterogeneity of security returns and the cross-market spillover of A and B share return volatilities (second moment transmission).

From a market microstructure perspective, price movement depends on the arrival of new information and the process that incorporates this information into market prices[2]. During the trading period, informed traders may arrive at each market with private information regarding the value of financial assets. The arrival of new private information thus induces a sequence of trades that reveal the pricing implication of the latent information. Therefore, the information content of price is reflected in both the first and the second conditional moments of stock returns (conditional mean and conditional variance). In this study, we examine the short-run dynamic information transmission between the Chinese A and B share markets using a Bivariate Generalized Autoregressive Conditional Heteroskedasticity (GARCH) framework, which simultaneously models the return transmission and volatility spillover across the two markets.

Multivariate GARCH models allow for interaction effects within the conditional mean and conditional variance of two or more time series. Theodossiou and Lee (1993), Karolyi (1995), and Kearney and Patton (2000), among others, use the Multivariare GARCH model to study the return and volatility spillover across equity markets and currency markets. These studies provide valuable insight into the mechanism through which stock market movements are transmitted across various markets. By applying the Multivariate GARCH to the Chinese A and B share markets, we explicitly model

the return and volatility interactions between these two markets in an integrated framework. This allows us to gain a better understanding of the dynamic information transmission and price discovery mechanism between the Chinese A and B share markets. It also has important implications for pricing, for evaluating trading strategies, and for formulating regulatory policies in the Chinese A and B share markets. We find that there are significantly positive return (first moment) and volatility (second moment) interactions between A and B shares, and that the mean and variance spillovers from B to A shares are stronger than that from A to B shares. On the other hand, empirical results show that A B share cross-market volatility spillover effects are still much weaker than the A B share own-market volatility spillover effects, suggesting that A and B share prices may be driven by different underlying forces. This is also consistent with Fung, Lee and Leung (2000), who used a latent variable asset pricing model to show that A and B share markets are segmented.

In principle, shares issued by the same company should have the same rights, same dividends and same valuations. Investors should require the same return on these shares and hence, price these shares at the same level. However, Chinese B shares are traded at deep discount to A shares issued by the same company. One obvious factor that might have contributed to the foreign share discount is ownership restrictions: A shares can only be traded among domestic investors while B shares can only be traded among foreign investors. These ownership restrictions lead to different supply and demand equilibrium for Chinese A and B shares. Su (1999) developed and tested a one-period Capital Asset Pricing Model (CAPM) with ownership restrictions to explain the excess return between A and B shares. He demonstrated that the difference between A and B share returns is related to difference between A and B share betas (systematic market risk) resulted from market segmentation.

While A share investors (Chinese domestic residents) are likely to be more sensitive to government interventions and policy factors, B share investors (foreign investors) may be more sensitive to the listed company's fundamental financial strength. We hypothesize that the degree of B share price discount may be negatively related to the listed company's financial strength. Our results show a significant negative relationship between B share percentage price discount and company earnings, suggesting that foreign investors tend to react more strongly to weakness in the listed company's ability to generate earnings. This observed significant negative relationship between earnings and B share percentage price discount may be explained by difference in accounting standards, difference in perception of Chinese stock markets' political and policy risks, and the resulted difference in sensitivity to company's current ability to generate earnings. Our empirical results further indicate that capital structure and ownership structure have explanatory power for the percentage B share discount even after considering the earnings effect. Higher financial leverage, lower State ownership, and lower percentage of outstanding shares in B shares, are associated with lower B share percentage price discount. The ownership structure has significant impact on corporate

controls and managerial decisions, and hence affects B share percentage price discount. Dividend payout ratio and B share relative liquidity ratio, however, do not have significant relationship with the B share percentage price discount.

The remainder of this paper is organized as follows. In Section 2, we discuss the data and describe our sample. In Section 3, we describe the bivariate GARCH methodology and present the estimation results for the short-term dynamic return transmission and volatility between the Chinese A and B share markets. Following this, we formulate and estimate an empirical model that examines the relationship between long-term foreign share discount and the listed company's fundamental financial strength in Section 4. Finally, we summarize our findings in Section 5.

II. DATA

For Chinese A and B shares, daily time series of price and volume are obtained from the Great China database created by TEJ. Company profiles, annual earnings, dividends, and capital changes are also obtained from the Great China database. Our sample period starts from January 1994 to May 1999. As of May 1999, there are more than 900 companies listed on SHSE and SZSE, and 80 of them issued both A shares and B shares. Among these 80 Chinese A and B share pairs, only 30 pairs were issued before the end of 1993. Our sample includes these 30 companies that have listed their A and B shares before the start of 1994 and have complete price and volume time series from January 1994 to May 1999.

Table 1 lists the profile and share structure of the thirty companies included in our sample. The established date in Table 1 indicates the date when the enterprise was first founded. The reorganized date refers to the date that the Chinese government allowed the State-owned enterprise to reorganize as a corporate limited company, and the listing date is the date that its stocks are first offered at the SHSE or SZSE. The purpose of converting State-owned enterprises to stock holding companies is to enhance the allocation efficiency of domestic capital, to attract foreign investments, and to improve the operational efficiency of State assets. In the Chinese shareholding system, there are capital contributions by the state or State-owned legal entities (State-owned shares), by the public (public shares) and by foreign investors (foreign shares). Table 1 also presents the share structure (as of December 1998) of companies included in the sample. On average, 53% of the company shares are state shares, 16% are public shares and 31% are foreign shares. The Chinese socialist shareholding system preserves predominant state public ownership through this unique share structure.

A shares are domestically listed Chinese shares including State-owned and public shares, while B shares are domestically listed foreign shares. State-owned A shares[3] are precluded from trading in stock exchanges and hence, only B shares and public A shares are outstanding in the market.

Table 2 describes the A and B share structure (as of December 1998), and daily average returns and share turnover ratios (from Jan 1994 to May 1999). The share turnover ratio is computed as daily trading volume in shares over the company's outstanding shares. During the sample period, the cross-sectional mean of daily return is 0.056% for A shares, and –0.024% for B shares. The liquidity of B shares is also significantly lower than that of A shares – the cross-sectional mean B share liquidity ratio is 89% below the A share liquidity ratio. On average, A shares have no trade in only 0.61% of the trading days, but the B share daily no-trade frequency is as high as 21%. Due to ownership restriction and other institutional and market differences, the A and B share classes seem to be quite heterogeneous in their pricing and liquidity. In the next two sessions, we examine the quality and quantity of the short-term information transmission across the two share classes, and formulate an empirical model to investigate the financial determinants of long-term foreign share price discount.

III. SHORT-RUN DYNAMICS OF RETURN TRANSMISSION AND VOLATILITY SPILLOVER

To capture the dynamic behavior of cross-market information transmission between Chinese A and B shares, we carry out the analysis using a Bivariate Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model for the sample period from January 1994 to May 1999. The ARCH (Autoregressive Conditional Heteroskedasticity) model by Engle (1982) imposed an autoregressive process on the conditional variance of a time series. Bollerslev (1986) further developed the GARCH (Generalized Autoregressive Conditional Heteroskedasticity) model by allowing the conditional variance to depend upon past squared residual of the process. In a GARCH (1,1), the autoregressive component captures the persistence in conditional variance of return, while the past squared residual component captures the information shocks to stock return. The GARCH model was subsequently extended to a multivariate framework. Numerous parameterizations of the conditional variance-covariance matrix H_t exist (see Engle and Kroner (1995)), including the Diagonal vector parameterization by Bollerslev, Engle and Woodridge (1988) and the BEKK parametrization by Baba, Engle, Kraft and Kroner (1990). The BEKK process is preferred because it guarantees by construction a positive definite conditional variance-covariance H_t matrix (see Engle and Kroner (1995) and Karolyi (1995)).

Table 1: Company profile and share structure

ID	Company Name	A Share Code	B share Code	Stock Exchange[1]	Established date	Reorganized date[2]	Listing date	State Shares %[3]	Public Shares %[4]	Offshore Shares %[5]	Total Shares (millions)[6]	Company MV in RMB (millions)[7]
1	China Bicycle	0017	2017	SZSE	8/24/84	1/1/91	3/31/92	23.28	16.01	60.71	479.43	897.83
2	China Textile Mach	600610	900906	SHSE	1/1/20	5/5/92	8/5/92	59.16	7.21	33.64	357.09	1,615.15
3	Chiwan Wharf Holdings	0022	2022	SZSE	9/1/82	.	5/5/93	58.84	13.26	27.90	381.52	2,044.33
4	Chlor Alkali	600618	900908	SHSE	1/1/60	5/6/92	11/13/92	62.69	2.39	34.91	1,058.62	8,603.00
5	Dajiang (Group)	600695	900919	SHSE	8/10/85	7/27/93	11/22/93	87.31	3.81	8.88	676.31	5,200.43
6	Dazhong Taxi	600611	900903	SHSE	12/1/88	5/1/92	8/7/92	28.35	25.12	46.53	435.85	3,583.07
7	Erfangji	600604	900902	SHSE	1/1/23	12/10/91	3/27/92	46.93	12.42	40.64	573.12	2,364.01
8	First Pencil	600612	900905	SHSE	1/1/35	4/28/92	8/14/92	40.77	11.55	47.68	193.68	1,764.37
9	Fiyta	0026	2026	SZSE	10/1/87	2/1/92	6/3/93	52.24	24.37	23.39	249.32	1,706.84
10	Gintian Industry	0003	2003	SZSE	1/1/84	2/8/88	1/14/91	20.15	57.59	22.26	333.43	1,175.08
11	Health Mineral Eater	0028	2028	SZSE	1/1/83	4/30/92	8/9/93	61.90	19.05	19.05	160.08	1,441.61
12	Huafa Electronics	0020	2020	SZSE	1/1/81	12/3/91	4/28/92	44.12	19.86	36.02	283.16	1,352.89
13	Jin Jiang Tower	600650	900914	SHSE	8/1/84	6/2/92	6/7/93	63.22	7.58	29.20	417.89	2,407.90
14	Jinqiao	600639	900911	SHSE	9/11/90	4/27/92	3/26/93	53.91	16.79	29.30	634.40	4,927.25
15	Konka Group	0016	2016	SZSE	12/1/79	7/31/91	3/27/92	34.04	26.50	39.46	389.38	5,547.25
16	Lianhua Fibre	600617	900913	SHSE	10/1/84	4/30/92	10/13/92	73.09	5.38	21.53	167.20	1,894.50
17	Lionda	0030	2030	SZSE	2/18/84	6/7/93	9/29/93	72.31	13.96	13.73	288.42	1,221.38
18	Lizhu Pharmaceutical	0513	2513	SZSE	1/1/85	3/1/92	10/28/93	22.24	37.80	39.97	306.04	1,295.20
19	Merchants Shekou	0024	2024	SZSE	1/1/79	1/27/93	6/7/93	39.58	12.86	47.56	360.36	2,490.90
20	Phoenix	600679	900916	SHSE	1/1/58	7/29/93	10/8/93	65.88	5.69	28.43	464.32	2,976.26
21	Refrige Compressor	600619	900910	SHSE	1/1/57	5/5/92	11/16/92	52.75	4.80	42.45	422.58	2,160.69
22	Rubber Belt	600614	900907	SHSE	.	4/30/92	8/28/92	56.49	7.25	36.26	115.13	878.32
23	Sanmao Textile	600689	900922	SHSE	7/1/33	7/29/93	11/8/93	41.63	34.10	24.27	149.55	871.32
24	Shenbao Industrial	0019	2019	SZSE	1/1/74	00/01/91	10/12/92	65.89	18.43	15.68	166.71	1,222.39
25	Shenzhen Petrochemical	0013	2013	SZSE	12/5/90	11/12/91	5/6/92	72.28	16.92	10.80	303.36	1,768.43
26	Shenzhen Properties	0011	2011	SZSE	11/1/82	10/27/91	3/30/92	71.78	16.87	11.34	541.80	3,899.69
27	Tyre & Rubber	600623	900909	SHSE	6/19/90	5/5/92	12/4/92	70.09	2.57	27.33	889.47	6,740.23
28	Vacuum Electron	600602	900901	SHSE	.	12/25/86	12/19/90	45.76	24.16	30.07	637.31	5,702.21
29	Victor Onward Textile	0018	2018	SZSE	1/1/81	11/2/91	6/16/92	46.99	11.96	41.04	169.14	1,621.76
30	Wai Gaoqiao	600648	900912	SHSE	9/11/90	5/19/92	5/4/93	65.78	7.31	26.92	615.75	6,785.55
Mean	Shanghai Stock Exchange Sample (16 Companies)							57.11	11.13	31.75	488.02	2,907.84
	Shenzhen Stock Exchange Sample (14 Companies)							48.97	21.82	29.21	315.15	2,831.02
	Full Sample (30 Companies)							53.32	16.12	30.57	407.35	2,871.99

[1] Stock Exchange –This column indicates the exchange in which company's A and B shares are listed. SHSE refers to Shanghai Stock Exchange, while SZSE refers to Shenzhen Stock Exchange.
[2] Reorganized date – Before the reorganized date, the organization belonged to the State. The reorganized date is the date that the Chinese government allowed the organization to reorganize as a corporate limited company.
[3] State Share % – It is the percentage of shares held by the State and State-owned Legal Persons by the end of 1998.
[4] Public Share % – It is the percentage of shares held by the Public by the end of 1998.
[5] Offshore Share % -- It is the percentage of shares held by foreign investors by the end of 1998.
[6] It is the total shares of the company, which is sum of the State, Public and Offshore Shares.
[7] Company's Total Equity Market Value in Million RMBs by the end of 1998.

Table 2: Daily A and B share return and trading frequency
Sample period: Jan 1994 – May 1999

ID	Company Name	Stock Exchange	A Share %[1]	B Share %[2]	A Share Daily Return %[3]	B Share Daily Return %[4]	Daily A Share Turnover Ratio (%)[5]	Daily B Share Turnover Ratio (%)[6]	A Share No- trade frequency (%)[7]	B Share No- trade frequency (%)[8]
1	China Bicycle	SZSE	39.3	60.7	0.001	-0.155	2.41	0.19	0.38	15.63
2	China Textile Mach	SHSE	66.4	33.6	0.087	-0.050	3.34	0.24	0.53	20.53
3	Chiwan Wharf Holdings	SZSE	72.1	27.9	0.052	-0.069	1.90	0.23	0.30	18.83
4	Chlor Alkali	SHSE	65.1	34.9	0.083	-0.055	2.43	0.19	0.38	2.87
5	Dajiang (Group)	SHSE	91.1	8.9	0.057	-0.086	2.64	0.37	0.45	29.28
6	Dazhong Taxi	SHSE	52.4	47.6	0.060	-0.018	1.73	0.28	0.30	8.83
7	Erfangji	SHSE	58.9	41.1	0.061	-0.095	2.28	0.27	0.45	5.13
8	First Pencil	SHSE	52.3	47.7	0.066	0.032	2.42	0.33	0.68	16.13
9	Fiyta	SZSE	76.6	23.4	0.039	0.008	3.05	0.29	0.38	17.24
10	Gintian Industry	SZSE	77.7	22.3	-0.048	-0.121	1.61	0.25	0.46	21.87
11	Health Mineral Eater	SZSE	81.0	19.0	0.101	-0.028	3.30	0.47	0.61	29.54
12	Huafa Electronics	SZSE	64.0	36.0	0.083	0.193	2.78	0.07	0.53	34.62
13	Jin Jiang Tower	SHSE	70.8	29.2	0.025	-0.105	1.58	0.22	0.38	9.36
14	Jinqiao	SHSE	70.7	29.3	0.025	-0.087	2.53	0.25	0.53	1.58
15	Konka Group	SZSE	60.5	39.5	0.068	0.086	1.84	0.06	0.53	32.50
16	Lianhua Fibre	SHSE	78.5	21.5	0.078	-0.054	2.43	0.44	0.30	44.53
17	Lionda	SZSE	86.3	13.7	0.034	-0.044	2.93	0.22	0.53	37.21
18	Lizhu Pharmaceutical	SZSE	60.0	40.0	0.010	-0.032	2.11	0.33	0.23	27.18
19	Merchants Shekou	SZSE	52.4	47.6	0.069	-0.002	1.99	0.18	0.61	17.56
20	Phoenix	SHSE	71.6	28.4	0.056	-0.102	2.14	0.32	0.68	14.64
21	Refrige Compressor	SHSE	57.5	42.5	0.049	-0.029	2.36	0.39	0.53	7.02
22	Rubber Belt	SHSE	63.7	36.3	0.084	0.025	3.66	0.29	0.45	40.83
23	Sanmao Textile	SHSE	75.7	24.3	0.052	0.100	2.66	0.50	4.91	41.58
24	Shenbao Inudstrial	SZSE	84.3	15.7	0.082	0.110	2.84	0.34	0.53	30.83
25	Shenzhen Petrochemical	SZSE	89.2	10.8	0.033	-0.056	2.08	0.22	0.30	34.24
26	Shenzhen Properties	SZSE	88.7	11.3	0.029	-0.113	1.93	0.21	0.53	28.83
27	Tyre & Rubber	SHSE	72.7	27.3	0.065	-0.089	1.91	0.21	0.68	3.70
28	Vacuum Electron	SHSE	69.9	30.1	0.135	0.103	2.66	0.22	0.53	9.13
29	Victor Onward Textile	SZSE	59.0	41.0	0.129	0.081	2.86	0.11	0.23	37.36
30	Wai Gaoqiao	SHSE	73.1	26.9	0.011	-0.076	1.19	0.24	0.53	1.43
SHANGHAI STOCK EXCHANGE (SHSE) A AND B SHARES (16 COMPANIES)										
CROSS-SECTIONAL MEAN			67.3	32.7	0.062	-0.037	2.37	0.30	0.769	16.036
CROSS-SECTIONAL MEDIAN			68.5	31.5	0.061	-0.055	2.42	0.27	0.528	9.245
CROSS-SECTIONAL STDEV			12.9	12.9	0.029	0.068	0.61	0.09	1.110	14.987
SHENZHEN STOCK EXCHANGE (SZSE) A AND B SHARES (14 COMPANIES)										
CROSS-SECTIONAL MEAN			71.7	28.3	0.049	-0.010	2.40	0.23	0.439	27.388
CROSS-SECTIONAL MEDIAN			72.1	27.9	0.046	-0.030	2.26	0.22	0.494	29.184
CROSS-SECTIONAL STDEV			12.2	12.2	0.045	0.098	0.54	0.11	0.134	7.753
FULL SAMPLE (30 COMPANIES)										
CROSS-SECTIONAL MEAN			69.4	30.6	0.056	-0.024	2.39	0.26	0.615	21.334
CROSS-SECTIONAL MEDIAN			70.7	29.2	0.058	-0.047	2.41	0.25	0.528	19.679
CROSS-SECTIONAL STDEV			12.5	12.5	0.037	0.083	0.57	0.10	0.820	13.278

[1] Percentage of A shares by the end of 1998.
[2] Percentage of B shares by the end of 1998.
[3] Average Daily A Share Return based on A share daily closing prices.
[4] Average Daily B Share Return based on B share daily closing prices.
[5] Average daily A share turnover ratio, calculated as average daily A share trading volume over outstanding A shares.
[6] Average daily B share turnover ratio, calculated as average daily B share trading volume over outstanding B shares.
[7] Average Percentage of trading days with no trades for A shares
[8] Average Percentage of trading days with no trades for B shares.

In this study, the following bivariate GARCH model is posited for the joint process governing the A and B share return series using the BEKK parameterization:

$$\text{Conditional Mean Equation: } R_t = \alpha + \beta R_{t-1} + \varepsilon_t \quad (1)$$

$$\text{Conditional Variance Equation: } H_t = CC + G'H_{t-1}G + A'\varepsilon_{t-1}\varepsilon'_{t-1}A \quad (2)$$

where $R_t = [R_{A,t}, R_{B,t}]'$ is the returns of A and B shares at time t,
$R_{t-1} = [R_{A,t-1}, R_{B,t-1}]'$ is the past returns of A and B shares,
$\varepsilon_t = [\varepsilon_{A,t}, \varepsilon_{B,t}]'$ is the residual (error) term for A and B share returns at time t, and ε_t is assumed to be from a bivariate normal distribution,
H_t is the conditional variance - covariance matrix of ε_t, with the diagonal terms σ^2_A and σ^2_B being the conditional error variance of A and B share returns.

We jointly model the return transmission and volatility spillover between Chinese A and B share classes in a bivariate GARCH framework. This allows us to gain new insight into the dynamic information transmission and price discovery mechanism between the two share classes. It also has important implications for pricing, for evaluating trading strategies, and for formulating regulatory policies in the Chinese A and B share markets. Parameter estimates of the bivariate GARCH model are presented in Table 3. To minimize the bias effects induced by non-synchronous trading, we construct three equally weighted portfolios: full sample portfolio in Panel A (including all 16 SHSE AB pairs and 14 SZSE AB pairs), Shanghai Stock Exchange portfolio in Panel B (including all 16 SHSE AB pairs), and Shenzhen Stock Exchange portfolio in Panel C (including all 14 SZSE AB pairs).

For all three panels, the results for the conditional mean equations indicate significant positive return transmission from B shares to A shares, and to a lesser extent, from A shares to B shares. For the full sample presented in panel A, the return transmission coefficient from B share to A share is 0.1100, implying that positive returns in the B shares on one day cause positive returns in the A shares on the next trading day. The return transmission coefficient from A share to B share is 0.0550, implying that positive returns in the A shares on one day are followed by positive returns in the B shares. Our results imply that the mean spillover from B shares to A shares is stronger than that from A shares to B shares, which is consistent with Chui and Kwok (1998). We also find that the own-market first-moment return autoregressive coefficients are relatively insignificant and negative for the A shares, but relatively significant and positive for the B shares. This suggests that the first moment of stock return is more persistent for the B shares than for the A shares, and that the return generating dynamics for the two shares might be heterogeneous.

Empirical results from the conditional variance equations confirm the presence of significant heteroskedasticity and high volatility persistence in both

the A and B share stock returns. Significant own-volatility spillovers are present in both shares (the own volatility spillover coefficient is 0.2352 for the A shares and is 0.1665 for the B shares for the full sample presented in Panel A). In addition, there are significant cross-market volatility spillovers between A and B shares, but the cross-market volatility spillovers are much weaker than their own-market volatility spillover (the cross-market volatility spillover coefficient from B share to A share is 0.0035 and from A share to B share is 0.0004). Our results also indicate that the volatility spillovers from B to A shares are stronger than the spillovers from A to B share.

Panel B (SHSE sample) and Panel C (SZSE sample) show similar patterns to Panel A (full sample) in the dynamics of return transmission and volatility spillover between Chinese A and B shares, but the cross-market spillover effects are much stronger for the SZSE sample than for the SHSE sample. This indicates that the Shenzhen Stock Exchange A and B share markets are less segmented than the Shanghai Stock Exchange A and B share markets.

In summary, empirical results from the bivariate GARCH model provide new insight into the dynamics of information flow transmission between the Chinese A and B share classes. We find significant cross-market return transmissions (first moment interactions) and volatility spillovers (second moment interactions) between the two share classes. The first and second moment spillover parameter estimates indicate that information flow transmissions from B to A shares are stronger than the transmissions from A to B shares, which implies that B shares incorporate information (especially fundamental analysis) more quickly and more precisely than A shares, and as a result, A share investors may extract better quality information from the pricing implications of B shares. To a lesser extent, B share investors also extract information from A share prices, given that the A shares respond faster to certain news (such as Chinese government intervention policies). On the other hand, both Chinese A and B shares have strong return volatility persistence, and the own-market volatility persistence coefficients are much higher than the cross-market volatility spillover coefficients, indicating limited information transmission between the two markets.

IV. THE DETERMINANTS OF LONG TERM FOREIGN SHARE PRICE PERCENTAGE DISCOUNT

In principle, shares issued by the same company should have the same rights, same dividends and same prices. Investors should require the same return on these shares and hence, price these shares at the same level. However, Chinese A shares can only be bought by Chinese domestic investors while B shares can only be bought by foreign investors.

Table 3: Bivariate GARCH model estimates

This table provides the bivariate GARCH estimates for the Return Transmission and Volatility Spillover between the Chinese A and B share stock returns on daily data from January 1994 to May 1999 for three equally weighted portfolios (full sample, SHSE sample and SZSE sample). The specification for the bivariate GARCH model is discussed in the text.

PANEL A: FULL SAMPLE (30 COMPANIES)				
Conditional Mean Equation (Return Transmission Parameters)	**A Share Return ($R_{A,t}$)**		**B Share Return ($R_{B,t}$)**	
Independent Variables	Coefficient	t Ratio	Coefficient	t Ratio
Constant	0.0180	2.57*	-0.1230	-15.38*
Lag A Share Return ($R_{A,t-1}$)	-0.0070	-1.17	0.0550	7.86*
Lag B Share Return ($R_{B,t-1}$)	0.1100	13.75*	0.1980	24.75*
Conditional Variance Equation (Volatility Spillover Parameters)	**A Share Conditional Variance ($\sigma^2_{A,t-1}$)**		**B Share Conditional Variance ($\sigma^2_{B,t-1}$)**	
Independent Variables	Coefficient	t Ratio	Coefficient	t Ratio
Constant	1.2811	99.31*	0.5383	62.75*
Lag A Squared Residuals ($\varepsilon^2_{A,t-1}$)	0.2352	60.63*	0.0004	3.50*
Lag B Squared Residuals ($\varepsilon^2_{B,t-1}$)	0.0035	7.38*	0.1665	51.00*
Lag A Conditional Variance ($\sigma^2_{A,t-1}$)	0.6368	133.00*	0.0001	2.00*
Lag B Conditional Variance ($\sigma^2_{B,t-1}$)	0.0036	8.57*	0.7157	169.20*
PANEL B: SHANGHAI STOCK EXCHANGE A AND B SHARES (16 COMPANIES)				
Conditional Mean Equation (Return Transmission Parameters)	**A Share Return ($R_{A,t}$)**		**B Share Return ($R_{B,t}$)**	
Independent Variables	Coefficient	t Ratio	Coefficient	t Ratio
Constant	0.0010	0.17	-0.1370	-17.13*
Lag A Share Return ($R_{A,t-1}$)	-0.0030	-0.50	0.0250	3.57*
Lag B Share Return ($R_{B,t-1}$)	0.0620	7.75*	0.1560	19.50*
Conditional Variance Equation (Volatility Spillover Parameters)	**A Share Conditional Variance ($\sigma^2_{A,t-1}$)**		**B Share Conditional Variance ($\sigma^2_{B,t-1}$)**	
Independent Variables	Coefficient	t Ratio	Coefficient	T Ratio
Constant	1.1534	147.19*	0.2611	37.13*
Lag A Squared Residuals ($\varepsilon^2_{A,t-1}$)	0.1884	54.25*	0.0001	1.67**
Lag B Squared Residuals ($\varepsilon^2_{B,t-1}$)	0.0004	2.50*	0.1436	47.38*
Lag A Conditional Variance ($\sigma^2_{A,t-1}$)	0.7039	167.80*	0.0000	1.50
Lag B Conditional Variance ($\sigma^2_{B,t-1}$)	0.0014	6.33*	0.8082	224.75*
PANEL C: SHENZHEN STOCK EXCHANGE A AND B SHARES (14 COMPANIES)				
Conditional Mean Equation (Return Transmission Parameters)	**A Share Return ($R_{A,t}$)**		**B Share Return ($R_{B,t}$)**	
Independent Variables	Coefficient	t Ratio	Coefficient	t Ratio
Constant	-0.0120	-2.40*	-0.1770	-16.09*
Lag A Share Return ($R_{A,t-1}$)	-0.0290	-3.22*	0.1030	10.30*
Lag B Share Return ($R_{B,t-1}$)	0.1180	11.80*	0.1370	12.45*
Conditional Variance Equation (Volatility Spillover Parameters)	**A Share Conditional Variance ($\sigma^2_{A,t-1}$)**		**B Share Conditional Variance ($\sigma^2_{B,t-1}$)**	
Independent Variables	Coefficient	t Ratio	Coefficient	t Ratio
Constant	1.4444	62.55*	1.6068	94.14*
Lag A Squared Residuals ($\varepsilon^2_{A,t-1}$)	0.2430	49.30*	0.0005	2.20*
Lag B Squared Residuals ($\varepsilon^2_{B,t-1}$)	0.0059	7.70*	0.2034	45.10*
Lag A Conditional Variance ($\sigma^2_{A,t-1}$)	0.6724	117.14*	0.0180	12.18*
Lag B Conditional Variance ($\sigma^2_{B,t-1}$)	0.0013	3.27*	0.6448	114.71*

Note: The asterisk (*) sign indicates a significance level of five percent or better for two-tailed test whereas the sign (**) indicates a significance level of five percent or better for one-tailed test.

Table 4: Annual A and B share price, return and share turnover summary statistics by year (from 1994 to 1998) and exchange (shse and szse)[1]

			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Statistics	Year	Exchange	DIST	PRICE_A	PRICE_B	RETURN_A	RETURN_B	TURNBA	TO_A	TO_B
			(%)	(RMB)	(RMB)	(%)	(%)	(%)	(%)	(%)
Mean	1994	BOTH	54.296	8.883	3.377	-10.613	0.589	6.967	777.460	51.129
Median	1994	BOTH	64.685	6.325	3.247	-17.925	-7.025	6.787	622.694	51.582
std dev	1994	BOTH	22.870	5.813	1.479	49.221	42.193	3.428	489.710	32.148
Skewness	1994	BOTH	-0.776	1.958	1.151	1.923	1.150	0.364	1.011	0.330
Kurtosis	1994	BOTH	-0.727	4.786	2.954	4.726	2.252	0.068	0.166	-0.979
Mean	1995	BOTH	59.878	6.348	2.231	-14.900	-2.761	14.645	267.057	36.972
Median	1995	BOTH	65.847	5.765	1.917	-17.825	-8.820	11.813	276.651	31.250
std dev	1995	BOTH	18.779	3.542	1.092	22.088	41.081	12.025	124.863	27.428
Skewness	1995	BOTH	-0.844	1.484	1.596	1.396	1.173	1.883	0.406	0.707
Kurtosis	1995	BOTH	-0.047	2.187	3.559	2.554	2.374	4.872	-0.070	-0.038
Mean	1996	BOTH	59.428	9.560	3.901	99.472	82.188	11.311	838.490	74.452
Median	1996	BOTH	61.981	8.855	4.060	85.625	65.450	10.226	793.269	55.667
std dev	1996	BOTH	10.678	3.624	1.804	93.983	63.568	9.024	449.164	50.431
Skewness	1996	BOTH	-0.224	0.455	0.791	0.744	1.061	2.143	0.270	1.429
Kurtosis	1996	BOTH	-1.276	-0.673	1.578	0.138	1.048	5.861	-0.884	2.211
Mean	1997	BOTH	77.172	9.424	2.279	11.547	-28.610	11.265	642.228	56.647
Median	1997	BOTH	77.337	7.800	1.933	9.825	-36.800	8.180	618.123	54.481
std dev	1997	BOTH	7.578	4.635	1.802	37.219	28.679	9.972	247.851	25.830
Skewness	1997	BOTH	-0.423	1.845	2.451	0.838	1.509	2.481	0.134	0.466
Kurtosis	1997	BOTH	-0.073	3.469	6.488	0.519	2.883	6.816	-0.644	-0.782
Mean	1998	BOTH	87.337	8.327	1.090	2.812	-40.883	11.028	470.128	35.935
Median	1998	BOTH	89.766	7.835	0.843	1.410	-44.850	7.676	484.256	36.962
std dev	1998	BOTH	5.449	2.606	0.817	25.479	21.757	14.334	244.511	24.873
Skewness	1998	BOTH	-1.342	0.880	2.891	0.124	1.129	3.998	0.111	0.348
Kurtosis	1998	BOTH	1.866	0.292	8.696	-0.847	1.024	18.932	-0.961	-1.112
Mean	94-	SHSE	75.430	9.414	2.321	12.789	-3.059	14.170	595.891	59.232
Median	94-	SHSE	75.109	8.585	1.726	2.205	-18.895	10.620	491.469	54.712
std dev	94-	SHSE	11.465	4.372	1.618	36.551	49.531	12.493	378.955	24.504
Skewness	94-	SHSE	-0.397	1.598	1.382	1.509	1.045	2.916	1.508	0.686
Kurtosis	94-	SHSE	-0.199	4.857	1.976	3.366	0.632	10.763	2.838	-0.092
Mean	94-	SZSE	58.699	7.473	2.866	23.235	8.006	7.469	602.708	41.650
Median	94-	SZSE	63.107	6.610	2.555	-15.240	-12.555	6.022	487.971	25.762
std dev	94-	SZSE	22.176	3.989	1.834	89.626	69.561	6.166	416.370	44.073
Skewness	94-	SZSE	-0.506	2.003	1.266	1.652	1.591	2.305	0.849	2.064
Kurtosis	94-	SZSE	-0.585	5.368	2.235	2.240	2.613	8.863	-0.081	5.211
Mean	94-	BOTH	67.622	8.508	2.575	17.664	2.105	11.043	599.073	51.027
Median	94-	BOTH	70.971	7.430	2.020	-0.800	-16.190	8.224	488.842	47.361
std dev	94-	BOTH	19.172	4.295	1.738	66.750	59.768	10.564	395.518	35.990
Skewness	94-	BOTH	-1.055	1.673	1.321	2.130	1.548	3.236	1.149	1.460
Kurtosis	94-	BOTH	0.828	4.456	2.108	5.587	2.913	14.753	1.159	4.200

Notes: (1) DIST=(1-PRICE_B/PRICE_A)*100% is the percentage of B share price discount from A share price, where (2) PRICE_A is the annual closing price in RMB for A share and (3) PRICE_B is the annual closing price for B share, converted to RMB from HK dollar or US dollar using the corresponding exchange rates; (4) RETURN_A is the annual return on A share, (5) RETURN_B is the annual return on B share; (6) TURNBA=TO_B/TO_A*100% is the B share to

[1] These summary statistics are based on annual data from the thirty companies described in Table 1.

Table 5: Annual corporate earnings, dividends, share structure, and capital structure statistics by year (from 1994 to 1998) and exchange (shse and szse)[1]

Statistics	Year	Exch-ange	(1) EPS (RMB)	(2) NI(million RMBs)	(3) ROE (%)	(4) DivNI (%)	(5) DPS (RMB)	(6) Dividend Indicator	(7) T.Shares (millions)	(8) SECB (%)	(9) OUTB (%)	(10) STATE (%)	(11) DEBT (%)
Mean	1994	BOTH	0.254	104.395	14.443	23.170	0.062	0.700	319.480	30.024	68.537	56.161	41.093
Median	1994	BOTH	0.250	99.216	14.220	12.610	0.040	1.000	281.210	29.365	76.052	57.988	42.177
std dev	1994	BOTH	0.131	69.235	8.165	25.445	0.086	0.466	212.825	12.572	16.911	15.894	12.818
Skewness	1994	BOTH	0.327	0.628	0.454	1.099	2.543	-0.920	1.388	0.156	-0.593	-0.441	-0.307
Kurtosis	1994	BOTH	0.638	-0.275	0.972	0.192	7.381	-1.242	2.135	-0.084	-0.824	0.065	-0.488
Mean	1995	BOTH	0.176	73.771	9.941	35.320	0.097	0.767	333.216	30.725	68.648	54.814	40.401
Median	1995	BOTH	0.156	51.875	7.986	28.670	0.079	1.000	284.815	29.365	74.745	57.829	40.424
std dev	1995	BOTH	0.138	69.007	8.270	28.916	0.089	0.430	210.823	12.294	16.709	16.319	15.468
Skewness	1995	BOTH	1.807	1.281	1.243	0.095	0.754	-1.328	1.274	0.184	-0.786	-0.484	-0.243
Kurtosis	1995	BOTH	5.641	1.318	1.684	-1.531	-0.350	-0.257	1.711	-0.006	-0.197	-0.178	-0.735
Mean	1996	BOTH	0.163	66.664	7.466	27.786	0.077	0.633	352.458	30.786	68.108	54.308	41.144
Median	1996	BOTH	0.145	41.753	7.236	30.245	0.045	1.000	324.847	29.689	72.148	56.656	39.767
std dev	1996	BOTH	0.181	81.188	6.899	24.313	0.105	0.490	207.319	12.303	17.159	16.489	15.941
Skewness	1996	BOTH	2.161	1.747	0.461	-0.006	2.315	-0.583	1.139	0.119	-0.634	-0.475	-0.116
Kurtosis	1996	BOTH	8.308	4.345	-0.274	-1.672	6.843	-1.784	1.492	-0.106	-0.472	-0.144	-0.929
Mean	1997	BOTH	0.043	19.200	-1.448	20.625	0.054	0.400	354.224	30.999	67.871	53.819	42.562
Median	1997	BOTH	0.100	34.627	3.641	0.000	0.000	0.000	358.726	29.689	73.297	56.656	45.632
std dev	1997	BOTH	0.328	143.676	19.338	28.161	0.099	0.498	183.408	12.546	17.216	16.865	19.469
Skewness	1997	BOTH	-0.488	-0.964	-2.506	0.940	3.156	0.430	0.431	0.126	-0.596	-0.430	-0.202
Kurtosis	1997	BOTH	2.115	2.862	7.741	-0.549	12.612	-1.950	-0.255	-0.244	-0.549	-0.315	-1.150
Mean	1998	BOTH	-0.033	-12477	-23.284	20.420	0.046	0.333	377.632	30.618	66.495	53.239	47.880
Median	1998	BOTH	0.070	20.437	2.802	0.000	0.000	0.000	357.092	29.250	68.890	55.200	46.402
std dev	1998	BOTH	0.522	204.359	86.835	31.200	0.109	0.479	202.170	12.527	17.823	17.081	22.460
Skewness	1998	BOTH	-0.974	-1.035	-3.815	1.044	3.936	0.745	0.602	0.205	-0.415	-0.335	0.214
Kurtosis	1998	BOTH	3.089	3.928	15.367	-0.696	17.880	-1.554	-0.003	-0.217	-0.901	-0.486	-0.854
Mean	94-98	SHSE	0.127	64.309	6.240	26.493	0.056	0.488	401.796	31.946	78.045	58.511	41.858
Median	94-98	SHSE	0.153	53.423	7.331	0.000	0.000	0.000	386.936	30.074	80.000	59.153	43.269
Std dev	94-98	SHSE	0.156	84.927	9.748	30.793	0.081	0.503	242.206	9.494	10.542	13.347	14.060
Skewness	94-98	SHSE	-1.371	-0.477	-2.174	0.583	1.820	0.051	0.489	-0.387	-0.983	-0.034	-0.453
Kurtosis	94-98	SHSE	3.725	1.099	9.298	-1.255	3.617	-2.049	-0.460	0.692	1.159	0.424	-0.228
Mean	94-98	SZSE	0.117	36.635	-3.065	23.834	0.081	0.657	285.792	29.126	56.374	49.848	43.255
Median	94-98	SZSE	0.150	42.791	8.441	18.055	0.053	1.000	288.420	26.537	51.394	50.279	41.750
Std dev	94-98	SZSE	0.417	163.447	57.732	24.148	0.114	0.478	118.145	14.778	15.470	18.223	20.631
Skewness	94-98	SZSE	-1.349	-1.376	-5.690	0.577	2.524	-0.677	0.459	0.493	0.026	-0.282	0.250
Kurtosis	94-98	SZSE	4.806	5.833	36.458	-1.092	7.186	-1.588	-0.552	-0.711	-1.101	-1.262	-0.914
Mean	94-98	BOTH	0.122	51.230	1.842	25.263	0.067	0.567	346.972	30.630	67.932	54.468	42.518
Median	94-98	BOTH	0.152	45.519	7.444	13.030	0.036	1.000	322.720	29.303	73.446	56.822	42.595
std dev	94-98	BOTH	0.308	128.456	40.430	27.856	0.098	0.497	201.671	12.285	16.953	16.342	17.427
Skewness	94-98	BOTH	-1.689	-1.572	-8.008	0.619	2.469	-0.272	0.955	0.151	-0.578	-0.420	0.114
Kurtosis	94-98	BOTH	9.325	8.523	74.527	-1.069	7.708	-1.952	0.755	-0.275	-0.688	-0.349	-0.428

Note: (1) EPS is the Earning Per Share in RMB (adjusted for stock splits and rights issues); (2) NI is the company's Net Income in million RMBs; (3) ROE is the Return on Equity which is calculated as Net Income divided by Total Equity; (4) DivNI is the Dividend Payout Ratio which is calculated as Total Dividend divided by Net Income; (5) DPS is the Dividend Per Diluted Share in RMB; (6) DIVYES is the Dividend Indicator which equals 1 if the company pays dividend during the year and 0 otherwise; (7) is the company's total number of shares in millions; (8) SECB is the percentage of B shares over the company's total number of shares; (9) OUTB is the percentage of B shares over the company's total outstanding shares; (10) STATE is the percentage of company shares held by the State or State-owned legal persons; and (11) DEBT is the debt ratio which is calculated as total debt over total assets.

[1] These summary statistics are based on annual data from the thirty companies described in Table 1.

Table 4 presents the cross-sectional summary statistics of annual A and B share price, return and share turnover data from 1994 to 1998. At the end of 1998, the cross-sectional mean DIST (B share percentage price discount)[4] is 75% at the Shanghai Stock Exchange, and 59% at the Shenzhen stock exchange. B shares are on average traded at 54% below A share in 1994 and 87% below A shares in 1998. There appears to be a large foreign share price discount in the Chinese stock markets. In light of the limited information transmission and the large price difference between the domestic & foreign share classes in the Chinese stock markets, we further formulate an empirical model to capture the financial determinants of long-term foreign share discount. Are company's fundamental financial variables important determinants of the degree of foreign share discount?

Table 5 presents the cross-sectional summary statistics of annual corporate earnings, dividends, share structure and capital structure. Annual EPS (earning per share) and DPS (dividend per share) are both adjusted for company's capital changes (such as rights offerings and stock dividends). The companies' NI (Net Income), ROE (Return on Equity), and DivNI (Dividend payout ratio) are also described in the Table 5. In addition to these company cash flow measures, we also develop OUTB (percentage of B shares over the company's total outstanding shares), STATE (percentage of State-owned shares over the company's total shares), and DEBT (percentage of total debt over total assets) to reflect the companies' share structure and capital structure.

While A share investors (Chinese domestic residents) are likely to be more sensitive to government interventions and policy factors, B share investors (foreign investors) may be more sensitive to the listed company's fundamental financial strength. We hypothesize that the degree of B share price discount may be related to the listed company's earnings, dividends, ownership structure, capital structure and liquidity factors. The following model is constructed to examine the determinants of foreign share price discount in the Chinese stock market.

$$\begin{aligned} DIST_t = {} & b_0 + b_1 TURNAB_{i,t} + b_2 EPS_{i,t} + b_3 DIVNI_{i,t} + b_4 OUTB_{i,t} + b_5 STATE_{i,t} \\ & + b_6 STATE_{i,t} + b_7 D95_t + b_8 D96_t + b_9 D97_t + b_{10} D98_t + b_{11} SHSE_i \end{aligned} \quad (3)$$

where $DIST_{i,t}$ is the B share percentage price discount; TURNBA is the B share to A share relative liquidity ratio in %; EPS is the Earning Per Share in RMB adjusted for stock splits and rights issues; DivNI is the Dividend Payout Ratio which is calculated as Total Dividend divided by Net Income; OUTB is the percentage of B shares over the company's total outstanding shares; STATE is the percentage of company shares held by the State or State-owned legal persons; DEBT is the percentage debt ratio which is calculated as total debt over total assets; D95, D96, D76, and D98 are indicator (dummy) variables of years 1995, 1996, 1997 and 1998, respectively; and SHSE is an indicator variable for companies traded in Shanghai Stock Exchange.

Table 6: Cross-sectional time series regression for B share percentage price discount

This regression model is estimated using annual data from 1994 through 1998 for the thirty companies described in Table 1. The dependent variable $DIST_{i,t}$ is the B share percentage price discount from A share in year t for company i, which is calculated as (1-PRICE_B$_{i,t}$ /PRICE_A$_{i,t}$)*100%. This B share percentage price discount measure is regressed against the following variables: *TURNBA*=TO_B/TO_A*100% is the B share to A shares liquidity ratio in %; *EPS* is the Earning Per Share in RMB (adjusted for stock splits and rights issues); *DivNI* is the Dividend Payout Ratio which is calculated as Total Dividend divided by Net Income; *OUTB* is the percentage of B shares over the company's total outstanding shares; *STATE* is the percentage of company shares held by the State or State-owned legal persons; *DEBT* is the percentage debt ratio which is calculated as total debt over total assets; D95, D96, D76, and D98 are indicator variables of years 1995, 1996, 1997 and 1998, respectively; and *SHSE* is an indicator variable for companies traded in Shanghai Stock Exchange.

$$DIST_{i,t} = b_0 + b_1 TURNAB_{i,t} + b_2 EPS_{i,t} + b_3 DIVNI_{i,t} + b_4 OUTB_{i,t} + b_5 STATE_{i,t}$$
$$+ b_6 DEBT_{i,t} + b_7 D95_t + b_8 D96_t + b_9 D97_t + b_{10} D98_t + b_{11} SHSE_i$$

Variable	Coefficient Estimate	Standard Error	t ratio[1]	Significant Level	Tolerance Level	Variance Inflation Factor (VIF)	Sequential Sum of Squares (*SSS*)[2]	*SSS* divided by Regression Sum of Squares (*SSR*)[3]
PANEL A: FULL SAMPLE (30 COMPANIES) R^2 = 76.59%; Adjusted R^2 = 72.41%; F Value = 18.320								
CONSTANT (b_0)	39.401	6.438	6.120*	0.000				
TURNBA(b_1)	-0.183	0.101	-1.807**	0.073	0.788	1.269	192.10	0.51%
EPS(b_2)	-14.352	3.278	-4.378*	0.000	0.777	1.287	8720.90	23.02%
DIVNI(b_3)	0.013	0.035	0.379	0.706	0.847	1.180	81.50	0.22%
OUTB(b_4)	0.146	0.071	2.047*	0.043	0.552	1.811	5758.10	15.20%
STATE(b_5)	0.141	0.058	2.420*	0.017	0.865	1.157	1091.80	2.88%
DEBT(b_6)	-0.161	0.055	-2.938*	0.004	0.879	1.137	502.40	1.33%
D95(b_7)	5.635	2.998	1.880**	0.062	0.579	1.726	1651.80	4.36%
D96(b_8)	5.684	2.862	1.986*	0.049	0.587	1.702	3179.60	8.39%
D97(b_9)	22.125	2.926	7.563*	0.000	0.562	1.779	449.10	1.19%
D98(b_{10})	33.126	3.075	10.772*	0.000	0.551	1.816	13209.90	34.87%
SHSE (b_{11})	13.918	2.600	5.353*	0.000	0.476	2.101	3042.20	8.03%
PANEL B: SHANGHAI STOCK EXCHANGE A AND B SHARES (16 COMPANIES) R^2 = 71.91%; Adjusted R^2 = 69.53%; F Value =30.250								
CONSTANT (b_0)	49.419	7.279	6.789*	0.000				
TURNBA(b_1)	-0.070	0.075	-0.939	0.351	0.749	1.336	32.77	0.48%
EPS(b_2)	-18.239	6.072	-3.004*	0.004	0.638	1.568	2110.18	30.60%
DIVNI(b_3)	0.025	0.027	0.924	0.359	0.849	1.178	7.12	0.10%
OUTB(b_4)	0.296	0.076	3.900*	0.000	0.864	1.157	428.16	6.21%
STATE(b_5)	0.092	0.062	1.482	0.143	0.800	1.250	14.76	0.21%
DEBT(b_6)	-0.120	0.063	-1.925**	0.059	0.765	1.307	64.11	0.93%
D95(b_7)	-0.274	2.490	-0.110	0.913	0.574	1.743	347.85	5.04%
D96(b_8)	-3.582	2.483	-1.443	0.154	0.550	1.817	1980.07	28.72%
D97(b_9)	10.513	2.548	4.125*	0.000	0.522	1.915	3.94	0.06%
D98(b_{10})	19.359	2.897	6.683*	0.000	0.473	2.113	1906.33	27.65%
PANEL C: SHENZHEN STOCK EXCHANGE A AND B SHARES (14 COMPANIES) R^2 = 71.62%; Adjusted R^2 = 67.19%; F Value = 16.150								
CONSTANT (b_0)	34.336	10.971	3.130*	0.003				
TURNBA(b_1)	-0.096	0.273	-0.350	0.728	0.735	1.361	725.00	2.81%
EPS(b_2)	-7.578	4.203	-1.803**	0.077	0.674	1.484	6769.80	26.26%
DIVNI(b_3)	-0.127	0.071	-1.778**	0.081	0.705	1.418	69.00	0.27%
OUTB(b_4)	0.084	0.111	0.758	0.451	0.714	1.400	0.00	0.00%
STATE(b_5)	0.145	0.088	1.651	0.104	0.827	1.209	49.00	0.19%
DEBT(b_6)	-0.177	0.074	-2.399*	0.020	0.898	1.113	666.70	2.59%
D95(b_7)	13.589	5.204	2.611*	0.012	0.527	1.896	1094.30	4.25%
D96(b_8)	18.489	4.813	3.841*	0.000	0.548	1.823	1274.90	4.95%
D97(b_9)	37.156	4.826	7.699*	0.000	0.546	1.833	745.90	2.89%
D98(b_{10})	50.707	5.016	10.110*	0.000	0.505	1.980	14380.80	55.79%

[1] The asterisk (*) sign indicates a significance level of five percent or better for two-tailed test whereas the sign (**) indicates a significance level of five percent or better for one-tailed test.

[2] Sequential Sum of Squares (*SSS*) indicates the sequential reduction in the variability of the dependent variable DIST for each independent variable added to the regression.

[3] The ratio of sequential Sum of squares (*SSS*) to Regression Sum of Squares indicates the percentage contribution by each independent variable in explaining the variability of the dependent variable DIST.

The cross-sectional time series regression estimates of Equation 3 based on annual data from 1994 to 1998 for the thirty companies are reported in Table 6. The four year indicators (1995, 1996, 1997 and 1998) all have significantly positive relationship with the foreign share price percentage discount, suggesting higher level of share discount in 1995-1998 than that in 1994. The dramatic annual fluctuations in foreign share discount can be partly explained by volatility in Chinese government market intervention policies, time series variations in foreign exchange rates, and changes in overseas stock market relative performance (such as the US and HK stock markets). In addition, the SHSE indicator has a significant coefficient of 13.92, which indicates that B share percentage discount at SHSE is on average 13.92% higher than the discount at SZSE for companies with the same financial strength. Since B shares are traded by foreign investors in US dollars on SHSE and HK dollars on SZSE, most SZSE B share investors are Hong Kong residents/mutual funds who know more about Chinese local policies and company information than SHSE B share investors and hence, price the B shares at a smaller discount than the SHSE B shares.

Consistent with our expectation, the coefficient of Earning Per Share (EPS) is negative and highly significant, indicating that lower Earning Per Share is associated with higher B share price percentage discount. EPS accounts for 31% of the regression explanatory power at SZSE. This significant negative relationship between B share percentage price discount and company earnings shows that foreign investors tend to react more strongly to weakness in the listed company's ability to generate earnings. The earnings of listed companies have deteriorated during the sample period, with the cross-sectional median EPS (adjusted for stock splits and rights issues) ranging from 0.250 RMB in 1994, 0.156 RMB in 1995, 0.145 in RMB in 1996, 0.100 RMB in 1997, to 0.07 RMB in 1998. Unlike Chinese domestic investors, foreign investors place stronger emphasis on the listed company's current earnings. In addition, this stronger emphasis on earnings valuation by B share investors might be due to the differences in accounting earnings reported to A and B share investors. Chen, Gul and Su (1999) examined the difference between earnings based on Chinese GAAP (released to A share investors) and those based on International Accounting Standard – IAS (released to B share investors). They found that earnings under the Chinese GAAP are on average 20-30% higher than those reported under the IAS. In summary, the observed significant negative relationship between company earnings and B share percentage price discount may be explained by difference in accounting standards, difference in perception of Chinese stock markets' political and policy risks, and the resulted difference in sensitivity to company's current ability to generate earnings.

However, the DivNI (dividend payout ratio) does not appear to have additional explanatory power beyond company earnings. The DivNI coefficient is insignificant and only accounts for 0.22% of the regression's explanatory power. The cross-sectional median of dividend payout ratio (see Table 5) evolved from 12% in 1997, 35% in 1995, 28% in 1996, to 0 in 1997 and 1998.

The decrease in dividend payout ratio for Chinese companies in recent years was accompanied by an increase in the use of stock dividends (or bonus issues). It appears that the degree of dividend payout does not have significant impact on the B share percentage price discount.

B shares are traded far less frequently than A shares, which leads to a substantially lower B share turnover ratio. We include the B share relative liquidity ratio (TURNBA= B share turnover ratio/A Share Turnover Ratio*100%) in the regression to see whether companies with higher B share relative liquidity ratio are associated with lower B share percentage price discount. Our results indicate a negative but insignificant relationship between TURNBA and B share percentage price discount. The size of long-term foreign share percentage discount does not appear to be affected by the B share relative liquidity ratio.

In addition, the debt ratio (DEBT), which measures a company's capital structure, has a significantly negative regression coefficient, which suggests that companies with higher leverage are associated with lower B share percentage price discounts. Theories and empirical evidence regarding the effect of capital structure on the value of US firms are mixed. On one hand, it is argued that issuing bonds can lower the cost of capital, avoid equity dilution due to issuance of additional common stocks, and hence, increase the value of the firm. On the other hand, it is suggested that bankruptcy costs may increase as a result of the increasing use of risky debt. In China, companies mostly obtain external financing through borrowing from State banks or issuing bonds to employees and other investors. On average, B share investors' favorable valuation of higher leveraged Chinese listed firms might be due to relatively low bankruptcy rate associated with Chinese State-owned enterprises. However, the capital structure as measured by the debt ratio only contributes to 1.33% of the regression explanatory power in the full sample.

To examine the impact of ownership structure on the B share percentage price discount, we include STATE (percentage of company shares held by the State or State-owned legal persons) and OUTB (percentage of B shares over the company's total outstanding shares) in equation 3. Both coefficients are positive and significant in the full sample, with STATE contributing to 2.88% of the regression explanatory power, and OUTB contributing to 15.2% of the regression explanatory power. Chinese government maintains a controlling stake of the listed company through direct ownership by the State or indirect ownership by State-owned legal persons, which accounts for an average 53% of listed company shares in 1998. A higher State ownership could result in more government intervention in the listed company's managerial decisions and hence, creates potential conflict of interests between and the State and public shareholders. Therefore, foreign investors have negative reaction to companies with higher State ownership, which is consistent with our empirical finding that State ownership percentage and B share percentage price discount are positively related. Since State-owned shares cannot be traded in the market, company's outstanding shares only consist of non-State public A shares and B

shares. OUTB indicates the number of B shares as a percentage of the company's total outstanding shares, which is about 66% in 1998. Since most B shareholders are offshore, only non-State public A shareholders will be able to monitor and participate in managerial decision making process of the listed company on a regular basis. Therefore, we observe a positive relationship between OUTB and B share percentage price discount, suggesting that a higher percentage of offshore public share ownership be related to lower protection for the public shareholders' interests. In summary, the ownership structure of Chinese company has significant impact on corporate controls and managerial decisions, and hence affects B share percentage price discount.

V. SUMMARY

This study investigates the short-run dynamic transmission of information flow between Chinese A and B shares for the period January 1994 to May 1999. The analysis is carried out using a bivariate GARCH framework that jointly models the first and second moments of stock returns from both share classes. We find significant cross-market return transmissions (first moment interactions) and volatility spillovers (second moment interactions) between the two share classes. The first and second moment spillover parameter estimates indicate that information flow transmissions from B to A shares are stronger than the transmissions from A to B shares, which implies that B shares incorporate information (especially company fundamental analysis) more quickly and more precisely than A shares, and as a result, A share investors may extract better quality information from the pricing implications of B shares. To a lesser extent, B share investors also extract information from A share prices, given that the A shares respond faster to certain news (such as Chinese government intervention policies). However, the A B share cross-market volatility spillover coefficients are much lower than their own-market volatility persistence coefficients, indicating weak information transmission and segmentation between the Chinese A and B share markets.

In light of the limited information transmission and the large price difference between the domestic & foreign share classes in the Chinese stock markets, we further formulate an empirical model to capture the financial determinants of long-term foreign share discount. We examine the relationship between annual B share percentage price discount and the listed company's fundamental financial variables, including measures of company earnings, dividend payout, ownership structure, and capital structure. Our results show a significant negative relationship between B share percentage price discount and company earnings, suggesting that foreign investors tend to react more strongly to weakness in the listed company's ability to generate earnings. Furthermore, our results indicate that companies with higher financial leverage are associated with lower B share percentage price discount. In addition, a higher State ownership could result in more government intervention in the listed company's managerial decisions and hence, results in a positive

relationship with B share percentage price discount. Due to its important implications for corporate controls and managerial decisions, ownership structure has significant effect on the B share percentage price discount. However, dividend payout ratio does not appear to have additional explanatory power for the B share percentage price discount after considering the company's earnings, capital structure and ownership structure.

The findings of this study shed new light on the dynamic information transmission across markets with ownership restrictions and the financial determinants of long-term foreign share price discount.

ACKNOWLEDGMENTS

The authors would like to thank the seminar participants at the University of Missouri - St. Louis and the 2000 FMA meetings in Seattle for helpful comments and discussions. The financial support of Beaumont Faculty Development Fund from Saint Louis University is gratefully acknowledged**.**

NOTES

1. Besides A and B shares listed in China, Chinese companies can list "H" shares at Stock Exchange of Hong Kong and "N" shares at New York Stock Exchange upon approval by the State.
2. See Glosten and Milgrom (1985) and Easley and O'Hara (1991).
3. State-owned A shares are sometimes referred to as C shares.
4. The B share percentage price discount $DIST_{i,t}$ from A share in year t for company i is calculated as (1-PRICE_$B_{i,t}$ /PRICE_$A_{i,t}$)*100%, where the B share annual closing price has been converted to RMB using the corresponding exchange rate at the end of year t.

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