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The Market Efficiency of the Chinese A-B-share Market

by

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Abstract:

Although two classes of shares on the same Chinese companies differ only in that the A-share class trade in Yuan and the B-share class in dollars, the B-shares have traded at a significant and persistent discounts to the A-shares since inception of the B-share market in the early 1990s. The persistence of the discount has been a puzzle. We find that liquidity differences between the less liquid B-shares and the A-shares do not explain the discount or changes in the discount. Moreover, discounts do not arise because the proper clientele for the B-shares are foreign investors who need higher rates of return to hold these shares because of home-country bias. The data indicate that the marginal investors who buy and sell shares in this market are generally Chinese (small) investors. The returns on the B-shares respond to the returns on the Shanghai (and not foreign) markets and the returns on the B-shares do not differ significantly from the returns on the A-shares. The evidence indicates that the various behavioral economics models such as investor sentiment or over-bidding of stocks by large volume traders are not supported by the data. The changes in the discounts of the A-shares and the B-shares fluctuate randomly.

Key Words: Clientele Effect; Marginal Investor; A-B-shares; Discounts; Efficient Markets, Behavioral Finance, China

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1. Introduction

The A-share and B-share markets in Shanghai and Shenzhen provide an interesting controlled experiment to understand and contrast like assets in differentiated markets. The B-shares are traded in dollars (US dollars for Shanghai-listed B-share companies, and Hong Kong dollars for Shenzhen-listed B-share companies); the A-shares on the same company are traded in Yuan (RMB). Other than the currencies in which they trade, there are no other differences in the property rights of the respective shares. The B-shares trade less frequently and sell at a significant discount to their A-share counterparts ($(P_a - P_b)/P_a$, where P_a is the price of the A-shares and P_b is the price of the B-shares) and have done so over their entire history since their issuance in the early 1990s¹.

We discuss the segmented-market (cliente effects) hypothesis, wherein investors in China might be the proper clients (natural investors) for the A-shares and investors outside of China might be the proper clientele for B-shares. Marginal investors are indifferent between owning A-shares and B-shares. Asymmetric information differences between Chinese and foreign investors affect their investment decisions and determine investment clienteles. Can these differences in costs explain the discount in the B-shares relative to the A-shares? That is, do foreign B-shareholders earn higher rates of return than A-shareholders to compensate them for the higher costs of investing in Chinese stock than domestic Chinese investors? If, on the other hand, the marginal investor in the B-shares is a domestic Chinese investor, the rate of return on holding A-shares should

² The B-share market was established in the early 1990s to provide Chinese companies with access to foreign capital. Currency controls and investment restrictions blocked other routes for foreigners to invest in Chinese equities. Over time, routes such as the expansion of the H-share market in Hong Kong, the N-share market in New York, the liberalization of investment-company rules in the A-share market, have provided alternatives to foreigners to invest in Chinese equities. In fact, as we discuss below, in 2001, Chinese citizens who were allowed to buy B-shares for the first time replaced foreign investors as investors in the B-shares. Given these alternative routes, other than its continuation providing researchers a rich research database with which to study market pricing, the B-share market most likely will disappear as government authorities allow B-shares to disappear through merger, or conversion into A-shares or listing on the H-share market in Hong Kong.

be the same as the rate of return to holding B-shares unless the B-shares are less liquid than are the A-shares. In that case, the costs to buy and sell B-shares would be greater than the cost of trading the A-shares and the B-shareholders might require higher rates of return to compensate them for the lack of liquidity.

If, however, the rates of return on the B-shares are the same as the rates of return on the A-shares, this would indicate that the marginal investor setting prices in the market is most likely the small investor in the B-shares who can move at low cost between holding the A-shares and the B-shares given changes in expected returns and in discounts. Larger institutional investors most likely would be the clientele for the more liquid A-shares. They would achieve the same rates of return at lower trading costs if they needed to adjust their portfolio holdings.

If the rates of return are the same on the B-shares as the A-shares, the discounts on the B-shares relative to the A-shares should change randomly. If, for example, the A-shares are bid up relative to the B-shares, marginal investors would buy the B-shares, which would offer a greater expected return. If the B-shares are bid up relative to the A-shares, the marginal investors would buy the A-shares. We find that the discounts do change randomly. We also find that the returns on the A-shares are insignificantly different from the returns on the B-shares, which are far less liquid than the A-shares.

If foreign investors, whose portfolio are the “world” portfolio, are the marginal investors in the B-shares, the returns on the B-shares most likely would be more responsive to the returns on the world portfolio. We find, however, that both the A-shares and the B-share returns are most responsive (and equally so) to the returns on the Chinese markets (Shanghai returns) and not the world markets. This implies that although foreign investors might buy B-shares, the marginal investor in the B-shares is most likely a Chinese investor.²

³ If all assets were substitutes for each other in providing returns and risk attributes, the markets would be integrated in that investors are indifferent as to whether, for example, they hold a Chinese or US stock. Chinese companies would differ only from US companies in the risks of their return streams.

Chinese investors have no incentive to eliminate the discount. Other than share buybacks, which are not possible without government approval, (or similar substitutes), there is no mechanism that will bring the B-share prices into line with (eliminate the discount) the A-shares. For example, arbitrageurs would not make money by buying the B-shares, thereby, bidding up their prices (paying a premium) and holding them until the company transforms B-shares into more efficient forms.³ They don't know the expected holding period for their investments. In fact, if the discount narrows, small investors at the margin would sell B-shares buy A-shares. As a result, the arbitrageurs would lose money for after having bid up prices in building up their positions in the B-shares, other marginal B-share investors would sell their B-shares and buy A-shares causing the discounts to return to near previous levels. The B-shares are therefore “not cheap” to the A-shares. Once, the market sets an equilibrium discount, if marginal investors remain Chinese investors, the changes in the discount should be random and the returns on the two share classes should be insignificantly different from each other.

The empirical evidence supports the hypothesis that marginal investors in the B-shares are the small Chinese investor. The discount cannot be explained by foreigners demanding higher rates of return than domestic Chinese investors and cannot be explained by differences in the costs of buying and selling the less liquid B-shares.

And, the discount is not evidence of home-country bias.⁴ Some might expect that foreigners don't know the Chinese companies or do not want to incur the costs to analyze

With segmentation (possibly arising from home country bias and information advantages), the returns might differ among the various markets.

⁴Some would argue, that private equity firms pay a premium, a so-called “control premium” to change the operating characteristics of the firms that they acquire. The arbitrageur here, however, can't affect the decisions of the company to eliminate the B-shares. In fact, government policy impedes the ability of the company to change the character of the B-shares, which makes arbitrage even more difficult.

⁵ The **home country bias problem** is the term given to describe the fact that individuals and institutions in most countries hold only modest amounts of foreign equity. This is puzzling since observed returns on national equity portfolios suggest substantial benefits from

them, especially institutional investors who might be able to acquire only small positions in B-share companies, which trade much less frequently than their A-share counterparts. This would imply that B-shares should exhibit higher returns than the A-shares. The analysis shows, however, that foreigners, who buy B-shares, earn the same returns as investors in the A-shares.

This paper combines theory and empirical work. It is rare in finance that the same company has two share classes traded on the same exchange that differ only in the currency required to buy the shares (an approximate exception being Royal Dutch and Shell or Unilever, but their shares are traded in different markets; the Dutch and U.K. markets with different tax and withholding tax implications.) This allows us to test the behavioral-finance literature models of the effects of investor sentiment and excess trading volume on stock prices by using the time series of the changes in discounts on the A-shares and the B-shares. New theory and empirical evidence are developed on clienteles, return differences based on liquidity and investor sentiment.

2. Clientele Effects Hypothesis: Identifying the Marginal Investor in the B-shares

2.1 Theoretical Analysis and Hypothesis

international diversification. French and Poterba (1991) were the first to document “home-country bias” in equities.

One argument for B-share discounts is that the market is segmented, partially walled off from the A-share market, by cost differences between owning A-shares when compared to owning B-shares. The B-share sells at discounts to its A-share “equivalent” for myriad reasons (e.g. liquidity or information differences or outright constraints on investment). Each class of shares attracts a particular clientele. The A and B-share prices might represent the equilibrium values of each class of shares. The B-shares attract worldwide investors while the A-shares are traded to the most extent (by law) by domestic investors, and trade at premiums to their B-share counterparts. Or it might be that the costs of foreign investors to hold B-shares are such that Chinese investors hold most of the B-shares or are the marginal investors in B-shares, in particular, after 2001. Or, sophisticated foreign institutional investors might hold the B-shares while individual Chinese investors hold the A-shares. Clienteles do exist in markets and price differences persist.⁵

Or, the B-share markets represent the value of shares to an alternative foreign (and partial domestic Chinese) clientele. The market prices in each segment (either A-share or B-share market) are “correct” for the respective clienteles that trade in each market. It is frictions (costs) or constraints that prevent the market prices of the A and B-shares to trade at the same price. Some investors might be the proper clienteles for the A-shares and other investors might be the proper clienteles for the B-shares. Costs separate the A-share market from the B-share market and, it is these costs that explain the price discounts.

Most important to the argument is that those in the A-share market **know** that the B-shares sell a discount (and vice versa) and the A-shareholders **know** that they might be giving up returns but continue to hold the A-shares even if the B-shareholders receive higher dividend yields (or returns) and discounts remain constant or fluctuate randomly. These A-share investors would prefer to hold the higher returning B-shares but the costs

⁶ For example, in the United Kingdom, pension funds are required by law to hold long-maturity government bonds. As a result, the prices of these bonds are bid up such that the expected return is lower than alternative shorter-maturity bonds. There is not enough supply to eliminate the premium.

to them of holding the B-shares might be greater than the lost returns (if any) of holding A-shares. Costs or constraints separate the markets, not market irrationality or behavioral tendencies or the limits of arbitrage.⁶

Both classes of investors make rational decisions. Most B-shareholders are infra marginal; they benefit by holding B-shares when compared to A-shares. Most A-shareholders are infra marginal; they benefit by holding A-shares. This produces a separating equilibrium. Thus, the A-shareholders know that they might be giving up gross returns by holding A-shares but do so willingly. Another way to put this is that the known cost to a subset of Chinese citizens of holding B-shares is greater than any excess return (if any) that they might achieve by holding B-shares when compared to holding A-shares. They are the clients for the A-shares. These separating equilibrium arguments produce separate clienteles.

There are, however, investors at the margin who are indifferent between holding A-shares and B-shares and move between them depending on relative prices and expected returns. These are the marginal investors. A- and B-share prices will move with changes in the economics of the company but will not necessarily move lock-step because of differential needs or constraints of the respective investors in the A- and B-shares. Unless there are sufficient marginal investors who have limited costs or constraints, all investors expect, however, that B-shares will (almost) always sell at a discount to the A-shares and earn higher rates of returns. If, hypothetically, the A-shares and the B-shares sold at the same price, many B-shareholders would sell their shares and buy A-shares because the costs to them to hold the B-shares would be too great (alternatively, the return differential would be too low to continue holding B-shares). They would be driven out of the market given their costs to hold the B-shares.

⁷ Our evidence shows that although over the ten-year period, 2001 - 2011, the returns to higher dividend yielding B-shares exceed those of their A-share counterparts, the volatility of the differential returns is such that we can't claim that there is a significant difference in returns. However, this evidence is consistent with a higher reward to dividend-paying stocks.

The B-shares are less liquid, trade less frequently and in smaller share sizes than do the A-shares. Smaller Chinese investors trade in small trade sizes in both the A- and B-share markets. If a larger investor were to place an order to buy or to sell B-shares, the price to acquire the shares might result in the investor paying a large transaction cost or price premium. Realizing that the shares are less liquid, large investors do not buy the B-shares. They participate in the economics of the company through buying the A-shares. Or if they were to buy B-shares and bid up their prices, other investors would tend to sell their B-share holdings over time and the discount would be reestablished. For them, they sell because the new price might imply that they would receive a lesser return by continuing to hold the B-shares than switching to the A-shares. If everyone realizes these possible scenarios in advance, the discount is maintained and fluctuates randomly over time.

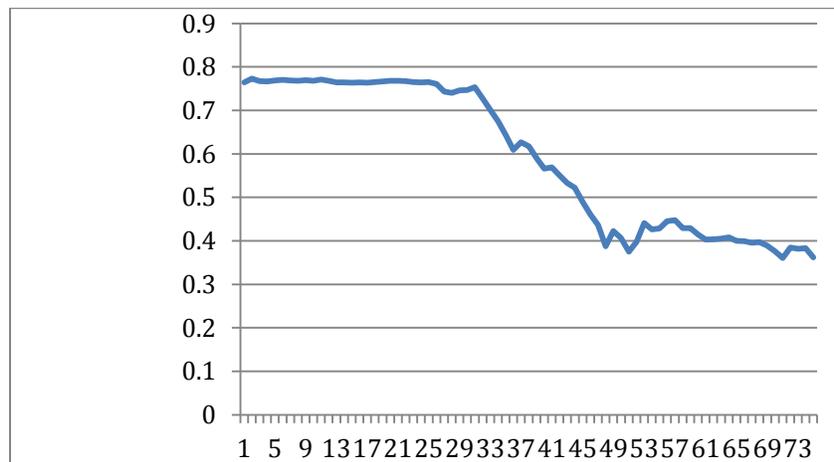
This cost model, however, implies that returns on the B-shares must be greater than the returns on the A-shares. And, if this were so, the discount would need to compress over time.

Of interest here, is that on February 19, 2001, the regulatory authorities allowed Chinese citizens to use dollars to buy B-shares legally. Prior to then, only foreigners could buy B-shares. As reported in Darrat, Gilley, Wu and Zhong (2010) the discount on B-shares fell dramatically after this date from approximately 80%, on average, to 40%, on average. With the lifting of the restriction, Chinese citizens bought B-shares from foreigners. Under the segmentation hypothesis, this fall in the discount (and subsequent return possibilities) would force many foreign investors to leave the B-share market (sell their shares to Chinese citizens who might have become the marginal holders of the B-shares). Chinese citizens could make higher after-cost returns on the B-shares than on holding the A-shares if their costs to do so were lower than the previous foreign marginal investors in B-shares. The foreign investors were “forced” to leave the market.⁷

⁸ Actually, foreign investors might enter the market for B-shares if they believe that the RMB will appreciate more than the discount implies. Or, they might enter the market if they believe that the Chinese market is undervalued or that Chinese companies might repurchase the B-shares.

In Figure 1, we plot the value-weighted daily discount in the Shenzhen market of B-shares to A-shares from January 1, 2001 until the end of April, 2001. After Chinese citizens were allowed to buy B-shares, the discount fell from approximately .75 to .35.⁸ One explanation is that costs for many Chinese citizens of holding B-shares were lower than those of foreigners.

Figure 1
Discount Levels of B-shares Relative to A-shares.
Trading Days, January through April 2001



With this argument we would expect that the A-share and B-share markets became more co-integrated after the change in regulations that allowed Chinese investors to use dollars to buy the B-shares. With fewer foreign investors wishing to hold the B-shares, information that affected the company would be incorporated into both the A- and B-shares more quickly because both classes of shares were now held by Chinese citizens. Darrat et. al. do show a greater degree of co-integration subsequent to the change in the

⁹ The same pattern was observed in the Shanghai market and if we used equally weighted discounts in Shenzhen or Shanghai.

regulations. We turn to an examination of the A-share and B-share markets subsequent to May 2001.

Under the clientele hypothesis, the discount fell because the costs to hold B-shares were lower for Chinese citizens and, as a result, when allowed to buy B-shares they crowded out the foreign investors. Chinese citizens, however, are only allowed to convert a limited amount of Yuan into dollars each year (e.g. \$20,000 prior to August, 2007, and \$50,000 subsequently). At times, foreign investors might want to buy or to sell Chinese stocks. They might be willing to hold the B-shares if they expect higher rates of return (in excess of their holding costs) in holding B-shares relative to other risky assets in their portfolios. Since the discount did not disappear, however, our analysis implies, that to understand the persistence of the discount requires an understanding of the costs to the Chinese investors who might be the new marginal investors likely setting the prices in the market.

What might be some of the costs and constraints that create the two-clientele model? These differential costs rationally create a separation of A-B-shareholders. For foreign investors we include here (1) governance issues, (2) B-shares that have little analyst following outside of China, (3) Political issues in China such as “confiscation” of the B-shares, (4) different risk characteristics of B-shares that are traded in world market portfolios (e.g., influenced more by external market factors than are the domestic A-shares), (5) B-shares returns affected by world-wide market movements, and (6) alternatives to garnering participation in the Chinese market (such as opening up the A-share markets to institutional investors, or futures and swap contracts), which might reduce liquidity in the B-share market and increase the costs to foreign investors.

If we concentrate on the extra costs to the Chinese investor we must consider (1) size of B-share issue and trading interest among Chinese citizens (liquidity issues), (2) the political costs of holding dollar-denominated accounts in China, (3) the degree to which B-shares are co-integrated with the A-share market, (4) the lack of convertibility of Yuan into dollars causes investors to concentrate in the A-share market generally, and (5) the

costs of converting RMB into dollars to buy B-shares and the cost of holding foreign currency and experiencing currency fluctuations when citizens consume in RMB. These differential costs create separation of A-B-shareholders, which might be entirely rational. The costs of the marginal holders of A- or B-shares, however, might depend entirely on the liquidity of the B-share market.

Moreover, the marginal investor in either the A- or B-shares might change over time. Thus, there is no reason to believe that the costs or the constraints of the marginal investor in one period are the same for that investor or successor marginal investors in subsequent time periods. And, the marginal investor in the larger capitalized A-shares might be different from the marginal investor in the less capitalized A-shares because the costs to hold A- or B-shares for investors might differ in the cross-section of stocks. And, for some B-shares that are thinly traded, the cost of the marginal investor might be so great that the prices of the B-shares don't adjust frequently.

Table 1
Consistency of Discounts and Returns on A and B-shares

Group	Dis	R(Dis)	B-Val	RA(%)	RB(%)	B-Sh T
1	.62	.60	0.63	-.41	-.12	1.78
2	.54	.55	0.75	.02	-.03	1.80
3	.48	.48	1.04	.70	.52	1.71
4	.41	.42	1.31	.51	.18	1.52
5	.29	.31	2.09	.38	-.10	1.35

In Table 1, we display the results for A-B-shares sorted by the B-share discount in the previous year (Dis) into five groups with those twenty percent of the stocks (86 A-B stocks in total) that had displayed the largest discount assigned to Group 1 and those with the lowest discount assigned to Group 5 (one extra stock assigned here). The stocks were distributed according to their group number. Each cell contains the average values for each year from 2002-2011 (2001-2010 for the group selection criteria, Dis). That is, stocks were sorted into five groups in 2001 based on the B-share discount, and the

average realized discount, $R(\text{Dis})$, for stocks in each group was computed for 2002. The stocks were again sorted into five groups from highest to lowest discount in 2001 and the realized average discount was computed for each group (20% of the stocks assigned to a group) for 2002. This sorting and re-assignment was repeated for each year through 2011. Each cell of the $R(\text{DIS})$ column of Table 1 contains the average of the 10 annual realized discounts for a particular Group. Each cell of the Dis column of Table 1 contains the average of the 10 annual sorting-year discounts. Those stocks in Group 1 exhibited a group selection average Dis of .62 and a realized average discount ($R(\text{Dis})$) of .60 or 60%. The Group 5 stocks had a realized discount of 31%. Although there is a regression to the mean as expected, it is small. The discounts appear to be preserved year-to-year. Moreover, all of the B-shares trade at a discount to their A-share counterpart. The B-Val column contains the corresponding average market value of the B-shares for each group. Lower market value B-shares exhibit larger discounts. $\text{RA}(\%)$ and $\text{RB}(\%)$ are the average of the realized monthly percentage returns of the A-shares and B-shares respectively for each group, averaged over the entire 10-year period. Preliminarily, there does not appear to be any consistent pattern in realized returns among the groups based on discount. The last column, B-Sh T is the realized average share trading volume of the B-shares (that is, number of shares traded). It appears that the B-shares with the largest discounts are lower-priced securities.⁹

The B-shares trade at a discount to the A-shares for all market values (B-Val). There are significant differences in the realized discounts between Group 1 and Group 5 stocks and

¹⁰ By breaking the sorting criteria to determine groups into a different year from the statistics used for analysis, we are able to follow strategies that an investor might follow in constructing portfolios or making investment decisions. An investor would not be able to have bought stocks with greater trading volume until he could compute trading volume, and then it would have been too late to do so. Portfolios or groups help us identify strong associations and display the results. We also are able to average out outliers and data errors within each group. We generally take the simple average each period within groups. That is, for returns, we always use the average of the monthly returns on the stocks with each group. There are some months in which stocks don't trade because they have been suspended by the CRSC for a short period. There may be slight downward bias in returns induced by this lack of trading. We don't think that it is significant, however, for the results are similar across many different approaches.

significant differences between the market value of the B-shares (B-Val) for the groups. Greater discounts are associated with B-shares that have lower market values. The returns on the A- and B-shares appear to be insignificantly different from each other, and the returns on the A-share-B-share pairs appear to be insignificantly different from each other within groups. Share turnover (B-Sh T) is negatively related to B-share market value. As expected, everything else being equal, shares of companies with lower market value turnover more frequently.

In addition, Chinese domestics worry about using dollars to buy shares traded on the Chinese markets. With the lack of easy convertibility (e.g., currently \$50,000 per year by domestics), Chinese citizens might want to invest outside of China for diversification and to hedge changes in policies regarding holding of foreign currencies. Having international reserves are of value to domestic Chinese. The cost of the lack of convertibility might lead Chinese citizens to prefer not to hold B-shares. Other foreign-asset holdings (outside of China) are of greater value than domestic foreign exchange holdings in B-shares.

Moreover, many citizens who have dollars have obtained them through other market means than the permitted channels. After incurring these costs, citizens might prefer to keep the acquired dollars outside of China and out of the eyes of the regulators.

The extra returns earned, if any, on holding B-shares might be too small for the extra costs incurred to enter into a position. Moreover, the lack of convertibility might force Chinese citizens into A-shares, their only investment outlet, especially for the larger institutional investors. The implied cost of capital might be lower for A-shares not because of lack of risk aversion of Chinese citizens but because they have few outlets for investments other than in stocks, real estate or other assets that have been approved by the political process.

2.2 Return Differences Between A and B-shares.

If Chinese investors were the marginal investors in the B-shares, we would expect that the returns on the B-shares respond more to factors in China than outside of China because of the restrictions on convertibility of Yuan into dollars. Most Chinese individual and institutional investors invest only in Chinese securities and assets.

Also, we don't expect that the B-shares will be responsive to changes in the world market risk factors (such as the returns on Hong Seng index returns) unless Chinese A-shares are responsive as well. (We know that only Chinese citizens can hold A-shares.)

Chinese citizens who hold the less liquid B-shares most likely do so for longer holding periods than those holding the A-shares. (The turnover of B-shares is far less than the turnover of A-shares.) B-shares would naturally attract a clientele that has a longer investment horizon than A-shareholders.

We argued above that for various cost reasons, that the marginal investor in the A- and B-share market was the Chinese investor (and not a speculator or arbitrageur.) Chinese investors hold Chinese stocks. Foreign investors hold foreign shares and could hold B-shares. If the marginal investor in the B-shares were a foreign investor, we would argue that it should be responsive to the returns on the Hang Seng index in addition to the Shanghai index. That is so because foreigners are more sensitive to world market events and need to adjust their portfolio holdings accordingly. Another way to see this is that the foreigner would consider the world market as the market portfolio and would consider the Chinese B-share market as a sub-portfolio (like an industry component). If marginal investors were Chinese investors, they would think of the A- and B-shares as being the same in their optimal portfolios. The returns on A-shares and B-shares should respond to the Shanghai and Hang Seng index returns about the same. We argue that with the restrictions on foreigners holding A-shares, that the Hang Seng returns will have little effect on either the A- or B-shares. This identifies the marginal investor in the B-share market.

Table 2**Regression Statistics of Monthly Returns on A and B-shares on Shanghai or Hang Seng returns (2001-2011)**

Statistics	A-Shares	A-Shares	B-Shares	B-Shares	B-Shares	A-B-shares
R-Square	0.713	0.705	0.609	0.605	0.731	0.082
Intercept	-0.003	-0.004	-0.005	-0.005	-0.001	0.001
t-stat of intercept	-0.615	-0.731	-0.902	-0.821	-0.252	0.241
Slope						
Shanghai	1.052	0.989	0.887	0.937		0.053
t-stat	15.426	16.803	10.908	13.435		0.896
Slope	-0.164		0.131			
Hang Seng						
t-stat	-1.766		1.185			
Slope					0.874	
A-Shares						
t-stat					17.917	

In Table 2, we present the summary statistics of the regressions of the monthly returns on the A-shares on the returns of the Shanghai and Hang Seng indices and the summary statistics of the regression of the B-share returns on the A-share returns. The monthly returns on the A-shares is an equally weighted portfolio of the returns on the underlying A-shares for each month from January 2002 through December 2011. The same is true for the B-shares. Notice from column 2, that when the returns on the A-shares are regressed on the returns of both the Shanghai and Hang Seng indices that the intercept is insignificantly different from zero ($t\text{-stat} = -0.615$) and that while the slope on the Shanghai returns (1.05) is highly significant ($t=15.4$) the slope on the Hang Seng returns

(-1.16) is insignificant (-1.76). When regressing the A-share returns on the Shanghai index returns alone, the R-Square of the relation remains essentially unchanged as does the slope and its significance. The A-shares returns respond to the returns on the Shanghai index. This is also so for the B-share returns. They too respond to the returns on the Shanghai and secondarily the Hang Seng index. Moreover, if we regress the returns on the B-shares on the A-shares (the second-to-last column of Table 2), the B-share returns are more highly correlated to the returns on the A-shares than are their returns on the returns on the Shanghai index. The returns on the B-shares are insignificantly different from the returns on the A-shares (t-statistic = -.25).

In the last column of Table 2, we regress the difference of the returns on the A-shares from the B-shares on the Shanghai returns. This is equivalent to buying the A-shares and selling the B-share portfolio to finance the purchase of the A-shares. Both, the slope and the intercept are insignificantly different from zero. There is no difference in the returns on the A-shares and the B-shares over the sample period. There does not appear to be a liquidity premium return to hold B-shares. The intercept is far from being significantly negative.

Table 2 results provide strong evidence that the marginal investor in the B-shares is a Chinese investor. On the whole, they set prices in the markets. There is little additional association of the returns on the Hang Seng index. The returns to both the A and B-shares are approximately the same.

3 Tests of the Behavioral Markets Hypothesis: Investor Sentiment versus Clienteles

A-shares are held by Chinese investors. As A-share prices increase and positive momentum drives A-share prices higher (or lower with negative momentum), in the short run, the more liquid A-shares, which tend to be held by institutional investors might outperform the B-shares, which tend to be held by small investors or foreigners far removed from the Chinese markets. The discount would increase until the less active B-shares catch up. That is, although the discount might not change on average, or the returns on A-shares are insignificantly different from the returns on B-shares, positive momentum could drive up A-share prices relative to B-share prices, thereby increasing the A-share-B-share discount. With momentum or investor sentiment, we would expect to see trends in changes in the level of the discounts (and returns). The discounts would exhibit strong shorter-term trend following and longer-term mean-reverting properties. The behavioral market hypothesis would argue that markets exhibit irrational price movements based on investor sentiment. This implies that the A-share and B-share market are not co-integrated (or tightly coupled) in response to news, or that sentiment affects the price of the A-shares relative to those of the B-shares.

The behavioral hypothesis implies that changes in the discounts should not follow a random walk, and exhibit periods of positive followed by periods of negative drift (and the opposite) depending on market sentiment. Shiller (1981) argued that excess volatility in stock prices could be indicative of fads and overreaction to changes in fundamentals. In Shiller (1984) argued that irrational trading would make stock prices excessively volatile that would result in short-term fads. Shiller and Perron (1985) showed that increasing the time span of the tests increases their efficiency. Shiller (1981) also argued that psychological biases influence stock investors. Fads and the opinions of others will affect stock prices. Smart money does not have enough wealth to eliminate the fads in the short run.

Does the empirical evidence back up these claims? For example, following on from Zweg (1973) that closed-end equity funds typically trade at discounts to their net asset values, Lee, Shleifer and Thaler (1991) argued that these discounts could be interpreted as measures of irrational investor sentiment. Discounts across closed-end funds exhibit

significant co-movement and co-move with the returns on small stocks. Baker and Wurgler (2007) showed that their “sentiment index” is highly correlated with aggregate stock market returns.

At times, the A-shares will have much higher volume than the B-shares and this volume will affect the B-share discount. Miller (1977) argued that differences in opinion among investors and constraints on short selling would lead to over-optimistic stock prices. Harrison and Kreps (1978) made similar arguments in a dynamic setting and showed that differences in opinion can lead to speculative bubbles. Actually, Mei, Scheinkman, and Wei (2009), elaborating on the volume hypotheses, provided confirmatory tests using the A-B-share discount for the period prior to 2001.

We found, however, that the returns on the A-shares are insignificantly different from the returns on the B-shares. In addition, the returns on the two classes of shares are highly correlated. The evidence indicates that the small Chinese investor moves between the A and B-share markets such that the returns are insignificantly different from each other. That is, the market is efficient and there appears to be no evidence of investor sentiment. If the discount increases because of investor sentiment, the marginal investor would buy the B-shares. And, conversely, if the discount decreased because of investor sentiment, the marginal investor would buy A-shares. There might be slight mean reversion, negative serial correlation at low frequencies, as investors need time to bring the prices into line. But, there should be no obvious opportunities to make money by trading on the dynamics of the discount.

Fama (1970) emphasized that to test whether prices incorporate relevant information, so that deviations from expected returns are random, it is necessary to have a model of expected returns from which to measure deviations. We are unable generally to separate efficiency (analysis of deviations from the model) from the model’s expected returns. Since the A-shares and B-shares are on the same company, the underlying expected returns are the same, overcoming Fama’s difficulty. Although the B-shares trade at a

discount to the A-shares, the results demonstrate that both classes of shares earn the same returns. We can now look more closely at the market efficiency questions.

To attempt to separate the sentiment hypothesis from the efficient market hypotheses, we used the daily value weighted discounts on the Shanghai Exchange and on the Shenzhen Exchange from May 2001 through December 2011, approximately 2583 trading days. We started in May 2001 because we felt that the change in policy that allowed Chinese citizens to buy B-shares using dollars changed the equilibrium level of the discounts as Chinese investors acquired B-shares from foreign investors and, as the evidence suggests, became the marginal investor setting prices in the B-share market.

Over the entire sample period, the average daily change in the discount was $4.77E-06$ (.00000477) on the Shanghai Exchange and $-1.67E-05$ (.0000167) on the Shenzhen Exchange. There is no evidence of a consistent increase or decrease in the discount over the 10.5-year sample period.

We tested for serial correlation of the daily changes in the discounts over the entire 2583 days and for various sub periods based on the change in market prices of the Shanghai index – large up markets or large down markets to test the fad hypothesis. If the serial correlation of changes in the discount showed high positive correlation, this would support the behavioral-sentiment hypothesis. If the number of runs in changes in the discounts were larger than expected, this also would support the behavioral hypothesis. The advantage of using runs tests is that they are distribution free.

If, on the other hand, the serial correlations were low, this would indicate that the efficient market model was more likely to prevail. Thus, the marginal investors would move randomly between the A and B-shares such that the changes in the discount would be random. They would keep the market in line quickly. Larger investors might move the A-share market prices but B-shares follow quickly. Thus, most likely both the changes in the A-shares and B-shares are random or efficient.

Table 3**Serial Correlation Tests of Daily Equally-Weighted Changes of the B-share Discount on the Shanghai and Shenzhen Markets**

Dates	Serial Correlation	Shanghai	Shenzhen
05/2001-12/2011	C lag 1	0.224	0.176
	C lag 2	0.038	0.033
05/2001-04/2006	C lag 1	0.079	0.108
	C lag 2	0.002	-0.078
05/2006--07/2007	C lag 1	0.348	0.246
	C lag 2	0.060	0.155
08/2007-08/2010	C lag 1	0.170	0.183
	C lag 2	0.044	0.039
09/2010-12/2011	C lag 1	0.238	0.231
	C lag 2	0.060	0.108
01/2001-04/2001	C lag 1	0.145	0.119
	C lag 2	-0.075	-0.030

In Table 3, we show the first and second order serial correlations over the entire period and various sub periods. For example, the first order serial correlation (C lag 1) of the change in the discounts is .224 for the entire sample period, May 2001 through December 2011. The second order serial correlation (C lag 2) (a two-day lag of the changes in the discount) drops to .038 for the entire sample period. Each of the subsamples displays low serial correlation for each lag of 2 regardless in the change in the Shanghai index during the sub-period. This is evidence against the larger institutional investors bidding up prices of A-shares relative to those of B-shares.

Notice that the first order serial correlation is greater in each case than the lagged second-order correlation. There is fast decay in persistence or runs at lag 2 (and subsequent lags not reported in Table 3). This first order serial correlation is to be expected in economic

time series when the end-of-day stock prices of the A-share or the B-shares samples are not lined up exactly. All A-shares and B-shares don't all stop trading at exactly the same time at the end of the day. If some of the shares trade earlier in the day but not at the end of the day, their reported end-of-day prices are stale relative to their A- or B-share counterparts that do trade at the end of the day. They catch up with the first trades of the following day. That is, if other shares had traded up the day before, it is more probable that the shares that did not trade at the end of day will open up the next day. This, however, induces positive serial correlation into the time series. No one, however, can make money on knowing the reported serial correlations in the table. If they were to attempt to trade, the prices would change.

Notice, however, how quickly this effect disappears. By the second day the changes in the discounts are random. This randomness tends to support the clientele hypothesis that the marginal investors are Chinese investors who move quickly between A and B-shares to bring prices into line. There is no information in the previous discount that will indicate changes in the subsequent economic discounts over this sample period.

In Table 4, we observe the same results for the value-weighted discount changes. Although the first order serial correlation tests show positive serial correlations, the second order tests show complete randomness. This is an indication that neither smaller stocks (dominating the equal-weighted index) nor larger stocks (dominating the value-weighted index) exhibit sentiment or fads over this long time frame.

Table 4**Serial Correlation Tests of Daily Value-Weighted Changes of the B-share Discount on the Shanghai and Shenzhen Markets**

Dates	Serial Correlation	Shanghai	Shenzhen
05/2001-12/2011	C lag 1	0.20	0.11
	C lag 2	0.00	0.01
05/2001-04/2006	C lag 1	0.14	0.10
	C lag 2	-0.01	-0.07
05/2006-07/2007	C lag 1	0.23	0.11
	C lag 2	-0.01	0.06
08/2007-08/2010	C lag 1	0.19	0.12
	C lag 2	0.05	0.01
09/2010-12/2011	C lag 1	0.25	0.09
	C lag 2	0.05	0.06
01/2001-04/2001	C lag 1	0.16	0.09
	C lag 2	-0.07	-0.01

In Table 5, we show the results for runs tests on changes in the discount for different differencing intervals from 2 days to 30 days.¹⁰ The upper panel displays the results for the Shenzhen market; the lower panel shows the results for the Shanghai market. In addition, for both markets, we show the standard deviation of changes in the discount for

¹⁰ We computed the change in the discount for each of the differencing intervals, e.g. a two day change is the change in the discount over two trading days. The expected number of runs is $(1 + 2 * N_0 * N_1) / N$ where N_0 is the number of negative changes and N_1 is the number of positive changes in the discount for each differencing interval. N is the total number of changes in the sample. The variance of the runs is $(2 * N) * N_1 * (2 * N_0 * N_1 - N) / (N * N / (N - 1))$. The t-statistic is equal to the actual runs minus the expected runs divided by the square root of the variance of the runs.

different differencing intervals from 2 days to 30 days and the standard deviation per day below the actual standard deviation.¹¹

Table 5
Run Tests and Period Standard Deviations of Changes in the Equally-Weighted Discounts on the Shenzhen and the Shanghai Markets using Daily Changes in the Discount from 2001-05-08 through 2011-12-31

Panel A: Runs Tests and Standard Deviation							
for Shenzhen Market							
	2 days	5 days	10 days	15 days	20 days	25 days	30 days
Runs Achieved	597	239	125	83	73	57	41
N ₀	627	259	128	84	65	49	43
N ₁	666	258	130	88	64	54	43
N	1293	517	258	172	129	103	86
Ex(runs)	645.91	258.50	129.00	85.96	64.50	51.39	43.01
Var(runs)	322.41	129.00	64.24	42.70	31.99	25.38	21.25
t-stat	-2.72**	-1.72	-0.50	-0.45	1.50	1.11	-0.44
STDEV	0.0094	0.0169	0.0233	0.0318	0.0310	0.0368	0.0368
SD/day	0.0067	0.0076	0.0074	0.0082	0.0069	0.0074	0.0067

Panel B: Runs Tests and Standard Deviation for							
Shanghai Market							
	2 days	5 days	10 days	15 days	20 days	25 days	30 days
Runs Achieved	579	249	139	91	63	44	41
N ₀	612	246	124	85	58	45	42
N ₁	681	271	134	87	71	58	44
N	1293	517	258	172	129	103	86
Ex(runs)	644.66	257.90	128.81	85.99	63.85	50.69	42.99
Var(runs)	321.16	128.40	64.06	42.74	31.35	24.68	21.22
t-stat	-3.66**	-0.79	1.27	0.77	-0.15	-1.35	-0.43
STDEV	0.0115	0.0209	0.0249	0.0377	0.0344	0.0381	0.0436
StDev Per Day	0.0081	0.0093	0.0079	0.0097	0.0077	0.0076	0.0080

¹¹ We computed the standard deviation of the changes in the discount for each differencing interval. The per-day standard deviation is the interval standard deviation divided by the square root of the number of days in the differencing interval.

The t-statistics of the runs tests are significantly negative for 2 days on both exchanges. And, they are insignificant for days of length 5 and beyond. It seems that there are two few runs for two day changes. We find reversals are more frequent than momentum (sentiment) would imply. The A-share market does not seem to go up with the B-share market lagging, or vice versa. There is no evidence in the runs tests of investors bidding up the A-shares ahead of the B-shares. On the contrary, the evidence supports the view that if A-shares increase (and, as a result, the discount increases) the best estimate is that the B-shares will increase quickly (reducing the discount). These results support the marginal investor hypothesis, which claims that they make the A and B-share markets efficient by keeping the discounts in line. Only unanticipated factors change the level of the discount. There is no evidence of runs at longer differencing intervals or over the long time period.

In each panel of Table 5, the standard deviation of the changes in the discount increases with increases in the differencing interval. Following Jagannathan et. al. (2002) method of moments methods to test whether the distribution of the underlying changes is independent and identically distributed, we divided each of the interval standard deviations by the square root of the differencing interval to compute the standard deviation per day (StDev per day or SD/day). These are variance bound tests. Notice that the standard deviation per day is relatively unchanged for different differencing intervals. If it were an increasing function of the differencing interval, this would imply positive serial correlation of the changes in the discount. This would support the sentiment hypothesis. We do not find this, however. Like the runs tests, which are distribution free statistics, the variance bound tests support the view that the market is efficient. The marginal investors bring prices into line quickly.

All of the tests support the efficient-market hypothesis. Thus, there appears to be no persistence in the changes in the discounts at any higher lag other than one. This evidence is inconsistent with the view that irrational investors bid up the A-shares relative to the B-shares.

4. Conclusions

The evidence in the paper provides strong support to the efficient market model. It is rare that two classes of stock are traded in the same company that differ only in the currency in which they trade. The A-shares, however, can only be held by Chinese citizens and the B-shares by either foreigners or Chinese citizens. Using monthly returns on the A-shares and B-shares, we found that the return differences are insignificantly different from each other over the 2001-2011 sample period. The B-shares trade far less frequently than the A-shares, and sell at a discount to the A-shares, the more so the lower the market value of the B-shares. We find, however, that there was no liquidity premium return to holding B-shares. We used a novel approach to demonstrate that the marginal investor in the B-shares was the Chinese investor. That is, the returns on the B-shares were significantly related to the returns on the Shanghai Index and not the Hang Seng index implying that investors who invested in the B-share markets were like other Chinese investors dealing in segmented Chinese markets. The responses of the A-share returns were insignificantly different from the B-shares. Since the trading costs and restrictions on converting Yuan into dollars for large investors were high over the sample period, the evidence indicates that the marginal investors in the B-shares were individual Chinese investors while larger institutional investors traded in the A-shares. There were investors at the margin who traded in both markets.

Using the A-shares and the B-shares which exhibited the same returns, we were able to differentiate the predictions of the efficient market model and the behavioral finance models. Using daily data on the changes in the discount over the sample period (equal- and value-weighted) we demonstrated that changes in the discount were random over the entire sample period and during periods of large market movements. There seemed to be no indication that investor sentiment appreciably affected market prices. Moreover, there is no evidence that the heterogeneous expectations of investors as to the cheapness or richness of the A-B-shares affects their share prices differentially.

The clientele hypothesis would suggest that since the B-shares have differential costs to hold (or trade) than the A-shares, they would sell at a discount to the A-shares to offer investors sufficiently higher returns to cover these costs. Given that the returns on the two classes of shares were approximately the same, the discount cannot be explained by differential costs (liquidity or home-country bias) or by investors taking positions in the A-shares because of beliefs causing them to appreciate relative to the A-shares.

While in this paper we concentrated on modeling and testing the return differences and changes in the level of the discount to explain the discount and found that neither liquidity nor home-country biases or any behavioral biases could explain the level of the discount, in a subsequent paper, Zhang (2014) develops and finds strong empirical support for a model that explains the level of the B-share discount.

References

Baker, Malcolm, and Jeffrey Wurgler. 2007. "Investor Sentiment in the Stock Market," *Journal of Economic Perspectives*, vol. 21, no. 2 (Spring), 129–152.

Barberis, Nicholas, and Richard Thaler. 2003. "A Survey of Behavioral Finance," In *Handbook of the Economics of Finance*, vol. 1B. Edited by George M. Constantinides, Milton Harris, and René Stulz. Amsterdam: Elsevier.

Barberis, Nicholas, and Ming Huang. 2008. "Stocks as Lotteries: The Implications of Probability Weighting for Security Prices," *American Economic Review*, vol. 98, no. 5 (December), 2066–2100.

Barberis, Nicholas, and W. Xiong. 2010. "Realization Utility." Working paper, Yale University (July).

Bekaert, G., C. Harvey, and C. Lundblad, 2003. Liquidity and Expected Returns: Lessons from Emerging Markets, Working Paper.

Brennen and Subramanian, 1996, "Market Microstructure and Asset Pricing: On the Compensation for Illiquidity in Stock Returns," *Journal of Financial Economics* 41, 441-464.

Chan, K.A., A.J. Menkveld, and Z. Yang, 2003. Evidence on the Foreign Share Discount Puzzle in China: Liquidity or Information Asymmetry?" Working Paper.

Chan, Louis K. C., Narasimhan Jegadeesh, and Josef Lakonishok, 1996, "Momentum Strategies," *Journal of Finance* 51, 1681-1713.

Chen, J., H. Hong, and J. Stein, 2002. "Breadth of Ownership and Stock Returns," *Journal of Financial Economics* 66, 171-205.

Chen, Zhiwu and Peng Xiong, 2001 "Discounts on Illiquid Stocks: Evidence from China," working paper, Yale School of Management.

Chordia, T., A. Subrahmanyam and V. Anshuman, 2001. "Trading Activity and Expected Stock Returns," *Journal of Financial Economics* 59, 3-32.

Cornell, Bradford, and Richard Roll. 2005. "A Delegated-Agent Asset-Pricing Model," *Financial Analysts Journal*, vol. 61, no. 1 (January/February), 57–69.

Darrat, Ali F, Otis Gilley, Yanhui Wu and Maosen Zhong. 2010. "On the Chinese A-Share Discount Puzzle: Some New Evidence," *Journal of Business Research*, vol. 63, no. 8: (February), 895-902

Eun, C., S. Janakiramanan, and B. Lee, 2001. "The Chinese Discount Puzzle", Working Paper.

Fama, E.F., 1970, "Efficient Capital Markets: A Review of Theory and Empirical Work," *Journal of Finance*, 25, 383-417.

Fernald, J. and J. Rogers, 2002. "Puzzles in the Chinese Stock Market," *Review of Economics and Statistics* 84, 416-432.

French, Kenneth, and James Poterba, 1991. "Investor Diversification and International Equity Markets," *American Economic Review* 81 (2), 222-226.

Gao, S., 2002. "China Stock Market in a Global Perspective," Research Report, Dow Jones. Greene, W., 2002. *Econometric Analysis*, Prentice Hall.

Grundy, B., and J. Spencer Martin, 2001, "Understanding the nature of the risks and the source of the rewards to momentum investing," *Review of Financial Studies* 14, 29-78.

Harrison, J.M. and D.M. Kreps (1979), "Speculative Investor Behavior in a Stock Market with Heterogeneous Expectations," *Quarterly Journal of Economics* 92, 323-336.

Hietala, P., 1989. "Asset Pricing in Partially Segmented Markets: Evidence from the Finnish Market," *Journal of Finance* 44, 697-718.

Hong, H., J. Scheinkman, and W. Xiong, 2004. "Asset Float and Speculative Bubbles," *Journal of Finance*, forthcoming.

Ibbotson, Roger G., Wendy Y. Hu, and Zhiwu Chen, "Liquidity Strategies in U.S., Global, and International Markets," Yale Working Paper, April 2011.

Jagannatham, R., G. Skoulakis, and Z. Wang (2002), "Generalized Method of Moments: Applications to Finance," *Journal of Business and Economic Statistics* 20, 470-481.

Karolyi, A. and L. Li, 2003. "A Resolution of the Chinese Discount Puzzle," Working Paper.

- Kim, K and J. Mei, 2001. "What Makes the Stock Market Jump? — An Analysis of Political Risk on the Hong Kong Stock Returns," *Journal of International Money and Finance*, 1003-1016.
- Kumar, Alok. 2009. "Who Gambles in the Stock Market?" *Journal of Finance*, vol. 64, no. 4 (August), 1889–1933.
- Lee, C.M.C., A. Shleifer and R.H. Thaler (1991), "Investor Sentiment and the Closed-End Fund Puzzle," *Journal of Finance* 46, 75-109.
- Lo, A. and J. Wang, 2000. "Trading Volume: Definitions, Data Analysis, and Implications of Portfolio Theory," *Review of Financial Studies* 13, 257-300.
- Mei, Jianping, Jose Scheinkman, and Wei Xiong, "Speculative Trading and Stock Prices: Evidence from Chinese A-B-share Premia," *Annals of Economics and Finance*, 10-2, (2009), 225-255.
- Miller, E. (1977), "Risk, Uncertainty, and Differences of Opinion," *Journal of Monetary Economics* 15, 145-161.
- Obsfeld, Maurice and Kenneth Rogoff (2000). "The Six Major Puzzles in International Macroeconomics: Is There a Common Cause?" In Bernanke, Ben; Rogoff, Kenneth. *NBER Macroeconomics Annual 2000*. 15. The MIT Press, 339–390.
- Pastor, Lubos, and Robert Stambaugh, 2003, "Liquidity risk and expected stock returns," *Journal of Political Economy* 111, 642-685.
- Scheinkman, J. and W. Xiong, 2003. "Overconfidence and Speculative Bubbles," *Journal of Political Economy* 111, 1183-1219.
- Shiller, R.J., 1981, "The Use of Volatility Measures in Assessing Market Efficiency," *Journal of Finance* 36, 291-304.
- Shiller, R.J., 1984, "Stock Prices and Social Dynamics," *Carnegie Rochester Conference Series on Public Policy*, 457-510.
- Shiller, R.J. and P. Perron (1985), "Testing the Random Walk Hypotheses: Power vs. Frequency of Observation," *Economic Letters* 18, 381-386.
- Shleifer, Andrei. 2000. "Inefficient Markets: An Introduction to Behavioral Finance," Oxford, U.K.: Oxford University Press.
- Stulz, R.M. and W. Wasserfallen, 1995. "Foreign Equity Investment Restrictions and Shareholder Wealth Maximization: Theory and Evidence," *Review of Financial Studies*, 1019-1057.

Tenev, S., C. Zhang, and L. Brefort, 2002. "Corporate Governance and Enterprise Reform in China," The World Bank and the International Finance Corporation.

Van Nieuwerburgh, Stijn; Veldkamp, Laura, 2005, "Information Immobility and the Home Bias Puzzle," *NYU Working Paper FIN-04-026*.

Zweig, M.E. (1973), "An Investor Expectations Stock Price Predictive Model Using Closed-End Fund Premiums," *Journal of Finance*, 28, 67-78.

Zhang, S, 2014, "Understanding the Dynamics of Chinese A-B-Share Discount. Unpublished Working Paper, Nanjing University.