YALE
INTERNATIONAL
CENTER
FOR FINANCE

Yale ICF Working Paper No. 00-56
September 2001

DISCOUNTS ON ILLIQUID STOCKS: EVIDENCE FROM CHINA

Zhiwu Chen
Yale School of Management
Peng Xiong
Beijing University

Discounts on Illiquid Stocks: Evidence from China

By **Zhiwu Chen** and **Peng Xiong**[1]

September 2001

ABSTRACT

This paper provides evidence on the significant impact of illiquidity or non-marketability on security valuation. A typical listed company in China has several types of share outstanding: (i) common shares that are only tradable on stock exchanges, (ii) restricted institutional shares (RIS) that are not tradable and can only be transferred privately or through irregularly scheduled auctions, and (iii) state shares that are only transferable privately. These types of share are identical in every aspect, except that market regulations make state and RIS shares almost totally illiquid. Our analysis focuses on the price differences between RIS and common shares of the same company, using both auction and private-transfer transactions for RIS shares. Among our findings, the average discount for RIS shares relative to their floating counterpart is 77.93% and 85.59%, respectively based on auction and private transfers. The price for illiquidity is thus high, significantly raising the cost of equity capital. This illiquidity discount increases with both the floating shares' volatility and the firm's debt/equity ratio, but decreases with firm size, return on equity, and book/price and earnings/price ratios (based on the floating share price). However, RIS share price can either increase or decrease with the quantity being transacted, depending on whether it is through a private placement or an auction.

[1] Zhiwu Chen is Professor of Finance at the Yale School of Management, 135 Prospect Street, New Haven, CT 06520, U.S.A., (203) 432-5948 and zhiwu.chen@yale.edu, and Peng Xiong is a graduate student at the China Center for Economic Research (CCER), Beijing University, Beijing, China, (86) 10-6276-4182 and e-xp@263.net. We would like to thank Shanghai International Auctions Inc. for providing the Restricted Institutional Shares auction data, and Shenzhen GTA Information Technologies Inc. for providing the fundamental and price data for common shares of Chinese companies.

Introduction

Recent episodes of hedge fund failures have highlighted the economic significance of illiquidity and non-marketability on security valuation.[2] In these cases, the fund managers had to unwind positions in securities for which there was just no market or only limited quantities could be traded at best. While these high-profile cases have brought the importance of liquidity to the spotlight, the magnitude of the price for illiquidity is still not clear. How large can the discount be for a non-marketable or highly illiquid security?

In asset pricing theory, Longstaff (1995a, 1995b, 2001) has developed valuation models for illiquid securities, where illiquidity exists in the form of limits on the number of shares that can be traded. Among his results, the price discount for such an asset relative to its liquid counterpart can be as high as 90%, depending on the volatility of the liquid asset price. Amihud and Mendelson (1986) and Vayanos and Vila (1999) model illiquidity in the form of search, negotiation and transaction costs, and they find that the price discount for an illiquid asset is equal to the total present value of all current and future search and trading costs.[3] Their finding implies that the illiquidity discount must be increasing in both the rebalancing frequency of the illiquid asset and the costs.

To quantify the impact of illiquidity, one would ideally like to compare market prices for pairs of securities that are identical in every aspect, except that one is liquid and the other is not. In the existing literature, Silber (1991) shows that Rule 144 letter stocks with a two-year no-trading restriction have an average price discount of 35% relative to the freely traded, otherwise identical, common shares of the same company.[4] On the bond market side, Amihud and Mendelson (1991) and Kamara (1994) document that the average yield spread between illiquid Treasury notes and liquid Treasury bills of the

[2] Long Term Capital Management, D.E. Shaw, Ellington Capital Management, and Askin Capital Management are among the high-profile examples.
[3] With a few exceptions [e.g., Longstaff's (1995a, 1995b, 2000)], most valuation models for illiquid assets assume that illiquidity exists in the form of search and trading costs, or in the form of wide bid-ask spreads. See, for example, Duffie, Garleanu, and Pedersen (2000), Huang (2001),
[4] Other studies on price differences between identical or similar equity securities include Dimson and Hanke (2000), Goetzamann and Spiegel (2001), and Wruck (1989).

same maturity is more than 35 basis points. According to Boudoukh and Whitelaw (1991), the yield spread is more than 50 basis points between designated benchmark government bond and similar but less liquid government bonds in Japan.

In this paper, we document and analyze the price discounts for illiquid, non-publicly tradable stocks in China. Given that China started its stock market at the end of 1990 and is still in a gradual transition to a market economy, there are many regulatory rules that are shadows of the planned-economy days, including trading restrictions on certain stocks. These rules create a separation of otherwise identical shares into multiple classes: some liquid and others illiquid. Thus, China's stock market offers a unique laboratory for discovering the impact of illiquidity and non-marketability on security prices.

For a typical listed company in China, there are four major types of share outstanding: state shares (about 37% of the total), restricted institutional shares (RIS, 28%), and common A- and B-shares (35%).[5] Regardless of share type, its holder is entitled to the same cashflow and voting rights per-share. But, the method of exchange differs among the share types. Floating A-shares are freely tradable on the stock exchanges, except that they cannot be sold short. But, state and RIS shares cannot be traded publicly, and they can only be held by corporate or legal-entity institutions.[6] Officially, ownership transfer in state and RIS shares has to be done privately. However, as a practical matter, when there is no formal market for exchanging these shares, holders often find it impossible to find a buyer in a timely manner, let alone obtaining a fair price. As a compromise, there have been irregularly scheduled auctions in RIS shares since August 2000. Therefore, today there are two transfer methods for RIS shares: private placement and auction.

[5] Until recently, B-shares were only tradable by foreign investors in either U.S. or Hong Kong dollars, while A-shares are for domestic investors only. But, out of more than 1,100 listed companies, about 110 firms have B-shares traded. The B-share market is thus relatively small. See Bailey (1994) and others for the relative price behavior between A- and B-shares in China. The allocation of ownership across share types is obtained from the 1999 data published on the China Securities Regulatory Commission's website: www.CSRC.gov.cn.

[6] Strictly speaking, the RIS shares can only be held by corporate entities. But, this rule is inconsequential because an individual can easily form his own asset management firm and participate as an institutional investor.

Our study uses two sets of RIS transaction data from the period of August 2000 to July 2001: (i) 2,577 auction transactions and (ii) 242 private transfers. At the time of each such transaction, its floating A-share counterpart was traded either on the Shanghai Stock Exchange (SHSE) or the Shenzhen Stock Exchange (SZSE). We define the price discount for an RIS share relative to its contemporaneous floating A-share's market price. The higher the discount, the higher the impact of illiquidity on security prices. Our findings can be summarized below:

- The average discount for RIS shares is 77.93% based on auctions, and 85.59% based on private transfers. Thus, the price for illiquidity is high. Auctions lead to better prices for RIS shareholders than private transfers, partly due to the better liquidity afforded by auctions. However, the average transaction size in a private transfer is about 150 times that in an auction.
- The larger the firm size, or the higher the return on equity (ROE), or the higher the earnings/price (E/P) and book/price (B/P) ratios based on the floating shares' market price, the lower the RIS price discount. That is, RIS investors prefer larger and more value-oriented firms. The illiquidity discount increases with the firm's debt/equity ratio.
- The more volatile a company's floating share price, the higher its RIS discount. Investors prefer RIS shares issued by firms with less volatile A-shares. This result is consistent with the prediction in Longstaff (2001).
- Based on the auctions, the illiquidity discount varies directly with the RIS share quantity being sold, and inversely with the issuing firm's age since its IPO. But, based on private transfers, the discount decreases with the share quantity being sold and increases with the issuer's age. While buyers in private transfers prefer newer firms, they may also be motivated by the corporate control implications of the large blocks they are buying. The fact that the RIS share price increases with the quantity being transferred indicates a control premium that comes with large blocks.[7]

[7] See, for example, Barclay and Holderness (1989) and Wruck (1989). Block transactions studied in these papers usually carry a significant premium.

The illiquidty discounts observed in China are largely consistent with the model predictions of Amihud and Mendelson (1986), Duffie, Garleanu, and Pedersen (2000), Huang (2001), Longstaff (1995a, 1995b, 2001), and Vayanos and Vila (1999). For example, the search costs for sellers of a small firm's RIS shares must be higher than for a large firm's, and hence the former RIS shares must be discounted more. The auction mechanism must imply lower search costs for both sides, and bring more buyers and sellers, than private placement, and thus the former produces lower price discounts. Floating common and RIS shares come with the same rights, and yet the price difference is so large in magnitude.

Our evidence adds beyond Silber's (1991) findings on restricted stocks. The illiquidity discounts for Chinese RIS shares are more than two times the average discount for U.S. Rule 144 stocks. Furthermore, while Rule 144 stocks are allowed to float after a 2-year lock-up, it is not yet clear when the RIS shares can be traded publicly and freely. Still, given that RIS shares can be auctioned or sold privately, there is slightly more liquidity with the RIS shares than the Rule 144 stocks. It should also be noted that Rule 144 stocks are sold directly by issuers, whereas the RIS transactions studied here are all transfers from one investor to another. This distinction is important because when a firm issues a stock in a private placement, it is more likely to discount the issue for business strategic reasons (whether the issued stock is illiquid or not).[8] The discounts for Rule 144 stocks may thus contain some non-liquidity-related component. In contrast, the discounts for Chinese RIS shares should be more due to illiquidity. In any case, the conclusion from both the U.S. and Chinese evidence is the same: trading rules-induced illiquidity has a large, negative impact on security price.

The rest of the paper is organized as follows. Section I gives a brief overview of China's stock market and RIS share auctions. Section II describes the data and general summary statistics. The focus of Section III is on analyzing the properties of the price discounts. A formal statistical analysis is given in Section IV. Section V discusses implications and explanations of the discounts, and section VI offers concluding remarks.

[8] See Loughran and Ritter (2000) and references therein for studies on the IPO underpricing phenomenon.

I. Overview of China's Stock Market and RIS Share Auctions

In the late 1980's, China converted many state-owned enterprises (SOE) into stock companies. Prior to opening the Shanghai Stock Exchange in December 1990, the government was concerned about the potential loss of state assets if all shares of a restructured SOE were to be freely traded. As a concession, the ownership of each firm is split into (i) state shares, (ii) RIS shares and (iii) common A- and B-shares, with the restriction that no state or RIS shares would ever be floated. Regardless of share type, the holder of each share is entitled to the same cashflow and voting rights. Even today, when a stock company is formed as a new venture, shares allocated to founding corporate investors are automatically RIS shares and cannot be traded publicly. This clearly discourages participation in new ventures by institutions.

When China's stock market started in the early 1990's, all the firms that went public were large restructured SOEs. That is still the predominant background for public companies today, except that since 1999 several firms that did not have an SOE background have gone public. This short history is also responsible for the fact that the state remains the largest shareholder in a typical public company (owning an average of 37%). As of April 30, 2001, the SHSE had 597 companies listed, while the Shenzhen Stock Exchange had 511 companies. With both exchanges combined, the total market capitalization of the 1108 companies was over 5 trillion yuan (about $606 billion).

The trading restriction or illiquidity for RIS shares was not a problem in the early 1990's. In 1998, there were court cases in which the plaintiff sued the defendant corporations for over-due debt. The disputes occurred not because the defendant did not have assets to pay, but because the defendant's assets were illiquid RIS shares of public and private companies. To resolve such disputes, a judge in December 1998 ordered a defendant to have its RIS shares sold in an auction, which set a precedent and marked the beginning of a price-discovery mechanism for these illiquid shares. In early 2000, the China Securities Regulatory Commission (CSRC) introduced policy initiatives that hinted at the

possibility of eventually lifting the trading restriction on RIS shares, which prompted many individual and corporate investors to become immediately interested in participating in the auctions of RIS shares. Since August 2000, there have been irregularly scheduled auctions on RIS shares, usually in evenings or over weekends. Today, there are about 35 auction houses doing business in RIS shares.

II. Data and Summary Statistics

Several data sets are used in our study. First, the RIS auction transaction data is provided to us by Shanghai International Auction Company. It covers 2,577 transactions on 18 auction houses from August 2000 to July 2001, with a total transaction value of 1.527 billion yuan. Included in these auctions are 258 unique public companies. Second, the 242 private transfers are hand-collected from the corporate announcement archives of www.tsing.com. To ensure consistency, we have collected all private-transfer transactions only for the period from August 2000 to July 2001. A total of 138 public firms is included in the private transfers, with a total value of 13.08 billion yuan. Finally, accounting and financial data for the public companies, as well as daily closing prices for floating A-shares, is also from www.tsing.com.

A. Overall Picture

Table I shows a month-by-month summary of RIS share transactions, where the price discount, D_t , is calculated as

$$D_t = (P_t - p_t)/ P_t$$

with P_t being the recent A-share market price and p_t the RIS share transaction price. In Table I, auctions have increased steadily from August 2000 forward and reached a peak in May 2001 in terms of the number of stocks participating, number of transactions, and total transaction value. The price discount was initially low (68.46%) in August 2000 and high (82.16%) by the end of 2000, after which it has declined as the auction activities

have increased further. In contrast, private-transfer transactions have not shown a clear pattern in terms of both volume and price discount. Thus, private transfers are relatively insensitive to the on-going debate on whether to lift the RIS trading restriction.

Panel A of Table II displays overall summary statistics for the auction sample. First, the average price discount is 77.93%, namely, the average RIS auction price is about one fifth of the floating A-share price of the same company. The highest, median and lowest discounts are 97.22%, 78.90% and 36.98%, respectively, with a standard deviation of 6.65%. Thus, the price for illquidity varies substantially across both transactions and firms. We will return to explaining such variations shortly.

This average discount of 77.93% means that if there were two firms, X and Y, that are identical in every aspect except that X is publicly traded but Y is private, then Y would be valued at 22.17% of X's worth. Non-marketability indeed comes with a large price.

Among the auctions, the average transaction size is 621,881 yuan or 204,169 shares, with the largest being 12 million shares and the smallest auction being 5,000 shares. The average ROE is 8.12%, with an average book value of equity of 894 million yuan. Based on RIS auction prices, the average book/price (B/P) and earnings/price (E/P) are respectively 0.76 and 0.04. But, based on the floating A-share prices, the respective averages are 0.16 and 0.01 for B/P and E/P. In other words, the floating share's P/E and price/book are about 100 and 6.25 respectively, while the RIS share's are 25 and 1.32 based on the auctions.[9] Thus, the common A-shares are highly overpriced and the RIS auction prices are more reasonable.

Panel B of Table II gives summary statistics for the private transfers. Based on this mechanism, the average discount for RIS shares is 85.59% and hence the per-share price is even lower than obtained in auctions. The maximum, median and minimum discounts

[9] Note that in computing its average, we exclude observations with an E/P below –0.10 but allow other negative E/P observations, which lowers the average E/P, resulting in a higher average P/E than usual. The conventionally quoted P/E ratios often exclude cases with negative earnings.

are respectively higher than from the auctions. Private placement thus does not give investors the most value for their RIS holdings.

However, the average private-transfer size is 76.34 million yuan, or 31.80 million shares, about 155 times larger than the average transaction size in the auctions. Therefore, the higher discount in private placements may be caused by both the much larger blocks being transferred and the intrinsic lower liquidity of private placement. We will see shortly that large RIS share blocks actually carry a control premium, implying that the higher discount in Panel B of Table II must be due to the lower liquidity of the private-transfer method and other factors.

As private-transfer prices are lower than auction prices, the average private-transfer based B/P is 1.16, higher than the auction based B/P. This is true even though the average floating-share B/P is lower for the private-transfer sample than for the auction sample (see the two panels in Table II). In fact, the floating share's E/P and ROE are also lower among the companies in the private transfers than in the auctions. This suggests that the firms in the private-transfer sample are on average less profitable and also smaller in size (see the Book Value column in the two panels).[10]

In summary, auctions seem to favor larger and more profitable firms and yield better prices for RIS shares, while private placement may be more suited for large share blocks of smaller and less profitable firms. Auctions attract more participants (hence yielding better prices), facilitate faster transactions and allow for more direct competition, whereas private placement is a slow process with inefficient price discovery and imperfect competition.

B. Local Bias in Auctions

[10] Note that because of the difficulty in finding a proper price for RIS and state shares, it is hard to calculate the total market capitalization of public companies in China. Therefore, the only alternative for measuring a firm's size is to use either its total book value or its total revenue, both of which are applied in the present paper.

All auctions in our sample took place in Shanghai. Even for private transfers, corporate entities located in Shanghai tend to be the most active in acquiring stakes in other firms. One question is then: do auction participants have a bias favoring the RIS shares of local Shanghai firms?

To answer this question, we divide the RIS share firms into groups according to the province/city where the firm is headquartered. For example, a firm headquartered in Shanghai is considered a "Shanghai firm". Then, we take the average, median and standard deviation of the RIS price discounts for all Shanghai firms. Apply this step to other characteristics for the same geographic location. Table III reports several key statistics for the five provinces/cities whose firms together have the most transactions.

From Panel A of Table III, RIS shares of Shanghai firms are auctioned the most frequently (with a total of 519 transactions involving 65 stocks), followed by Guangdong firms, Hubei, and so on. According to the average and median price discounts, Shanghai RIS shares have the best auction prices (with an average discount of 73.31%), followed by Sichuan stocks, Hubei and Guangdong. Except for Guangdong, the median floating A-share E/P ratio is similar across Shanghai and the provinces.

Since most auction participants are Shanghai locals, the fact that Shanghai RIS shares have the most transactions and the lowest discount may simply reflect a strong local bias in investment behavior. This bias is a global phenomenon, consistent with the U.S. evidence documented in Coval and Moskowitz (1999) and Hubermann (2001), and the Finnish evidence in Grinblatt and Keloharju (2001). This bias may be more severe in China for corporate governance reasons. Like in other emerging markets, information disclosure requirements and enforcement, and auditing strictness are still in need of crucial improvement in China. Furthermore, corporate governance is also behind accepted international standards. As such, investing with the familiar or with the locals becomes a natural style.

In contrast with the auctions, the private-transfer sample does not have as strong a Shanghai concentration or bias. In Panel B of Table III, Guangdong province has the most private transfers, followed by Shanghai and Sichuan. Still, the private-transfer prices for Shanghai RIS shares are the highest (with the lowest discount), followed by Hubei. It should be noted that the private-transfer sample is much smaller than the auction sample, and in particular each province/city has no more than 20 observations (except for Guangdong). The statistics in Panel B are each based on a rather small sample.

A possible explanation for the persistently favorable treatment of Shanghai stocks is that Shanghai is the most developed region in China and the heart of the Chinese economy. Consequently, it has disproportionally more favorable business opportunities, with a concentration of financial firms, financial media, and high-spending consumers.[11] Its firms are more extensively covered by the media, resulting in better information dissemination and better awareness among investors. Relative to businesses in other regions, Shanghai firms may thus enjoy more advantageous growth opportunities and information disclosure. Consequently, their stocks receive a premium.

[11] China has practiced a "Special Economic Zone" policy for many years, which means special fiscal favors and special resource allocations via administrative channels. Such unequal treatment of regions clearly creates distortions and unequal economic opportunities for Shanghai versus other regions.

III: Company Characteristics and Illiquidity Discounts

To understand the illiquidity discount, we turn to analyzing its relationship with several firm-specific variables. We focus on valuation metrics of the firm's floating A-shares (B/P and E/P ratios), operating and financial measures (ROE and debt/equity ratio), viability characteristics (volatility, size and age since IPO), and ownership and transaction metrics (ratio of RIS to total shares and transaction quantity). Panel A of Table IV shows the correlations among these variables for the auction sample, while Panel B for the private transfers.

As a quick observation, note that in Table IV, the auctions-based price discount is the most strongly correlated with the RIS issuer's book value (firm size) and, in decreasing order, B/P (of the floating shares), E/P, age since IPO, transaction quantity, RIS/total shares ratio, ROE, A-share volatility, and debt/equity ratio. The illiquidity discount varies positively with debt/equity, transaction quantity, RIS/total shares, and volatility. Thus, RIS shares of companies with volatile A-shares, high debt/equity ratio or high RIS/total shares ratio are discounted more. The price for illiquidity varies negatively with firm size, B/P, E/P, ROE and age. RIS shares of large, mature and "value" firms are favored more by bidders. Here, note that firm size and B/P have a correlation of 0.70, while E/P has a correlation of 0.33 with both B/P and firm size. Debt/equity has a –0.95 correlation with ROE. Therefore, firm size and debt/equity seem to be redundant variables and are dropped from our analysis to follow.

For the private-transfer sample in Panel B of Table IV, the general conclusion is similar to Panel A, with a few interesting differences. First, the correlation between the price discount and B/P is –0.67 from the private transfers, and –0.44 from the auction prices. Furthermore, in Panel B the price discount is far more correlated with B/P and firm size than with any other variable, whereas in the auctions the discount is also the most correlated with B/P and firm size, but the correlations with these two are only slightly higher than with the next variable (E/P). A possible reason is that in private transfers buyers of RIS shares tend to peg their offer to the book value per share.

Second, in private transfers the price discount varies negatively with transaction quantity and positively with age, just the opposite of what is true in auctions. As noted earlier, the private-transfer transactions are mostly large blocks and the buyers are likely motivated by corporate control factors. The fact that in such transactions the larger the share block, the higher the per-share price implies a control premium for large blocks. It also means that private placement may be a better mechanism for large blocks than auction. When driven with control motives, buyers seem to prefer RIS shares of newer public firms.

Finally, purchasers in private placements are more sensitive to debt/equity and volatility than auction participants. The correlations between price discount and these two variables are respectively higher in Panel B than in Panel A. We will further discuss this shortly.

A: Constructing Quintiles Based on Characteristics

To compare the two methods of RIS share exchange and illustrate more clearly the relationship between these variables and illiquidity discount, we can also divide a given sample into quintile groups separately according to each of the variables. First, over the August 2000 to July 2001 period, some popular RIS stocks were repeatedly auctioned, sometimes on several auction houses on the same day, while other RIS stocks were auctioned only once or a few times. To reduce the impact of the popular stocks, we only focus on the auctions that took place in April, May and June 2001, for all auctions-based results in Tables IV and V. However, since the total number of private transfers is 242, we use the entire private-transfer sample for these tables.

Second, for each firm in the April 2001 sample, we obtain the average price discount based on all April auctions in the firm's RIS shares. We record this average as the firm's April price discount. Then, we repeat this step for May and June 2001 to get the firm's May and June price discounts, respectively, if its RIS shares were auctioned in one or both months. We apply these steps to all firms in the auction sample, to obtain a pooled collection of the monthly average discounts for all the firms and for the three months. In

effect, any given firm and its RIS price discount can appear at most three times in this final collection. For the private-transfer sample, there is no need to apply this averaging.

Third, to explain how the quintiles are obtained, take B/P ratio and the pooled auction sample as an example. We divide the pooled monthly observations (from the above steps) into quintiles according to each firm's B/P (where P is the price of the firm's floating A-shares). B/P quintile 1 (Q1) has all the RIS firms with the lowest B/P, while B/P quintile 5 (Q5) has all the firms with the highest B/P. Similarly, we use the floating A-share's B/P to divide the private-transfer sample into five quintiles.

Finally, we compute the average, median and standard deviation of the price discounts in each quintile, and report the results in Table V. We implement the same procedure separately according to each variable, except for "age since IPO." In that case, we divide the auction and the private-transfer samples into three groups: the young group has all the firms with no more than 2 years since IPO, the middle group with between 2 and 7 years, and the mature group with more than 7 years since IPO.

B: Valuation Ratios and Illiquidity Discounts

Let's begin with B/P of a firm's floating common share. In Panel A of Table V and based on the auction sample, the average price discount is 80.30% for the lowest B/P quintile and 72.16% for the highest B/P quintile: the spread between the two groups is a statistically significant 8.15% (with a t-statistic of 5.70 and p-value of 0). Thus, RIS shares of companies with high floating-share B/P (hence, value stocks) receive higher bids than those of "glamour" companies.

Recall that the publicly traded shares have an average P/E of about 100 and a price/book of 6.25, and that investors in the public market are mostly individuals.[12] The common

[12] As of July 2001, there were over 60 million stock accounts in China, about 5% of the entire population. Most investors trade speculatively. In 2000, the annual turnover rate was 477.19% on the Shanghai Stock Exchange and the Shenzhen Stock Exchange combined. These market statistics are obtainable from the China Securities Regulatory Commission's website: www.CSRC.gov.cn.

shares have a large "bubble" component, of which we will give a more detailed explanation shortly. Even given the apparent overvaluation of common shares, participants in the RIS auctions can still differentiate between "value" and "glamour" in submitting bids, suggesting more rationality among auction participants, perhaps because most of them are finance and investment professionals.

From the private-transfer sample, the average price discount is 91.74% for the low B/P and 78.43% for the high B/P quintile group. Thus, the spread is 13.31% (with a t-statistic of 10.94 and p-value of zero), whereas it is 8.14% for the auction sample. This means the private-transfer price is more sensitive to the B/P of a company's floating A-shares than the same RIS stock's auction price. A possible reason is that participants in RIS private transfers pay more attention to the target firm's book value than in auctions.

E/P (based on floating A-share price) is another popular measure of a stock's valuation. The higher the E/P, the more favorably valued the stock. In Panel B of Table V, RIS price discount is monotonically decreasing in E/P for the auction sample, but not for the private-transfer sample. The spread between low and high E/P quintiles is 7.57% for the former and 3.77% for the latter sample. Thus, auction bidders care more about the target firm's earnings than corporate purchasers in private transfers.

In summary, auction prices for RIS shares are almost equally related to a firm's floating-share B/P and E/P. But, private-transfer prices are far more explainable by the firm's book value than by its net profits. The exact reason for this asymmetry is not known, but it indicates some separation between the two methods of ownership transfer, let alone the fact that they are both in turn separated from the floating A-share market. While not shown in Table V, since both book value and revenue are highly positively correlated with B/P and E/P (Table IV), the price discount varies inversely with the firm's total book value and revenue, that is, the larger the firm, the higher its RIS share price, based on both the auction and private-placement samples.

C: Operating Performance, Risk and Illiquidity Discounts

Since both auction and private-transfer transactions are large relative to A-share trades on the exchanges, investors should be expected to prefer the RIS shares of firms with better economic performance. In particular, regardless of the ownership transfer mechanism, the price discounts should be decreasing in a firm's ROE.

Panel C of Table V displays the price discount statistics for ROE quintiles. The relationship between ROE and illiquidity discount is not monotone, based on either sample. Furthermore, from the auctions, the discount spread between low (Q1) and high ROE quintiles is 2.90% (with a t-statistic of 2.21 and a p-value of 0.03), and it is –4.55% (a t-statistic of –2.60) based on the private transfers. Therefore, the auctions seem to reward firms with high ROE, whereas the private transfers favor firms with low ROE, suggesting again that different rationale may be applied between auction and private-transfer investors. A possible explanation is that there is a high degree of asymmetric information between the two groups of participants, with the latter group possessing better information.[13]

Volatility or risk is another metric of a firm's quality and viability. It reflects not only projections of the firm's future, but also the effectiveness and possible truthfulness of its management. We use the three years of the floating A-share's daily returns prior to an RIS transaction, to compute the standard deviation or volatility of the firm. Then, all the firms in a given sample are divided into the volatility quintiles.

For both auction and private-transfer transactions, the resulting RIS discount varies negatively with the issuer's volatility, which is as expected. In Panel D of Table V, the discount spread between low and high volatility quintiles is –2.5% (with a t-statistic of –1.82 and a p-value of 0.08) for the auction sample, and –1.56% (with a t-statistic of –0.10

[13] Based on our conversations, executives of firms who have been active in purchasing RIS shares through private placement often indicate that they do not pay attention to ROE and earnings numbers simply because they don't trust these numbers. They are instead more interested in acquiring the "shell" of a public company and in the corporate control aspect of such purchases.

and p-value of 0.91) for private transfers. Therefore, statistically the relationship between volatility and illiquidity discount is not significant, which is against the predictions in Longstaff (2001).

In a competitive market environment, the viability of a business can be partly measured by how long the business has been operating or publicly traded. In China, competition has been increasing, but most industries are still largely regulated. It is therefore hard to measure a company's viability. With this caveat in mind, we can nonetheless examine the relationship between a firm's age (i.e., number of years since its IPO) and the price discount. If age is a good proxy for viability, we expect the discount to vary negatively with age.

Given that the first round of firms went public in December 1990, we divide each RIS sample into three groups (of unequal sizes): young (with less than 2 years since IPO), middle (with between 2 and 7 years), and mature group (with over 7 years). The price discount statistics for the groups are given in Panel E of Table V. Once again, auction and private placement show quite different relationships: the discount spread between the young and mature groups is 6.10% (with a t-statistic of 2.81 and p-value of 0.01, hence statistically significant) based on the auctions, and –1.99% (with a t-statistic of 0.80 and p-value of 0.43, hence statistically insignificant) based on the private placements. In other words, auction participants bid older firms' RIS shares higher and prefer to hold the more familiar, established names, but private-transfer purchasers prefer younger firms.

This finding is interesting by itself, as it again reflects a fundamental difference in investment decisions between participants in the two activities. Most bidders in auctions are individuals with a registered business, but they don't represent businesses of a large scale and hence are not interested in becoming a significant shareholder in a public company. While they may be more financially sophisticated than individuals in the public market, they still tend to go with familiar and perhaps popular firms that are formerly large state-owned enterprises (SOE). On the other hand, most buyers in private transfers are interested in acquiring control and in the long-term viability of the target firm. Since

all older public companies in China are restructured SOEs, it is well known that most of them have inherited socialist-policy related burdens (e.g., workers' pensions, housing obligations, strategic roles on behalf of the state).[14] For this reason, corporate purchasers who are control-motivated may simply choose to go with newer businesses that likely have less of such burdens. These newer firms are less constrained and can operate more efficiently.

C. Share Structure, Transaction Size and Illiquidity Discounts

The amount of RIS shares relative to total shares outstanding must be a significant determinant of an RIS stock's illiquidity and hence the associated price discount. The smaller the weight of RIS shares in a firm's ownership structure, the less downside pressure the floating A-shares will face upon the lifting of the trading restriction on RIS shares in the future. We should thus expect the discount to vary together with the relative RIS share amount.

Panel F of Table V demonstrates that regardless of the method of transfer, the RIS price discount increases with the RIS to total shares ratio. In this case, the discount spread between the low and high RIS/total ratio quintiles is approximately the same and statistically significant, based on both auction and private transactions.

In Panel G, we show the relationship between transaction size and illiquidity discount. In the case of auctions, the actual auctioning process has three steps. First, the auction house solicits RIS shares from shareholders. Second, the auctioneer announces in a newspaper or on the internet how many RIS shares of which company are to be auctioned off, and the time and location. Finally, the actual auction takes place. Thus, at a given auction, the share supply is pre-fixed and will typically not vary with the resulting bid price. We should expect the auction price to be inversely, and the price discount to be positively, related to transaction size. This prediction is supported by the discount spread of –5.45%

[14] See, for example, Lin, Li and Lu (2000) for a good overview and discussion on the lessons and problems facing the development of China's capital markets.

between the low and high transaction-quantity quintiles, with a t-statistic of 3.64 and a p-value of 0. Larger quantities come with a higher discount.

The discounts based on private-transfer prices show the opposite relationship: the larger the block, the higher the transaction price and the lower the discount. The discount spread is 6.41%, with a t-statistic of 4.44. The private market is thus a "seller's market," suggesting the existence of a significant control premium with larger blocks. This is consistent with the U.S. evidence documented in, for example, Barclay and Holderness (1989) and Wruck (1989). Given the lack of proper corporate governance, pyramidal corporate-family structure is increasingly more popular in China and the value of a controlling position in a public firm is consequently increasing as well.[15]

III. Statistical Analysis of the Discounts

We have so far focused on univariate relations between price discounts and firm-specific variables. Next, we want to understand what variables are statistically significant in the presence of other variables and how much they can collectively explain the variations in price disocunt. With these goals, we run multi-variate regressions in which the price discount for firm n, D_n, is the dependent variable.

In selecting the explanatory variables, we incorporate the considerations and results of Silber's (1991) statistical model. The list of variables includes:

- **Firm size** serves as a stand-in for the firm's credit-worthiness. We use both the **total book value** of equity and total revenue as two alternative measures of size. Let B_n be the log of firm n's total book value.
- **RIS/total shares ratio**, denoted by R_n, is a proxy for the marketability of firm n's RIS shares. In a separate experiment, we have also used the ratio between RIS plus state shares and the total shares outstanding, in place of $R_{n,t}$ because state shares are also not tradable. But, the results are similar.

[15] See Shleifer and Vishny (1997) for a comprehensive survey on corporate governance and pyramidal corporation structure, and references therein. See Lang, Zhang, Zhou and Tan (2001) for Chinese corporate structure cases, and Cha (2001) and Neoh (2000) for overviews of corporate governance issues in China.

- **B/P ratio**, denoted by BP_n, measures the floating A-share's valuation.
- **ROE_n** is the return on equity.
- **Age** since IPO and **volatility** are as explained before.
- Log of transaction quantity is denoted by Q_n.
- **Location bias** and **control-motivated purchase** are represented by two dummy variables: $SH_n = 1$ if the RIS firm is located in Shanghai and zero otherwise, and $CONTROL_n = 1$ if a private transfer makes the purchaser a controlling shareholder and zero otherwise.

To select the best subset of independent variables from the above list, we employ a *stepwise procedure of variable selection* [Hocking (1976)]. The stepwise method is based on the idea that each variable to be added to the model must be significant at two separate levels. First, a variable can be added only when the F-statistic is above some significant level for entry (i.e., the *entry criterion*). Second, after a variable is added, the stepwise method evaluates all the variables in the model and deletes any variable that does not produce an F-statistic above some significance level of stay (i.e., the *stay criterion*). Only after these tests are passed and the necessary deletions are done can another variable be added to the model. We set both the entry and stay criterion levels at 0.15. The local-bias and control dummies are imposed on the model, specifically to test for the two effects.

Table VI shows all the remaining explanatory variables out of the initial list above, where the F-value below each estimate reflects the variable's contribution to the model. It is clear that the F-values decrease as each new variable is added. The t-statistic is reported in square brackets [ ]. For comparison, we report in each selection step the adjusted R-square, F-value and Mallows' *Cp* value, denoted by *Cp* -value, in the table.[16]

[16] Mallows' *Cp* is a common metric used in model selection methods [see Mallows (1973)]. The metric compares the sum-of-squared errors in a selected model with the mean-squared errors for the full model. It is defined as

$$Cp = [(SSEp)/(s^2)] - (N - 2p)$$

where s^2 is the mean-squared errors (MSE) for the full model, and SSE_p is the sum-of-squared errors for a model with p parameters (including the intercept). If *Cp* is plotted against p, Mallows recommends the model in which *Cp* first approaches p. When the right model is chosen, the parameter estimates are unbiased, and this is reflected in *Cp* near p. For further discussion, refer to Daniel and Wood (1980).

For the auction sample in Panel A of Table VI, five explanatory variables remain after the filtering steps: B_n, BP_n, Age, Q_n and SH_n. They are each statistically significant, in terms of both t-statistics and F-values. The signs of each coefficient estimate is consistent with our preceding analysis. For example, for each unit more of the B/P ratio, the price discount is lower by 27%; For each additional year of existence since IPO, a firm's RIS shares are discounted by 1% less; Being a Shanghai company means its RIS shares are discounted by 6% less. These five variables together explain 70% of the cross-firm and cross-transaction variations in the price discount. But, note that the intercept of the full model is 78%, which is about the same as the average discount in Table II. This fixed amount is not explainable by variations in the firm and transaction characteristics, and illiquidity must be the reason behind.

For the private-transfer sample in Panel B, five different variables remain in the filtered model: BP_n, ROE_n, Q_n, SH_n and $CONTROL_n$. Out of the five, only the first three are all statistically significant and the control dummy is marginally significant. Therefore, whether a firm is located in Shanghai or not, it does not make a significant difference to the resulting price discount in a private transfer. Consistent with our earlier discussion, the location of the RIS company matters in an auction (Panel A) but does not in a private transfer. Furthermore, a larger block makes the discount lower in a private placement. Together these five variables explain 72% of the cross-transaction variations in the price discount. Still, there is a large intercept that cannot be explained by these firm characteristics.

IV. Explaining the Illiquidity Discounts

As a consequence of trading rules and restrictions, the three methods of ownership transfer represent three segmented markets in China. These rules cause illiquidity, which in turn leads to valuation distortions and creates a clientele effect for each method/market: corporate purchasers with a control motive choose the private-transfer method and pay the lowest price of all, investment professionals and individuals go with the auction mechanism and pay slightly more, and individuals stay with the liquid A-

shares traded on the stock exchanges and pay four times more for the same ownership rights.

One may argue that these formerly state-owned firms are not worth anything as about one third of these firms are not profitable, in particular given that many of the reported earnings and revenues cannot be trusted. While this might be true, it does not explain why the three markets can be segmented to such an extent. If a public company should be worth zero, then all shares should be worth zero. The trading rules must be responsible for keeping the relative valuation of the RIS and floating shares so far out of line.

One may also point out that there seem to exist three levels of informedness: corporate purchasers are the most informed (in the private market), auction participants the second, and the retail investors on the stock exchanges the least informed. Thus, the corporate purchasers value the firms the least, and the retail investors burn their money (without knowing what they are doing). While this might be true too, it does not explain why the three markets should be segmented so that participants do not learn or infer information from the other markets, or why information is not trasmited through cross-market trading. Again, the answer lies in the trading rules.

Another point often made is that the common shares held by individuals effectively have no voting power, whereas the RIS and state shares do. If this is the case, RIS shares should be priced higher, which is contradictory to the large discounts documented for RIS shares in this paper.

These factors and the variables analyzed in the preceding sections can together explain the majority of the cross-sectional variations in the RIS price discount (Table VI), but they do not explain why the discounts are on average so high. Overall, the following rules are responsible:

- RIS and state shares cannot be publicly traded and are hence illiquid;
- Since RIS and state shares cannot be traded, the supply of a typical firm's floating shares is very small (about 35%), making it easy both for the common shares to rise

without any bound and for market players to manipulate share price. The A-share market in China thus resembles the U.S. internet stock bubble in the late 1990's and 2000.

- No stock can be sold short.

The last rule seems unrelated to the price discount for RIS shares, because this rule cannot be binding for RIS shares. But, in fact, it plays a major role in determining the discount as it is binding on the floating A-share market. The no-short-selling rule has an impact in three ways. First, it forbids those who have a negative view on floating shares from sending such a signal (they cannot vote with short-sale orders). Second, observing the large price discrepancy between RIS and common shares, no one can engage in any arbitrage by buying RIS shares in auctions and selling short the respective A-shares. Thus, an important cross-market link is cut off. Third, short-selling is another way of creating share supply. The no-short-selling rule serves to further limit the supply of liquid shares.

Given its focus, the present paper does not intend to develop a valuation model to explain how much of the discount can be justified under these rules. Instead, we can calibrate approximately what a reasonable discount should be by applying two existing classes of models. First, Longstaff (1995a, b) provides upper bounds on discounts for securities that are not tradable for a period of T years. In his model, the other key determinant is the volatility of the liquid but otherwise identical stock, denoted by σ. Then, an upper bound on the price discount for such an illiquid stock is [equation (3) in Longstaff (1995a)]:

$$D(T) = 1 - p/P = (2 + \tfrac{\sigma^2 T}{2}) N(\tfrac{\sqrt{\sigma^2 T}}{2}) + \sqrt{\tfrac{\sigma^2 T}{2\pi}} \exp(-\tfrac{\sigma^2 T}{8}) - 1$$

In Figure 1, we evaluate this upper bound for different volatility values: 30%, 40%, 43.5% and 50%, where 43.5% is the average annual volatility of floating A-shares in China. The current debate in China suggests that the trading restriction on RIS shares is likely to be lifted within the next three to five years. Let's assume the expected value is T = 4 years. Then, the upper bound on price discount for the RIS shares is 90.50%. Thus,

based on Longstaff's model and Figure 1, the documented discounts in Tables I and II are not out of line.

In the case of RIS shares, ownership transfer is not totally prohibited as one can buy or sell them in auctions or private placements. Therefore, it may be more appropriate to model the trading frictions in terms of high search and transaction costs. That is, we can apply models such as Amihud and Mendelson (1986) and Vayanos and Vila (1999), to determine a reasonable range for the price discount. To adapt this class of models to China's context, we can decompose the discount into two components: one due to no-short-selling and the RIS trading restriction, and the other to the high transaction costs. First, from the recent U.S. experience with internet stocks, when the floating shares are only a small portion of a firm's total shares outstanding and when shorting is difficult to do or maintain, the stock price can go out of bound and it is difficult to increase the share supply. Assume that if the short-selling and trading restrictions did not exist (so that the float would be 100% of the shares outstanding), a fair P/E ratio for Chinese stocks would be 30, partly because interest rates are low (about 2% for bank savings rates) and partly because China's stock market is in an early emerging and growth stage. This debatable assumption is only for this illustrative exercise.

Second, the restriction that RIS shares can only be privately transferred or irregularly auctioned makes the costs of ownership transfer high. According to Amihud and Mendelson (1986), the discount due to trading costs for an otherwise liquid stock should equal the total present value of all future trading costs that occur whenever an exchange takes place. To obtain an approximate magnitude of this part of the discount, we assume that the one-way search, legal and trading costs are 5%, and that the cost of capital or discount rate is 10% (with an 8% risk premium).

In Figure 2, we evaluate three average holding periods (1 year, 1.5 years and 2 years) and 20 possible remaining times before the RIS trading restriction is lifted. The price discounts shown in Figure 2 are determined by

$$D(T) = 70\% + 30\% * d(T)$$

where the first term (70%) is due to the overvaluation of the floating A-shares (caused by no-short-selling and low float, and based on the assumed fair P/E of 30 and the actual average P/E of 100), and d(T) is the discount (to be applied to the A-share's fair value) determined by the total present value of all future expected transaction costs. For example, the expected time for lifting the RIS trading restriction is T = 4 years. Assume the average holding period is 1.5 years (i.e., each position is flipped every 1.5 years on average). Thus, the expected number of turnovers before the lifting is two. Then, applying the present value formula [Amihud and Mendelson (1986)], we estimate d(T) to be 21%. Applied to the fair P/E ratio of 30 for liquid and frictionless A-shares, this calculation results in a fair P/E of 23.7 for the illiquid RIS shares.

In Table II, the average P/E of floating A-shares is about 100. A fair P/E of 23.7 for RIS shares means that a reasonable RIS price discount is 76.3%, which is close to the average discount based on both auctions and private transfers in Table II.

It should be cautioned that the above two exercises are only illustrative, as the assumptions can be far apart from reality. A more rigorous analysis will require a formal model that incorporates the particular institutional structure and market rules of China. We leave that for future research.

V. Concluding Remarks

Policy makers in China are debating on how to lift the trading restrictions on both state and restricted institutional shares. While converting about 70% of each firm's total shares from non-floating to floating common shares is non-trivial at best and politically risky, the necessity of such a conversion is clear: the value loss under the restrictions is over 78%.

While the illiquidity caused by such trading restrictions still exists, China offers a unique laboratory for discovering the consequences and price of stock illiquidity. First, such illiquidity makes the cost of equity capital extremely high. Since corporate investors in new ventures receive restricted institutional shares, they would only be willing to invest if these shares would be deeply discounted, resulting in high financing costs for existing and new ventures. Second, since there is a 400% or higher value jump in going from illiquid private equity to publicly traded equity, the distorted valuation of common versus RIS shares provides the wrong price signal. This distorted price signal from the stock market has encouraged business managers to focus their efforts on corporate financial engineering, rather than on their core business competence [e.g., Neoh (2000)]. It does not enhance the efficiency of resource allocation. Third, when a large amount of a firm's ownership is locked up and illiquid, stock price manipulation (especially coupled with insider information) becomes easy and it gives market participants much incentive to do so.[17] Therefore, market rules and policies that create security illiquidity are detrimental to the intended capital-allocation and signaling roles of a capital market. The evidence from China adds to the existing literature on the significant impact of illiquidity on security valuation. It reinforces the importance of asset pricing models that incorporate market frictions [e.g., Stoll (2000)].

From an investor's perspective, the discounts on restricted shares represent an attractive opportunity. To get a sense of its potential benefits, we should realize that there are two major unknowns: the time when the restriction is lifted and the price of the common shares at the time of lifting. Given the on-going debate, the general sense is that the RIS shares will be floated within the next five years. For this reason, let us assume five possible horizons for the remaining time of the trading restriction: T =1 year, T=2 years, T=3 years, T=5 years and T=10 years. On the future common A-share price, we also assume five possibilities: P_T = 50%, 75%, 100%, 125%, and 150% of today's A-share price. About one quarter of public companies in China pay cash dividends, and among

[17] Several high-profile insider-trading and price manipulation cases have been reported in the Chinese media, and key players were fined by the CSRC. See Leahy (2001). Chinese financial magazines, such as *New Fortune* and *Money and Finance* (Caijing), have covered many corporate-governance abuse cases and stock price manipulation cases in detail.

those paying dividends the average dividend yield is about 0.72%. Thus, dividend income is not significant from investing in RIS shares, making capital gains the main source of income. Table VII shows the annual returns under the 25 assumed scenarios. The worst scenario is when the restriction stays on for 10 years and the common share price is 50% of today's price at the time of lifting, assuming that the firm does not disappear. Even under this scenario, the annual return will be 17.84%. Indeed, unless the macro environment would change dramatically in China, the illiquidity-caused discounts make RIS shares quite attractive to investors who can hold for the long term.

References

Amihud, Yakov and Haim Mendelson, 1986, "Asset Pricing and the Bid-Ask Spread," *Journal of Financial Economics* 17, 223-249.

Amihud, Yakov and Haim Mendelson, 1991, "Liquidity, Maturity, and the Yields on U.S. Treasury Securities.**"** *Journal of Finance* 46, 1411-1425.

Bailey, Warren, 1994, "Risk and Return on China's New Stock Marekts: Some Preliminary Evidence," *Pacific-Basin Finance Journal* 2, 243-260.

Barclay, Michael J. and Clifford G. Holderness, 1989, "Private Benefits from Control of Public Corporations," *Journal of Financial Economics* 25, 371-395.

Boudoukh, Jacob and Robert F. Whitelaw, 1993, "Liquidity as a Choice Variable: A Lesson from the Japanese Government Bond Market," *Review of Financial Studies* 6, 265-292.

Cha, Laura M., 2001, "The Future of China's Capital Markets and the Role of Corporate Governance," China Securities Regulatory Commission (CSRC).

Coval, Joshua and Tobias Moskowitz, 1999, "Home Bias at Home: Local Equity Preference in Domestic Portfolios," *Journal of Finance*, December 1999.

Daniel, C. and Wood, F., 1980, *Fitting Equations to Data*, Revised Edition, New York: John Wiley & Sons, Inc.

Dimson, Elroy and Bernd Hanke, 2000, "The Expected Illiquidity Premium: Evidence from Equity Index-Linked Bonds**,"** working paper**,** London Business School.

Duffie, Darrell, Nicolae Garleanu, and Lasse Pedersen, 2000, "Valuation in Dynamic Bargaining Markets," Graduate School of Business, Stanford University, April, 2000.

Goetzmann, William N. and Matthew Spiegel, 2001, "The Relative Valuation of Preferred and Common Shares of Russian Companies," *working paper*,Yale School of Management.

Grinblatt, Mark and Matti Keloharju, 2001, "How Distance, Language, and Culture Influence Stockholdings and Trades," *Journal of Finance* 56, June, 1053 – 1073.

Hocking, Robert R., 1976, "The Analysis and Selection of Variables in Linear Regression," *Biometrics*, 32, 1-50.

Huang, Ming, 2001, "Liquidity Shocks and Equilibrium Liquidity Premia," Stanford University, July 2001.

Kamara, Avraham, 1994, "Liquidity, Taxes, and Short-Term Treasury Yields," *Journal of Financial and Quantitative Analysis* 29, 403-417.

Lang, Larry, Xindong Zhang, Hongbo Zhou, and Haibo Tan, 2001, "The Delong Family: Chinese-Style Corporate Familty Structure," *New Fortune* (in Chinese) April issue.

Leahy, Joseph, 2001, "Asia Watch: Crackdown deflates China bubble**,"** *Financial Times*, August 13 2001.

Lin, Justin Yifu, Yongjun Li, and Lei Lu, 2000, "China's Financial Reforms: An Overview," working paper, China Center for Economic Research (CCER), Beijing University.

Longstaff, Francis A., 1995a, How Much Can Marketability Affect Security Values?, *The Journal of Finance* 50, 1767-1774.

Longstaff, Francis A., 1995b, Placing No-Arbitrage Bounds on the Value of Nonmarketable and Thinly-Traded Securities, *Advances in Futures and Options Research* 8, 203-228.

Longstaff, Francis A., 2001, Optimal Portfolio Choice and the Valuation of Illiquid Securities, *The Review of Financial Studies* 14, 407-431.

Loughran, Tim and Jay R. Ritter, 2000, "Why Don't Issuers Get Upset About Leaving Money on the Table in IPOs?," *Review of Financial Studies*, forthcoming.

Mallows, C.L., 1973, "Some Comments on C_p," *Technometrics*, 15, 661 –675.

Neoh, Anthony, 2000, "China's domestic capital markets in the new millennium," discussion article, China Securities Regulatory Commission.

Shleifer, Andrei and Robert W. Vishny, 1997, "A Survey of Corporate Governance," *Journal of Finance* 52, No. 2, 737-783.

Silber, William L., 1991, "Discounts on Restricted Stock: The Impact of Illiquidity on Stock Prices," *Financial Analysts Journal*, July-August 1991, 60-64.

Stoll, Hans R., 2000, "Presidential Address: Friction," *Journal of Finance* 55, 1479-1514.

Vayanos, Dimitri and Jean-Luc Vila, 1999, "Equilibrium Interest Rate and Liquidity Premium with Transaction Costs," *Economic Theory* 13, pp. 509-539.

Vayanos, Dimitri, 1998, "Transaction Costs and Asset Prices: A Dynamic Equilibrium Model," *Review of Financial Studies* 11, 1-58.

Wruck, Karen Hopper, 1989, "Equity Ownership Concentration and Firm Value: Evidence from Private Equity Financings," *Journal of Financial Economics* 25, 3-28.

Table I : Distribution of Sample Transactions by Month

The auction and private-transfer samples cover all respective transactions that have sufficient data between Aug 2000 to June 2001. Here "# of RIS shares Transacted" is the total number of RIS shares transferred each month. The total number of successful auctions each month is denoted by "# of Auctions". Similarly, "# of Private Transfers" stands for the total number of successful private transfers. The total number of unique firms whose RIS shares are transferred is denoted by "# of Firms."

	Auctions					Private Transfers				
Month	# of Firms in Transaction	# of Auctions	# of RIS Shares Transferred (in 1,000 shares)	Total Value of Transactions (in 1,000 yuan)	Average Price Discount	# of Firms in Transaction	# of Private Transfers	# of RIS Shares Transferred (in 1,000 shares)	Total Value of Transactions (in 1,000 Yuan)	Average Price Discount
Aug-00	2	2	161.70	652.19	68.46%	15	19	629,326.25	1,414,264.35	85.98%
Sep-00	N/A					20	22	644,799.93	1,391,718.41	85.62%
Oct-00	14	31	8,473.78	23,532.89	77.28%	14	14	355,900.35	994,749.71	82.46%
Nov-00	14	34	2,652.26	8,909.64	81.42%	22	24	949,159.70	1,587,362.98	89.32%
Dec-00	5	15	1,360.00	4,584.00	82.16%	18	21	300,576.69	1,078,832.32	82.77%
Jan-01	56	145	23,455.02	78,326.07	79.21%	12	17	336,480.46	872,065.47	86.82%
Feb-01	69	288	53,719.89	158,347.46	78.67%	11	11	111,428.48	242,398.51	88.34%
Mar-01	110	346	118,659.48	353,989.13	76.38%	17	19	384,229.85	870,501.07	85.39%
Apr-01	113	460	113,453.14	349,833.82	75.95%	11	13	229,936.10	446,973.78	86.12%
May-01	132	835	114,687.61	384,561.53	75.67%	19	22	766,549.98	1,666,390.60	84.56%
Jun-01	103	422	51,778.30	163,372.86	78.41%	27	39	840,557.56	2,401,109.27	85.34%
Jul-01	N/A					16	21	65,137.57	114,956.35	88.15%
Sum	618	2,578	488,401.17	1,526,109.59		202	242	5,614,082.92	13,081,322.81	

Table II : Summary Statistics for All Transactions

Panels A and B show summaries respectively for the auction and private-transfer samples. Price discount is defined as (floating share price - RIS price)/floating share price, multiplied by 100%. Auction B/P stands for the ratio between the book value of equity and the RIS auction price. Auction E/P is the ratio between the earnings per share (EPS) and the RIS auction price. Floating share B/P stands for the ratio between book value and floating share price. ROE is *Return on Equity* and defined by ratio of EPS to book value per share. Other variables are similarly defined. Std. Dev is shorthand for standard deviation, and Med for median.

Panel A: Auction Sample

	RIS Auction Transactions					***Floating Common Shares***		***Firm's Characteristics***	
	Price Discount	*Trans. Value (in 1,000 yuan)*	*Trans. Size (in 1,000 shares)*	*Auction: B/P*	*Auction: E/P*	*Floating Share: B/P*	*Floating Share: E/P*	*ROE*	*Book value (in 1,000 yuan)*
Avg.	77.93%	622	204	0.76	0.04	0.16	0.01	8.12%	931,134
(Std. Dev.)	(6.65%)	(674)	(242)	(0.42)	(0.08)	(0.09)	(0.01)	(6.75%)	(1,046,440)
Med	78.90%	424	136	0.67	0.05	0.14	0.01	7.98%	722,197
Max	97.22%	28,800	12,000	3.60	0.34	0.49	0.06	52.80%	15,725,240
Min	36.98%	13	5	0.00	-0.39	0.00	-0.06	-36.30%	244

Panel B: Private-Transfer Sample

	RIS Private Transfers					***Floating Common Shares***		***Firm's Characteristics***	
	Price Discount	*Trans. Value (in 1,000 yuan)*	*Trans. Size (in 1,000 shares)*	*Auction: B/P*	*Auction: E/P*	*Floating Share: B/P*	*Floating Share: E/P*	*ROE*	*Book value (in 1,000 yuan)*
Avg.	85.59%	76,340	31,800	1.16	0.04	0.13	0.01	5.02%	472,550
(Std. Dev.)	(8.32%)	(72,940)	(26,870)	(1.74)	(0.02)	(0.08)	(0.02)	(8.85%)	(431,470)
Med	87.03%	52,570	24,570	0.97	0.05	0.12	0.01	5.20%	388,460
Max	99.40%	494,810	326,830	20.39	0.46	0.39	0.06	52.82%	2,560,110
Min	56.28%	270	510	0.00	-0.62	0.00	-0.07	-45.52%	180

Table III: Local Bias in Transactions

Price discount is defined as (floating share price - RIS price)/floating share price, multiplied by 100%. Floating E/P is the ratio between EPS and floating share price. Book Value is the total book value of equity. Std. Dev is shorthand for standard deviation, and Med for median. The total number of auctions or private transfers is denoted by "# of Transactions". The total number of firms whose RIS shares are transferred is denoted by "# of Stocks".

	Auctions					**Private Transfers**				
	Shanghai	Guangdong	Hubei	Sichuan	Hainan	Guangdong	Shanghai	Sichuan	Zhejiang	Hubei
Price Discount: Avg.	73.31%	82.07%	81.34%	78.26%	82.68%	89.53%	83.07%	88.00%	86.11%	85.29%
Median	72.96%	81.95%	80.92%	78.48%	81.30%	90.71%	82.54%	90.64%	90.65%	88.86%
St. Dev.	(6.92%)	(4.8%)	(4.63%)	(4.21%)	(4.4%)	(5.83%)	(9.19%)	(7.37%)	(9.53%)	(8.34%)
E/P Ratio: Avg.	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	-0.01
Median	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01
St. Dev.	(0.02)	(0.03)	(0.03)	(0.01)	(0.01)	(0.03)	(0.02)	(0.01)	(0.01)	(0.03)
Book Value (in 1,000 yuan): Avg.	1,211,149	953,599	535,611	926,633	604,478	453,221	640,870	322,976	471,332	517,873
Median	676,387	817,874	519,388	364,458	321,024	154,368	388,173	252,851	490,177	531,447
St. Dev.	2,103,766	719,728	302,940	2,679,852	815,982	616,277	589,319	268,160	272,142	279,109
# of Transactions	519	145	133	121	88	26	18	17	16	15
# of Stocks	65	24	19	22	10	15	15	12	9	12

Table IV: Correlation Matrix

B/P is the ratio between book value and floating share price. E/P is the ratio between EPS and floating share price. ROE is *Return on Equity*. D/E is the debt to equity ratio. Volatility stands for the daily return volatility in the recent three years. RIS Ratio is the RIS/total shares ratio. Age is the number of years since the firm's IPO. Quantity is the log of transaction size in number of shares. Revenue is the log of the firm's total revenue in the prior year, and Book Value the total book value of equity.

Panel A: RIS Auctions

	Price discount	B/P	E/P	ROE	D/E	Volatility	Age	RIS ratio	Quantity	Revenue
B/P	-0.44									
E/P	-0.38	0.40								
ROE	-0.15	0.20	0.28							
D/E	0.10	-0.16	-0.10	-0.95						
Volatility	0.03	-0.26	0.00	0.03	-0.02					
Age	-0.32	-0.15	-0.02	-0.06	0.06	0.23				
RIS ratio	0.19	-0.30	-0.16	-0.02	-0.01	0.14	-0.04			
Quantity	0.23	-0.01	-0.09	0.00	-0.04	0.01	-0.09	0.08		
Revenue	-0.38	0.51	0.31	0.13	-0.09	-0.03	0.00	-0.36	-0.09	
Book Value	-0.47	0.70	0.45	0.54	-0.46	-0.14	-0.04	-0.29	-0.02	0.59

Panel B: RIS Private Transfers

	Price discount	B/P	E/P	ROE	D/E	Volatility	Age	RIS ratio	Quantity	Revenue
B/P	-0.67									
E/P	-0.23	0.46								
ROE	-0.06	0.21	0.47							
D/E	0.14	-0.22	-0.32	-0.75						
Volatility	0.08	-0.13	-0.01	-0.08	0.08					
Age	0.12	-0.22	-0.06	-0.06	0.14	0.12				
RIS ratio	0.14	-0.21	-0.10	-0.01	0.04	0.01	0.05			
Quantity	-0.31	0.24	-0.03	0.13	-0.25	-0.03	0.03	-0.20		
Revenue	-0.36	0.46	0.32	0.06	-0.07	-0.11	-0.06	-0.18	0.18	
Book Value	-0.45	0.69	0.60	0.60	-0.65	-0.03	-0.12	-0.14	0.26	0.45

Table V: Firm Characteristics and Illiquidity Discounts

Quintiles are used here except for the analysis based on Age since IPO. For example, take the B/P quintiles, where B/P is based on the floating A-share price. We divide all the firms in April, May and June 2001 in the case of auctions, and the entire sample in the case of private transfers, into quintile groups according to each sample firm's B/P ratio. Then, we compute the price discount statistics for each quintile. To test for the significance of the discount spread in relation to B/P, we conduct a T-test on the hypothesis that the price discounts are equal between the two extreme B/P quintiles, Q1 (low B/P) and Q5 (high B/P). The t-test results are reported in the column marked "Q1 – Q5", including the t-statistic for the discount difference in square brackets [ ] and the p-value in curly brackets { }. The test design applies to the other explanatory variables. For Age based grouping, we divide the respective samples into three groups: Young group of firms that have traded for less than 2 years since IPO, Middle group with between 2 and 7 years, and Mature group with over 7 years since IPO. The definition of each variable is the same as in Table IV. We use parentheses ( ) to indicate standard deviation. Q1 and Q5 stand respectively for the quintiles with the lowest and highest values of the grouping variable.

Panel A: Floating A-Share's B/P

	Auctions						**Private Transfers**					
Price Discount	Q1 (low B/P)	Q2	Q3 (mid)	Q4	Q5 (high B/P)	*Q1 – Q5 (diff. test)*	Q1 (low B/P)	Q2	Q3 (mid)	Q4	Q5 (high B/P)	*Q1 – Q5 (diff. test)*
Avg	80.30%	78.34%	77.72%	75.54%	72.16%	8.15%	91.74%	89.63%	86.57%	83.92%	78.74%	13.31%
(Std Dev)	(5.47%)	(5.59%)	(5.41%)	(6.96%)	(7.87%)	[5.70]	(8.15%)	(4.05%)	(6.80%)	(5.70%)	(6.66%)	[10.94]
Med	80.89%	80.02%	78.65%	77.60%	73.61%	{0.00}	93.76%	90.81%	87.31%	82.95%	77.42%	{0.00}

Panel B: Floating A-Share's E/P

	Auctions						**Private Transfers**					
Price Discount	Q1 (low E/P)	Q2	Q3 (mid)	Q4	Q5 (high E/P)	*Q1 – Q5 (diff. test)*	Q1 (low E/P)	Q2	Q3 (mid)	Q4	Q5 (high E/P)	*Q1 – Q5 (diff. test)*
Avg	78.61%	78.97%	76.90%	76.19%	71.04%	7.57%	87.07%	84.76%	86.88%	85.03%	82.14%	4.93%
(Std Dev)	(5.07%)	(5.96%)	(5.51%)	(7.76%)	(6.84%)	[5.17]	(8.18%)	(9.83%)	(6.90%)	(7.14%)	(7.91%)	[2.54]
Med	78.75%	79.47%	78.65%	78.44%	70.85%	{0.00}	88.92%	86.43%	87.94%	86.90%	83.73%	{0.02}

Panel C: ROE

	Auctions						Private Transfers					
Price Discount	Q1 (low)	Q2	Q3 (mid)	Q4	Q5 (high)	*Q1 – Q5 (diff. test)*	Q1 (low)	Q2	Q3 (mid)	Q4	Q5 (high)	*Q1 – Q5 (diff. test)*
Avg	78.75%	76.10%	76.29%	74.74%	75.85%	2.90%	82.72%	85.59%	84.05%	83.63%	87.27%	-4.45%
(Std Dev)	(4.68%)	(7.73%)	(7.41%)	(6.91%)	(6.86%)	[2.21]	(9.38%)	(9.40%)	(7.99%)	(8.12%)	(7.15%)	[-2.60]
Med	78.54%	77.60%	78.41%	73.75%	77.90%	{0.03}	85.63%	87.52%	85.76%	82.78%	88.78%	{0.01}

Panel D: Volatility

	Auctions						Private Transfers					
Price Discount	Q1 (low)	Q2	Q3 (mid)	Q4	Q5 (high)	*Q1 – Q5 (diff. test)*	Q1 (low)	Q2	Q3 (mid)	Q4	Q5 (high)	*Q1 – Q5 (diff. test)*
Avg	74.88%	77.92%	76.43%	77.22%	77.38%	-2.50%	84.98%	83.36%	85.16%	87.26%	86.54%	-1.56%
(Std Dev)	(7.45%)	(6.90%)	(7.29%)	(6.23%)	(6.14%)	[-1.82]	(7.76%)	(7.25%)	(10.38%)	(9.33%)	(6.28%)	[-0.10]
Med	77.10%	79.57%	76.71%	78.07%	78.54%	{0.08}	86.41%	84.06%	87.73%	90.65%	87.53%	{0.91}

Panel E: Age

	Auctions				Private Transfers			
Price Discount	Q1 (young firms)	Q2 (mid)	Q3 (mature firms)	*Q1 – Q3 (diff. test)*	Q1 (young firms)	Q2 (mid)	Q3 (mature firms)	*Q1 – Q3 (diff. test)*
Avg	77.85%	78.17%	71.75%	6.10%	86.26%	85.42%	88.25%	-1.99%
(Std Dev)	(8.32%)	(5.67%)	(7.72%)	[-2.81]	(8.50%)	(8.15%)	(0.66%)	[0.80]
Med	79.14%	79.19%	71.79%	{0.01}	87.64%	87.10%	91.43%	{0.43}

Panel F: RIS/Total Shares Ratio

	Auctions						Private Transfers					
Price Discount	Q1 (low)	Q2	Q3 (mid)	Q4	Q5 (high)	*Q1 – Q5 (diff. test)*	Q1 (low)	Q2	Q3 (mid)	Q4	Q5 (high)	*Q1 – Q5 (diff. test)*
Avg	73.89%	75.53%	77.12%	79.82%	77.29%	-3.40%	84.43%	85.68%	81.92%	87.83%	87.84%	-3.41%
(Std Dev)	(6.42%)	(6.69%)	(6.47%)	(5.12%)	(7.92%)	[-2.41]	(7.58%)	(7.09%)	(9.88%)	(8.95%)	(7.57%)	[-2.06]
Med	74.84%	78.06%	78.58%	80.68%	79.10%	{0.02}	86.87%	86.13%	83.19%	89.28%	91.27%	{0.04}

Panel G: Transaction Quantity

	Auctions						Private Transfers					
Price Discount	Q1 (low)	Q2	Q3 (mid)	Q4	Q5 (high)	*Q1 – Q5 (diff. test)*	Q1 (low)	Q2	Q3 (mid)	Q4	Q5 (high)	*Q1 – Q5 (diff. test)*
Avg	73.99%	75.91%	75.81%	78.66%	79.44%	-5.45%	89.03%	88.19%	83.49%	85.79%	82.62%	6.41%
(Std Dev)	(6.70%)	(6.04%)	(8.95%)	(5.06%)	(5.53%)	[-3.64]	(5.68%)	(6.72%)	(10.52%)	(9.24%)	(6.96%)	[4.44]
Med	73.97%	76.13%	77.89%	79.20%	80.50%	{0.00}	90.65%	90.65%	86.52%	88.29%	83.07%	{0.00}

Table VI: Explaining Cross-Sectional Variations in Illiquidity Discount

To account for cross-sectional variations in the price discount, we employ the *stepwise procedure of variable selection* outlined in Hocking (1976) to filter out insignificant and/or redundant explanatory variables. The initial list of variables includes the following. B_n is the log of firm n's total book value. RIS/total shares ratio is a proxy for the marketability of firm n's RIS shares. B/P ratio, denoted by BP_n, measures the floating A-share's valuation. ROE_n is the return on equity. Age since IPO and volatility are as explained before. Log of transaction quantity is denoted by Q_n. Location bias and control-motivated purchase are represented by two dummy variables: $SH_n = 1$ if the RIS firm is located in Shanghai and zero otherwise, and $CONTROL_n = 1$ if a private transfer makes the purchaser a controlling shareholder and zero otherwise.

After applying the stepwise procedure, we obtain two different regression models shown in Panels A and B, respectively for the auction and the private-transfer samples. The F-value below each estimate (in < > brackets) reflects the variable's contribution to the model. The t-statistic is reported in square brackets [ ]. For comparison, we report in each selection step the adjusted R-square, F-value and Mallows' *Cp* –value.

Panel A. Regression Coefficients for Auction Sample: $D_n = a_0 + a_1 B_n + a_2 BP_n + a_3 Age_n + a_4 Q_n + a_5 SH_n$

Step.	Intercept	B_n	BP_n	Age	Q_n	SH_n	Adj. R-square	<F-value>	Cp-value
0	.79 <41599.1> [293.96]					-.09 <128. 57> [-11.34]	.39	<128.57>	220.94
1	.85 <18764. 7> [136.98]		-.36 <110. 18> [-10.50]			-.09 <209. 05> [-14.46]	.60	<154.30>	73.77
2	.89 <9595. 04> [97. 95]		-.38 <136. 60> [−11. 69]	-.01 <32. 07> [−5. 66]		-.07 <104. 96> [−10. 24]	.66	<129. 53>	38. 1899
3	.69 <272. 03> [16. 49]		-.37 <149. 26> [−12. 22]	-.01 <37. 07> [−6. 09]	.02 <22. 88> [4. 78]	-.06 <82. 11> [−9. 06]	.69	<113.55>	16.03
4 Full Model	.78 <253. 44> [15.92]	-.01 <10. 97> [-3.31]	-.27 <36. 06> [-6.00]	-.01 <39. 04> [-6.05]	.02 <29. 06> [5.39]	-.06 <66. 92> [-8.18]	.70	<97. 61>	7.00

Panel B. Regression Coefficients for Private Transfers: $D_n = a_0 + a_1\ BP_n + a_2\ ROE_n + a_3\ Q_n + a_4\ SH_n + a_5\ CONTROL_n$

Step	Intercept	BP_n	ROE_n	Q_n	SH_n	$CONTROL_n$	Adj. R-square	<F-value>	Cp-value
0	.86 <11078.5> [105. 25]				-.01 <0.07> [−0. 26]	.01 <0.41> [0. 64]	-0.01	<0.25>	337.32
1	.97 <13954.6> [118. 13]	-.82 <281.71> [−16. 78]			.01 <0.44> [0. 66]	-.02 <3.82> [−1. 95]	.68	<94.44>	20.57
2	1.08 <1127.69> [33. 58]	-.80 <253.40> [−15. 92]		-.01 <11.20> [−3. 35]	.01 <0.98> [0. 99]	-.01 <2.27> [−1. 51]	.71	<79.36>	10.84
3 Full model	1.09 <1201. 37> [34.66]	-.81 <277. 47> [-16.66]	.00 <8. 63> [2.94]	-.02 <13. 58> [-3.68]	.01 <0. 94> [0.97]	-.01 <2. 38> [-1.54]	.72	<69. 09>	4. 33

Table VII: Investment Returns from Buying RIS Shares at Auction Price

Assume that one buys an RIS share at an average discount of 78% relative to the firm's floating A-share, and holds the position until the trading restriction in RIS shares are lifted. We consider five possibilities for T, where T is the number of years before the lifting, and five possible prices for the floating A-shares of the firm.

Share Price at Time of Lifting Is	Annual returns from holding RIS until the restriction is lifted in				
	T=1 Yr	T=2 Yrs	T=3 Yrs	T=5 Yrs	T=10 Yrs
50% of Today's Price	127.27%	50.76%	31.48%	22.78%	17.84%
75% of Today's Price	240.91%	84.64%	50.50%	35.88%	27.80%
100% of Today's Price	354.55%	113.20%	65.65%	46.01%	35.37%
125% of Today's Price	468.18%	138.37%	78.44%	54.39%	41.55%
150% of Today's Price	581.82%	161.12%	89.62%	61.59%	46.80%

Figure 1: Upper Bounds on Illiquidity Discount

The upper bounds on the price discount are based on equation (3) of Longstaff (1995a), where the illiquid stock is assumed to be locked up and non-tradable for T years and where the volatility for the liquid but otherwise identical stock is Sigma. We evaluate three values for Sigma: 30%, 40%, 43.5% and 50%. For Chinese common A-shares, the average annual volatility is 43.5%. T takes values from 1 year to 10 years.

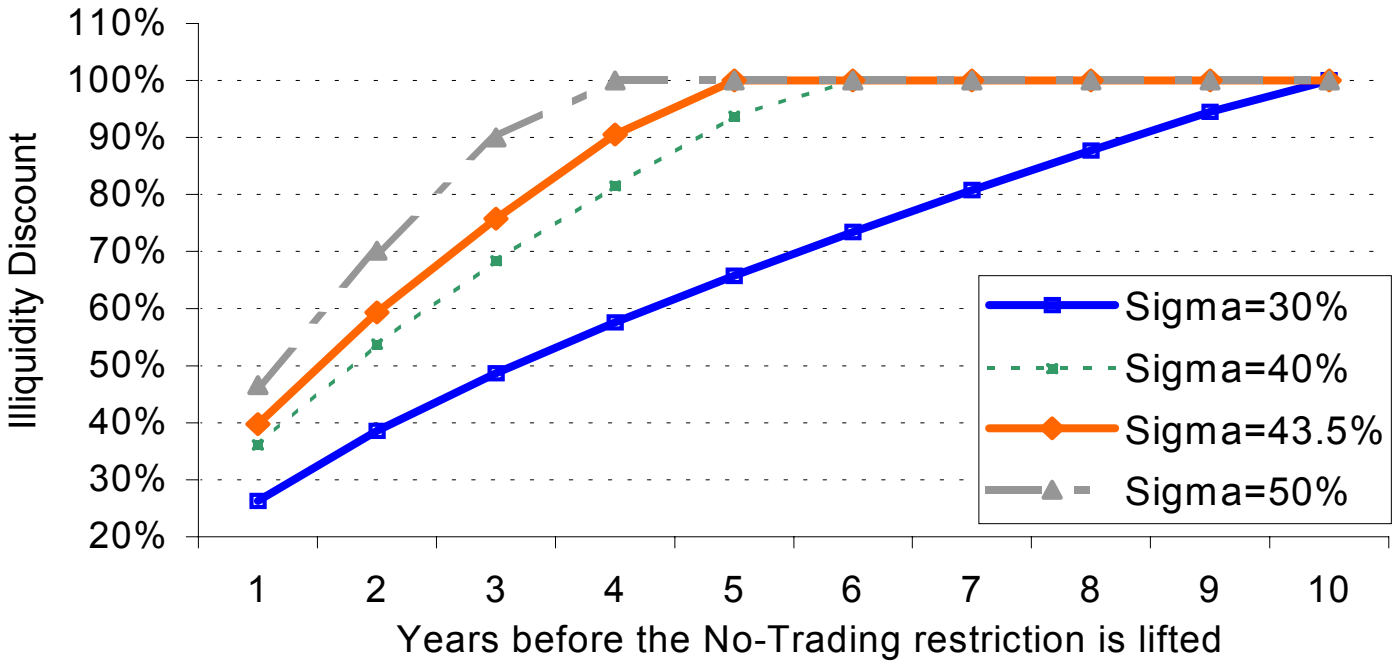

Figure 2: Illiquidity Discounts Based on Transaction-Cost Models

This chart shows possible price discounts for a stock that are subject to a 5% search and transaction costs for both the buyer and seller, until T years from now. In year T, the illiquid stock is converted into a liquid one without such costs. Three average holding periods are considered: 1 year, 1.5 years and 2 years. In the first scenario, for example, the holders own the stock typically for one year and then sell it to other investors. According to Amihud and Mendelson (1986), the price discount for such an illiquid stock should be the present value of all future transaction costs, until there are no more trading costs. The cost of capital is assumed to be 10%. Furthermore, for this chart, we assume that a fair P/E ratio for an average A-share stock in China should be 30 if there were no trading restrictions and no short-selling constraint. In reality, the average P/E for these A-shares is about 100. This chart shows the sum of the two components of the price discount: one due to the no-short-selling and trading restrictions, and the other due to the high search and transaction costs.