Bid-Ask Spreads for Trading Chinese Stocks Listed on Domestic and International Exchanges

Jun Cai
Department of Economics and Finance
City University of Hong Kong
Tat Chee Avenue, Kowloon
Hong Kong, P. R. China

Senior Visiting Financial Economist
Research Center
Shanhai Stock Exchange
South Pudong Road
Shanghai, P. R. China

September 2004

Abstract

China is one of the largest emerging markets in the world that adopts the limit order trading mechanism. In addition to the complicated ownership structure – a consequence a transitional economy – Chinese firms also actively seek to list and raise funds from a variety of overseas markets. This research provides a comprehensive study on bid-ask spreads and spread components for Chinese stocks listed on domestic and international exchanges. We find that domestic investors trading A- and B-shares inside China face lower bid-ask effective spreads than foreign investors trading ADRs in New York or trading H-shares and red-chips in Hong Kong. The wider effective spreads on international exchanges can be attributed to both a higher degree of information asymmetry (price impact) and higher revenues (realized spread) collected by liquidity suppliers. We also examine the implication of ownership structure on bid-ask spread and its components. Interestingly, we find that firms with a higher proportion of tradable A-shares face lower effective spreads and price impacts. Our evidence is consistent with both the liquidity (Amihud and Mendelson, 1986) and investor base hypotheses (Mertion, 1987).

We thank James Angel, Qi Chen, Ruying Hu, Ling Guo, Fenghua Wang and seminar participants at the Shanghai Stock Exchange for their helpful comments and suggestions. We also thank Shanghai Stock Exchange Senior Financial Economist Visiting Program for providing a variety of support. Jinghan Cai offered excellent research assistance. Financial support from City University of Hong Kong Small Scale Grant 2002-2003 (Cai) is gratefully acknowledged. All errors remain our own responsibility.

1. Introduction

The issue of trade execution costs in equity markets has long been a focus of market microstructure research. Earlier literature on trade execution costs is devoted primarily to equity markets in developed economies. There is surprisingly little genuine microstructure research on emerging markets (Bekaert and Harvey, 2003), despite the fact that emerging markets are characterized by a number of important features such as barriers to capital investment, larger cross-sectional variations, and higher return volatility. There are a few exceptions, however. Glen (2000) offers an introduction to market microstructure in emerging markets. Domowitz, Glen, and Madhavan (2002) and Jain (2001) provide a time-series and cross-sectional analysis of trading costs for world's leading exchanges, including those in emerging markets. Ghysels and Cherkaou (2003) conduct detailed studies of the Casablanca Stock Exchange in Morocco.[1]

Most newly-established emerging markets adopt an automated trading system in the form of an electronic limit order book (Domowitz, Glen, and Madhavan, 2002). Automated systems are cheaper to build and operate than the dealer and floor based systems that prevail in more mature markets (Domowitz and Steil, 1999). This mode of trading allows investors to place and execute market or limit orders directly from a remote terminal without intermediation from a dealer, a floor broker, or exchange specialist. This in turn generates a flurry of research investigating various issues related to automated trading. Nonetheless, despite the current trend towards a microstructure analysis of limit order book again focusing on developed nations[2], little is known about empirical regularities of automated trading in

[1] Domowitz, Glen, and Madhavan (2002) examine implicit and explicit trading costs for a group of 42 countries using quarterly data from 1996 to 1998. Jain (2001) collects and analyzes daily bid and ask quotes for the top 25 stocks on 51 exchanges, including 28 exchanges in emerging markets. Perold and Sirri (1993) use order and execution data from a U.S. asset management firm to study international equity trading costs. Domotitz, Glen, and Madhavan (1998) examine the impact of cross-listing Mexican stocks in the U.S. on order flow migration. Cho, Russell, Tiao, and Tsay (2003) investigate the magnetic effect of price limits on Taiwan Stock Exchange. Lesmond (2002) applies an indirect approach to measure trading costs in emerging markets.

[2] See Glosten (1994) and Seppi (1997) who provide a detailed summary of equilibrium models in limit-order markets. Empirical work includes Biais et al. (1995), Harris and Hasbrouck (1996), Hedvall et al. (1997), Chung et al. (1999), Kavajecz (1999), Ahn and Cheung (1999), and Ahn et al. (2002).

emerging markets.

The past decade also witnessed a significant acceleration in cross-border listing and stock trading. American Depositor Receipts (ADRs) offer the most important way for emerging market equities to cross-list in more liquid international exchanges. Studies of microstructure issues related to ADRs focus on event-study type liquidity effects such as changes in the trading volume, return volatility, and bid-ask spreads around the time of listings (Karolyi, 1998). More recently, Bacidore and Sofianos (2002) compare bid-ask spreads, spread components, specialists' inventory positions, participation rates, and stabalization rates for a sample of ADRs and matched U.S. stocks. ADRs are ideal candidates for testing the impact of market linkage/segmentation on the market quality of listed stocks, as the degree of linkgage/segmentation varies drastically between U.S. markets and ADR home markets.

The purpose of this research is to offer a comprehensive study on the bid-ask spreads and spread components for Chinese stocks listed on domestic and international equity exchanges. Our research makes an important contribution for the following reasons. First, China is one of the largest emerging markets in the world to adopt the limit order trading mechanism. The total market capitalization of shares available for domestic investors, measured using total shares outstanding, exceeds 4,352 billion yuan (526 billion US dollars). Measured using all tradable shares, the market has reached 1,446 billon yuan (175 billion US dollars) and has become the third largest in Asia, next only to Japan and Hong Kong.[3]

Second, the China market is characterized by a number of interesting features. For example, listed stocks in China are divided into A- and B-shares. Originally, domestic shareholders invested in A-shares while foreigners invested in B-shares. The relative illiquidity of the B-share market was a concern for regulatory bodies, and this eventually led to the opening up of the B-share market to domestic investors in 2001. The ownership structure of listed stocks in China is also very different from that in other markets. State-owned shares, legal person shares, tradable A-shares, employee shares, and shares only available to

[3] As of December 2001, the total market capitalization of the Tokyo Stock Exchange (first and second sections) and the Stock Exchange of Hong Kong (main board) are 2,249 and 498 billion US dollars, respectively.

foreign investors are the five classes of stocks commonly seen in Chinese firms. The investors in each class of stock have different incentives, expertise, and capability in monitoring and controlling the daily operations of the firm. The implication of ownership structure on trading costs has not been carefully studied. In addition to the complicated ownership structure – a consequence of a transitional economy – Chinese firms also actively seek to list and raise funds from a variety of overseas markets. Among, these, the New York Stock Exchange (NYSE) and Stock Exchange of Hong Kong (SEHK) are the primary exchanges where the markets are highly liquid and a large number of investors have genuine interests. The Chinese shares listed on the SEHK include both H-shares and red-chips. However, there has not yet been a systematic study simultaneously comparing the trading costs on these two major exchanges (ADRs, H-shares, and red-chips) and on domestic exchanges (A-shares and B-shares).

Our research is related to that of Chan, Menkveld, and Yang (2002) who, to our knowledge, provide the only other study on bid-ask spreads for listed firms in China. They analyze a sample of 76 firms that issue both A- and B-shares. Chan et al. (2002) employ the Glosten and Harris (1988) model to compare the adverse selection and order-processing components of A- and B-shares. Their main purpose is to use the estimated components to measure the degree of asymmetric information and liquidity of the markets and to test the two competing explanations (information and liquidity) for the commonly observed B-share discount relative to A-shares.

Our major findings can be summarized as follows. We analyze bid-ask spreads for a comprehensive sample of 819 A-shares, 86 B-shares, 16 ADRs, 31 H-shares, and 27 red-chip stocks over a 3-month period from October to December 2002. After controlling for the influence of stock price, firm size, trading activity, and return volatility, domestic investors trading A- and B-shares inside China face lower bid-ask effective spreads than foreign investors trading ADRs in New York or trading H-shares and red-chips in Hong Kong. The wider effective spreads on international exchanges can be attributed to both higher degree of information asymmetry (price impact) and higher revenues (realized spread) collected by liquidity suppliers.

The paper is organized into the following sections. Section 2 provides a brief introduction to

market structure, data sources, and sample construction. Section 3 presents the empirical results. The empirical study includes the summary statistics; cross-sectional and intraday patterns of bid-ask spreads; the relation between trade size, spreads, and spread components; the implication of ownership structure on spreads and its components; and cross-sectional determinants of spreads and spread components for different types of stocks listed on domestic and international exchanges. Finally, Section 4 concludes the paper.

2. Market Structure, Data Sources, and Sample Construction

2.1 A-Shares on Shanghai and Shenzhen Stock Exchanges

Trading of A-shares by domestic investors on Shanghai and Shenzhen Stock Exchanges takes the form of centralized competitive bidding or electronic limit order book. All orders are electronically routed to an automatic system. The system completes transactions based on the price and time precedence. Investors can only submit limit orders. Market orders are not allowed. Limit orders are routed from either the pit or from virtual trading seats. Pit orders are routed from members' seats located inside the exchanges. Orders from virtual trading seats are routed from terminals at members' sales departments. The trading hours are from Monday to Friday. During the morning session, the period from 9:15 a.m. to 9:25 a.m. is used for centralized group bidding. Trading hours between 9:30-11:30 a.m. and 13:00-15:00 p.m. are designed for consecutive bidding. Block trading takes place between 15:00 p.m. and 15:30 p.m.[4, 5]

We obtain the real-time trade and quote data for A-shares from Shanghai Stock Information Co. Limited. The database is time-stamped to the nearest second, and contains information on transaction prices, transaction volumes, and the best bid and ask quotes that correspond to the transactions. Quotes

[4] Block trades refer to transactions in excess of 50 million shares or 3 million yuan for A-shares. For B-shares, block trades must exceed 50 million shares or 300,000 US$.

[5] The transaction price for block trades is negotiated between the buyer and seller and must be within the daily high and low price range. If there is no transaction on a particular day, the closing price of the previous trading day is used to complete the block trade.

are updated when there are no transactions not included in the dataset. The sample period is from October 8 to December 31, 2002, giving a total of 61 trading days. Our initial sample of stocks includes 1,167 listed A-shares, with 684 stocks listed on the Shanghai Stock Exchange and 483 stocks listed on the Shenzhen Stock Exchange.[6]

To minimize the impact of infrequent trading on bid-ask spreads, we exclude stocks that are traded for fewer than 30 days during the 3-month period. We also require that each stock must have at least 20 valid transactions on each trading day to be retained in our sample. This leaves us a total of 1,131 stocks, with 664 in Shanghai and 467 in Shenzhen respectively.

Both the Shanghai and Shenzhen Stock Exchanges impose a daily price limit rule. The daily price limits are 10% for common listed A-shares stocks and 5% for stocks designated "ST" (Special Treatment).[7] During our sample period, the price never hits the daily limit for 854 stocks (508 in Shanghai and 346 in Shenzhen). To avoid confounding effects on the bid-ask spreads when the transaction price hits the daily limit, we exclude stocks that violate the price limit during the sample period.

Finally, we exclude stocks that had stock splits, stock dividends, or other capital structure changes such as seasoned equity offerings or rights issues during the 3-month sample period.

Our final sample then consists of 819 A-shares, with 492 listed on the Shanghai Stock Exchange and 327 listed on the Shenzhen Stock Exchange.

Opening transactions and negotiated block transactions after market close adopt a different trading mechanism: we therefore exclude them from our analysis. We further eliminate all trade and quote observations recorded before 9:30 a.m. or after 15:00 p.m.

---

[6] We exclude stocks that are designated "PT" (Particular Transfer) or new issues or shares suspended for a long time within the sample period. PT applies to stocks with three consecutive years of negative profit. These stocks are traded only once a week, on Friday after the market closes. The closing price will not be used in the calculation of stock market indices.

[7] Special treatment will be meted to the stock if an abnormal condition has occurred. This can include abnormal financial status such as two consecutive years of negative profit or shareholder equity falling below registered capital. Other examples include the company being in litigation, arbitration, the boarding being unable to conduct meetings, etc. See Shanghai Stock Exchange Fact Book 2003 for more details.

2.2 B-shares on Shanghai and Shenzhen Stock Exchanges

B-shares are foreign invested shares issued domestically by firms in China. They are also known as Renminbi (Yuan) Special Shares. B-shares are subscribed and traded in foreign currencies and are listed on stock exchanges inside China. Initially, only foreign investors could trade in B-shares. Since February 19, 2001, the B-share market has been open to all domestic investors.[8] The trading method and trading hours are essentially the same as for A-shares. Prior to China's accession to the World Trade Organization, foreign brokerage firms were able to trade B-shares only through local brokerage firms. Since 2002, foreign brokerages have been allowed to trade B-shares directly.

The real-time B-shares trade and quote data are provided by the Shanghai Stock Information Co. Ltd. The data items and format are the same as those for A-shares: time-stamped to the nearest second, transaction price and transaction volume, the corresponding best bid quotes, and the best ask quotes for a period of 61 trading days from October 8 to December 31, 2002. Our initial sample consists of 109 listed B-shares[9]. Among them, 53 are listed in Shanghai and 56 are listed in Shenzhen. We exclude one stock that changed the proportion of its tradable B-shares. We further exclude 22 firms that hit the daily price limit during the sample period. Our final sample of B-shares contains 43 stocks in Shanghai and 43 stocks in Shenzhen.

2.3 ADRs traded on New York Stock Exchange

The Bank of New York (BNY) maintains a webpage that provides a complete list of all ADRs issued in the U.S. from different countries.[10] The BNY list contains the name, symbol, cusip number, exchange, ADR ratio, country, industrial sector, sponsor, level, and effective date of the ADR issues. We begin

[8] According to the Shanghai Stock Exchange Fact Book 2003, 82.05% of B-share accounts belong to domestic investors (Chinese Mainland), followed by overseas Chinese (12.71%), Chinese Hong Kong (1.58%), U.S. investors (0.97%), and Chinese Taiwan (0.59%).

[9] We exclude stocks designated "PT" (Particular Transfer) or new issues or stocks suspended for a long time within the sample period.

[10] See http://www.adrbny.com/

with 47 ADRs issued by Chinese firms that are listed on the NYSE, NASDAQ, OTC, and Portal. We then search the NYSE Trade and Quote (TAQ) dataset and find tick data for 16 ADRs listed on NYSE. Most of these 16 ADRs are issued under Level III according to the U.S. Securities and Exchange Commission (SEC) regulatory rules.[11]

The NYSE is a hybrid limit order market with specialists. Hasbrouck, Sofianos, and Sosebee (1993) provide a detailed description of trading procedure on the NYSE. Simply speaking, orders are routed either electronically through NYSE's SuperDot system or walked to the specialists' trading posts by floor brokers. Superdot orders automatically enter the specialist's display book; orders from floor brokers can be entered manually by specialist's clerk. Specialists can execute the market order against the standing limit order in the display book, or execute it against his/her own inventory or against orders from the floor broker.

The TAQ database is time-stamped to the nearest second and includes the information on transaction price, transaction volume, the best bid quotes and depths, the best ask quotes and depths, condition codes for quotes and trades, and flags for opening and closing transactions. The sample period is from October 1 to December 31, 2002, giving a total of 63 trading days. We exclude opening transactions, negotiated large block transactions, and all observations recorded before 9:30 a.m. or after 4:00 p.m. Eastern Standard Time.

2.4 H-Shares and Red-Chips on the Stock Exchange of Hong Kong

Our sample of Chinese firms listed on the SEHK includes 31 H-shares and 27 red-chip stocks. H-shares refer to companies incorporated in mainland China that are listed on the SEHK. Red-chip stocks refer to companies incorporated and listed in Hong Kong with controlling Chinese shareholders. According to the SEHK, a company is deemed to be a China-controlled company if: (1) at least 30% of the shareholdings are held in aggregate directly by mainland China entities, and/or through companies

[11] Under the U.S. SEC regulatory rules, Level I ADRs trade on the OTC market and do not need to fully register with the SEC; however, issuing firms cannot raise capital. Level II and Level III ADRs must register and fully disclose their financial statement exactly as U.S. firms. Level III ADRs are allowed raise capital from the market.

which are controlled by mainland China entities; or (2) the company has below 30% but 20% or above shareholding held in aggregate directly by mainland China entities, and/or through companies which are controlled by mainland China entities and, there is a strong influential presence, on a judgmental basis, on the company's board of directors.[12]

Trading on the SEHK also takes the form of a centralized electronic limit order book. During the pre-opening session, orders are matched at the indicative equilibrium price.[13] During the continuous session, trading is conducted either through terminals in the Exchange's trading hall or through off-floor terminals at exchange members' offices. Investors place orders through their brokerage firms. The Automatic Order Matching and Execution System (AMS), which is a computerized limit-order driven trading system, executes the limit orders. Orders are executed in strict price and time priority.

The SEHK provides us with the trade record and bid and ask record from October 2 to December 31, 2002, giving a total of 63 trading days. The trade record dataset contains all transaction prices and transaction volumes with a time stamp to the nearest second. The bid and ask record dataset shows limit order prices, limit order quantities, and the number of orders in the same queue for up to five queues at 30-second intervals. The trading day on the SEHK is divided into the morning (10:00-12:30 a.m. local time) and afternoon (14:30-16:00 p.m. local time) sessions. We exclude opening transactions, negotiated large block transactions, and trades recorded before the opening hour or after the closing hour.

3. Empirical Results

3.1 Descriptive Statistics

Table 1 reports the descriptive statistics. We classify the stocks into the following eight categories: All A-shares, A-shares listed in Shanghai, A-shares listed in Shenzhen, B-shares listed in Shanghai, B-shares listed in Shenzhen, ADRs, H-shares, and red-chips. We report the mean statistics for each

[12] Mainland China entities include state-owned organisations and entities controlled by provincial or municipal authorities.

[13] The SEHK pre-opening session was launched in March 2002.

stock category. The descriptive statistics include the sample size, quoted spread, effective spread, price impact, realized spreads, stock price, market value, return volatility, and various measures of quoting and trading activities.

Since the quotes and transactions are denominated in different currencies for the sample of A-shares, B-shares, ADRs, H-shares and red-chips, our empirical evidence focuses on percentage spread measures. The simplest measure of trading cost is the quoted spread, which reflects the cost of a round-trip transaction. The percentage quoted spread for stock i at time t is calculated as the best ask price minus the best bid price on the limit order book divided by the mid price:

$$\text{Percentage quoted spread} = \frac{100 \times (\text{Ask}_{it} - \text{Bid}_{it})}{\text{Mid}_{it}},$$

where Ask_{it} is the ask price for security i at time t, Bid_{it} is the bid price for security i at time t, and $\text{Mid}_{it} = (\text{Ask}_{it} + \text{Bid}_{it})/2$ is the midpoint of bid and ask quotes at the time t. The quoted spread is a meaningful measure of trading cost up to the quoted depths. This is because large transactions exhaust the quoted depths associated with the best quotes. In addition, the quoted spread overstates the actual level of execution cost when transactions take place inside the quoted spread. Therefore we also calculate the percentage effective spread for stock i at time t:

$$\text{Percentage effective spread} = \frac{200 \times D_{it} \times (\text{Price}_{it} - \text{Mid}_{it})}{\text{Mid}_{it}},$$

where Price_{it} is the transaction price for security it at time t, D_{it} equals +1 for a market buy order and -1 for a market sell order. Since the quote and trade datasets for A-shares , B-shares, ADRs, H-shares, and red-chips do not provide information on trade direction, we rely on the trade classification algorithm developed by Ellis, Michaely and O'Hara (2000) to distinguish whether a trade was initiated as a buy

order or a sell order.[14]

Table 1 shows that the quoted spreads are 0.269% and 0.263% for A-shares in Shanghai and Shenzhen respectively; 0.398% and 0.658% for B-shares; 0.874% for ADRs traded on the NYSE; and 0.974% and 1.348% for H-shares and red-chips traded on the SEHK. The effective spreads are 0.242% and 0.252% respectively for A-shares listed in Shanghai and Shenzhen respectively; 0.380% and 0.594% for B-shares; 0.690% for ADRs traded on the NYSE; and 0.914% and 1.219% for H-shares and red-chips traded on the SEHK. Figure 1 shows that without adjustment for price level, firm size, trading volume, and return volatility, quoted and effective spreads are the highest for red-chips, followed by H-shares, ADRs, B-shares, and A-shares.

The mean market value is 1,094 million yuan for A-shares listed in Shanghai and 1,098 million yuan for A-shares listed in Shenzhen. The average B-share firms in Shanghai and Shenzhen have a market value of 944 and 600 million yuan respectively.[15] Comparing these figures with the mean firm size of 41,564 million yuan for ADRs, 4,007 million yuan for H-shares, and 25,716 million yuan for red-chips, it is clear that firms listed on domestic exchanges are smaller than those listed internationally.

Return volatility also reveals some important differences. For example, the monthly return standard deviation calculated using daily returns during our sample period is about 1.8% for both A- and B-shares. The monthly volatility is about 2.4% for ADRs, H-shares and red-chips. Translating these results into annual figures, the volatilities are 29% and 39% percent respectively.[16] Chinese stocks listed on international exchanges have a much higher volatility than those listed on domestic exchanges.

Both A- and B-shares are traded in a limit order market. Under normal double auction conditions, a trade should always hit either the bid or ask. Table 1 shows that 91.2% and 92.7% of A-share transactions on the Shanghai and Shenzhen exchanges happen on either the bid or ask side. Transactions

[14] Under the Ellis, Michaely, and O'Hara(2000) algorithm, all trades executed at the ask quote are categorized as buys. All trades executed at the bid quote are categorized as sells. All other trades are categorized by the tick rule. We also apply the Lee and Ready (1991) algorithm. The empirical results are essentially the same.

[15] The exchange rates are 8.28 yuan/US$ and 1.06 yuan/HK$.

[16] If we assume an average of 22 trading days within each calendar month, then the annualized volatilities are $1.8\%(22)^{0.5}(12)^{0.5}=29\%$ and $2.4\%(22)^{0.5}(12)^{0.5}=39\%$ respectively.

inside the spread account for 4.9% and 5.2% respectively. For B-shares, 90.4% and 88.2% happen on either the bid or ask sides; 7.0% and 10.6% happen inside the spreads. The notable difference comes from ADRs, where only 56.9% transactions happen exactly on the bid or ask quotes, while 42.9% happen inside the quotes. This is because of the NYSE trading mechanism. On the NYSE, specialists are obliged to serve as a last resort of liquidity, buying (selling) against his/her own inventory when there is an imbalance in the selling (buying) orders from the public. However, public orders have precedence over specialists' quotes. Therefore transactions inside the quoted spreads happen quite frequently under this market structure (Huang and Stoll, 1996). When an incoming market order arrives, specialists in general expose the order to the crowd for price improvement. At this point, the specialist can execute the order against another order in the limit order book (at an improved price), execute it against the order from the crowd (at the improved price), execute at the quoted price, or stop the order (Hasbrouck, Sofianos and Sosebee, 1993).[17] For H-shares and red-chips, 97.6% and 96.5% of transactions take place on the bid or ask quotes. The percentage of transactions taking place either inside or outside the quotes is negligible.

Finally, Table 1 reports the average daily number of transactions, average trade size, and average daily volume. Measured by the average daily number of transactions, A-shares turn out to be the most active market, with an average 220 transactions in Shanghai and 253 transactions in Shenzhen on a typical trading day. Measured by the average daily trading volume, H-shares and red-chips are the most active markets. However, the comparison must be interpreted carefully as no reference is made to the total shares outstanding. Similarly, since each ADR is equivalent to a multiple of the underlying share in the home market, comparing average trading volume and trade size of ADRs with other types of stocks must be adjusted for the ADR ratio.[18]

[17] The specialist guarantees execution at the prevailing quote (the stop price) while attempting to execute the order at a better price.

[18] For our sample of 16 ADRs, the ADR ratio is between 1:5 and 1:100.

3.2 Cross-Sectional Patterns of Spread and Spread Components

Theoretical bid-ask spread models have long established that trading costs are cross-sectionally related to firm and trading characteristics such as market value, trading volume, and return volatility in a systematic way (Demsetz, 1968; Stoll 1978a). The empirical evidence is strong and has changed little over time (Stoll, 2000). In this section, we document the cross-section patterns of bid-ask spread and its components. Our analysis focuses on A-shares as their much larger sample size allow us to make more reliable inferences. The analysis for B-shares, ADRs, H-shares, and red-chips is presented in Section 3.6 of this paper.

Table 2 sorts the A-shares by the market value, trading volume, and return volatility deciles. Panel A shows that the average effective spread is 0.299% for smallest firms and 0.175% for largest firms. The decline in effective spreads from smallest firms to largest firms is essentially monotonic. Similar patterns can be found in Panel B for portfolios sorted by trading volume. Most heavily traded stocks tend to have significantly lower quoted and effective spreads. Panel C sorts the stocks by daily return standard deviation. As expected, most volatile stocks have higher effective spreads than the least volatile stocks, although the monotonic pattern is less pronounced for stocks sorted on volatility.

Microstructure models that deal with order arrival and quote revisions in general decompose the spreads into three components: adverse selection (information asymmetry), order processing, and inventory cost. For limit order markets in China, Hong Kong, and NYSE, the inventory cost is less important. A sizeable literature proposes a number of models to carry out the actual decomposition using trade and quote data.[19] Here we apply the model free approach of Huang and Stoll (1996). This requires defining the following two variables. The first variable is percentage price impact:

$$\text{Percentage price impact} = \frac{200 \times D_{it} \times (V_{i,t+n} - \text{Mid}_{it})}{\text{Mid}_{it}},$$

[19] See the surveys by Goodhart and O'Hara (1997) and Madhavan (2000). Huang and Stoll (1997) develop a general spread decomposition model that reconciles various earlier models.

where $V_{i,t+n}$ is a measure of the true economic value of the security after the transaction. This is proxied by the midpoint of the first quote 30 minutes after the transaction. The price impact captures the permanent impact of a trade which contains information about the future value of the security. The second variable is realized spread:

$$\text{Percentage realized spread} = \frac{200 \times D_{it} \times (\text{Price}_{it} - V_{i,t+n})}{\text{Mid}_{it}},$$

Realized spreads measure the profit accruing to the liquidity provider as a result of the trade, net of the price impact. Intuitively, realized spreads compare the price the trader pays (receives) relative to its post-trade true value.

Panel A in Table 2 shows that for portfolios sorted by market value, the price impact drops notably from 0.219% for the smallest firms to 0.089% for the largest firms, while realized spreads drop slightly from 0.098% to 0.089%. The observed pattern of smaller effective spreads for large firms can therefore be mainly attributed to smaller price impacts. Since large firms are more visible among shareholders, they can attract more investors – in particular institutional investors. They also tend to be followed by more analysts. As such, large firms are subject to a lesser degree of information asymmetry.

A similar conclusion can be drawn for portfolios sorted by trading volume. Panel B shows that price impacts drop significantly from 0.243% for the most actively traded stocks to 0.093% for the least actively traded stocks. On the other hand, realized spreads drop by a much smaller magnitude, from 0.114% to 0.092%. This suggests that the wider effective spreads associated with less actively traded stocks are primarily caused by information effects. Overall Table 2 indicates that higher spreads associated with large and active stocks reflect the impact of information asymmetry more than the economies of scale in execution costs.

3.3 Intraday-Patterns of Spreads and Spread Components

One of the best-known stylized facts about intraday patterns in the bid-ask spread is that there is a broad U-shape in almost all equity markets, whether they are dealer markets, limit order markets, or hybrid markets. Traditional inventory considerations (Stoll, 1978b; Amihud and Mendelson, 1982) conclude that specialists respond to severe inventory imbalances towards the close of the market by setting a wider spread. Stoll and Whaley (1990) and Brock and Kleidon (1992) argue that specialist privileged access to order imbalance on the limit order book leads to a higher spread at the open and close of the trading session. Based on various assumptions, information models also predict a wider spread at the open and close (Admati and Pfleiderer, 1988; Madhavan, 1992; Foster and Viswanathan, 1994). On a pure limit-order market in China, there are no designated market makers such as dealers or specialists. Therefore modes based on private information about the value of the stocks should be more relevant in reconciling the intraday patterns than models based on inventory considerations or monopoly access to the limit order book.

There is conflicting existing empirical evidence on the source of this intraday variation. For example, Madhavan, et al. (1997) study a sample of firms on the hybrid NYSE market. Their major finding is that the adverse selection component declines steadily throughout the trading day, while the order-processing component increases over the course of the day, resulting in the well-known U-shape pattern. Ahn et al. (2002) examine the pure limit order book on the Tokyo Stock Exchange, where the inventory cost is negligible in the absence of designated market makers. They conclude that both adverse selection and order processing costs exhibit the U-shaped pattern for a large cross-section of firms. Chung et al. (1999) distinguish between quotes established by limit order traders and quotes established by NYSE specialists. They find that the U-shaped pattern in spreads is largely attributable to the behavior of limit order traders rather than specialists. However, Chung et al. (1999) do not decompose the spread components. To provide additional evidence on this issue, we examine the intraday pattern spreads and spread components for our sample of A-shares from pure a limit order book.

Table 3 reports the intraday patterns of effective spreads, price impacts, and realized spreads for firms

listed firms on the Shanghai and Shenzhen Stock Exchanges sorted by market value quintile groups. Exchange trading hours in Shanghai and Shenzhen are between 9:30 am and 15:00 pm with a lunch break between 11:30 am and 13:00 pm. We divide the 4-hour daily trading interval into sixteen 15-minute intervals. It is clear that regardless of the firm size, the opening intervals are associated with a higher price impact, realized spread, and effective spread than closing intervals. Figure 2 plots the intraday patterns when all stocks are aggregated. The higher effective spreads in the morning essentially level off as the trading hours elapse during the rest of the day. The intraday price impacts exhibit the familiar U-shaped pattern, except during the last two 15-minute intervals.[20] The pattern is in general consistent with the prediction of Admati and Pfleiderer (1988) who show that informed traders prefer to concentrate their trades during periods when the market is thick, i.e., when there are more liquidity traders, during the opening and closing sessions.

3.4 Trade Size, Spreads, and Spread Components

The relation between trade size and security price has long attracted the attention of researchers. Easley and O'Hara (1987) argue that informed traders prefer to trade large amounts at any given price. Then an adverse selection problem arises. The larger the transaction, the more likely the market maker (limit order investors) will be trading with an informed trader.

The predication of Easley and O'Hara (1987) finds support in Lin et al. (1995) and Ahn et al. (2002) who show that the adverse selection component increases with trade size while the order-processing component decreases with the trade component. On the other hand, Huang and Stoll (1997) conclude that large trades are associated with smaller adverse selection effects for a sample of NYSE firms. They argue that since large block trades are often negotiated in the upstairs market on the NYSE, brokers can certify the transaction and minimize the impact of adverse selection. Barclay and Warner (1993)

[20] This might be caused by differential time delays used in calculating $V_{i,t+n}$ during the closing intervals in the morning and afternoon sessions. For the two closing intervals 11:00-11:15 a.m. and 11:15-:1130 a.m. in the morning, we use the last quote before 11:30 a.m. to calculate $V_{i,t+n}$. Similarly, for the closing intervals 14:30-14:45 p.m. and 14:45-:15:00 p.m., we use the last quote before 15:00 p.m. to calculate $V_{i,t+n}$.

propose a stealthy trading hypothesis which states that informed traders concentrate on medium-sized transactions. Chakravary (2001) further concludes that it is institutional investors' medium-sized transactions that move prices in a disproportionate way. In this section, we examine the relation between trade size and spread components to provide additional insights on the issue.

On the Shanghai and Shenzhen exchanges, the minimum trading unit (MTU) is 100 shares for all A-shares. We define a trade to be small if the number of shares traded is equal to 5 MTUs or 500 shares. A medium-sized transaction trades between 5 MTUs and 50 MTUs. A large transaction trades more than 50 MTUs or 5,000 shares. For our sample of A-shares over the 3-month period, small, medium-sized and large transactions account for 37%, 53%, and 10% of all transactions respectively.

For each stock, we first group all transactions into three categories: small, medium-sized and large. For consecutive trades at t-1 and t-2, there nine possible transitions, i.e., small to small, small to medium, …, large to large, where t-1 and t-2 represent two previous sequence of the trades with respect to the current trade at t. We then calculate the spread and its components for each trade that falls into the particular transition category. Finally, we find the average spreads and spread components that correspond to each of the nine transitions. Our two-way variance analysis is based on the average numbers from individual stocks.

Table 4 summarizes the relations between trade size, effective spreads, and spread components. The column category refers to trade size at time t-1 and the row categories refer to trade size in t-2. Looking across the rows, effective spreads associated with transactions ending in a large trade at time t-1 are always higher than spreads associated with transactions ending in a small or medium trade at time t-1. The relation is monotonic. The corresponding F-values in the last column indicate that the difference is highly significant. A similar different pattern emerges from looking down the rows; effective spreads associated with transaction initiated from a large trade at time t-2 are higher than spreads associated with transactions initiated from a small or medium-sized trade.

Panel B tabulate the results for price impacts. The results also turn out to be similar to those in Lin et al. (1995) and Ahn et al. (2002). Large trades are associated with a larger price impact than small or

medium-sized trades. Looking across the rows, the relation is monotonic. For example, the price impacts are 0.141%, 0.145%, and 0.172% for transactions that end in small, medium-sized and large trades respectively at time t-1. The F-statistic of 26.31 is significant at the 5% level.

Panel C tabulates the results for realized spreads. In general, the results suggest little difference in order-processing costs associated with small, medium-sized or large transactions. The overall F-statistic is only 1.17, which is not significant at all. Therefore the differences in effective spreads can be primarily attributed to the differences in price impacts. Large trades carry more information than small or medium-sized trades, resulting in a larger price impact and higher effective spreads.

To verify whether our results are robust, we divide our sample of 819 A-share stocks into small, medium-sized and large stocks based on the average market capitalization over the 3-month sample period. We carry out the same analysis for the three groups of stocks sorted by firm size. Our conclusion is unchanged. Whether a stock is large, medium-sized or small, a large transaction always carries more information, which leads to a higher effective spread. The differences in post-trade revenues accrued to liquidity providers between transactions of different sizes are negligible.

3.5 Ownership, Spreads, and Spread Components

Chinese companies can have up to five different classes of equity: state-owned shares, legal person shares, tradable A-shares, employee shares, and shares only available to foreign investors. State shares are owned by the central and local governments. Legal-person shares can only be held by domestic institutions such as listed companies, state-private mixed firms, and non-bank financial institutions. State and legal person ownership shares are not traded on the exchanges. Except for employee and foreign ownership, the other three classes each account for a significant portion in the ownership structure. For example, Table 1 shows that the mean percentage of shares held by state and legal persons are 33.7% and 25.6% respectively. The mean proportion of tradable A-shares is 36.4%.

Although different classes of shareholders enjoy the same claims and voting power, their incentives, expertise, and capability in monitoring and controlling management vary significantly. Here, we

empirically study to the association between ownership structure, spreads, and spread components.[21] Our analysis starts with the one-way sorting of stocks into quartile groups based on each of the following four ownership variables: proportion of state shares, proportion of legal person shares; relative dominance of legal person versus state ownership: proportion of tradable A shares: and proportion of foreign shares.

Panel A of Table 5 shows that the average effective spreads of 0.244% for 148 firms with an average of 69% state ownership (the highest) is very close to the average effective spreads of 0.249% for 148 firms with an average of 19% state ownership. The t-statistic for testing the difference between the lowest and highest quartile groups fail to reject the null hypothesis. The F-statistic for testing the hypothesis that the effective spreads are the same across the quartile groups does not reject the null hypothesis either. The evidence from price impacts and realized spreads further confirms this. In a similar fashion, the t-statistics and F-statistics both reveal insignificant differences.

Panels B reports the sorting outcome based on legal person ownership. A larger proportion held by legal persons will reinforce the monitoring role of institutional investors and alleviate the problem associated with information asymmetry (Qi, Wu, and Zhang, 2000). Then firms with more legal-person entities as their shareholders should observe lower effective spreads. The average effective spread of 0.255% for firms with an average of 67% legal person ownership is, on the contrary, significantly higher than the average of 0.238% for firms with an average of only 3% legal person ownership. Moreover, this significant difference is driven by the significant difference in price impacts. However, the F-statistics for testing the overall differences across the quartile groups do not provide support for the t-statistic results.

To further explore this issue, we sort the stocks based on the relative dominance of state versus legal person ownership, as measured by the difference between the proportion of state ownership and legal person ownership. Panel C shows that although the t-statistics remain negative for both effective spreads and price impacts, they are no longer significant. We form a conjecture that the negative sign in

[21] A number of papers have examined the relation between ownership structure and corporate performance and the relation between ownership structure and stock return performance. See Qi, Wu, and Zhang (2000) and Bailey, Cai, Cheung, and Zhang (2004).

Panels B and C might be related to ownership concentration of legal-person entities. It is likely that a few legal identities hold a majority stake in some firms. In this case, the ownership is highly concentrated. A higher degree of ownership concentration leads to a greater extent of information asymmetry and larger bid-ask spreads. Therefore it will be interesting to explore the relation between bid-ask spreads and the percentage shares held by top-10 legal person identities. Unfortunately, data on ownership concentration for A-share stocks in China is not yet available

Amihud and Mendelson (1986) suggest that a large number of investors may enhance liquidity. Merton's (1987) investor base hypothesis argues that an increase in a firm's shareholder base increases investors' awareness of the firm. Both hypotheses predict a negative association between spreads and the proportion of tradable A-shares. We test the prediction in Panel D where we sort the stocks according to the proportion of tradable A-shares. The average effective spread is 0.236% for stocks with an average of 54% tradable A-shares, compared with the average spread of 0.245% for stocks with an average of 20% tradable A-shares. Although the t-statistic is not significant, the F-statistic of 7.20 for testing the equality of effective spreads across quartile groups is firmly rejected at the 5% level. More interestingly, the differences in price impacts (0.157% versus 0.169%) has a t-statistic of 2.04, and the corresponding F-statistic of 5.34 further reinforces the significant difference. Overall, we find that firms with a higher proportion of tradable shares are associated with lower price impacts and effective spreads: this result is consistent with the liquidity and investor base hypotheses.

Finally, Panel E compares the bid-ask spreads for stocks with high and low foreign ownership. Due to language barriers, different accounting standards, and lack of reliable information about local firms, foreign investors face an information disadvantage in trading A-shares relative to domestic investors (Chakravarty et al., 1998). Under this hypothesis, a higher percentage of foreign ownership should be associated with wider effective spreads and price impacts. Alternatively, Chui and Kwok (1998) and Wang and Jiang (2003) argue, with evidence, that foreign investors receive news about China faster than domestic investors because information flows come under tighter control for domestic investors. A higher percentage of foreign ownership therefore implies narrower effective spreads and price impacts.

The positive relation is somewhat evident in our small sample of stocks with foreign ownership. However, the statistical significance is not strong enough for us to make reliable inferences.[22]

3.6 Spreads and Spread Components for B-Shares, ADRs, H-Shares, and Red-Chips

We now turn to the analysis for other stock classes. Since the sample sizes are much smaller for B-shares, ADRs, H-shares, and red-chips, we therefore divide the stocks into active and inactive groups according to the average daily number of trades. Within each group, we further classify all transactions into three categories: small, medium-sized and large. Table 6 reports the effective spreads, price impacts, and realized spreads for each trade size category within the active and inactive groups of stocks.[23] We also tabulate the F-statistics for the differences between small, medium-sized and large trades and t-statistics for the differences between active and inactive stocks. Nevertheless, the discussions below should be interpreted with care sine we have a relatively small sample of stocks.

Overall, the evidence from B-shares in Panel A indicates that inactively traded stocks in general have higher effective spreads (0.458 versus 0.299%), higher price impacts (0.268 versus 0.196%), and higher realized spreads (0.190 versus 0.103%) compared with inactively traded stocks. This basically reflects higher adverse selection costs and order-processing costs associated with inactively traded stocks. In addition, regardless of whether the stock is active or not, large transactions are associated with higher effective spreads and price impacts. In B-share markets, foreign institutional investors are likely to be more important than foreign individual investors. These foreign institutional investors have the

[22] Chakravarty et al. (1998), Chui and Kwok (1998), and Wang and Jiang (2003) examine the discounts of B-shares and H-shares relative to A-shares. However, the argument can be readily applied to bid-ask spreads and foreign ownership in A-shares.

[23] For B-shares, the MTU is 100 shares. We define a trade to be: (1) small if trade size ≤ 10 MTU; (2) medium-sized if 10 MTU < trade size ≤ 100 MTUs; (3) large if trade > 100 MTUs. The distribution is 40%, 51% and 9% for small, medium-sized and large transactions in Shanghai. The distribution is 44%, 46%, and 10% for small, medium-sized and large transactions in Shenzhen. For ADRs, the MTU is 100 shares, we define a trade to be: (1) small if trade size = 1 MTU; (2) medium-sized if 1 MTU < trade size ≤ 10 MTUs; (3) large if trade > 10 MTUs. The distribution is 37%, 48% and 15% respectively. For H-shares and red-chips, we define a trade to be: (1) small if trade size ≤ 10,000 shares; (2) medium-sized if 10,000 shares < trade size ≤ 100,000 shares; (3) large if trade > 100,000 shares. The distribution of small, medium-sized and large transactions for H-shares is 27%, 59% and 14%. The distribution is 48%, 43% and 9% for red-chips.

incentive and resources to spend more time and effort in assembling information from the B-share market. They will also trade larger quantities based on the information they acquire.

Panel B reports the results from ADRs traded on the NYSE. Noticeably, the effective spreads for actively traded ADRs are more than 3 times that of inactively traded ADRs (1.057% versus 0.324%). This is driven by dramatic differences in both the price impacts (0.667% versus 0.183%) and realized spreads (0.390% versus 0.141%). Larger transactions for ADRs on the NYSE contain more information than small and medium-size transactions, particularly for a group of actively traded ADRs. The corresponding F-statistic of 5.22 is highly significant. The F-statistics for effective spreads are not significant, although the magnitude of effective spreads suggests quite obvious differences. This is most likely related to the small number of observations.

The patterns from H-shares traded on SEHK are intriguing. There is little detectable difference between active and inactively traded stocks in either effective spreads, price impacts, or realized spreads. Large trades carry for more information. In the meantime, realized spreads are much smaller for large trades. For example, the average realized spread for large transactions is more than 5 times that of small transactions if the stocks are actively traded (0.442% versus 0.083%). For inactively traded stocks, the difference is almost 3 times (0.466% versus 0.163%). The combined effect is that there is little difference in effective spreads for large and small trades.

Inactively traded red-chips listed on the SEHK are characterized by higher price impacts, higher realized spreads, and consequently wider spreads. Other than this difference, the patterns essentially mirror those for H-shares. On one hand, large transactions carry much more information. On the other hand, large trades face much lower realized spreads. Overall, the differences in effective spreads are minimal.

3.7 Cross-Sectional Determinants of Spreads and Spread Components

Previous sections analyze bid-ask spreads for different types of stocks listed on domestic and international exchanges on an individual basis. In this section, we provide a comparison across these

stocks. We test for the difference in spreads and spread components after controlling for firm and trading characteristics. Formally, we the run the following OLS regressions:

$$y_i = d_1 \ln(1/P_i) + d_2 \ln(MV_i) + d_3 \ln(N_i) + d_4 \ln(s_i^2) +$$
$$d_5 D_i^{ShanghaiA} + d_6 D_i^{ShenzhenA} + d_7 D_i^{ShanghaiB} + d_8 D_i^{ShenzhenB} +$$
$$d_9 D_i^{NYSE,ADR} + d_{10} D_i^{HongKong,H\text{-}share} + d_{11} D_i^{HongKong,Red\text{-}chip} + e_i .$$

In the regressions, the dependent variable y_{it} takes the value of percentage effective spreads, percentage price impacts, and percentage realized spreads. For independent variables, we add dummy variables that correspond to the following seven categories of stocks: A-shares in Shanghai, A-shares in Shenzhen, B-shares in Shanghai, B-shares in Shenzhen, ADRs on the NYSE, H-shares in Hong Kong, and red-chips in Hong Kong. The other control variables used in the regressions include the log of the inverse of stock price (P), the log of market value (MV), the log of average daily number of transactions (N), and the log of daily return volatility. To reduce measurement error associated with a single trading day, we average the daily effective spreads, price impacts, and realized spreads across 61 trading days in our sample period. Similarly, stock price is calculated as the average of daily closing prices. Market value is calculated as shares outstanding × average of daily closing prices. Other than the dummies, we subtract the mean from each observation of the independent variables in the regressions.

The regressions results appear in Panel A of Table 7. All control variables have the expected signs with highly significant t-statistics. The coefficients on the dummy variables that correspond to different type of stocks in general confirm the evidence from descriptive statistics reported in Table 1. On an adjusted basis, red-chips have the widest effective spread of 0.905%; B shares in Shanghai have the narrowest spreads of 0.205%. The price impact is also the largest for red-chips (0.475%) and smallest for B shares in Shanghai (0.123%). The same inference can be made for realized spreads. Figure 3 plots the estimated coefficients on the seven dummy variables, which essentially mirror those in Figure 1.

For regressions from Model 1, Panel B of Table 7 carries out the formal tests for the pair-wise comparison of spreads and spread components. Overall we can comfortably conclude that domestic investors trading A- and B-shares inside China face lower bid-ask effective spreads than foreign investors trading ADRs in New York or trading H-shares and red-chips in Hong Kong. The wider effective spreads can be attributed to both a higher degree of information asymmetry and higher revenues collected by liquidity suppliers in international exchanges.

4 Conclusions

In this paper, we provide a comprehensive study on the bid ask spreads and spread components for Chinese stocks listed on domestic and international equity markets. Our sample of listed stocks includes A-shares in Shanghai and Shenzhen, B-shares in Shanghai and Shenzhen, ADRs in New York, and H-shares and red-chips in Hong Kong. Simple summary statistics suggest that both quoted and effective spreads are the highest for red-chips, followed by H-shares, ADRs, B-shares, and A-shares. Since ADRs, H-share, and red-chips typically have a much higher market value and return volatility, we also compare the spreads after adjusting for these differences. Our regression results confirm that foreign investors trading Chinese stocks listed on international exchanges face wider spreads than Chinese citizens trading on domestic exchanges. The large effective spreads on international exchanges reflect both a higher degree of information asymmetry and higher revenues demanded by liquidity suppliers.

The Chinese economy is gradually moving from being a centrally planned economy to a market economy. This transition is characterized by the unique feature in the ownership structure of Chinese enterprises. In particular, the state and other legal entities hold a significant portion of many listed firms. These shares are typically not traded on domestic exchanges. The large cross-sectional variation in the proportion of state-owned shares, legal person shares, tradable A-shares, and foreign ownership thus offer an interesting environment for testing the implication of ownership structure on equity transaction costs. Here we have made a first attempt to explore this issue. Interestingly, we find that firms with a higher proportion of tradable A-shares face lower effective spreads and price impacts. Our evidence is in favor

of both the liquidity (Amihud and Mendelson, 1986) and investor base hypotheses (Mertion, 1987)

Finally, we find it difficult to reconcile the fact that investors face higher bid-ask spreads trading H-shares and red-chips in Hong Kong than trading ADRs in New York. Geographically, Hong Kong is much closer to China than New York is. Moreover, investors in Hong Kong share the same ethnic, language, and cultural background as investors from inside China. Investors in Hong Kong should have a more genuine interest and a higher urge to understand the business practices, earnings ability, and growth prospects of Chinese firms. All these should help minimize the impact of asymmetric information. Our evidence suggests quite the opposite. This remains an interesting issue to be addressed in future research.

References

Admati, A., Pfleiderer, P., 1988. A theory of intraday patterns: Volume and price variability. Review of Financial Studies 1, 3-40.

Ahn, H. J., Cai, J., Hamao, Y., Ho, R., 2002. The components of the bid-ask spread in a limit-order market: Evidence from the Tokyo Stock Exchange. Journal of Empirical Finance 9, 399-430.

Ahn, H. J., Cheung Y. L., 1999. The intraday patterns of the spread and depth in a market without market makers: The Stock Exchange of Hong Kong. Pacific-Basin Finance Journal 7, 539-556.

Amihud, Y., Mendelson H., 1982. Asset pricing behaviour in a dealership market. Financial Analysts Journal 38, 50-59.

Amihud, Y., Mendelson H., 1986. Asset pricing and the bid-ask spread. Journal of Financial Economics 17, 223-249.

Bacidore, J., Sofianos, G., 2002. Liquidity provision and specialist trading in NYSE-listed non-U.S. stocks. Journal of Financial Economics 63, 133-158.

Bailey, W., Cai, J., Cheung Y. L., Zhang, Z., 2004. The cross-sectional determinants of stock returns in China: Further evidence on characteristics, factors, and momentum. Working paper, Cornell University, Ithaca, NY.

Barclay, M., Warner, J., 1993. Stealthy trading and volatility: Which trades move prices? Journal of Financial Economics 34, 281-305.

Bekaert, G., Harvey, C., 2003. Emerging market finance. Journal of Empirical Finance 10, 3-55.

Biais, B., Hillton, P., Spatt, C., 1995. An empirical analysis of the limit order book and the order flow in the Paris Bourse. Journal of Finance 50, 1655-1689.

Brock W., Kleidon, A., 1992. Periodic market closure and trading volume: A model of intraday bids and asks. Journal of Economic Dynamics and Control 16, 451-489.

Chan K., Menkveld, A., Yang, Z., 2002. Evidence on the foreign share discount puzzle in China: Liquidity or information asymmetry? Working paper, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong.

Chakravarty, S., 2001. Stealth trading: Which traders' trades move stock prices? Journal of Financial Economics 61, 289-307.

Chakravarty, S., Sarkar, A., Wu. L. F., 1998. Information asymmetry, market segmentation and the pricing of cross-listed shares: Theory and evidence from Chinese A and B shares. Journal of International Financial Markets, Institutions and Money 8, 325-356.

Cho, D. C., Russell, J., Tiao, G. C., Tsa, R., 2003. The magnet effect of price limits: Evidence from high frequency data on Taiwan Stock Exchange. Journal of Empirical Finance 10, 135-170.

Chui, A., Kwok, C., 1998. Cross-autocorrelation between A shares and B shares in the Chinese stock market. Journal of Financial Research 21, 333-353.

Chung, K. H., Van Ness, B. F., Van Ness, R. A., 1999. Limit orders and the bid-ask spread. Journal of Financial Economics 53, 255-287.

Demsetz, H., 1968. The cost of transacting. Quarterly Journal of Economics 82, 33-53.

Domowitz, I., Glen J., Madhavan, A., 1998. International cross listing and order flow migration: Evidence from an emerging market. Journal of Finance 53, 2001-2028.

Domowitz, I., Glen J., Madhavan, A., 2002. Liquidity, volatility, and equity trading costs across countries and over time. International Finance 4, 221-255.

Domowitz, I., Steil, B., 1999. Automation, trading costs, and the structure of the securities trading industry. Brookings-Wharton Papers on Financial Services 2, 33-92.

Easley, D., O'Hara, M., 1987. Price, trade size, and information in securities market. Journal of Financial Economics 19, 69-90.

Ellis, K., Michaely R., O'Hara, M., 2000. The accuracy of trade classification rules: Evidence from NASDAQ. Journal of Financial and Quantitative Analysis 35, 529-552.

Foster, F., Viswanathan, S., 1994. Strategic trading with asymmetrically informed investors and long-lived information. Journal of Financial and Quantitative Analysis 29, 499-518.

Ghysels, E., Cherkaou, M., 2003. Emerging markets and trading costs: Lessons from Casablanca. Journal of Empirical Finance 10, 171-200.

Glen, J., 2000. An introduction to the microstructure of emerging markets. Working paper, International Finance Corporation.

Glosten, L., 1994. Is the electronic open limit order book inevitable? Journal of Finance 49, 1127-1161.

Glosten, L., Harris L., 1988. Estimating the components of the bid-ask spread. Journal of Financial Economics 21, 123-142.

Goodhart, C., O'Hara, M., 1997. High frequency data in financial markets: Issues and applications. Journal of Empirical Finance 4, 73-114.

Harris, L., Hasbrouck, J., 1996. Market versus limit orders: the SuperDot evidence on order submission strategy. Journal of Financial and Quantitative Analysis 31, 213-231.

Hasbrouck, J., Sofianos, G., Sosebee, D., 1993. New York Stock Exchange systems and trading procedure. New York Stock Exchange, New York.

Hedvall, K., Niemeyer, J., Rosenqvist, G., 1997. Do buyers and sellers behave similarly in a limit order book? A high-frequency data examination of the Finnish Stock Exchange. Journal of Empirical Finance 4, 279-293.

Huang R., Stoll, H., 1996. Dealer versus auction markets: A paired comparison of execution costs on NASDAQ and the NYSE. Journal of Financial Economics 41, 313-357.

Huang R., Stoll, H., 1997. The components of bid-ask spread: A general approach. Review of Financial Studies 10, 995-1034.

Jain, P., 2001. Institutional design and liquidity at stock exchanges around the world. Working paper, Indiana University, Bloomington, IN.

Karolyi, A., 1998. Why do companies list shares abroad? A survey of the evidence and its managerial implications. Financial Markets, Institutions & Instruments 7, 1-47.

Kavajecz, K., 1999. A specialist's quoted depth and the limit-order book. Journal of Finance 54, 747-771.

Lee, C., Ready, M., 1991. Inferring trade direction from intra-day data. Journal of Finance 46, 733-746.

Lesmond, D. A., 2002. The costs of equity trading in emerging markets. Working paper, Tulane University, New Orleans, LA.

Lin, J. C., Sanger, G., Booth, G., 1995. Trade size and components of bid-ask spreads. Review of Financial Studies 8, 1153-1183.

Madhavan, A., 1992. Trading mechanisms in securities markets. Journal of Finance 47, 607-642.

Madhavan, A., 2000. Market microstructure: A survey. Journal of Financial Markets 3, 205-258.

Madhavan, A., Richardson, M., Roomans, M., 1997. Why do securities prices change? A transaction-level analysis of NYSE stocks. Review of Financial Studies 10, 1035-1064.

Merton, R. C., 1987. A simple model of capital market equilibrium with incomplete information. Journal of Finance 42, 483-510.

Perold A., Sirri E., 1993. The cost of international equity trading. Working paper, Harvard University, Boston, MA.

Qi, D., Wu, W., Zhang H., 2000. Shareholding structure and corporate performance of partially privatized firms: Evidence from listed Chinese companies. Pacific-Basin Finance Journal 8, 587-610.

Seppi, D., 1997. Liquidity provision with limit orders and a strategic specialist. Review of Financial Studies 10, 103-150.

Stoll, H., 1978a. The supply of dealer services in securities markets. Journal of Finance 33, 1133-1151.

Stoll, H., 1978b. The pricing of security dealer services: An empirical study of NASDAQ stocks. Journal of Finance 33, 1153-1172.

Stoll, H., 2000. Friction. Journal of Finance 55, 1479-1514.

Stoll, H., Whaley, R., 1990. Stock market structure and volatility. Review of Financial Studies 3, 37-71.

Wang S. S., Jiang L., 2003. Location of trade, ownership restrictions, and market illiquidity: Examining Chinese A- and H-shares. Journal of Banking and Finance, forthcoming.

Table 1 Summary Statistics for Chinese Stocks Listed on Domestic and International Exchanges

This table provides summary statistics for listed A- and B-share stocks traded on the Shanghai and Shenzhen Stock Exchanges, ADRs on the NYSE, and H-shares and red-chip stocks on the SEHK. The statistics are pooled time-series cross-sectional averages across sample firms from October 8 to December 31, 2002 for a period of 61 trading days. Statistics include the number of listed stocks in the sample; quoted spreads in yuan and percentage terms; effective spreads in yuan and percentage terms; price impact; realized spread; the proportion of price impact; daily stock price; end-of-the month market capitalization calculated using tradable A-shares; return volatility measured by the daily return standard deviation; the proportion of transactions on either the bid or ask sides and the proportions of transactions inside and outside the spreads; average number of daily transactions; average trade size in yuan; and average daily volume in shares. The percentage quoted spread is calculated as $[100*(Ask_{it}-Bid_{it})/Mid_{it}]$, where Mid_{it} is the midpoint of bid (Bid_{it}) and ask (Ask_{it}) quotes at the time of transaction. The percentage effective spread for stock i at time t is calculated as $[200*D_{it}*(Price_{it}-Mid_{it})/Mid_{it}]$, where dummy D_{it} equals +1 for a market buy and -1 for a market sell, $Price_{it}$ is the transaction price. Summary statistics are also provided for ownership structure variables including the proportion of shares held by the central and local government (state), by domestic legal entities and institutions (legal person LP), the relative dominance of legal person ownership (LP – State), by domestic investors (tradable A-shares), and by overseas investors (foreign). The ownership data are for the fiscal year ending in December 2002. Since the quotes, stock prices, and market value are denominated in different currencies for the sample of B-shares, ADRs, H-shares, and red-chips, we convert them into yuan using the exchange rate of 8.28 yuan/US$ and 1.06 yuan/HK$.

	All A	Shanghai A	Shenzhen A	Shanghai B	Shenzhen B	ADR	H-share	Red-chip
Number of listed stocks in the sample	819	492	327	43	43	16	31	27
Quoted spread (in yuan)	0.030	0.031	0.026	0.023	0.032	0.895	0.021	0.029
Quoted spread in percentage terms	0.267	0.269	0.263	0.398	0.658	0.874	0.974	1.348
Effective spread (in yuan)	0.024	0.025	0.023	0.022	0.029	0.659	0.019	0.027
Effective spread in percentage terms	0.246	0.242	0.252	0.380	0.594	0.690	0.914	1.219
Price impact in percentage terms	0.168	0.167	0.171	0.233	0.316	0.425	0.591	0.655
Realized spread in percentage terms	0.089	0.087	0.092	0.147	0.279	0.265	0.323	0.564
Price impact/(price impact + realized spread)	0.661	0.667	0.653	0.649	0.563	0.649	0.649	0.587
Stock price (in yuan)	9.836	10.367	9.036	5.589	4.683	121.334	2.428	3.592
Market value (in million yuan)	1096	1094	1098	944	600	41564	4007	25716
Return volatility (daily return std. dev.)	0.018	0.017	0.018	0.018	0.019	0.024	0.023	0.025
Average daily number of quotes	233	220	253	94	67	404	169	145
Average quote depth (ask, in 1,000 shares)						1.4	1064	500
Average quote depth (bid, in 1,000 shares)						1.6	1046	441

% of transactions on the bid or ask	0.918	0.912	0.927	0.904	0.882	0.569	0.976	0.965
% of transactions inside spread	0.050	0.049	0.052	0.070	0.106	0.429	0.014	0.012
% of transactions outside spread	0.032	0.040	0.021	0.026	0.012	0.001	0.010	0.023
Average daily number of transactions	233	220	253	94	67	55	128	117
Average trade size (in 1,000 yuan)	18	19	16	18	13	89	115	198
Average daily trading volume (in 1,000 shares)	561	541	593	413	312	85	12209	5844
State ownership (in percentage)	33.7	33.9	33.4					
Legal person ownership	25.6	26.4	24.5					
Legal person – state ownership	-8.1	-7.5	-8.9					
Tradable A-shares	36.4	34.8	38.7					
Foreign ownership	3.5	3.9	2.9					

Table 2 Effective Spread, Price Impact, and Realized Spread by Market Value, Trading Volume, Volatility Deciles

This table reports the effective spreads, price impacts, and realized spreads for listed A-share firms traded on the Shanghai and Shenzhen Stock Exchanges sorted by market value, trading volume, and volatility deciles. The statistics are pooled time-series cross-sectional averages across sample firms from October 8 to December 31, 2002 for a period of 61 trading days. The percentage effective spread for stock i at time t is calculated as $200*D_{it}*(Price_{it}-Mid_{it})/Mid_{it}$, where dummy D_{it} equals +1 for a market buy and -1 for a market sell, P_{it} is the transaction price, and Mid_{it} is the midpoint of bid and ask quotes at the time of transaction. The percentage price impact is calculated as $200*D_{it}*(V_{i,t+n}-Mid_{it})/Mid_{it}$, where $V_{i,t+n}$ is a measure of true economic value of the stock after the trade. $V_{i,t+n}$ is proxied by the midpoint of the first quote reported 30 minutes after the trade. The percentage realized spread is calculated as $200*D_{it}*(Price_{it}-V_{i,t+n})/Mid_{it}$. The market value decile is determined by tradable A-shares outstanding × average daily stock price. The trading volume decile is determined by average daily trading volume in shares. The volatility decile is determined by daily return standard deviation during the sample period.

Panel A: Market Value Decile

	Smallest	2	3	4	5	6	7	8	9	Largest	All
Effective spread	0.299	0.285	0.263	0.261	0.262	0.251	0.239	0.213	0.212	0.175	0.246
Price impact	0.219	0.207	0.195	0.190	0.182	0.170	0.163	0.145	0.121	0.089	0.168
Realized spread	0.098	0.094	0.081	0.083	0.093	0.092	0.085	0.075	0.097	0.089	0.089
Stock price (yuan)	11.56	10.84	9.97	9.68	9.20	8.87	9.20	8.76	9.26	11.04	9.84
Market value (million yuan)	370	505	592	672	781	887	1041	1279	1633	3225	1096

Panel B: Trading Volume Decile

	Lowest	2	3	4	5	6	7	8	9	Highest	All
Effective spread	0.337	0.292	0.273	0.260	0.239	0.238	0.232	0.209	0.199	0.181	0.246
Price impact	0.243	0.208	0.196	0.188	0.169	0.170	0.150	0.139	0.127	0.093	0.168
Realized spread	0.114	0.101	0.092	0.086	0.081	0.078	0.091	0.076	0.077	0.092	0.089
Stock price (yuan)	12.81	10.61	10.12	10.06	9.79	9.04	9.12	8.89	9.19	8.72	9.84
Trading volume (1,000 shares)	111	174	216	263	323	392	474	623	862	2197	490

Panel C: Volatility Decile

	Lowest	2	3	4	5	6	7	8	9	Highest	All
Effective spread	0.204	0.259	0.271	0.259	0.246	0.256	0.253	0.244	0.243	0.226	0.246
Price impact	0.111	0.157	0.183	0.185	0.180	0.179	0.185	0.177	0.167	0.111	0.168
Realized spread	0.100	0.113	0.101	0.087	0.077	0.088	0.081	0.078	0.086	0.100	0.089
Stock price (yuan)	12.14	10.39	10.94	9.93	9.23	8.83	9.39	8.74	9.19	9.58	9.84
Volatility (daily ret. std. dev.)	0.010	0.014	0.015	0.016	0.017	0.018	0.019	0.020	0.021	0.026	0.018

Table 3 Intraday Patterns of Effective Spreads, Price Impacts, and Realized Spreads

This table reports the intraday patterns of effective spreads, price impacts, and realized spreads for listed A-share firms traded on the Shanghai and Shenzhen Stock Exchanges sorted by market value quintile groups. Exchange trading hours in Shanghai and Shenzhen are between 9:30 am and 15:00 pm with a lunch break between 11:30 am and 13:00 pm. The 4-hour daily trading interval is broken into sixteen 15-minute intervals. The statistics are pooled time-series cross-sectional averages across sample firms from October 8 to December 31, 2002 for a period of 61 trading days. The percentage effective spread for stock i at time t is calculated as $200*D_{it}*(Price_{it}-Mid_{it})/Mid_{it}$, where dummy D_{it} equals +1 for a market buy and -1 for a market sell, P_{it} is the transaction price, and Mid_{it} is the midpoint of bid and ask quotes at the time of transaction. The percentage price impact is calculated as $200*D_{it}*(V_{i,t+n}-Mid_{it})/Mid_{it}$, where $V_{i,t+n}$ is a measure of the true economic value of the stock after the trade. $V_{i,t+n}$ is proxied by the midpoint of the first quote reported 30 minutes after the trade. The percentage realized spread is calculated as $200*D_{it}*(Price_{it}-V_{i,t+n})/Mid_{it}$. For the two closing intervals 11:00-11:15 a.m. and 11:15-:1130 a.m. in the morning, we use the last quote before 11:30 to calculate $V_{i,t+n}$. Similarly, for the two dosing intervals 14:30-14:45 p.m. and 14:45-:15:00 p.m. in the afternoon, we use the last quote before 15:00 to calculate $V_{i,t+n}$. The market value quintile groups are determined by tradable A-shares outstanding × average daily stock price.

Market value quintile groups	9:30-9:45	9:45-10:00	10:00-10:15	10:15-10:30	10:30-10:45	10:45-11:00	11:00-11:15	11:15-11:30	13:00-13:15	13:15-13:30	13:30-13:45	13:45-14:00	14:00-14:15	14:15-14:30	14:30-14:45	14:45-15:00
Smallest																
Effective spread	0.628	0.450	0.383	0.343	0.324	0.314	0.304	0.304	0.293	0.280	0.274	0.270	0.270	0.267	0.258	0.255
Price impact	0.324	0.227	0.202	0.197	0.193	0.191	0.152	0.106	0.138	0.165	0.158	0.175	0.175	0.192	0.166	0.099
Realized spread	0.304	0.223	0.180	0.146	0.131	0.123	0.153	0.199	0.155	0.114	0.116	0.094	0.095	0.075	0.092	0.156
2																
Effective spread	0.550	0.385	0.326	0.294	0.285	0.276	0.272	0.270	0.258	0.251	0.246	0.243	0.241	0.242	0.238	0.234
Price impact	0.288	0.200	0.191	0.192	0.175	0.161	0.145	0.101	0.123	0.138	0.148	0.161	0.171	0.186	0.139	0.091
Realized spread	0.263	0.185	0.135	0.102	0.110	0.116	0.126	0.169	0.136	0.113	0.098	0.082	0.070	0.056	0.099	0.143
3																
Effective spread	0.556	0.380	0.315	0.283	0.273	0.263	0.257	0.260	0.249	0.243	0.240	0.239	0.237	0.236	0.230	0.230
Price impact	0.270	0.196	0.164	0.163	0.145	0.148	0.136	0.097	0.110	0.134	0.134	0.148	0.165	0.167	0.136	0.087
Realized spread	0.286	0.184	0.152	0.120	0.128	0.115	0.120	0.163	0.139	0.109	0.106	0.092	0.072	0.069	0.094	0.143
4																
Effective spread	0.449	0.310	0.263	0.244	0.236	0.231	0.226	0.228	0.223	0.215	0.212	0.212	0.210	0.211	0.206	0.205
Price impact	0.214	0.155	0.141	0.142	0.145	0.138	0.123	0.089	0.093	0.134	0.128	0.133	0.140	0.149	0.127	0.081
Realized spread	0.235	0.155	0.122	0.102	0.091	0.093	0.103	0.140	0.129	0.081	0.084	0.080	0.071	0.063	0.079	0.124
Largest																
Effective spread	0.326	0.236	0.210	0.201	0.198	0.194	0.193	0.193	0.191	0.188	0.185	0.185	0.186	0.185	0.182	0.185
Price impact	0.128	0.097	0.092	0.097	0.094	0.102	0.099	0.075	0.067	0.090	0.088	0.095	0.102	0.116	0.120	0.079
Realized spread	0.198	0.139	0.117	0.104	0.104	0.091	0.094	0.117	0.124	0.098	0.097	0.090	0.083	0.068	0.063	0.105

Table 4 Effective Spreads, Price Impact, and Realized Spreads by Trade Size

This table reports effective spreads, price impacts, and realized spreads for listed firms traded on the Shanghai and Shenzhen Stock Exchanges sorted by trade size categories. The statistics are pooled time-series cross-sectional averages across sample firms from October 8 to December 31, 2002 for a total of 61 trading days. For each stock, we group all transactions into three categories: small, medium-sized and large. For consecutive trades at t-1 and t-2, there nine possible transitions, i.e., small to small, small to medium, …, large to large, where t-1 and t-2 represent two previous sequence of the trades with respect to the current trade at t. We define a trade to be small if the number of shares traded is equal to 5 MTUs (500 shares). A medium-sized transaction trades between 5 MTUs and 50 MTUs. A large transaction trades at more than 50 MTUs (5,000 shares). The spread and its components are calculated for each of the nine transitions. The percentage effective spread for stock i at time t is calculated as $200*D_{it}*(Price_{it}-Mid_{it})/Mid_{it}$, where dummy D_{it} equals +1 for a market buy and -1 for a market sell, P_{it} is the transaction price, and Mid_{it} is the midpoint of bid and ask quotes at the time of transaction. The percentage price impact is calculated as $200*D_{it}*(V_{i,t+n}-Mid_{it})/Mid_{it}$, where $V_{i,t+n}$ is a measure of the true economic value of the stock after the trade. $V_{i,t+n}$ is proxied by the midpoint of the first quote reported 30 minutes after the trade. The percentage realized spread is calculated as $200*D_{it}*(Price_{it}- V_{i,t+n})/Mid_{it}$. Also reported are the F-statistics for testing the equality of the estimates across each row and column. ** and * indicate significance at the 5 and 10% levels respectively.

Panel A: Effective Spreads

t-2 \ t-1	Small	Medium	Large	F-value
Small	0.225 (0.055)	0.226 (0.056)	0.258 (0.079)	69.26**
Medium	0.224 (0.055)	0.228 (0.060)	0.253 (0.081)	45.07**
Large	0.248 (0.072)	0.249 (0.077)	0.283 (0.132)	33.73**
F-value	41.41**	30.36**	20.94**	53.64**

Panel B: Price Impacts

t-2 \ t-1	Small	Medium	Large	F-value
Small	0.141 (0.055)	0.145 (0.056)	0.172 (0.142)	26.31**
Medium	0.145 (0.055)	0.150 (0.058)	0.171 (0.141)	18.34**
Large	0.158 (0.136)	0.173 (0.146)	0.190 (0.345)	4.11**
F-value	7.70**	19.74**	1.81	9.91**

Panel C: Realized Spreads

t-2 \ t-1	Small	Medium	Large	F-value
Small	0.084 (0.048)	0.081 (0.045)	0.086 (0.136)	0.61
Medium	0.080 (0.043)	0.077 (0.048)	0.082 (0.127)	0.51
Large	0.091 (0.132)	0.075 (0.130)	0.092 (0.355)	1.33
F-value	3.43**	0.95	0.45	1.17

Table 5 Effective Spread, Price Impact, and Realized Spread by Ownership Structure

This table reports the effective spreads, price impacts, and realized spreads for listed firms traded on the Shanghai and Shenzhen Stock Exchanges sorted by ownership structure. The statistics are pooled time-series cross-sectional averages across sample firms from October 8 to December 31, 2002 for a total of 61 trading days. The percentage effective spread for stock i at time t is calculated as $200*D_{it}*(Price_{it}-Mid_{it})/Mid_{it}$, where dummy D_{it} equals +1 for a market buy and -1 for a market sell, P_{it} is the transaction price, and Mid_{it} is the midpoint of bid and ask quotes at the time of transaction. The percentage price impact is calculated as $200*D_{it}*(V_{i,t+n}-Mid_{it})/Mid_{it}$, where $V_{i,t+n}$ is a measure of the true economic value of the stock after the trade. $V_{i,t+n}$ is proxied by the midpoint of the first quote reported 30 minutes after the trade. The percentage realized spread is calculated as $200*D_{it}*(Price_{it}-V_{i,t+n})/Mid_{it}$. Ownership structure variables include the proportion of shares held by the central and local government (state), by domestic legal entities and institutions (legal person LP), the relative dominance of legal person ownership (LP – State), by domestic investors (tradable A-shares), and by overseas investors (foreign). The ownership data are for the fiscal year ending in December 2002. Also reported are the F-statistics for testing the equality of the estimates within the quartile groups and t-statistics for testing the difference between the lowest and highest quartile groups. ** and * indicate significance at the 5% and 10% levels respectively.

Panel A: State Ownership

	All	0%	Lowest Quartile	2nd Quartile	3rd Quartile	Highest Quartile	T-test (low=high)	F-value
Effective spread	0.246	0.247	0.249	0.247	0.243	0.244	0.55	0.23
Price impact	0.168	0.169	0.170	0.167	0.170	0.166	0.65	0.22
Realized spread	0.089	0.089	0.090	0.091	0.084	0.090	-0.04	0.67
State ownership (%)	33.67	0.00	18.64	41.06	56.86	69.12		
Market value (mil. yuan)	1096	1093	1204	994	1093	1097		
Number of observations	819	225	148	149	149	148		

Panel B: Legal Person Ownership

	All	0%	Lowest Quartile	2nd Quartile	3rd Quartile	Highest Quartile	T-test (low=high)	F-value
Effective spread	0.246	0.239	0.238	0.252	0.247	0.255	-2.15**	1.86
Price impact	0.168	0.165	0.163	0.170	0.167	0.178	-2.17**	1.76
Realized spread	0.089	0.084	0.086	0.093	0.091	0.090	-0.82	0.49
LP ownership (%)	25.61	0.00	2.95	16.73	41.95	67.08		
Market value (mil. yuan)	1096	1211	1084	1128	1114	940		
Number of observations	819	168	162	163	163	163		

Panel C: Legal Person - State Ownership

	All	Lowest Quartile	2nd Quartile	3rd Quartile	Highest Quartile	T-test (low=high)	F-value
Effective spread	0.246	0.242	0.244	0.246	0.253	-1.64	1.11
Price impact	0.168	0.167	0.168	0.165	0.174	-1.23	0.84
Realized spread	0.089	0.086	0.086	0.091	0.091	-1.01	0.65
LP– state ownership (%)	-8.1	-65.72	-40.76	10.69	63.27		
Market value (mil. yuan)	1096	1064	1115	1223	982		
Number of observations	819	204	205	205	205		

Panel D: Tradable A-Shares

	All	Lowest Quartile	2nd Quartile	3rd Quartile	Highest Quartile	T-test (low=high)	F-value
Effective spread	0.246	0.245	0.264	0.240	0.236	1.50	7.20**
Price impact	0.168	0.169	0.181	0.167	0.157	2.04**	5.34**
Realized spread	0.089	0.088	0.096	0.084	0.088	-0.00	2.00
Tradable A-shares (%)	36.38	20.43	32.02	39.34	53.65		
Market value (mil. yuan)	1096	1106	863	951	1464		
Number of observations	819	204	205	205	205		

Panel E: Foreign Ownership

	All	0%	Lowest Half	Highest Half	T-test (low=high)	F-value
Effective spread	0.246	0.247	0.238	0.245	-0.48	0.23
Price impact	0.168	0.169	0.158	0.171	-0.99	0.99
Realized spread	0.089	0.089	0.090	0.085	0.57	0.33
Foreign ownership (%)	3.52	0.00	18.90	37.59		
Market value (mil. yuan)	1096	1104	1170	911		
Number of observations	819	717	51	51		

Table 6 Effective Spreads, Price Impact, and Realized Spreads: B-Shares, ADRs, H-Shares, and Red-Chips

This table provides statistics on effective spreads, price impacts, and realized spreads for listed B-shares traded on the Shanghai and Shenzhen Stock Exchanges, ADRs on the NYSE, and H-share and red-chip stocks on the SEHK. The sample period is from October 8 to December 31, 2002 for a total of 61 trading days. Stocks are first sorted into the active and inactive groups based on the average daily number of trades. Within each group, we calculate the effective spreads, price impacts, and realized spreads for small, medium-sized and large trades respectively. The classification of trade size groups for B-shares, ADRs, H-shares, and red-chip stocks can be found in Footnote 23. The percentage effective spread for stock i at time t is calculated as $200*D_{it}*(Price_{it}-Mid_{it})/Mid_{it}$, where dummy D_{it} equals +1 for a market buy and -1 for a market sell, P_{it} is the transaction price P_{it}, and Mid_{it} is the midpoint of bid and ask quotes at the time of transaction. The percentage price impact is calculated as $200*D_{it}*(V_{i,t+n}-Mid_{it})/Mid_{it}$, where $V_{i,t+n}$ is a measure of the true economic value of the stock after the trade. $V_{i,t+n}$ is proxied by the midpoint of the first quote reported 30 minutes after the trade. The percentage realized spread is calculated as $200*D_{it}*(Price_{it}- V_{i,t+n})/Mid_{it}$. Also reported are the F-statistics for testing the equality of the estimates for small, medium-sized and large transactions and t-statistics for testing the difference between actively and inactively traded stocks. ** and * indicate significance at the 5% and 10% percent levels respectively.

Panel A: B-share Stocks in Shanghai and Shenzhen

	B-Share Shanghai			B-share Shenzhen		
	All	Active	Inactive	All	Active	Inactive
Number of stocks	43	21	22	43	21	22
Average daily number of trades	94	132	57	67	99	37
Effective spread in percentage terms						
Overall	0.380	0.299	0.458**	0.594	0.484	0.699**
Small trades	0.363	0.281	0.441**	0.584	0.471	0.692**
Medium-sized trades	0.383	0.300	0.462**	0.591	0.482	0.695**
Large trades	0.514	0.395	0.628**	0.687	0.593	0.777**
F-value	9.34**	24.07**	5.62**	4.48**	6.61**	1.83
Price impact in percentage terms						
Overall	0.233	0.196	0.268**	0.316	0.279	0.350**
Small trades	0.205	0.160	0.247**	0.294	0.261	0.324**
Medium-sized trades	0.251	0.214	0.286**	0.344	0.290	0.396**
Large trades	0.294	0.248	0.338**	0.407	0.339	0.472**
F-value	7.48**	9.50**	3.00*	6.67**	4.00**	4.23**
Realized spread in percentage terms						
Overall	0.147	0.103	0.190**	0.279	0.205	0.349**
Small trades	0.158	0.121	0.194**	0.291	0.210	0.368**
Medium-sized trades	0.132	0.086	0.177**	0.247	0.191	0.299**
Large trades	0.220	0.147	0.290**	0.280	0.254	0.305
F-value	3.41**	6.19**	1.93	0.86	1.93	0.90

Panel B: ADRs on NYSE, H-shares and Red-chip Stocks on SEHK

	ADR			H-share			Red-chip		
	All	Active	Inactive	All	Active	Inactive	All	Active	Inactive
Number of stocks	16	8	8	31	15	16	27	13	14
Average daily number of trades	55	104	6	128	197	64	117	204	36
Effective spread in percentage terms									
Overall	0.690	0.324	1.057**	0.914	0.887	0.939	1.219	0.841	1.570**
Small trades	0.638	0.289	0.987**	0.956	0.937	0.974	1.352	0.907	1.766**
Medium-sized trades	0.718	0.335	1.101**	0.895	0.873	0.916	1.117	0.806	1.407**
Large trades	0.939	0.429	1.450**	0.933	0.885	0.978	1.198	0.842	1.529**
F-value	1.13	1.01	1.58	0.42	0.26	0.26	1.02	0.38	1.17
Price impact in percentage terms									
Overall	0.425	0.183	0.667**	0.591	0.584	0.598	0.655	0.482	0.816**
Small trades	0.293	0.103	0.483**	0.502	0.494	0.508	0.506	0.377	0.626**
Medium-sized trades	0.540	0.229	0.851**	0.600	0.588	0.612	0.692	0.504	0.866**
Large trades	0.655	0.279	1.031**	0.809	0.802	0.815	0.940	0.750	1.117**
F-value	1.71	5.22**	1.34	17.91**	6.59**	12.13**	12.47**	21.05**	6.57**
Realized spread in percentage terms									
Overall	0.265	0.141	0.390*	0.323	0.303	0.341	0.564	0.359	0.754**
Small trades	0.345	0.186	0.504**	0.454	0.442	0.466	0.846	0.530	1.140**
Medium-sized trades	0.178	0.106	0.250	0.295	0.285	0.305	0.426	0.301	0.541**
Large trades	0.284	0.150	0.419	0.125	0.083	0.163	0.258	0.092	0.412*
F-value	0.54	0.81	0.34	30.45**	19.06**	12.07**	8.42**	12.51**	4.68**

Table 7 Cross-Sectional Determinants of Effective Spreads, Price Impacts, and Realized Spreads

Panel A of this table reports the ordinary least square (OLS) regressions of effective spreads, price impacts, and realized spreads on a number of firm and trading characteristics. The sample includes listed A- and B-share stocks traded on the Shanghai and Shenzhen Stock Exchanges, ADRs on the NYSE, and H-shares and red-chip stocks on the SEHK. The sample period is from October 8 to December 31, 2002 for a total of 61 trading days. To reduce measurement errors associated with a single trading day, the trade-by-trade effective spreads, price impacts, and realized spreads are averaged over 61 trading days. We include 7 dummies as independent variables representing different type of stocks listed on different exchanges. The other control variables in Model 1 include the log of the inverse of average daily stock price, the log of average daily market capitalization calculated using tradable A-shares, the log of return volatility measured by the daily return standard deviation, and the log of average daily number of transactions. For A-shares, we also run Model 2 regressions, where we add ownership structure variables such as the proportion of shares held by the central and local government (state), by domestic legal entities and institutions (legal person LP), and by domestic investors (tradable A-shares). The ownership data are only available for A-shares. The ownership variables correspond to the fiscal year ending in December 2002. Panel B of this table reports the F-statistics from testing various hypotheses for the equality of effective spreads, price impact, and realized spreads between different types of stocks listed on different exchanges. Since stock prices and market value are denominated in different currencies for the sample of B-shares, ADRs, H-shares and red-chips, we convert them into yuan using the exchange rate of 8.28 yuan/US$ and 1.06 yuan/HK$. ** and * indicate significance at the 5% and 10% levels respectively based on the standard t-statistics.

Independent Variables	Effective Spreads		Price Impacts		Realized Spreads	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Log(inverse price)	0.091 (10.22)**	0.029 (7.09)**	0.065 (12.60)**	0.041 (10.01)**	0.022 (2.70)**	-0.014 (-2.82)**
Log(market value)	-0.010 (-1.42)	-0.002 (-0.57)	-0.022 (-5.25)**	-0.026 (-8.13)**	0.011 (1.65)*	0.023 (5.68)**
Log(return volatility)	0.110 (7.24)**	0.074 (12.06)**	0.090 (10.14)**	0.056 (9.08)**	0.025 (1.79)*	0.024 (3.17)**
Log(number of trades)	-0.176 (-20.31)**	-0.119 (-32.20)**	-0.100 (-19.74)**	-0.079 (-21.39)**	-0.082 (-10.40)**	-0.050 (-10.82)**
State ownership		0.006 (0.41)		-0.003 (-0.19)		0.010 (0.56)
Legal person ownership		0.018 (1.29)		0.005 (0.39)		0.015 (0.85)
Tradable A shares		-0.007 (-0.55)		0.001 (0.07)		-0.010 (-0.57)
$D_{it}^{\text{Shanghai, A}}$	0.287 (52.86)**	0.263 (21.92)**	0.194 (61.24)**	0.184 (15.33)**	0.104 (21.06)**	0.091 (6.08)**
$D_{it}^{\text{Shenzhen, A}}$	0.301 (47.08)**	0.281 (23.01)**	0.198 (52.93)**	0.190 (15.59)**	0.115 (19.78)**	0.103 (6.80)**
$D_{it}^{\text{Shanghai, B}}$	0.205 (11.77)**		0.123 (12.12)**		0.078 (4.92)**	
$D_{it}^{\text{Shenzhen, B}}$	0.327 (17.66)**		0.143 (13.25)**		0.178 (10.54)**	
$D_{it}^{\text{NYSE, ADR}}$	0.536 (11.11)**		0.399 (14.16)**		0.115 (2.62)**	
$D_{it}^{\text{Hong Kong, H-Share}}$	0.668 (25.47)**		0.438 (28.58)**		0.232 (9.71)**	
$D_{it}^{\text{Hong Kong, Red-chip}}$	0.905 (28.03)**		0.475 (25.14)**		0.430 (14.63)**	
Number of observations	979	819	979	819	979	819
Adjusted R^2	0.936	0.978	0.943	0.956	0.739	0.792

Panel B: F-test for Various Hypothesis

Hypothesis	Effective Spreads	Price Impacts	Realized Spreads
Shanghai A = Shanghai B	18.21**	39.95**	2.22
Shenzhen A = Shenzhen B	1.66	20.22**	11.23**
A share = B share	12.08**	16.51**	8.91**
A share = ADR	14.65**	25.62**	1.32
A share = H share	89.86**	108.77**	12.51**
A share = Red chip	158.84**	95.92**	53.27**
B share = ADR	31.11**	45.45**	11.57**
B share = H share	140.28**	213.17**	21.65**
B share = Red chip	238.01**	187.68**	71.78**
ADR = H share	6.34**	1.62	5.95**
ADR = Red chip	54.75**	6.69**	47.98**
H share = Red chip	66.76**	4.61**	56.28**