Tradable Blocks, Liquidity and Threat of Exit: The Chinese Experience

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Abstract

Large shareholders may affect managerial decisions through the threat of selling their holdings and influencing price negatively. The split-share structure of Chinese corporate ownership imposes restrictions on ownership and shares trading. Using these institutional features, we test the hypothesis that the presence of a blockholder who is potentially able to trade on private information may help discipline management and improve information disclosures thereby improving stock liquidity. The results show that exit threat is closely associated with shares tradability and to the extent that tradable (non-tradable) blockholders can discipline management through exit threats they exert a positive (negative) liquidity effect through both real and information friction channels. The split-share structure reform which increases the number of tradable shares is found to adversely decrease the positive liquidity effect of tradable blockholders as exit costs rise when more tradable shares are acquired. This evidence is consistent with the result that the liquidity effect of tradable blockholders follows an inverted U-shape fashion. Lastly, state owned enterprises (SOEs) who are tradable blockholders whose objectives are more aligned with the state, exhibit lower liquidity effect than non-SOE blockholders.

Keywords: Liquidity, block ownership, non-tradable shares, China's stock market, Exit threats

JEL Codes: G; G1; G3; G32

Introduction

The pervasiveness of blockholders in capital markets has led to extensive studies on the relationship between block ownership and secondary-stock liquidity. A well-known stream of literature argues that block ownership and liquidity are negatively related. Some attribute the negative liquidity effect of block owneship to the adverse effect on trading activity; blockholders are known to trade significantly less than non-blockholders and by reducing the number of shareholders who can trade in the firm's stock engenders real friction[1] (Brockman et al., 2009). Others, however, argue that blockholders are informed traders who may use their private information to trade against the uninformed[2] (Booth and Chua, 1996; Bolton and Thadden, 1998; Brockman and Yan, 2009) to the extent that block ownership is inversely associated with secondary market liquidity (Hefin and Shaw, 2000).

Studies demonstrating the positive liquidity effect of block ownership are few and far between. Block ownership has the potential to increase liquidity by improving the informational environment and enhancing trading activity in the market. Given blockholders have significant cash flow and control rights in the firm, they have more incentives to collect, analyze and act on costly information than diffusely distributed shareholders. Accordingly, blockholders are able to access more precise, firm-specific information at lower cost compared to non-blockholders. Blockholders can utilize this information to intervene and change management behavior (e.g., Admati et al., 1994) although such activism may be costly with a relatively small fraction of the benefits potentially realized (Admati and Pfleiderer, 2009). Be that as it may, recent studies argue that blockholders can put this informational advantage to effective use through the threat of exit or selling their holdings. A blockholder's exit threat may be an effective governance mechanism (Admati and Pfleiderer, 2009; Edmans, 2009; Edmans and Manso, 2011; Bharath et al., 2013). The intuition is that if managers' compensation is tied to share prices and should a blockholder's exit impact on price negatively, then the presence of blockholders who can trade on private information may: firstly, help instill discipline in management; and secondly, improve corporate

[1] Stoll (2000) defines a real friction as "the real resources used up" in the liquidity-provision process (i.e., order processing and inventory costs), and it is closely related to trading activity. For example, the increase in trading activity will reduce real friction costs by spreading fixed real costs over more trades.

[2] Stoll (2000) defines it as an information friction. Market makers are concerned about the potential losses of trading against informed traders, leading them to increase spreads – an adverse selection effect.

governance. Management, in an effort to dissuade blockholders from selling their holdings, will be forced to act in the interests of shareholders, thus restricting the management's ability and reducing its incentives to distort information disclosures. Instead management will act to improve financial and operational transparency (Leuz et al., 2003; Ajinkya et al., 2005; Karamanou and Vafeas, 2005). In this sense, the exit threat posed by blockholders may bring about lower information asymmetry and enhance stock liquidity.

For the exit threat to be credible, blockholders must not encounter any constraint on their ability to trade their shares. Non-tradable blockholders clearly do not pose such threats. In addition, if the exit threat is so costly to the extent that blockholders' stakes are too large to carry it out, then this mechanism will fail to produce its desired impact on liquidity (Admati and Pfleiderer, 2009). The threat to exit by blockholders as a channel through which blockholders can influence liquidity can be formally tested using the unique ownership structure in the Chinese stock market - the split-share structure. The split-share structure, which is designed in accordance with the Chinese government's political ideology and economic objectives, gives government control over firms by retaining substantial non-tradable shares while permitting issuance of minority tradable shares to the public. By the end of 2004, approximately two-thirds of China's stock market consisted of non-tradable shares (NTS), of which approximately 74% were state-owned.[3]

The split-share structure of the Chinese stock market is appropriate for the purpose of testing whether block ownership could positively influence stock liquidity through its exit threat. Compared to non-tradable blockholders, as long as tradable blockholders wield an information advantage over other investors, the exit threat can have a disciplinary effect on management. Consequently, the presence of tradable blockholders may enhance the informational environment and decrease informed trading. Equally, tradable blockholders may increase market liquidity by enhancing trading activity. Given that there is no restriction on trading faced by tradable blockholders, their presence increases the number of shares that can be traded in the market. This consequently enhances trading activity and reduces real friction costs through the spread of fixed real costs over more trades. Furthermore should the exit threat be credible, the

[3] The holders of NTS are entitled to have the same rights as the holders of ordinary shares except for public trading. There is an explicit contract between investors and the regulator stipulating that NTS are not allowed to be traded on the stock market.

presence of tradable blockholders would encourage other investors to participate by eliciting more trades due to their informational advantage.

Non-tradable blockholders of Chinese firms on average own large stakes but they face the constraint of not being able to trade their shares. Naturally, the presence of NTS may reduce stock liquidity. First, NTS decreases the number of free-float shares that can be traded in the secondary market, thereby dampening liquidity through inactive trading. Second, NTS shield blockholders from stock price movements that are not in their favor, and this increases the discrepancy in the interest between non-tradable large shareholders and tradable minority shareholders. Third, given the substantial portion of non-tradable shares available, this shifts the balance of power away from minority shareholders to blockholders, to the extent that minority shareholders are unable to monitor a firm's performance and affect management decisions. In other words, the presence of large non-tradable blockholders reduces the effectiveness of direct intervention. Consequently, more often than not the presence of non-tradable shares results in poor corporate governance and operational inefficiency (see Shleifer and Vishny, 1986; La Porta et al., 2000; Attig et al., 2006; Liu and Tian, 2012). Poor corporate governance, in turn, exerts a negative impact on firm liquidity by affecting information efficiency in the market (Chung et al., 2010; Dumitrescu, 2010; Tang, 2011; Chung et al., 2012).

Given that a firm's trading activity and informational environment can influence its liquidity (Stoll, 2000; Brockman et al., 2009), we can exploit the split-share structure of Chinese firms to identify the two distinct channels through which both tradable and non-tradable block ownership affect liquidity. In this paper, we re-examine the relationship between block ownership and secondary-stock liquidity by focusing on the size of block ownership and distinguishing whether the block shares are tradable or non-tradable. Previous studies have never addressed this issue, given that all blockholders are regarded as identical; no distinction was made whether blockholders are permitted to trade or are prohibited from trading due to regulatory concerns. There are a few reasons why past studies fail to demonstrate the positive liquidity effect of block ownership. Firstly, most blockholders do not trade their shares, consequently their exit threats are not deemed to be credible and hence the liquidity effect of blockholders may not be positive. Secondly, in developed financial markets like the U.S. diffused ownership of firms would mean that

blockholders own a significant amount of shares which imply that any attempt to exit the firm will result in significant exit costs and to that effect it is not likely that their exit threats will instill discipline in management and bring about improvement in information disclosures. The purpose of this paper is to help fill this void in the literature by examining the different liquidity effects between tradable and non-tradable block ownership of Chinese listed firms. The two distinct channels are through the real friction channel and the information friction channel. We follow Barclay and Hendershott (2004) and Hendershott et al. (2011) by decomposing the spread into the realized spread and the price impact using high frequency transactions data. The former is a proxy for real friction cost while the latter is a proxy for information friction cost. This approach is superior to those used in previous studies as it separates the informational component from the non-informational component of the spread.[4]

There are two unique features of the Chinese equity market which can help identify the channels through which the exit threat posed by a tradable blockholder could influence stock liquidity. First, China's stock market is dominated by state-owned enterprises (SOEs) and, by and large, the state is the largest blockholder. If the state is the firm's owner, its holdings are aligned with the state's political preference and social objectives; therefore its purchase and sale of shares are largely influenced by the state's decision (Xu et al., 2006; Lin and Rowe, 2006). State-authorized organizations that are permitted to invest and trade in the company on behalf of the state include central ministries, State-owned Assets Supervision and Administrations Commission (SASAC), local state asset management bureaus and local governments. Numerous studies have shown there is a conflict of interest between government owners and minority shareholders (e.g., Liu et al., 2007; Jiang et al., 2010; Qian et al., 2011). They demonstrate that government owners are less likely to implement a strict maximization of shareholder value objective than private owners. Government-based interests often include the maximization of employment, tax revenues, or other social objectives. For these reasons, we hypothesize that the threat of an exit by tradable blockholders is less likely to influence a firm's management and corporate governance of SOEs. Should the threat of an exit by a tradable blockholder have a positive effect on market liquidity, this outcome is

[4] See, for example, Lin, Sanger and Booth (1995) and Huang and Stoll (1997) used in Heflin and Shaw (2000) and Brockman et al. (2009).

expected to be weaker for SOEs because the interests of state owners are more aligned with political objectives rather than value-maximizing decisions.

A second feature relates to China's launch of the split-share structure reform in 2005 with the objective of converting non-tradable shares into tradable shares. The greater the number of tradable shares which are traded in the market, the more likely that tradable block ownership will increase to the extent that the cost of implementing an exit strategy by tradable blockholders is higher following the reform. With higher costs associated with executing an exit strategy by blockholders, the exit threat is perceived to be less credible. If our conjecture is supported by the data, this means that post-reform tradable blockholders are less inclined to trade and there will be an increase in informed trading caused by blockholders' limited ability to discipline managers. In this regard, the split-share structure reform can be viewed as a natural experiment to examine whether the exit threat posed by tradable blockholders is a probable channel through which they are able to influence stock liquidity. In addition, the reform increased tradable shares significantly due to the conversion of non-tradable shares, which were originally state and legal shares. These tradable shares were clearly not affected by stock market liquidity so that there is less concern about tradeable block ownership being an endogenous variable. Furthermore the reverse causality may bias the measurement of the impact of tradable block ownership on stock liquidity post-reform (i.e. the period 2009-2012).[5]

Based on a sample of Chinese listed firms in the Shanghai and Shenzhen stock exchanges for the period 2003-2012, our empirical results are summarized as follows. First, we find that block ownership has an adverse liquidity impact, which is manifested by wider quoted and realized spreads and a higher price impact. However, the adverse liquidity effect of block ownership is muted when we control for a firm's non-tradable shares ownership. Further, we show that tradable block ownership has a different effect on stock liquidity compared to non-tradable block ownership. Tradable block ownership is significantly and negatively related to the effective and quoted spreads and it is positively related to market depth. The statistically significant negative effect on price impact and realized spread suggests that the positive liquidity effect of tradable block ownership operates through both the real and information friction channels.

[5] Panel D of Table 1 indicates that tradable block ownership did increase from around 10% to 30% between 2006 and 2009 and it has remained at this high level until 2012.

This result departs from past studies (Hefin and Shaw, 2000; Brockman et al., 2009), which do not consider the tradable nature of shares in the market.

With regard to the liquidity effect of tradable block ownership between SOEs and non-SOEs, we find that the exit threat posed by SOEs tradable block ownership is less credible and their ownership is associated with greater information and real friction costs. When examining the effect of split-share structure reform, the interaction term of the tradable block ownership and the split-share structure reform dummy displays a significant positive effect on the effective and quoted spreads, and on price impact and realized spread. These results suggest that the increase in tradable shares resulting from the reform significantly increases informed trading and reduces trading activity, thus reducing the positive liquidity impact of tradable block ownership. These results corroborate our hypothesis that an increase in ownership may incur higher costs for tradable blockholders when they exit the firm to the extent that their exit threat becomes less credible. Our hypothesis also leads to a possible nonlinear, inverted U-shaped relationship between block ownership and liquidity, which is supported by the data.

The rest of the paper is organized as follows. Section 2 provides the background of China's institutional and corporate ownership structure in the capital market and develops some hypotheses. Section 3 describes the data sources, liquidity measures and control variables and presents summary statistics and correlation results between the variables of interest. Section 4 describes the empirical models and results. Section 5 provides robustness tests. Section 6 concludes the paper.

The split-share structure of the Chinese market

China's stock market is a two-tier system consisting of tradable shares and non-tradable shares (NTS). The non-tradable shares are not listed and can only be transacted either through the authorities' approval or through auction, while tradable shares can be transacted in the secondary market.[6] Even after the transfer or auction, these shares remain restricted and cannot be traded on the stock exchanges. The aim of this dual share ownership structure is to ensure that the state retains effective control of state-owned enterprises for political and social objectives by forbidding the transaction of state-owned shares in the secondary market.

[6] Authorities' approval of the NTS transaction involves setting the transfer price near the book value. NTS are auctioned with a substantial illiquidity discount on their value to specific negotiated parties.

In addition to state-owned shares, shares issued to non-state legal persons, natural persons, and foreigners before IPOs are restricted from trading in the secondary market. Only the new shares issued in IPOs, together with seasoned cash offerings, those derived from tradable shares in rights offerings, and stock splits, are tradable. However, in recent years, the Chinese government has recognized that such an ownership structure has caused substantial problems in the functioning and development of the country's financial markets, especially in the quality of firms' corporate governance and efficiency of firm performance. In an effort to modernize its capital market, the Chinese government introduced the split-share structure reform to the market in 2005, converting non-tradable shares into tradable shares.[7] An important feature of the block ownership structure in China's stock market that differentiates it from overseas markets is that a substantial portion of blockholder holdings belongs to NTS. This is particularly so prior to the split-share structure reform. Such non-tradable shares held by blockholders could dramatically hamper trading activity in the market because those shares cannot be traded in the secondary market.

Data source, measures of liquidity and control variables

3.1 Data and sample selection

Data on block ownership are obtained from the Wind database, which provides information about a firm's top 10 shareholder ownership. We exclude firms for which the 10th largest shareholder ownership is more than 5%.[8] This implies that nearly all the firms' blockholders in the sample are the top 10 shareholders of a given firm. The aggregate block ownership in the top 10 shareholders is equivalent to the total block

[7] The China Securities Regulatory Commission (CSRC) announced its decision to mandate the elimination of the trading constraints imposed on all restricted shares on 29th April, 2005. Two groups of firms were chosen for an initial piloting of the scheme on 9th May and 19th June 2005. On 4th September 2005 official guidelines were issued, providing formal operational procedures. To avoid a sharp price drop in the stock market, the government required the release of trading constraints to be gradual and a compensation deal to be agreed upon by and paid out to existing tradable shareholders. Once the negotiation process was complete and the compensation deal had been agreed upon, the portion of restricted shares offered as compensation to the minority private investors would become tradable at once. After a 12-month period following the ratification of the compensation deal, all restricted shares held by those shareholders holding less than 5% of the firm's ownership could also be traded on the stock market. Within a further 12 (24) months, large shareholders holding more than 5% of the firm's ownership would also be allowed to trade up to 5% (10%) of their restricted shares. Finally, all restricted shares would become fully tradable on the stock market 36 months after the compensation plan had been ratified.

[8] According to previous studies, a shareholder is defined as a blockholder if the shareholder holds 5% or more of a firm's shares. This rule results in the exclusion of two firms and 17 year-observations in our sample.

ownership of a firm. We exclude firms that are listed for less than 3 years and operate in the finance industry. Additionally we study firms issuing only A-shares to avoid any cross-market effect. This results in the exclusion of 48 firms. The sample period for our study is 2003 to 2012, which covers the period before, during and after the split-share structure reform.

The data for liquidity measures are obtained from the Thomson Reuters tick history data that is distributed by Sirca. The dataset includes quote date, time stamp, transaction price, bid price and ask price, with a time stamp recorded to the nearest second. We assume no reporting delay and make no time adjustment.[9] We filter the trades and quote data following the standard market microstructure literature.[10] All information in our dataset is available to market participants in real time through the computerized information dissemination system. We use all stocks listed on the Shanghai (SHSE) and Shenzhen (SZSE) stock exchanges; these two exchanges are purely order-driven markets, and both markets run electronic automated trading systems. The two stock exchanges open with a call market and operate as a continuous market for the remainder of the trading day. To avoid contaminating the data with different trading structures, we do not use the trade and quote data before and after the exchanges open and close, respectively.

3.2 Dependent variables

Liquidity has multiple dimensions and therefore it is difficult for a single measure to capture all aspects of liquidity. By and large, studies on the intraday behavior of market microstructure focus on the spread alone. In this paper, we apply two dimensions of liquidity and provide evidence that our results are robust to a number of liquidity measures. The three liquidity measures are effective spread, quoted spread and quoted depth. The spread is a measure of tightness in the market for a stock because it reflects the cost of turning over a position in a short period of time. Depth refers to the market's ability to absorb quantities without a large effect on price.

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[9] We also follow the approach of Lee and Ready (1991), who suggest identifying a quote as prevailing at the time of the transaction if it was the latest quote for the stock and was at least five seconds old. The results are qualitatively unchanged.

[10] See, for example, Huang and Stoll (1997): (1) delete quotes if either the bid or ask price is negative; (2) delete quotes if either the bid or ask size is negative; (3) delete quotes if the bid-ask spread is greater than 25% of the transaction price or negative; (4) delete trades and quotes if they are out of time sequence; (5) delete trades if the price or volume is negative; and (6) delete trades and quotes if they changed by more than 10% compared to the last transaction price and quote.

The three proxies for liquidity measures are as follows:

$$\text{Effective}_{\text{Spread}}(\text{ES})_{i,t} = \frac{2\, Q_{it}\, (\text{Price}_{i,t} - M_{i,t})}{M_{i,t}}, \quad (1)$$

$$\text{Quoted}_{\text{Spread}}(\text{QS})_{i,t} = \frac{\text{ask\_price}_{i,t} - \text{bid\_price}_{i,t}}{M_{i,t}}, \quad (2)$$

$$\text{Quoted}_{\text{Depth}}(\text{DEP})_{i,t} = \text{ask\_size}_{i,t} + \text{bid\_size}_{i,t}, \quad (3)$$

where $\text{Price}_{i,t}$ is the transaction price for stock at time t and $M_{i,t}$ is the midpoint of the prevailing quote at time t. $Q_{i,t}$ is an indicator for trade type at time t that takes the value of $+1$ if the trade is a buyer-initiated transaction and -1 if the trade is a seller-initiated transaction[11], $\text{ask\_price}_{i,t}$ is the quoted ask price and $\text{bid\_price}_{i,t}$ is the quoted bid price. Likewise, $\text{ask\_size}_{i,t}$ is the number of shares available at the ask side at the first level of the order book, and $\text{bid\_size}_{i,t}$ is the number of shares available on the bid side.

To explore the mechanism through which block ownership affects liquidity (i.e. real friction versus information friction), we follow Barclay and Hendershott (2004) and Hendershott et al. (2011), and decompose the spread into the realized spread (RS) and the price impact (PI). The measure is based on the behavior of price subsequent to a transaction. It assumes that the informational component of trading costs should lead to a permanent decrease (increase) in the security value after sells (buys) while the non-informational component should only lead to a temporary deviation from its value. The advantage of using this measure is that it separates the informational component from the non-informational component of the spread: these two components are directly associated with two channels through which block ownership is linked to liquidity. The price impact measures the gross losses to liquidity demanders due to adverse selection and is thus referred to as the information friction. The realized spread measures the non-informational component of spread, which is associated with inventory, order processing costs and market power, and it is thus referred to as the real friction.

We assume that the liquidity provider is able to close the position at the quote midpoint, 5 minutes after the trade[12], and the realized spread is defined as:

[11] Using high-frequency data, we classify trades at prices above the prevailing quote midpoint as buyer-initiated trades ($D_{i,t} = 1$) and trades at prices below the prevailing quote midpoint as seller-initiated trades ($D_{i,t} =$, td. In addition, we employ a tick test (Lee and Ready, 1991) if the trade's price is equal to the prevailing quote midpoint. A tick test involves assigning $D_{i,t} = 1$ ($D_{i,t} =$, t) for trades that occur at a price higher (lower) than the price at $t - 1$.

[12] We also calculate the 30-minute realized spread and the price impact with similar results.

$$\text{Realized spread}_{it} = Q_{it}(\text{Price}_{it} - M_{i,t+5})/M_{i,t}, \quad (4)$$

The 5-minute price impact of a trade is defined as:

$$\text{Price impact}_{it} = Q_{it}(M_{i,t+5} - M_{i,t})/M_{i,t}, \quad (5)$$

where Q_{it}, Price_{it} and $M_{i,t}$ are defined as Eq. (1) and $M_{i,t+5}$ is the quote midpoint 5 minutes after the time t. Note that the sum of the realized spread and the price impact is equal to the effective half-spread, which is:

$$Q_{it}(\text{Price}_{it} - M_{i,t})/M_{i,t} = Q_{it}(\text{Price}_{it} - M_{i,t+5})/M_{i,t} + Q_{it}(M_{i,t+5} - M_{i,t})/M_{i,t}, \quad (6)$$

(Effective half-spread) = (Realized spread) + (Price impact).

We calculate the average daily realized spread and the price impact of a trade for each firm using intraday data. We then average daily observations over each calendar year to obtain yearly measures for each firm.

Many studies suggest real frictions are directly linked to the trading activity such as the number of trades and trading volume (Demsetz, 1968; Stoll, 2000; Rubin, 2007). Brockman et al. (2009) find that blockholders impair market liquidity because they are inactive traders compared to relatively diffused shareholders. We further examine how block ownership is associated with trading activity. We calculate two straightforward daily measures of trading activity: the number of transactions (NT, henceforth) and trading volume (VOM, henceforth). We average the daily trading activity observations to obtain quarterly measures of trading activity for each firm.

We also introduce two alternative measures to estimate the adverse selection component of the spread to proxy the information friction for robustness testing, which are commonly used by previous studies.[13] The first proxy is the one developed by Lin, Sanger and Booth (1995) (LSB, henceforth). This is estimated by the following firm-specific regression using ordinary least squares:

$$\Delta M_{i,t} = \delta\left(P_{i,t-1} - M_{i,t-1}\right) + \varepsilon_{i,t}, \quad (7)$$

where $\Delta M_{i,t} = M_{i,t} - M_{i,t-1}$ is the change in the spread midpoint between time $t-1$ and time t for firm i, and $P_{i,t-1}$ is the transaction price at time $t-1$. The estimate of the adverse selection component is the

[13] See, for example, Helfin and Shaw (2000) and Brockman et al. (2009).

regression coefficient δ. The second proxy is developed by Huang and Stoll (1997) (HS, henceforth), and the model that is estimated is as follows:

$$\Delta \mathrm{M}_{\mathrm{i,t}} = \alpha\left(\frac{P_{i,t-1}^{ask}-P_{i,t-1}^{bid}}{2}\mathrm{D}_{\mathrm{i,t-1}}\right)+\varepsilon_{\mathrm{i,t}}, \quad (8)$$

where $\Delta M_{i,t} = M_{i,t} - M_{i,t-1}$ is defined as in Eq. (2), $P_{i,t-1}^{ask}$ and $P_{i,t-1}^{bid}$ are the quoted ask and bid prices at time $t-1$ and $D_{i,t-1}$ is defined the same as in equation (1). The estimate of the adverse selection component (HS) is the regression coefficient α. Following Huang and Stoll (1997), the estimate is interpreted as the combination of the adverse selection and inventory holding cost components of the spread.

The pitfall of these two measures for the adverse selection component of the spread is that LSB assumes that inventory costs are negligible, and HS does not separate the adverse selection component from the inventory component. Additionally, estimation errors can be introduced if the underlying model is not correctly specified. Similarly, the adverse selection components and trading activity variables are averages across all trading days of each calendar year.

3.3 Control variables

According to prior studies (see for example, Diamond and Verrecchia, 1991; Brockman and Chung, 1999; Hefin and Shaw, 2000; Brockman et al., 2009), the control variables include firm size, share price, return volatility, share turnover rate, institutional ownership and leverage ratio. Firm size is measured by the book value of a firm.[14] Share price is the mean of the daily stock price over the current year. We measure return volatility as the standard deviation of the daily stock return. The share turnover rate is calculated by dividing the total number of shares traded in a year by the average number of shares outstanding for that year.[15] More importantly, given that the dual share structure in China's stock market could influence the

[14] China's stock market consists of A-shares, B-shares and oversea shares, and thus market capitalization is partially determined by the B-shares and overseas shares markets. However, we only focus on the A-share market. Therefore, to remove the effect of the cross-market effect, we use the book value of a firm instead of market capitalization as a proxy for size. Additionally, many of the shares in the listed firms were not tradable before the split-share structure reform in the secondary stock market, so the market capitalization based on tradable shares is not a good proxy for a firm's size. In addition, we examine the regression by using market capitalization, and the results are similar and are available from the authors upon request.

[15] The results are qualitatively unchanged when we replace the turnover rate by the average daily number of trades or trading volume or both.

effect of block ownership on liquidity, the non-tradable ownership variable measured by non-tradable shares to total shares in a firm will be used to examine whether the inclusion of this variable could change the impact of block ownership on liquidity. All of the control variables are obtained from the Wind database. Finally, the database also provides information about the timing when a firm finishes the split-share structure reform. We define the split-share structure reform as a dummy variable taking the value 1 if a firm completes the reform and 0 otherwise. The dummy variable is then used to examine whether the split-share structure reform alters the impact of block ownership on firm liquidity.

3.4 Descriptive statistics

Table 1 presents the summary statistics of the variables used in this study. We see that in Panel A, the average relative effective spread is 0.202% while the quoted spread is 0.208%. Apart from two spreads, the mean of market depth is 69202 shares. The price impact, on average, is approximately 0.037%, while the realized spread is approximately 0.069%. These two components' sum is equal to the effective half-spread. Stoll (2000) documents that the bid-ask spread figures capture both real friction costs and information friction costs. He shows that the adverse selection component (the information friction) consists of approximately 35% of the spread, while the non-informational component (the real friction) consists of approximately 65% of the spread. The statistics about the two alternative measures for the adverse selection component of the spread based on LSB (0.316) and HS (0.301) indicate that the adverse selection cost is made up of approximately 30% of the spread, which is similar to the measure from the price impact. Regarding trading activity, the average trading volume (VOM) of a firm is approximately 5.362 million shares per day over the year, and the average number of trades (NT) is approximately 1,815 per day over the year.

For block ownership (panel B), the average number of blockholders in a firm is approximately two, and the mean of total block ownership is approximately 49%, which is much higher than other developed markets in previous studies (e.g., Heflin and Shaw, 2000; Brockman et al., 2009). This suggests that the ownership structure is highly concentrated and that many firms are controlled by a few blockholders in China's stock market. When we divide the blockholders into tradable and non-tradable block ownership, we

find that the average non-tradable block ownership is approximately 40.5% while tradable block ownership is approximately 8.5%. This indicates that most of the block shares are not permitted to be traded in the secondary stock market until 2012.

Panel C in Table 1 displays the statistics about the other control variables. The average book value of firm size is approximately 2.214 billion yuan, and the average share price is 12.607 yuan. The mean value of the ratio of non-tradable shares to total shares outstanding is 0.451, and the mean of return volatility is 0.977 per day. The mean value of the share turnover rate and leverage ratio is approximately 5.916 and 0.519, respectively. Finally, the average percentage of institutional investors in the top 10 outstanding shareholding (tradable shares) of a firm is approximately 3.3%.

[Table 1 about here]

Figure 1 illustrates the trends concerning the total block ownership, non-tradable ownership, and tradable block ownership for each year from 2003 to 2012. We find there is a slight decrease in a firm's total block ownership after 2005 to approximately 46%, while the average block ownership is between 52% and 54% before 2006. In addition, the figures indicate that non-tradable block ownership declined from approximately 54% in 2003 to 26% in 2012 over the sample period. However, in terms of tradable block ownership, it was less than 1% in pre-2006 and it increased significantly post-2006 from 1% to 22% in 2012. Figure 1 also reveals that after 2007 (around the time many of the firms completed the split-share structure reform) the deviation from block ownership to non-tradable ownership increases over the period. This suggests that many shares held by blockholders were non-tradable before 2007, but after 2007 and until 2012, more than half of the block shares were converted into tradable shares.

[Figure 1 about here]

Panel D of Table 1 shows the trends of tradable block ownership for the sample that only includes tradable block ownership over the period 2003-2012. It shows that the average tradable block ownership for the sample has increased dramatically after the reform, especially after 2008. The average tradable block ownership has increased from 16% to 30% from 2008 to 2009. This is due to two key restrictions on shares trading after the split-share structure reform. The first restriction is the 12-month lockup period for non-tradable shareholders after the reform plan's effective day in an attempt to dilute the effect of a

possible stock overhang following a massive sale of shares. The second restriction is that non-tradable shareholders were prohibited from selling more than 5% (10%) of total shares outstanding within 12 (24) months after expiration of the lock-up. Accordingly, the shares that are in the lock-up period and are not permitted to be traded are not regarded as tradable shares. Hence, we observe a significant increase in tradable block ownership post-2008 even though the reform started on April 30, 2005 whilst many of the firms completed the reform around 2007. Furthermore, Panel D suggests that there are very few firms with tradable blockholders before the reform with less than 20 firm-year observations, and the reform has significantly increased the firms with tradable blockholders (i.e. the firm-year observations is around 1456 in 2012).

Table 2 presents the Pearson's correlation coefficients between variables. First, we find that both the effective spread and quoted spread are positively correlated with the price impact (0.88 and 0.87) and the realized spread (0.95 and 0.95) while both of them are negatively related to market depth (-0.11 and -0.1), trading volume (-0.15 and -0.14) and number of trades (-0.29 and -0.27). The price impact is positively related to the realized spread (0.7). Furthermore the effective spread, quoted spread, price impact, and the realized spread are all positively correlated with LSB and HS but negatively correlated with market depth, trading activity (trading volume and number of trades). Second, we find that the correlation between block ownership and the relative effective spread (0.02), quoted spread (0.03), market depth (-0.09), price impact (0.04), and realized spread (0.02) are all small. This implies that there could be no correlation between block ownership and liquidity. However, a firm's non-tradable ownership is significantly and positively related to the effective spread (0.15), quoted spread (0.14), price impact (0.19) and realized spread (0.15) while it is significantly and negatively related to market depth (-0.1). Nonetheless the coefficient estimates are much stronger, which is consistent with our hypothesis that a firm's non-tradable shares potentially impede its stock liquidity due to their positive impacts on the real and information friction costs. This is also supported by evidence shown in Table 4 that the non-tradable ownership is positively correlated with LSB and HS and negatively correlated with trading activity. Moreover, the correlation coefficient between block ownership and non-tradable ownership is approximately 0.48. This is in line with Figure 1, which indicates that a

significant portion of block ownership is non-tradable.

More interestingly, we find that the tradable block ownership, however, is inversely correlated with both the effective spread (-0.23) and quoted spread (-0.22), but positively correlated with market depth (0.05). This suggests that the tradable block ownership, in contrast to the non-tradable block ownership, is positively related to stock liquidity. This is consistent with our hypothesis that the threat of an exit by a tradable blockholder could reduce informed trading by disciplining management and enhancing corporate governance, or it could increase trading activity by inducing more share trading. This is supported by evidence shown in Table 2 that the tradable block ownership is negatively correlated with price impact (-0.22), realized spread (-0.23), LSB (-0.29) and HS (-0.28) whilst it is positively correlated with trading volume (0.09) and number of trades (0.2).

Table 2 also shows that size (price, volatility, turnover and institutional ownership) is negatively correlated with the effective spread, quoted spread, price impact, and realized spread, while leverage is positively correlated with them. However, size (price, volatility, turnover and leverage) is positively correlated with market depth, while institutional ownership is negatively correlated with market depth.

[Table 2 about here]

Empirical models and results

4.1 Model specification

We perform pooled OLS regressions on the unbalanced panel data comprising 1923 firms spanning the period 2003 to 2012. A special feature of our dataset is that it includes a large number of firms with relatively few time-series observations. Consequently, it is important to account for the effects of cross-sectional correlation among firms and, less so, the serial correlation across time to avoid the problem of biased standard errors. To circumvent this problem, we employ the Driscoll and Kraay (1998) and Hoechle (2007) nonparametric covariance matrix estimator for the unbalanced panel, which is robust to different forms of spatial and temporal dependence.[16]

[16] More specifically, Driscoll-Kraay standard errors are robust to very general residual correlation; both within a firm over time and across firms in the same period and between different periods. We specify a maximum lag of one in the autocorrelation structure to control for the persistence in firm liquidity over time. All results remained similar when we

The base regression model is as follows:

$$LIQ_{i,t} = \alpha_0 + \alpha_1 BLOCK_{i,t-1} + \alpha_2 NTR_{i,t-1} + \alpha_3 STATE_{i,t-1} + \alpha_4 SIZE_{i,t-1} + \alpha_5 PRICE_{i,t} + \alpha_6 VOL_{i,t} + \alpha_7 TO_{i,t} + \alpha_8 IO_{i,t-1} + \alpha_9 LEV_{i,t-1} + \sum_I \gamma_I D_I + \sum_y \beta_y D_y + \varepsilon_{i,t} \quad (9)$$

$$LIQ_{i,t} = \alpha_0 + \alpha_1 TBLOCK_{i,t-1} + \alpha_2 NTBLOCK_{i,t-1} + \alpha_3 STATE_{i,t-1} + \alpha_4 SIZE_{i,t-1} + \alpha_5 PRICE_{i,t} + \alpha_6 VOL_{i,t} + \alpha_7 TO_{i,t} + \alpha_8 IO_{i,t-1} + \alpha_9 LEV_{i,t-1} + \sum_I \gamma_I D_I + \sum_y \beta_y D_y + \varepsilon_{i,t} \quad (10)$$

where LIQ is defined as either the effective spread (ES), quoted spread (QS), market depth (DEP), price impact of a trade (PI), realized spread (RS), trading activity measured by trading volume (VOM) and number of trades (NT), or adverse selection component of spread (LSB and HS). The model (9) examines the general relationship between total block ownership (BLOCK) and stock liquidity. We run two different regressions for model (9): one without and another with the non-tradable ratio (NTR). The aim is to determine whether the non-tradable ratio could alter the impact of block ownership on liquidity. Model (10) examines how the tradable block ownership (TBLOCK) and non-tradable block ownership (NTBLOCK) are related to stock liquidity with the other control variables being the same as in model (9). We use the information about the type of block ownership in the previous year to investigate the effect of block ownership on liquidity. The information with respect to block ownership is not reported at the end of each year but is reported in late March the following year. For this reason the previous year's information is employed to circumvent the delayed release of information. Furthermore the use of previous year's information can better capture the causal effect compared to contemporaneous values.[17]

The control variables, namely non-tradable ratio (NTR), state dummy (STATE), size (SIZE), stock return volatility (VOL), share price (PRICE), share turnover rate (TO), institutional ownership (IO) and leverage ratio (LEV), are measured as described in Section 3.3. Following prior studies on block ownership (Heflin and Shaw, 2000; Agarwal, 2007; Brockman and Yan, 2009; Brockman et al., 2009), the lag values of NTR, STATE, SIZE, IO, and LEV are also applied in the regression. We also control for the industry dummies (D_I)[18] and the yearly time dummies (D_y)[19]. We transform all of the dependent variables

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specify a maximum lag of two.

[17] For the robustness check, we also estimated model (9) and (10) using contemporaneous information about the block ownership, non-tradable and tradable block ownership in a firm. The results remained qualitatively unchanged.

[18] The industry classification is released by CSRC and the data are provided in the WIND database. Based on CSRC,

together with SIZE, PRICE, VOL, and TO by taking the natural logarithm to: firstly, reduce the high degree of skewness and kurtosis observed in the data; and secondly, remove any possible outlier effects.

4.2 Aggregate block ownership and firm liquidity

Table 3 presents the regression results of the stock liquidity effect of block ownership, and the impact of blockholders' NTS on liquidity. We run two regressions for each dependent variable, one without the non-tradable ratio (NTR) and another with this ratio. Columns (1), (3) and (5) (2, 4, and 6) report the results without (with) the NTR covariate. Should non-tradable shares exert no influence on the relationship between block ownership and liquidity, we would expect the sign and significance of the coefficient on block ownership to remain unchanged after controlling for NTR.

[Table 3 about here]

The results in column (1) indicate that block ownership is positively related to the effective bid-ask spread. The coefficient estimate of 0.247 is statistically significant and implies that a 10% increase in block ownership increases the effective spread by approximately 2.47%. This is also true for the quoted spread (column 3, 2.24%). As for market depth, column (5) shows that block ownership is negatively and significantly related to market depth. The coefficient estimate -1.028 indicates that a 10% increase in block ownership is associated with an approximately 10% decrease in market depth.

However, when we control for NTR in the regression, we find that the effects of block ownership on both the effective and quoted spreads (columns (2) and (4), respectively) are no longer statistically and economically significant. The coefficients of block ownership on the effective and quoted spreads are reduced significantly, from 0.247 to 0.025 and from 0.224 to 0.026, respectively. This is also true for market depth (column 6), from -1.028 to -0.748, although the coefficient of block ownership on market depth is still statistically significant. This result is interesting because it shows that NTR is an important determinant of the relationship between block ownership on liquidity. In addition, NTR is positively and significantly related to the effective spread (0.322), the quoted spread (0.286), and negatively related to market depth

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there are 13 industries, all of which are large.

[19] The yearly time dummies (D_y) capture common shocks and potential time trends.

(-0.403). These findings suggest that excluding non-tradable shares may lead to the spurious identification of a negative impact of block ownership on liquidity, whilst tradable block ownership may not exert any effect or it may exert a positive effect on stock liquidity.

Regarding the control variables, these results are by and large consistent with prior studies (see, e.g., Benston and Hagerman, 1974; Stoll and Whaley, 1983; Agarwal, 2007; Brockman and Yan, 2009; Brockman et al., 2009). Briefly, firms with a larger size, higher price, greater turnover rate, more volatile return, lower institutional ownership and larger leverage ratio are negatively related to the spreads and positively related to market depth. Moreover, the coefficient estimates on size, price, turnover rate, and leverage ratio are statistically significant. Interestingly, we find a significantly different effect on the liquidity between SOEs and non-SOEs, and this result indicates that state-owned firms have, on average, a 4.4% (3.6%) lower relative effective spread (quoted spread) and a 8.4 greater market depth. This is in line with the view espoused by Ding and Suardi (2015) who state that a major state shareholder in a firm indicates government confidence in the firm and provides a more efficient monitoring mechanism than a non-state shareholder. The presence of state ownership not only enhances investors' willingness to invest and trade in the stock but also enhances the firm's corporate governance, thereby improving liquidity by increasing trading activity and information efficiency in the market.

4.3 Tradable, non-tradable block ownership and stock liquidity

The results summarized in Table 3 imply that tradable block ownership may exert different effects on stock liquidity compared to non-tradable block ownership. Accordingly, we classify blockholders into tradable and non-tradable blockholders. The results are shown in columns (1), (2) and (3) of Table 4. Consistent with our predictions, the results show that tradable block ownership (TBLOCK), unlike non-tradable block ownership (NTBLOCK), is positively related to stock liquidity. We find that the coefficient estimates of tradable block ownership on the effective spread, the quoted spread and market depth are -0.402, -0.353 and 0.516, respectively, while the corresponding coefficient estimates of non-tradable block ownership are 0.271, 0.244 and -1.060, respectively. All these estimates are statistically significant. The coefficient estimates indicate that a 10% increase in tradable block ownership is associated

with an approximately 4% decrease in spreads and 5% increase in market depth, while a 10% increase in non-tradable block ownership is associated with an approximately 2.5% increase in spreads and a 10% decrease in market depth. These findings are congruent with the results in Table 3 that the non-tradable block ownership adversely affects stock liquidity. Further, the results support our hypothesis that if block shares were tradable their presence could enhance stock liquidity. In the next sub-section, we examine the channels through which tradable block ownership positively influences stock liquidity. The coefficient estimates of other control variables are similar to those in Table 3.

[Table 4 about here]

4.4 Real friction channel, information friction channel and tradable block ownership

We now seek to determine whether the positive association between tradable block ownership and stock liquidity operates through the real friction channel, the information friction channel or both. As explained in Section 3.2, we decompose the effective half-spread into the realized spread and price impact, of which the former is related to the real friction channel while the latter is related to the information friction channel. Columns (1) and (2) in Table 5 show the results of regressing the realized spread and price impact on similar explanatory variables as in the panel regression in Eq. (10). Our first result is that tradable block ownership is significantly and negatively linked to the realized spread (RS, -0.405), suggesting that tradable block investors' participation reduces real friction costs such as inventory and order processing costs. Furthermore, many studies suggest that these real friction effects are directly associated with the level of trading activity, for instance number of trades and trading volume (Demsetz, 1968; Rubin, 2007; Brockman et al., 2009). Therefore, we next examine whether the reduced real frictions are related to higher trading activity, which is measured by the number of trades (TRA) and the trading volume (TV). Columns (5) and (6) of Table 5 show the results associated with the former and latter measure of trading activity. We find that higher tradable block ownership is positively linked to trading activity. Taken together, these results support our hypothesis that tradable block shares due to their informational advantage increase the number of shares traded in the stock market, thereby encouraging other investors' participation through eliciting more trades.

[Table 5 about here]

Second, we find that tradable block ownership is significantly negatively associated with the price impact (PI), a proxy for the information frictions, suggesting that tradable block shareholders could alter a firm's informational environment. This result supports the view that the participation of tradable block ownership decreases the degree of information asymmetry between liquidity suppliers and informed traders. The results from the two alternative measures of the adverse selection component (LSB and HS), reported in columns (3) and (4) in Table 5, are consistent with the result for the price impact. These findings support our hypothesis that should a tradable blockholder who is potentially able to trade on private information exit the firm, this could result in a negative price impact. Consequently, such a threat may help discipline management and reduce management's ability and incentive to distort information disclosures, but improve financial and operational transparency. In other words, the exit threat posed by a tradable block shareholder may improve the informational environment, reduce informed trading and enhance stock liquidity.

Finally, for non-tradable blockholders the results are consistent with those reported in Table 4. Non-tradable block ownership, in contrast to tradable block ownership, increases realized spread, increases price impact, increases the adverse selection component (LSB and HS), but decreases the number of trades and trading volume. These findings also support our hypothesis that non-tradable shares decrease trading activity by reducing the number of shares traded in the market and increases informed trading. It does this by widening the informational asymmetry between liquidity suppliers and informed traders.

4.5 State-owned enterprises, information friction cost and stock liquidity

To investigate whether the exit threat posed by a tradable blockholder may decrease informational asymmetry between liquidity suppliers and informed traders by instilling discipline in management and increasing information disclosures, financial and operational transparency, we test whether the effect of tradable ownership on stock liquidity is different between state-owned enterprises (SOEs) and non-SOEs. Many studies argue that given managers in SOEs are affiliated with the government, their interests in acquiring political credit are aligned with each other and they are less sensitive to market pressures to increase the quality of information (e.g., Xu et al., 2006; Lin and Rowe, 2006; Chaney et al., 2011; Jiang et al., 2010). Equally, we hypothesize that if the exit threat posed by a tradable blockholder could instill

discipline in managers and motivate them to improve information disclosure, then it is likely that this effect will show up more weakly for SOEs. In other words, the positive effect of tradable block ownership on stock liquidity is greater for non-SOEs than for SOEs.

[Table 6 about here]

Table 6 shows whether the effect of tradable block ownership on stock liquidity is different between SOEs and non-SOEs. This is tested by interacting TBLOCK (tradable block ownership) with STATE (indicating 1 if a firm is SOE and 0 otherwise). We find that the interactive terms between TBLOCK and STATE on the effective spread and quoted spread are positive and statistically significant (0.131 and 0.119) while this interactive term on market depth is significantly negative (-0.351). These findings provide evidence that the effect of tradable block ownership on stock liquidity is weaker for SOEs than for non-SOEs, thus supporting our hypothesis that the exit threat posed by a tradable blockholder is more limited in its ability to discipline managers and to improve informational environment in SOEs than in non-SOEs. The finding in column (4) further supports this view when we use price impact, a proxy for the information friction. We find that the effect of tradable block ownership on price impact (PI) is greater for SOEs than non-SOEs (0.257). However, regarding the realized spread (RS) shown in column (5), a proxy for real frictions, we find no evidence that there is a differential effect of tradable block ownership on realized spread between SOEs and non-SOEs. Taken together, the results in columns (4) and (5) indicate that the different effects of tradable block ownership on stock liquidity between SOEs and non-SOEs are mainly driven by reduced information friction.[20] This is largely due to tradable blockholders being able to use exit threats to discipline managers and to improve the information environment of non-SOEs. Overall, the results support our view that the exit threat posed by tradable blockholders may influence the degree of information asymmetry between informed and uninformed traders reflected in a firm's stock liquidity.

4.6 The split-share structure reform, tradable block ownership and stock liquidity

We have established in the above results that the presence of tradable blockholders could enhance

[20] We also examine the relationship between tradable block ownership and trading activity. We find that the results are consistent with the result in column 5 that tradable block ownership is significantly negatively related to number of trades and trading volume.

managers' incentives to improve a firm's information environment and trading activity possibly through exit threats, which reduces informed trading and increases stock liquidity. However, some studies argue that this threat is only credible when the exit cost is not excessive otherwise blockholders will not exit (Admati and Pfleiderer, 2009). This prediction leads us to test whether there is a decreasing liquidity effect of tradable block ownership particularly when the level of ownership exceeds a certain level which is associated with high exit costs. To test this prediction the split-share structure reform, which significantly increases the extent of tradable block ownership, provides an opportunity to determine the validity of our conjecture. As Figure 1 indicates, the sharp increase in tradable block ownership from 1% pre-2005 reform to about 20% in 2012 post-reform implies that there may be a diminishing effect of tradable block ownership as a result of rising exit costs which are associated with the increase in ownership. To test this hypothesis, we perform the regression by including an additional variable which interacts the reform dummy (REFORM) with the tradable block ownership (TBLOCK). The results are reported in the first three columns of Table 7.

[Table 7 about here]

The results reported in columns (1), (2) and (3) indicate that the interaction terms between tradable block ownership and the reform dummy are positively and significantly related to the quoted and realized spreads. The findings suggest that the increased tradable shares held by tradable blockholders resulting from the reform reduce the positive liquidity effect of block ownership. Post-reform, the overall effect of tradable blockholders on the effective spread is -0.161 while on the quoted spread is -0.128, which differ from the results of pre-reform, -0.365 and -0.325, respectively. While the sign of the TBLOCK*REFORM coefficient on market depth (DEP) is negative, it is not statistically significant. However, the overall results show a decrease in the liquidity effect of tradable block ownership post-reform. The findings are consistent with our hypothesis that the exit costs of tradable blockholders are greater post-reform to the extent that any exit threats are deemed less credible. Moreover, if the threat is deemed as less credible, it means that tradable blockholders are less likely to trade and they are less able to instill discipline in management. The results are a fall in trading activity and a rise in the level of informed trading. The results from columns (4) and (5) further provide evidence to support this hypothesis. Equally, we find that the effects of tradable block ownership on both price impact and realized spread increase post-reform. More importantly, as previously

argued, many tradable block shares are converted from non-tradable shares and they do not arise from stock liquidity following the reform. Consequently, the significant positive effect of tradable block ownership on stock liquidity further confirms the causal relationship between tradable block ownership and stock liquidity.

Referring to non-tradable block ownership, the coefficient estimate of the interactive term between non-tradable block ownership and reform dummy has the expected sign (negative for effective, quoted, price impact and realized spread while positive for market depth) although it is not statistically significant. As Figure 1 suggests, the non-tradable block ownership has decreased significantly post-reform but it has remained at the level of about 25% in 2012, thus many non-tradable shareholders are still controlling shareholders. The majority of these non-tradable shares, additionally, are state or legal persons shares (SOEs) and their interests are more aligned with political or social objectives. Therefore the reform may not significantly improve the liquidity effect of non-tradable block ownership. The non-tradable shares themselves continue to impair stock liquidity and exert a negative liquidity effect, and this effect is not associated with the level of non-tradable block ownership.

4.7 Non-linear relationship between tradable block ownership and stock liquidity

Results from Table 7 suggest there could be a nonlinear relationship between the level of tradable blockownership and stock liquidity. Based on these results, we hypothesize there may be an inverted U-shaped relationship between tradable block ownership and stock liquidity. To examine this hypothesis, we add a quadratic term of tradable block ownership in Eq. (10) to determine whether tradable block ownership is related to stock liquidity in a nonlinear fashion. We find that there are no significant results in the quadratic term of tradable block ownership on all liquidity measures[21] even though it has the expected sign. However, as discussed in Section 3.4 (Table 2), the one-year lock-up period and selling restrictions after the 2005 reform suggest that the significant effect of tradable block ownership shows up in the period following 2008 (around 30%). We believe that the low level of tradable block ownership pre-2008 is likely to reduce the statistical significance of the squared tradable block ownership estimate

[21] The results are not reported here for brevity but are available from the authors upon request.

when the entire sample from 2003 to 2012 is employed. For this reason, we restrict the sample to post-2008 to study the nonlinear relationship between tradable block ownership and stock liquidity.

[Table 8 about here]

To test this hypothesis, we perform the regressions by including an additional variable – the quadratic term of tradable block ownership (TBLOCK^2) – in Eq. (10). The results are shown in Table 8. We find that the effects of the quadratic term of block ownership on both effective and quoted spreads (columns 1 and 2) are positive and statistically significant (0.134 and 0.079, respectively) although we find a similar insignificant negative effect for market depth like in Table 7. Furthermore, we examine whether this quadratic relationship operates through the two channels through which tradable block ownership is related to stock liquidity (i.e. information and real friction channels). The results shown in columns (4) and (5) indicate that the coefficient estimate of the quadratic term on price impact (PI) and realized spread (RS) is positive and statistically significant (i.e. 0.226 and 0.137, respectively). These findings provide support for the reduced liquidity effect of tradable block ownership post-reform which is congruent with those reported in Table 7. Furthermore, the results support our hypothesis that when tradable block ownership reaches a given level which causes the threat of exit to be less credible, the presence of tradable blockholders could reduce trading activity and increase informed trading.

Robustness tests

5.1 Propensity score matching approach

Tradable blockholders (regarded as treatment) in a firm may be associated with confounding variables like firm characteristics, which also influence liquidity. Consequently, for an unbiased treatment comparison the estimation method needs to adjust for confounding exposures to treatment arising from firm characteristics. This is done through propensity score matching in which we select a subset of firms without tradable block ownership (control group) with firm characteristics that are similar to those with tradable block ownership (treatment group). We choose state dummy, firm size, share price, volatility, share turnover rate, institutional ownership and leverage ratio as confounders and employ logistic

regression[22] to obtain propensity score. There are very few units with exact matching so we employ nearest neighbor matching[23], radius matching[24] and stratification matching[25] with replacement. Table 9 shows the average treatment effect (ATE)[26] with nearest neighbor matching. The results from radius and stratification matching are similar to the ones from nearest neighbor matching, hence they are not presented here for brevity but they are available from the author upon request. As shown in Table 10, there are altogether 5913 observations for the treatment group. Referring to effective spread, there are 3087 observations matched with treatment group based on nearest neighbor matching, and the effective spread is greater (0.221%) in the control group than the one in the treatment group (0.162%). We find similar results for the quoted spread, price impact and realized spread. In addition, there are 2869 observations in the control group matching with the treatment group for market depth, and it is greater in the treatment group (78314) than the control group (62228). All these results point to a causal relationship between tradable block ownership and stock liquidity.

[Table 9 about here]

5.2 Endogeneity and reverse causality

It is possible that both tradable block ownership and stock liquidity could be jointly determined by some omitted variables. Another possible concern is the reverse causality from liquidity to block ownership. However, as we argued previously, many tradable shares between 2009 and 2012 are converted from non-tradable shares rather than being determined by stock liquidity. Consequently, the significant and positive liquidity effect of tradable block ownership reported in Table 8, which is based on the post-reform sub-sample, is less likely to suffer from reverse causality bias. To allay concerns about the endogeneity problem, we perform the fixed effects regression and change-in-variables regression. For brevity, we do not report these results but they are available from the authors upon request.

[22] We obtain similar results when we employ a probit model.
[23] This involves matching the point in a given set that is closest (or most similar) to a given point.
[24] The point is matched within a radius.
[25] Individuals are stratified based on estimated propensity scores and the difference is estimated as the average of within-stratum effects.
[26] The ATE is the average effect, at the population level, of moving an entire untreated population to treated. A related measure of treatment effect is the average treatment effect for the treated (ATT). Since the barriers for an investor to become a tradable blockholder are minimal, the ATE may be of greater interest than ATT. Nonetheless, we obtain similar results when using the ATE.

In the pooled OLS regressions, omitted variables could exist which may simultaneously influence the dependent variable and some of the explanatory variables, thus giving rise to a possible endogeneity problem. The fixed effects regression controls for omitted variables, which are assumed to differ across firms but are time-invariant. By and large, the results of the fixed effects regressions remain qualitatively unchanged. The results are shown in Table 10. We find that tradable block ownership is negatively associated with effective, quoted, price impact and realized spread while positively associated with market depth. Moreover, the coefficient estimates of the other control variables are qualitatively similar to the pooled regression results

[Table 10 about here]

We also re-estimate regression (10) using change-in-variables (or first differencing) method, which mitigates the problem of spurious correlation that is likely to occur with the use of variables in levels. We find similar results which are shown in Table 11; the change in tradable block ownership is significantly and negatively related to changes in the effective spread, quoted spread, price impact, and realized spread while it is positively related to market depth. The results are consistent with earlier findings that it is the tradable blockholders' shares which exert a positive liquidity effect.

[Table 11 about here]

However, propensity score matching is based on the observed data and the result will be unreliable if there are unobserved confounding variables affecting both treatment and outcome. In other words, it is possible that both tradable block ownership and stock liquidity could be jointly determined by some omitted variables. Another possible concern is the reverse causality running from liquidity to block ownership. However, as we have previously argued, many tradable shares between 2009 and 2012 are converted from non-tradable shares rather than arising from stock liquidity.

5.3 Stock market effects

We test to determine whether the results are robust to certain stock market features such as firm characteristics[27] and distinct inherent factors such as transaction cost differences in the two stock markets

[27] For example, the Shanghai stock exchange attracts larger firms and state-owned firms, while the Shenzhen stock exchange attracts smaller and medium-sized firms.

(i.e. Shenzhen and Shanghai). This is done by re-estimating regression (10) based on data on the individual stock market and the results remain qualitatively similar, suggesting that our results are robust to stock market-specific effects.

Concluding remarks

In this paper we conduct an extensive empirical study on the relationship between block ownership and stock liquidity of a large emerging market. Unlike studies based on developed markets, which exhibit a negative impact of block ownership on stock liquidity, we show for the first time that the positive liquidity effect of blockholders can arise if they have a propensity to trade and through credible exit threats they can instill discipline in management to bring about greater transparency in information disclosures (Admati and Pfleiderer, 2009; Edmans, 2009; Edmans and Manso, 2011; Bharath et al., 2013). Our hypothesis is examined using the Chinese stock market for the period 2003-2012, which is characterized by a highly concentrated ownership structure operating in a special institutional and political environment for which listed firms divide their shares into tradable and non-tradable shares – the split-share structure. There is evidence that block ownership has an adverse liquidity impact, which is manifested by wider quoted and realized spreads and a higher price impact. However, this adverse liquidity effect of block ownership is muted when the firm's non-tradable shares ownership is controlled for.

It is apparent in our empirical results that the nature of block ownership, whether shares are tradable or not, has important and different implications on the stock liquidity effect of block ownership. Tradable block ownership is significantly and negatively related to the effective and quoted spreads and it is positively related to market depth. The statistically significant negative effect on price impact and realized spread suggests that the positive liquidity effect of tradable block ownership operates through both real and information friction channels. These results are supportive of the hypothesis that tradable blockholders can use their influence, possibly through exit threats, on management to bring about greater liquidity through both real and information friction channels. On the other hand, the non-tradable shares prevent many blockholders from trading their holdings in the secondary market, which implies that exit threats posed by non-tradable blockholders are not likely to be credible and will not have a positive influence on liquidity.

Our empirical results confirm that non-tradable shares not only impair trading activity, they also increase the adverse selection costs in the secondary market. We find, furthermore, that SOEs and non-SOEs tradable block ownerships have different stock liquidity effects. Given that the exit threats posed by SOEs tradable block ownership are less credible since they are more closely aligned with the political objectives of the state, their ownership is associated with greater information and real friction costs.

When examining the effect of split-share structure reform, post-reform tradable block ownership has a significant positive effect on the effective and quoted spreads, and on price impact and realized spread. These results suggest that the increase of tradable shares resulting from the reform significantly increases informed trading and reduces trading activity, thus reducing the positive liquidity impact of tradable block ownership. These results support our hypothesis that an increase in ownership may incur higher costs for tradable blockholders when they exit the firm to the extent that their exit threat becomes less credible. Our hypothesis also leads to a possible nonlinear, inverted U-shaped relationship between block ownership and liquidity, which is supported by the data.

In conclusion, our empirical results provide the first evidence in which the liquidity effect of block ownership can be positive. The rationale of this observed relationship is explained through the institutional and political environment in which blockholders operate, which provides the basis for testing the hypothesis that exit threats posed by blockholders can yield effective governance. These threats can actually improve liquidity through both real and information friction channels. More importantly, we demonstrate that when studying the liquidity impact of block ownership, it is important to consider the institutional setting in which firms operate to better understand the true liquidity effect of block ownership.

Table 1. Summary statistics of liquidity measures, types of block ownership and control variables

This table reports the summary statistics of sample firms for the dependent variables (Panel A), types of block ownership (Panel B), and the control variables (Panel C). Data for Panel A are taken from Thomson Reuters tick history distributed by Sirca. They are averaged across all trading days for each stock in each year. Data for Panel B are taken from the Wind database. Blockholders include non-tradable and tradable blockholders. Data for Panel C are taken from the Wind database. Firm size is measured as book value of a firm. Share price (PRICE) is the mean of daily stock price over the current year. The non-tradable share ratio is measured as a firm's total non-tradable shares divided by the turnover rate, which is calculated as total trading volume over the current year divided by shares outstanding. Volatility is calculated as standard deviation of daily stock returns over the current year. The leverage ratio is measured as a company's total debt divided by its total assets. The sample includes stocks traded on both the Shanghai and Shenzhen Stock Exchanges for the period 2003-2012.

Panel A: Dependent Variables	**# of Obs**	**Mean**	**Std**	**95th**	**75th**	**50th**	**25th**	**5th**
Effective spread (QS, %)	13642	0.212	0.105	0.403	0.259	0.188	0.141	0.094
Quoted spread (QS, %)	13642	0.208	0.101	0.388	0.253	0.186	0.139	0.094
Market depth (DEP, '000 shares)	12773	69.202	186.812	219.086	70.365	32.643	15.021	6.260
Price impact (PI, %)	13642	0.037	0.023	0.080	0.048	0.032	0.022	0.011
Realized spread (RS, %)	13642	0.069	0.034	0.126	0.083	0.062	0.047	0.029
LSB adverse selection	13641	0.316	0.106	0.454	0.398	0.340	0.236	0.126
HS adverse selection	13641	0.301	0.108	0.441	0.385	0.327	0.214	0.110
Trading Volume (million shares per day)	14817	5.362	11.702	17.769	6.134	2.665	1.105	0.559
Number of Trades ('000 per day)	8814	1.815	2.216	5.203	2.029	1.375	0.769	0.306
Panel B: Variables of interest	**# of Obs**	**Mean**	**Std**	**95th**	**75th**	**50th**	**25th**	**5th**
# of Blockholders	14824	1.989	1.115	4.000	3.000	2.000	1.000	1.000
Block ownership	14824	0.490	0.160	0.730	0.608	0.504	0.378	0.212
Non-tradable block ownership (NTBLOCK)	14824	0.405	0.225	0.716	0.582	0.442	0.254	0.000
Tradable block ownership (TBLOCK)	14824	0.085	0.161	0.487	0.100	0.000	0.000	0.000
Panel C: Control variables	**# of Obs**	**Mean**	**Std**	**95th**	**75th**	**50th**	**25th**	**5th**
Firm size (yuan, billion)	14815	2.214	7.632	6.602	1.749	0.888	0.467	0.099
Share price (yuan)	14817	12.607	12.021	33.648	14.812	8.999	5.996	3.272
Non-tradable share ratio	14824	0.451	0.244	0.750	0.642	0.504	0.287	0.000
Volatility (per day)	14702	0.977	3.776	7.132	0.043	0.032	0.026	0.020
Share turnover rate (per year)	14824	5.916	4.275	14.312	8.104	4.799	2.678	1.164
Institutional ownership (%)	14758	0.033	0.048	0.136	0.050	0.010	0.000	0.000
Leverage ratio	14799	0.519	0.455	0.858	0.639	0.494	0.322	0.110

Table 1 continue

Panel D: Summary statistics regarding tradable block ownership (TBLOCK) within sample only including tradable block ownership

Year	Mean	Obs	25th	Median	75th
2003	0.1144635	11	0.0650845	0.0978399	0.1375123
2004	0.1984303	12	0.0713496	0.1541662	0.2585253
2005	0.1764138	17	0.0844346	0.1118873	0.245525
2006	0.1051203	91	0.05	0.0713933	0.120102
2007	0.0937361	286	0.05	0.0715285	0.1
2008	0.1614767	618	0.0764692	0.1	0.1967317
2009	0.3032959	919	0.127818	0.2889985	0.444288
2010	0.3281715	1121	0.1856543	0.3200028	0.461868
2011	0.3258387	1382	0.1757929	0.3123781	0.464
2012	0.3436064	1456	0.2000874	0.3368098	0.4834417

Figure 1. Non-tradable ownership, tradable ownership and total block ownership over the sample period 2003 - 2012

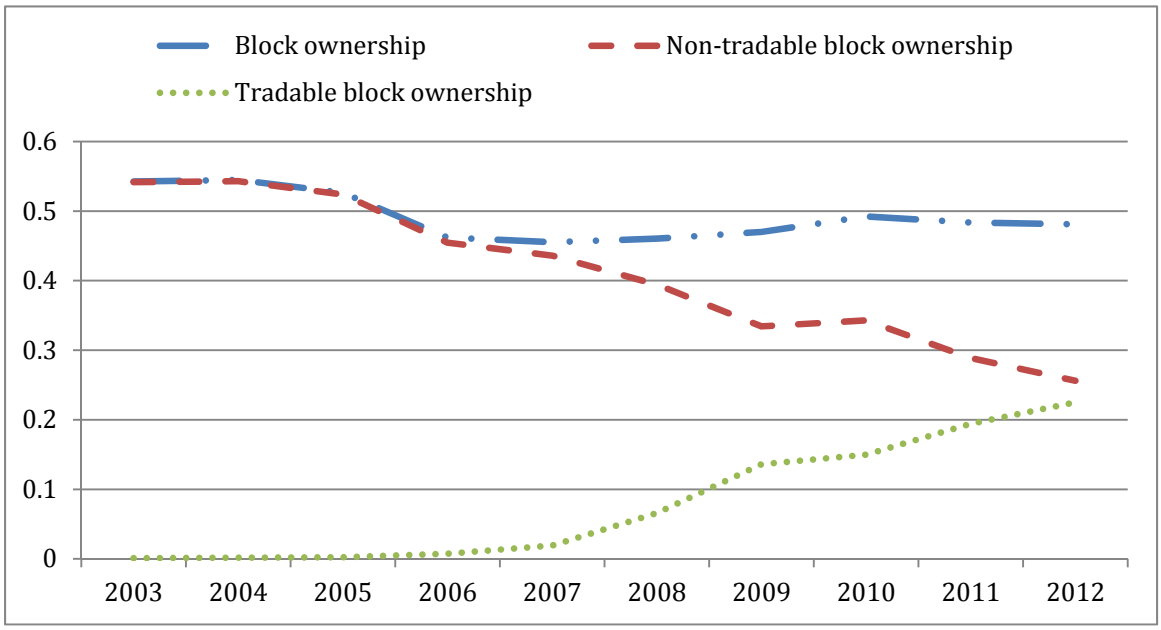

Table 2. Pearson's correlation coefficient

The table presents Pearson's correlation coefficient between variables for effective spread (ES), quoted spread (QS), market depth (DEP), price impact (PI), realized spread (rs), LSB, HS, trading volume (VOM), number of trades (NT), block ownership (BLOCK), non-tradable block ownership (NTBLOCK), tradable block ownership (TBLOCK), non-tradable share ratio (NTR), book value of a firm (SIZE), share price (PRICE), volatility (VOL), turnover rate (TO), institutional ownership (IO) and leverage ratio (LEV). The sample includes stocks traded on both the Shanghai and Shenzhen Stock Exchanges for the period 2003-2012.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18))	(19)
ES(1)	1																		
QS(2)	1	1																	
DEP(3)	-0.11	-0.1	1																
PI(4)	0.88	0.87	-0.24	1															
RS(5)	0.95	0.95	-0.09	0.7	1														
LSB(6)	0.21	0.18	-0.36	0.36	0.14	1													
HS(7)	0.23	0.2	-0.36	0.38	0.16	1	1												
VOM(8)	-0.15	-0.14	0.5	-0.21	-0.13	-0.42	-0.41	1											
NT(9)	-0.29	-0.27	0.31	-0.35	-0.24	-0.68	-0.69	0.71	1										
BLOCK(10)	-0.02	-0.03	-0.09	0.04	-0.02	0.23	0.23	-0.1	-0.11	1									
NTBLOCK(11)	0.15	0.14	-0.1	0.19	0.15	0.37	0.36	-0.14	-0.22	0.7	1								
TBLOCK(12)	-0.23	-0.22	0.05	-0.22	-0.23	-0.29	-0.28	0.09	0.2	0.02	-0.7	1							
NTR(13)	0.16	0.16	-0.1	0.22	0.17	0.41	0.41	-0.16	-0.25	0.58	0.92	-0.72	1						
SIZE(14)	-0.13	-0.13	0.31	-0.15	-0.12	-0.3	-0.29	0.48	0.47	0.08	-0.06	0.16	-0.07	1					
PRICE(15)	-0.39	-0.39	0.08	-0.37	-0.34	-0.04	-0.05	-0.04	0.05	0.15	0.09	0.03	0.13	0.04	1				
VOL(16)	-0.15	-0.15	0.13	-0.12	-0.14	0.06	0.05	0.09	-0.03	0.15	0.2	-0.13	0.28	-0.01	0.32	1			
TO(17)	-0.32	-0.32	0.11	-0.35	-0.28	-0.2	-0.21	0.15	0.21	-0.08	0.04	-0.14	0.03	-0.1	0.12	-0.02	1		
IO(18)	-0.22	-0.21	-0.01	-0.23	-0.17	-0.14	-0.14	0.03	0.08	-0.07	-0.15	0.13	-0.17	0.06	0.28	-0.07	-0.06	1	
LEV(19)	0.25	0.26	0.07	0.17	0.26	-0.13	-0.13	0.02	0.04	-0.15	-0.1	-0.01	-0.09	0	-0.2	-0.11	-0.06	-0.08	1

Table 3. Pooled Regression Results of Block Ownership, Non-tradable Shares and Stock Liquidity

This table presents the regression results for three liquidity measures (effective spread: ES; quoted spread: QS; and market depth: DEP) on lagged value of total block ownership. It also examines whether a firm's non-tradable shares determine the impact of block ownership on liquidity. The sample includes stocks traded on both the Shanghai and Shenzhen Stock Exchanges for the period 2003-2012. The reported Driscoll-Kraay standard errors are robust to correlation across residuals within a firm over time and across firms in the same year, and different years. ***, ** and * denote that the coefficient is significant at the 1%, 5% and 10% level, respectively.

	Dependent variables					
Independent variables	(1) Log(ES)	(2) Log(ES)	(3) Log(QS)	(4) Log(QS)	(5) Log(DEP)	(6) Log(DEP)
BLOCK	0.247***	0.025	0.224***	0.026	-1.028***	-0.748***
	(0.029)	(0.038)	(0.028)	(0.038)	(0.096)	(0.146)
NTR		0.322***		0.286***		-0.403***
		(0.073)		(0.069)		(0.096)
STATE	-0.058**	-0.044***	-0.048**	-0.036***	0.101***	0.084***
	(0.018)	(0.012)	(0.016)	(0.010)	(0.027)	(0.023)
log(SIZE)	-0.121***	-0.121***	-0.118***	-0.118***	0.320***	0.320***
	(0.021)	(0.020)	(0.021)	(0.020)	(0.041)	(0.040)
log(PRICE)	-0.357***	-0.377***	-0.345***	-0.363***	-0.121	-0.095
	(0.032)	(0.033)	(0.032)	(0.033)	(0.082)	(0.077)
log(VOL)	-0.026	-0.012	-0.020	-0.008	0.284**	0.266**
	(0.019)	(0.021)	(0.020)	(0.022)	(0.114)	(0.103)
log(TO)	-0.175***	-0.209***	-0.172***	-0.202***	0.259***	0.303***
	(0.025)	(0.013)	(0.023)	(0.013)	(0.050)	(0.052)
IO	0.081	0.164	0.093	0.166	-0.647	-0.747
	(0.122)	(0.126)	(0.111)	(0.115)	(0.595)	(0.547)
LEV	-0.106*	-0.084*	-0.083	-0.063	0.673***	0.645***
	(0.051)	(0.039)	(0.045)	(0.035)	(0.073)	(0.073)
R2	0.767	0.782	0.767	0.779	0.541	0.547
Time dummy	YES	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES	YES
Observations	11751	11751	11751	11751	11341	11341

Table 4. Tradable and Non-tradable Block Ownership and Stock Liquidity

The table presents the regression results for three liquidity measures (ES, QS and DEP) on lagged value of non-tradable (NTBLOCK) and tradable (TBLOCK) block ownership. The interactive term (TBLOCK*STATE) examines the difference in liquidity impact by tradable block ownership between state-owned enterprises and non-state-owned enterprises. The sample includes stocks traded on both the Shanghai and Shenzhen Stock Exchanges for the period 2003-2012. The reported Driscoll-Kraay standard errors are robust to correlation across residuals within a firm over time and across firms in the same year, and different years. ***, ** and * denote that the coefficient is significant at the 1%, 5% and 10% level, respectively.

Independent variables	(1) Log(ES)	(3) Log(QS)	(5) Log(DEP)
NTBLOCK	0.271***	0.244***	-1.060***
	(0.034)	(0.032)	(0.092)
TBLOCK	-0.402***	-0.353***	0.516***
	(0.052)	(0.050)	(0.086)
STATE	-0.047***	-0.038***	0.086***
	(0.012)	(0.011)	(0.022)
log(SIZE)	-0.123***	-0.120***	0.323***
	(0.020)	(0.020)	(0.040)
log(PRICE)	-0.367***	-0.355***	-0.107
	(0.032)	(0.032)	(0.080)
log(VOL)	-0.008	-0.005	0.260**
	(0.022)	(0.023)	(0.100)
log(TO)	-0.217***	-0.208***	0.314***
	(0.014)	(0.014)	(0.051)
IO	0.126	0.131	-0.701
	(0.118)	(0.108)	(0.561)
LEV	-0.077	-0.057	0.635***
	(0.043)	(0.039)	(0.067)
R2	0.781	0.778	0.547
Time dummy	YES	YES	YES
Industry dummy	YES	YES	YES
Observations	11751	11751	11341

Table 5. Non-tradable and Tradable Block Ownership, Real Friction and Information Friction Channels

This table presents the regression results for two channels through which block ownership is related to liquidity. (1) Real friction channel: real spread (RS); number of trades (NT); trading volume (VOM). (2) Information friction channel: price impact (PI); LSB; HS) on lagged value of non-tradable and tradable block ownership. The sample includes stocks traded on both the Shanghai and Shenzhen Stock Exchanges for the period 2003-2012. The reported Driscoll-Kraay standard errors are robust to correlation across residuals within a firm over time and across firms in the same year, and different years. ***, ** and * denote that the coefficient is significant at the 1%, 5% and 10% level, respectively.

	Dependent variables					
Independent variables	(1) Log(RS)	(2) Log(PI)	(3) Log(HS)	(4) Log(LSB)	(5) Log(NT)	(6) Log(VOM)
NTBLOCK	0.224***	0.413***	0.469***	0.425***	-0.686***	-1.408***
	(0.052)	(0.038)	(0.054)	(0.046)	(0.100)	(0.080)
TBLOCK	-0.405***	-0.424***	-0.402***	-0.314***	0.894***	1.190***
	(0.057)	(0.048)	(0.058)	(0.058)	(0.098)	(0.115)
STATE	-0.047**	-0.072***	-0.055**	-0.041**	0.083***	0.120***
	(0.017)	(0.010)	(0.017)	(0.014)	(0.007)	(0.032)
log(SIZE)	-0.118***	-0.122***	-0.188***	-0.183***	0.337***	0.498***
	(0.014)	(0.034)	(0.016)	(0.015)	(0.021)	(0.063)
log(PRICE)	-0.314***	-0.414***	0.132***	0.152***	-0.078**	0.393***
	(0.036)	(0.044)	(0.017)	(0.018)	(0.023)	(0.034)
log(VOL)	0.001	-0.030	0.016	0.021	0.089	0.221***
	(0.028)	(0.031)	(0.019)	(0.017)	(0.059)	(0.060)
log(TO)	-0.215***	-0.216***	-0.038	-0.023		
	(0.013)	(0.026)	(0.029)	(0.029)		
IO	0.182*	0.256	-0.126	-0.098	0.274	1.499***
	(0.093)	(0.284)	(0.178)	(0.166)	(0.167)	(0.385)
LEV	-0.037	-0.225***	-0.302***	-0.268***	0.386***	0.638***
	(0.052)	(0.033)	(0.040)	(0.035)	(0.046)	(0.068)
R2	0.672	0.609	0.478	0.486	0.724	0.833
Time dummy	YES	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES	YES
Observations	11751	11751	11750	11750	7475	12678

Table 6. State-owned enterprise, information friction cost and stock liquidity

The table presents the regression results for effective spread (ES), quoted spread (QS), market depth (DEP), price impact (PI) and realized spread (RS) on lagged value of non-tradable (NTBLOCK) and tradable (TBLOCK) block ownership. The interactive term (TBLOCK*STATE) examines the difference in liquidity impact by tradable block ownership between state-owned enterprises and non-state-owned enterprises. The reported Driscoll-Kraay standard errors are robust to correlation across residuals within a firm over time and across firms in the same year, and different years. ***, ** and * denote that the coefficient is significant at the 1%, 5% and 10% level, respectively.

Independent variables	(1) Log(ES)	(2) Log(QS)	(3) Log(DEP)	(4) Log(PI)	(5) Log(RS)
NTBLOCK	0.269***	0.243***	-1.054***	0.410***	0.223***
	(0.033)	(0.032)	(0.0913)	(0.039)	(0.052)
TBLOCK	-0.479***	-0.424***	0.723***	-0.576***	-0.446***
	(0.052)	(0.051)	(0.098)	(0.041)	(0.068)
TBLOCK*STATE	0.131**	0.119**	-0.351***	0.257***	0.070
	(0.044)	(0.038)	(0.093)	(0.044)	(0.053)
STATE	-0.060**	-0.051**	0.123**	-0.098***	-0.054*
	(0.023)	(0.020)	(0.046)	(0.023)	(0.025)
log(SIZE)	-0.123***	-0.120***	0.323***	-0.122***	-0.118***
	(0.020)	(0.020)	(0.040)	(0.034)	(0.014)
log(PRICE)	-0.368***	-0.356***	-0.104	-0.416***	-0.315***
	(0.032)	(0.032)	(0.078)	(0.043)	(0.037)
log(VOL)	-0.007	-0.004	0.260**	-0.030	0.001
	(0.022)	(0.024)	(0.100)	(0.031)	(0.028)
log(TO)	-0.216***	-0.208***	0.313***	-0.215***	-0.215***
	(0.014)	(0.014)	(0.051)	(0.026)	(0.013)
IO	0.137	0.142	-0.732	0.278	0.188*
	(0.111)	(0.101)	(0.565)	(0.269)	(0.089)
LEV	-0.078	-0.058	0.636***	-0.226***	-0.037
	(0.043)	(0.038)	(0.067)	(0.032)	(0.052)
R2	0.781	0.779	0.548	0.610	0.672
Time dummy	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES
0bservations	11751	11751	11341	11751	11751

Table 7. Differential Impact of Non-tradable and Tradable Block Ownership on Liquidity before and after Split-share Structure Reform

The table presents the regression results of the difference in the effect of non-tradable and tradable block ownership on liquidity before and after split-share structure reform. REFORM is a dummy variable which equals 1 if a firm has completed the reform and 0 otherwise. The sample includes stocks traded on both the Shanghai and Shenzhen Stock Exchanges for the period 2003-2012. The reported Driscoll-Kraay standard errors are robust to correlation across residuals within a firm over time and across firms in the same year, and different years. ***, ** and * denote that the coefficient is significant at the 1%, 5% and 10% level, respectively.

	Dependent variables				
Independent variables	(1) Log(ES)	(2) Log(QS)	(3) Log(DEP)	(4) Log(PI)	(5) Log(RS)
NTBLOCK	0.201***	0.187***	-0.876***	0.313***	0.183**
	(0.036)	(0.036)	(0.027)	(0.031)	(0.062)
TBLOCK	-0.365***	-0.325***	0.382***	-0.349***	-0.390***
	(0.044)	(0.045)	(0.114)	(0.042)	(0.041)
NTBLOCK*REFORM	-0.054	-0.042	0.067	-0.060	-0.038
	(0.043)	(0.045)	(0.118)	(0.055)	(0.042)
TBLOCK*REFORM	0.204***	0.197***	-0.061	0.163**	0.216***
	(0.025)	(0.027)	(0.130)	(0.056)	(0.032)
REFORM	-0.079***	-0.057***	0.189**	-0.173***	-0.042***
	(0.011)	(0.016)	(0.070)	(0.033)	(0.012)
STATE	-0.035***	-0.030***	0.041***	-0.041***	-0.037***
	(0.005)	(0.005)	(0.009)	(0.010)	(0.005)
log(SIZE)	-0.121***	-0.118***	0.330***	-0.118***	-0.107***
	(0.021)	(0.020)	(0.040)	(0.023)	(0.006)
log(PRICE)	-0.374***	-0.359***	-1.089***	-0.425***	-0.318***
	(0.024)	(0.023)	(0.074)	(0.023)	(0.037)

log(VOL)	0.022	0.023	0.106	-0.004	0.030
	(0.025)	(0.026)	(0.074)	(0.026)	(0.028)
log(TO)	-0.217***	-0.208***	0.341***	-0.223***	-0.222***
	(0.009)	(0.010)	(0.053)	(0.017)	(0.006)
IO	0.161*	0.149*	-0.660	0.428*	0.189*
	(0.078)	(0.075)	(0.634)	(0.188)	(0.088)
LEV	0.041*	0.047**	0.209***	-0.017	0.062**
	(0.021)	(0.020)	(0.049)	(0.018)	(0.019)
R2	0.780	0.775	0.651	0.622	0.676
Time dummy	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES
Observations	11751	11751	11341	11751	11751

Table 8. Non-linear relationship between tradable block ownership and stock liquidity

The table presents the regression results for effective spread (ES), quoted spread (QS), market depth (DEP), price impact (PI) and realized spread (RS) on lagged value of non-tradable (NTBLOCK) and tradable (TBLOCK) block ownership. The quadratic term (TBLOCK ^2) examines. The sample includes stocks traded on both the Shanghai and Shenzhen Stock Exchanges for the period 2008-2012. The reported Driscoll-Kraay standard errors are robust to correlation across residuals within a firm over time and across firms in the same year, and different years. ***, ** and * denote that the coefficient is significant at the 1%, 5% and 10% level, respectively.

	Dependent variables				
Independent variables	(1) Log(ES)	(2) Log(QS)	(3) Log(DEP)	(4) Log(PI)	(5) Log(RS)
NTBLOCK	0.252**	0.219**	-1.161***	0.402***	0.248*
	(0.060)	(0.059)	(0.061)	(0.029)	(0.089)
TBLOCK	-0.456***	-0.378**	1.021***	-0.548***	-0.473**
	(0.073)	(0.067)	(0.138)	(0.089)	(0.097)
TBLOCK^2	0.134**	0.079*	-0.062	0.226*	0.137*
	(0.026)	(0.028)	(0.133)	(0.113)	(0.046)
STATE	-0.055***	-0.044***	0.075*	-0.065***	-0.051**
	(0.008)	(0.007)	(0.025)	(0.005)	(0.011)
log(SIZE)	-0.088***	-0.084***	0.274***	-0.124***	-0.107***
	(0.008)	(0.008)	(0.042)	(0.023)	(0.006)
log(PRICE)	-0.394***	-0.380***	-1.177***	-0.403***	-0.365***
	(0.040)	(0.040)	(0.037)	(0.032)	(0.042)
log(VOL)	0.021	0.026	0.260*	-0.015	0.026
	(0.025)	(0.027)	(0.104)	(0.027)	(0.020)
log(TO)	-0.198***	-0.191***	0.312*	-0.220***	-0.211***
	(0.022)	(0.021)	(0.102)	(0.022)	(0.013)
IO	-0.036	-0.022	-1.086***	0.313	0.099
	(0.200)	(0.188)	(0.169)	(0.205)	(0.186)
LEV	0.004	0.014	0.146***	-0.022	0.032
	(0.014)	(0.013)	(0.009)	(0.020)	(0.015)
R2	0.486	0.724	0.833	0.486	0.724
Time dummy	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES
Observations	11751	11751	11341	11751	11751

Table 9. Propensity Score Matching

The treatment group is the subsample of firms with tradable block ownership while the control group is the selected subsample of firms having similar firm characteristics with the treatment group based on nearest neighbor matching. ATE is defined as the average effect, at the population level, of moving an entire population from untreated to treated.

Variable	Treatment group	Control group	ATE	*p*-value
Relative effective spread (ES, %)	0.162 (5913)	0.221 (3087)	0.059	0.000
Quoted spread (QS, %)	0.169(5913)	0.225(3087)	0.056	0.000
Quoted depth (DEP, '000 shares)	78.314 (5913)	62.228 (2869)	16.088	0.000
Price impact (PI, %)	0.043 (5913)	0.029 (3274)	0.014	0.000
Realized spread (RS, %)	0.077 (5913)	0.057 (3274)	0.020	0.000

Table 10. Results with fixed effect model

The table presents fixed effects panel regressions of liquidity measures (ES, QS and DEP) and two components of liquidity (PI and RS) on lagged value of non-tradable and tradable block ownership. The sample includes stocks traded on both the Shanghai and Shenzhen Stock Exchanges for the period 2003-2012. The reported Driscoll-Kraay standard errors are robust to correlation across residuals within a firm over time and across firms in the same year, and different years. ***, ** and * denote that the coefficient is significant at the 1%, 5% and 10% level, respectively.

Independent variables	(1) Log(ES)	(2) Log(QS)	(3) Log(DEP)	(2) Log(PI)	(2) Log(RS)
NTBLOCK	0.138**	0.129**	-0.866***	0.206**	-0.133***
	(0.047)	(0.048)	(0.102)	(0.063)	(0.020)
TBLOCK	-0.204***	-0.186***	0.538***	-0.126***	-0.125***
	(0.034)	(0.034)	(0.064)	(0.024)	(0.021)
STATE	0.013	0.012	-0.001	-0.012	0.010
	(0.009)	(0.008)	(0.020)	(0.020)	(0.009)
log(SIZE)	-0.059***	-0.058***	0.034*	-0.196***	-0.142***
	(0.015)	(0.015)	(0.016)	(0.030)	(0.013)
log(PRICE)	-0.380***	-0.363***	0.051	-0.590***	-0.348***
	(0.035)	(0.035)	(0.099)	(0.045)	(0.048)
log(VOL)	-0.005	-0.001	0.233***	-0.034	0.020
	(0.021)	(0.021)	(0.049)	(0.037)	(0.025)
log(TO)	-0.210***	-0.202***	0.490***	-0.255***	-0.213***
	(0.017)	(0.016)	(0.026)	(0.022)	(0.011)
IO	0.042	0.038	-0.352*	0.570	0.145
	(0.138)	(0.131)	(0.182)	(0.318)	(0.128)
LEV	0.087**	0.096**	0.245**	-0.011	0.047***
	(0.029)	(0.032)	(0.078)	(0.009)	(0.008)
Within R2	0.815	0.806	0.660	0.662	0.700
Time dummy	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES
Observations	11751	11751	11341	11751	11751

Table 11. Results with changes in the variables

The table presents the panel regressions of changes in the effective spread (ES), quoted spread (QS), the order book depth (DEP), price impact (PI) and realized spread (RS) on changes in the non-tradable and tradable ownership. The sample includes stocks traded on both the Shanghai and Shenzhen Stock Exchanges for the period 2003-2012. The reported Driscoll-Kraay standard errors are robust to correlation across residuals within a firm over time and across firms in the same year, and different years. ***, ** and * denote that the coefficient is significant at the 1%, 5% and 10% level, respectively.

Independent variables	(1) ΔLog(ES)	(2) ΔLog(QS)	(3) ΔLog(DEP)	(4) ΔLog(PI)	(5) ΔLog(RS)
ΔNTBLOCK	0.323**	0.310**	-1.179***	0.500**	0.146***
	(0.136)	(0.134)	(0.142)	(0.185)	(0.030)
ΔTBLOCK	-0.302**	-0.310**	0.168**	-0.271**	-0.295**
	(0.122)	(0.126)	(0.071)	(0.099)	(0.124)
ΔSTATE	0.018	0.014	-0.067*	0.025	0.026*
	(0.013)	(0.013)	(0.030)	(0.034)	(0.012)
Δlog(SIZE)	-0.062***	-0.062***	0.031**	-0.016**	-0.021**
	(0.018)	(0.017)	(0.012)	(0.007)	(0.008)
Δlog(PRICE)	-0.425***	-0.393***	0.463***	-0.249***	-0.278***
	(0.044)	(0.047)	(0.107)	(0.070)	(0.063)
Δlog(VOL)	-0.028***	-0.027***	0.070***	-0.027***	-0.026***
	(0.006)	(0.007)	(0.012)	(0.006)	(0.007)
Δlog(TO)	-0.205***	-0.198***	0.586***	-0.371***	-0.174***
	(0.045)	(0.045)	(0.030)	(0.072)	(0.040)
ΔIO	0.504***	0.479***	-0.494*	0.386***	0.789***
	(0.075)	(0.072)	(0.223)	(0.105)	(0.079)
ΔLEV	0.030*	0.031*	0.018	0.013	0.034*
	(0.015)	(0.015)	(0.015)	(0.013)	(0.018)
R2	0.591	0.568	0.422	0.210	0.354
Time dummy	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES
Observations	9741	9741	9343	9741	9741

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