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Abstract

This paper documents that state ownership is associated with higher stock liquidity, a finding consistent with lower investor risk perception of firms which benefit from state ownership, like preferential financing and regulation, and implicit government guarantees. The effect is found to be stronger when government ownership confers stronger benefits like firms with state controlling rather than non-controlling shareholders, and when the benefits of government ownership are important – for smaller firms, for financially constrained firms, and especially during the financial crisis period. These results suggest that investors perceive government ownership as value-enhancing, which increases their willingness to trade in such stocks.

Keywords: State controlling shareholder; Stock liquidity; Information asymmetries; Trading activity
JEL Classification: G12; G18; G32; C23

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1. Introduction

The established literature has shown that a firm's stock liquidity is significantly influenced by block ownership through the firm's trading activity and/or its information environment (Bolton and Thadden, 1998; Brockman et al., 2009; Hefin and Shaw, 2000). Given that blockholders trade significantly less than non-blockholders, the costs of order processing and inventory increase with the fall in trading as these costs are spread over lesser trades. At the same time, to the extent that blockholders are regarded as informed traders due to their access to private information, the presence of information asymmetry forces market makers and uninformed traders to be reluctant to trade with informed traders; their concern about potential losses when trading with informed traders could lead them to increase spreads – an adverse selection effect (Copeland and Galai, 1983; Kyle, 1985). The fall in market depth and higher spreads imply that stock liquidity is lower in the presence of blockholders. In this paper, we study a type of block ownership – large state shareholding – and its effect on firm-level stock liquidity.

There are two diametrically opposed points of view concerning the effect of government ownership on firm-level stock liquidity. The most apparent reason that government ownership could improve liquidity is the implicit guarantee on the firm's debt that the state provides to prevent the firm from defaulting and the state-owned firm's preferential access to credit (Borisova et al., 2015; Borisova and Megginson, 2011; Faccio, Masulis, and McConnell, 2006). The reasons for the provision of implicit guarantee are that the government needs to achieve certain political objectives that deliver economic and social well-being by keeping unemployment low and economic growth high; the need to ensure the survival of certain key industries that provide vital services to the economy; and to safeguard the government's reputation in ensuring that the investment does not fail (Borisova et al., 2015). The perceived lower risk of default of state-owned firms would in turn attract investors and reduce the risk premiums required by investors (Faccio et al., 2006). Government participation through investing in a given equity can therefore promote investors' willingness to invest and trade in that equity because of the benefits enjoyed by such firms. Consequently, trading activities in stocks with government ownership are

predicted to increase, causing stock liquidity to improve. From market makers' or other liquidity providers' perspective, they face inventory carry costs and inventory risk, both of which are linked to risk. Implicit guarantees which stem from the presence of a government shareholder lower the riskiness of an asset, thereby reducing inventory risk and inventory financing costs for market makers, which should ultimately result in lower spreads.

On the other hand, there are a number of factors that could cause government ownership to lower firms' stock liquidity. The political view of government is that they operate through state-owned enterprises (SOEs) to pursue their political objectives, which go against the profit maximization objective of the firm (Boycko, Shleifer, and Vishny, 1994).[1] There is also the view that the "grabbing hand" of the government can lead to minority shareholder expropriation (Megginson, 2016). It has been pointed out that government-controlled firms have few incentives to improve transparency (Guedhami, Pittman, and Saffar, 2009). Further, moral hazard could arise from implicit government guarantees as managers and shareholders take on greater risks knowing that public funds are used to bail firms out when they are financially distressed. If investors believe government ownership will lead to the agency problem, impair firm value and information symmetry, they are unlikely to buy such stocks, thereby leading to reduced trading activity and higher spreads, with an eventual decline in stock liquidity (Brockman et al., 2009; Lang, Lins, and Maffett, 2012). The overall effect of government ownership on a firm's stock liquidity stemming from implicit guarantees, political goals of state owners, minority shareholder expropriation, ineffective monitoring, and moral hazard, is hard to predict theoretically, and hence this is addressed empirically (Borrisova et al., 2015).

For the purpose of examining the liquidity effect arising from large state shareholding, we turn our attention to the Chinese market, which is regarded as an important emerging market given its unique institutional setting and large market size. China is suitable for studying this issue because its market is uniquely saturated with a large proportion of state involvement in

[1] A firm is defined as a SOE if the government holds a controlling stake (i.e. the government is the largest shareholder).

business activities and the government holds equity in many listed companies. State participation or investment in Chinese listed firms is determined by the political preference of the state to fulfil its social objectives (Xu et al., 1999; Xu et al., 2006; Lin and Rowe, 2006) rather than stock market performance and/or liquidity; this is especially true in China's key enterprises.[2] State asset management of listed firms was established so that they would comply with industrial policy programs and prioritize on national investment. State shares are also not legally tradable. We capitalize on this unique institutional setting to examine how large government shareholding influences stock liquidity.[3]

However, unlike developed markets, developing countries normally face a poor legal and regulatory environment – the Chinese market is no exception. Chinese companies are known for their lack of financial disclosure, poor investor protection and they depend heavily on the banking system.[4] There is poor law enforcement. Large block shareholders in Chinese public listed companies comprise private, state and institutional shareholders. Following China's economic reform, small- and medium-sized state-owned enterprises (SOEs) are privatized while large SOEs are corporatized, which led to high levels of state ownership in many Chinese publicly listed companies. Under such an institutional setting, the government may secure better protection of SOEs compared to non-SOEs. Against the background of China's economic reform, it remains an important question as to whether large government ownership wields a positive or negative effect on stock liquidity.

Given that government ownership is not random and governments invest selectively, thus potentially giving rise to the problem of reverse causality between government ownership and

[2] They comprise the entire spectrum of sensitive key sectors of the national economy with firms being involved in power generation and distribution, telecommunications and natural resources.

[3] The problem of reverse causality operating from liquidity to government ownership is less likely to be present in the Chinese data. Nonetheless, we employ methods which help to circumvent a possible endogeneity problem with government ownership and liquidity.

[4] Claessens and Fan (2002) highlight a number of corporate governance issues in Asia, in particular, corporate opacity due to relationship-based transactions, rent-seeking, large group structures, and financial structures that are risky. All of these are commonly observed in Chinese public listed companies.

firm-level stock liquidity, we adopt the propensity score matching approach to match firms with government ownership with firms without government ownership and ascertain that the two groups of firms have similar characteristics. We then confirm our main findings by using the benchmark sample in models with firms' fixed effects to circumvent any concerns for potential endogeneity of government ownership. In the robustness analysis section, we use the instrumental variables approach as an alternative method to show the robustness of our results.

Studies showing a positive liquidity effect of large state ownership are few and far between. For the first time, we find evidence of a positive liquidity effect for large state ownership. We investigate whether this positive liquidity effect is consistent with the reduction of firm's risk perception given state's implicit guarantees and possible access to preferential financing. We test this conjecture along a number of dimensions. First, the extent of implicit guarantees and preferential treatment provided by the government is also likely to be correlated with the type of shareholding, which we document in this study by reference to controlling state shareholders[5] and central government ownership. Tian and Estrin (2005) and Qian (2003) find that when the government is not a large shareholder, it has neither the authority nor the incentive to control firm management; moreover, it fails to provide a firm with preferential treatment and benevolence. Government partiality is likely to come at the expense of its financial interests. We disentangle the liquidity effects engendered by different controlling government entities, specifically by local and central state ownership. In so doing, we show that the extent to which large government ownership is able to exert significant positive liquidity effects also crucially depends on the affiliation of SOEs with the level of government hierarchy (i.e., SOEs' affiliation with local governments versus central government). Chen et al. (2009) demonstrate that centrally controlled SOEs are not only more devoted to their responsibilities they are also more effective as

[5] The China Securities Regulatory Commission (CSRC) stipulates that the state is the controlling shareholder if: (1) the state controls directly or indirectly over 50% of total shares outstanding; (2) the state controls directly or indirectly over 30% of total voting rights; and (3) the state's voting rights can elect over 50% of board directors, or the state can significantly influence decisions made at shareholders meetings (Ding et al., 2017).

controlling shareholders of listed firms than locally controlled SOEs.[6] Furthermore, due to their higher political hierarchy, centrally controlled SOEs are more likely to receive more state resources, financial support and bailouts during crises from the central government compared to locally controlled SOEs. Secondly, we show that implicit guarantees and preferential access to credit and resources granted by government ownership are best enjoyed by smaller firms, more financially constrained firms and firms which are more likely to be in distress, particularly during a financial crisis.[7] The liquidity promoting benefits associated with state controlling ownership are larger for smaller than for larger firms because the costs of bailing out small firms are substantially lower than those of large firms. Small firms also confront a greater risk of experiencing financial difficulty and are more resource constrained than large firms. Firms that are more financially constrained and are subject to greater risk of default during the financial crisis, are expected to benefit more from the liquidity improvement engendered by controlling government ownership, which carries implicit guarantees and access to credit and resources.

This paper follows the literature by examining the two primary mechanisms through which controlling state ownership influences market liquidity, namely by altering the level of market trading activity (i.e., trading-activity effect) and the market information environment (i.e., informed-trading effect). Stoll (2000) refers to the former mechanism as a "real friction effect" and to the latter as an "informational frictions effect". The level of trading activity, measured by average turnover, number of trades and trading volume, influences the "real friction effect". We

[6] The central government oversees centrally controlled SOEs hence the latter are supervised more strictly and are monitored by a number of departments, including the SASAC and the National Audit Office (NAC). These SOEs' chairpersons are chosen on the basis of their excellent management skills, and they are groomed to eventually become the state vice ministers. Given that these chairpersons are promoted based on their job performances they are less likely to expropriate minority shareholders and perform poorly in managing the listed companies.

[7] The benefits of government ownership in the form of improved liquidity is in line with the literature which shows government ownership reduces the cost of debt (Borisova et al., 2015), increases shareholders' wealth surrounding announcements of government investment (Holland, 2018), and improves banks' performance during the global financial crisis (Acharya and Kulkarni, 2012). To some degree all of these have been rationalized through the provision of implicit (and explicit) government guarantees and preferential access to financing.

find a positive trading-activity effect (or a reduction in real friction effect) with controlling state shareholders. Firms with government involvement can benefit from implicit debt guarantees, can access debt financing with ease and can receive preferential treatment in the face of competition for government resources and investment opportunities. On the one hand, government involvement can often help a firm alleviate its financial constraints and difficulties (Li et al., 2008; Cull et al., 2009; Boubakri et al., 2012). On the other hand, government involvement in a transition economy, such as that of China, also facilitate entrepreneurs by granting access to key state-controlled resources (Agrawal and Knoeber, 2000; Li et al., 2006). As such, the presence of large controlling state ownership could be perceived by investors as value-enhancing, and promotes domestic investors to trade more in that stock so that the real friction costs decline as fixed real costs are spread over more trades. This channel of liquidity improvement provides another novel explanation for the stream of literature that looks at the link between an expanded shareholder base and market quality. Past studies have documented the positive association between the firm's base of individual investors and liquidity through the reduction in minimum lot sizes for stocks in Japan (Amihud et al., 1999) and stock splits to an expanded ownership base (Muscarella and Vetsuypens, 1996; Mukherji et al., 1997).

Regarding the informational friction component of liquidity, the informed-trading effect with controlling state shareholders is less clear cut. There are studies showing that turnover-performance sensitivity in China is higher for SOEs than for non-SOEs (e.g., Qian, 2003; Tian and Estrin, 2008; Jiang et al., 2013). One rationale is that the State-owned Assets Supervision and Administration Commission (SASAC) is subject to an explicit policy guideline to remove managers from SOEs if they were found to perform poorly. This is not at all surprising given that SOEs play an important role in the Chinese economy and that they dominate China's strategic sectors and pillar industries. They are also key instruments for implementing Chinese Communist Party (CCP) policies and strategic initiatives. Nevertheless, as previously discussed, given the issues with moral hazard, ineffective monitoring, and political goals associated with state owners, it is possible that there is greater opacity in the firm's information environment. As

such, the net effect of government ownership on the firm's overall information environment is a matter of empirical investigation.

Our paper finds, first, that government ownership, specifically controlling state shareholders, is positively related to liquidity, indicated by a lower quoted spread and higher order book depth. This finding contrasts with the results of Boutchkova and Megginson (2000) and Bortolotti et al. (2007) who examine the link between privatization and aggregate liquidity. Here, privatization is associated with the reduction in state ownership in an international sample of privatized firms. This notable difference in results could stem from China's unique institutional setting in which the shift away from this once centrally planned economy would mean that firms continue to benefit largely from state interventions through the presence of controlling state shareholders. The second set of results shows how improved liquidity arising from government ownership is consistent with the implications of securing implicit government guarantees and accessing credit and resources granted by the government. We show that SOEs affiliated with the central government, small SOEs and SOEs which are more financially constrained during the 2008-2010 financial crisis, enjoy a greater positive liquidity effect compared to SOEs affiliated with local governments, large SOEs and SOEs which are less financially constrained. The third set of results shows that the increased stock liquidity associated with controlling government ownership is driven by higher levels of trading activity with no evidence of any informed trading effects. These findings provide support for the view that the activities in a stock with controlling state ownership are closely monitored and regarded as a value-enhancing signal by investors. Finally, the results of a number of additional tests indicate that our results are robust to: (1) other liquidity measures; (2) possible endogeneity and reverse causality associated with controlling state ownership; and (3) possible quadratic nonlinear relationship between controlling state ownership and liquidity.

The remainder of this paper is structured as follows. Section 2 provides the data description, explains the liquidity measures used and the control variables. This section also provides the data summary statistics and the results of preliminary univariate analysis. Section 3

specifies the panel data model and discusses the regression results. Section 4 discusses the results of various robustness checks. The final section provides a summary of the findings and the study's concluding remarks.

2. Data, Liquidity Measures and Control Variables

2.1 The shareholding structures of Chinese listed firms

Information about a firm's top 10 shareholders is obtained from the Wind database. Specifically, the database reports whether the shareholders are state or non-state entities, and the percentage of shares they hold. We study firms that issue only A-share[8] in order to remove cross-market effects, and exclude stocks of financial companies and stocks that are listed for less than three years. The final sample comprises 2,532 firms spanning the period 2003-2012, thus yielding 17,500 firm-year observations.

There are two types of state shares, namely solely state-owned shares and state legal entity (or state legal person shares). The state legal person shares are shares held by SOEs, which are characterized by market-oriented economic entities and qualified for independent legal-entity. On the other hand, solely state-owned shares are defined by the China's Company Law (1993) as shares that are wholly owned by state-authorized organizations comprising institutions, government departments and agencies such as central ministries, SASAC, local state asset-management bureaus and local governments. The state-authorized organization appoints the chairman and deputy chairman in solely state-owned enterprises. Another important difference is that important decisions like mergers and acquisitions, dissolution, change of capital, and bond issuance are made by state-authorized organizations. The role of the boards of directors is limited to less important business decision-making processes. Accordingly, these state shares are less likely to be driven by stock liquidity and are less likely to suffer from the endogeneity problem,

[8] The B-share market is a very small and separate market from the A-share market. There are approximately 110 stocks in the B-share market. Mei et al. (2009) argue that there may be political reasons for B-share issuance. Hence, issuance of B-shares is not necessarily a good representative of firm quality.

thus allowing examination of the causal relationship between government involvement and stock liquidity.

-Table 1 Panel A about here –

Panel A of Table 1 profiles the two types of top 10 shareholders in our sample, namely state-owned and non-state-owned. In column 2, for the largest shareholders who are state-owned there are 9,554 firm-year observations. In column 4, for the largest shareholder who is non-state-owned, there are 7,423 firm-year observations.[9]

The number of firm-year observations from the largest state shareholder (9,554) to the tenth largest state shareholder (952) is decreasing, and so is the percentage of shares owned by these shareholders. On average the two largest government shareholders in SOEs own approximately 41.48% and 10.26% of shares, while the tenth-largest government shareholder owns, on average, 0.76% of shares in SOEs. For non-state-owned shareholders, the trend for the number of firm-year observations is reversed; it rises from 7,423 to 15,712 firm-year observations. In aggregate, there are 12,916 firm-year observations for the top 10 state-owned shareholders and 17,280 firm-year observations for the top 10 non-state-owned shareholders. Independent of the type of shareholder, more than 30% of the shares are owned by the largest shareholder, reflecting the highly concentrated ownership structure in Chinese listed firms. Finally, the last row of Panel A reports the number of firm-year observations (9,320) for firms which are ultimately controlled[10] by the state (SOEs) and this number is slightly smaller than that with which the state is the largest shareholder (9,554). This is indicative that there are only a few firms which are ultimately controlled by non-state entities for which the state is the largest

[9] Non-state-owned shareholders comprise non-state-owned legal entities and natural persons.

[10] The ultimate controlling investor is the head of a chain of companies, who controls all the chain of enterprises directly or indirectly and is free from control by another investor. For the state to be the ultimate controlling investor of a firm, the state controls (either directly or indirectly) more than 50% of the total shares outstanding, more than 30% of the total voting rights, and the state's voting rights can either elect more than 50% of board directors or influence decisions made at shareholders meetings.

shareholder. Owing to the complicated ownership and corporate governance structure of such firms, we drop these firms from our sample. Accordingly, the largest state ownership in SOEs in our sample is also regarded as the controlling state ownership.

-Table 1 Panel B about here –

Panel B of Table 1 reports the percentage of state ownership and total number of firms for SOEs and non-SOEs on an annual frequency for the period 2003-2012. There is a slight decline in the percentage of state ownership in SOEs (i.e., from 50.11% to 43.92%) over the sample period, while the average state ownership in SOEs is approximately 45% over the same period. On the other hand, state ownership in non-SOEs is decreasing over the years (i.e., from 12.24% to 4.60%), which implies that state has a propensity to invest less in private sector companies. The total number of listed companies with state investments has risen steadily from 1130 to 1447 over the sample period. The total number firms for SOEs reflect a similar pattern rising from 915 to 955 over the sample period albeit the number of firms falls in 2006, and again in 2009 and 2010 due to the split share structure reform. In contrast, the number of listed firms without state ownership has dramatically increased over the sample period (i.e., from 138 to 1023) as does the number of firms for non-SOEs (i.e., from 352 to 1384). By comparing the number of firms for SOEs vis-à-vis non-SOEs and that with and without state ownership, it appears that in aggregate state investments is stable in all industries[11].

- Figures 1a, 1b, 1c about here –

[11] The industry classification is released by the CSRC (Chinese Securities Regulatory Commission). There are 13 industries. They are: A =agriculture, forestry, animal husbandry and fishery; B =mining industry; C =manufacturing industry; D =power, gas and water production and supply industry; E =construction industry; F =transportation and storage industry; G =information technology industry; H =wholesale and retail trade; I =finance and insurance industry; J =real estate industry; K =social service industry; L=communication and cultural industry; and M =comprehensive category.

Figure 1a shows the percentage of state ownership in different industries between SOEs and non-SOEs. Generally, for all SOEs across the 13 industries the percentage of state ownership is above 30%. The percentage of state ownership is higher in mining, power, gas and water production and supply, transportation, communication and cultural industries. These numbers corroborate the view put forward by Wei et al. (2005) and Tian and Estrin (2008) that state ownership is explicitly determined by the government in strategic and important industries, such as energy, iron and steel, oil refining and petrochemicals, communications, and heavy machinery. Turning to the total number of firms with and without state ownership (Figure 1b), and the total number of firms which are SOEs and non-SOEs (Figure 1c), by and large, we observe similar patterns with a large number of firms concentrated in the manufacturing industry. This is perhaps not surprising given that of the total 2532 firms in our sample more than half (1606) belong to the manufacturing industry. However, when compared with other industries, the total number of firms without state ownership (non-SOEs) is a lot larger than that with state ownership (SOEs). Clearly, the manufacturing industry is more attractive to the private investors.

2.2 Liquidity measures

To compute the liquidity measures, we use Thomson Reuters' tick history data of SIRCA. The dataset on transaction price, bid price, ask price, bid depth, and ask depth has a time stamp to the nearest second. We assume there is no reporting delay hence no time adjustment is required.[12] Following the standard microstructure literature, the trade and quote data are filtered.[13] All of the information in our dataset is available to market participants in real time through the computerized information dissemination system. Our sample includes all of the stocks listed on both the

[12] We also use the method of Lee and Ready (1991), who suggest identifying a quote as prevailing at the time of the transaction if it was both the last quote for the stock and at least five seconds old. Using this method the results remain qualitatively unchanged.

[13] The filtering of data involves deleting quotes if (1) either the bid or ask price is negative; (2) either the bid or ask size is negative; (3) the bid-ask spread is either greater than 25% of the transaction price or negative, and deleting trades and quotes if (1) they are out of the time sequence; (2) the price or volume is negative; and (3) they changed by more than 10% compared to the last transaction price and quote (see Huang and Stoll, 1997).

Shanghai (SHSE) and Shenzhen (SZSE) stock exchanges, which are purely order-driven markets that run electronic automated trading systems. These stock exchanges open with a call market and operate as a continuous market for the remainder of the trading day. No trade and quote data are used before the markets open or after they close so as to avoid contaminating the data with different trading structures.

Given that liquidity is multi-faceted it is difficult to rely on a single measure to reflect all aspects of liquidity. The spread is commonly used in many market microstructure studies. In this paper, we apply the two dimensions of liquidity; spread and depth to show that our results are robust to various liquidity measures. The spread captures "tightness in the market for a stock" due to "the cost of turning over a position in a short period of time" while the depth measures "the market's ability to absorb quantities without a large effect on price" (Ding et al., 2017). For the two dimensions of liquidity, we use the effective spread, quoted spread and quoted depth as measures of liquidity. They are computed as follows:

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

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

$$Quoted_{Depth}(DEP)_{i,t} = ask\_size_{i,t} + bid\_size_{i,t}, \quad (3)$$

where $\mathrm{Price}_{i,t}$ is the transaction price for stock at time t and $\mathrm{M}_{i,t}$ is the midpoint of the prevailing quote at time *t*. $\mathrm{Q}_{i,t}$ is an indicator for trade type at time t that takes the value of $+1$ (-1) if the trade is a buyer-initiated (seller-initiated) transaction[14]. The $\mathrm{ask\_price}_{i,t}$ ($\mathrm{bid\_price}_{i,t}$) is the quoted ask (bid) price. The $\mathrm{ask\_size}_{i,t}$ ($\mathrm{bid\_size}_{i,t}$) is the number of shares available at the ask side (bid side) at the first level of the order book.

To examine the real and informational friction costs of state owned firms, we decompose the spread into realized spread (RS) and price impact (PI) following Barclay and Hendershott

[14] For the high-frequency data, we classify trades at prices above (below) the prevailing quote midpoint as buyer-initiated trades (seller-initiated trades) so that $\mathrm{D}_{i,t} = 1$ ($\mathrm{D}_{i,t} = -1$). In addition, we implement the tick test of Lee and Ready (1991) when the trade's price is equal to the prevailing quote midpoint. The tick test involves assigning $\mathrm{D}_{i,t} = 1$ ($\mathrm{D}_{i,t} = -1$) for trades that occur at a price higher (lower) than the price at $\mathrm{t} - 1$.

(2004) and Hendershott et al. (2011). These measures focus on price changes following a transaction by assuming that a permanent fall (rise) in the security value after sells (buys) stems from the informational component of trading costs, while the temporary deviation from value is attributed to the non-informational component. By separating the informational component of the spread from its non-informational component, we can determine the two channels (i.e., informational friction channel and the real friction channel) through which government ownership is related to liquidity. Specifically, the PI is associated with informational frictions as it captures the gross losses to liquidity demanders arising from adverse selection. The RS is associated with real frictions as it measures the non-informational component of spread, which is associated with inventory and order processing costs.

It is assumed that 5 minutes after the trade the liquidity provider is able to close the position at the quote midpoint[15]. The 5-minute RS and PI are defined, respectively, as follows:

$$RS_{it} = \frac{Q_{it}(Price_{it} - M_{i,t+5})}{M_{i,t}} \quad (4)$$

$$PI_{it} = \frac{Q_{it}(M_{i,t+5} - M_{i,t})}{M_{i,t}}, \quad (5)$$

where Q_{it}, $Price_{it}$ and $M_{i,t}$ are defined as equations (1) and (2) and $M_{i,t+5}$ is the quote midpoint 5 minutes after time t. Note that the effective half-spread is the sum of the RS and the PI[16]. The average daily realized spread and the average daily price impact of a trade for each firm are calculated using intraday data, following which the yearly measures for each firm are obtained by averaging the daily observations over each calendar year.

In addition, to ensure that our results are robust to different measures of the informational friction channel, we use two alternative measures for the adverse selection component of spread following Lin, Sanger and Booth (1995) and Huang and Stoll (1997). The first adverse selection cost measure is that of Lin, Sanger and Booth (1995), denoted as LSB while the second measure

[15] We also consider and calculate the 30-minute realized spread and the price impact. They yield qualitatively similar results.

[16] This can be expressed as follows: $\frac{Q_{it}(P_{it} - M_{i,t})}{M_{i,t}} = \frac{Q_{it}(P_{it} - M_{i,t+5})}{M_{i,t}} + \frac{Q_{it}(M_{i,t+5} - M_{i,t})}{M_{i,t}}$.

is that of Huang and Stoll (1997), denoted as HS. The computation of these measures is discussed in the robustness test results of Section 4.1. Further, the real friction channel is found to be directly associated with trading activity (see Stoll, 2000; Brockman et al. 2009). We calculate three daily measures of trading activity: the trade size (TS)[17], the number of trades (NO.TRA) and trading volume (TRAVM). Yearly measures of alternative adverse selection cost and trading activity for each firm are obtained by averaging those daily measures.

2.3 Control variables

Motivated by earlier studies, the following control variables which influence liquidity are included in the regression: the firm size, return volatility, share price, share turnover rate, institutional ownership and leverage ratio (see Stoll and Whaley, 1983; Agarwal, 2007; Rhee and Wang, 2009; Brockman et al. 2009; Chung et al. 2010). Firm size is the book value of asset.[18] Return volatility is the average daily stock volatility over the current year. Share price is the mean of the daily stock price over the current year. Share turnover rate is the average daily turnover rate for that year.[19] The one period lagged share turnover rate is employed to circumvent the problem of endogeneity since it is itself a measure of liquidity. Institutional ownership consists of qualified foreign institutional investors (QFIIs) and domestic institutional investors who are among the top 10 largest (tradable) shareholders of a firm.[20] Ding et al. (2017) find evidence that QFIIs and large outstanding domestic institutional investors have significant but different impacts

[17] Trade size is measured by share trading volume divided by the number of trades.

[18] China's stock market comprises A-shares, B-shares and overseas shares. China's stock market capitalization is partially determined by the B-share and overseas share markets. We focus on the A-share market as the A-shares can only be purchased by mainland citizens while foreigners can only invest through the Qualified Foreign Institutional Investor (QFII) system. As a size proxy, the book value of firm's assets is used instead of market capitalization so as to eliminate any cross-market effect. Nonetheless, we consider the use of market capitalization for the A-share in the regression analyses, which yield results that are qualitatively unchanged.

[19] We replace the turnover rate with the average daily number of trades, the daily average trade size, the daily trading volume. The results remain qualitatively unchanged.

[20] These public data are reported every quarterly. It is a requirement that all listed companies report their top 10 outstanding shareholders to the China Securities Regulatory Commission (CSRC). The open-end funds, security, insurance, trust companies, and pension funds make up for the five largest domestic institutions in the top 10 outstanding shareholders.

on liquidity in China's stock market. Leverage ratio is the total debt divided by total asset. The regressions also incorporate both time-fixed and industry-fixed effects.

Beltratti et al. (2012) address that most firm shares are not tradable in the secondary markets prior to the split-share structure reform in China's stock market, thus dampening trading activity. Further, the shares of most state shareholders cannot be traded in the secondary market (Deng et al. 2008; Liao et al. 2014) to the extent that liquidity is influenced by the restricted state participation. It is, therefore, important to control for non-tradable shares in the regression, which is expressed in percentages of non-tradable shares as a portion of a firm's total shares. The data for the control variables is obtained from the Wind database. Table A1 in the Appendix provides detailed variable definitions associated with the tables of results.

2.4 Descriptive Statistics

- Table 2 about here –

Table 2 presents descriptive statistics for state ownership, the three liquidity measures, price impact, realized spread, two adverse selection components of spread based on LSB and HS, trading activity measures, and all of the control variables. All variables are winsorized at 1% and 99%. The mean state ownership is 27.71% while there are no observations found in the 5th and 25th percentiles. This is consistent with Table 1 Panel A in which the state is amongst the top 10 largest shareholders in listed firms. The mean of controlling state ownership is 22.71% while that of non-controlling state ownership is 5.00%. Referring to liquidity measures, the average relative effective spread is around 0.21%, whereas the relative quoted spread is marginally lower indicating that most trades occur at the bid or ask price. The average quoted depth is 83,756 shares. The average price impact and realized spread are approximately 0.04% and 0.07%, respectively. The effective half-spread is the sum of the average price impact and realized spread. It is observed that the informational (non-informational) component makes up approximately 35% (65%) of the spread. The adverse selection component based on the LSB (HS) is 0.31 (0.29) on average, which suggests that 30% of the spread is made up of the adverse selection component.

On average there are 2,504 trades per day while the average trade size (or volume per trade) is 2,852 shares. The daily mean of share turnover rate is 1.914 while the daily mean of trading volumes is about 1.61 billion yuan. For the control variables reported in Table 2, on average, the non-tradable ratio is 0.41, the book value of the firm is 2.92 billion yuan, the share price is 12.75 yuan, the daily volatility is 1.094, the institutional ownership is 4.7% and leverage ratio is 0.518.

2.5 Univariate Analyses Based on Propensity Score Matching (PSM)

To ameliorate concerns of sample selection bias and endogeneity, that is government may choose to invest in targeted firms with certain characteristics, we apply propensity score matching (PSM) to match firms with state ownership with firms that do not have state ownership but they have similar firm characteristics. We estimate a logit model in which the dependent variable is set to one for firms with state ownership and zero otherwise, and we use the predicted probabilities (propensity scores) to match firms with state ownership with those without state ownership. For firms with no state ownership this refers to firms with no government ownership in the top 10 shareholders. The logit model includes control variables related to firm characteristics, such as size, non-tradable ratio, share price, volatility, share turnover rate, institutional ownership and firm's leverage ratio. Each firm that has state ownership is matched to a firm that has no state ownership based on the closest propensity score such that the propensity score match in set within 0.01. This approach yields two groups of firms (i.e., state-owned and non-state-owned) with very similar firm characteristics.

The matching procedure produces 4348 pairs. We perform a t-test on the difference between the two groups' firm characteristics for the non-matched and matched samples. Table 3 Panel A shows that except for volatility, all other firm characteristics are significantly different between firms with and without state ownership in the non-matched sample. However, the difference in all of the control variables between firms with and without state ownership becomes insignificant for the matched samples, with the non-tradable ratio being the only exception. Nevertheless, the difference in non-tradable ratio between these two types of firms has fallen by

0.07 after applying the PSM even though the difference remains statistically significant at the 1% level. The results from this diagnostic test imply that the sample selection problem might be much more severe in the non-matched sample compared to the matched sample.

- Table 3 about here -

Results of the univariate analyses on the relationship between state participation and market liquidity based on the matched sample are reported in Table 3 Panel B. We test the mean difference of liquidity measures, the price impact of a trade, the adverse selection component and trading activity between firms with and without state participation (i.e., STATE versus non-STATE). We conjecture that if state participation influences the total market friction, which is made up of informational and real frictions, then the mean difference for each measure will be statistically and significantly different from zero. We find that, on average, firms with state participation enjoy greater liquidity than firms without state participation; the effective spread (0.160%) and quoted spread (0.166%) of firms with state participation are lower, while their market depth (78,008) are higher compared to firms without state participation. The same pattern of results are shown for price impact, realized spread, LSB, HS and trading activity; STATE have lower mean values of price impact (0.029%), lower realized spread (0.057%), lower LSB (0.278) and lower HS (0.261) compared to those of non-STATE. The number of trades (2,279), trade size (2,568) and trading volumes (1.890) for STATE are, on average, larger than those of non-STATE. Column (4) of Table 3 shows that the mean difference between STATE and non-STATE for each measure is statistically and significantly different from zero at the 5% level.

3. Empirical Model and Results

3.1 Panel regression specifications

We estimate fixed effects model on the unbalanced panel data. Our dataset has a large number of firms relative to the time-series observations. To ameliorate concerns of biased

standard errors arising from possible cross-sectional correlation among firms and serial correlation across time, we use the Driscoll and Kraay (1998) and Hoechle (2007) non-parametric covariance matrix estimator. This estimator is robust to various forms of spatial and temporal dependence.[21]

The relationship between firms with state participation and market liquidity is examined in the regression below:

$$\mathrm{LIQ}_{i,t} = \alpha_0 + \alpha_1 \mathrm{STAOWN}_{i,t} + \alpha_2 \mathrm{NOT}_{i,t} + \alpha_3 \mathrm{SIZE}_{i,t} + \alpha_4 \mathrm{PRICE}_{i,t} + \alpha_5 \mathrm{VOL}_{i,t} + \alpha_6 \mathrm{TO}_{i,t-1} + \alpha_7 \mathrm{IO}_{i,t} + \alpha_8 \mathrm{LEV}_{i,t} + \sum_I \gamma_I D_I + \sum_y \beta_y D_y + \varepsilon_{i,t}, \quad (6)$$

where $\mathrm{LIQ}_{i,t}$ represents the three measures of liquidity, namely the effective spread (ES), the relative quoted spread (QS) and the market depth (DEP). State ownership (STAOWN) is denoted as a continuous variable and the variable of interest. The control variables are non-tradable ratio (NOT), the size of company (SIZE), share price (PRICE), return volatility (VOL), turnover rate (TO), institutional ownership (IO), leverage ratio (LEV), industry dummies (D_I) and year dummies (D_y)[22].

We take the natural logarithm of all the dependent variables, the size of company, share price, return volatility, and turnover rate to reduce the high degree of skewness and kurtosis in the data. It is common to take the natural logarithm of the share price given that the spread might be non-linearly correlated to price (Brockman et al., 2009; Chung et al., 2010).[23] Further, other than turnover rate, all control variables enter contemporaneously in the regression. The parameter of interest is α_1, the slope coefficient of STAOWN that captures how state ownership affects liquidity. Should state ownership improve liquidity, we predict $\alpha_1 < 0$ ($\alpha_1 > 0$) for a regression with effective spread and quoted spread (quoted depth) as the dependent variable.

[21] The Driscoll-Kraay standard errors are robust to very general residual correlation arising from within a firm over time, across firms in the same period, and across different periods. A maximum lag of one is specified in the autocorrelation structure, which controls for the persistence in firm liquidity over time. Results for a maximum lag of two or three remain qualitatively unchanged.

[22] The year dummies (D_y) capture common shocks and potential time trends.

[23] The use of 1/Price or both 1/Price and log (Price) yield regression results that remain qualitatively unchanged.

3.2 State ownership and stock liquidity

- Table 4 about here -

Table 4 presents the regression results of model (6) using both pooled OLS and fixed-effects models for the three liquidity measures (i.e., effective spread, quoted spread and market depth) and two decompositions of spread (i.e., price impact and realized spread) for non-matched and matched samples. If there are unobservable time-invariant factors that can simultaneously affect both state shareholding stake and stock liquidity in equation (6), this omitted variable can give rise to endogeneity problem associated with government shareholding and liquidity. To circumvent this problem, we perform a fixed-effect panel regression but assume that the omitted variable differs only across firms but does not vary with time. The results from this regression can be used to determine whether our results are sensitive to endogeneity problem arising from possible omitted variable bias.

Additionally, as can be seen in Table 3 Panel A that firm characteristics between firms with and without state ownership are significant, sample selection problem might arise. For purpose of comparison and to determine whether our results are robust to possible problems of sample selection bias and endogeneity bias, we run pooled OLS and fixed effects models on the full sample (or non-matched sample) with the results reported in Table 4 Panel A, and on the matched sample with the results reported in Table 4 Panel B. Finally, to determine the channels through which state ownership affects stock liquidity, we consider both the real friction channel and the informational friction channel. As discussed in Section 2.2, we decompose the effective half-spread into the price impact and the realized spread, of which the former is related to the informational friction channel and the latter is related to the real friction channel.

Columns (1), (2) and (3) in Table 4 Panel A illustrate the impact of state ownership (STAOWN) on liquidity. There is evidence to suggest that state ownership enhances liquidity through lower effective spread (column 1), lower quoted spread (column 2) and greater market depth (column 3). Specifically, the statistically significant coefficient estimates of STAOWN are -0.08%, -0.06% and 0.05% for the regressions with effective spread, quoted spread and market

depth, respectively, being the dependent variables. This implies that a 10% increase in state ownership reduces the effective spread and quoted spread by 0.8% and 0.6%, respectively, and increases market depth by 0.5%. We find similar results from the fixed effects model (see columns (6) to (8)) but the magnitudes of coefficients are bigger (i.e., 0.12% for effective spread, 0.13% for quoted spread and 0.58% for market depth). The results suggest that firms with state ownership are associated with higher liquidity. These results could stem from the benefits that government shareholders could bestow upon firms by either enhancing the quality of firm informational disclosure thus reducing informed trading, or enhancing investors' willingness to invest and trade, thus increasing trading activity.

We examine the channels through which liquidity improves for firms with state ownership and the results are reported in columns (4) and (5). State ownership is significantly and negatively linked to the price impact (0.1%) and the realized spread (0.07%) in the pooled OLS regression results. However, for the fixed effects model results (see columns (9) and (10)) the effect of state ownership on price impact becomes statistically insignificant. The effect of state ownership on realized spread not only remains statistically significant at the 5% level, it has become larger (0.15%).[24] A 10% increase in state ownership is associated with a lower realized spread (1.5% lower) implying that participation of state investors could reduce real friction costs, such as inventory and order-processing costs. Because these real friction effects are directly associated with the level of trading activity, such as the number of trades and trading volume (Demsetz, 1968; Rubin, 2007; Brockman et al., 2009), the finding is consistent with our hypothesis that government shareholding enhances investors' trading activity.

For the coefficients of the control variables, we find they are by and large strongly related to spreads and depth, and they accord with past studies (see Benston and Hagerman, 1974; Stoll and Whaley, 1983; Agarwal, 2007; Brockman et al., 2009). Specifically, a larger size, a higher

[24] The contrast in results for the price impact for the pooled OLS and the fixed effects model could be due to omitted variables bias that plagues the pooled OLS estimation method.

trading volume and a higher return volatility are significantly associated with a lower effective spread, a lower quoted spread and a higher quoted depth. However, we find mixed results for the price and leverage ratio, with a higher price reducing both spreads and market depth while a higher leverage ratio increases both spreads and market depth. Moreover, institutional ownership is found to be positively related to spreads and negatively related to market depth. The non-tradable ratio is significantly and negatively associated with liquidity suggesting that non-tradable shares in Chinese listed firms tend to dampen trading activity and represent a source of agency problems (Deng et al., 2008; Liao et al., 2014). Our regression models explain a large proportion of the variation in the liquidity measures (i.e., the two spreads and market depth) with the R^2 for each regression being in the order of 0.5 or higher.

The results reported in Table 4 Panel B are for the matched sample which controls for similar firm characteristics and could potentially circumvent possible sample selection bias. For the fixed effects model, state ownership is significantly and negatively associated with effective and quoted spreads but it is positively related to market depth. State ownership is negatively related to realized spread at the 5% significance level, albeit it is not statistically significant for the price impact. These findings corroborate the results in Table 4 Panel A in that liquidity improvement arising from state ownership is likely to operate through the real friction channel; an increase in trading activities as investors are more willing to invest in firms with state ownership. Controlling for similar firm characteristics gives rise to a smaller order of magnitude for the coefficient of STAOWN. The results of the fixed-effects model suggest that a 10% increase in state ownership is associated with a lower effective spread of 0.7%, a lower quoted spread of 0.6%, a higher market depth of 3.1% and a lower realized spread of 1.6%. For the analyses that follow, we only report the results for the fixed-effects model.

3.3 Controlling state ownership and stock liquidity

We further examine the type of state shareholders who exert positive liquidity effects. This is done by classifying state ownership into controlling state ownership (CONTROLS) and

non-controlling state ownership (NON-CONTROLS). If we believe that state shareholders could provide preferential treatment, then it is most likely to come from controlling state shareholders who have an incentive to provide such costly partiality to a firm. Controlling state shareholders by virtue of their large shareholding and possessing voting rights, they can elect over 50% of board directors and they can significantly influence decisions made at shareholding meetings. Given their vested interest in the firm, they are unlikely to undertake activities and make business decisions that will cause the firm to fail, contravening themselves through the provision of implicit guarantees. Accordingly, investors perceive controlling state ownership to be value-enhancing and they are receptive to investing in such stocks leading to higher stock liquidity.

- Table 5 about here –

To ameliorate the problem of sample selection bias, we estimate the fixed-effect model for the matched sample. Table 5 reports the results from both non-matched and matched samples. It can be seen that it is the controlling state ownership that wields a positive liquidity effect rather than non-controlling state ownership. For the matched sample, (see columns (6) to (10)) a 10% increase in controlling state ownership (CONTROLS) is negatively associated with the effective spread and quoted spread by 0.8% at the 5% significance level, and it is positively related to market depth by 3.2% at the same level of significance. In contrast, the results are not statistically significant for non-controlling state ownership (NON-CONTROLS). Finally, similar to the results in Table 4 Panel B, controlling state ownership exerts a statistically significant effect on the realized spread at the 5% level but not on the price impact. Taken together, we conclude that it is the controlling state shareholders who wield a positive liquidity effect.

3.4 Implicit government guarantees, state ownership and stock liquidity

In this section, we examine whether SOEs with government ownership which carries implicit government guarantees and provides access to credit and resources could display greater

firm-level stock liquidity. This is examined through SOEs which are affiliated with the central government, and for small firms which are more resource constrained, and for firms which are more financially constrained and are subject to greater risk of defaulting during the financial crisis.

3.4.1 Central and local state ownership

The results from Table 5 suggest that when the government is the controlling shareholder, it has the authority and the incentives to provide firms with preferential treatment and benevolence, thus resulting in higher stock liquidity through reduced real frictions. We pursue this line of enquiry by testing whether the liquidity effect is different between controlling central and controlling local state ownership. Implicit government guarantees and preferential access to credit and state resources are more likely to be available to centrally controlled SOEs than locally controlled SOEs. If controlling state ownership is positively related to liquidity due to such implicit government guarantees and/or easier access to credit and state resources, we expect that the liquidity effect of centrally controlled SOEs is higher than that of locally controlled SOEs through the real friction channel.

- Table 6 about here –

We divide the sample of SOEs into firms that are ultimately controlled by the central government (SASAC) and firms that are ultimately controlled by a local government (including local government bureaus and local state asset management bureaus). Within each category of firms, we identify firms with controlling state ownership. We define the continuous variables, CENOWNS and LOCOWNS, which are defined as the % of shares owned by controlling central government in SOEs, and the % of shares owned by controlling local government in SOEs, respectively. We replace STAOWN in equation (6) with the variables, CENOWNS and LOCOWNS. The results are reported in Table 6. We find that both controlling central and local state ownership are positively associated with liquidity. The coefficient estimates of CENOWNS are all statistically significant and they possess the expected sign: -0.08% for the effective spread

regression, -0.07% for the quoted spread regression, and 0.09% for the market depth regression. The coefficient estimates of LOCOWNS are also statistically significant, except for the market depth and price impact regressions and they possess the expected sign.

However, the association between locally controlled SOEs and liquidity is noticeably weaker; the coefficients of LOCOWNS for locally controlled SOEs are -0.03% for the effective spread regression, -0.03% for the quoted spread regression, and 0.07% for the market depth regression. The Wald test statistic reported in Panel B shows that the differential impact on liquidity between CENOWNS and LOCOWNS is statistically significant, which suggests SOEs that are ultimately controlled by the central government have greater liquidity compared to those controlled by a local government. We further examine whether the different liquidity effect comes from the two channels of friction. The results in columns (4) and (5) indicate that centrally controlled SOEs exhibit significantly lower real friction effect compared to locally controlled SOEs, albeit there is no statistically significant effect for price impact. The statistically significant and different liquidity effect between CENOWNS and LOCOWNS provides evidence that the improved liquidity effect engendered by controlling state ownership might stem from preferential treatment like implicit guarantees and access to credit.

3.4.2 Firms' size effects and stock liquidity

It is common wisdom that small firms tend to experience higher default risk and higher informational asymmetry between insider and outside investors. At the same time, it is widely recognized that large firms have better access to financial and state resources in comparison to small firms. If state-owned firms enjoy greater liquidity through implicit government guarantees, we conjecture that this guarantee will bring more benefits to small firms than large firms. Accordingly, we expect that controlling state ownership in small firms has a more appreciable effect on liquidity than that in big firms. State ownership can be perceived by outside investors as value-enhancing, which could increase investors' willingness to invest and trade in stocks.

We examine whether the significant positive effect of state ownership on liquidity is greater in small firms than big firms. We run a fixed-effect regression of equation (6) and include an additional interactive term between the variable CONTROLS and firm size (i.e., log(size)).

- Table 7 about here –

The results in Table 7 show that compared to large firms, small firms tend to have narrower effective (0.04%) and quoted spreads (0.05%) and wider market depth (0.14%). The results suggest that improved liquidity effect from state ownership is greater for small firms than large firms. The transmission channel of this improved liquidity is shown to manifest through the realized spread; the coefficient of the interactive term between CONTROLS and log(size) is statistically significant at the 5% level, which means that smaller firms with controlling state ownership exhibit less real friction than large firms with controlling state ownership, due to higher trading activity.

3.4.3 Financial constraints, financial crisis and stock liquidity

Previously, we conjecture that implicit government guarantees or easier access to credit and state resources granted by state ownership of listed firms enhances investors' willingness to trade and invest in the stocks of those companies. Here, we examine whether state provided preferential treatment engenders a greater effect on more financially constrained firms during a financial crisis. To test this hypothesis, we use the firm's leverage and the recent global financial crisis to identify firms that are more financially constrained in a financial crisis.

We construct the dummy variable DL which takes the value 1 if the firm's leverage is more than the mean leverage of the sample and 0 otherwise. We also generate a dummy variable DF that takes the value 1 during the financial crisis period (i.e., 2008-2010) and 0 otherwise. To separate the effects of more financially constrained firms in a financial crisis from those that are less financially constrained, we generate the interactive dummy variables: HF= CONTROLS *DL*DF and LF= CONTROLS *(1-DL)*DF. Here, HF (LF) signifies a more (less) financially constrained firm due to the high (low) leverage in a financial crisis. To separate the effects

between more and less financially constrained firms in a non-crisis period, we generate the interactive dummy variables: HNF=CONTROLS*DL*(1-DF) while LNF=CONTROLS *(1-DL)*(1-DF). Here, HNF (LNF) signifies a more (less) financially constrained firm due to the high (low) leverage in a non-financial crisis period. These dummies are included in equation (6), alongside the control variables and the two-way interactive variable DL*DF.[25] Table 8 results are presented against firms with non-controlling state ownership.

- Table 8 about here -

The coefficients of HF on all liquidity measures are statistically significant except for the price impact regression, indicating that controlling state ownership wields a greater liquidity effect on more financially constrained firms during the financial crisis. Further, the liquidity effect is perceived to be bigger than that of less financially constrained firms (i.e., firms with lower leverage) during the financial crisis (i.e., refer to the coefficient of LF). The Wald test statistic reported in the bottom of Table 8 illustrates that the differential impact on liquidity between more and less financially constrained firms during the financial crisis is statistically significant at the 1% level. When comparing the liquidity effect engendered by state ownership in firms which are more financially constrained between the financial crisis and the non-crisis period, we find that coefficient of HF is greater than that of HNF, and the difference is statistically significant at the 1% level. This implies that state ownership engenders greater liquidity benefits to more financially constrained firms during the financial crisis.

4. Robustness Checks

4.1 Other liquidity measures

We have shown that government shareholding improves firm liquidity through higher trading activity rather than lower informational asymmetry. We employ two other liquidity measures: the adverse selection component of the bid-ask spread. The first adverse selection cost

[25] The inclusion of other two-way interactive variables is found to give rise to perfect collinearity and the problem of dummy variable trap, hence these two-way interactive variables have not been included in the regression specification.

measure is that of Lin, Sanger and Booth (1995; hereafter, LSB). We estimate the firm-specific regression: $\Delta M_{i,t} = \delta\left(Price_{i,t-1} - M_{i,t-1}\right) + \varepsilon_{i,t}$.Here, $\Delta \mathrm{M_{i,t}} = \mathrm{M_{i,t}} - \mathrm{M_{i,t-1}}$ is the change in the spread midpoint between time $\mathrm{t-1}$ and time t for firm i. The adverse selection component estimate is given by the slope coefficient estimate δ. The second adverse selection cost measure is that of Huang and Stoll (1997; hereafter, HS). We estimate the following regression: $\Delta M_{i,t} = \alpha\left(\frac{ask\_price_{i,t-1} - bid\_price_{i,t-1}}{2} Q_{i,t-1}\right) + \varepsilon_{i,t}$. Here, the estimated α reflects both the adverse selection and inventory holding cost component of spread. Table 9 reports the results of robustness checks on whether an increase in controlling state ownership could have negative effects on two alternative measures of the adverse selection component of the bid-ask spread (i.e., LSB (1995) and HS (1997)) and positive effects on three trading activity measures,[26] namely, number of trades (No.TRA), trade size (TS) and trading volumes in yuan (TRAVM)[27]. We employ these measures as the dependent variables in equation (6) instead of the liquidity measures.

- Table 9 about here –

The results in columns (1) and (2) show that, like price impact in the previous analysis, both the adverse selection component of the bid-ask spread (as measured by LSB and HS) is not statistically significantly These findings further corroborate our earlier findings that government shareholding may not improve a firm's informational environment. As well, the results in columns (3), (4) and (5) reveal that government ownership is associated with higher trading activity in terms of the trade size, number of trades and trading volumes in yuan. The increase in Log(TS), Log(No. TRA) and Log(TRAVM**)** is 0.60%, 0.43% and 0.32%, respectively. These results not only corroborate the findings in Table 4 but also provide further evidence that

[26] When trading activity appears as the dependent variable, we exclude the variable turnover rate in equation (6) since turnover rate, the number of trades and the trade size are all measures of trading activity, and they are highly correlated.

[27] The results are qualitatively unchanged when we use share turnover rate.

government shareholding could enhance investors' willingness to invest and trade in firms' stocks.

4.2 Endogeneity and reverse causality

While we argue that the unique institutional setting of the Chinese financial market may not pose a concern regarding issues of reverse causality between state ownership and liquidity, we undertake additional tests to circumvent potential issues of endogeneity and reverse causality. It is possible that both state participation and liquidity are jointly determined by omitted variables. This endogenous problem is addressed using a fixed-effect regression in the previous sections. Here, we address these issues by using alternative methods: the first difference model and two-stage least squares (2SLS) regression.

4.2.1 First difference model

We re-estimate the regression in equation (6) in first difference form. Table 10 reports the results.

- Table 10 about here –

The results show that controlling state ownership is significantly and negatively associated with the change of the effective spread (-0.17%) and the quoted spread (-0.18%), while the change in controlling state ownership is significantly and positively associated with the change in market depth (0.26%). For the spread decomposition into the price impact and realized spread, we find that the change in controlling state ownership is significant and negatively associated with the change of realized spread (-0.17%). Nonetheless, the change in controlling state ownership is not associated with the change in the price impact. These results corroborate earlier findings that the positive relationship between controlling state ownership and liquidity is attributed to reduced real friction as a result of increased trading in stocks in which the state participates.

4.2.2 Results from the two-stage least squares regression

To address the issue of potential simultaneity bias or reverse causality, we perform two-stage least squares (2SLS) by first estimating equation (7) below:

$$\text{CONTROLS}_{i,t} = \beta_0 + \beta_2 \text{CONT}_{i,t} + \beta_3 \text{SIND} + \varepsilon_{i,t}. \quad (7)$$

Based on the regression results not reported here for brevity, we estimate equation (7) with the one period lagged liquidity but fail to produce a statistically significant result at the 5% level. For this reason, we exclude the one period lagged liquidity in equation (7). We follow Wei et al. (2005) and Tian and Estrin (2008) who argue that state ownership is explicitly determined by government involvement in strategic and important industries, for instance energy, iron and steel, oil refining and petrochemicals, telecommunications, and heavy machinery. Accordingly, we use the strategic industry variable (SIND) as an instrumental variable together with a vector of control variables denoted by the variable, CONT, comprising firm size and firm's leverage, which are equally important determinants of state involvement.[28] In the 2SLS procedure, the predicted value of the dependent variable (CONTROLS) is used in the second stage regression of equation (6) in place of the regressor, CONTROLS.

- Table 11 about here –

Column 1 in Table 11 summarizes the results from the first-stage regression with controlling state ownership as the dependent variable. Consistent with Wei et al. (2005) and Tian and Estrin (2008), we find that SIND is statistically significant and is positively related to controlling state ownership. The results of the second-stage regression (see columns (2) to (6)) corroborate our earlier findings that controlling state ownership is significantly associated with

[28] According to Ding et al. (2017), foreign ownership is associated with stock liquidity hence we do not include foreign ownership in the set of control variables for government shareholding. Wei et al. (2005) assume that government ownership decisions are independent of the levels of foreign and managerial ownership. Tian and Estrin (2008) assume that state ownership is independent of managerial ownership. When we control for both foreign and managerial ownership in equation (7), our results remain qualitatively unchanged.

greater stock liquidity as indicated in the effective spread (-0.49%), quoted spread (-0.49%), market depth (4.3%) and the realized spread (-0.76%).

4.3 Additional robustness tests

Wei et al. (2005) and Tian and Estrin (2008) show that there is a U-shaped relationship between government ownership and corporate value, meaning that with an increase in the size of government's shareholding, corporate performance declines initially but later increases at some level. To determine whether such a U-shape relationship exists between government ownership and stock liquidity, we include the variable STATE^2 in equation (6) and test whether the coefficient of STATE^2 is statistically significant and registers a positive value. The results, again not reported here for brevity but available from the author upon request, show that the coefficient of STATE^2 is statistically insignificant for all liquidity measures. The conjectured U-shaped relationship between government ownership and stock liquidity is not supported by the data.

5. Concluding Remarks

This paper expands the established literature on the link between block ownership and firm liquidity (Brockman et al., 2009) by studying a specific blockholder – the government (or state). The association between stock liquidity and state ownership is not clear cut due to two opposing views. The political view of state ownership suggests that the state's conflicting political and economic objectives are not aligned with an individual firm's objectives. Furthermore, the associated agency problem and information asymmetry arising from state ownership will cause investors to demand less of stocks belonging to firms with state ownership and greater spreads, thus lowering liquidity. By contrast, the soft-budget-constraint view of state ownership implies that investors who value the extensive financial benefits granted through implicit government guarantees and the preferential treatment in competition for government resources and investment opportunities would view such stocks as value-enhancing and trade in them.

Using China's stock market data, we find evidence supporting the soft-budget-constraint view with respect to the liquidity effect of state ownership. In fact, substantial controlling government holdings in Chinese publicly listed companies have spurred investors to invest and trade in these companies' stocks. The stock liquidity of firms associated with the central government, smaller firms and more financially constrained businesses during the financial crisis is found to be higher than that of firms associated with local governments, larger firms, and less financially constrained firms in the crisis period. This positive association between (controlling) state ownership and stock liquidity operates through the real friction channel, indicating that the value-enhancing signal of state participation does two things: firstly, it increases trading activity; and secondly, it reduces the costs of real frictions on the stock market in China.

Table 1

Panel A. Summary statistics for state and non-state shareholders for the top 10 largest shareholders in Chinese listed firms

The Wind database provides information about the firms and type of firms for the top 10 largest shareholders. This information includes whether the shareholders are state-owned shareholders and non-state-owned shareholders, non-state-owned legal entities, natural persons and foreign shareholders. The total sample has 17,500 firm-year observations. The percentage of ownership for state-owned and non-state-owned is the average ownership calculated with respect to its sample category (i.e. whether they are SOEs or non-SOEs and over the period 2003-2012) and not the total sample of 17,500 firm-year observations. For example, the total firm-year observations for the state-owned firms with the largest state shareholder are 9,554 and on average the largest state shareholder owns approximately 41.48% of the shares. No. 1 to 10 denotes the ranking of the shareholders with respect to the percentage of shares they own in the firms in descending order. Top 10 denotes the firm-year observations for firms whose shareholder is regarded as one of the top ten shareholders. Note that firm-year observations of the Top 10 are not the sum of firm-year observations from all of the top 10 largest shareholders.

Top 10 largest shareholders in Chinese listed firms				
Shareholder	**State-owned (firm-year obs)**	**Average % of shares owned by state shareholder**	**Non-state-owned (firm-year obs)**	**Average % of shares owned by non-state shareholder**
No. 1 (the largest shareholder)	9554	41.48%	7423	32.92%
No. 2	4952	10.26%	10865	7.69%
No. 3	3644	4.79%	12835	3.54%
No. 4	2784	2.81%	13903	2.12%
No. 5	2227	1.90%	14540	1.46%
No. 6	1827	1.38%	14871	1.10%
No. 7	1510	1.14%	15220	0.86%
No. 8	1182	0.97%	15556	0.71%
No. 9	1108	0.80%	15630	0.60%
No. 10 (the 10^{th} largest shareholder)	952	0.76%	15712	0.52%
Top 10	12916	37.42%	17280	27.57%
Firm-year observations for state-owned and non-state-owned enterprises				
SOEs (obs)	9320		**Non-SOEs(obs)**	7776

Panel B. Annual percentage of state ownership and total number of firms in SOEs and non-SOEs, and the total number of firms with and without state ownership

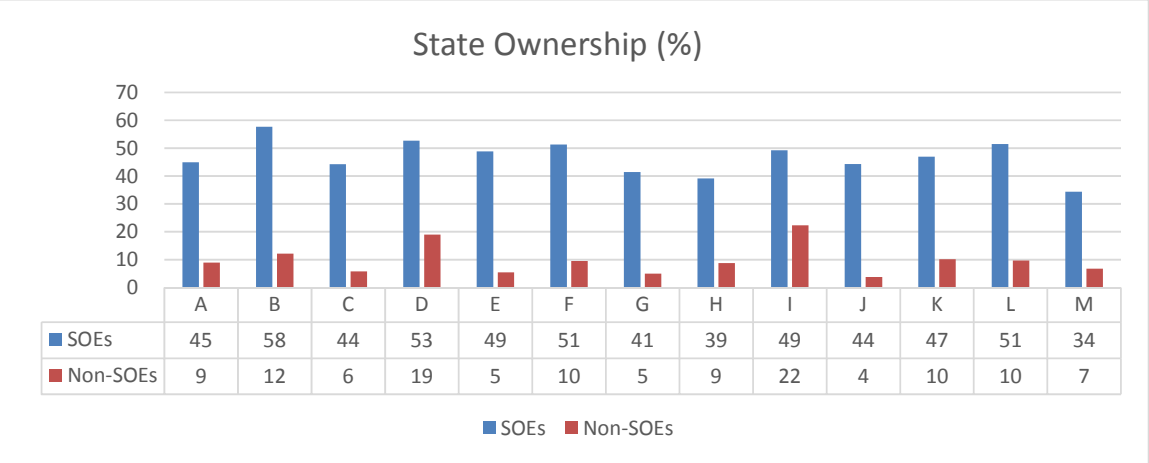
The percentage of state ownership is the average shares owned by state in each of the SOEs and non-SOEs categories.

	State Ownership (%)		Total Number of Firms			
Year	**SOEs**	**Non-SOEs**	**With State Ownership**	**Without State Ownership**	**SOEs**	**Non-SOEs**
2003	50.11	12.24	1130	138	915	352
2004	49.66	10.87	1171	184	923	432
2005	47.61	9.43	1159	192	922	429
2006	43.31	7.49	1184	250	915	519
2007	43.13	6.16	1226	322	929	619
2008	43.00	5.02	1234	368	956	646
2009	43.58	5.03	1259	492	952	799
2010	43.46	7.57	1391	717	898	1210
2011	44.20	4.41	1433	908	955	1386
2012	43.92	4.60	1447	1023	955	1384
All	45.18	6.38	1796	1263	1259	1620

Figure 1 Distribution of state ownership and total number of firms across the 13 industries

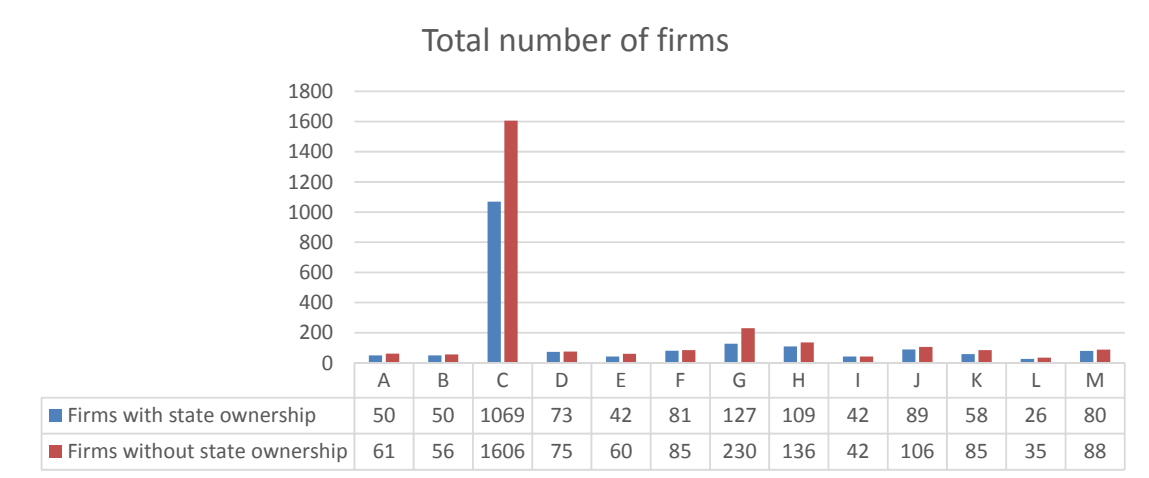
The industry classification is released by the CSRC (Chinese Securities Regulatory Commission). A =agriculture, forestry, animal husbandry and fishery; B =mining industry; C =manufacturing industry; D =power, gas and water production and supply industry; E =construction industry; F =transportation and storage industry; G =information technology industry; H =wholesale and retail trade; I =finance and insurance industry; J =real estate industry; K =social service industry; L=communication and cultural industry; M =comprehensive category.

Figure 1a



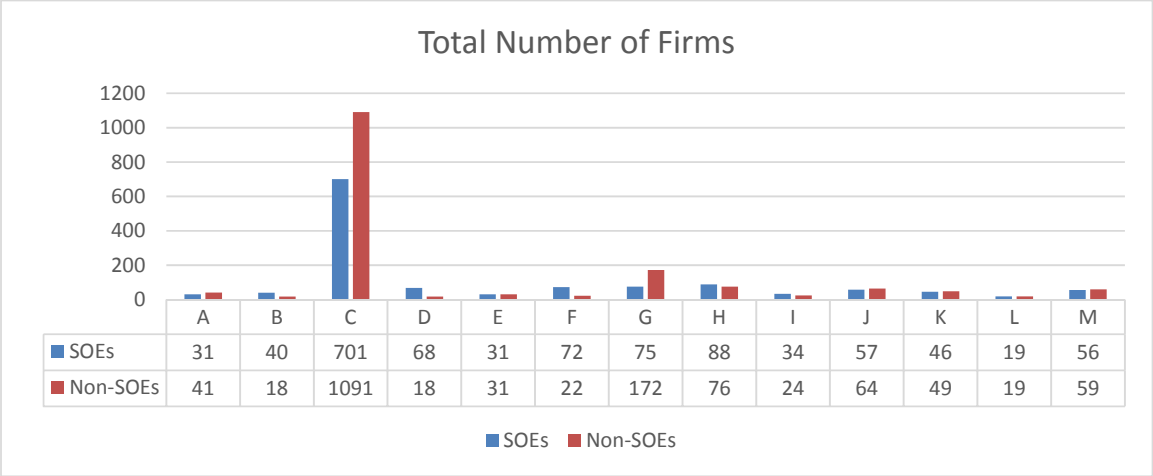
	A	B	C	D	E	F	G	H	I	J	K	L	M
SOEs	45	58	44	53	49	51	41	39	49	44	47	51	34
Non-SOEs	9	12	6	19	5	10	5	9	22	4	10	10	7

Figure 1b



	A	B	C	D	E	F	G	H	I	J	K	L	M
Firms with state ownership	50	50	1069	73	42	81	127	109	42	89	58	26	80
Firms without state ownership	61	56	1606	75	60	85	230	136	42	106	85	35	88

Figure 1c



	A	B	C	D	E	F	G	H	I	J	K	L	M
SOEs	31	40	701	68	31	72	75	88	34	57	46	19	56
Non-SOEs	41	18	1091	18	31	22	172	76	24	64	49	19	59

Table 2. Summary statistics of dependent and independent variables

Intraday data from Thomson Reuters tick history, which is distributed by SIRCA, are used to calculate the relative effective spread (ES), the quoted spread (QS), the quoted depth (DEP), the price impact of a trade (PI), the realized spread (RS), two measures for the adverse selection component of spread are based on Lin, Sanger and Booth (1995) (LSB) and Huang and Stoll (1997) (HS), the number of trades and trade size (i.e., share trading volume divided by the number of trades). Non-tradable ratio, firm size, share price, return volatility, turnover rate, yuan trading volumes, institutional ownership, and leverage ratio are obtained from the CCER database. Firm size is calculated by the book value of the asset. Non-tradable ratio is calculated by non-tradable shares divided by total shares. Return volatility is estimated by the mean of daily stock return volatility over the current year. Share price is the mean of daily stock price over the current year. Degree of leverage is the ratio of total debt to total assets. Institutional ownership is the ratio of the number of shares held by institutional investors to the total number of shares outstanding.

Variable	Obs	Mean	Std.dev	95th	75th	50th	25th	5th
State ownership (%)	17266	27.711	25.333	69.303	50.376	26.312	0.000	0.000
Controlling state ownership (%)	17266	22.708	23.899	63.840	42.840	19.590	0.000	0.000
Non-controlling state ownership (%)	17266	5.004	8.435	24.160	6.580	0.639	0.000	0.000
Effective_spread (ES,%)	16371	0.211	0.105	0.401	0.257	0.186	0.140	0.093
Quoted spread (QS, %)	16371	0.201	0.097	0.380	0.244	0.180	0.135	0.092
Market_depth (DEP,'000 shares)	14761	83756	914643	239171	71248	32253	14574	5926
Price_impact (PI, %)	16371	0.037	0.023	0.080	0.047	0.032	0.022	0.011
Realized spread (RS, %)	16371	0.068	0.034	0.126	0.082	0.062	0.047	0.029
LSB	15729	0.307	0.11	0.453	0.394	0.331	0.219	0.114
HS	15729	0.291	0.112	0.439	0.382	0.317	0.195	0.101
Non-tradable ratio	17021	0.412	0.270	0.750	0.636	0.472	0.163	0.000
SIZE (yuan, billion)	17222	2.920	42.200	2.540	0.431	0.189	0.095	0.037
PRICE (yuan)	16977	12.750	11.715	33.366	15.193	9.230	6.119	3.352
Volatility (per day)	16846	1.094	4.054	7.868	0.042	0.031	0.026	0.019
Leverage ratio	17185	0.518	0.461	0.867	0.641	0.492	0.319	0.108
Number_of _Trades (‘000 per day)	16009	2.504	3.182	7.908	2.708	1.576	0.779	0.315
Turnover_rate (per day)	17096	1.914	6.448	3.527	2.038	1.105	0.474	1.914
Trade_size (‘000 per day)	9414	2.852	2.648	6.786	3.420	2.215	1.433	0.824
Yuan trading volumes (yuan, billion)	15393	1.609	3.473	4.876	1.897	1.097	0.601	0.236
Institutional_ownership (%)	11913	4.70	5.07	14.82	7.00	2.92	0.91	0.19

Table 3. Propensity Score Matching

Panel A. Univariate analysis of firms' characteristics between STATE and non-STATE firms

This table compares the mean value of the firms' asset value, stock price, non-tradable ratio, stock price volatility, turnover ratio, IO and leverage for two groups of firms: firms with (STATE) and without (non-STATE) state ownership. STATE refers to firms with government ownership in the top 10 shareholders while non-STATE refers to firms with no government ownership in the top 10 shareholders. The firms are listed on the Shanghai and Shenzhen Stock Exchanges for the sample period 2003-2012. Non-matched sample refers to the full sample. The matched sample is constructed from the propensity score matching method. The last column shows the p-value for a two-tailed t-test for the null hypothesis of equality in the mean value of the firms' characteristic with state ownership and without state ownership.

		Mean for STATE	Mean for non-STATE	T-Statistics	Prob>|t|
Asset (yuan,billion)	Non-matched	3.600	1.600	2.300	0.021
	Matched	3.600	3.400	0.370	0.710
Price	Non-matched	11.462	14.703	-11.820	0.000
	Matched	11.466	11.096	1.500	0.134
Non-tradable ratio	Non-matched	0.416	0.473	-8.480	0.000
	Matched	0.416	0.400	2.280	0.022
Volatility	Non-matched	0.048	0.045	0.300	0.764
	Matched	0.048	0.043	0.820	0.412
Turnover ratio	Non-matched	5.714	6.870	-14.180	0.000
	Matched	5.715	5.714	0.010	0.989
Institutional Ownership	Non-matched	0.032	0.036	-4.140	0.000
	Matched	0.032	0.033	-1.590	0.112
Leverage	Non-matched	0.581	0.447	9.310	0.000
	Matched	0.581	0.580	0.020	0.981

Panel B. Univariate analysis of liquidity, trading activity and adverse selection measures between STATE and non-STATE firms

This table compares the mean value of the effective spread, quoted depth, price impact, the adverse selection components of spread and trading activity for firms with and without state ownership. Non-state refers to firms with no government ownership in the top 10 shareholders. The firms are listed on the Shanghai and Shenzhen Stock Exchanges for the sample period 2003-2012. The last column shows the p-value for a two-tailed t-test for the null hypothesis of equality in the mean value of the variable with and without state ownership. Intraday data from Thomson Reuters tick history are used to calculate the relative effective spread (ES), the quoted spread (QS), the quoted depth (DEP), the price impact (PI), the realized spread (RS), the two measures of the adverse selection component of spread based on Lin, Sanger and Booth (1995) (LSB) and Huang and Stoll (1997) (HS), the number of trades and the trade size. The number in the bracket is the total firm-year observations in the sample for the variable concerned.

Variable	Mean for non-STATE	Mean for STATE	p-value
Relative effective spread (ES, %)	0.177 (4182)	0.160 (4082)	0.000
Quoted spread (QS, %)	0.182 (4182)	0.166 (4082)	0.000
Quoted depth (DEP, '000 shares)	49.389 (4064)	97.801 (4071)	0.000
Price impact (PI, %)	0.034 (4182)	0.029 (4082)	0.000
Realized spread (RS, %)	0.063 (4182)	0.057 (4082)	0.000
LSB	0.334 (4182)	0.278 (4081)	0.000
HS	0.320 (4182)	0.261 (4081)	0.000
Number of trades (’000 per day)	1.648 (3239)	2.279 (2635)	0.000
Trade size (‘000 per day)	2.042 (3233)	2.568 (2635)	0.000
Yuan trading volumes (billion, per day)	1.419 (4183)	1.890 (4309)	0.000

Table 4. Government ownership and stock liquidity

The dependent variables are ES, QS, DEP, PI, RS, which denote effective spread, quoted spread, market depth, price impact and realized spread, respectively. STAOWN is the lagged value of state ownership. NOT is the lagged value of non-tradable ratio. Lagged values of size (SIZE), institutional ownership (IO) and debt ratio (LEV) are also included as regressors in the regressions. Return volatility (VOL) is estimated by the standard deviation of daily stock return over the current year. Share price (PRICE) is the mean of daily stock price over the current year. TO is the lagged value of the mean of daily share turnover rate in a year. The sample period is 2003-2012 and the sample is an unbalanced panel data. Panel A (Panel B) shows the results from both pooled OLS and fixed effects model based on the full (matched) sample. All regressions include year and industry fixed effects (FE). R-squared for fixed effects model denotes within R-squared. 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.

Panel A	**Pooled OLS**					**Fixed Effects**				
Independent Variables	**(1) Log(ES)**	**(2) Log(QS)**	**(3) Log(DEP)**	**(4) Log(PI)**	**(5) Log(RS)**	**(6) Log(ES)**	**(7) Log(QS)**	**(8) Log(DEP)**	**(9) Log(PI)**	**(10) Log(RS)**
STAOWN	-0.0008***	-0.0006***	0.0005*	-0.0010***	-0.0007***	-0.0012**	-0.0013**	0.0058***	-0.0005	-0.0015**
	(0.0001)	(0.0001)	(0.0003)	(0.0002)	(0.0002)	(0.0005)	(0.0005)	(0.0011)	(0.0005)	(0.0006)
NOT	0.4048***	0.3631***	-0.8099***	0.5146***	0.3817***	0.5104***	0.4796***	-1.4134***	0.6273***	0.5292***
	(0.0559)	(0.0530)	(0.0562)	(0.0502)	(0.0698)	(0.0437)	(0.0482)	(0.2148)	(0.0333)	(0.0655)
Log(SIZE)	-0.1064***	-0.1032***	0.3276***	-0.1354***	-0.1003***	-0.1203***	-0.1151***	0.2680***	-0.0758***	-0.1206***
	(0.0077)	(0.0076)	(0.0155)	(0.0151)	(0.0077)	(0.0263)	(0.0262)	(0.0437)	(0.0207)	(0.0218)
log(PRICE)	-0.3617***	-0.3497***	-1.1370***	-0.3819***	-0.3233***	-0.4356***	-0.4109***	-0.6938***	-0.6149***	-0.3460***
	(0.0318)	(0.0317)	(0.0617)	(0.0336)	(0.0364)	(0.0359)	(0.0381)	(0.1260)	(0.0430)	(0.0502)
log(VOL)	-0.0113***	-0.0104***	0.0225***	-0.0081**	-0.0091***	-0.0145***	-0.0131***	0.0321***	-0.0143***	-0.0133***
	(0.0022)	(0.0023)	(0.0052)	(0.0026)	(0.0024)	(0.0011)	(0.0011)	(0.0042)	(0.0018)	(0.0010)
log(TO)	-0.1968***	-0.1901***	0.3827***	-0.2194***	-0.1940***	-0.1532***	-0.1423***	0.6152***	-0.2616***	-0.1248***
	(0.0110)	(0.0105)	(0.0501)	(0.0246)	(0.0079)	(0.0160)	(0.0174)	(0.0642)	(0.0330)	(0.0220)
IO	0.4397***	0.4222***	-0.7577	0.2932	0.6679***	0.7993***	0.7744***	-0.8327***	0.4933	1.1219***
	(0.1141)	(0.1126)	(0.5486)	(0.1715)	(0.0777)	(0.1470)	(0.1411)	(0.2468)	(0.3330)	(0.0829)
LEV	0.0499***	0.0549***	0.1775***	-0.0034	0.0656***	0.0584***	0.0622***	0.1756***	0.0201	0.0582***
	(0.0132)	(0.0118)	(0.0462)	(0.0172)	(0.0133)	(0.0051)	(0.0047)	(0.0242)	(0.0110)	(0.0060)
Obs	15536	15536	14570	15536	15536	15536	15536	14570	15536	15536
R-squared	0.759	0.755	0.698	0.590	0.649	0.662	0.684	0.491	0.499	0.441
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Panel B	Pooled OLS					Fixed Effects				
Independent Variables	(1) Log(ES)	(2) Log(QS)	(3) Log(DEP)	(4) Log(PI)	(5) Log(RS)	(6) Log(ES)	(7) Log(QS)	(8) Log(DEP)	(9) Log(PI)	(10) Log(RS)
STAOWN	-0.0006***	-0.0003**	0.0019***	-0.0012***	-0.0003*	-0.0007***	-0.0006***	0.0031***	-0.0001	-0.0016***
	(0.0001)	(0.0001)	(0.0005)	(0.0002)	(0.0001)	(0.0002)	(0.0002)	(0.0008)	(0.0003)	(0.0002)
NOT	0.4154***	0.3679***	-1.0735***	0.5567***	0.3981***	0.2328***	0.2203***	-0.6877***	0.3135***	0.2091***
	(0.0449)	(0.0448)	(0.0418)	(0.0498)	(0.0530)	(0.0323)	(0.0295)	(0.0697)	(0.0408)	(0.0334)
Log(SIZE)	-0.1182***	-0.1129***	0.3117***	-0.1463***	-0.1231***	-0.1028***	-0.1003***	0.0977***	-0.0872***	-0.1154***
	(0.0071)	(0.0066)	(0.0100)	(0.0227)	(0.0050)	(0.0098)	(0.0096)	(0.0189)	(0.0148)	(0.0065)
log(PRICE)	-0.3192***	-0.3102***	-1.0089***	-0.3293***	-0.2904***	-0.3068***	-0.2918***	-0.8137***	-0.4148***	-0.2387***
	(0.0371)	(0.0365)	(0.0763)	(0.0277)	(0.0331)	(0.0128)	(0.0126)	(0.0973)	(0.0272)	(0.0232)
log(VOL)	-0.0125***	-0.0114***	0.0209***	-0.0093**	-0.0108***	-0.0163***	-0.0147***	0.0297***	-0.0157***	-0.0156***
	(0.0029)	(0.0028)	(0.0043)	(0.0033)	(0.0030)	(0.0017)	(0.0016)	(0.0024)	(0.0024)	(0.0020)
log(TO)	-0.1988***	-0.1908***	0.4162***	-0.2328***	-0.2010***	-0.2068***	-0.1988***	0.5080***	-0.2696***	-0.1984***
	(0.0153)	(0.0140)	(0.0495)	(0.0339)	(0.0098)	(0.0176)	(0.0165)	(0.0329)	(0.0295)	(0.0151)
IO	0.6529***	0.6366***	-1.6017***	0.4806***	0.8972***	0.4774***	0.4606***	-0.9512***	-0.0599	0.9452***
	(0.0905)	(0.0899)	(0.2569)	(0.1131)	(0.0816)	(0.0513)	(0.0475)	(0.2529)	(0.1053)	(0.0734)
LEV	0.0288***	0.0345***	0.2058***	-0.0260	0.0410***	0.0096	0.0099	0.0697*	0.0128	0.0002
	(0.0088)	(0.0069)	(0.0447)	(0.0158)	(0.0090)	(0.0166)	(0.0164)	(0.0323)	(0.0114)	(0.0154)
Obs	8223	8223	8096	8223	8223	8223	8223	8096	8223	8223
R-squared	0.6872	0.6873	0.6875	0.4983	0.5721	0.7028	0.6947	0.4457	0.5159	0.5564
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 5 Controlling state ownership and stock liquidity

We divide firms with state ownership into firms with controlling state ownership (CONTROLS) and firms with non-controlling state ownership (NON-CONTROLS). The other regressors are the same as those reported in Table 4. The sample period is 2003-2012. The fixed effects regression model is run on the full sample and the matched sample. The regressions include both year and industry fixed effects. 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.

	Full Sample					Matched Sample				
Independent Variables	**(1) Log(ES)**	**(2) Log(QS)**	**(3) Log(DEP)**	**(4) Log(PI)**	**(5) Log(RS)**	**(6) Log(ES)**	**(7) Log(QS)**	**(8) Log(DEP)**	**(9) Log(PI)**	**(10) Log(RS)**
CONTROLS	-0.0011*	-0.0012**	0.0058***	-0.0005	-0.0013**	-0.0008***	-0.0008***	0.0032**	-0.0002	-0.0017***
	(0.0005)	(0.0005)	(0.0012)	(0.0006)	(0.0005)	(0.0002)	(0.0002)	(0.0012)	(0.0005)	(0.0004)
NON-CONTROLS	-0.0018	-0.0019	0.0060	-0.0006	-0.0029	-0.0000	-0.0001	0.0029	-0.0017	-0.0008
	(0.0011)	(0.0011)	(0.012)	(0.0012)	(0.0023)	(0.0009)	(0.0009)	(0.0018)	(0.0012)	(0.0011)
NOT	0.5119***	0.4812***	-1.4129***	0.6274***	0.5331***	0.2341***	0.2217***	-0.6881***	0.3168***	0.2107***
	(0.0471)	(0.0513)	(0.2203)	(0.0324)	(0.0707)	(0.0373)	(0.0347)	(0.0663)	(0.0457)	(0.0374)
Log(SIZE)	-0.1198***	-0.1146***	0.2681***	-0.0758***	-0.1196***	-0.1026***	-0.1001***	0.0977***	-0.0867***	-0.1152***
	(0.0264)	(0.0264)	(0.0469)	(0.0198)	(0.0215)	(0.0129)	(0.0127)	(0.0202)	(0.0222)	(0.0090)
log(PRICE)	-0.4357***	-0.4110***	-0.6938***	-0.6149***	-0.3462***	-0.3069***	-0.2919***	-0.8137***	-0.4151***	-0.2388***
	(0.0415)	(0.0439)	(0.1335)	(0.0402)	(0.0568)	(0.0184)	(0.0177)	(0.0960)	(0.0285)	(0.0298)
log(VOL)	-0.0145***	-0.0131***	0.0321***	-0.0143***	-0.0133***	-0.0163***	-0.0147***	0.0297***	-0.0157***	-0.0156***
	(0.0012)	(0.0012)	(0.0041)	(0.0021)	(0.0012)	(0.0016)	(0.0015)	(0.0031)	(0.0032)	(0.0019)
log(TO)	-0.1533***	-0.1424***	0.6152***	-0.2616***	-0.1250***	-0.2069***	-0.1988***	0.5080***	-0.2698***	-0.1985***
	(0.0159)	(0.0170)	(0.0612)	(0.0361)	(0.0210)	(0.0185)	(0.0174)	(0.0321)	(0.0325)	(0.0171)
IO	0.7969***	0.7719***	-0.8335***	0.4932	1.1161***	0.4765***	0.4597***	-0.9509***	-0.0632	0.9437***
	(0.1443)	(0.1389)	(0.2518)	(0.3260)	(0.0838)	(0.0593)	(0.0562)	(0.2796)	(0.1225)	(0.0668)
LEV	0.0586***	0.0624***	0.1756***	0.0201	0.0587***	0.0095	0.0097	0.0698*	0.0128	0.0002
	(0.0052)	(0.0049)	(0.0263)	(0.0114)	(0.0076)	(0.0159)	(0.0158)	(0.0345)	(0.0162)	(0.0142)
Obs	15536	15536	14570	15536	15536	8223	8223	8096	8223	8223
Within R-squared	0.683	0.661	0.491	0.548	0.524	0.553	0.532	0.382	0.413	0.411
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 6. Centrally controlling, locally controlling state ownership and liquidity

CENOWNS is the one period lagged value of centrally state-controlled firms, which are owned by SASAC. LOCOWNS is the one period lagged value of locally state-controlled firms, which are owned by local governments or local state asset management bureaus. The other regressors are the same as those reported in Table 4. The sample period is 2003-2012. The fixed effects regression model is run on the matched sample. The last row shows the statistical test result for the null of equality in coefficients of CENOWNS and LOCOWNS. 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.

Panel A	**Dependent variables**				
Independent	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Variables	**Log(QS)**	**Log(ES)**	**Log(DEP)**	**Log(PI)**	**Log(RS)**
CENOWNS	-0.0008***	-0.0007***	0.0009***	-0.0003	-0.0008***
	(0.0002)	(0.0001)	(0.0003)	(0.0006)	(0.0001)
LOCOWNS	-0.0003**	-0.0003*	0.0007	-0.0003	-0.0005**
	(0.0001)	(0.0001)	(0.0007)	(0.0005)	(0.0002)
NOT	0.5863***	0.5593***	-1.2479***	0.7103***	0.5865***
	(0.0748)	(0.0760)	(0.2155)	(0.0817)	(0.0723)
log(SIZE)	-0.1839***	-0.1782***	0.2508***	-0.1722***	-0.2029***
	(0.0351)	(0.0351)	(0.0380)	(0.0316)	(0.0326)
log(PRICE)	-0.3645***	-0.3432***	-0.7418***	-0.5157***	-0.2689***
	(0.0412)	(0.0435)	(0.1456)	(0.0203)	(0.0610)
log(VOL)	-0.0175***	-0.0159***	0.0287***	-0.0180***	-0.0173***
	(0.0020)	(0.0020)	(0.0034)	(0.0025)	(0.0023)
log(TO)	-0.2020***	-0.1912***	0.5505***	-0.3042***	-0.1854***
	(0.0250)	(0.0254)	(0.0538)	(0.0449)	(0.0246)
IO	0.6481***	0.6246***	-1.1740***	0.0344	1.1052***
	(0.1069)	(0.1056)	(0.2511)	(0.1285)	(0.0784)
LEV	0.0087	0.0106	0.1260***	-0.0141	-0.0080
	(0.0155)	(0.0149)	(0.0301)	(0.0094)	(0.0135)
Obs	8249	8249	8120	8249	8249
Within R2	0.7039	0.5337	0.3837	0.4142	0.4119
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Panel B	**Test of equality in coefficients of CENOWNS and LOCOWNS**				
F-test statistic	14.77***	12.67***	6.12**	1.13	29.59***

Table 7. Controlling state ownership, firm size and stock liquidity

CONTROLS is the one period lagged value of the controlling state ownership. The other regressors are the same as those reported in Table 4. The sample period is 2003-2012. The fixed-effect regression model is run on the matched sample. 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	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Variables	**Log(ES)**	**Log(QS)**	**Log(DEP)**	**Log(PI)**	**Log(RS)**
CONTROLS	-0.0090**	-0.0098**	0.0276***	-0.0015	-0.0224***
	(0.0036)	(0.0036)	(0.0078)	(0.0054)	(0.0066)
CONTROLS*log(SIZE)	0.0004**	0.0005**	-0.0014***	0.0001	0.0010***
	(0.0002)	(0.0002)	(0.0004)	(0.0002)	(0.0003)
NOT	0.2349***	0.2224***	-0.6988***	0.2131***	0.3138***
	(0.0319)	(0.0292)	(0.0698)	(0.0340)	(0.0396)
log(SIZE)	-0.1076***	-0.1056***	0.1125***	-0.1164***	-0.1003***
	(0.0098)	(0.0096)	(0.0181)	(0.0082)	(0.0178)
log(PRICE)	-0.3084***	-0.2935***	-0.8083***	-0.2394***	-0.4184***
	(0.0131)	(0.0130)	(0.0987)	(0.0234)	(0.0274)
log(VOL)	-0.0163***	-0.0147***	0.0296***	-0.0156***	-0.0156***
	(0.0017)	(0.0016)	(0.0023)	(0.0020)	(0.0027)
log(TO)	-0.2060***	-0.1979***	0.5055***	-0.1982***	-0.2677***
	(0.0176)	(0.0165)	(0.0332)	(0.0150)	(0.0311)
IO	0.4933***	0.4781***	-0.9959***	0.9476***	-0.0211
	(0.0455)	(0.0414)	(0.2449)	(0.0651)	(0.1055)
LEV	0.0088	0.0089	0.0726*	-0.0002	0.0094
	(0.0167)	(0.0165)	(0.0330)	(0.0157)	(0.0142)
Obs	8249	8249	8096	8249	8249
Within R^2	0.7030	0.6951	0.4460	0.5165	0.5564
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Table 8. Financial constraints, financial crisis and stock liquidity

DL is a dummy variable which equals 1 if the firm's leverage is greater than the mean leverage of firms in the sample, and 0 otherwise. DF is a dummy variable which equals 1 for the financial crisis period (2008-2010) and 0 otherwise. The interactive dummy variables are HF=controlling state ownership*DL*DF; LF=controlling state ownership*(1-DL)*DF; HNF=controlling state ownership*(1-DL)*(1-DF); and LNF=controlling state ownership*DL*(1-DF). HF (LF) denotes firms with controlling state ownership in financial crisis period which have high (low) leverage (or more (less) financially constrained). HNF (LNF) refers to firms with controlling state ownership in non-financial crisis period which have high (low) leverage. The fixed-effect regression model is run on the matched sample. 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. Test (HF-LF) and Test (HF-HNF) are the Wald test statistic for equality in the coefficient of HF and LF, and equality in the coefficient of HF and HNF, respectively.

	Dependent variables				
Independent	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Variables	**Log(ES)**	**Log(QS)**	**Log(DEP)**	**Log(PI)**	**Log(RS)**
HF	-0.0015***	-0.0012***	0.0025***	-0.0002	-0.0019***
	(0.0001)	(0.0002)	(0.0007)	(0.0002)	(0.0003)
LF	-0.0004***	-0.0005***	0.0008***	-0.0001	-0.0007***
	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0002)
HNF	-0.0009***	-0.0008***	0.0013	-0.0001	-0.0033***
	(0.0001)	(0.0001)	(0.0008)	(0.0003)	(0.0005)
LNF	-0.0004	-0.0003	0.0011***	-0.0002	-0.0007**
	(0.0004)	(0.0004)	(0.0003)	(0.0005)	(0.0003)
DL*DF	-0.0249*	-0.0260**	0.0190	-0.0070	-0.0179
	(0.0129)	(0.0104)	(0.0307)	(0.0116)	(0.0317)
DL	0.0628***	0.0729***	0.0739	0.0864***	0.0186
	(0.0171)	(0.0149)	(0.0528)	(0.0196)	(0.0217)
DF	0.0272***	0.0297***	-0.0892**	0.0018***	0.0662***
	(0.0033)	(0.0032)	(0.0355)	(0.0003)	(0.0089)
NOT	0.5091***	0.4679***	-1.3386***	0.4836***	0.6818***
	(0.0266)	(0.0255)	(0.1618)	(0.0335)	(0.0392)
log(SIZE)	-0.1074***	-0.1049***	0.3309***	-0.1047***	-0.1346***
	(0.0044)	(0.0043)	(0.0218)	(0.0029)	(0.0079)
log(PRICE)	-0.4120***	-0.3976***	-0.9733***	-0.3616***	-0.4646***
	(0.0129)	(0.0139)	(0.0537)	(0.0253)	(0.0301)
log(VOL)	-0.0133***	-0.0124***	0.0279***	-0.0117***	-0.0116***
	(0.0020)	(0.0020)	(0.0060)	(0.0025)	(0.0022)
log(TO)	-0.1766***	-0.1670***	0.5486***	-0.1521***	-0.2791***
	(0.0122)	(0.0129)	(0.0721)	(0.0201)	(0.0292)
IO	0.7725***	0.7553***	-1.0416**	1.0162***	0.5405***
	(0.0473)	(0.0440)	(0.4510)	(0.0371)	(0.0760)
Obs	8238	8238	8111	8238	8238
R^2	0.6972	0.6889	0.6494	0.4156	0.5561
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Test (HF-LF)	100.85***	86.86***	36.19***		180.02***
Test (HF-HNF)	81.35***	51.29***	8.92**		85.61***

Table 9. Controlling state ownership relationship with adverse selection cost and trading activity

LSB and HS are two measures of the adverse selection component of spread based on Lin, Sanger and Booth (1995) (LSB) and Huang and Stoll (1997) (HS), respectively. TS is the trade size and No.TRA is the number of trades. TRAVM is daily yuan trading volumes. The other variables are the same as those reported in Table 4. The fixed effects regression model is run with matched sample. 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	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Variables	**Log(LSB)**	**Log(HS)**	**Log(TS)**	**Log(No.TRA)**	**Log(TRAVM)**
CONTROLS	-0.0003	-0.0003	0.0060**	0.0043*	0.0032**
	(0.0004)	(0.0005)	(0.0023)	(0.0020)	(0.0011)
NOT	0.4732***	0.5134***	-0.0883	-0.5152*	-0.4222
	(0.0915)	(0.0973)	(0.0781)	(0.2298)	(0.2390)
log(SIZE)	-0.1401***	-0.1485***	0.1373***	0.2500***	0.2339***
	(0.0117)	(0.0121)	(0.0214)	(0.0362)	(0.0573)
log(PRICE)	-0.0570	-0.0900*	-0.4794***	0.3216***	0.4264***
	(0.0367)	(0.0404)	(0.0673)	(0.0332)	(0.0433)
log(VOL)	-0.0148***	-0.0171***	0.0402**	0.0179***	0.0376***
	(0.0015)	(0.0015)	(0.0135)	(0.0014)	(0.0018)
log(TO)	-0.1427***	-0.1588***			
	(0.0243)	(0.0260)			
IO	0.1831	0.2161	0.1091	-1.3245***	-0.3368
	(0.1671)	(0.1884)	(0.4679)	(0.1385)	(0.2019)
LEV	-0.0621**	-0.0656**	-0.0258	0.1032	0.0450
	(0.0220)	(0.0219)	(0.0645)	(0.0668)	(0.0517)
Obs	8223	8223	5847	5853	8355
Within R^2	0.3422	0.3788	0.2331	0.2368	0.2123
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Table 10. Results for the first difference regression model

The table shows panel regressions of changes in the liquidity measures on the first difference of CONTROLS and the other regressors, which are defined in Table 4. The sample period is 2003-2012. A pooled OLS regression is run using year and industry fixed effects. 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	**(1)**	**(2)**	**(4)**	**(5)**	**(6)**
Variables	**ΔLog(ES)**	**ΔLog(QS)**	**ΔLog(DEP)**	**ΔLog(PI)**	**ΔLog(RS)**
△CONTROLS	-0.0017***	-0.0018***	0.0026*	-0.0039	-0.0017***
	(0.0004)	(0.0003)	(0.0011)	(0.0037)	(0.0003)
△NOT	0.3547***	0.3457***	-0.5796***	0.3691***	0.1898***
	(0.0289)	(0.0284)	(0.0843)	(0.0808)	(0.0400)
△log(SIZE)	-0.1015***	-0.1006***	0.0008	-0.0808**	-0.0590***
	(0.0105)	(0.0107)	(0.0246)	(0.0273)	(0.0132)
△log(PRICE)	-0.3919***	-0.3660***	-0.6521***	-0.5087***	-0.2185***
	(0.0584)	(0.0623)	(0.1698)	(0.0492)	(0.0650)
△log(VOL)	-0.0213***	-0.0197***	0.0340***	-0.0243***	-0.0179***
	(0.0050)	(0.0050)	(0.0036)	(0.0061)	(0.0053)
△log(TO)	-0.2441***	-0.2348***	0.5377***	-0.3734***	-0.2218***
	(0.0606)	(0.0603)	(0.0404)	(0.1058)	(0.0560)
△IO	0.3031**	0.2936**	-1.1578***	-0.3770*	0.5761***
	(0.1126)	(0.1185)	(0.2550)	(0.1785)	(0.1039)
△LEV	0.0148	0.0147	0.0849**	-0.0173	0.0179
	(0.0311)	(0.0308)	(0.0312)	(0.0324)	(0.0231)
Obs	6112	6112	5986	6112	6112
R^2	0.5341	0.5134	0.2817	0.3387	0.3120
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Table 11. Results for the two-stage least squares regression

This table reports the regressions of different liquidity measures on controlling state ownership using the two-stage least squares regression. The first column shows the results from the first-stage regression in which controlling state ownership is the dependent variable. The other columns show the results from the second-stage regression in which the dependent variable is various liquidity measures. The size of controlling state ownership (CONTROLS), is instrumented on SIND, Log(asset) and a firm's leverage (LEV). SIND is the strategic industry dummy variable which equals one if a firm belongs to one of the five strategic industries (energy, iron and steel, oil refinery and petrochemicals, communications, and heavy machinery). CONTROLSHAT is the fitted value from the first-stage regression. Fixed effects model is estimated in both stages. 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 significance at the 1%, 5% and 10% level, respectively.

Independent	**(1)**	(2)	**(3)**	**(4)**	**(5)**	**(6)**
Variables	**CONTROLS**	**Log(ES)**	**Log(QS)**	**Log(DEP)**	**Log(PI)**	**Log(RS)**
CONTROLSHAT		-0.0049**	-0.0049**	0.0436*	-0.0062	-0.0076***
		(0.0023)	(0.0023)	(0.0256)	(0.0042)	(0.0028)
NOT		0.5985***	0.5713***	-1.1433***	0.7205***	0.6105***
		(0.0160)	(0.0158)	(0.0653)	(0.0287)	(0.0195)
log(SIZE)	0.6708***	-0.1798***	-0.1738***	0.3298***	-0.1668***	-0.1925***
	(0.1890)	(0.0072)	(0.0071)	(0.0323)	(0.0130)	(0.0088)
log(PRICE)		-0.3631***	-0.3417***	-0.6960***	-0.5145***	-0.2656***
		(0.0080)	(0.0079)	(0.0318)	(0.0140)	(0.0095)
log(VOL)		-0.0175***	-0.0158***	0.0078	-0.0180***	-0.0173***
		(0.0007)	(0.0007)	(0.0151)	(0.0013)	(0.0008)
log(TO)		-0.1996***	-0.1889***	0.5653***	-0.3043***	-0.1823***
		(0.0048)	(0.0048)	(0.0155)	(0.0085)	(0.0058)
IO		0.6440***	0.6212***	-1.1133***	0.0337	1.1106***
		(0.0880)	(0.0867)	(0.2875)	(0.1525)	(0.1038)
LEV	0.6911**	0.0118	0.0137	0.1364***	-0.0121	-0.0045
	(0.7786)	(0.0118)	(0.0116)	(0.0409)	(0.0178)	(0.0122)
SIND	3.4129**					
	(1.4700)					
Obs	8560	8223	8223	6101	8223	8223
Within R^2	0.1458	0.5426	0.5215	0.4596	0.5401	0.5471
Industry FE	NO	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	YES	YES	YES

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Appendix

Table A1. Variables and definitions

Variable	Definition
ES	Effective spread is a proxy of liquidity and is defined in equation (1).
QS	Quoted spread is a proxy of liquidity and is defined in equation (2).
DEP	Quoted depth is a proxy of liquidity and is defined in equation (3).
PI	Price impact is defined in equation (5) and it is associated with informational frictions.
RS	Realized spread is defined in equation (4) and it is associated with real frictions.
LSB	A measure of adverse selection following Lin, Sanger and Booth (1995) and is defined in equation (7).
HS	A measure of adverse selection following Huang and Stoll (1997) and is defined in equation (8).
TS	Trade size.
No. TRA	Number of trades.
TRAVM	Trading volume in Yuan.
Size	Firm size is calculated by the book value of asset.
STAOWN	State ownership is the % of shares owned by the state.
PRICE	Share price is the mean of the daily stock price over the current year.
VOL	Return volatility is the mean of daily stock volatility over the current year.
TO	Share turnover rate is the mean of daily turnover rate for the current year.
IO	Institutional ownership comprises qualified institutional investors (QFIIs) and domestic institutional investors who are among the top 10 largest shareholders of a firm.
LEV	Leverage ratio is the ratio of total debt over total asset.
NOT	Non-tradable shares refer to the percentage of a firm's total shares that are non-tradable.
CONTROLS	Controlling state ownership is the % of shares owned by controlling state shareholders.
NON-CONTROLS	Non-controlling state ownership is the % of shares owned by non-controlling state shareholders.
CENOWNS	Controlling central state ownership is the % of shares owned by central government in SOEs.
LOCOWNS	Controlling local state ownership is the % of shares owned by local government in SOEs.

DL	A dummy which takes the value 1 if the firm's leverage is more than the mean leverage of the sample and 0 otherwise.
DF	A dummy which takes the value 1 during the financial crisis period (2008-2010) and 0 otherwise.
HF	A more financially constrained firm in the financial crisis period. It is defined as CONTROLS*DL*DF.
LF	A less financially constrained firm in the financial crisis period. It is defined as CONTROLS*(1-DL)*DF.
HNF	A more financially constrained firm in the non-financial crisis period. It is defined as CONTROLS*DL*(1-DF).
LNF	A less financially constrained firm in the non-financial crisis period. It is defined as CONTROLS*(1-DL)*(1-DF).
SIND	This is the strategic industry dummy variable which equals one if a firm belongs to one of the five strategic industries (i.e. energy, iron and steel, oil refinery and petrochemicals, communications, and heavy machinery).
CONTROLSHAT	This is the fitted value of CONTROLS from regressing CONTROLS on log(SIZE), LEV and SIND.