Margin Trading and Short Selling with Asymmetric Information*

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Abstract

We provide evidence that allowing margin trading and short selling (MTSS) can negatively affect stock liquidity in a market with severe information asymmetry. Exploiting the Chinese pilot MTSS program that permits MTSS on a set of securities, we find that the MTSS permission reduces uninformed investors' trading activities and worsens stock liquidity. These negative impacts are larger for stocks with severer information asymmetry—i.e., those with less press coverage, less analyst coverage, or larger analyst forecast errors. Stock liquidity is more negatively affected for stocks with larger declines in uninformed investors' trading activities, suggesting that the induced changes in market micro-structure are crucial.

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1 Introduction

The effect of margin trading and short selling (MTSS) on market quality is an ongoing debate among both academic researchers and financial practitioners.[1] By examining the Chinese pilot MTSS program that permits MTSS on a set of securities, we provide evidence that the MTSS permission can make uninformed investors reluctant to trade and, in turn, negatively affect stock liquidity through the information asymmetry channel.

Theoretical works generate ambiguous predictions that are based on two opposite effects of MTSS on financial markets: On the one hand, MTSS permits more informative trades and, thus, helps incorporate information into asset prices (e.g., Diamond and Verrecchia (1987) and Bai, Chang, and Wang (2006)). We refer to this effect as the *information incorporation* effect. On the other hand, MTSS may enhance information asymmetry by increasing the proportion of better-informed investors, which will decrease market liquidity or even lead to market crash, as implied by the No-Trade Theorem (see Milgrom and Stokey (1982), Glosten and Milgrom (1985), Easley and O'hara (1987) and Bhattacharya and Spiegel (1991)). This effect is referred to as the *asymmetric information* effect in our analysis. The key to which effect dominates is how MTSS reshapes the market structure. As Beber and Pagano (2013) point out, "This result [the validity of the information incorporation effect in Diamond and Verrecchia (1987)] only applies if the ban [of short selling] equally constrains informed and uninformed investors."If allowing MTSS brings more informed investors than uninformed investors into the market, the asymmetric information effect can dominate and, thus, damage stock liquidity. This is likely to be the case in a market with serious asymmetric information issues, due to the fact that MTSS traders are mostly the informed ones (Boehmer, Jones, and Zhang (2008)). While there is considerable evidence on the information incorporation effect, the evidence for the asymmetric information effect is scarce.

The Chinese financial market environment and the MTSS pilot program provide us a

[1] Whereas nearly 20 countries that impose a (partial) ban on short selling among the 30 developed countries in their sample (Beber and Pagano (2013)), developing markets, such as China, modernize their financial markets by permits MTSS, hoping to improve security liquidity in the financial market.

good opportunity to study the asymmetric information effect. First, the Chinese stock market is subject to severe information asymmetry, with 42.8% of the total market capitalization held by individual investors who accounted, on average, for 85.6% of total transactions from 2007 to 2012.[2] Allowing MTSS in such a market can substantially change the market structure. When informed investors enter the market, to avoid being exploited, the large number of uninformed individual investors stop trading (as predicted by Milgrom and Stokey (1982) and Bhattacharya and Spiegel (1991)). The ratio of informed to uninformed investors is largely changed. Then the asymmetric information effect may dominate. However, developed markets, which are the focus of previous studies, consist mainly of institutional investors that are likely to be equally informed. Policy changes in short selling do not lead to substantial changes in the composition of investors; therefore, the information incorporation effect dominates.[3]

Second, the Chinese MTSS program is conducted during a normal time, unlike the policy changes in previous works, which usually occur during crisis periods, when stock liquidity is intensively affected by other aggregate factors. Moreover, the Chinese pilot program permits MTSS on 736 stocks in different industries among about 2500 listed firms, while the policy changes in previous works usually ban short selling on either all stocks or only on financial stocks.[4] This allows us to construct proper control groups and implement an improved difference-in-difference analysis.[5]

Consistent with the prediction of the theory based on the asymmetric information effect, we find that allowing MTSS decreases stock liquidity significantly in both the statistical

[2]The data are from a report (in Chinese) from the Shenzhen Stock Exchange, which is available at http://www.szse.cn/main/aboutus/bsyw/39749823.shtml.

[3]Diether, Lee, and Werner (2009) show that the suspension of the Uptick rule causes only slight changes in the short selling activities and market quality in the United States.

[4]The identification in Beber and Pagano (2013) relies on the different starting and ending times of short selling bans in 20 countries, which improve the identification but may still be subject to the effects of the characteristics of different markets.

[5]That the Chinese program is an MTSS permission, as opposed to the temporary bans in previous studies, can also make a difference. A permission is more likely to change market structure because existing investors may exit, while in a ban, investors are less likely to enter the market because of the cost of gathering information for the affected stocks.

sense and the economic sense: After an average stock is added to the MTSS permission list, compared to control stocks that are not on the list, its Amihud illiquidity ratio increases by 0.77, weighting 29.5% of the ratio before the permission; the turnover ratio decreases by about 0.18, corresponding to 12.4% of the turnover ratio before the permission; the bid-ask spread increases by 0.42, which is 3.3% of the spread before the permission. In our analysis, we construct two different control groups, a quasi-full control that rules out only the small-sized stocks and a matched control group using the minimum distance matching methods (following Beber and Pagano (2013)), to alleviate any concerns that the treated stocks are not randomly chosen. Actually, this non-randomness should have weakened our findings because the stocks in the pilot program are those with larger market capitalization and better pre-program liquidity and, thus, are the ones whose liquidity is likely less affected. But it is still crucial to properly construct control groups because of the possible overtime variation in investors' risk appetite: They may prefer large-sized stocks more in some periods and small-sized stocks in other periods. Similar results are found for both methods of constructing control groups.

We then test the information asymmetry channel of these negative impacts. We first show that the negative effects of MTSS on stock liquidity is more pronounced for stocks with greater information asymmetry. We use three proxies of information asymmetry. The first proxy is press coverage, which Tetlock (2010) uses as an information source that narrows information asymmetry between the informed and the uninformed investors. The remaining two measures are sell-side analyst coverage and analyst forecast errors, which are widely used in the literature (e.g., Clarke and Shastri (2000) and Kelly and Ljungqvist (2012)). Sell-side analysts' work is to bring information to investors, and, thus, information asymmetry is more significant for stocks with less analyst coverage and more forecast errors. With these measures, we find that liquidity drops more for the stocks with less press coverage, less analyst coverage or more forecast errors.

Then we show that information asymmetry plays an important role in the way that

MTSS permission reshapes the market micro-structure and, in turn, affects stock liquidity. In particular, we collect intra-day transaction-level data on each stock and empirically measure the trading of uninformed investors by the small-sized trades that have no price impact, following Fang, Qian, and Zhang (2012). And we find that the uninformed investors significantly reduce their trading activities on stocks when MTSS is permitted. Moreover, we find that the reduction is more dramatic for stocks with greater information asymmetry.

Finally, we complete the linkage between the changes in market micro-structure and stock liquidity by showing that stock liquidity worsens more for stocks with a larger reduction in uninformed investors' trading amounts. These results suggest that in a market with severe asymmetric information issues, such as China's, an MTSS permission can make the uninformed investors reluctant to trade and, thus, provide less liquidity.

We conduct additional tests to show that our findings are not due to pre-program trends of stock liquidity and that they still hold if we switch the minimum distance matching method to the propensity score matching method. Moreover, we rule out the possibility that our findings are due to other specific characteristics of the Chinese market, rather than to the severe information asymmetry issue, by documenting that allowing MTSS improves the liquidity of exchange traded funds (ETFs) that are subject to little information asymmetry.

Our work relates to several strands of literature. First, we provide evidence on the negative effect of information asymmetry on market micro-structure and, thus, on stock liquidity. This is a classic prediction of theoretical works; see, for example, Milgrom and Stokey (1982), Glosten and Milgrom (1985), Easley and O'hara (1987), Bhattacharya and Spiegel (1991) and Easley and O'hara (2004). But the empirical evidence is rare.

Second, our work contributes to the literature on the effect of short selling on market efficiency. Diamond and Verrecchia (1987) and Bai, Chang, and Wang (2006) provide theories that predict that a short selling ban widens bid-ask spreads in a setup in which the short selling policy change does not shift the market structure. Bris, Goetzmann, and Zhu (2007) provide a comprehensive description of short selling policies in different countries.

Chang, Cheng, and Yu (2007), Chang, Luo, and Ren (2014), Saffi and Sigurdsson (2010) and Boehmer and Wu (2012) show that allowing short selling improves price discovery speed. Boehmer, Jones, and Zhang (2013), Beber and Pagano (2013) and Marsh and Payne (2012) find that short selling bans during the crisis periods damaged stock liquidity in the United States, 20 developed countries and the United Kingdom, respectively. Diether, Lee, and Werner (2009) study how the suspension of short selling price tests in the United States affected short sellers' trading activities, per se, and find that the tested stocks experienced no significant increases in daily returns and volatility. Different from these works, our study shows that in a developing market with large amount of uninformed investors and, thus, severe asymmetric information issues, allowing MTSS can substantially change the market structure and negatively affect stock liquidity.

Finally, our findings extend the understanding of the effect of short selling by adding new evidence from different information environments, especially from developing markets. Jones (2012) investigates how, in 1930s, short-selling policy changes impacted liquidity in the United States, when the financial market was still a developing one. He finds that the 1932 requirement that brokers secure written authorization before lending to short sellers reduced stock liquidity, but in 1931 and 1938, another restriction that required short sales to be executed only on upticks increased liquidity.

Closely related to our work, several recent papers also study the Chinese pilot program, including Chang, Luo, and Ren (2014), Chen, Kadapakkam, and Yang (2016) and Li, Lin, Zhang, and Chen (2017). With weekly stock return data, Chang, Luo, and Ren (2014) show that stock returns incorporates firm specific information after MTSS is allowed and that these stocks experience negative return after the permission of MTSS. Chen, Kadapakkam, and Yang (2016) exploit the intraday stock trade and quote data and show that MTSS activities escalate on stocks with MTSS during the five days immediately before significant information events compared to stocks without MTSS permission and show that the average price efficiency measure is larger for the sample with MTSS and the sample without MTSS

around firm events.[6] They also show that the asymmetric information component of bid-ask spreads for the sample with MTSS is smaller but they simply take the mean value of measure of the two groups, which is subject to effects of confounding aggregate factors. Different from their works, we focus on the effects of MTSS permission on stock liquidity and investigate the mechanism of the effects.

Li, Lin, Zhang, and Chen (2017) is mostly close to our work. Besides their similar findings of improved stock price discovery speed as in Chang, Luo, and Ren (2014) and Chen, Kadapakkam, and Yang (2016), they also study the effects of MTSS permission on stock liquidity. They find mixed results: They find that, for stocks with MTSS permission, the bid-ask spread decreases but the Amihud illiquidity ratio insignificantly increases.[7] The disparity of our findings may come from the three differences in the empirical research designs. First, they conduct analysis at the month-level whereas we conduct week-level analysis, which allows us to control for the confounding week-level factors in a stricter way by adding week fixed effects. Second, they estimate the bid-ask spread with highest and lowest prices whereas we use bid and ask prices information from Datastream to directly construct the bid-ask spread. Lastly and probably most importantly, their control stocks are selected from other firms that have never participated in the program in the sample period whereas we include these stocks as candidate control stocks: the stocks that are selected for the program in later waves can be ideal control stocks for those stocks that participate the program in earlier waves. With our empirical method, we find consistent results that the MTSS permission worsens stock liquidity, when it is measured by bid-ask spreads, stock turnover ratio, and Amihud illiquidity ratio. And on top of this, we show that this is due to that the small traders are reluctant to trade the stocks with MTSS permission due to the severe information asymmetry.

The rest of the paper is organized as follows. In Section 2, we describe the Chinese stock

[6]The finding that the MTSS activities escalate five days before firm events provide additional support for the severe information asymmetry issue in Chinese market.

[7]Goyenko, Holden, and Trzcinka (2009) show that the Amihud illiquidity ratio is a good measure of price impact when daily stock data are used.

market and the pilot MTSS program in detail. Section 3 develops testable hypotheses, and Section 4 provides information on our data, measures and methodology. In Section 5, we present our findings. Section 6 conducts robustness tests, and Section 7 concludes.

2 The Chinese Stock Market and the MTSS Program

The Stock Market. Although its large size makes the Chinese stock market comparable to developed countries, it differs in two aspects. First, the Chinese stock market consists of a large number of retail investors who trade frequently. According to a report from Shenzhen Stock Exchange, from 2007 to 2012, 42.8% of the total market capitalization was held by individual investors who conducted 85.6% of the total transactions.[8] Second, the Chinese market has severe information asymmetries due to the weak investor protection institutions and murky accounting practices. Brockman and Chung (2003) show that the weak investor protection environment in the Chinese market fails to minimize information asymmetries and, thus, damages stock liquidity. Chen and Yuan (2004) document the low quality of earning reports of Chinese listed firms. Wang, Wong, and Xia (2008) provide evidence on the weak monitoring of auditors in China. Choi, Jin, and Yan (2013) provide direct evidence that Chinese institutional investors have a strong information advantage over individual investors.

The MTSS Program. As a step towards liberalizing its financial market, on February 12, 2010, the Chinese financial market authority, China Securities Regulation Commission (hereafter referred to as CSRC), launched a pilot program permitting MTSS on 90 stocks. The list of stocks with the MTSS permission was extended in three waves: on December 5, 2011, 185 stocks were added to the list; on January 31, 2013, 275 stocks were added; and on September 16, 2013, 186 stocks were added. By the end of 2013, a total of 736 stocks had

[8]The report (in Chinese) is available at http://www.szse.cn/main/aboutus/bsyw/39749823.shtml.

been added to the list in the four waves.[9] The detailed timeline of the program is presented in Panel A of Table 1.

[Table 1: Timeline of China's Margin-Trading and Short-Selling Program]

According to *Detailed Rules for Implementation of Margin Trading in Shanghai (Shenzhen) Stock Exchange* (SSE (2011), SZSE (2011), hereafter *Rules-2011*), to maintain eligibility for the program, the securities should satisfy the following six requirements: (1) they must have been traded in the stock market for longer than three months; (2) their market capitalization must be more than 800 million RMB (approximately 120 million USD); (3) the number of shareholders is greater than 4,000; (4) the average daily turnover is greater than 15% of the average daily turnover benchmark, and the daily trading value is not less than 50 million RMB (approximately 7.5 million USD); (5) the deviation of the average daily quote change is less than 4% from the benchmark; and (6) the volatility is less than five times that of the benchmark. The securities that fail to satisfy these conditions will be delisted from the program. These choice rules mean that the selected stocks are those that are of larger size and better market liquidity. A potential concern about our analysis is, then, that the selection is not random. But such a choice rule would make it less likely that the market liquidity of the chosen stocks is negatively affected by the pilot program.

Another major characteristic of the Chinese MTSS program is that MTSS is open only to relatively sophisticated investors. According to the administrative rules promulgated by the CSRC, only qualified investors can conduct MTSS. Though the qualification requirements differ slightly across the security companies that undertake these business transactions, the qualified investors are more likely to be the informed ones. For example, qualified investors in the Haitong Securities Company (one of the biggest brokerage houses in China) must (1) have a trading history of more than one and a half years using the company's brokerage service (reduced to half a year after December 2011); (2) have invested at least half a million

[9] Additional six stocks were added in other dates, making the stocks with MTSS permission total 742. We focus on the four waves because our regression analysis includes wave fixed effects to control for the effect of time-varying trading preference, which is not applicable to small changes to the list.

RMB in the stock market; and (3) pass an exam and a risk-attitude test to show that they understand the riskiness and complexity of MTSS trading. These restrictions are strict: in the first quarter of 2010, only 2.96% of the 52 million accounts held a portfolio with market value higher than half a million RMB.[10] Moreover, conducting MTSS in China is very costly. Haitong Securities Company charged an annualized interest rate of 8.6% on MTSS in July 2012, which is higher than the bank loan rate by three percentage points. The high cost further excludes small investors from MTSS. Therefore, it could be expected that only the professional traders who have strong informational advantages in the market will engage in MTSS trading. This, together with fact that the Chinese stock market consists of a large share of uninformed investors, makes the program a proper setup in which to study the asymmetric information effect of MTSS on stock liquidity.

3 Testable Hypotheses

Our main hypothesis is that due to the asymmetric information issue, the MTSS permission makes the uninformed investors reluctant to trade and, thus, decreases stock liquidity. This hypothesis is based on the theoretical works on how informational asymmetry can affect market efficiency (Milgrom and Stokey (1982), Glosten and Milgrom (1985), Ausubel (1990), Bhattacharya and Spiegel (1991), and Easley and O'hara (2004), among others). These works predict that due to the presence of traders with superior information, the market makers will charge a higher bid-ask spread at the cost of uninformed investors' loss to subsidize their trading loss with the informed investors. Knowing this, uninformed investors are less willing to participate in the market. Glosten and Milgrom (1985) show that when the proportion of informed investors is not large (as in the Chinese market), the expected time needed for nearly all information to be revealed is approximately proportional to the inverse of the squared share of informed investors, and the bid-ask spread is approximately

[10]Statistics are from China Securities Depository and Clearing Corporation Limited and can be found in Wind. According to the statistics, the proportion of accounts that were valued at over half a million (item (2)) varied from 1.97% to 3.34% in the time period of our analysis.

proportional to the share of informed investors. Otherwise stated, an increase in the ratio of the informed investors can speed up the price discovery procedure (as documented by previous empirical works such as Chang, Cheng, and Yu (2007), Saffi and Sigurdsson (2010), Beber and Pagano (2013) and Boehmer, Jones, and Zhang (2013)). At the same time, it can enhance the information asymmetry issue and lead to a shallower market with worse stock liquidity.

We test this hypothesis in several steps. We first test the prediction concerning the negative effect of MTSS on stock liquidity, which is formulated as follows:

Hypothesis 1 *After being added to the MTSS permission list, the stocks experience a decrease in stock liquidity compared to control stocks that are not on the list.*

If information asymmetry is crucial in leading to the negative impact of MTSS on stock liquidity, we expect that such a negative effect is stronger for stocks with severer information asymmetries. We examine this conjecture by testing Hypothesis 2.

Hypothesis 2 *Liquidity of stocks on the MTSS permission list worsens in line with the severity of the information asymmetry associated with the stocks.*

We then investigate the trading behaviors of the uninformed investors. (The measurement of the trading behaviors is described in the next section.) The theories predict that uninformed investors are more reluctant to trade when there are more informed investors. We expect that after the MTSS program, the uninformed investors' trades decrease on stocks selected into the program. Moreover, the decrease should be greater for stocks with severer information asymmetry. We summarize these predictions as:

Hypothesis 3 *After being added to the MTSS permission list:*

(a) uninformed investors' trading activities decrease for the stocks, compared to control stocks that are not on the list; and

(b) such decreases are more dramatic for the stocks with greater information asymmetry.

Finally, we show that the changes in the market micro-structure in Hypothesis 3 are crucial in reducing stock liquidity. In particular, we show that for stocks that experience larger decreases in uninformed investors' trading behaviors, the stock liquidity worsens more. We express this prediction in Hypothesis 4.

Hypothesis 4 *After being added to the MTSS permission list, stocks' liquidity worsens in line with the decreases in the uninformed investors' trading activities.*

4 Data, Measures and the Empirical Strategy

4.1 Data and Measures

We conduct the analysis with weekly data in a 40-week time window around the four stock-addition waves. To be more specific, we take the 20 weeks before the announcement week as the benchmark time window and the 20 weeks after the effective week as the treatment time window to observe the changes in stock liquidity. The weeks between the announcement and the effective week are dropped to have a clear evaluation of the effects of the permission.

In the analysis, we merge several databases. We obtain the list of stocks with MTSS permission from the websites of the Shanghai Stock Exchange and the Shenzhen Stock Exchange. We screen the announcements of the exchanges involving the changes in the list from January, 2010 to December, 2013. As summarized above in Panel A of Table 1, by the end of 2013, MTSS had been approved for 736 stocks. As shown in Panel B of Table 1, soon after their addition to the list, 52 stocks (ten were added on January 31, 2013, and 42 were added on September 16, 2013) were selected into another *re-financing* program that allows institutions to borrow assets from a government-backed institution (China Serenities Finance) when they can not meet the borrowing demand from investors.[11] This new program may had affected stock liquidity, and, thus, we exclude these 52 stocks from our analysis to

[11]The *re-financing* program is called "Zhuǎn Róng Zī" and "Zhuǎn Róng Quàn" in Chinese. It affects only these 52 stocks in our analysis because the other assets in this program are chosen from the MTSS program but are outside of the time window of our analysis.

avoid any contamination and are left with 684 treated stocks after this step.

We obtain stocks' daily closing price, trading volume, trading value, and bid and ask prices from Datastream. And we acquire the month-level information of firms' characteristics, including their market capitalization and common shares outstanding from Worldscrop. We then merge these two databases by ISIN code. Two treated stocks have a missing ISIN code and five are suspended for trading for longer than two months around the events. We drop these seven stocks and, thus, we are left with 677 treated stocks in the program, with 26,293 stock-week observations.

With this information, we construct three measures of stock liquidity at the weekly level. The first one is the turnover ratio, which is defined as the weekly average of the ratio of daily trading volume divided by common shares outstanding. A higher value of the turnover ratio indicates larger trading frequencies and, thus, better liquidity. The second variable is the Amihud illiquidity ratio (see Amihud and Mendelson (1986) and Amihud (2002)), which is calculated as the absolute value of daily stock returns divided by the trading value and then averaged over each week. A higher value of the Amihud illiquidity ratio means that for per-unit share trades, the price impact is larger and, thus, liquidity is worse. The third variable is the weekly average of daily bid-ask spreads. A larger value of bid-ask spread means worse stock liquidity.

We measure asymmetric information severity associated with a stock in three ways. The first measure is press coverage. For this, we use the *Financial News Database* from *CSMAR*, which collects financial news from the main financial media in China. It assigns each piece of news with an identity, and provides information on the date and time that the news story was published, and the related security code. For each stock, we calculate the number of news stories shown in the press in the 20 weeks before the stock-addition waves. The information asymmetry is, thus, measured by $-ln(1+\ Press\ Coverage)$, where we put a minus symbol for easy interpretation. The remaining two measures are based on analyst forecasts, the information on which is also acquired from *CSMAR*. Our second measure is

analyst coverage. We count the number of brokerage houses that have issued forecasts or reports on a stock within 20 weeks before the stock-addition waves and use $-ln(1+$ *Analyst Coverage)* to measure information asymmetry. The third measure is the analysts' *forecast error* on firms' earnings-per-share (EPS) for the current year. We use the last forecast issued by each brokerage house within 20 weeks before the stock-addition events to calculate the consensus forecasts and then compute the forecast errors. Some stocks have no forecasts, and we assign the largest forecast error of all stocks in the same period as their forecast errors.[12]

Finally, we manually collect the intraday transaction data for each stock from the SINA financial website.[13] SINA finance provides the execution time, transaction price, trading volume, and trading value for each trade. Following Fang, Qian, and Zhang (2012), we measure the trading of uninformed investors by small trades with no price impact. In particular, we pick the trades with values less than 7,776 RMB (approximately 1,200 USD), which represent the bottom 25% of all trades in the sample sorted by trading value, and have no price impact. Given that more than 80% of the trading accounts (valued at less than 100 thousands RMB) are held by individual investors who have little information on stocks, it is reasonable to assume that these small trades, which do not cause any price impact, are executed by uninformed investors.

4.2 Construction of the Control Group

Our main empirical model is a difference-in-difference regression that estimates the changes in stock liquidity of the stocks with MTSS permission relative to control stocks. We construct the control group in two ways to narrow the differences between the treated stocks and the control stocks. According to *Rules-2011*, the major characteristics that determine the selection of the treated stocks are the stocks' market capitalization and turnover ratio.

[12] Our results hold if we drop observations that have missing values in forecast errors.

[13] SINA finance provides collective financial information about the Chinese financial market to the public. One can find the intraday transaction information at: http://vip.stock.finance.sina.com.cn/mkt/. We obtain the data from April 15, 2015.

Therefore, the differences to be mitigated between the treated and control stocks are in these two variables. Though the non-random choice does not create an endogeneity problem for us, as it should have made our findings less likely to happen, the choice of the control group deserves some effort. This is because of the concern about the time-varying investors' investing preferences: investors may prefer larger capitalized stocks to small capitalized stocks under certain market conditions, whereas they may have the opposite preference under other market conditions.

In the first method, the control group includes all the ineligible stocks that have a market capitalization and turnover ratio greater than the 5th percentile of the treated stocks for each addition wave.[14] Such a choice is based on two observations: (1) the stocks with larger market capitalization and turnover ratio are selected to the treated group earlier; and (2) the market capitalization and turnover ratio of stocks vary considerably across the 2500 listed firms. We refer to this control group as the *quasi-full control group* in the following analysis.

We then employ the percentage distance matching method (following Beber and Pagano (2013) and Boehmer, Jones, and Zhang (2013)) to find the control stocks for each treated stock. The variables that are used to construct the matching are the market capitalization and the stock prices, as in the literature. Here, we apply a further restriction that requires the matching to happen within exchanges, due to the fact that the listed stocks in the two exchanges in China are substantially different in size and ownership structure.[15]

To be more specific, for each treated stock i, the matched stock is chosen by solving the

[14] As a robustness check, we also try to select the control stocks according to other variables, such as price, trading volume or trading value, as well as using 1% instead of 5% as the selection threshold. All results still hold. Five percent is a better choice due to the great difference in the market capitalization and turnover of the treated group and control group when 1% is used.

[15] SSE has more stated-owned large-sized listed firms, whereas SZSE has more non-state-owned relatively small-sized listed firms.

following problem:

$$\arg\min_{j} \sqrt{|(MV_j - MV_i)/MV_i|^2 + |(P_j - P_i)/P_i|^2} \quad (1)$$
$$s.t.: \text{ Ineligible Stock j is from the same exchange as the Treated Stock i,}$$

where MV is the market capitalization at the end of the previous fiscal year and P is the average price during the 30 days before the addition is announced. The 30-day average price before the announcement day is chosen to avoid a potential liquidity shock on a stock, which could distort the matching procedure. We refer to the control group chosen by percentage distance matching as the *matched control group*.

[Table 2: Summary Statistics]

Table 2 reports the summary statistics of the stock-week level variables for the treatment and two control groups, separately. Compared to stocks in the quasi-full control group, the treated stocks have greater market capitalizations, more press coverage, analyst coverage and smaller forecast errors, on average. The matched control stocks are more similar to the treated ones.

5 Empirical Results

5.1 Descriptive Evidence

Figure 1 plots the evolution of the liquidity measurements for the treated and control groups for 40 weeks around the MTSS permission waves. The calculation of the group mean excludes the effects of stock-specific factors. In particular, we use the following model to estimate the mean of liquidity measures for each group in each week:

$$y_{i,t} = \sum_{t=-20}^{20} \beta_t D_t + \alpha_i + \gamma X_{i,t} + \varepsilon_{i,t}, \quad (2)$$

where $y_{i,t}$ is the (il)liquidity measurement of stock i for week t, which can be turnover ratio, Amihud illiquidity ratio and bid-ask spread. α_i is the $stock \times wave$ fixed effect. Because the time intervals between waves can be longer than a year, we treat stocks as different ones in different waves to capture the over-time variation in liquidity of a stock. $X_{i,t}$ is the vector of other stock-level control variables, including the logarithm value of market capitalization and stock return volatility. D_t is the week dummy, and its coefficient captures the group mean for week t.

[Figure 1: Liquidity Impact of the MTSS Program]

The figure shows that after the program is implemented, the turnover ratio decreases, and the Amihud illiquidity ratio increases for the treated stocks compared to both control groups. Checking the bid-ask spread, it also increases for the treatment group relative to the matched control group. The figure, thus, lends some support to our intuition.

[Table 3: Univariate Analysis]

Table 3 reports the univariate analysis to show the changes after the MTSS program. In columns (1-2), (3-4) and (6-7), the mean value with the standard deviation, in parenthesis, for each liquidity measure is separately reported for the treated and control stocks before and after the treatment. Within-group comparison of the liquidity measures (comparing columns (1) with (2), (3) with (4) and (6) with (7)) indicates that the Amihud illiquidity ratio and bid-ask spread decrease in both the treated group and the two control groups; the turnover ratio decreases for the treated group but increases for the control groups. Thus the message is mixed, and this justifies the necessity of a difference-in-difference analysis, the results of which are reported in columns (5) and (8). These two columns show that, compared to the stocks in both control groups, the turnover ratio decreases and the Amihud illiquidity ratio and the bid-ask spread increase after a stock is added to the MTSS permission list. And the difference is significantly different from 0 at the 1% level. These results suggest that the

liquidity of a stock worsens after MTSS is allowed. The rest of this section provides further evidence by presenting the results of regressions that include control variables.

5.2 Negative Impact on Stock Liquidity

In this section, we report the results of the test of Hypothesis 1 and show that the MTSS program negatively affects stock liquidity in China. To achive this goal, we estimate the following empirical model:

$$y_{i,t} = \alpha_i + \beta_1 Post_t + \beta_2 Treat_{i,t} + \beta_3 Post_t * Treat_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t}, \tag{3}$$

where $y_{i,t}$ is the (il)liquidity measurement of stock i for week t, which can be turnover ratio, Amihud illiquidity ratio and bid-ask spread. α_i is the $stock \times wave$ fixed effect. $Post_t$ is a dummy variable that is equal to 1 after a set of stocks are added to the MTSS program in a wave, and 0 before the addition. $Treat_{i,t}$ is a dummy variable that indicates whether stock i is in the MTSS program, which is equal to 1 if stock i is eligible for the program in the wave, and 0 otherwise.[16] $X_{i,t}$ is the vector of other stock-level control variables including the logarithms value of market capitalization and stock return volatility. All standard errors are two-way clustered at the $stock \times wave$ and week levels.

The parameter of interest is β_3, which captures the changes in liquidity of stocks with MTSS permission compared to control stocks. If Hypothesis 1 is true, β_3 should be significantly negative when $y_{i,t}$ is the stock liquidity measured by turnover ratio, and significantly positive when $y_{i,t}$ is the stock illiquidity measured by Amihud illiquidity ratio or bid-ask spread.

[Table 4: Impact of MTSS on Stock Liquidity]

The results of the estimation of model (3) are reported in Table 4. In the following

[16]Note that if a stock was added to the program in the previous waves, it is not included with the control stocks in the analysis for later waves.

analysis, without further specification, Panel A reports the results of the comparison between the treated group and the quasi-full control group, and Panel B reports the regression results with the matched control group. In Table 4, the estimates without $stock \times wave$ fixed effects are reported in columns (1), (3) and (5) so that we can compare them, respectively, with the results in columns (2), (4) and (6), which include the fixed effects. A comparison of the estimates suggests that the stock-specific characteristics are not important in determining the changes in stock liquidity. Hereafter, we focus on the estimates with the fixed effects to save space.

We look at Panel A first. The results in column (2) suggest that the turnover ratio decreases by 1.76 basis points for the treated stocks, compared to the stocks in the quasi-full control group. This decrease is not only statistically significant at the 5% level, but also economically important: it amounts to 12.4% of the turnover ratio for the treated stocks before being added to the MTSS program. The estimates in column (4) show that Amihud illiquidity ratio increases significantly more, by 0.77, for the treated stocks than for the control stocks. This accounts for 29.5% of the Amihud illiquidity ratio for the treated stocks before they were selected for the MTSS program. And in column (6), the bid-ask spread increases by 4.22 basis points for the treated stocks, which amounts to 3.3% of the bid-ask spread for the treated group before being added to the program. In Panel B, we find similar results with only slight differences in the estimated coefficients when the control group is the matched one.

These results suggest that after MTSS is permitted on a stock, its trading volume decreases; the impact of the per-unit trading volume on stock prices increases; and the bid-ask spread enlarges compared to stocks that are not in the program. Therefore, we conclude that the MTSS permission worsens stock liquidity in China.

5.3 The Role of Information Asymmetry

We then investigate the role of information asymmetry in determining such a negative impact. In particular, we estimate the following empirical model to test Hypothesis 2, which predicts that the negative impact of MTSS on stock liquidity is stronger for stocks with severer information asymmetry.

$$\begin{aligned} y_{i,t} &= \alpha_i + \beta_1 Post_t + \beta_2 Treat_{i,t} + \beta_3 Asym_{i,t} + \beta_4 Post_t * Treat_{i,t} + \beta_5 Post_t * Asym_{i,t} \\ &\quad + \beta_6 Treat_{i,t} * Asym_{i,t} + \beta_7 Post_t * Treat_{i,t} * Asym_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t}, \end{aligned} \tag{4}$$

where $Asym_{i,t}$ is the measure of the information asymmetry associated with stock i at time t; it is valued in three ways in our analysis: when we use the number of news stories to proxy the information environment of a firm, $Asym_{i,t} = -ln(1+\ Press\ Coverage)$; when we use information provided by analysts to measure the information asymmetry status, $Asym_{i,t} = -ln(1+\ Analyst\ Coverage)$; or when it is equal to the forecast error of the consensus. The control variables are the same as in the empirical model (3), and the standard errors are also two-way clustered at the *stock* $\times$ *wave* and time levels. β_7 is the parameter of interest. We expect that β_7 will be significantly negative when $y_{i,t}$ is the stock liquidity measured by the turnover ratio and will be significantly positive when $y_{i,t}$ is the stock illiquidity measured by the Amihud illiquidity ratio or bid-ask spread.

[Table 5: Effects of Information Asymmetry on the Impacts of MTSS on Stock Liquidity]

The results are reported in Table 5. The dependent variables are the turnover ratio in columns (1-3), the Amihud illiquidity ratio in columns (4-6) and the bid-ask spread in columns (7-9). The information asymmetry measure consists of the press coverage ($-ln(1+\ Press\ Coverage)$) in columns (1), (4) and (7), the analyst coverage ($-ln(1+\ Analyst\ Coverage)$) in columns (2), (5) and (8), and the forecast errors in columns (3), (6) and (9). From the results of the two panels, the estimated value of β_7 is negative when the stock liquidity is

measured by turnover ratio with all three information asymmetry measures and both control groups, and it is significantly different from 0 at the 1% level. When the dependent variable is the Amihud illiquidity ratio, the estimated value of β_7 is positive and significantly different from 0 at least at the 5% level, except when the information asymmetry is measured by the forecast errors and the control group is the matched one. When stock illiquidity is measured by bid-ask spread, the estimated value of β_7 is not significantly different from 0.

These results suggest that when there is severe asymmetric information associated with a stock, after MTSS is permitted, its liquidity decreases more compared to those stocks that are permitted for MTSS but with less information asymmetry.[17]

5.4 Uninformed Investors' Trading Behaviors

This section provides evidence that uninformed investors reduce their trading on stocks in the MTSS program and shows that this reduction is crucial in decreasing stock liquidity. The results of testing Hypothesis 3 and 4 are reported.

To test the (a) part of Hypothesis 3, we estimate an empirical model similar to (3) in Section 5.1, with the dependent variable changed to be trading amounts of the uninformed investors. It is measured by the logarithms of 1 plus the trading volume in column (1), logarithms of 1 plus the trading value in column (2) and logarithms of 1 plus the number of trades in column (3).

[Table 6: The Impacts of MTSS on Uninformed Investors' Trades]

We find that the estimated coefficient of the interaction term $Post \times Treat$ is negative with all the three measures. From Panel A, uninformed investors' trading measure on the stocks in the MTSS program decreases by 0.081 when the measure is constructed with trading volume, 0.063 with trading value and 0.066 with the number of trades. The decrease is not

[17] Our results can also explain the findings of Boehmer, Jones, and Zhang(2013), who find a decrease in the liquidity of large-sized stocks, but little impact on small-sized stocks, when examining the 2008 U.S. shorting bans. Since stock size is closely correlated with the level of information asymmetry, the heterogeneous effects found by the authors are mainly due to the difference in information asymmetry.

only statistically significant at the 1% level, but it is also economically important: for an average stock, the decrease weights to 7.8% in trading volume, 6.1% in trading value and 6.4% in the number of trades.[18] And from Panel B, the decrease is 5.8% in trading volume, 5.2% in trading value, and 5.0% in the number of trades.

We test Hypothesis 3(b) by estimating an empirical model similar to (4) in Section 5.2, with the dependent variable now being the trading amounts of the uninformed investors. And similar to empirical model (4), the parameter of interest is the coefficient of the triple interaction term that measures the effect of information asymmetry on the negative impacts of MTSS on the uninformed investors' trading behaviors. Table 7 reports the results of the estimation. The dependent variable is the trading activity measure that is equal to logarithms of 1 plus the trading volume in columns (1-3); logarithms of 1 plus the trading value in columns (4-6), and logarithms of 1 plus the number of trades in columns (7-9). The information asymmetry measure is the press coverage ($-ln(1+\ Press\ Coverage)$) in columns (1), (4) and (7), analyst coverage ($-ln(1+\ Analyst\ Coverage)$) in columns (2), (5) and (8), and forecast errors in columns (3), (6) and (9).

[Table 7: Effects of Information Asymmetry on the Impacts of MTSS on Uninformed Investors' Trades]

The estimated coefficient of the term $Post\times Treat\times Information\text{-}Asymmetry$ is negative and significantly different from 0 when the control group is the matched one, except for the case in which *Information Asymmetry* is measured by the analyst coverage. And when the control group is the quasi-full one and information asymmetry is measure by the press coverage, the coefficient is significantly negative. Therefore, information asymmetry is crucial in making uninformed investors reluctant to trade when there are more informed investors after the Chinese MTSS program. These results provide evidence on the prediction of the

[18] The calculation of the decrease rate is from the formula: $\frac{Trading_{\text{after}}-Trading_{\text{before}}}{Trading_{\text{before}}} = \frac{(1+Trading_{\text{before}})(e^{\hat{\beta}}-1)}{Trading_{\text{before}}}$, where $\hat{\beta}$ is the estimated coefficient of $Post\times Treat$.

No-Trade Theorem that information asymmetry can reduce the trading activities of the uninformed investors.

Our final step is to show that the reduction in uninformed investors' trading activities is the direct reason for the worsened stock liquidity. We test Hypothesis 4 by estimating an empirical model that is similar to (4). But, now, the measures of information asymmetry are replaced with the measures of decreases in uninformed investors' trading activities. In particular, we use the percentage change in trading volume, trading value and the number of trades to measure the decrease in uninformed investors' trading. The parameter of interest is the coefficient of the triple interaction term *Post*× *Treat*× *Trade-Decrease*, which captures the effect of the decrease in trading activities on the negative impacts of MTSS on uninformed investors' trading behavior.

[Table 8: Effects of Information Asymmetry on the Impacts of MTSS on Uninformed Investors' Trades]

The estimation results are reported in Table 8. In both panels, the results of the estimation with stock liquidity measured by *turnover ratio* are reported in columns (1-3); with stock illiquidity measured by the *Amihud illiquidity ratio* in columns (4-6); and with stock illiquidity measured by *bid-ask spreads* in columns (7-9). *Trade-Decrease* is measured by the percentage change in the average of uninformed investors' trades after the MTSS program (compared to that before the program). The results of estimation with uninformed investors' trading decreases measured by the percentage change in *volume* are reported in columns (1), (4) and (7); by the percentage change in *value* in columns (2), (5) and (8); and by the percentage change in the *number of trades* in columns (3), (6) and (9).

The estimated coefficient of the triple interaction term is positive and significantly different from 0 for all the three measures of trade decreases when the dependent variable is the stock illiquidity measured by the Amihud illiquidity and bid-ask spread. It is negative for all the measurements of trade decreases when the dependent variable is the stock liquidity

measured by turnover ratio and significantly different from 0 except in Panel B, which the trade decrease is measured by the percentage change in trading volume and trading value.

These results indicate that after MTSS is permitted on a stock, if uninformed investors are more reluctant to trade the stock, its liquidity decreases more. From the previous findings that the MTSS permission reduces the uninformed investors' trading activities on the stock and that this reduction is more dramatic when there is more information asymmetry, we conclude that in a financial market with a lot of asymmetric information issues, allowing MTSS actually leads to a reduction of liquidity provision from the uninformed investors and, thus, damages stock liquidity.

6 Robustness

6.1 The Pre-Program Trend

One concern is that our results may be due to different pre-program trends in the liquidity of the treated and control stocks. To address this concern, we construct a time trend variable, *Trend*, which is equal to 0 for the 20th week before MTSS, increases by 1 after each week, and equals 40 for the 20th week after the program. Then we regress the (il)liquidity measurements on *Trend*, as well as the interaction term of *Trend* with the treated stock dummy. If our findings are driven by the trend, we should observe that the coefficient for the interaction term is significantly negative when the dependent variable is stock liquidity measured by turnover ratio, and significantly positive when the dependent variable is stock illiquidity measured by the Amihud illiquidity ratio or bid-ask spread.

[Table 9: Effects of Information Asymmetry on the Impacts of MTSS on Uninformed Investors' Trades]

The estimation results are reported in Table 9. We find that there is no difference between the treated and control stocks in terms of the Amihud illiquidity ratio. Although

there are significant differences between the two groups in the turnover ratio and bid-ask spreads, the sign is opposite to the negative liquidity impact found above, implying that the differences in pre-program trends cannot drive our findings.

6.2 Propensity Score Matched Control Group

We show that our results are also robust if we construct the control group using the propensity score matching method. Following Foucault, Sraer and Thesmar (2011), we compute the propensity score by estimating a logistic regression of the treatment dummy on stock capitalization and stock prices (30 days' average before the stock-addition events). Then, we match each treated stock with an ineligible stock that has the closest score. With this matched control group, we estimate the same empirical model as (3) and report the results in Table 10. The estimated value of the coefficient of the interaction term $Post \times Treat$ is similar to our results in the quasi-full control group and the control group constructed with the least distance matching method.

[Table 10: Impact on Stock Liquidity with Propensity Score Matched Control Group]

6.3 The Impact of MTSS on Exchange Traded Funds (ETFs)

One may be concerned that our findings are due to other specific factors in the Chinese stock market besides the information asymmetry issues. To provide further evidence on the importance of information asymmetry, in this section, we show that the MTSS permission actually improves the liquidity of ETFs that are subject to little information asymmetry. By the end of 2013, ten ETFs had been included for the program. Three out of these ten funds were selected shortly after their foundation and, thus, are excluded from our analysis due to the lack of pre-program data. And because the number of ETFs in China is small, we include all of the remaining 24 ineligible ETFs as the control funds.

We estimate a model similar to (3) for ETFs and report the results in Panel A of Table

11. The dependent variable is the fund liquidity measure that is equal to trading volumes of funds or the fund illiquidity measure that is equal to the Amihud illiquidity ratios or bid-ask spreads. These measures are constructed in a similar way for stocks. We find that the estimated coefficient of the interaction term *Post*× *Treat* is significantly positive when the dependent variable is trading volume and significantly negative when the dependent variable is the Amihud illiquidity ratio or bid-ask spread. These results suggest that the fund liquidity is improved after MTSS is allowed.

[Table 11: The Impacts of MTSS on ETF Liquidity]

We then split the ETFs sample into passive funds and active funds. Five out of the seven funds in the program are passive ones that simply replicate market indices, and two are active funds. One of the active funds tracks the stocks with a high and stable dividend payout ratio (SSE 180 Corporation Administration), while the other one tracks the stocks with better corporate governance (Huatai-Pine Bridge SSE Dividend Index). The passive funds involve only systemic risks and, thus, are less likely to have any information asymmetry issues compared to the active funds. Therefore, we expect that the positive impact is stronger for the passive funds than for the active funds. The estimated results are reported in Panel B of Table 11, from which we find that the positive impact on fund liquidity is driven mainly by the effect on the liquidity of passive funds.

Therefore, we conclude that the negative impact of the Chinese MTSS program on stock liquidity is not due to other characteristics of the Chinese market, but due to the information asymmetry problems associated with the stocks.

7 Conclusion

This paper exploits the Chinese pilot MTSS program to study the dark-side effect of short selling on stock liquidity. We provide evidence that after MTSS is permitted on a stock,

its liquidity decreases, and such decreases are larger when the information asymmetry associated with the stock is more serious. We further identify the critical role of information asymmetry in leading to the decreases in the uninformed investors' trading activities, and we show that the stocks with larger decreases in uninformed investors' trading activities experience a greater reduction in their liquidity. We exclude the effects of other possible characteristics of the Chinese market by showing that allowing MTSS improves the liquidity of ETFs that are selected to the program, because the ETFs are subject to little information asymmetry. Putting these findings together, our results provide an investigation into the information asymmetry channel of the effects of MTSS on financial market quality, which is a classic prediction of the theoretical literature, but has been largely overlooked by the empirical short-selling literature.

Our findings extend the empirical literature on the effects of MTSS by looking into a market environment that differs from developed markets. We highlight the importance of the specific market environment in determining the direction of the effect of MTSS on stock liquidity. In a developing financial market like China's, with serious information asymmetry and a large proportion of small investors, allowing MTSS generates a negative effect on stock liquidity – the opposite of the findings in the developed markets by Beber and Magano (2013). Thus, this paper provides some insights for policy makers in making short-selling policies, which remains the focus of an ongoing debate among researchers and regulators.

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Figures and Tables

Table 1: Timeline of the China's Margin-Trading and Short-Selling Program

Panel A illustrates China's *margin-trading and short-selling* (MTSS) program. The paper covers four waves of addition events that extended the sets of stocks eligible for MTSS. Column (1) assigns a wave number for each stock-addition event. Column (2) lists the announcement date of the addition events, and column (3) gives effective dates when MTSS was permitted on the stocks in the program. Column (4) shows the number of treated stocks that were added to the set in each addition event. Panel B reports the timeline of China's *re-financing program* to the end of 2013. Column (4) gives the number of stocks selected to this program that overlap with those in the MTSS program. 52 stocks (ten from the addition event of January 31, 2013 and 42 from the addition event of September 16, 2013) were added to the *re-financing program* soon after they were added to the MTSS program and, thus, are excluded in our analysis. The information in the table is from the websites of the Shanghai Stock Exchanges (SSE) and the Shenzhen Stock Exchanges (SZSE).

(1) Wave Number	(2) Announcement Date	(3) Effective Date	(4) Number of Treated Stocks
Panel A: MTSS Program			
Wave 1	February 12, 2010	March 31, 2010	90
Wave 2	November 25, 2011	December 5, 2011	185
Wave 3	January 25, 2013	January 31, 2013	275
Wave 4	September 6, 2013	September 16, 2013	186
			Total: 736
Panel B: Re-financing Program			
	February 26, 2013	February 28, 2013	
			53 from Wave 1
			23 from Wave 2
			10 from Wave 3
			Total: 86
	September 16, 2013	September 18, 2013	
			21 from Wave 1
			64 from Wave 2
			80 from Wave 3
			42 from Wave 4
			Total: 207

Table 2: Summary Statistics

The table reports the means of the key variables with their standard deviations in parentheses below the means, for the treated and control groups. Column (1) is for the treatment group; column (2) is for the quasi-full control group; and column (3) is for the matched control group. *Stock-Week Obs.* is the number of stock-week observations in each group. *Number of Stocks* is the number of stocks in each group. *Turnover ratio* is the weekly average ratio of daily trading volume divided by common shares outstanding. *Amihud illiquidity ratio* is the absolute value of daily stock returns divided by trading value and then averaged over each week, which is denoted in basis points per million RMB. *Bid-ask spread* is computed as the difference between bid and ask prices divided by the mean of the bid and ask prices, and then averaged over each week, which is denoted in basis points. *Volume*, *Value* and *Number of trades* are the weekly averages of the total daily trading volume, trading value and the number of trades that are less than 7,776 RMB (which represent the bottom 25% of all trades in the sample sorted by trading volume) and have no impact on stock prices. *Press Coverage* is the number of new stories on a stock in the main financial medias in the 20 weeks before the announcement date. *Analyst Coverage* the number of forecasters (research departments) covering a stock in the main financial media in the 20 weeks before the announcement date. *Forecast Error* is the forecast error of the consensus of forecasters' most recent forecasts in the 20 weeks before the announcement date, and assigned to be the largest forecast error if the stock is not covered. *Volatility* is the weekly standard deviation of daily raw returns. *MV* is the stocks market capitalization in the previous fiscal year end denoted in thousands of RMB.

Variable	Treated Group	Quasi-full Control Group	Matched Control Group
Stock-Week Obs.	26293	75655	26098
Number of Stocks	677	1968	677
Turnover ratio (%)	1.349	1.092	0.882
	(1.394)	(1.078)	(0.963)
Amihud iliquidity ratio	2.552	5.897	5.354
	(2.824)	(5.800)	(5.878)
Bid-ask spread (%)	12.973	14.654	14.482
	(8.274)	(8.888)	(9.111)
Press Coverage	41.445	31.642	33.562
	(27.788)	(9.731)	(12.582)
Analyst Coverage	7.228	5.274	6.097
	(6.942)	(5.520)	(5.921)
Forecast Error	0.428	0.564	0.391
	(0.730)	(0.834)	(0.583)
ln(1+Volume)	6.327	6.206	6.021
	(1.202)	(1.045)	(1.177)
ln(1+Value)	13.453	13.305	13.234
	(0.598)	(0.520)	(0.588)
ln(1+ Number of trades)	5.294	5.167	5.088
	(0.601)	(0.523)	(0.582)
Stock Volatility	2.405	2.348	2.299
	(1.263)	(1.312)	(1.339)
ln(MV)	16.258	15.559	16.007
	(0.993)	(0.587)	(0.769)

Table 3: Univariate Analysis

The table reports the results of the univariate analysis changes of liquidity (in Panel A) and that of the transactions by uninformed investors (in Panel B) after the MTSS program. Means of the variables with standard deviations in parentheses are reported separately for the treated and control groups. Columns (1) and (2) are the means of the variables in the 20 weeks before and the 20 weeks after the MTSS program for the treated group. Columns (3) and (4) are the means of the variables in the 20 weeks before and the 20 weeks after the MTSS program for the quasi-full control group. Column (5) reports the changes of the variables in the quasi-full control group after the MTSS program, compared to the treated group. Columns (6) and (7) are the means of the variables in the 20 weeks before and the 20 weeks after the MTSS program for the matched control group. Column (8) reports the changes of the variables in the matched control group after the MTSS program compared to the treated group. *, **, and *** denote significance at the 10%, 5% and 1% levels, respectively.

	Treated Group		Quasi-full Control Group			Matched Control Group		
	(1) Before	(2) After	(3) Before	(4) After	(5) diff-in-diff	(6) Before	(7) After	(8) diff-in-diff
Panel A: Luiqidity Measures								
Turnover (%)	1.414	1.284	1.037	1.148	-0.241***	0.848	0.928	-0.202***
	(1.490)	(1.284)	(1.048)	(1.105)	(-14.415)	(0.959)	(0.991)	(-9.655)
Amihud illiquidity ratio	2.610	2.492	6.468	5.317	1.033***	6.036	4.763	1.129***
	(3.027)	(2.598)	(6.408)	(5.042)	(13.940)	(7.081)	(5.130)	(13.204)
Bid-ask spread (%)	12.849	13.102	14.950	14.353	0.850***	14.741	14.228	0.730***
	(8.205)	(8.342)	(9.012)	(8.750)	(6.798)	(9.137)	(9.220)	(4.803)
Panel B: Transaction by Uninformed Investors								
ln(1+Volume)	6.284	6.369	6.164	6.249	-0.001	5.977	6.064	-0.002
	(1.196)	(1.206)	(1.060)	(1.027)	(-0.038)	(1.190)	(1.163)	(-0.074)
ln(1+Value)	13.421	13.486	13.256	13.353	-0.032***	13.181	13.285	-0.040***
	(0.647)	(0.542)	(0.549)	(0.485)	(-4.184)	(0.621)	(0.549)	(-3.837)
ln(1+Number of trades)	5.256	5.333	5.115	5.219	-0.027***	5.033	5.141	-0.030***
	(0.645)	(0.551)	(0.542)	(0.497)	(-3.452)	(0.600)	(0.560)	(-2.921)

Figure 1: Liquidity Impact

The figure displays the time dummy estimates from the regression $y_{i,t} = \sum_{t=-20}^{20} \beta_t D_t + \alpha_i + \gamma X_{i,t} + \varepsilon_{i,t}$, for the treated and both control groups. Time is measured weekly. $y_{i,t}$ is the (il)liquidity measurement of stock i for week t, which can be the turnover ratio, the Amihud illiquidity ratio and the bid-ask spread. α_i is the *stock* $\times$ *wave* fixed effect. $X_{i,t}$ is the vector of other stock-level control variables, including the logarithm's value of market capitalization and stock return volatility. D_t is the week dummy, and its coefficient captures the group mean for week t. The sample period covers 21 weeks before and 20 weeks after MTSS was implemented. Similar to the regression analysis, we drop the weeks between the event and announcement days. Therefore, week zero in this figure is the first week after the treatment is implemented and week minus one is the previous week before the event is announced.

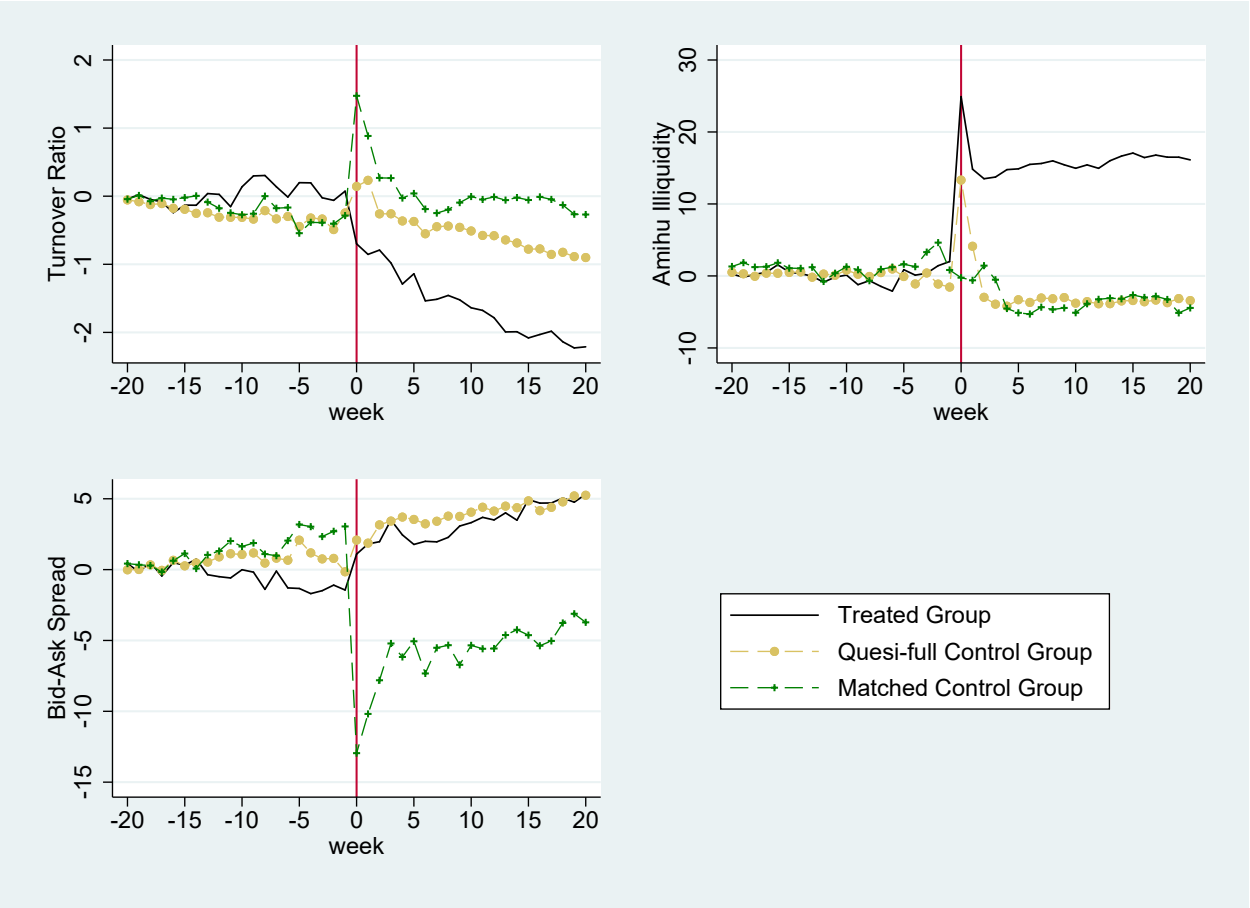

Table 4: Impact of MTSS on Stock Liquidity

This table reports results of the estimation of the impacts of MTSS on stock liquidity. Panel A presents the results of the comparison between the treated group and the quasi-full control group, and Panel B presents the results of the comparison between the treated group and the matched control group. In each panel, the results of the estimation with stock liquidity measured by *turnover ratio* are reported in columns (1-2), with stock illiquidity measured by the *Amihud illiquidity ratio* in columns (3-4) and with stock illiquidity measured by *bid-ask spreads* in columns (5-6). In all the regressions, *Treat* is the dummy variable that is equal to 1 if the stock is in the MTSS program and 0 otherwise. *Post* is the dummy variable that is equal to 1 after the stock-addition events and 0 before the events. We include market capitalization (*Ln(MV)*) and stock daily return volatility (*Volatility*) as controls, and we include week fixed effects in all regressions and *stock*×*wave* fixed effects in columns (2), (4), and (6). All standard errors are two-way clustered at the *stock*×*wave* and week levels. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Quasi-full Control Group

Dependent Variable:	Turnover		Amihud-Ratio		B-S Spread	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat	0.663***		-2.634***		-0.416	
	(11.18)		(-8.12)		(-1.34)	
Post*Treat	-0.204***	-0.176***	0.774**	0.769**	0.476**	0.422**
	(-4.10)	(-4.40)	(2.12)	(2.33)	(2.21)	(2.45)
Volatility	0.411***	0.306***	-0.049	0.207***	-1.291***	-0.329***
	(17.66)	(14.59)	(-1.18)	(5.76)	(-12.04)	(-8.78)
Ln(MV)	-0.521***	0.148**	-1.597***	-1.983***	-1.954***	-1.522***
	(-15.60)	(2.14)	(-11.09)	(-5.54)	(-7.12)	(-4.68)
Stock*Wave FEs	No	Yes	No	Yes	No	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observation	101,948	101,948	101,948	101,948	101,948	101,948
R^2	0.333	0.181	0.341	0.012	0.121	0.007

Panel B: Matched Control Group

Dependent Variable:	Turnover		Amihud-Ratio		B-S Spread	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat	0.666***		-2.838***		-1.255***	
	(11.46)		(-8.47)		(-3.42)	
Post*Treat	-0.210***	-0.156***	0.714**	0.707***	0.597***	0.447**
	(-3.86)	(-3.79)	(2.19)	(2.61)	(2.81)	(2.37)
Volatility	0.385***	0.285***	-0.094*	0.176***	-1.161***	-0.264***
	(10.79)	(9.47)	(-1.75)	(5.25)	(-8.03)	(-6.07)
Ln(MV)	-0.548***	0.028	-1.213***	-1.955***	-1.630***	-1.067***
	(-15.64)	(0.34)	(-7.90)	(-3.99)	(-5.34)	(-3.77)
Stock*Wave FEs	No	Yes	No	Yes	No	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observation	52,391	52,391	52,391	52,391	52,391	52,391
R^2	0.376	0.162	0.324	0.021	0.136	0.006

Table 5: Effects of Information Asymmetry on the Impacts of MTSS on Stock Liquidity

This table reports results of the estimation of the effects of information asymmetry on impacts of MTSS on stock liquidity. Panel A presents the results of the comparison between the treated group and the quasi-full control group, and Panel B shows the results of the comparison between the treated group and the matched control group. In both panels, the results of the estimation with stock liquidity measured by *turnover ratio* in columns (1-3), with stock liquidity measured by the *Amihud illiquidity ratio* in columns (4-6), and with stock liquidity measured by *bid-ask spreads* are reported in columns (7-9). Results with information asymmetry are measured by $-ln(1+$ *Press Coverage)* (*#News*) in columns (1), (4) and (7), by $-ln(1+$ *Analyst Coverage)* (*#Analyst*) in columns (2), (5) and (8), and by analysts' forecast errors in columns (3), (6) and (9). *Asym* is the corresponding information asymmetry measure as indicated. We include market capitalization (*Ln(MV)*) and stock return volatility (*Volatility*) as controls, and we include week fixed effects and *stock*×*wave* fixed effects in all regressions. All standard errors are two-way clustered at the *stock*×*wave* and week levels. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Quasi-full Control Group

Dependent Variable:	Turnover Ratio			Amihud Ratio			Bid-Ask Spread		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Asym-Infor Measure:	#News	#Analyst	Forecast-Error	#News	#Analyst	Forecast-Error	#News	#Analyst	Forecast-Error
Post*Treat	-1.741***	-0.492***	-0.043	7.747***	1.405***	0.589**	0.117	0.388	0.535***
	(-5.42)	(-5.66)	(-1.21)	(3.38)	(2.97)	(1.97)	(0.07)	(1.50)	(2.73)
Post*Asym	0.212***	0.034**	0.033*	-0.772	-0.030	0.006	0.359	0.218**	0.126
	(3.40)	(2.22)	(1.78)	(-1.35)	(-0.27)	(0.05)	(0.86)	(2.40)	(1.45)
Post*Treat*Asym	-0.442***	-0.197***	-0.294***	1.965***	0.391***	0.410**	-0.097	-0.049	-0.225
	(-5.17)	(-5.53)	(-5.59)	(3.39)	(2.71)	(2.26)	(-0.21)	(-0.36)	(-1.34)
Volatility	0.305***	0.305***	0.305***	0.209***	0.209***	0.208***	-0.329***	-0.327***	-0.329***
	(14.55)	(14.59)	(14.59)	(5.82)	(5.80)	(5.80)	(-8.78)	(-8.75)	(-8.78)
Ln(MV)	0.142**	0.137**	0.134**	-1.950***	-1.950***	-1.951***	-1.510***	-1.470***	-1.509***
	(2.06)	(2.01)	(1.98)	(-5.49)	(-5.46)	(-5.46)	(-4.63)	(-4.57)	(-4.69)
Stock*Wave FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	101,948	101,948	101,948	101,948	101,948	101,948	101,948	101,948	101,948
R^2	0.183	0.184	0.185	0.014	0.013	0.013	0.007	0.008	0.007

Panel B: Matched Control Group

Dependent Variable:	Turnover Ratio			Amihud Ratio			Bid-Ask Spread		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Asym-Infor Measure:	#News	#Analyst	Forecast-Error	#News	#Analyst	Forecast-Error	#News	#Analyst	Forecast-Error
Post*Treat	-1.499***	-0.438***	-0.040	6.565***	1.429***	0.560**	-0.563	0.410	0.460**
	(-4.34)	(-4.77)	(-1.03)	(2.73)	(2.85)	(2.33)	(-0.28)	(1.31)	(2.11)
Post*Asym	0.170**	0.005	0.002	-0.555	-0.134	-0.010	0.543	0.241*	-0.012
	(2.11)	(0.22)	(0.05)	(-0.91)	(-0.75)	(-0.04)	(0.95)	(1.82)	(-0.05)
Post*Treat*Asym	-0.376***	-0.168***	-0.341***	1.632***	0.440**	0.430	-0.298	-0.042	-0.041
	(-4.06)	(-4.38)	(-4.44)	(2.62)	(2.43)	(1.51)	(-0.51)	(-0.25)	(-0.14)
Volatility	0.285***	0.284***	0.284***	0.177***	0.178***	0.178***	-0.264***	-0.260***	-0.264***
	(9.47)	(9.47)	(9.48)	(5.30)	(5.32)	(5.33)	(-6.09)	(-6.01)	(-6.09)
Ln(MV)	0.028	0.012	0.008	-1.952***	-1.923***	-1.930***	-1.063***	-1.050***	-1.070***
	(0.34)	(0.15)	(0.10)	(-4.01)	(-3.96)	(-3.97)	(-3.75)	(-3.72)	(-3.80)
Stock*Wave FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	52,391	52,391	52,391	52,391	52,391	52,391	52,391	52,391	52,391
R^2	0.163	0.167	0.168	0.023	0.022	0.021	0.006	0.006	0.006

Table 6: The Impacts of MTSS on Uninformed Investors' Trades

This table reports the estimation of the impacts of MTSS on the transactions conducted by uninformed investors. Panel A presents the results of the comparison between the treated group and the quasi-full control group, and Panel B shows the results of the comparison between the treated group and the matched control group. In each panel, the results of the estimation with uninformed investors' trades measured by *ln(1+Volume)* are reported in column (1), *ln(1+Value)* in column (2) and *ln(1+Number of trades)* in column (3). (*Volume*, *Value* and *Number of trades* are the weekly averages of the total daily trading volume, trading value and the number of trades that are less than 7,776 RMB, which represent the bottom 25% of all trades in the sample sorted by trading volume, and have no impact on stock prices.) We include market capitalization (*Ln(MV)*) and stock return volatility (*Volatility*) as controls, and we include week fixed effects and *stock*×*wave* fixed effects in all regressions. All standard errors are two-way clustered at the *stock*×*wave* and week levels. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Quasi-full Control Group			
Dependent Variable:	Volume	Value	Number
	(1)	(2)	(3)
Post*Treat	-0.081***	-0.063***	-0.066***
	(-2.84)	(-2.78)	(-2.99)
Volatility	0.034***	0.050***	0.043***
	(8.71)	(12.35)	(12.15)
Ln(MV)	-0.225***	-0.016	-0.043*
	(-6.48)	(-0.57)	(-1.67)
Stock*Wave FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Observation	99,729	99,729	99,729
R^2	0.016	0.027	0.024

Panel B: Matched Control Group			
Dependent Variable:	Volume	Value	Number
	(1)	(2)	(3)
Post*Treat	-0.060*	-0.053**	-0.051**
	(-1.82)	(-2.05)	(-2.04)
Volatility	0.012**	0.025***	0.020***
	(2.49)	(4.87)	(4.52)
Ln(MV)	-0.277***	-0.076**	-0.100***
	(-5.55)	(-2.04)	(-2.74)
Stock*Wave FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Observation	51,081	51,081	51,081
R^2	0.014	0.008	0.008

Table 7: Effects of Information Asymmetry on the Impacts of MTSS on Uninformed Investors' Trades

This table presents the results of the estimation of the effects of Information Asymmetry on the Impact of MTSS on Uninformed Investors' Trades. Panel A presents the results of the comparison between the treated group and the quasi-full control group, and Panel B shows the results of the comparison between the treated group and the matched control group. In each panel, the results of the estimation with uninformed investors' trades measured by *ln(1+Volume)* are reported in columns (1-3), *ln(1+Value)* in columns (4-6) and *ln(1+Number of trades)* in columns (7-9). In the row after the column numbers, the measure of information asymmetry is indicated. Results with information asymmetry measured by *-ln(1+ Press Coverage)* (*#News*) are reported in columns (1), (4) and (7), by *-ln(1+ Analyst Coverage)* (*#Analyst*) in columns (2), (5) and (8), and by analysts' forecast errors in columns (3), (6) and (9). *Asym* is the corresponding information asymmetry measure as indicated. We include market capitalization (*Ln(MV)*) and stock return volatility (*Volatility*) as controls, and we include week fixed effects and *stock×wave* fixed effects in all regressions. All standard errors are two-way clustered at the *stock×wave* and week levels. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Quasi-full Control Group

Dependent Variable:	Volume			Value			Number		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Asym-Infor Measure:	#News	#Analyst	Forecast-Error	#News	#Analyst	Forecast-Error	#News	#Analyst	Forecast-Error
Post*Treat	-0.814**	-0.103***	-0.067**	-0.783***	-0.101***	-0.049*	-0.698***	-0.088***	-0.056**
	(-2.53)	(-2.91)	(-2.08)	(-2.79)	(-3.66)	(-1.91)	(-2.61)	(-3.25)	(-2.26)
Post*Asym	0.034	-0.018*	-0.006	-0.002	-0.019**	-0.016*	-0.004	-0.020***	-0.017**
	(0.55)	(-1.72)	(-0.51)	(-0.05)	(-2.52)	(-1.82)	(-0.09)	(-2.83)	(-2.06)
Post*Treat*Asym	-0.205**	-0.011	-0.033	-0.200**	-0.021	-0.036**	-0.176**	-0.011	-0.026
	(-2.24)	(-0.56)	(-1.54)	(-2.50)	(-1.35)	(-2.19)	(-2.31)	(-0.76)	(-1.63)
Volatility	0.034***	0.034***	0.034***	0.050***	0.050***	0.050***	0.043***	0.043***	0.043***
	(8.69)	(8.69)	(8.70)	(12.36)	(12.32)	(12.32)	(12.17)	(12.12)	(12.12)
Ln(MV)	-0.231***	-0.231***	-0.229***	-0.022	-0.023	-0.022	-0.049*	-0.049*	-0.049*
	(-6.56)	(-6.62)	(-6.56)	(-0.79)	(-0.84)	(-0.81)	(-1.86)	(-1.93)	(-1.91)
Stock*Wave FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	99,729	99,729	99,729	99,729	99,729	99,729	99,729	99,729	99,729
R^2	0.017	0.017	0.016	0.030	0.029	0.029	0.027	0.026	0.025

Panel B: Matched Control Group

Dependent Variable:	Volume			Value			Number		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Asym-Infor Measure:	#News	#Analyst	Forecast-Error	#News	#Analyst	Forecast-Error	#News	#Analyst	Forecast-Error
Post*Treat	-1.114***	-0.124***	-0.015	-1.067***	-0.125***	-0.019	-1.001***	-0.113***	-0.021
	(-2.65)	(-2.58)	(-0.39)	(-3.14)	(-3.40)	(-0.62)	(-3.10)	(-3.22)	(-0.71)
Post*Asym	0.088	0.006	0.072*	0.042	-0.003	0.021	0.038	-0.001	0.022
	(0.84)	(0.28)	(1.93)	(0.59)	(-0.16)	(0.78)	(0.57)	(-0.04)	(0.88)
Post*Treat*Asym	-0.293**	-0.038	-0.125***	-0.281***	-0.042**	-0.099***	-0.263***	-0.036*	-0.087***
	(-2.43)	(-1.36)	(-2.72)	(-2.88)	(-1.98)	(-2.84)	(-2.84)	(-1.85)	(-2.72)
Volatility	0.012**	0.012**	0.012**	0.025***	0.025***	0.025***	0.019***	0.019***	0.019***
	(2.44)	(2.43)	(2.47)	(4.84)	(4.79)	(4.80)	(4.50)	(4.45)	(4.46)
Ln(MV)	-0.278***	-0.281***	-0.283***	-0.077**	-0.080**	-0.081**	-0.101***	-0.104***	-0.105***
	(-5.65)	(-5.62)	(-5.66)	(-2.13)	(-2.17)	(-2.17)	(-2.85)	(-2.85)	(-2.86)
Stock*Wave FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	51,081	51,081	51,081	51,081	51,081	51,081	51,081	51,081	51,081
R^2	0.018	0.015	0.016	0.015	0.010	0.010	0.016	0.010	0.010

Table 8: Effects of Decreases in Uninformed Investors' Trades on the Impacts of MTSS on Stock Liquidity

This table presents the results of the estimation on how MTSS affects stock liquidity through decreasing uninformed investors' trades. Panel A presents the results of the comparison between the treated group and the quasi-full control group, and Panel B shows the results of the comparison between the treated group and the matched control group. In each panel, the results of the estimation with stock liquidity measured by *turnover ratio* are reported in Columns (1-3), with stock liquidity measured by *Amihud illiquidity ratio* in columns (4-6) and with stock liquidity measured by *bid-ask spreads* in columns (7-9). The decreases are measured by the percentage change in the average of uninformed investors' trades after the MTSS program (compared to that before the program). In the row after the column numbers, the measure of uninformed investors' trades is indicated. The results of the estimation with uninformed investors' trading decreases measured by the percentage change in *volume* are reported in columns (1), (4) and (7), by the percentage change in *value* in columns (2), (5) and (8) and by the percentage change in *number of trades* in columns (3), (6) and (9). We include market capitalization (*Ln(MV)*) and stock return volatility (*Volatility*) as controls, and we include week fixed effects and *stock*×*wave* fixed effects in all regressions. All standard errors are two-way clustered at the *stock*×*wave* and week levels. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Quasi-full Control Group

Dependent Variable:	Turnover Ratio			Amihud Ratio			Bid-Ask Spread		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Trades Decreases in(%):	Volume	Value	Number	Volume	Value	Number	Volume	Value	Number
Post*Treat	-0.164***	-0.164***	-0.150***	0.928***	0.932***	0.867**	0.390**	0.392**	0.336*
	(-4.43)	(-4.44)	(-4.10)	(2.66)	(2.67)	(2.49)	(2.18)	(2.18)	(1.89)
Post*Trade Decreases	0.605***	0.618***	1.323***	-2.777***	-2.838***	-5.718***	-1.872***	-1.943***	-4.893***
	(11.96)	(12.43)	(12.75)	(-9.71)	(-9.98)	(-10.39)	(-9.66)	(-10.18)	(-11.47)
Post*Treat*Trade Decreases	-0.170***	-0.177***	-0.346***	1.956***	1.993***	3.991***	0.645***	0.688***	1.621***
	(-3.10)	(-3.25)	(-3.06)	(6.98)	(7.11)	(7.35)	(3.65)	(3.91)	(4.20)
Volatility	0.310***	0.310***	0.308***	0.257***	0.259***	0.261***	-0.305***	-0.303***	-0.291***
	(18.16)	(18.14)	(18.24)	(6.65)	(6.70)	(6.74)	(-8.41)	(-8.38)	(-8.15)
Ln(MV)	-0.074	-0.074	-0.109*	-1.107***	-1.103***	-1.021***	-0.899***	-0.888***	-0.643**
	(-1.17)	(-1.18)	(-1.75)	(-3.68)	(-3.68)	(-3.43)	(-2.99)	(-2.95)	(-2.24)
Stock*Wave FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	99,301	99,301	99,301	99,301	99,301	99,301	99,301	99,301	99,301
R^2	0.220	0.221	0.224	0.039	0.040	0.040	0.014	0.014	0.018

Panel B: Matched Control Group

Dependent Variable:	Turnover Ratio			Amihud Ratio			Bid-Ask Spread		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Trades Decreases in(%):	Volume	Value	Number	Volume	Value	Number	Volume	Value	Number
Post*Treat	-0.114***	-0.113***	-0.105***	0.824***	0.827***	0.774***	0.326*	0.327*	0.262
	(-2.91)	(-2.90)	(-2.70)	(2.85)	(2.86)	(2.69)	(1.68)	(1.68)	(1.37)
Post*Trade Decreases	0.389***	0.415***	0.920***	-1.980***	-2.078***	-4.083***	-1.434***	-1.541***	-3.569***
	(7.75)	(8.56)	(8.62)	(-7.30)	(-7.77)	(-7.92)	(-6.25)	(-7.16)	(-7.32)
Post*Treat*Trade Decreases	-0.069	-0.086	-0.217*	1.569***	1.642***	3.212***	0.450**	0.529**	1.080**
	(-1.15)	(-1.47)	(-1.74)	(5.48)	(5.78)	(5.89)	(2.00)	(2.46)	(2.27)
Volatility	0.314***	0.313***	0.312***	0.189***	0.191***	0.192***	-0.268***	-0.266***	-0.258***
	(17.89)	(17.86)	(17.92)	(5.47)	(5.53)	(5.56)	(-6.75)	(-6.71)	(-6.54)
Ln(MV)	-0.113	-0.118	-0.148*	-1.398***	-1.383***	-1.333***	-0.521*	-0.501*	-0.340
	(-1.42)	(-1.48)	(-1.90)	(-2.75)	(-2.72)	(-2.60)	(-1.91)	(-1.83)	(-1.27)
Stock*Wave FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	50,611	50,611	50,611	50,611	50,611	50,611	50,611	50,611	50,611
R^2	0.199	0.201	0.204	0.040	0.041	0.040	0.012	0.012	0.015

Table 9: Pre-Program Trend in Stock Liquidity

This table reports the results of the tests for the pre-program trend of stock liquidity. Panel A presents the results of the comparison between the treated group and the quasi-full control group and Panel B the results of the comparison between the treated group and the matched control group. In each panel, the results of the estimation with stock liquidity innovation trend before the MTSS program measured by *turnover ratio* are reported in column (1) (with different fixed effects), with stock liquidity measured by *Amihud illiquidity ratio* in column (2) and with stock liquidity measured by *bid-ask spreads* in columns (3). In all the regressions, *Trend* is the time trend that is equal to 0 for the 20th week before MTSS, and increases by 1 after each week, and is equal to 40 for the 20th week after the program. We include market capitalization (*Ln(MV)*) and stock return volatility (*Volatility*) as controls, and we include week fixed effects and *stock*×*wave* fixed effects in all regressions. All standard errors are two-way clustered at the *stock*×*wave* and week levels. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Quasi-full Control Group			
Dependent Variable:	Turnover	Amihud-Ratio	B-S Spread
	(1)	(2)	(3)
Trend	0.009	-0.393***	-1.005***
	(0.18)	(-3.36)	(-13.98)
Trend*Treat	0.007	-0.009	-0.058***
	(1.54)	(-0.23)	(-3.43)
Volatility	0.264***	0.290***	-0.259***
	(9.07)	(5.89)	(-5.68)
Ln(MV)	-0.149*	-0.896**	-0.506
	(-1.83)	(-2.19)	(-1.18)
Stock*Wave FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Observation	51,477	51,477	51,477
R^2	0.155	0.008	0.004

Panel B: Matched Control Group			
Dependent Variable:	Turnover	Amihud-Ratio	B-S Spread
	(1)	(2)	(3)
Trend	-0.061	-0.362**	-1.633***
	(-0.77)	(-2.20)	(-13.48)
Trend*Treat	0.009*	-0.010	-0.046**
	(1.96)	(-0.25)	(-2.43)
Volatility	0.265***	0.226***	-0.224***
	(5.71)	(4.85)	(-4.17)
Ln(MV)	-0.220**	-1.435**	-0.420
	(-2.43)	(-2.53)	(-1.22)
Stock*Wave FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Observation	26,389	26,389	26,389
R^2	0.148	0.009	0.004

Table 10: Impact on Stock Liquidity with Propensity Score Matched Control Group

This table reports the results of the estimation of the impacts of MTSS on stock liquidity with the propensity score matched control group. The results of the estimation with stock liquidity measured by *turnover ratio* are reported in columns (1-2), with stock liquidity measured by *Amihud illiquidity ratio* in columns (3-4) and with stock liquidity measured by *bid-ask spreads* in columns (5-6). We include market capitalization (*Ln(MV)*) and stock daily return volatility (*Volatility*) as controls, and we include week fixed effects in all regressions and *stock*×*wave* fixed effects in columns (2), (4), and (6). All standard errors are two-way clustered at the *stock*×*wave* and week levels. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable:	Turnover		Amihud-Ratio		B-S Spread	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat	0.669***		-3.134***		-1.460***	
	(11.93)		(-8.82)		(-3.69)	
Post*Treat	-0.196***	-0.144***	0.764**	0.808***	0.536**	0.401**
	(-3.77)	(-3.60)	(2.19)	(2.65)	(2.32)	(2.05)
Volatility	0.419***	0.313***	-0.161***	0.176***	-1.379***	-0.268***
	(19.67)	(17.28)	(-3.43)	(5.18)	(-10.50)	(-7.35)
Ln(MV)	-0.554***	0.022	-1.316***	-1.792***	-1.340***	-1.117***
	(-15.95)	(0.28)	(-8.60)	(-4.11)	(-4.31)	(-3.71)
Stock*Wave FEs	No	Yes	No	Yes	No	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observation	52,331	52,331	52,331	52,331	52,331	52,331
R^2	0.388	0.173	0.321	0.016	0.140	0.005

Table 11: The Impacts of MTSS on ETF Liquidity

This table reports the impact of MTSS on the liquidity of exchange-traded funds (ETFs). Panel A compares the treated and control ETFs. In Panel B, the treated ETFs are divided into active and passive funds, and they are compared to the control ETFs separately. In each panel, results with the liquidity of ETFs measured by *ln(Volume)* (*Volume* means *trading volume*) are reported in columns (1-2), by *Amihud illiquidity ratio* in columns (3-4) and by *bid-ask spreads* in columns (5-6) (with different fixed effects). *Treat* is the dummy variable that is equal to 1 if the fund is in the MTSS program and 0 otherwise. *Post* is the dummy variable that is equal to 1 if the MTSS is implemented and 0 before the program. *Volatility* is the standard deviation of daily fund returns. We include week fixed effects in all regressions and *fund*×*wave* fixed effects in columns (2), (4), and (6). All standard errors are two-way clustered at the fund and week levels. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Average Effects

Dependent Variable:	Volume		Amihud-Ratio		B-S Spread	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat	3.285***		-3.092**		-0.394***	
	(4.42)		(-2.50)		(-4.15)	
Post*Treat	0.598***	0.784***	-1.446*	-1.903***	-0.193**	-0.212***
	(3.37)	(4.54)	(-1.75)	(-2.97)	(-2.09)	(-3.06)
Volatility	0.478**	0.019	1.133	0.908*	0.105*	0.097***
	(2.13)	(0.42)	(1.12)	(1.70)	(1.96)	(3.03)
Fund FEs	No	Yes	No	Yes	No	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1,069	1,069	1,069	1,069	1,069	1,069
R^2	0.458	0.057	0.123	0.017	0.210	0.029

Panel B: Passive Funds Versus Active Funds

Dependent Variable:	Volume		Amihud Ratio		Bid-Ask Spread	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat	3.277***		-3.089**		-0.393***	
	(4.39)		(-2.50)		(-4.14)	
Post*Passive	1.635***	0.919***	-1.771**	-2.079***	-0.296***	-0.254***
	(2.64)	(7.03)	(-2.25)	(-3.35)	(-2.88)	(-4.30)
Post*Active	-2.034**	0.446	-0.622	-1.460**	0.070	-0.105
	(-2.53)	(1.34)	(-0.64)	(-2.24)	(0.34)	(-0.89)
Volatility	0.394*	0.015	1.160	0.912*	0.113**	0.098***
	(1.79)	(0.35)	(1.13)	(1.70)	(2.14)	(3.09)
Fund FEs	No	Yes	No	Yes	No	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1,069	1,069	1,069	1,069	1,069	1,069
R^2	0.521	0.063	0.123	0.017	0.219	0.031

Appendix A: Definitions of the Variables

In this appendix, we define the variables used in the empirical tests. The three liquidity measurements are defined as follows:

- *Turnover ratio* is the weekly average ratio of daily trading volume divided by common shares outstanding.
- *Amihud illiquidity ratio* is the absolute value of daily stock returns divided by trading value and then averaged over each week and denoted in basis points per million RMB.
- *Bid-ask spread* is computed as the ratio of the difference between bid and ask prices divided by the mean of the bid and ask prices, and then averaged over each week and denoted in basis points.

Three variables are used to measure information asymmetry:

- *Press Coverage* is the number of news stories shown in the main financial media in the 20 weeks before the stock-addition event for each stock.
- *Analyst Coverage* is the number of brokerage houses that have issued forecasts or reports on a stock within 20 weeks before the stock-addition events.
- *Forecast Error* is the forecast error of the consensus of the last forecasts by analysts following a stock in the 20 weeks before the stock-addition events.

Three variables are used to measure the behavior of uninformed investors:

- *Volume* is the weekly average value of the total daily trading volume by investors whose trades are less than 7,776 RMB (which represent the bottom 25% of all trades in the sample sorted by trading volume) and have no impact on stock prices.
- *Value* is the weekly average value of the total daily trading value by investors whose trades are less than 7,776 RMB (which represent the bottom 25% of all trades in the sample sorted by trading volume) and have no impact on stock prices.
- *Number of trades* is the weekly average value of the number of trades by investors whose trades are less than 7,776 RMB (which represent the bottom 25% of all trades in the sample sorted by trading volume) and have no impact on stock prices.

Dummy variables and Controls:

- *Treat* is the dummy variable that is equal to 1 if the stock is in the MTSS program and 0 otherwise.
- *Post* is the dummy variable that is equal to 1 after the stock-addition events and 0 before the events.
- *MV* is the stocks market capitalization denoted in thousands of RMB.
- *Volatility* is the weekly standard deviation of daily raw returns.