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Liquidity, informed trading, and a market surveillance system: Evidence from the Vietnamese stock market

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ABSTRACT

This paper investigates the effectiveness of a market surveillance system (MSS) on improving the market quality of the Vietnamese stock market, as measured by liquidity and informed trading level. We find that market liquidity decreases after the introduction of the MSS, and that the effect is more pronounced for small firms. Although the level of informed trading, on average, does not change significantly after the MSS, the subsample analysis indicates a significant decrease in informed trading among large and liquid firms.

1. Introduction

A growing body of evidence suggests that whether secondary stock market regulation is beneficial to market quality is an empirical question. Some studies report positive effects of these regulations. Bushman et al. (2005) find a more pronounced increase in analyst activity following restriction of insider trading activities in emerging markets. Ojah et al. (2020) document that effective insider trading law improves stock price informativeness in South Africa (and similarly in other emerging markets, including Chile, Indonesia, Malaysia, and Turkey). On the other hand, some policies have not worked effectively. For instance, the enactment of criminal sanctions for insider trading in New Zealand in 2008 worsened the cost of trading, degree of information asymmetry, and the probability of informed trading (Frijns et al., 2013). Chung and Chuwonganant (2012) find that the quoted and effective spreads increased, the quoted depth decreased, and the market quality index decreased after the implementation of the Regulation National Market System (Reg NMS) in the US financial market. Bhattacharya et al. (2000) and Cheuk et al. (2006) document that the regulations were ineffective in curbing insider dealings in Mexico and Hong Kong, respectively. Budsaratragoon et al. (2012) show that the insider trading regulation in Thailand, which mimics developed market rules, fails on all three measures of success.

More importantly, many studies show the effectiveness of secondary market regulation, to a large extent, depends on a country's infrastructure and prior regulatory conditions. Not only are there differences between developed and emerging markets, but findings might vary from one emerging market to another (e.g., Bhattacharya et al., 2000; Fernandes and Ferreira, 2009; Budsaratragoon et al., 2012; Christensen et al., 2016; Chen et al., 2017; Aghanya et al., 2020; Ojah et al. (2020)). Different aspects of regulations, such as the introduction, implementation, and enforcement of the same regulation rules, might have different effects. See, for example, Bhattacharya and Daouk (2002), Aitken et al. (2015), and Bhattacharya and Daouk (2009). These findings highlight the need for a more

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detailed analysis of particular secondary market regulation.

In this study, we investigate this question by examining a market surveillance system (MSS) launched in the Vietnamese stock market in 2013. As Cumming et al. (2015) illustrate, surveillance in financial markets refers to computer algorithms directed at detecting insider trading and other forms of market manipulation, which allows the surveillance authorities to oversee trading activities more effectively and is an important component of regulation enforcement. In particular, this system (1) collects data from stock exchanges and the Vietnam Securities Depository (VSD); (2) monitors all trades and provides alerts and reports in the event of various types of unusual activities, including abnormal price changes, changes in volume, and breaches of the trading rules; and (3) supports data retrieval for the sake of market surveillance.[1] This MSS provides a setting to empirically examine the effect of strengthened secondary market regulation. A vital advantage of this setting is that it allows us to study this question in the context of an emerging market where market regulation is most needed.

As liquidity and informed trading level are two key measures of a stock market's quality and essential for a well-functioning stock market,[2] we evaluate market quality through the changes of liquidity and informed trading level around the MSS event using a sample from March 2012 to March 2014. We measure the market liquidity using the bid-ask spread and other liquidity measures, such as the Amihud and Pastor-Stambaugh measure, and turnover ratio. Then, we use the Madhavan et al. (1997) model (hereafter the MRR model) to estimate the information asymmetry level.[3] We use this information asymmetry level as the measure of informed trading. We conduct *t*-tests and run regressions to examine the changes in the liquidity and informed trading levels in a six-month and one-year window around the MSS event. We also investigate the relationship between quality measure change and firm characteristics. We document several findings.

First, our empirical results show that the liquidity of 270 stocks at the Ho Chi Minh Exchange (HOSE)[4] becomes worse after the implementation of the MSS. Moreover, we find limited evidence showing that the MSS improves informed trading across the market.

Second, we analyze the impact of the MSS on firms with different characteristics. We consider size, trading frequency, and turnover ratio. We sort firms into terciles according to each firm characteristic separately, and test the difference in impact between the top and bottom groups using both *t*-test and regression analysis. We find that the worsening effect of the MSS on stock liquidity mainly happens for small, low-trading-frequency, and high-turnover-ratio firms. Meanwhile, the informed trading of large and high-trading-frequency firms improves after the implementation of the MSS. Both the *t*-test and regression analysis show similar results. Aslan et al. (2011) find that smaller, younger firms and firms followed by few analysts are more likely to have higher information risk. This finding means they are more likely to be targeted by the MSS to improve market quality. In contrast with Aslan et al. (2011), we find that only the informed trading of large and liquid firms improves after the MSS so the policy is not effective in regulating small and illiquid firms.

Third, we run cross-sectional regressions of the market quality measure change on selected firm characteristics variables. We find that the stock liquidity becomes worse for small and low-trading-frequency firms. These results, along with the fact of the overall decline of market liquidity after the MSS implementation, suggest that the worsening effect of the MSS on liquidity is stronger for small and low-trading-frequency firms. We also document that the information asymmetry measure decreases more for small and low-trading-frequency firms. These results, along with the overall effect of no significant impact of the MSS on information asymmetry, show that large and high-trading-frequency firms tend to have an improved informed trading level on the Vietnamese stock market.

We also discuss the theoretical and policy implications of our main findings and investigate whether other events drive our results. We collected all the regulations, circulars, and policies related to the Vietnamese stock market between December 2011 and March 2014, and find no other policy is relevant to our findings. We finally run several robustness tests and find our results hold.

Our study contributes to the literature in several ways. First, our work adds to the budding literature on the effectiveness of insider trading and market manipulation regulation in an emerging market. Since the financial market is in development and the market governance quality is still a big concern, there is a greater demand to explore the construction of sound regulatory regimes in emerging markets than in developed markets. The literature also shows that even emerging markets are not homogeneous. Our study provides detailed evidence on the effectiveness of regulation in the Vietnamese stock market. For such an emerging market that has been receiving increased attention in recent years, this issue has not been explored yet. Chang and Su (2010) examine the relationship between the Vietnamese stock market and the US, Japanese, Singapore, and Chinese stock markets. They find the Vietnamese stock market was influenced by the news from the Japanese and Singapore stock markets. Farber and Vuong (2004) use the method of cross-sectional standard deviation to find evidence of herd behavior in the Vietnamese stock market. Loc et al. (2010) test the market efficiency of the Vietnamese stock market. They use an autocorrelation test, a runs test, and a variance-ratio test and document that the Vietnamese stock market was not efficient in weak-form. This paper fills the gap by studying the liquidity and informed trading of the Vietnamese stock market and how the implementation of the MSS affects them.

[1] Source: State Securities Commission of Vietnam website (http://ssc.gov.vn).

[2] Liquidity reflects how quickly stock is traded without a significant impact on the price, while informed trading level measures the degree of information asymmetry among investors. Campbell et al. (1997) show that informed trading measured by information asymmetry cost means that some investors are better informed about a security's value than the market makers. Informed trading is also likely to be driven by illegal insider information that is under strict regulation. See, for example, Meulbroek (1992), Bhattacharya and Daouk (2002), Acharya and Johnson (2007), and Ahern (2017).

[3] Madhavan et al. (1997) propose a model to decompose the bid-ask spread into liquidity and information asymmetry components.

[4] We choose stocks listed at HOSE as our sample because HOSE is a more active exchange than the Hanoi Stock Exchange (HNX) in the Vietnamese stock market. Data from Thompson Reuters show that the average number of transactions per day in HOSE from 2009 to 2013 was 11,108 trades, compared with 5904 trades in HNX in the same period.

Second, we provide new and direct evidence on the impact of stock market surveillance. As one of the most fundamental regulatory components, surveillance performs a pivotal role in the whole regulatory framework (Domowitz, 2012).[5] In exploring the effects of secondary market regulation, most of the literature has focused on the introduction and enforcement of regulations, while there is relatively little research examining market surveillance. To the best of our knowledge, only a few papers have explored the effects of market surveillance. Using unique confidential surveillance data, Comerton-Forde and Rydge (2006)examine surveillance efforts at the Australian Stock Exchange and its impact on market integrity. They find that a process of continuous enhancement of surveillance effort enhances market integrity in areas of persistent and targeted surveillance effort. They also find evidence of a reduction in the incidence of traditional types of market manipulation as a result of targeted efforts to detect and reduce its incidence. Using survey data on surveillance characteristics from 25 exchanges, Cumming and Johan (2008) explore the relationship between market surveillance activities and market efficiency and trading activity proxied by trading velocity, listings, and market capitalization. They find that surveillance technology and information sharing facilitate market integrity and that cross-market surveillance is more effective than single-market surveillance. Later, Cumming et al. (2011) and Aitken et al. (2015) use the data from Cumming and Johan (2008) to examine the joint effect of detailed trading rules and surveillance. Cumming et al. (2011) find that surveillance improves market liquidity, while Aitken et al. (2015) document that more detailed exchange trading rules and surveillance over time reduce the number of suspected insider trading cases. Different from those studies that show the surveillance efforts are most effective, we find that the aggregate market quality of the Vietnamese stock market does not improve after the MSS implementation and thus provide new evidence on the effectiveness of market surveillance.

Our results also contribute to the literature by documenting the complications of financial market regulation in an emerging market. Our research shows that, in the Vietnamese stock market, the MSS does not improve the aggregate market quality, but the policy effects differ across firms. On the whole, our findings are consistent with prior studies that document the difficulties of implementing and enforcing new rules in emerging markets (e.g., Fernandes and Ferreira, 2009; Budsaratragoon et al., 2012; Christensen et al., 2016; Chen et al., 2017) and early work on the economics of regulation and the enforcement theory (e.g., Stigler, 1971; Posner, 1974; Becker, 1983; Djankov et al., 2003). Our findings demonstrate once again that secondary market regulation is a complicated issue. The mere introduction or enforcement of a single regulation rule can be unfruitful and it requires a series of complementary institutional and infrastructure reforms to make the regulation effective. Meanwhile, our study reveals that the effects of regulation are different not only among countries but also among firms within the same country. This highlights the need for more granular regulatory rules and enforcement targeting firm characteristics.

The rest of the paper is organized as follows. Section 2 describes the market quality measures used in the paper. Section 3 describes the historical background and data and reports the main empirical findings. Section 4 discusses the theoretical and policy implications of the main empirical results and tests if any other policy besides the MSS may have an impact on the market quality of the Vietnamese stock market. We do a robustness check in Section 5. Section 6 concludes.

2. Market quality measures

2.1. Liquidity measures

We employ the liquidity measures that are widely used in the literature. The measures we use include bid-ask spread, the Amihud illiquidity measure, turnover ratio, and the Pastor and Stambaugh (2003) measure. To study how the MSS affects liquidity, we calculate the liquidity measures in one year or six months around March 2013 and study their differences before and after that. Since the quoted spread, effective spread, Amihud illiquidity measure, and turnover ratio are daily data, we use their means during each period in the empirical analysis.

2.1.1. Bid-ask spread

Bid-ask spread is widely used in the literature as a proxy of liquidity. For example, Chordia et al. (2008) and Chung and Hrazdil (2010) use the bid-ask spreads to investigate the relationship between liquidity and market efficiency. We consider two different types of the bid-ask spread: the quoted bid-ask spread and the effective bid-ask spread.

We first follow Lesmond (2005) to calculate the quoted bid-ask spread as the ratio of the difference between ask and bid prices on the midpoint of the quotes (mid quote).

$$QS_{i,t}^{k} = \frac{A_{i,t}^{k} - B_{i,t}^{k}}{Midquote_{i,t}^{k}}, \tag{1}$$

where $Midquote_{i,t}^{k} = \frac{A_{i,t}^{k} + B_{i,t}^{k}}{2}$, and $A_{i,t}^{k}(B_{i,t}^{k})$ is the best quoted ask (bid) price of kth transaction for stock i on day t. We also calculate the effective bid-ask spread, which is the measure of the round-trip transaction costs for an average-size order. The effective bid-ask spread

[5] For example, in April 2005, the US Securities and Exchange Commission (SEC) charged the New York Stock Exchange (NYSE) with failing to police specialists. The SEC pointed out the NYSE surveillance efforts were inadequate in detecting, investigating, and disciplining specialist behavior. In settling this action, the NYSE consented to undertake several significant remedial measures, including enhancing its surveillance efforts. In March 2020, when the SEC approved the rule change to facilitate NYSE electronic auctions in response to COVID-19, information about surveillance procedures associated with these modifications was required to be provided at the same time.

is the absolute value of the difference between the actual trade price and the midpoint of the market quotes (bid and ask quotes), divided by the midpoint.

$$ES_{i,t}^{k} = \frac{\left|P_{i,t}^{k} - Midquote_{i,t}^{k}\right|}{Midquote_{i,t}^{k}}, \tag{2}$$

where $P_{i,t}^{k}$ is the price of the kth transaction for stock i on day t. We calculate the daily quoted and effective spreads using their averages within a day. That is to say, $QS_{i,t} = \frac{1}{N_{it}}\sum_{k=1}^{N_{it}} QS_{i,t}^{k}$ and $ES_{i,t} = \frac{1}{N_{it}}\sum_{k=1}^{N_{it}} ES_{i,t}^{k}$, where N_{it} is the number of transactions for stock i on day t. We then calculate the average quoted and effective spreads for a stock during a period (one year or six months before and after March 2013) using the following formula:

$$QS_{iy} = \frac{1}{D_{iy}}\sum_{t=1}^{D_{iy}} QS_{iy,t}, \tag{3}$$

$$ES_{iy} = \frac{1}{D_{iy}}\sum_{t=1}^{D_{iy}} ES_{iy,t}, \tag{4}$$

where D_{iy} is the number of trading days for stock i in period y. $QS_{iy,\,t}$ and $ES_{iy,\,t}$ are the daily quoted and effective spreads of stock i on day t of period y, respectively. Both the quoted spread and effective spread reveal the overall trading cost that the investors incur, although they have their different ways to process the bid and ask prices. A higher spread is associated with a lower degree of market quality. Therefore, we should expect a decrease in the spreads after the implementation of the MSS if the system is effective.

2.1.2. Amihud illiquidity measure

The Amihud illiquidity measure is the daily ratio of absolute stock return to dollar volume (Amihud, 2002). For the Vietnamese market, we use the Vietnamese dong (VND) instead of the US dollar to compute the volume in the currency. For each stock, we calculate the Amihud illiquidity using the average ratio of the daily absolute return to the VND trading volume on that day during a period. The formula for a stock's Amihud illiquidity is defined as follows:

$$ILLIQ_{iy} = \frac{1}{D_{iy}}\sum_{t=1}^{D_{iy}} \frac{\left|r_{iy,t}\right|}{VOLD_{iy,t}}, \tag{5}$$

where $r_{iy,\,t}$ is the return on stock i on day t of period y, $VOLD_{iy,\,t}$ is the corresponding daily trading volume in VND.

2.1.3. Turnover ratio

Following Lesmond (2005), we calculate the turnover ratio as follows:

$$Turnover_{iy} = \frac{1}{D_{iy}}\sum_{t=1}^{D_{iy}} \frac{Volume_{iy,t}}{Share_{iy,t}}, \tag{6}$$

where $Volume_{iy,\,t}$ is the number of shares traded in stock i on day t of period y, and $Share_{iy,\,t}$ is the corresponding number of outstanding shares.

2.1.4. Pastor-Stambaugh measure

Following Pastor and Stambaugh (2003), we calculate the Pastor-Stambaugh liquidity measure for stock i in period y using the following regression:

$$r_{iy,t+1}^{e} = \theta_{iy} + \phi_{iy} r_{iy,t} + \gamma_{iy} sign\left(r_{iy,t}^{e}\right) VOLD_{iy,t} + \varepsilon_{iy,t+1}, \tag{7}$$

where $r_{iy,\,t}^{e} = r_{iy,\,t} - r_{my,\,t}$, $sign(x)$ is an indicator function that equals 1 if x is positive, -1 if x is negative, and 0 otherwise. $r_{my,\,t}$ is the market return on the same day. γ_{iy} captures the reversal for a given volume (in VND) of stock i in period y, and it is used to measure the illiquidity. Pastor and Stambaugh (2003) show that the greater the reversal for a given volume (a more negative value of γ_{iy}), the lower the stock's liquidity.

2.2. Informed trading measures

We use the information asymmetry level as the measure of informed trading on the Vietnamese stock market. We estimate the information asymmetry level using the quasi-structural model of Madhavan et al. (1997) (the MRR model), which is one of the most

widely used market microstructure models.[6] The MRR model links the revision in the belief to innovations in order flows and public information shocks. The following is a general description of the model and the estimated parameters used as the proxy of informed trading.

Let μ_t be the expected stock value at time t. The revision in belief of μ_t is the sum of order flow innovation and new public information which is random,

$$\mu_t = \mu_{t-1} + \theta(x_t - \rho x_{t-1}) + \varepsilon_t. \tag{8}$$

In this equation, θ captures the impact of order flow innovation on the expected stock value and measures information asymmetry. ρ is the first-order autocorrelation of order flow and $x_t - \rho x_{t-1}$ captures the order flow innovation. x_t is an indicator variable for trade initiation. x_t equals 1 if the trade is buyer initiated, -1 if the trade is seller initiated, and 0 otherwise. Let λ denote the unconditional probability that the transaction occurs within the quoted spread, or $\lambda = Pr[x_t = 0]$, and assume that buys and sells are equally likely, then we have $E[x_t] = 0$ and $var[x_t] = (1 - \lambda)$.

The transaction price p_t could be written as the sum of expected stock value, liquidity cost and stochastic rounding errors,

$$p_t = \mu_t + \phi x_t + \xi_t, \tag{9}$$

where ϕ captures the liquidity impact and measures liquidity cost. The change of transaction price is then

$$\Delta p_t \equiv p_t - p_{t-1} = (\phi + \theta)x_t - (\phi + \rho\theta)x_{t-1} + \varepsilon_t + \xi_t - \xi_{t-1}. \tag{10}$$

Following Madhavan et al. (1997), we use the generalized method of moments (GMM) to estimate the model. The moment conditions are

$$E\begin{pmatrix} x_t x_{t-1} - x_{t-1}^2\rho \\ |x_t| - (1-\lambda) \\ z_t - \alpha \\ (z_t - \alpha)x_t \\ (z_t - \alpha)x_{t-1} \end{pmatrix} = 0,$$

where $z_t = \varepsilon_t + \xi_t - \xi_{t-1}$. The estimated parameters include θ (the information asymmetry), ϕ (the liquidity cost), λ (the probability a transaction takes place inside the spread), and ρ (the autocorrelation of the order flow).

While using θ as the main proxy for informed trading level in our study, we also calculate the proportion of the spread that is attributed to information asymmetry, π, as follows:

$$\pi = \frac{\theta}{(\phi + \theta)}. \tag{11}$$

A decrease in this ratio means that the proportion of information asymmetry in the bid-ask spread becomes lower. It, thus, means a reduction of the probability of informed trading in the market. We use this as another measure of informed trading in addition to the information asymmetry level.

3. Data and empirical results

3.1. Historical background and data

The Vietnamese stock market started to operate in July 2000. The Ho Chi Minh City Securities Trading Center officially executed its first trading session on 28 July 2000, with two stock codes listed. In 2007, the trading center was renamed and upgraded to the Ho Chi Minh Stock Exchange (HOSE). The Vietnamese stock market has grown over time. Its market capitalization, main indices (VNI, HNXI, and VNIAS), and foreign investment have increased remarkably in recent years and have come to the attention of international markets. For example, the Vietnamese stock market indices are being watched at MSCI (a provider of critical decision-support tools and services for the global investment community) and FTSE Russell (a British provider of stock market indices and associated data services, wholly owned by the London Stock Exchange and operated from premises in Canary Wharf). In June 2018, FTSE put the Vietnamese market on the watch list for possible reclassification to a second-tier emerging market.

To ensure a fair playing field and encourage the stable and sustainable development of the Vietnamese stock market, the Vietnam government has been introducing laws to regulate the secondary market since 2006. The Securities Law No. 70/2006/QH11 10 dated 29 June 2006 (Security Law 2006) was the first law to regulate participants and activities related to the stock market. It specifies that the Ministry of Finance (MOF) is responsible for legislating securities laws and regulations, while the State Securities Commission (SSC) supervises financial institutions and market participants and is empowered to inspect, monitor, and execute violations in securities activities. The Security Law 2006 prohibits insiders from trading on private or price-sensitive information and providing such

[6] Examples of using the MRR model include Frijns et al. (2008); He et al. (2009a); He et al. (2009b); and Frijns et al. (2013).

Table 1
Descriptive statistics.

	Full sample	One-year window		Six-month window	
		Pre-change	*Post-change*	*Pre-change*	*Post-change*
Average price (VND)					
Mean	18,382	17,299	19,540	16,417	18,643
Std Dev	18,001	16,084	20,314	16,994	20,897
Max	156,950	139,142	170,916	157,021	197,680
Min	2752	2677	2243	2399	1708
Average trades per day (trades)					
Mean	52.14	46.63	57.19	39.62	45.40
Std Dev	70.05	62.79	82.11	58.17	70.63
Max	501.96	429.39	576.39	470.38	408.66
Min	2.23	2.32	2.14	1.46	1.86
Average volume per trade (shares)					
Mean	3314	3002	3581	3014	4044
Std Dev	4088	2915	7023	3540	13,278
Max	49,128	20,008	101,620	28,290	199,067
Min	151	27	244	12	199
Volatility in daily return (%)					
Mean	2.65	2.69	2.55	2.52	2.57
Std Dev	0.62	0.58	0.85	0.70	0.98
Max	4.68	5.62	5.56	5.66	5.57
Min	1.29	1.52	0.94	1.12	0.55
N	270	270	270	270	270

This table presents the statistics of the full sample and the one-year and six-month windows around the market surveillance system (MSS) implemented in the Vietnamese stock market on 19 March 2013. The full sample contains data of 270 firms in our sample from 1 March 2012 to 31 March 2014. Pre-change and post-change are the periods before and after the MSS event, respectively. We exclude the data for March 2013 when analyzing the two windows. *Average price* is the mean daily price of the stocks traded in the market. *Average trades per day* is the number of trades that occur in one trading day in each window. *Average volume per trade* is the number of shares that are executed in one transaction. Finally, *Volatility in daily return* is the standard deviation of daily stock returns. The figures reported in this table are the cross-sectional summary statistics.

information to a third party, or making the trades through other individuals and organizations. Circular 2007, along with its amendments Circular 2010 and Circular 2012, also provides the regulations for insider trading disclosures.

The SSC has also been trying to regulate market manipulation. In 2010, the Vietnam SSC prosecuted the nation's first share-price manipulation case, sending a clear message that any stock price manipulation will be punished strictly. The Criminal Code of 2015 considers secondary market manipulation as a crime if a person deliberately commits manipulating acts and earns a profit of over VND 500mil (US$22,500) or causes a loss to investors of over VND 1bil. (US$ 45,000).

To collect necessary data for overseeing trading activities and enforcing secondary market regulation, the SSC launched a market surveillance system (MSS) in the Vietnamese stock market on 19 March 2013. This event marks a new development stage of transparency improvement at the Vietnamese stock market by strengthening regulation and supervision capacity over trading activities. Before the MSS implementation, the surveillance duties, from detecting an abnormal transaction, analyzing it, to applying a punishment if applicable, were completely manual. The surveillance results, therefore, mostly depended on the supervisors' experience on the relevant laws and subjects. Thanks to the technical functions of the MSS described earlier, regulators can quickly collect information on daily transactions and correctly detect an abnormal transaction. This helps prevent not only the current insider trading problem but also stock price manipulation and information disclosure violations. The percentage of administrative sanctions against violations related to abnormal trading increased from 28.37% during 2010–2012 to 43.85% during 2014–2016 in the Vietnamese stock market.[7]

To study how the MSS affects the market quality, we collect a sample covering data of HOSE from 1 March 2012 to 31 March 2014. We include all stocks listed on the HOSE, but exclude the new firms which are listed on the exchange after the MSS event. To study the event carefully, we examine two different windows around it. Specifically, we examine the liquidity and informed trading levels in the six-month or one-year periods before and after the MSS. Therefore, we split the sample into pre-change and post-change samples using the cut-off point of 19 March 2013. To control the possible short-term impact of the MSS event, we also exclude the data for March 2013 in our analysis. For example, some market participants might anticipate the implementation of the MSS and react before the event. After the implementation, it might also take several days for the market to adopt the new policy fully.

We collect intraday information from the Thompson Reuters Tick History (TRTH) database available from SIRCA. The TRTH dataset provides the limit order book and transaction information of all stocks on the HOSE during the sample period. We collect the number of outstanding shares, market capitalization, and price/earnings (PE) ratio of each firm from the Bloomberg terminal. We have a sample of 274 stocks. However, since we need at least six months transaction data before and after the MSS event to run our empirical

[7] Data source: the State Securities Commission of Vietnam.

Table 2
Market liquidity measures.

	Mean			*p*-value
	Pre-change	*Post-change*	*Difference*	pair-matched
	(1)	*(2)*	*(3 = 2–1)*	***t*-test**
Six-month window ($N = 270$)				
Turnover ratio (%)	0.27	0.37	0.10	0.44
Amihud illiquidity measure ($\times 10^{-2}$)	2.12	2.53	0.41	0.18
Quote spread (%)	2.43	2.60	0.17	0.00
Effective spread (%)	1.20	1.27	0.07	0.02
Pastor-Stambaugh measure ($\times 10^{-7}$)	4.61	0.73	−3.89	0.15
One-year window ($N = 270$)				
Turnover ratio (%)	0.32	0.46	0.14	0.05
Amihud illiquidity measure ($\times 10^{-2}$)	1.47	1.90	0.43	0.08
Quote spread (%)	2.23	2.40	0.17	0.00
Effective spread (%)	1.11	1.17	0.06	0.02
Pastor-Stambaugh measure ($\times 10^{-7}$)	1.66	0.39	−1.27	0.09

Whole sample ($N = 270$)				
	Mean	*Std dev*	*Maximum*	*Minimum*
Turnover ratio (%)	0.40	0.79	9.49	0.01
Amihud illiquidity measure ($\times 10^{-2}$)	1.69	3.89	37.68	0.00
Quote spread (%)	2.32	1.21	5.57	0.29
Effective spread (%)	1.14	0.58	2.81	0.17
Pastor-Stambaugh measure ($\times 10^{-7}$)	0.40	0.99	9.85	0.00

This table reports the summary statistics of liquidity measures. The calculations of these measures are explained in Section 3.1. We report the cross-sectional mean of each measure during different periods. Pre-change and post-change are the periods before and after the MSS event, respectively. We apply a pair-matched *t*-test to test the significance of the mean differences. The sample size is 270.This table reports the summary statistics of liquidity measures. The calculations of these measures are explained in Section 3.1. We report the cross-sectional mean of each measure during different periods. Pre-change and post-change are the periods before and after the MSS event, respectively. We apply a pair-matched *t*-test to test the significance of the mean differences. The sample size is 270.

analysis, we exclude four firms that had their initial public offerings (IPOs) less than six months before the MSS and use the remaining 270 stocks in our empirical analysis.

We first clean the data by excluding the observations with bid quotes greater than ask quotes, and replacing missing bid or ask quotes with the last available non-missing quotes. To determine the trade initiation direction, we follow Madhavan et al. (1997) and apply Lee and Ready (1991) using the order book and transaction information. Specifically, we use the tick test method to define trade initiation. A transaction is defined as a buyer initiation (x_t equals 1) if the transaction price is higher than the previous price, or as a seller initiation (x_t equal to −1) if the transaction price is lower than the last price. A trade initiation is zero when its transaction price equals the midpoint of the bid-ask spread.

Table 1 reports the summary statistics of the data sample used in our analysis. We report the average stock price, average trading frequency per day, average volume per transaction, and the standard deviation of daily returns. For the whole sample, the number of trades per day averages at 52.14 deals, suggesting that the Vietnamese stock market is still a thin-trading market.[8]

We also observe an increase in trading activity after the implementation of the MSS. Most of the trading frequency measures (average trades per day and average volume per trade) increase after the launch of the system both in the six-month and one-year windows. For instance, the average trades per day increase from 39.62 to 45.40 in the six-month window, and rise from 46.63 to 57.19 in the one-year window. This result shows that the Vietnamese stock market becomes more active after the MSS event. Meanwhile, the standard deviation of daily returns shows a limited difference before and after the MSS implementation.

3.2. The market quality measures around the MSS: Full sample analysis

In this section, we investigate whether the MSS helps to improve the liquidity and reduce the informed trading level using the whole data sample. This analysis provides an overall evaluation of the MSS's effectiveness.

Table 2 reports the results of liquidity measures before and after the MSS implementation. We report the mean of liquidity measures before and after the event and the differences between these two periods. The last column indicates the *p*-value of the pair-matched *t*-test for the difference. At first sight, we find that the bid-ask spreads on the Vietnamese stock market are much higher than those on the US market reported in Chung and Chuwonganant (2012), which reflects the high transaction cost of an emerging market.

We find a significant increase in bid-ask spreads after the MSS event. In the six-month window, the quoted spread changes from

[8] Madhavan et al. (1997) report the number of 95 daily transactions on the NYSE.

Table 3
Parameter estimates of the MRR model.

	Full sample	One-year window			Six-month window		
		Pre-change	*Post-change*	*Difference*	*Pre-change*	*Post-change*	*Difference*
		(1)	*(2)*	*(3 = 2–1)*	*(4)*	*(5)*	*(6 = 5–4)*
Information asymmetry (θ)							
Mean	0.3283	0.3605	0.3405	−0.0200	0.4196	0.4363	0.0167
Std.error	0.0170	0.0175	0.0208		0.0316	0.0353	
Std.dev	0.2791	0.2881	0.3415		0.5188	0.5806	
Median	0.2730	0.3118	0.2556		0.3082	0.2791	
Order-processing and inventory costs (ϕ)							
Mean	0.5077	0.5188	0.5263	0.0075	0.5806	0.6152	0.0346
Std.error	0.0198	0.0193	0.0239		0.0279	0.0343	
Std.dev	0.3252	0.3173	0.3932		0.4577	0.5630	
Median	0.4442	0.4670	0.4246		0.5513	0.4990	
Probability of trade within the quotes (λ)							
Mean	0.1053	0.1342	0.0851	−0.0491***	0.1295	0.1011	−0.0284***
Std.error	0.0038	0.0041	0.0044		0.0050	0.0057	
Std.dev	0.0624	0.0678	0.0717		0.0818	0.0941	
Median	0.0952	0.1246	0.0712		0.1096	0.0857	
First-order autocorrelation in order flow (ρ)							
Mean	0.1896	0.1897	0.1818	−0.0079*	0.1781	0.1615	−0.0166***
Std.error	0.0066	0.0064	0.0075		0.0075	0.0080	
Std.dev	0.1080	0.1046	0.1226		0.1239	0.1307	
Median	0.1702	0.1776	0.1598		0.1681	0.1440	
Proportion of information asymmetry cost (π)							
Mean	0.3729	0.4003	0.3565	−0.0438***	0.3874	0.3729	−0.0145
Std.error	0.0085	0.1426	0.1625		0.0120	0.0143	
Std.dev	0.1399	0.0087	0.0099		0.1968	0.2349	
Median	0.3956	0.4177	0.3707		0.3878	0.3747	
N	270	270	270	270	270	270	270

This table reports the summary statistics of the parameter estimates in Eq. (10) for the full sample in both one-year and six-month windows. *Mean* is the simple average of the parameters of the stocks in the full sample in each window. We also report the standard error (*Std.error*), standard deviation (*Std.dev*), and the median of each parameter. The full sample contains data of 270 firms in our sample from 1 March 2012 to 31 March 2014. All data for March 2013 are excluded from the estimation in the two windows. Pre-change and post-change are the periods before and after the MSS event, respectively. The difference in the means between the post-change and pre-change periods is tested by the pair-matched *t*-test. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

2.43% to 2.60%. The difference is 0.17% and significant at the 1% level. The effective spread increases by 0.07%, which is also significant at the 5% level. The results of the one-year window are similar. Also, the increase in the Amihud measure in the one-year window is significant at the 10% level. These findings imply that the Vietnamese stock market becomes less liquid after the MMS implementation.

We then use the MRR model to estimate the information asymmetry level for each firm in each window and report the results in Table 3. In Table 3, we report the cross-sectional mean of information asymmetry level θ, order-processing and inventory cost ϕ (liquidity cost), probability of trade within the quotes λ, first-autocorrelation in order flow ρ, and proportion of information asymmetry in the bid-ask spread π. We focus on information asymmetry θ and the proportion of information asymmetry π. They are used as measures of informed trading levels in our study.

In Table 3, we find there is no significant change in the informed trading level after the MSS implementation. In the one-year window, the mean θs before and after the MSS are 0.3605 and 0.3405 respectively, giving a difference of −0.02 with a *p*-value of 0.17. Only π significantly decreases in the one-year window. In the six-month window, both θ and π have insignificant changes. Overall, we fail to find consistent evidence that the informed trading level of the Vietnamese stock market reduces after the MSS event.

The full sample analysis shows that the market liquidity on the HOSE becomes worse after the MSS implementation. Moreover, there is no clear evidence to state that the informed trading level reduced. We then turn to subsample analysis to investigate whether the impact of the MSS is different among the firms with different characteristics.

3.3. Firm characteristics and impact heterogeneity

3.3.1. Univariate analysis

So far, we have shown that the introduction of the MSS is associated with a decline in market quality. Another issue of interest is whether the effect of the MSS varies across all firms in the market. To understand more about the impact of the MSS, we next carry out several sets of subsample analyses to explore the differential effects of MSS along with firm characteristics.

The first dimension we examine is firm size. Since large firms are more likely to receive regulatory attention and are usually

Table 4
Liquidity and informed trading level for large and small firms.

Panel A. Sample results

	One-year window			Six-month window		
	Pre-change	*Post-change*	*Difference*	*Pre-change*	*Post-change*	*Difference*
	(1)	*(2)*	*(3 = 2–1)*	*(4)*	*(5)*	*(6 = 5–4)*
Large firms ($N = 90$)						
(i) Turnover ratio (%)	0.26	0.54	0.28	0.19	0.60	0.41
(ii) Amihud illiquidity measure ($\times 10^{-2}$)	0.35	0.26	−0.10*	0.55	0.36	−0.19*
(iii) Quote spread (%)	1.57	1.50	−0.07	1.78	1.71	−0.07
(iv) Effective spread (%)	0.80	0.75	−0.05	0.90	0.87	−0.03
(v) Pastor-Stambaugh measure ($\times 10^{-7}$)	0.19	0.11	−0.08**	0.30	0.18	−0.12
(vi) Information asymmetry cost IAC (θ)	0.24	0.19	−0.05***	0.28	0.27	−0.02
(vii) Proportion of IAC (π)	0.41	0.33	−0.08***	0.39	0.37	−0.02**
Small firms ($N = 90$)						
(i) Turnover ratio (%)	0.33	0.37	0.03	0.25	0.21	−0.04
(ii) Amihud illiquidity measure ($\times 10^{-2}$)	2.98	3.89	0.91	4.43	5.36	0.93
(iii) Quote spread (%)	2.72	3.17	0.45***	3.08	3.43	0.35***
(iv) Effective spread (%)	1.34	1.54	0.20***	1.51	1.68	0.17***
(v) Pastor-Stambaugh measure ($\times 10^{-7}$)	4.03	0.57	−3.46	11.84	1.09	−10.75
(vi) Information asymmetry cost IAC (θ)	0.45	0.46	0.01	0.59	0.67	0.08
(vii) Proportion of IAC (π)	0.39	0.37	−0.02	0.39	0.40	0.01

Panel B. Regression Analysis

$Y_{i,t} = \beta_0 + \beta_1 AfterMSS_t + \beta_2 LargeFirm_i + \beta_{inter} AfterMSS_t \times LargeFirm_i + \varepsilon_{i,t}$

	One-year window					Six-month window				
	β_1	β_2	β_{inter}	R^2	N	β_1	β_2	β_{inter}	R^2	N
(i) Turnover ratio (%)	0.03	−0.08	0.25	0.01	360	−0.04	−0.06	0.45	0.01	360
(ii) Amihud illiquidity measure ($\times 10^{-2}$)	0.90	−2.63***	−1.00	0.11	360	0.92	−3.88***	−1.11	0.12	360
(iii) Quote spread (%)	0.45***	−1.15***	−0.52**	0.32	360	0.35*	−1.29***	−0.42	0.26	360
(iv) Effective spread (%)	0.20***	−0.53***	−0.26**	0.30	360	0.17*	−0.61***	−0.21	0.23	360
(v) Pastor-Stambaugh measure ($\times 10^{-7}$)	−3.35**	−3.85***	3.39	0.02	360	−10.75*	−11.54**	10.63	0.02	360
(vi) Information asymmetry cost IAC (θ)	−0.01	−0.21***	−0.06	0.15	360	0.08	−0.31***	−0.10	0.08	360
(vii) Proportion of IAC (π)	−0.02	0.02	−0.06*	0.03	360	0.01	0.01	−0.03	0.00	360

This table reports the liquidity and informed trading measures for large and small firms around the MSS implementation. Large (small) firms are defined by firms on the top (bottom) 33% of the sample firms sorted by their average market capitalization measured in the one-year or six-month period before the MSS introduction date. Panel A reports the univariate analysis results, which show the mean of liquidity or informed trading measures before (pre-change) and after (post-change) the MSS implementation, followed by the pair-match *t*-test for their difference. Panel B reports the result of the regression analysis that tests whether the effect of MSS on market quality measures significantly varies between large and small firms. The sample size is 270 firms. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

associated with better governance, we expect that the revealed market quality decline following the MSS implementation is less likely to be contributed by large firms. To test this hypothesis, we evenly sort all sample firms into three groups according to the 33% and 66% percentile values of average market capitalization measured in one year or six months before the introduction of MSS. Using the sorting variable (i.e., firm size) before the introduction of MSS ensures that the sample sorting is not endogenously biased by any factors related to MSS. The difference in the change of market quality measures between firms in the top tercile (large firms) and those in the bottom tercile (small firms) would capture whether and how the effect of MSS varies by firm size.[9]

Panel A of Table 4 presents the mean of each quality measure. The left and right columns indicate the results of the one-year and six-month window, respectively. We find some moderate evidence that the liquidity of large firms improves after the MSS event. In contrast, the liquidity of small firms becomes significantly worse. For instance, in the one-year window, the change of the Pastor-Stambaugh measure around the MSS event for large firms is -0.08×10^{-7} and statistically significant at the 5% level. Meanwhile, the quoted spread and effective spread of small firms increase by 0.45% and 0.20%, respectively, during the one-year window around the MSS event. The differences are significant at the 1% level.

We also observe a significant decrease in the information asymmetry measure for large firms. For example, θ and π drop by 0.05 and 0.08, respectively, during the one-year window. Both of these changes are significant at the 1% level. The impact of the MSS on the information asymmetry of small firms is much weaker. The results of the six-month window are weaker but similar. In summary, we find that the MSS event negatively affects the liquidity of small firms, but positively reduces the information asymmetry of large firms.

Next, we use the regression approach to do the analysis in a more rigorous manner. The regression model is specified as:

[9] In the robustness test section, we also use the 20% and 80% percentile values.

Table 5
Liquidity and informed trading level for high- and low-trading-frequency firms.

Panel A. Sample results

	One-year window			Six-month window		
	Pre-change	*Post-change*	*Difference*	*Pre-change*	*Post-change*	*Difference*
	(1)	*(2)*	*(3 = 2–1)*	*(4)*	*(5)*	*(6 = 5–4)*
High-trading-frequency firms ($N = 90$)						
(i) Turnover ratio (%)	0.68	1.00	0.31	0.63	0.91	0.28
(ii) Amihud illiquidity measure ($\times 10^{-2}$)	0.00	0.01	0.01*	0.00	0.01	0.01
(iii) Quote spread (%)	1.14	1.20	0.06	1.20	1.29	0.09*
(iv) Effective spread (%)	0.61	0.63	0.02	0.63	0.69	0.06
(v) Pastor-Stambaugh measure ($\times 10^{-7}$)	0.10	0.06	−0.04***	0.08	0.08	0.00
(vi) Information asymmetry cost IAC (θ)	0.12	0.08	−0.04***	0.12	0.14	0.02
(vii) Proportion of IAC (π)	0.33	0.23	−0.10***	0.32	0.27	−0.05***
Low-trading-frequency firms ($N = 90$)						
(i) Turnover ratio (%)	0.07	0.10	0.03*	0.05	0.08	0.03
(ii) Amihud illiquidity measure ($\times 10^{-2}$)	3.76	4.04	0.28	5.54	5.98	0.44
(iii) Quote spread (%)	3.33	3.67	0.34***	3.67	3.91	0.24*
(iv) Effective spread (%)	1.63	1.74	0.11**	1.79	1.88	0.09
(v) Pastor-Stambaugh measure ($\times 10^{-7}$)	4.40	0.78	−3.62	12.98	1.48	−11.50
(vi) Information asymmetry cost IAC (θ)	0.62	0.63	0.01	0.78	0.80	0.02
(vii) Proportion of IAC (π)	0.44	0.45	0.01	0.46	0.47	0.01

Panel B. Regression Analysis
$Y_{i,\,t} = \beta_0 + \beta_1 AfterMSS_t + \beta_2 HighFrequency_i + \beta_{inter} AfterMSS_t \times HighFrequency_i + \varepsilon_{i,\,t}$

	One-year window					Six-month window				
	β_1	β_2	β_{inter}	R^2	N	β_1	β_2	β_{inter}	R^2	N
(i) Turnover ratio (%)	0.03	0.61***	0.28	0.11	360	0.03	0.58**	0.25	0.04	360
(ii) Amihud illiquidity measure ($\times 10^{-2}$)	0.28	−3.76***	−0.27	0.19	360	0.44	−5.53***	−0.44	0.19	360
(iii) Quote spread (%)	0.33***	−2.19***	−0.27	0.66	360	0.24*	−2.46***	−0.15	0.59	360
(iv) Effective spread (%)	0.11*	−1.02***	−0.09	0.60	360	0.09	−1.16***	−0.03	0.52	360
(v) Pastor-Stambaugh measure ($\times 10^{-7}$)	−3.62**	−4.30***	3.59	0.03	360	−11.49**	−12.90**	11.50	0.02	360
(vi) Information asymmetry cost IAC (θ)	0.01	−0.49***	−0.05	0.51	360	0.01	−0.66***	0.01	0.25	360
(vii) Proportion of IAC (π)	0.01	−0.11***	−0.11***	0.30	360	0.01	−0.14***	−0.07	0.13	360

This table reports the liquidity and informed trading measures for high- and low-trading-frequency firms around the MSS. High- (low-) trading-frequency firms are firms on the top (bottom) 33% of the sample firms sorted by their average number of transactions executed per day in the one-year or six-month period before the MSS introduction date. Panel A reports the univariate analysis result, which shows the mean of liquidity or informed trading measures before (pre-change) and after (post-change) the MSS implementation, followed by the pair-match *t*-test for their difference. Panel B reports the regression analysis that tests whether the effect of MSS on market quality measures significantly varies between high- and low- trading-frequency firms.The sample size is 270. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

$$Y_{i,t} = \beta_0 + \beta_1 AfterMSS_t + \beta_2 LargeFirm_i + \beta_{inter} AfterMSS_t \times LargeFirm_i + \varepsilon_{i,t}, \tag{12}$$

where $Y_{i,\,t}$ denotes one of the market quality measures. $AfterMSS_t$ is a dummy variable that takes a value of 1 for the time after the introduction of MSS and 0 otherwise. $LargeFirm_i$ is a dummy that equals 1 for firms in the top tercile of the sample sorted by average market cap measured in the one year or six months before the introduction of MSS and equals 0 for firms in the bottom tercile. Like the univariate analysis, the regression analysis does not consider firms assigned to the middle tercile. The coefficient of interest β_{inter} captures the change of the market quality measure between large and small firms around the introduction of MSS.

Table 4, Panel B reports the regression results. In the one-year event window, we find that large firms and small firms feature a significant difference in terms of the change in market quality measures. In particular, the estimated β_{inter} of quoted spread and effective spread of −0.52 and − 0.26 are both statistically significant at the 5% level. These results suggest that the impact of the MSS event on the liquidity of large firms is significantly weaker than that of small firms, which is consistent with the results in Panel A.

Table 5 reports the results for firms sorted by trading frequency. We evenly sort all sample firms into three groups according to the 33% and 66% percentile values of the average number of transactions executed per day in one year or six months before the MSS implementation. The analysis in Panel A indicates that the impact of the MSS event on the liquidity of firms with different trading frequency is inconclusive. For example, for the high-trading-frequency firms, the Pastor-Stambaugh measure drops by -0.04×10^{-7} in the one-year window, while the Amihud measure increases by 0.01. We also find mixed results for the low-trading-frequency firms. Their quoted spread and effective spread increase by 0.34% and 0.11%, respectively, during the one-year window, while their Pastor-Stambaugh measure drops by 3.62×10^{-7}. These results also reflect that liquidity is hard to define, and a different liquidity measure captures a different aspect of liquidity.

On the other hand, we find that the level of informed trading of the high-trading-frequency firms becomes significantly smaller after the MSS event, but this tendency does not apply for low-trading-frequency firms. For example, the changes in θ and π during the one-

Table 6
Liquidity and informed trading level for high- and low-turnover-ratio firms.

Panel A. Sample results

	One-year window			Six-month window		
	Pre-change	*Post-change*	*Difference*	*Pre-change*	*Post-change*	*Difference*
	(1)	*(2)*	*(3 = 2–1)*	*(4)*	*(5)*	*(6 = 5–4)*
High-turnover-ratio ($N = 90$)						
(i) Turnover ratio (%)	0.77	1.08	0.30	0.69	0.93	0.24
(ii) Amihud illiquidity measure ($\times 10^{-2}$)	0.10	0.50	0.40*	0.19	0.65	0.45
(iii) Quote spread (%)	1.47	1.69	0.21***	1.63	1.82	0.20***
(iv) Effective spread (%)	0.76	0.86	0.10***	0.83	0.94	0.11**
(v) Pastor-Stambaugh measure ($\times 10^{-7}$)	0.14	0.14	−0.01	0.11	0.19	0.08
(vi) Information asymmetry cost IAC (θ)	0.17	0.14	−0.03***	0.18	0.23	0.05
(vii) Proportion of IAC (π)	0.34	0.26	−0.08***	0.31	0.28	−0.02
Low-turnover-ratio ($N = 90$)						
(i) Turnover ratio (%)	0.04	0.08	0.04***	0.02	0.08	0.05***
(ii) Amihud illiquidity measure (%)	2.80	3.18	0.38	4.70	5.00	0.30
(iii) Quote spread (%)	2.78	2.92	0.14	3.27	3.27	0.00
(iv) Effective spread (%)	1.56	1.38	0.02	1.59	1.58	−0.01
(v) Pastor-Stambaugh measure ($\times 10^{-7}$)	4.32	0.71	−3.60	13.13	1.26	−11.87
(vi) Information asymmetry cost IAC (θ)	0.49	0.49	0.00	0.69	0.60	−0.09
(vii) Proportion of IAC (π)	0.43	0.42	−0.01	0.45	0.42	−0.03

Panel B. Regression Analysis

$$Y_{i,\,t} = \beta_0 + \beta_1 AfterMSS_t + \beta_2 HighTurnover_i + \beta_{inter} AfterMSS_t \times HighTurnover_i + \varepsilon_{i,\,t}$$

	One-year window					Six-month window				
	β_1	β_2	β_{inter}	R^2	N	β_1	β_2	β_{inter}	R^2	N
(i) Turnover ratio (%)	0.04	0.73***	0.26	0.15	360	0.05	0.67**	0.19	0.04	360
(ii) Amihud illiquidity measure ($\times 10^{-2}$)	0.38	−2.70***	0.02	0.10	360	0.31	−4.50***	0.14	0.11	360
(iii) Quote spread (%)	0.14	−1.30***	0.07	0.25	360	0.00	−1.64***	0.19	0.27	360
(iv) Effective spread (%)	0.03	−0.60***	0.07	0.21	360	−0.01	−0.76***	0.13	0.22	360
(v) Pastor-Stambaugh measure ($\times 10^{-7}$)	−3.60**	−4.18***	3.60	0.03	360	−11.87**	−12.95**	11.50	0.02	360
(vi) Information asymmetry cost IAC (θ)	0.00	−0.31***	−0.04	0.29	360	−0.08	−0.51***	0.14	0.16	360
(vii) Proportion of IAC (π)	−0.01	−0.09***	−0.07**	0.18	360	−0.02	−0.14***	0.00	0.11	360

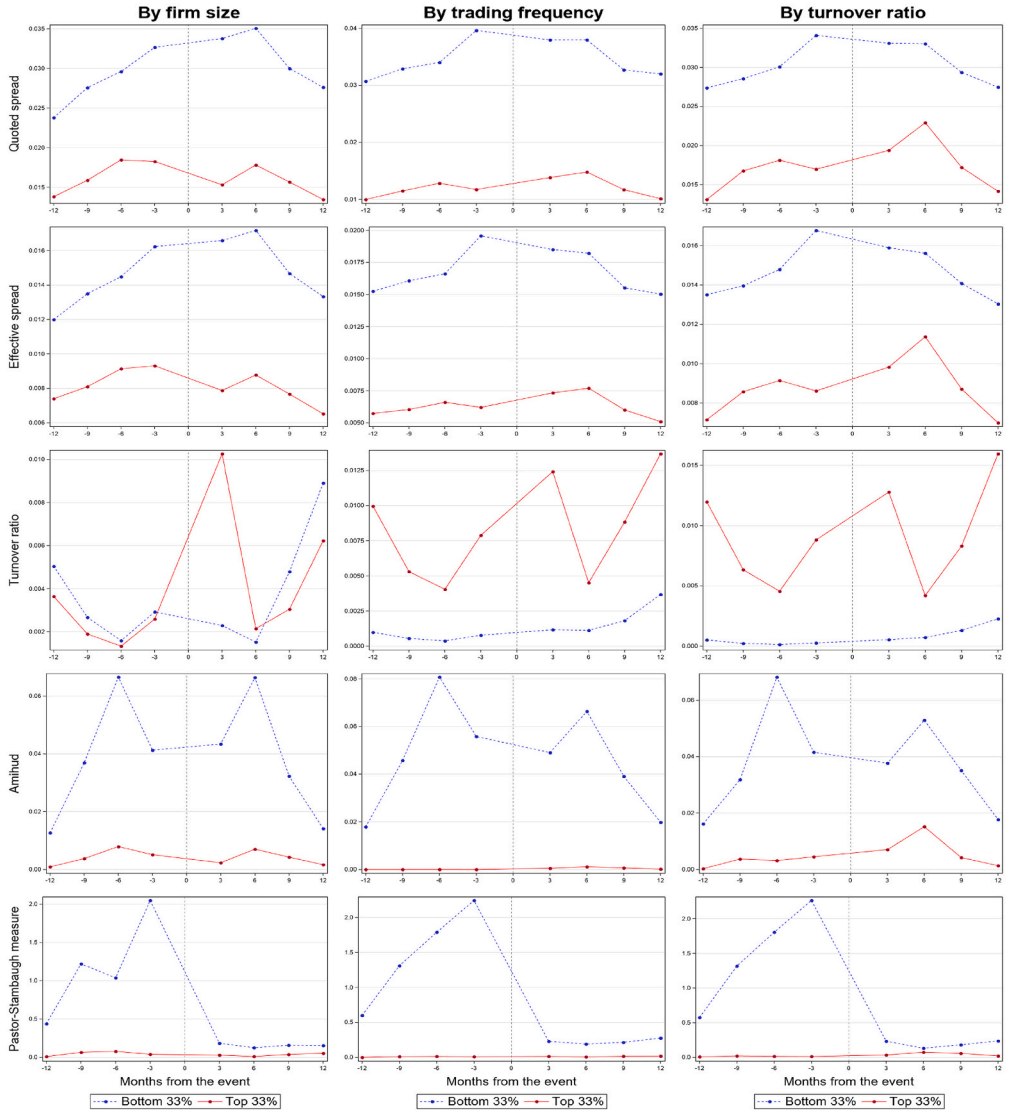
This table reports the liquidity and informed trading measures for high- and low-turnover-ratio firms around the MSS. High- (low-) turnover firms are firms on the top (bottom) 33% of the sample firms by their average stock turnover ratios measured in the one-year or six-month period before the MSS implementation. Panel A reports the univariate analysis result, which shows the mean of liquidity or informed trading measures before (pre-change) and after (post-change) the MSS introduction date, followed by the pair-match *t*-test for their difference. Panel B reports the result of the regression analysis that tests whether the effect of MSS on market quality measures significantly varies between high- and low-turnover firms. The sample size is 270. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

year window around the MSS event are −0.04 and − 0.10, respectively, and significant at the 1% level for high-trading frequency-firms, but are close to zero and insignificant for low-trading-frequency firms. The results of the six-month window are similar.

We also use a regression model to test whether the difference in the change of market quality measures is statistically significant between high-trading-frequency and low-trading-frequency firms. We adopt the same regression model as specified in Eq. (12) except that we replace the *LargeFirm* dummy with the *HighFrequency* dummy that marks the top tercile of firms sorted by the average number of transactions executed per day measured in one year or six months before the MSS implementation. In Table 5, Panel B, the results suggest that the change of liquidity is not significantly different between high-trading-frequency and low-trading-frequency firms. However, when it comes to informed trading, the MSS appears to reduce the information asymmetry more for high-trading-frequency firms. In summary, we find that the impact of the MSS on the liquidity of different trading frequency firms is inconclusive and that the MSS event mainly reduces the information asymmetry of high-trading-frequency firms.

Table 6 reports the results for the firms grouped by turnover ratio. We evenly sort all sample firms into three groups according to the 33% and 66% percentile values of the average daily turnover ratio in one year or six months before the MSS implementation. Similar to Tables 4 and 5, we report the sample mean in Panel A and run the regressions in Panel B. In Panel A, both high- and low-turnover firms demonstrate a decrease in the level of liquidity after the implementation of MSS across all liquidity measures, though the decrease for the low-turnover group is not statistically significant. To run the regression, we replace the *LargeFirm* dummy variable of Eq. (12) with the *HighTurnover* dummy that equals one for the firms in the top tercile of average daily turnover ratio measured in one year or six months before the MSS implementation. The regression analysis in Panel B indicates the difference in the change of liquidity between low-turnover firms and high-turnover firms is not statistically significant. In contrast, the high-turnover firms and low-turnover firms demonstrate a significant difference in terms of the change in the level of informed trading: the information asymmetry cost for high-turnover firms significantly declines following the introduction of MSS whereas that for low-turnover firms remains stable.

To graphically exhibit how the market quality measures of different firms change with the time, we plot the liquidity and informed



Informed trading

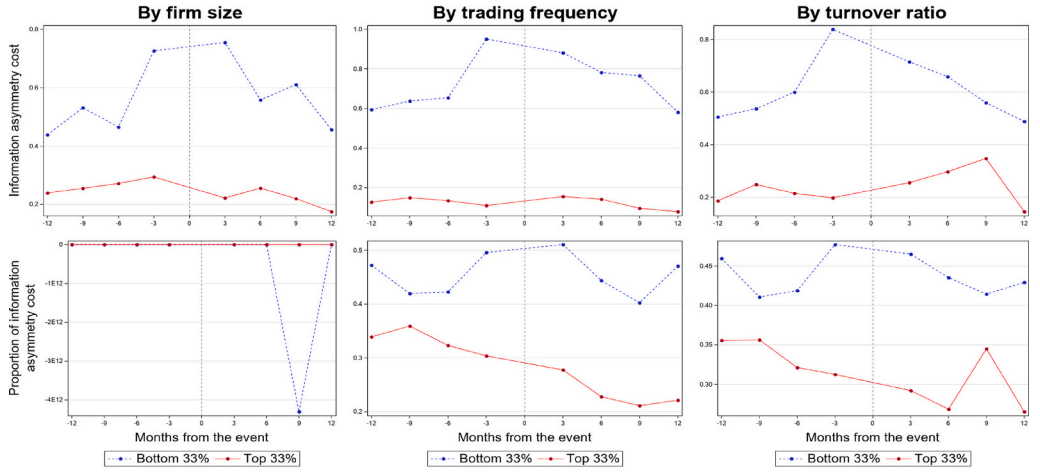


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Fig. 1. Liquidity and informed trading of top and bottom groups over time.
This figure plots the liquidity and informed trading measures of the top and bottom groups of sample firms sorted by each firm characteristics variable, including firm size, trading frequency, and turnover ratio. Each chart presents the cross-sectional average of liquidity and informed trading measures every three months during one year before until one year after the MSS event.

trading measures of the top and bottom groups in each quarter in Fig. 1. We plot one year before until one year after the MSS event. The left, middle, and right columns plot the results sorted by firm size, trading frequency, and turnover ratio, respectively.

The patterns are consistent with those results reported in Tables 4 to 6. For example, the quoted spreads of small firms increase more than large firms after the MSS event. This result is consistent with the findings in Table 4. The proportion of information asymmetry becomes smaller after the MSS event for high-trading-frequency firms. This pattern is also consistent with the results in Table 5.

3.3.2. Cross-sectional regression

In this section, we run cross-sectional regressions of market quality measure change on selected firm characteristics variables to further investigate the relationship between firm characteristics and the MSS impact. We consider six firm characteristics variables: firm size, trading frequency, turnover ratio, trading volume, P/E ratio, and the dummy variable for financial firms.

$$\begin{aligned}\Delta m_{i,t} = \alpha + \beta_1 ln(size)_{i,(t-1)} + \beta_2 ln(tradingfreq)_{i,(t-1)} + \beta_3 turnover_{i,(t-1)} \\ + \beta_4 ln(tradingvol)_{i,(t-1)} + \beta_5 PE_{i,(t-1)} + \beta_6 FINA_{i,(t-1)} + \varepsilon_{i,t},\end{aligned} \tag{13}$$

where Δm is the difference in the selected quality measure before and after the MSS implementation. *ln*(*size*), *ln*(*tradingfreq*), and *ln*(*tradingvol*) are the natural logarithms of firms' average market capitalization, average number of transactions executed per day, and daily trading volume. *turnover* is firms' turnover ratio. *PE* is the P/E ratio, and *FINA* is a dummy variable that equals 1 if the firm is a financial firm and 0 otherwise. We consider two event windows: one year and six months around the MSS event.

Table 7 reports the regression results. The left and right columns report the results of the one-year and six-month window, respectively.[10] We find a negative relationship between firm size and liquidity measure change. This relationship is significant and robust after controlling for other variables and in both periods. For example, in the six-month window, the coefficients of β_1 for the quoted and effective spread are both negative and significant at the 1% level when we use only *ln*(*size*) as the independent variable. They are negative and significant at the 5% level when we include other controlling variables. Since the MSS overall negatively affects the market liquidity of the Vietnamese stock market, these regression results suggest that the worsening effect of the MSS on liquidity is stronger for small firms.

We also document a negative relationship between the firm's trading frequency and liquidity measure change. The coefficients of β_2 in all full regressions are negative for the Amihud measure, quoted spread, effective spread, and the Pastor-Stambaugh measure, while it is positive for turnover ratio. These results, along with the evidence of an overall decline of market liquidity after the MSS implementation, show that low-trading-frequency firms are more negatively affected by the MSS.

The regression results of the information asymmetry measure θ are weaker than those of the liquidity measure. The coefficients of firm size and trading frequency are significantly negative during the six-month window when all variables are used in the regression. These results, along with the overall outcome of no significant impact of the MSS on the information asymmetry measure, show that large firms and high-trading-frequency firms tend to have an improved informed trading level at the Vietnamese stock market. These results are consistent with those reported in Tables 4–6.

4. Discussions

4.1. Theoretical discussions and policy implications

Our findings document the complexity of secondary stock market regulation in an emerging market. After the implementation of the MSS, the liquidity indicators of the Vietnamese stock market have deteriorated overall, especially for small firms. We offer two possible explanations to justify the decreased market liquidity after the introduction of the MSS. First, prior studies have shown that the liquidity impact of secondary stock market regulation may have two opposite effects. On the one hand, if informed trading does improve, the adverse selection problem of uninformed investors trading with an informed trader would reduce. Furthermore, this reduction will provide market participants with incentives to trade more actively. This will lead to improved market liquidity (Kyle, 1985; Bhattacharya and Spiegel, 1991; Easley and O'Hara, 2004). On the other hand, there is evidence that insiders tend to exhibit an abnormally high level of trading activity (Easley and O'Hara, 1987; Meulbroek, 1992). Insider trading restrictions will restrain them from conducting transactions for which the marginal benefits are lower than the increased marginal costs (Palan and Stöckl, 2017). The less-developed structure of the Vietnamese capital market means that a significant portion of market participants will be involved in trading activities that will be captured by the newly introduced surveillance system as abnormal or insider and subject to sanctions. Restraining these participants from the market means that the liquidity contributed by the participants would also be withdrawn, at least in the short run. This impact is stronger for the firms that are more likely to be affected by these restrictions, for example, small

[10] The regressions using *PE* as one independent variable have only 253 observations since there are 17 firms with missing information of earnings.

Table 7
Cross-sectional regression.

	One-year window									Six-month window								
Δm	α	β_1	β_2	β_3	β_4	β_5	β_6	R^2	N	α	β_1	β_2	β_3	β_4	β_5	β_6	R^2	N
	−0.09	0.02						0.00	270	−0.50	0.05						0.00	270
	−0.18		0.10*					0.01	270	−0.18		0.10					0.00	270
	0.11			5.09				0.00	270	0.09			2.29				0.00	270
ΔTurnover ratio	−0.31				0.04			0.00	270	−0.02				0.01			0.00	270
	0.11					0.00		0.00	253	0.11					−0.01		0.00	253
	0.14*						−0.01	0.00	270	0.14						−0.17	0.00	270
	1.31	−0.02	0.40***	−7.73	−0.19*	0.00	−0.09	0.03	253	1.62	0.02	0.58**	−5.50	−0.32*	−0.01	−0.29	0.02	253
	3.89*	−0.27*						0.01	270	4.03	−0.28						0.01	270
	0.46		−0.01					0.00	270	0.64		−0.08					0.00	270
	0.44			−3.60				0.00	270	0.45			−16.29				0.00	270
ΔAmihud illiquidity	−0.98				0.13			0.00	270	−1.05				0.14			0.00	270
measure	0.18					0.07		0.00	253	0.12					0.08		0.00	253
	0.45						−0.11	0.00	270	0.38						0.15	0.00	270
	−3.55	−0.65***	−1.14**	−126.19*	1.50***	0.04	−0.40	0.09	253	−4.99	−0.56**	−1.67***	−110.77	1.66***	0.06	−0.06	0.05	253
	1.65***	−0.11***						0.04	270	1.47***	−0.10***						0.03	270
	0.41***		−0.08*					0.01	270	0.32***		−0.06					0.01	270
	−0.12**			15.79				0.01	270	0.13**			14.00				0.01	270
ΔQuoted spread	0.57*				−0.04			0.01	270	0.10				0.01			0.00	270
	0.13**					0.03*		0.01	253	0.12**					0.02		0.01	253
	0.19***						−0.07	0.00	270	0.18***						−0.08	0.00	270
	0.36	−0.06	−0.27**	28.19	0.12	0.03*	0.03	0.08	253	−0.63	−0.10**	−0.46***	13.52	0.31***	0.02	−0.05	0.12	253
	0.80***	−0.06***						0.04	270	0.73***	−0.05***						0.02	270
	0.13*		−0.02					0.00	270	0.11		−0.01					0.00	270
	0.03			5.37				0.01	270	0.05			7.48				0.01	270
ΔEffective spread	0.16				−0.01			0.00	270	−0.03				0.01			0.00	270
	0.02					0.02**		0.02	253	0.03					0.01**		0.01	253
	0.06**						−0.01	0.00	270	0.08**						−0.02	0.00	270
	0.27	−0.04*	−0.10*	8.41	0.06	0.02**	0.01	0.07	253	−0.21	−0.06**	−0.19***	2.82	0.15***	0.01*	−0.03	0.11	253
	−1.32**	0.09*						0.01	270	−3.43	0.24						0.01	270
	−0.60		0.16					0.02	270	−1.79***		0.50***					0.02	270
	−0.16*			14.32				0.00	270	−0.50*			41.32				0.00	270
ΔPastor-Stambaugh	−2.37***				0.21***			0.09	270	−7.32***				0.66***			0.09	270
measure	−0.12					−0.02		0.00	253	−0.36					−0.08		0.00	253
	−0.15*						0.15	0.00	270	−0.50*						0.49	0.00	270
	−5.80***	−0.09	−0.86***	−38.06	0.89***	−0.02	−0.23	0.22	253	−14.32***	−0.42*	−2.41***	−140.37*	2.55***	−0.09	−0.66	0.22	253
	0.14	−0.01						0.01	270	0.36	−0.03						0.01	270
	0.03		−0.02					0.01	270	0.01		0.00					0.00	270
	−0.02			−0.99				0.00	270	0.01			2.56				0.00	270
ΔInformation asymmetry	0.10				−0.01			0.01	270	−0.23				0.02			0.01	270
cost (θ)	−0.03**					0.00		0.00	253	−0.02					0.00		0.00	253
	−0.01						−0.03	0.00	270	0.01						0.01	0.00	270
	0.07	−0.01	0.00	−0.14	0.00	0.00	−0.01	0.01	253	−0.45**	−0.04**	−0.12***	−7.97	0.13***	0.00	−0.03	0.09	253

This table reports the results of cross-sectional regressions of market quality measure change around the MSS event on firm characteristics variables,

$$\Delta m_{i,\,t} = \alpha + \beta_1\, ln\,(size)_{i,\,(t-1)} + \beta_2\, ln\,(tradingfreq)_{i,\,(t-1)} + \beta_3 turnover_{i,\,(t-1)} + \beta_4\, ln\,(tradingvol)_{i,\,(t-1)} + \beta_5 PE_{i,\,(t-1)} + \beta_6 FINA_{i,\,(t-1)} + \varepsilon_{i,\,t},$$

where *Δm* is the difference in the selected quality measure before and after the MSS implementation. *ln*(*size*), *ln*(*tradingfreq*), and *ln*(*tradingvol*) are the natural logarithms of firms' average market capitalization, the average number of transactions executed per day, and daily trading volume. *turnover* is the firms' turnover ratio. *PE* is the P/E ratio, and *FINA* is a dummy variable that equals 1 if the firm is a financial firm and 0 otherwise. We consider two time periods: a one-year and a six-month window around the MSS event. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 8
Regulation of the Vietnamese stock market between December 2011 and March 2014.

Number sign	Date	Subject
No.366-QD-TTg	11/03/2014	Decision approving plan on formation and development of the Vietnamese derivative securities market.
216/2013/TT-BTC	31/12/2013	Circular amending Circular No. 38/2011/TT-BTC dated 16/3/2011 stipulating the rate, collection-payment regime, management, and use of fees from securities operations applying with security service organizations.
217/2013/TT-BTC	31/12/2013	Circular guiding on administrative penalties for violations in the field of securities and securities market.
108/2013/ND-CP	23/09/2013	Decree of administrative penalties for violations in securities and securities market.
91/2013/TT-BTC	28/06/2013	Circular providing guidelines for registration of establishment, organization, and operation of representative offices of foreign securities business institutions and branches of foreign fund management companies in Vietnam.
73/2013/TT-BTC	29/05/2013	Circular guiding in detail a number of articles about securities listing at the Decree No. 58/2012/ND-CP dated 20/7/2012.
165/2012/TT-BTC	30/12/2012	Circular amending and supplementing a number of Articles of the Circular No.226/2010/TT-BTC dated 31/12/2010 of the Ministry of Finance, on the prudential ratio and the handling measures for the securities institutions that fail to achieve the prudential ratio.
229/2012/TT-BTC	27/12/2012	Circular guiding the establishment and management of Exchange Traded Funds.
227/2012/TT-BTC	27/12/2012	Circular guiding the establishment, organization, and management of investment companies
228/2012/TT-BTC	27/12/2012	Circular guiding establishment and management of real estate investment funds
212/2012/TT-BTC	05/12/2012	Circular request form for certificate for the establishment and operation registration of fund management companies.
210/2012/TT-BTC	30/11/2012	Circular providing guidelines on establishment of securities companies.
121/2012/TT-BTC	26/07/2012	Circular providing regulations on corporate governance applicable to public companies.
58/2012/ND-CP	20/07/2012	Decree providing detailed regulations for implementation of a number of articles of the law on securities (amended).
No.58–2012-ND-CP	20/07/2012	Decree providing detailed regulations for implementation of a number of articles of the law on securities (amended) dated 20 July 2012 as amended by Decree 60 dated 26 June 2015.
52/2012/TT-BTC	05/04/2012	Circular on disclosure of information on the securities market.
183/2011/TT-BTC	16/12/2011	Circular guiding the establishment and management of open-end investment funds.

This table lists the regulations, circulars, and policies of the Vietnamese stock market from December 2011 to March 2014. These documents are available on the official website of the State Securities Commission of Vietnam.

firms.

Second, the rules underlying a new surveillance system can always come with ambiguities, which might not only restrain the market manipulators but also hold back legal market investors. In other words, there is a learning period for investors to adapt to the new regulatory regime. The negative effect of rule ambiguities on liquidity can be further aggravated when compounded with a less developed legal system in Vietnam. Since the violation of the rules can be consequential (e.g., criminal conviction for an illegal trading profit of US$22,500), the market investors may need an even longer time to learn and digest what kind of trading activities are permitted or banned by the new system.

Our findings also suggest that the MSS fails to improve the market quality of small firms. Their liquidity becomes worse and the degree of information asymmetry does not improve after the implementation of the MSS. This finding implies that the Vietnam SSC needs to keep monitoring small firms and introduce new regulatory policies if necessary. One potential suggestion is to introduce new policies to improve the information quantity for small firms. The MSS focuses on improving the information quality, but not quantity. Easley and O'Hara (2004) point out that both the quality and quantity of information matter in the stock market. Merton (1987) shows that if the information is incomplete, in the sense that not all agents know about every asset, the investor base will be small and the value of a firm is always lower. In a thin-trading emerging market like Vietnam, incomplete information is a serious issue for small firms due to their less news or analyst coverage, which makes it difficult for the MSS to work. A supplementary policy that improves the information quantity of small firms, for example, mandating more timely and detailed information disclosures, might help change that information environment and improve the effectiveness of the MSS in the long run.

4.2. Discussions on other confounding events

In this subsection, we investigate whether there exist other simultaneous policy changes that might affect the market liquidity and informed trading at the Vietnamese stock market. We manually collect all the regulations and policies of the Vietnamese stock market

Table 9
Robustness test 1: Using 20% and 80% percentile values.

	One-year window					Six-month window				
	Top (1)	*Bottom (2)*	*Top-Bottom (1–2))*			*Top (1)*	*Bottom (2)*	*Top-Bottom (1–2)*		
			β_{inter}	R^2	N			β_{inter}	R^2	N
Panel A. Firm size										
*(i)*Turnover ratio (%)	0.06***	0.04	0.02	0.01	216	0.02	−0.05	0.07	0.00	216
*(ii)*Amihud illiquidity measure ($\times 10^{-2}$)	−0.03	1.47	−1.50	0.15	216	−1.47	1.47	−1.62	0.15	216
*(iii)*Quote spread (%)	−0.04	0.56***	−0.60***	0.55	216	−0.11	0.34**	−0.45	0.47	216
*(iv)*Effective spread (%)	−0.04	0.28***	−0.32***	0.52	216	−0.04	0.19**	−0.23	0.42	216
*(v)*Pastor-Stambaugh measure ($\times 10^{-7}$)	−0.04	−5.13	5.09	0.03	216	0.00	−5.35	5.35	0.02	216
*(vi)*Information asymmetry cost IAC (θ)	−0.05***	0.03	−0.08	0.28	216	−0.01	0.16**	−0.17	0.15	216
*(vii)*Proportion of IAC (π)	−0.10***	−0.01	−0.09*	0.07	216	−0.05***	0.04	−0.09	0.02	216
Panel B. Trading frequency										
*(i)*Turnover ratio (%)	0.41	0.01	0.40	0.11	216	0.46	0.01	0.45	0.04	216
*(ii)*Amihud illiquidity measure ($\times 10^{-2}$)	0.00	−0.01	0.01	0.21	216	0.00	0.19	−0.19	0.23	216
*(iii)*Quote spread (%)	0.07*	0.46***	−0.39*	0.76	216	0.04	0.40**	−0.36	0.70	216
*(iv)*Effective spread (%)	0.02	0.15**	−0.13	0.70	216	0.02	0.15	−0.12	0.65	216
*(v)*Pastor-Stambaugh measure ($\times 10^{-7}$)	−0.04***	−5.59	5.55	0.04	216	0.00	−18.72	18.72	0.03	216
*(vi)*Information asymmetry cost IAC (θ)	−0.03***	0.03	−0.06	0.55	216	0.00	0.04	−0.04	0.31	216
*(vii)*Proportion of IAC (π)	−0.11***	0.01	−0.12***	0.41	216	−0.06***	0.00	−0.06	0.16	216
Panel C. Turnover ratio										
*(i)*Turnover ratio (%)	0.45	0.02***	0.43	0.19	216	0.39	0.05***	0.34	0.05	216
*(ii)*Amihud illiquidity measure ($\times 10^{-2}$)	0.48	−0.19	0.29	0.12	216	0.02	−0.17	0.20	0.12	216
*(iii)*Quote spread (%)	0.23***	0.27*	−0.04	0.33	216	0.23***	−0.12	0.35	0.33	216
*(iv)*Effective spread (%)	0.09**	0.08	0.01	0.27	216	0.12**	−0.07	0.20	0.27	216
*(v)*Pastor-Stambaugh measure ($\times 10^{-7}$)	−0.04**	−5.71	5.67	0.04	216	0.03	−19.35	19.38	0.03	216
*(vi)*Information asymmetry cost IAC (θ)	−0.03***	0.02	−0.05	0.35	216	0.04	−0.17**	0.21	0.19	216
*(vii)*Proportion of IAC (π)	−0.09***	0.00	−0.09**	0.21	216	−0.04**	−0.05	0.01	0.17	216

This table reports the results of market quality measure change using 20% and 80% percentile values to group firms. Panels A, B, and C group the firm on the top (bottom) 20% of the sample firms sorted by their average market capitalization, average number of transactions executed per day, and average daily turnover ratio measured in the one-year or six-month period before the MSS introduction date, respectively. The significance of the changes of the top and bottom groups is tested using the pair-matched *t*-test, while the significance of the difference is tested using the regression analysis. The left and right columns report the results of the one-year and six-month window, respectively. The sample size is 270. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

in the sample period and qualitatively discuss whether they might affect its trading activities.

Table 8 lists all the regulations, circulars, and policies related to the Vietnamese stock market from December 2011 to March 2014.[11] Most of the policies listed in Table 8 do not target the market activity but rather the corporate governance of securities institutions. For example, Circular No. 91/2013/TT-BTC, issued on 28 June 2013, provides guidelines for the registration of the establishment, organization, and operation of representative offices of foreign securities institutions and branches of foreign fund management companies in Vietnam. It directly influences the operation of the foreign institutions but not the order flow of the stock market.

Among all the policies, Circular No. 52/2012/TT-BTC is about the disclosure of information on the securities market, which might affect the trading activities of the Vietnamese stock market. For example, this circular requires that public companies disclose financial and non-financial information on fixed dates; public companies can delay their report to the SSC (State Securities Commission) of Vietnam when the stock prices exceed the daily ceiling or floor prices up to five consecutive trading days; only big companies (those capitalized at more than 120 billion VND and possessed by more than 300 shareholders) need to report to the SSC when their stock prices exceed the daily ceiling or floor prices on 10 consecutive trading days. However, this policy was implemented on 4 May 2012, which is the beginning of our sample period. As a result, this policy only potentially affects the market quality in both the pre- and post-change periods and is not the event that will drive our empirical results.

5. Robustness tests

In this section, we conduct three tests to check the robustness of our empirical results. In the first set, we use 20% and 80% percentile values of each firm characteristic variable to identify the firms in the top and bottom groups and report the results in Table 9.

We report the change of each market quality measure for the top and bottom groups and their difference. The difference is tested using the regression of Eq. (12). Results are similar to those reported in Tables 4 to 6. Liquidity becomes worse for small firms after the MSS event. For example, the quoted spreads of small firms increase by 0.56% in the one-year window, while they decrease by 0.04% for larger firms. Their difference is −0.60% and significant at the 1% level. The results of effective spread and the six-month window

[11] These documents are available on the official website of the State Securities Commission of Vietnam.

Table 10
Robustness test 2: Excluding three months before and after the MSS.

	(33%, 66%)					(20%, 80%)				
	Top (1)	*Bottom (2)*	*Top-Bottom (1–2))*			*Top (1)*	*Bottom (2)*	*Top-Bottom (1–2)*		
			β_{inter}	R^2	N			β_{inter}	R^2	N
Panel A. Firm size										
*(i)*Turnover ratio (%)	0.12**	0.09	0.03	0.02	360	0.10***	0.11	−0.01	0.03	216
*(ii)*Amihud illiquidity measure ($\times 10^{-2}$)	−0.07	0.98	−1.05	0.12	360	0.02	1.50	−1.55	0.15	216
*(iii)*Quote spread (%)	−0.07	0.37**	−0.44*	0.26	360	−0.02	0.44*	−0.46	0.42	216
*(iv)*Effective spread (%)	−0.07	0.16*	−0.23	0.25	360	−0.03	0.21*	−0.24*	0.40	216
*(v)*Pastor-Stambaugh measure ($\times 10^{-7}$)	−1.59***	1.76***	−3.35***	0.10	360	−2.01***	2.24***	−4.25***	0.15	216
*(vi)*Information asymmetry cost IAC (θ)	−0.05***	0.01	−0.06	0.15	360	−0.05***	0.01	−0.06	0.28	216
*(vii)*Proportion of IAC (π)	−0.09***	−0.03*	−0.07**	0.05	360	−0.12***	−0.02	−0.10**	0.10	216
Panel B. Trading frequency										
*(i)*Turnover ratio (%)	0.26***	0.03*	0.23*	0.25	360	0.23***	0.02	0.21	0.26	216
*(ii)*Amihud illiquidity measure ($\times 10^{-2}$)	0.01*	−0.13	−0.12	0.18	360	0.00	−0.04	−0.04	0.19	216
*(iii)*Quote spread (%)	0.04	0.38***	−0.35**	0.63	360	0.05	0.55***	−0.50**	0.73	216
*(iv)*Effective spread (%)	0.01	0.13**	−0.13	0.57	360	0.01	0.19**	0.18	0.68	216
*(v)*Pastor-Stambaugh measure ($\times 10^{-7}$)	−1.36***	0.93***	−2.19***	0.10	360	−1.82***	1.15***	−2.97***	0.14	216
*(vi)*Information asymmetry cost IAC (θ)	−0.06***	0.02	−0.08	0.48	360	−0.05***	0.05	−0.10	0.52	216
*(vii)*Proportion of IAC (π)	−0.13***	0.01	−0.14***	0.31	360	−0.13***	0.02	−0.15***	0.42	216
Panel C. Turnover ratio										
*(i)*Turnover ratio (%)	0.26***	0.05***	0.21	0.31	360	0.33**	0.05***	0.28	0.41	216
*(ii)*Amihud illiquidity measure ($\times 10^{-2}$)	1.00*	0.23	0.77	0.05	360	0.68	0.21	0.47	0.10	216
*(iii)*Quote spread (%)	0.24***	−0.01	0.25	0.17	360	0.26***	0.02	0.24	0.23	216
*(iv)*Effective spread (%)	0.09***	−0.05	0.14	0.15	360	0.10**	−0.04	0.14	0.18	216
*(v)*Pastor-Stambaugh measure ($\times 10^{-7}$)	0.00	0.09	−0.09	0.05	360	−0.01	0.50	−0.51	0.06	216
*(vi)*Information asymmetry cost IAC (θ)	−0.04***	0.00	−0.04	0.28	360	−0.04***	0.04	−0.08	0.34	216
*(vii)*Proportion of IAC (π)	−0.10***	−0.01	−0.09***	0.19	360	−0.10***	−0.01	−0.10**	0.21	216

This table reports the results of market quality change using the data of the one-year window, excluding three months before and after the MSS implementation. Panels A, B, and C report the results by firm size, trading frequency, and turnover ratio, respectively. We report the results of liquidity and informed trading change for the top and bottom groups and their differences. The significance of the changes of top and bottom groups is tested using the pair-matched *t*-test, while the significance of the difference is tested using the regression analysis. The left and right columns report the results using (33%, 66%) and (20%, 80%) to group the firms, respectively. The sample size is 270. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

are similar. Meanwhile, the informed trading level is improved for large, high-trading-frequency and high-turnover-ratio firms after the MSS event.

In the second test, we exclude the three months before and after the MSS implementation to control for the possible policy uncertainty around the event, and repeat the analyses in the one-year window. Table 10 reports the results. The left and right columns tabulate the results using (33%, 66%) and (20%, 80%) percentile values, respectively. The main conclusions still hold. The results of Tables 9 and 10 suggest that our empirical findings are robust to the choice of critical values to group the stocks and to the sample period used in the analysis.

To address the concern that the observed results are part of a trend that is not relevant to the introduction of the MSS, we perform a placebo test akin to our last robustness check. We choose three pseudo dates, including 19 March 2012, 19 March 2014, and 19 March 2015, and rerun our regressions of Eq. (12). If the nonparallel changes of liquidity and informed trading around the implementation of the MSS for firms with different characteristics are part of a trend, then we should observe similar patterns on these pseudo dates. That is, the worsening effect of liquidity is more pronounced for small firms, while there exists a significant decrease in informed trading among large and liquid firms.

We only consider a six-month period for the two dates of 19 March 2012 and 19 March 2014 since using the one-year window will overlap the MSS implementation period. For 19 March 2015, we consider both a six-month and one-year period. Table 11 reports the results. For simplicity, we only report the coefficients of our interest, β_{inter}, which tests the difference in change between two groups.

Panel A of Table 11 reports the results by firm size. We do not observe patterns for the sign of these coefficients. The coefficients of each variable fluctuate around zero with both positive and negative signs. For example, for the quoted and effective spreads, the coefficients are negative for three cases and positive for one case. For the information asymmetry cost, the coefficients are negative for two cases. Moreover, none of the coefficients is significant at the 5% level or above, which suggest there exists no significant difference in change of liquidity and informed trading level between large and small firms around these three pseudo dates. Panels B and C of Table 11 report the results by trading frequency and turnover ratio, respectively. The results are similar to those of Panel A in that there is no pattern on the signs of the coefficients. Overall, the insignificant results in the placebo tests reported in Table 11 do not support the hypothesis of a similar pattern at these three pseudo dates and provide further support to the main findings of the MSS effect on market quality.

Table 11
Placebo test.

	Six-month period									One-year period		
Pseudo date	19/03/2012			19/03/2014			19/03/2015			19/03/2015		
	β_{inter}	R^2	N	β_{inter}	R^2	N	β_{inter}	R^2	N	β_{inter}	R^2	N
Panel A. Firm size												
(i) Turnover ratio (%)	−0.45	0.03	354	−0.47	0.01	364	1.04	0.02	364	0.37	0.01	364
(ii) Amihud illiquidity measure ($\times 10^{-2}$)	0.41	0.12	354	1.52	0.12	364	−0.73	0.12	364	−1.16	0.12	364
(iii) Quote spread (%)	0.23	0.19	354	−0.05	0.26	364	−0.31	0.24	364	−0.14	0.26	364
(iv) Effective spread (%)	0.17	0.17	354	−0.01	0.25	364	−0.14	0.22	364	−0.08	0.24	364
(v) Pastor-Stambaugh measure ($\times 10^{-9}$)	0.00	0.02	354	0.00	0.05	364	0.00	0.02	364	0.01*	0.08	364
(vi) Information asymmetry cost IAC (θ)	0.11	0.12	354	0.10	0.14	364	−0.08	0.15	364	−0.06	0.16	364
(vii) Proportion of IAC (π)	0.01	0.04	354	0.03	0.05	364	−0.01	0.07	364	−0.01	0.10	364
Panel B. Trading frequency												
(i) Turnover ratio (%)	1.83**	0.18	354	−1.34	0.20	364	−1.90**	0.13	364	−2.28**	0.15	364
(ii) Amihud illiquidity measure ($\times 10^{-2}$)	−0.14	0.17	354	1.69	0.14	364	−0.72	0.14	364	−0.73	0.12	364
(iii) Quote spread (%)	−0.21	0.62	354	0.14	0.51	364	−0.07	0.37	364	0.19	0.42	364
(iv) Effective spread (%)	−0.05	0.52	354	0.06	0.47	364	−0.04	0.34	364	0.05	0.38	364
(v) Pastor-Stambaugh measure ($\times 10^{-9}$)	0.26	0.00	354	0.00	0.00	364	0.00	0.00	364	0.00*	0.00	364
(vi) Information asymmetry cost IAC (θ)	0.04	0.32	354	0.27**	0.29	364	−0.05	0.33	364	0.01	0.35	364
(vii) Proportion of IAC (π)	−0.01	0.29	354	0.13***	0.30	364	0.01	0.43	364	0.02	0.45	364
Panel C. Turnover ratio												
(i) Turnover ratio (%)	2.10***	0.23	354	−1.11	0.23	364	−2.41***	0.17	364	−3.07***	0.23	364
(ii) Amihud illiquidity measure ($\times 10^{-2}$)	−0.30	0.11	354	1.42	0.09	364	−0.44	0.09	364	−0.73	0.08	364
(iii) Quote spread (%)	−0.29	0.28	354	−0.02	0.22	364	0.10	0.15	364	0.27	0.15	364
(iv) Effective spread (%)	−0.11	0.23	354	−0.01	0.20	364	0.05	0.14	364	0.11	0.14	364
(v) Pastor-Stambaugh measure ($\times 10^{-9}$)	−0.26	0.01	354	0.00	0.01	364	0.00	0.01	364	0.00	0.01	364
(vi) Information asymmetry cost IAC (θ)	−0.03	0.16	354	0.18	0.16	364	−0.01	0.17	364	0.00	0.18	364
(vii) Proportion of IAC (π)	−0.03	0.17	354	0.10*	0.16	364	0.01	0.21	364	0.01	0.21	364

This table presents the results of the placebo test. We choose three pseudo dates, including 19 March 2012, 19 March 2014, and 19 March 2015, and rerun the regressions specified in Tables 4 to 6, respectively. We only consider the six-month period for the two dates of 19 March 2012 and 19 March 2014 since it will include our even date if we use one year for them. For 19 March 2015, we consider both a six-month and one-year period. Panels A, B, and C report the results by firm size, trading frequency, and turnover ratio, respectively. For simplicity, we only report the coefficients of our interest, β_{inter}, which tests difference in change between two groups. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

6. Conclusion

In this paper, we investigate the effectiveness of the MSS on improving the market quality of the Vietnamese stock market. We document that the aggregate market quality of the Vietnamese stock market does not improve after the MSS implementation. In contrast, the liquidity measures, especially bid-ask spreads, significantly increase after the event. This finding suggests market liquidity becomes worse. We also find limited evidence of the improvement of informed trading. These findings, together with other literature that documents the ineffectiveness of regulation policy, suggest that stock market regulation is a complicated issue. More robust policy evaluation is necessary to help it achieve the target.

We also find that different firms are affected by the MSS differently. MSS mainly negatively affects the liquidity of small firms. Meanwhile, it also improves the informed trading of large, high-trading-frequency and high-turnover-ratio firms. These results suggest that policy affects different firms to a varying degree. An analysis of the different responses by different firms will help improve the effectiveness of a regulation policy in the financial market.

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