# Pre-trade Transparency and Market Quality: Evidence from China A Shares Markets ${ }^{1}$ 

Feng Dong ${ }^{2}$ Liyan Han
School of Economics \& Management
Beijing University of Aeronautics and Astronautics
Beijing, China


#### Abstract

The information disclosure of limit-order book, which is a key aspect of pre-trade transparency, could influence the market quality to some extent. But there are two viewpoints about the influence of high transparency: some believe that the influence is positive, while others don't think so. We examine the effects of the improved transparency in China A shares markets, and our results support the former opinion evidently. We find that after the improvement of transparency, the informative efficiency of most stocks is improved, although a few stocks are deteriorated; the liquidity of market is greatly increased, and the volatility is decreased, which all mean that the market quality is improved.


Keywords: Market microstructure; Transparency; Market quality

## 1. Introduction

In stocks markets, transparency is very important. It is a key feature of market design as well as a key aspect of market performance. So, more and more attention is put on it. As O'Hara (1995) defines, transparency is the ability of market participants to observe information in the trading process. As information could be divided into pre- and post-trade information, accordingly, we can get pre- and post-trade transparency (Madhavan, 2000). Our focus in this paper is on a particular form of the pre-trade transparency, i.e. the disclosed content of limit-order book.

On Dec. 8th, 2003, the rules of information disclosure of China A shares markets were changed. After that, market participants can observe information about depth at the top five price levels in the limit-order book, whereas only the top three price levels were disclosed before. So the pre-trade transparency of markets is evidently increased. It's attractive to find whether this change influences the market quality or not, and if it does, what the influences are.

Intuitively, increased transparency will improve market quality. In fact, it is not so simple. Many researches, both theoretical and empirical, have been made on the effects of pre-trade transparency, and the results are different. Some researchers support that higher pre-trade transparency will lead to better market quality, but others

[^0]disagree on it. However, all these researches are carried out of China. So we examine this question in the background of China stocks markets in order to go further in this research. In the following section, we will introduce in more details the existing research on the effects of pre-trade transparency.

As our purpose is to study the effects of pre-trade transparency on market quality in a way of empirical analysis, we must decide how to measure the market quality quantificationally. To do so, we will examine three features, i.e. the informative efficiency, liquidity and volatility of the stocks markets. These aspects are very important to the stock market, and are often used to measure the quality of stocks markets. In addition, we can measure them quantificationally using existing methods. All those will make our study simpler, and make the results more powerful.

The structure of this paper is as follows. In section 2, we give a general review of the existing work. A discussion about the data and methodology is given in section 3. And we analyze the results of our empirical study in section 4 and make a conclusion in section 5 .

## 2. Literature review

Many researches have been made on transparency, for example, Madhavan (1996) has compared markets with different transparency based on models of game theory; Pagano and Roell (1996) have compared the transparency of markets with different structures; Bloomfield and O'Hara (1999) also study the effects of transparency, but use a method of laboratory experiments. In these works, however, only a few are concentrated on the study of the content of limit-order book, and the results are very different. Baruch (2005) constructs theoretical models to infer how the disclosed content of limit-order book affects market performance, and he finds that increased transparency can improve liquidity and informational efficiency of stocks markets. Madhavan, Porter and Weaver (2000) also study the same question by theoretical inference, but their viewpoint is different from Baruch (2005). Their conclusion is that higher transparency leads to lower liquidity, and higher volatility and execution costs.

Information disclosure rules have been changed to improve market quality in some stocks markets. These changes provide natural experiments for scholars to study the effects of transparency. Madhavan, Porter and Weaver (2000) have examined such a change by empirical study to support their theoretical results. On April 12, 1990, Toronto Stock Exchange instituted a computerized system to disseminate information about depth at the top four price levels in the limit-order book. Madhavan, Porter and Weaver (2000) compare the market performances before and after the event, and find that increased pre-trade transparency decreases liquidity of the market, and increases the execution costs and volatility. Another empirical study comes from NYSE. On January 24, 2002, the OpenBook service was introduced for all NYSE securities simultaneously, and as a result of that, participants can observe much more information in the limit-order book. Boehmer, Saar, and Yu (2005) conduct an empirical investigation of the change, and it is interesting that they conclude very different conclusions. They find that the liquidity and informational efficiency of the market are both largely increased, and it means that the market quality is improved.

## 3. Data and Experiment Design

## A. Choosing Event Periods

As our purpose is to find whether increased transparency improves market quality, we must compare the market performance before and after the event of transparency change. To do this, we should choose the pre- and post-event periods at first. Boehmer, Saar and Yu (2005) think that the traders' strategies would not be influenced too much before the event, whereas it would take a longer time for traders to accommodate the change after the event, so they choose the previous two weeks as the pre-event period, and set four post-periods (every contains two weeks) which belong to the four months after the event. We will follow the way of Boehmer, Saar and Yu (2005), but make a little difference. We will choose one pre-event period and three post-event periods, and each period equals a month. We believe that the longer period would contain more information. Because the information disclosure rules are changed on Dec. 8th, 2003, our pre-event period is November 2003, and the three post-event periods are January, February and March 2004, respectively.

## B. Sample and Data

Our sample is from Shanghai and Shenzhen A shares markets of China, and contains three hundred stocks (about one-fourth of all stocks in the markets at that time). At first, we sort all the stocks by average trading volume in November 2003. And then, we choose three groups from the sorted stocks, and every group contains one hundred stocks: the stocks in the first group are the most active ones, i.e. their trading volume was the largest in November 2003; the second group was common; and the third group was the most inactive. We will conduct the analysis for the whole sample as well as for each group separately.

Our data is from the company of Guo Tai An Information Technology, and the high frequency data contains two types: one is about all information of each transaction, and the other is the snapshots of the market whose frequency is one time per five minutes.

## C. The Three Aspects of Market Performance

We will compare three aspects of market performance before and after the event, i.e. informative efficiency, liquidity and volatility, and for every aspect we will measure it quantificationally.

As the informative efficiency is concerned, we will follow the way of Boehmer, Saar and Yu (2005). Using the five-minute snapshot data, we can calculate the return of every stock in each day, and then we can calculate the first order autocorrelation of these returns. The informative efficiency could be measured by the absolute value of the autocorrelation. It is obvious that a weaker autocorrelation means a stronger informative efficiency, and vice versa.

To measure the liquidity, we choose seven indices materially which are listed in

Table 1, and the spreads and depth are defined by Chordia, Richard and Subrahmanvam (2000).

Table 1. Measures of liquidity

| Measures | Definition | Unit |
| :--- | :--- | :--- |
| Trading volume in shares | -- | share |
| Trading volume in Yuan | -- | Yuan |
| Quoted spread | $\mathrm{P}_{\mathrm{A}}-\mathrm{P}_{\mathrm{B}}$ | cent |
| Proportional quoted spread | $\left(\mathrm{P}_{\mathrm{A}}-\mathrm{P}_{\mathrm{B}}\right) / \mathrm{P}_{\mathrm{M}}$ | $\%$ |
| Effective spread | $2\left\|\mathrm{P}_{\mathrm{t}}-\mathrm{P}_{\mathrm{M}}\right\|$ | cent |
| Proportional effective spread | $2\left\|\mathrm{P}_{\mathrm{t}}-\mathrm{P}_{\mathrm{M}}\right\| / \mathrm{P}_{\mathrm{t}}$ | $\%$ |
| Depth | $\left(\mathrm{Q}_{\mathrm{A}}+\mathrm{Q}_{\mathrm{B}}\right) / 2$ | share |

Note: In Table $1, \mathrm{P}_{\mathrm{A}}$ is the ask price, and $\mathrm{P}_{\mathrm{B}}$ is the bid price. $\mathrm{P}_{\mathrm{M}}=\left(\mathrm{P}_{\mathrm{A}}-\mathrm{P}_{\mathrm{B}}\right) / 2$, and $\mathrm{P}_{\mathrm{t}}$ is current price. $Q_{A}$ denotes the quantity for sale at the price $P_{A}$, and, $Q_{B}$ denotes the quantity to buy at the price $\mathrm{P}_{\mathrm{B}}$.

We can calculate the spreads and depth by the data of each transaction.
The volatility measure is very easy. Using the five-minute snapshot data, we can calculate the return of every stock in each day, and then we can calculate the standard deviation of these returns. The standard deviation is usually a sound measure of volatility.

## 4. Results Analysis

In this section, we will analyze the results in the order of previous section. First, we look at the changes in informative efficiency following the change of information disclosure rules. Second, we examine the liquidity. Finally, we compare the volatility before and after the event.

## A. Informative Efficiency

Perhaps informative efficiency would be influenced the most directly by the change of transparency, because the changed rules allow traders to observe more trading information.

As Boehmer, Saar and Yu (2005) have pointed, a more efficient price process would be closer to a random walk, and therefore exhibits less autocorrelation (both negative and positive). We divide the trading day into 5-minute intervals and compute the returns from the price at the beginning and end of each interval. After that, we calculate the absolute value of 5-minute first-order intra-day returns autocorrelation, and present the main results in Table 2.

Table 2. Changes of the absolute autocorrelation

|  |  | Mean | Median | p-value of <br> Wilcoxon Test |
| :---: | :---: | :---: | :---: | :---: |
| Entire Sample | 2003.11 | 0.1470 | 0.1430 | -- |
|  | 2004.1 | 0.1386 | 0.1304 | 0.002 |
|  | 2004.2 | 0.1304 | 0.1236 | 0.000 |
| Group 1 | 2004.3 | 0.1367 | 0.1314 | 0.000 |
| (most active | 2003.11 | 0.1320 | 0.1288 | -- |
| stocks) | 2004.1 | 0.1098 | 0.1074 | 0.000 |
|  | 2004.2 | 0.1103 | 0.1065 | 0.000 |
|  | 2004.3 | 0.1104 | 0.1050 | 0.000 |
| Group 2 | 2003.11 | 0.1532 | 0.1513 | -- |
|  | 2004.1 | 0.1371 | 0.1334 | 0.000 |
|  | 2004.2 | 0.1251 | 0.1193 | 0.000 |
| Group 3 | 2004.3 | 0.1342 | 0.1322 | 0.000 |
|  | 2003.11 | 0.1559 | 0.1458 | -- |
| stocks) | 2004.1 | 0.1688 | 0.1661 | 0.005 |
|  | 2004.2 | 0.1557 | 0.1518 | 0.665 |
|  | 2004.3 | 0.1655 | 0.1563 | 0.023 |

From the statistics of the entire sample in Table 2, we can conclude that the absolute autocorrelation of returns significantly declines after the increase of transparency, and it means that the informative efficiency of the market is increased. This is consistent with Boehmer, Saar and Yu (2005); moreover, we also find other phenomena that are not mentioned by them.

First, we find from the entire sample that the mean and median of the absolute autocorrelation of returns both decline at first, but they rise a little in the last month. It is not occasional, because the liquidity also shows the same trend (see that in the following section). It might be an overreaction in some sense and we will discuss this question in more details in the following section. In addition, we compare the change of each group, and find a very interesting phenomenon. From the statistics of Group 1 and Group 2, it is obvious that the informative efficiency of these stocks declines significantly as the market become more transparent, but the absolute autocorrelation of stocks in Group 3 become stronger after the event, which is contrary to stocks of Group 1 and Group 2 as well as our intuition. We will try to explain it as well as we can. After the change of transparency, traders can observe more information about the true value of the stocks. So, if the stocks are transacted actively, the information will be reflected by the transaction price more quickly, and as a result, the informative efficiency will increase. If the stocks are transacted much inactively, however, the more disclosed information can't be reflected by the transaction price in time, and would be used by some traders to infer the future prices of the stocks, so the information efficiency would probably decrease.

In order to examine the effects of transparency to informative efficiency more exactly, we compare the autocorrelation changes of other stocks. We select another
group of stocks, which is named as the "second-inactive" group, and it contains 100 stocks which are more active than the 100 most inactive stocks but more inactive than all the other stocks. Then we separate the 100 stocks into two parts - one part includes the 50 more active stocks and the other part contains the 50 more inactive stocks left. Again, we compute the absolute value of 5 -minute first-order intra-day return autocorrelation for the "second-inactive" group, and show the main results in Table 3.

Table 3. Changes of the absolute autocorrelation for the "second-inactive" group

|  |  | Mean | Median | p-value of <br> Wilcoxon Test |
| :---: | :---: | :---: | :---: | :---: |
| "second-inactive" | 2004.1 | 0.1459 | 0.1446 | -- |
| group | 2004.2 | 0.1553 | 0.1554 | 0.580 |
|  | 2004.3 | 0.1560 | 0.1502 | 0.001 |
|  | 2003.11 | 0.1621 | 0.1458 | 0.353 |
| more active 50 | 2004.1 | 0.1519 | 0.1527 | -- |
| stocks | 2004.2 | 0.1380 | 0.1333 | 0.626 |
|  | 2004.3 | 0.1540 | 0.1512 | 0.360 |
| more inactive 50 | 2003.11 | 0.1476 | 0.1430 | -- |
| stocks | 2004.1 | 0.1588 | 0.1591 | 0.194 |
|  | 2004.2 | 0.1394 | 0.1335 | 0.211 |
|  | 2004.3 | 0.1581 | 0.1502 | 0.033 |

From Table 3, we see that the informative efficiency of the whole "second-inactive" group either changes insignificantly or increases a little in the three post-event periods, and it is different from that of the least active group of stocks. Furthermore, in the "second-inactive" group, the more active stocks become more informative efficient after the event, whereas the more inactive stocks show contrary result. So we could conclude that the effects of transparency improvement are not the same for all stocks. If the stock is active, the impact of transparency increase will be positive; and if the stock is comparatively inactive, the effect of transparency increase will be weaker or be insignificant at all; finally, if the stock is very inactive, the impact of transparency increase will be negative.

## B. Liquidity

Liquidity is another very, if not the most, important aspect of market performance. It indicates the activity of market and often is related to the transaction cost. We use several material indices to measure liquidity, and these indices as well as their values are listed in Table 4.

Table 4. Changes of the liquidity

|  |  | Average Volume (in millions) |  | Average Volume (in million Yuan) |  | Quoted Spread (in cents) |  | Quoted Spread(in \%) |  | Effective Spread (in cents) |  | Effective Spread (in \%) |  | $\begin{gathered} \text { Depth } \\ \text { (in } 100 \mathrm{~s} \text { ) } \\ \hline \end{gathered}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Mean | p | Mean | p | Mean | p | Mean | P | Mean | p | Mean | p | Mean | p |
| Entire <br> Sample | 2003.11 | 2.8451 | -- | 19.1356 | -- | 3.66 | -- | 0.4255 | -- | 3.99 | -- | 0.4627 | -- | 104.72 | -- |
|  | 2004.1 | 4.2671 | 0.000 | 34.7631 | 0.000 | 2.88 | 0.000 | 0.3097 | 0.000 | 3.13 | 0.000 | 0.3376 | 0.000 | 124.55 | 0.000 |
|  | 2004.2 | 5.0413 | 0.000 | 42.0015 | 0.000 | 2.47 | 0.000 | 0.2409 | 0.000 | 2.71 | 0.000 | 0.2638 | 0.000 | 144.67 | 0.000 |
|  | 2004.3 | 3.1958 | 0.039 | 27.5052 | 0.000 | 2.49 | 0.000 | 0.2461 | 0.000 | 2.70 | 0.000 | 0.2671 | 0.000 | 128.28 | 0.001 |
| Group 1 | 2003.11 | 7.8372 | -- | 52.2073 | -- | 1.32 | -- | 0.2132 | -- | 1.47 | -- | 0.2347 | -- | 248.26 | -- |
|  | 2004.1 | 11.1498 | 0.000 | 90.5363 | 0.000 | 1.24 | 0.090 | 0.1797 | 0.000 | 1.36 | 0.076 | 0.1943 | 0.000 | 272.74 | 0.131 |
|  | 2004.2 | 12.5492 | 0.000 | 103.0971 | 0.000 | 1.24 | 0.109 | 0.1608 | 0.000 | 1.36 | 0.088 | 0.1739 | 0.000 | 312.89 | 0.002 |
|  | 2004.3 | 7.6920 | 0.772 | 65.1761 | 0.003 | 1.24 | 0.091 | 0.1572 | 0.000 | 1.34 | 0.041 | 0.1687 | 0.000 | 267.12 | 0.271 |
| Group 2 | 2003.11 | 0.7308 | -- | 5.0379 | -- | 2.13 | -- | 0.3348 | -- | 2.36 | -- | 0.3686 | -- | 52.92 | -- |
|  | 2004.1 | 1.5343 | 0.000 | 12.0819 | 0.000 | 1.66 | 0.000 | 0.2496 | 0.000 | 1.84 | 0.000 | 0.2746 | 0.000 | 79.58 | 0.000 |
|  | 2004.2 | 2.1709 | 0.000 | 17.5030 | 0.000 | 1.54 | 0.000 | 0.2005 | 0.000 | 1.70 | 0.000 | 0.2197 | 0.000 | 93.82 | 0.000 |
|  | 2004.3 | 1.5436 | 0.000 | 12.9909 | 0.000 | 1.62 | 0.000 | 0.2115 | 0.000 | 1.78 | 0.000 | 0.2309 | 0.000 | 80.86 | 0.000 |
| Group 3 | 2003.11 | 0.1170 | -- | 1.1536 | -- | 7.46 | -- | 0.7284 | -- | 8.06 | -- | 0.7848 | -- | 17.29 | -- |
|  | 2004.1 | 0.3237 | 0.000 | 3.3443 | 0.000 | 5.69 | 0.000 | 0.4999 | 0.000 | 6.14 | 0.000 | 0.5440 | 0.000 | 25.79 | 0.000 |
|  | 2004.2 | 0.6289 | 0.000 | 7.2372 | 0.000 | 4.58 | 0.000 | 0.3615 | 0.000 | 5.02 | 0.000 | 0.3977 | 0.000 | 31.88 | 0.000 |
|  | 2004.3 | 0.4867 | 0.000 | 5.4787 | 0.000 | 4.57 | 0.000 | 0.3698 | 0.000 | 4.94 | 0.000 | 0.4018 | 0.000 | 29.35 | 0.000 |

From Table 4, we could see that all the spreads decrease evidently after the increase in transparency. From November 2003 to March 2004, both the quoted spread and the effective spread decrease about $32 \%$, and their proportional value, i.e. the proportional quoted spread and the proportional effective spread, decrease about $42 \%$. At the same time, there is $12.3 \%$ increase of trading volume in shares, $43.7 \%$ increase of trading volume in Yuan and $22.5 \%$ increase of market depth. Lower spreads mean that the market liquidity has increased. Furthermore, spreads are often used to measure transaction cost in stocks markets. A smaller spread usually means the transaction cost is decreased and the market quality is increased therefore. We also find that the trading volume (both in shares and Yuan) and depth are both increased after the event, and it means the market becomes more active. So, all the changes in spreads, volume and depth indicate the market liquidity is increased and market quality is improved. This result is also consistent with Boehmer, Saar and Yu (2005), but is inconsistent with Madhavan, Porter and Weaver (2000). However, there's something that they paid no attention to. Firstly, we find that there is an obvious and persistent increase of liquidity from November 2003 to February 2004, but it decrease to some extent in March 2004. We could draw the above conclusion from the changes of all the spreads, volume (both in shares and Yuan) and market depth. This trend is very similar to that of informative efficiency. We think that the reason might be traders overreacting to the change of information disclosure rules. China stocks markets are emerging markets and have many deficiencies. Furthermore, traders in China stocks markets are not rational in general. These facts often lead to overreaction. At the beginning of the change in transparency, more information was disclosed, and traders, especially the uninformed traders, would therefore expect the true value of stocks more accurately. This would arouse the enthusiasm of them to transact with others. So the trading volume and liquidity of market would increase. After that, traders, especially informed traders, would find that they got no more excess return (because the informative efficiency became stronger), or even suffered some loss, and then they would reduce transactions. So the trading volume and liquidity of market would decrease. Another conclusion could be drawn from the data of different groups. It is that the extent of liquidity increase is different for different groups. For example, from November 2003, to March 2004, there is a $8.84 \%$ decrease of the effective spread in the first group, $24.58 \%$ in the second group, and $38.71 \%$ in the third group. It is obvious that the change in the third group is the greatest, and the change in the first group is the smallest. After we compute the changes of other spreads, volume and depth, we find the same result. It means that the more inactive a stock was before the event, the more greatly it would be influenced after the event. Intuitively, it is normal and maybe a marginal effect. What is abnormal is, however, that the changes are so significantly, because after all, the change in transparency is not so great. If we rethink about the overreaction, maybe there's something helpful. Since most indices in March 2004 are worse than in February 2004 for all groups, we believe that the liquidity would be lower in the following months.

In stocks markets, spreads are also influenced by other factors, such as trading
volume, volatility and price. In general, higher volume will reduce spreads, whereas higher volatility as well as price will enlarge spreads. So we can't attribute the increase of liquidity entirely to higher transparency. In order to examine the effects of transparency to liquidity more accurately, we design an econometric model following Boehmer, Saar and Yu (2005) and Madhavan, Porter and Weaver (2000).

$$
\begin{equation*}
\text { ESpread }_{i t}=\gamma_{\mathrm{i}}+\alpha_{1} \text { AvgStdDev }_{\mathrm{it}}+\alpha_{2} \text { AvgPrc }_{\mathrm{it}}+\alpha_{3} \text { Dummy }_{\mathrm{it}}+u_{\mathrm{it}} \tag{1}
\end{equation*}
$$

Where ESpreadit is the effective spread (in cents) of stock $\mathrm{i}(\mathrm{i}=1,2, \ldots 300)$ in time $\mathrm{t}(\mathrm{t}=$ pre-event or post-event $), \gamma_{\mathrm{i}}$ is a stock-specific mean, AvgStdDev represents the average intra-day volatility ( in \% ), AvgPre is the average daily close price ( in Yuan), and Dummy is a dummy variable which equals zero before the event and one after the event. Boehmer, Saar and Yu (2005) and Madhavan, Porter and Weaver (2000) also think that the trading volume will affect the spread, but we find that the trading volume and the intra-day volatility are correlated, which is presented in the following section, so we eliminate it. To eliminate the stock-specific mean, we examine differences between the post- and pre-event periods as Boehmer, Saar and Yu (2005).

$$
\begin{equation*}
\Delta \text { ESpread }_{\mathrm{i}}=\alpha_{1} \Delta \operatorname{AvgStdDev}_{\mathrm{i}}+\alpha_{2} \Delta \operatorname{AvgPrc}_{\mathrm{i}}+\alpha_{3}+\varepsilon_{\mathrm{i}} \tag{2}
\end{equation*}
$$

Where $\Delta$ denotes a difference between the post- and pre-event periods.
We estimate the equation (2) using OLS and compute test statistics based on White's heteroskedasticity-consistent standard errors, and the results are presented in Table 5.

Table 5. Results of the estimation of equation (2)

|  |  | $\alpha_{1}$ | $\alpha_{2}$ | $\alpha_{3}$ | Adjusted R <br> (in \%) |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 2003.11 and | estimator | 3.484535 | 0.219833 | -0.922255 |  |
|  | t-stat. | $(5.10)$ | $(2.10)$ | $(-6.47)$ | 37.56 |
|  | p-value | $(0.000)$ | $(0.036)$ | $(0.000)$ |  |
| 2003.11 and | estimator | 3.463718 | 0.276493 | -1.573237 |  |
|  | t-stat. | $(5.28)$ | $(2.99)$ | $(-6.65)$ | 28.62 |
|  | p-value | $(0.000)$ | $(0.003)$ | $(0.000)$ |  |
| 2003.11 and | estimator | 3.603262 | 0.364682 | -1.522196 |  |
|  | t-stat. | $(5.54)$ | $(2.85)$ | $(-4.35)$ | 23.93 |
|  | p-value | $(0.000)$ | $(0.005)$ | $(0.000)$ |  |

From Table 5, we find that all the estimators of coefficients are significant at the significance level of $5 \%$. And we also see that the coefficients of average intra-day volatility and average daily close price are positive, which is consistent with the common sense of stocks markets. It means that our model is good. And then, we find the estimators of the dummy variable coefficients are all negative and significant (even at the $1 \%$ significance level). It means that if we control other factors, the change of transparency would reduce the effective spread significantly. In addition, we also see that the three estimators of the dummy variable coefficient are -0.922255 , -1.573237 and -1.522196 respectively, and their absolute values decrease after an
increase, which is consistent with the conjecture of overreaction.
We also use the model to other spreads (we need modify the model sometime, for example, when used to proportional spreads, we must eliminate the average price from the model), and draw similar conclusions.

## C. Volatility

When measuring the volatility of market, we use the standard deviation of intra-day returns. We compare the volatility in different months during the observing period, and the results are put in Table 6.

Table 6. Changes of the volatility

|  | Average Standard <br> Deviation of Intra-day <br> Return (in \%) |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Entire | 2003.11 | 0.4313 | t-stat. | p-value |
| Sample | 2004.1 | 0.4171 | -- | -- |
|  | 2004.2 | 0.3987 | 2.51 | 0.013 |
|  | 2004.3 | 0.3376 | 5.68 | 0.000 |
| Group 1 | 2003.11 | 0.4331 | 15.22 | 0.000 |
|  | 2004.1 | 0.4259 | -- | -- |
|  | 2004.2 | 0.4032 | 0.79 | 0.429 |
|  | 2004.3 | 0.3287 | 10.53 | 0.002 |
|  | 2003.11 | 0.4185 | -- | -- |
| Group 2 | 2004.1 | 0.3921 | 3.23 | 0.002 |
|  | 2004.2 | 0.3705 | 6.70 | 0.000 |
|  | 2004.3 | 0.3219 | 11.91 | 0.000 |
|  | 2003.11 | 0.4423 | -- | -- |
| Group 3 | 2004.1 | 0.4336 | 0.75 | 0.455 |
|  | 2004.2 | 0.4225 | 1.61 | 0.111 |
|  | 2004.3 | 0.3620 | 6.06 | 0.000 |

From Table 6, it is obvious that the volatility has a persistent and evident decrease from November 2003 to March 2004. From November 2003 to March 2004, there is a $24.11 \%$ decrease of volatility in the first group, a $23.08 \%$ decrease in the second group, and an $18.18 \%$ decrease in the third group. From the average standard deviation of intra-day return in November 2003, we can see that the most volatile group is the third group, and the most stable group is the second group. The reduced marginal effects don't appear here, and it is strange to some extent. Perhaps, we can only attribute this abnormity to the change of trading volume. Let's look at Table 4 again. We find that the trading volume in shares of the third group in February 2004 is 5.38 times of that in November 2003, and the trading volume in March 2004 is 4.16 times of that in November 2003. The other two groups have not experienced so great changes, although they do increase a lot. The increased volume could enlarge the volatility, and we believe that the effects of transparency change to volatility are counteracted to some extent. In order to examine the effects of transparency to volatility more accurately, we design an econometric model.

$$
\begin{equation*}
\operatorname{StdDev}_{\mathrm{it}}=\eta_{\mathrm{i}}+\beta 1 \mathrm{AvgVol}_{\mathrm{it}}+\beta_{2} \text { Dummy }_{\mathrm{it}}+\mathrm{u}_{\mathrm{it}} \tag{3}
\end{equation*}
$$

Where AvgStdDev represents the average intra-day volatility, $\gamma_{i}$ is a stock-specific mean, Avg Vol is the (log) average daily volume ( in million shares), and Dummy is a dummy variable which equals zero before the event and one after the event. Again, we examine differences between the post- and pre-event periods.

$$
\begin{equation*}
\Delta \operatorname{StdDev}_{\mathrm{i}}=\beta_{1} \mathrm{AvgVol}_{\mathrm{i}}+\beta_{2}+\varepsilon_{\mathrm{i}} \tag{4}
\end{equation*}
$$

Where $\Delta$ denotes a difference between the post- and pre-event periods.
We estimate the equation (4) using OLS and compute test statistics based on White's heteroskedasticity-consistent standard errors, and the results are presented in Table 7.

Table 7. Results of the estimation of equation (4)

|  |  | $\beta_{1}$ | $\beta_{2}$ | Adjusted R <br> (in \%) |
| :---: | :---: | :---: | :---: | :---: |
| 2003.11 and | estimator | 0.038679 <br> $(3.45)$ | -0.036126 <br> $(-4.08)$ | 5.47 |
| 2004.1 | t-stat. |  |  |  |
| p-value |  |  |  |  |$\left(\begin{array}{c}(0.001)\end{array} \begin{array}{c}(0.000)\end{array}\right.$

From Table 7 we could see that the estimators of average daily volume are positive and become larger and larger. Besides that, the trading volume become lager after the event, so we think that the effects of transparency change to market volatility are largely counteracted by the change of volume. And what is more important is that, we find the estimators of the dummy variable are all negative and significant (at the $1 \%$ significance level), so we can conclude that the higher transparency reduces the market volatility. Furthermore, we can see that the estimators of the dummy variable are -0.036126, -0.074130 and -0.123329 respectively, whose absolute value become larger and larger too, and it shows again that the event made the market volatility decreased persistently.

## 5. Conclusion

We have studied the effects of the disclosure information rules change in China A shares markets in Dec. 8, 2003. We find the market performance is influenced largely by the event, and there are great changes in the three aspects we examine.

First, the informative efficiency of markets becomes stronger after the event. We use the absolute value of 5-minute first-order intra-day return autocorrelation to measure the informative efficiency, and find that the value after the event is evidently smaller than that before the event. It means that the informative efficiency of markets is improved. We also find that the informative efficiency shows a decrease following an increase after the event, and perhaps, it is an overreaction to
some extent. Furthermore, we see that the effects of the event are different for different stocks. If the stocks were active before the event, their first order autocorrelation of return will become weaker after the event; on the contrary, some inactive stocks show less efficient after the event.

Second, the liquidity of markets is improved after the change of transparency. All the measures of liquidity become better after the event. There might be some overreaction in liquidity too, and we attribute that to the irrationality of China stocks markets traders. In addition, different stocks show different changes. We find that the more inactive the stock was before the event, the more it would be influenced by the event, which is like the phenomenon of reduced marginal effects.

Finally, the volatility of China A shares markets is decreased by the event. What is different is that the overreaction and marginal effects don't appear here, and we think that the reason might be the increased trading volume counteracts the effects of transparency change.

To conclude, we can see that the quality of China A shares markets is evidently improved after the increase of pre-trade transparency.

## Reference

Baruch, S., 2005, "Who Benefits from an Open Limit-Order Book", Journal of Business, 4: 1267-1306.
Bloomfield, R. and M. O’Hara, 1999, "Market transparency: who wins and who loses", Review of Financial Studies, 12: 5-35.
Boehmer, E., G. Saar and L. Yu, 2005, "Lifting the Veil: an Analysis of Pre-trade Transparency at the NYSE", Journal of Finance, 2: 783-815.
Chordia, T, R. Richard and A. Subrahmanvam, 2000, "Commonality in Liquidity", Journal of Financial Economics, 56: 3-28.

Madhavan, A., D. Porter and D. Weaver, 2000, "Should Securities Markets be Transparency", Working paper, University of Southern California.
Madhavan, A., 2000, "Market Microstructure: a Survey", Journal of Financial Markets, 3: 205-258.

Pagano, M. and A. Roell, 1996, "Transparency and liquidity: a comparison of auction and dealer markets with informed trading." Journal of Finance, 51: 579-611.
O’Hara, M., 1995, "Market Microstructure Theory", Basil Blackwell, Cambridge, MA.


[^0]:    ${ }^{1}$ We are grateful to Dr. Donghui Li for comments and suggestions. We alone bear responsibility for any mistakes and inaccuracies.
    ${ }^{2}$ Corresponding author. Tel: +86-10-82316149; Cell: 13520857400; E-mail address: df7792@126.com (Feng Dong).

