Security Transaction Tax and Its Impact

On Trading Volume and Return Volatility:

A Stock-Level Approach

by

Jun Cai (Yulanda)

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Professor Marti G. Subrahmanyam   Professor Jeffery Wurgler
Professor Jiawei Zhang

Faculty Advisers   Thesis Adviser

Executive Summary

The imposition of Security Transaction Taxes (STT) is under debate of a number of countries. In Asia, while many countries such as Japan and Singapore has abolished the STT, China has continued to levy tax on traders and to use STT as an active tool to "correct" market performance. Since Chinese Securities Market's commencement in 1991, Chinese government has imposed overall twelve STT rate adjustments in the two stock exchanges in China: Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE), and each adjustment was connected with macroeconomic situation. In other words, STT in China has been expected to be used as a fiscal tool for Chinese policy makers to stabilized the stock market and counter the excessive market behavior.

This fact has led to the main objective of this research paper, which is to investigate how STT fluctuations impact stock trading volume and market volatility. As an emerging market with recent and relatively frequent STT adjustments, and with a large proportion of unsophisticated individual traders, Chinese securities market is worth undertaking a close investigation. Previous empirical studies provided mixed conclusions regarding STT's impact on indexes in Chinese securities market. This leaves space the in-depth investigation in this paper. On one hand, few researches has conducted empirical researches on all STT adjustments in the history. On the other hand, almost no studies took their research into the individual stock level. Therefore, this paper will generate empirical evidences to provide new materials for discussion regarding STT. The evidences of this paper could provide guidance to policy makers when they use STT as a tool for market correction, and they could provide advices to investors' trading strategies during the post-adjustment period of STT.

In order to investigate the problem, the paper focuses on the eight STT rate adjustments and their short-term effects on Shanghai and Shenzhen A-Share indexes, as well as their effects

on individual constituent stocks of SSE-180 Index. On the index level, it collects the adjusted-closing price, trading volume and market capitalization from the WIND platform. On the stock level, it also collects the data of average turnover, market capitalization, price to book value ratio, price to sales ratio, dividend yield, average standard deviation, beta, and earnings per share, for individual stocks. These variables are used to further investigate what kind of stocks are more sensitive to STT fluctuations. In order to determine the reaction of indexes and individual stocks to tax adjustment, the paper follows the study approach of test hypothesis provided by Baltagi et al (2006). Firstly, it observes the intervals of *2n* valid trading days centered around the tax adjustment date, where sample intervals $n = 15, 20, 30, 50, 75$. Then, it conducts t-test of the equality of mean trading volume and f-test of the equality of adjusted return variances, before and after the STT rate adjustment. Eventually, it takes the median of corresponding values to suggest STT rate adjustment's "typical" impact on indexes and individual stocks. For individual stocks, it further runs linear regression model of the ratio of volume or volatility after and before the event date in the $n = 15$ sample interval, on the variables mentioned above. The methodology taken here are adapted from Baltagi et al. (2006) and Su and Zheng (2014).

The paper's first hypothesis is that the mean trading volume remains the same before and after STT rate adjustments within the sample intervals. In the index level, the empirical evidences suggest that trading volume declined significantly after STT rate increases, and it increased significantly after STT rate was lowered. In other words, STT adjustments counter the trading volume significantly in the index level. In the stock level, empirical results suggest that when STT rate increases, investors trade significantly less frequently in general, yet individual stocks have discriminate behavior. On the contrary, when STT rate decreases, stocks are traded more frequently as a whole with little discrimination. The trading volume affected by STT rate decreases is less significant than it is affected by STT rate increases.

The paper's second hypothesis is that the variances of adjusted return remain the same before and after STT rate adjustments within the sample intervals. In the index level, the empirical evidences suggest that market volatility increases significantly no matter whether STT is shifted upward or downward. In the stock level, the empirical results discriminate by STT adjustments. The paper concludes that stock volatility increases in response to an increased STT rate adjustment. Nevertheless, the response of stock volatility to a decreased STT rate adjustment was mixed. As it is the case for t-test of the equality of mean trading volume, STT fluctuation's impact on individual stocks' volatility is not significant.

By running linear regression on individual stocks in terms of turnover, the results suggest that the average turnover before the adjustment has a negative relation with the trading volume immediately after STT rate decrease. Besides, stocks with larger price to book value ratio and price to sales ratio prior to STT adjustments are more sensitive to STT increases in terms of their trading volume. The regression results in terms of volatility suggest that the average standard deviation of stocks has a positive impact on volatility increase in the short-term period after STT adjustments. What's more, stocks with larger market capitalization, beta value and earning per share are generally more sensitive to STT adjustments in terms of their volatility. Notably, the regressions only suggest a directional affection of the above-mentioned variables on volume and volatility. In general, the variables' impact on volume and volatility were not significant.

Overall, the paper's investigation should contribute to show that policy makers could use STT as a tool to steer the trading volume of the securities market in China, so as to correct the market counter-cyclically, yet the manipulation will lead to a more volatile market in the short term. To avoid risk of volatility in the short-term period after STT adjustment, investors could adjust their portfolios to stocks with higher market capitalization, lower average volatility prior to the tax adjustments, lower beta, and lower earnings per share.

1. Introduction

1.1. Background Overview

The "Stamp Duty on Stock Transactions" in China, or equivalently the Stock Transaction Tax (STT) on securities trading, was first levied by Chinese local government of Shenzhen at a unilateral rate[1] of 0.6% in June 1990. Following the precedent of Shenzhen Stock Exchange (SZSE), Shanghai Stock Market (SSE) started STT levy at a unilateral rate of 0.3% in October 1991. From its commencement, STT went through overall 12 adjustments in both stock markets; the final adjustment lies on September 19, 2008, and is currently levied at a bilateral rate of 0.1%. (See Table 1)

Table 1: STT Adjustments in Shanghai and Shenzhen stock market

Year	Starting Time	Adjustment	Rate	Tax Type	Effective Market
1990	July 1	*Start Date*	0.6%	Unilateral	SZ
1990	November 23	Increase	0.6%	Bilateral	SZ
1991	June 01	Decrease	0.3%	Bilateral	SZ
1991	October 10	*Start Date*	0.3%	Bilateral	SH
1997	May 12	Increase	0.5%	Bilateral	SH, SZ
1998	June 12	Decrease	0.4%	Bilateral	SH, SZ
1999	June 01	Decrease	0.3%	Bilateral	SH, SZ, B-Share
2001	November 16	Decrease	0.2%	Bilateral	SH, SZ
2005	January 24	Decrease	0.1%	Bilateral	SH, SZ
2007	May 30	Increase	0.3%	Bilateral	SH, SZ
2008	April 24	Decrease	0.1%	Bilateral	SH, SZ
2008	September 19	Decrease	0.1%	Unilateral	SH, SZ

Sources: Shanghai Stock Exchange, Shenzhen Stock Exchange
Notes: SH and SZ stands respectively for Shanghai stock market and Shenzhen stock market; Unilateral means that the STT is imposed on seller of the stocks; Bilateral means that both seller and buyer shall pay the STT; On October 10, 1991, the 1‰ decrease of stamp duty only applied to the B-share market in Shanghai and Shenzhen stock market; a "Start Date" of stamp duty levy is counted towards an STT rate increase for simplicity.

Generally speaking, STT "not only aims to raise government revenue, but is meant to fulfill regulatory functions, to correct market failure, and to steer individual behavior towards

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[1] "Unilateral" tax is imposed on seller of the stocks; "Bilateral" tax is imposed on both the seller and buyer of the stocks

efficient outcomes" (Schön 2016)[2]. As China's case of STT rate adjustment shown in Table 1, each adjustment since its commencement is connected with macroeconomic situation. In other words, the adjustments acted as tools for Chinese policy makers to counter the stock market (Peng et al 2014)[3]. For instance, the starting point of STT levy in Shenzhen was carried out to overcome the overheated speculative investment in over-the-counter market, which was at that time lack of regulation and control; After all, it was not until December 1, 1990 that Shenzhen Stock Exchange (SZSE) was officially established[4]. Similarly, the government increased the STT rate on May 30, 2007, anticipating a latent bubble burst, aimed to restrain excessive expansion of the stock market caused by exuberant investor sentiment, and to counter potential economic downturn. On the contrary, in June 1998 and 1999 respectively, the central government decreased the STT rate by 0.1% successively to counter the market slump, and to simulate the development of B-share market. Comparably, the STT rate dropped again in both April and September 2008 in order to shore up the depressed market affected by the international financial crises and to accelerate market recovery.

Nevertheless, one has reason to speculate if the STT rate adjustments manipulate the market as policy makers anticipate – to adjust counter investor's trading behavior and to stabilize the market; and if so, by how much. Further, it is also under question of this paper that whether STT adjustments impact individual stocks discriminately. Therefore, the principle objective of this paper is to take empirical researches and to investigate how tax regime fluctuations affect the trading volume and market volatility. Empirical evidences of this paper could provide policy makers with guidance when they use STT as a tool for market correction, and

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[2] Schön, Wolfgang, Regulation and Taxation of the Financial Markets, ECFR 2016, 424-452

[3] Zhe Peng , Qiming Tang & Kent Wang (2014), Adjustment of the Stamp Duty on Stock Transactions and Its Effect on the Chinese Stock Market, Emerging Markets Finance and Trade, 50:1, 183-196

[4] Lu, Yi, The Cause and Effect of Stamp Duty on Stock Transactions in China, The Financial Times Chinese website, October 18, 2011

they could provide advices to investors' trading strategies during the post-adjustment short-term period of STT adjustments.

1. Literature Review

Regarding the impact of Stock Transaction Tax (STT) adjustment on securities trading, the conventional view insists that a change in tax regime – whether it be a change in tax rate or a shift between bilateral and unilateral collection – would counter the market, either "discouraging speculative trading or stimulating a depressed market" (Peng et al 2014)[5]. Most empirical studies base their observation and analysis on the effect of STT fluctuation on trading volume, volatility and market efficiency, yet they have shown mixed opinions.

Baltagi et al examines the impact of a single tax increase adjustment in 1997 on Shanghai and Shenzhen A share market. They used T-test, Levene's statistic and GARCH model respectively on trading volume, market volatility, and market efficiency, and reported that "trading volume decreased and market volatility increased after the tax rate increased in 1997" (Baltagi et al 2006). Following the same methods as that of Baltagi et al, yet expanding the number of tax change under investigation (five in Shanghai stock market and four in Shenzhen stock market), Su and Zheng (2011) studied the short-term behavior after STT adjustment (within a maximum 60-day interval). They state that both increases and reductions in the STT rate result in significant increases in market volatility, which is consistent with findings of Baltagi et al. In addition, Su and Zheng report, with empirical evidences, that "whereas increases in the STT rate have mixed effects on market efficiency, either improving or curbing it, reductions usually either make the market less efficient or have no effect on it" (Su and Zheng 2014)[6] .

[5] Zhe Peng , Qiming Tang & Kent Wang (2014), Adjustment of the Stamp Duty on Stock Transactions and Its Effect on the Chinese Stock Market, Emerging Markets Finance and Trade, 50:1, 183-196
[6] Yongyang Su & Lan Zheng (2011) The Impact of Securities Transaction Taxes on the Chinese Stock Market, Emerging

Nevertheless, in the empirical study of STT's short-term effects by Peng et al (2014), who based their investigation on an interval autoregressive model of three tax adjustments in Shanghai and Shenzhen Composite Indexes, they state that "the STT's effects on interval return are trivial, and its ability to influence trading volume and market volatility is also dubious" (Peng et al 2014)[7]. Furthermore, Fu et al (2014) studied the impact of STT rate adjustment to the general Chinese stock market on May 30, 2007. They conclude that STT adjustment only had effect in the short term[8]: in spite of a sharp decrease at the first day of STT adjustment, the long-term relationship – a negative relationship between STT rate and price level as well as trading volume – does not exist anymore.

To summarize, the analyses mentioned above could not substantiate a comprehensive view of the market behavior impacted by a change of tax regime, and therefore leave some space for further research in this paper. On one hand, few researches has conducted empirical researches on all STT adjustments in the history. On the other hand, almost no studies took their research into the individual stock level. Thus, this paper will extend existing empirical work by investigating the effects of all STT adjustments and by looking at the impact on representative stocks. Hopefully, this paper will generate empirical evidences to provide new materials for discussion regarding STT.

2. Methodology and Data

3.1. Data:

On the index level, the paper collects data of Shanghai A-Share Index starting from 12/19/1990 and Shenzhen A-Share starting from 12/19/1995, until 12/31/2009. As is stated in

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[7] Zhe Peng , Qiming Tang & Kent Wang (2014), Adjustment of the Stamp Duty on Stock Transactions and Its Effect on the Chinese Stock Market, Emerging Markets Finance and Trade, 50:1, 183-196

[8] Fu, Tong, Abrokwa, Kennedy K., Bhattarai, Keshab R. (2014), Impacts of Securities Transaction Tax Adjustments in Stock Market in China, Advances in Economics and Business 2(7): 249-260

Baltagi et al (2006), since the study of Chinese B-share market will not be included in this paper, because the trading of B-share markets is extremely small comparing to A-share markets. On the stock level, the paper investigates the constituent stocks included in SSE-180 index. All individual stock data are collected since their IPO (initial public offering) dates.

The paper investigates all eight tax adjustments in Shanghai stock market and all seven in Shenzhen stock markets, and it collects the adjusted-closing price, trading volume and market capitalization of every indexes and stocks according to availability of data from the WIND platform. On the stock level, it also collects the data of average turnover, market capitalization, price to book value ratio, price to sales ratio, dividend yield, average standard deviation, beta, and earnings per share[9], for each individual stock. These variables or, the "influence factors", are used to further investigate what kind of stocks are more sensitive to STT fluctuations. In order to test the different behavior of volume and volatility before and after the STT rate adjustment, for each STT adjustment date ("event date"), the paper observes the intervals of *2n* valid trading days centered around the adjustment date. Each interval is divided into two subgroups, and each subgroup contains a sample interval of n valid trading days, where $n = 15, 20, 30, 50, 75$, when the adjusted daily returns does not equal to zero. The first subgroup includes pre-adjustment dates which end at one valid trading day before the event days, whereas the second subgroup includes post-adjustment dates which start from the event date, or the first valid trading day after the event date.

The paper uses adjusted daily returns $R_t = ln \frac{p_t}{p_{t-1}}$, where p_t denotes the adjusted closing prices at date t. The market trading volume, including both market trading volume and individual stock trading volume, are measured in billion RMB.

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[9] Average turnover represents the 250-day average turnover prior to the tax adjustment; beta represents the 100-week average beta prior to the tax adjustment; and other variables are taken at their values on the STT adjustment dates.

A summary statistic for Shanghai Stock Exchange (SSE) index and Shenzhen Stock Exchange (SZSE) index is displayed in Table 2.

Table 2: Summary Statistics for Indexes

	Pre-event	Post-event	Whole-Sample
Panel A: Shanghai A-Share			
Number of Observations	112	119	230
Maximum	0.0584	0.0679	0.0752
Minimum	-0.0632	-0.0632	-0.0698
Mean	-0.0002	0.0002	0.0001
Mean absolute deviation	0.0174	0.0181	0.0178
Standard deviation	0.0191	0.0196	0.0195
Skewness	-0.2112	0.4899	0.0103
Kurtosis	2.6491	7.6446	4.4387
	Pre-event	Post-event	Whole-Sample
Panel B: Shenzhen A-Share			
Number of Observations	111	117	228
Maximum	0.0625	0.0693	0.0736
Minimum	-0.0750	-0.0754	-0.0812
Mean	-0.0005	-0.0010	-0.0006
Mean absolute deviation	0.0202	0.0222	0.0215
Standard deviation	0.0222	0.0237	0.0231
Skewness	-0.4362	-0.2764	-0.3645
Kurtosis	3.0846	2.2986	2.6127

Notes: Each data unit in this table displays the mean value of all tax adjustments under investigation in Shanghai and Shenzhen stock markets.

3.2. Methodology:

This paper follows the methodology proposed by Baltagi et al (2004), and Su and Zheng (2014); It evaluates how each STT rate adjustments impact short-term behavior of trading volume and market volatility of Shanghai and Shenzhen A-share Indexes. It then extends the work to the individual constituent stocks included in SSE-180 index with the same method. The paper uses t-test to investigate differences between means of trading volume within pre-adjustment and post-adjustment sample intervals; and it uses f-test to investigate differences between variances of return within pre-adjustment and post-adjustment sample intervals. The main values from both investigations to look at are (1) ratio r of means and variances, where $r_t = \frac{\bar{x}_2}{\bar{x}_1}$

and $r_f = \frac{s_2}{s_1}$, (2) t statistics and f statistics, and (3) p value of both statistics[10]. The paper will then take the median of this three main values to suggest STT rate adjustment's "typical" impact on indexes and individual stocks, not skewing by extremely large or small values. The paper will then analyze the result and study the factors causing the amount of disturbance by tax regime changes, for both the market and individual stocks. In the stock level, the paper will run linear regression, of the ratio of volume or volatility after and before the event date in the 15-day sample interval on the influence factors[11] mentioned above. The paper will also study the macro-economic reasons that could impact the securities market in the index level for those event dates that display abnormal behavior.

3.2.1. T-Test for the impact on trading volume:

To examine how STT rate adjustment impact trading volume of individual stocks in Chinese stock market, a sequence of n trading days before and after the STT rate adjustment date is observed. Denote the trading volumes (in 10 billion RMB) as $x = x_{11}, x_{12}, \dots, x_{1n}$ for n valid trading days before the event day, and $x = x_{21}, x_{22}, \dots, x_{2n}$ for n trading days after the event day. The null hypothesis and alternative hypothesis of equal trading volume are then written as:

Null Hypothesis:

$$H_0: \bar{\mu}_1 = \bar{\mu}_2, \qquad H_1: \bar{\mu}_1 \neq \bar{\mu}_2$$

T Statistic:

$$t = \frac{\bar{x}_2 - \bar{x}_1}{S_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}, \qquad \text{where } S_p = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

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[10] $\bar{x}_1$ and $\bar{x}_2$ denote the sample mean of trading volume before and after the event day, and s_1^2 and s_2^2 denote their corresponding sample variances.

[11] The variables are: average turnover, market capitalization, price to book value ratio, price to sales ratio, dividend yield, average standard deviation, beta, and earnings per share

Where:

$\bar{x}_1$ and $\bar{x}_2$ are sample mean of trading volume before and after the event day,

s_1^2 and s_2^2 are their corresponding sample variances, and

n_1 and n_2 are their corresponding degrees of freedom.

3.2.2. F Statistic for Changes in Market Volatility:

With notation being the same as T statistic discussed in the previous section, The null hypothesis and alternative hypothesis of equal sample variances (return volatility) are then written as:

Null Hypothesis:

$$H_0: \sigma_1^2 = \sigma_2^2, \qquad H_1: \sigma_1^2 \neq \sigma_2^2$$

F Statistic:

$$\chi^2 = \frac{(n-1)s_2^2}{s_1^2}$$

where:

s_1^2 and s_2^2 are the sample variances of return before and after the event day, and

n is the number of valid trading days before or after the event dates.

4. Empirical Results

The paper first reports the test statistics results in trading volume and return volatility in the index level. Then it reports the test statistics results in turnover and volatility in the stock level. Eventually, it reports the linear regression results of SSE-180 constituent stocks. Each section is followed with a conclusion.

4.1. SSE Index and SZSE Index

4.1.1. Results of T-Statistics

Table 3 and Table 4 displays the t-statistics results, each value being the median of the corresponding values of the whole sample. Table 5 displays the detailed results of t-statistics of all eight tax adjustments.

Table 3: Summary Results of T-Test for Shanghai Stock Exchange (SSE)

Panel A: Whole Sample Adjustments					
Sample Period	15	20	30	50	75
Mean Ratio (after/before)	1.187	1.010	0.997	0.985	0.947
t statistic	0.784	-0.199	0.158	-0.107	0.001
	(0.001)	(0.002)	(0.002)	(0.047)	(0.018)
Panel B: STT Increases					
Sample Period	15	20	30	50	75
Mean Ratio (after/before)	0.711	0.759	0.810	0.883	0.846
t statistic	-2.254	-1.661	-3.276	-1.864	-0.795
	(0.032)	(0.002)	(0.002)	(0.065)	(0.101)
Panel C: STT Decreases					
Sample Period	15	20	30	50	75
Mean Ratio (after/before)	1.636	1.548	1.285	1.112	1.049
t statistic	3.947	3.340	2.408	1.111	0.798
	(0.000)	(0.003)	(0.003)	(0.029)	(0.001)

Notes: Each value in the table displays the median of corresponding mean ratio and t statistics in SSE. Panel A suggests the median of corresponding value of all eight tax adjustments; panel B displays the median of corresponding value of three tax increases in 1991, 1997, and 2007; and Pane C displays the median of corresponding value of five tax decreases in 1998, 2001, 2005, 04/2008, and 09/2008.

The empirical results show that for all three tax increases in SSE, and both two increases in SZSE, the median ratios of the mean trading volume in the post-adjustment and in the pre-adjustment periods are less than one, except for the STT adjustment date on June 12, 1998. This result suggests that trading volume declined after the STT rates were raised. On the contrary, for the four tax decreases in SSE and SZSE, the ratios of the average trading volume are greater than one, which suggest that trading volume increased after the STT rates were lowered. Almost all t statistics are significant on a 95 and 99 percent confidence interval, which suggest that STT rate adjustments have significant impact on investor's trading

behavior; investors respond to the reduced STT rates by trading more actively and respond to raised STT rates by reducing their trading frequencies.

Table 4: Summary Results of T-Test for Shenzhen Stock Exchange (SZSE)

Panel A: Whole Sample Adjustments					
Sample Period	15	20	30	50	75
Mean Ratio (after/before)	1.408	1.120	1.069	0.954	1.033
t statistic	3.109	0.643	0.479	-0.490	0.535
	(0.001)	(0.000)	(0.000)	(0.140)	(0.022)
Panel B: STT Increases					
Sample Period	0.804	0.834	0.757	0.803	0.925
Mean Ratio (after/before)	-2.000	-1.824	-3.526	-3.318	-1.247
t statistic	(0.241)	(0.002)	(0.002)	(0.070)	(0.015)
Panel C: STT Decreases					
Sample Period	1.659	1.423	1.134	0.994	1.033
Mean Ratio (after/before)	3.699	2.958	1.293	-0.089	0.535
t statistic	(0.000)	(0.000)	(0.000)	(0.546)	(0.022)

Notes: Each value in the table displays the median of corresponding mean ratio and t statistics in SZSE. Panel A suggests the median of corresponding value of all seven tax adjustments; panel B displays the median of corresponding value of two tax increases in 1997, and 2007; and Pane C displays the median of corresponding value of five tax decreases in 1998, 2001, 2005, 04/2008, and 09/2008.

Notably, also, the event date on June 12, 1998 showed abnormal trading volume behavior, as compared to other tax decreases. This result confirms with previous investigation from Su and Zheng (2014). A review of literature suggests possible reasons for this abnormality. In 1998, the Asia financial crises impacted negatively on China's macroeconomic situation, and "the persistent decline of price levels and the significant slowdown of the economy led to a deflation in China" (Yu 2001), even with the government turning to the expansionary fiscal policy in the middle of 1998, including lowering the interest rate and security transaction tax rate. As stated in Yu, China's growth rate and investment rate continued to decline, and "the most worrisome development was the continuous decline in the growth rate of investment" (2001). This situation continued until the fourth quarter of 1999.[12]

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[12] Yu, Yong-ding (2001) A Review of China's Macroeconomic Development and Policies in the 1990s, China and World Economy, November 6, 2001

Table 5: T-test for Trading Volume (in billion RMB)

Shanghai A-share		Sample Interval				
		15	20	30	50	75
Tax Increases						
10/03/1991	Mean Ratio	0.56	0.76	0.88	0.98	0.85
(0.3%)	T-statistic	-2.25	-1.01	-0.47	-0.08	-0.79
		(0.032)	(0.642)	(0.642)	(0.934)	(0.428)
05/12/1997	Mean Ratio	0.71	0.74	0.66	0.65	0.69
(0.5%)	T-statistic	-3.77	-4.28	-5.44	-7.02	-4.76
		(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
05/30/2007	Mean Ratio	0.92	0.91	0.81	0.88	1.10
(0.3%)	T-statistic	-1.51	-1.66	-3.28	-1.86	1.65
		(0.142)	(0.002)	(0.002)	(0.065)	(0.101)
Tax Decreases						
06/12/1998	Mean Ratio	0.71	0.68	0.61	0.53	0.67
(0.4%)	T-statistic	-4.57	-5.31	-8.48	-13.59	-6.65
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
11/16/2001	Mean Ratio	1.64	1.11	1.11	1.11	1.35
(0.2%)	T-statistic	4.90	0.61	0.78	1.11	3.46
		(0.000)	(0.437)	(0.437)	(0.269)	(0.001)
01/24/2005	Mean Ratio	1.46	1.70	1.74	1.37	1.05
(0.1%)	T-statistic	3.08	4.69	6.63	4.89	0.80
		(0.005)	(0.000)	(0.000)	(0.000)	(0.426)
04/24/2008	Mean Ratio	1.88	1.68	1.31	0.99	0.75
(0.1%)	T-statistic	7.41	6.12	3.14	-0.13	-4.52
		(0.000)	(0.003)	(0.003)	(0.897)	(0.000)
09/19/2008	Mean Ratio	1.81	1.55	1.28	1.22	1.15
(0.1%*)	T-statistic	3.95	3.34	2.41	2.21	2.12
		(0.000)	(0.019)	(0.019)	(0.029)	(0.036)
Shenzhen A-share		Sample Interval				
		15	20	30	50	75
Tax Increases						
05/12/1997	Mean Ratio	0.65	0.71	0.69	0.70	0.71
(0.5%)	T-statistic	-3.28	-2.88	-4.04	-5.15	-4.69
		(0.003)	(0.000)	(0.000)	(0.000)	(0.000)
05/30/2007	Mean Ratio	0.96	0.96	0.83	0.91	1.14
(0.3%)	T-statistic	-0.72	-0.77	-3.01	-1.49	2.20
		(0.478)	(0.004)	(0.004)	(0.140)	(0.029)
Tax Decreases						
06/12/1998	Mean Ratio	0.63	0.60	0.53	0.48	0.61
(0.4%)	T-statistic	-6.32	-7.63	-11.29	-16.82	-8.19
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
11/16/2001	Mean Ratio	1.70	1.12	1.07	0.95	1.25
(0.2%)	T-statistic	5.59	0.64	0.48	-0.49	2.31
		(0.000)	(0.634)	(0.634)	(0.625)	(0.022)
01/24/2005	Mean Ratio	1.41	1.71	1.74	1.35	1.03
(0.1%)	T-statistic	3.11	4.99	7.13	4.70	0.54
		(0.004)	(0.000)	(0.000)	(0.000)	(0.593)
04/24/2008	Mean Ratio	1.83	1.68	1.32	0.99	0.75
(0.1%)	T-statistic	9.54	8.39	3.76	-0.09	-4.56
		(0.000)	(0.000)	(0.000)	(0.930)	(0.000)
09/19/2008	Mean Ratio	1.66	1.42	1.13	1.06	1.07
(0.1%*)	T-statistic	3.70	2.96	1.29	0.61	1.03
		(0.001)	(0.201)	(0.201)	(0.546)	(0.303)

Notes: The percentage points in the first column displays the new STT rate after adjustment.
* The 0.1% tax rate is unilateral (only levied on the seller of stocks)

Overall, the results suggest that the response of market trading volume counters significantly to STT adjustments in both Shanghai and Shenzhen A-share markets.

4.1.2. Results of F-Statistics:

Table 6 and Table 7 displays the f-statistics results, each value being the median of the corresponding values of the whole sample. Table 8 displays the detailed results of f-statistics showing all eight tax adjustments.

Table 6: Summary Results of F-Test for Shanghai Stock Exchange (SSE)

Panel A: Whole Sample Adjustments					
Sample Period	15	20	30	50	75
Stdev Ratio (after/before)	1.528	1.565	1.369	1.478	1.146
f statistic	2.338	2.450	1.876	2.187	1.315
	(0.033)	(0.006)	(0.018)	(0.002)	(0.064)
Panel B: STT Increases					
Sample Period	15	20	30	50	75
Stdev Ratio (after/before)	1.573	1.713	1.655	1.559	1.181
f statistic	2.474	2.936	2.738	2.429	1.394
	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)
Panel C: STT Decreases					
Sample Period	15	20	30	50	75
Stdev Ratio (after/before)	1.484	1.548	1.352	1.434	1.112
f statistic	2.202	2.397	1.827	2.056	1.236
	(0.051)	(0.026)	(0.042)	(0.007)	(0.182)

Notes: Each cell in the table displays the median of corresponding standard deviation ratios and f statistics of SSE. Panel A suggests the median of corresponding value of all eight tax adjustments; panel B displays the median of corresponding value of three tax increases in 1991, 1997, and 2007; and Pane C displays the median of corresponding value of five tax decreases in 1998, 2001, 2005, 04/2008, and 09/2008.

As shown in Table 6 and 7, all the median ratios of standard deviations are more than one. This empirical evidence implies that the standard deviations of returns in the post-adjustment period periods are generally larger than the corresponding standard deviations in the pre-adjustment periods, whether it be the case of a STT rate increase or a STT rate decrease. Most of the f statistics are significant at a 95 percent and a 90 percent confidence interval, except for some $n = 75$ sample interval. These result suggest that market volatility significantly increased after STT rate adjustments, especially in the short-term.

Table 7: Summary Results of F-Test for Shenzhen Stock Exchange (SZSE)

Panel A: Whole Sample Adjustments					
Sample Period	15	20	30	50	75
Mean Ratio (after/before)	1.624	1.618	1.344	1.502	1.169
t statistic	2.638	2.619	1.807	2.257	1.367
	(0.021)	(0.005)	(0.033)	(0.003)	(0.003)
Panel B: STT Increases					
Sample Period	2.246	2.217	1.989	2.002	1.412
Mean Ratio (after/before)	5.159	4.947	3.966	4.011	2.001
t statistic	(0.006)	(0.001)	(0.000)	(0.000)	(0.000)
Panel C: STT Decreases					
Sample Period	1.308	1.393	1.157	1.289	1.055
Mean Ratio (after/before)	1.710	1.939	1.339	1.661	1.113
t statistic	(0.040)	(0.021)	(0.046)	(0.039)	(0.363)

Notes: Each cell in the table displays the median of corresponding standard deviation ratios and f statistics of SZSE. Panel A suggests the median of corresponding value of all seven tax adjustments; panel B displays the median of corresponding value of two tax increases in 1997, and 2007; and Pane C displays the median of corresponding value of five tax decreases in 1998, 2001, 2005, 04/2008, and 09/2008.

Table 8 reports the test results of each event date separately. The table displays that most reaction of market return volatility to tax adjustments in accordance with the "typical" reaction displayed before, except for the event date on 1991 and 2001. Most f statistics are significant at a 99 percent and 95 percent confidence interval, except for the two event dates on 2008. This further confirms that the market generally becomes more volatile after STT rate adjustments. Here, Su and Zheng has also confirmed that the "more noise trading and destabilizing speculations resulted from a decreased transaction cost – when STT rates are lowered – is also to contribute to market volatility" (2014).

Regarding the abnormal return behavior in 2001, literature reviews are done to investigate the possible reason. Wang and Li propose in their research that China's entry to the World Trade Organization on November 10, 2001, was likely to "complicate the effect of the STT adjustments" (Wang and Li 2012).[13]

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[13] Wang, N., and D. Li. 2012. "Impact of the Securities Transaction Tax on Stock Markets: Evidence from Chinese Stock Markets." Chinese Economy 45, no. 5: 26–49.

Table 8: F-test for Return Volatility

Shanghai A-share		Sample Interval				
		15	20	30	50	75
Tax Increases						
10/03/1991	Stdev Ratio	0.13	0.22	0.22	0.35	0.45
(0.3%)	F-statistic	0.02	0.05	0.05	0.13	0.20
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
05/12/1997	Stdev Ratio	1.57	1.71	1.65	1.56	1.18
(0.5%)	F-statistic	2.47	2.94	2.74	2.43	1.39
		(0.051)	(0.012)	(0.004)	(0.001)	(0.001)
05/30/2007	Stdev Ratio	2.32	2.23	1.79	1.83	1.20
(0.3%)	F-statistic	5.37	4.97	3.21	3.36	1.43
		(0.002)	(0.001)	(0.001)	(0.000)	(0.062)
Tax Decreases						
06/12/1998	Stdev Ratio	1.48	1.55	1.42	1.94	1.79
(0.4%)	F-statistic	2.20	2.40	2.02	3.78	3.21
		(0.076)	(0.032)	(0.032)	(0.000)	(0.000)
11/16/2001	Stdev Ratio	0.54	0.33	0.42	0.89	0.96
(0.2%)	F-statistic	0.30	0.11	0.17	0.79	0.93
		(0.015)	(0.000)	(0.000)	(0.204)	(0.373)
01/24/2005	Stdev Ratio	1.57	1.58	1.39	1.52	1.19
(0.1%)	F-statistic	2.47	2.50	1.92	2.32	1.42
		(0.051)	(0.026)	(0.042)	(0.002)	(0.066)
04/24/2008	Stdev Ratio	1.05	0.99	0.94	1.16	1.02
(0.1%)	F-statistic	1.11	0.98	0.81	1.36	1.03
		(0.423)	(0.482)	(0.289)	(0.146)	(0.448)
09/19/2008	Stdev Ratio	2.26	2.11	1.35	1.43	1.11
(0.1%*)	F-statistic	5.09	4.45	1.83	2.06	1.24
		(0.002)	(0.001)	(0.055)	(0.007)	(0.182)

Shenzhen A-share		Sample Interval				
		15	20	30	50	75
Tax Increases						
05/12/1997	Stdev Ratio	1.91	2.03	2.08	2.05	1.49
(0.5%)	F-statistic	3.64	4.13	4.34	4.22	2.22
		(0.011)	(0.002)	(0.000)	(0.000)	(0.000)
05/30/2007	Stdev Ratio	2.58	2.40	1.90	1.95	1.34
(0.3%)	F-statistic	6.68	5.76	3.60	3.81	1.79
		(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Tax Decreases						
06/12/1998	Stdev Ratio	1.31	1.39	1.34	1.85	1.63
(0.4%)	F-statistic	1.71	1.94	1.81	3.41	2.66
		(0.164)	(0.079)	(0.058)	(0.000)	(0.000)
11/16/2001	Stdev Ratio	0.57	0.36	0.43	0.97	1.06
(0.2%)	F-statistic	0.32	0.13	0.19	0.94	1.11
		(0.021)	(0.000)	(0.000)	(0.412)	(0.412)
01/24/2005	Stdev Ratio	1.62	1.62	1.38	1.50	1.17
(0.1%)	F-statistic	2.64	2.62	1.89	2.26	1.37
		(0.040)	(0.021)	(0.046)	(0.003)	(0.003)
04/24/2008	Stdev Ratio	0.80	0.79	0.71	1.04	0.96
(0.1%)	F-statistic	0.63	0.63	0.50	1.08	0.92
		(0.201)	(0.161)	(0.033)	(0.396)	(0.363)
09/19/2008	Stdev Ratio	2.03	1.86	1.16	1.29	1.00
(0.1%*)	F-statistic	4.12	3.47	1.34	1.66	1.01
		(0.006)	(0.005)	(0.218)	(0.039)	(0.489)

Notes: The percentage points in the first column displays the new STT rate after adjustment.
* The 0.1% tax rate is unilateral (only levied on the seller of stocks)

Overall, the results show that market volatility in SSE and SZSE A-share market increased significantly after the STT rate adjustments, both increases and decreases. On contrary to policy maker's intention to stabilize the market through tax adjustments, the adjustments have significant impact on the stock market. Therefore, policy makers should avoid using the tax adjustment method to stabilize the market.

4.2. SSE-180 Constituent Stocks

4.2.1. Results of T-Statistics

In this section, tests are performed to investigate whether trading volume of each individual stocks contained in the SSE-180 index changes after the STT rate changes. All medians ratios (ratios of turnover of stocks after and before the event date) are divided into two categories denoted respectively "above" and "below". The "above" ("below") category contains stocks that have ratios above (below) the median ratio in the 30-day sample interval. The results are then displayed in Table 9.

In Panel A, the empirical results show that almost all medians of the mean trading volume ratios (the means of post-adjustment samples divided by corresponding means of pre-adjustment samples) of stocks in the "above" category are less than one, which means that the trading volume of stocks after the STT rate increases are generally smaller than the trading volume before the event. Besides, the results also show that the medians of mean trading volumes in the "above" category differs largely from the medians in the "below" category. This empirical evidence suggests that the trading volume of individual stocks respond to STT rate increase discriminately. Further, almost all t-statistics are significant in a 90 percent, 95 percent or 99 percent confidence interval, except some example intervals. Hence we can conclude that the trading volume of individual stocks respond significantly to STT rate increases; investors generally trade less significantly for individual stocks.

Table 9: Summary Results of T-Test for SSE-180 Individual Stocks

Panel A: STT Increases

Date	Ratio		r-15	r-20	r-30	r-50	r-75	t-15	t-20	t-30	t-50	t-75	p-15	p-20	p-30	p-50	p-75
May 10, 1997	0.3-0.5	Overall*	0.67	0.66	0.61	0.56	0.59	-3.07	-3.27	-3.58	-4.50	-3.81	(0.003)	(0.002)	(0.001)	(0.000)	(0.000)
		Above**	1.07	1.24	1.27	1.18	1.05	1.80	1.73	1.67	2.51	2.49	(0.075)	(0.096)	(0.100)	(0.014)	(0.015)
		Below***	0.41	0.37	0.32	0.30	0.33	-3.73	-4.23	-5.33	-6.83	-6.55	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
May 30, 2007	0.1-0.3	Overall	0.97	0.97	0.83	0.91	1.11	-1.72	-2.03	-2.30	-2.39	2.02	(0.088)	(0.045)	(0.025)	(0.019)	(0.047)
		Above	1.26	1.23	1.04	1.12	1.32	1.46	1.73	0.88	1.25	3.02	(0.149)	(0.087)	(0.394)	(0.213)	(0.003)
		Below	0.75	0.72	0.63	0.71	0.91	-1.98	-2.26	-3.60	-3.03	-1.59	(0.051)	(0.026)	(0.001)	(0.003)	(0.115)

Panel B: STT Decreases

Date	Ratio		r-15	r-20	r-30	r-50	r-75	t-15	t-20	t-30	t-50	t-75	p-15	p-20	p-30	p-50	p-75
June 12, 1998	0.5-0.4	Overall	0.88	0.85	0.69	0.57	0.68	-1.91	-2.16	-3.15	-3.73	-3.87	(0.059)	(0.033)	(0.002)	(0.000)	(0.000)
		Above	1.52	1.39	1.21	1.03	1.09	1.77	1.27	1.52	2.05	3.13	(0.080)	(0.206)	(0.131)	(0.043)	(0.002)
		Below	0.61	0.50	0.45	0.34	0.52	-2.31	-2.77	-4.13	-5.57	-4.10	(0.023)	(0.007)	(0.000)	(0.000)	(0.000)
Nov 16, 2001	0.4-0.2	Overall	1.48	0.95	1.04	1.06	1.27	1.85	-1.09	1.13	1.68	2.24	(0.067)	(0.279)	(0.260)	(0.096)	(0.026)
		Above	2.02	1.47	1.44	1.50	1.49	2.15	1.72	1.69	2.00	2.55	(0.034)	(0.089)	(0.093)	(0.049)	(0.013)
		Below	1.21	0.84	0.78	0.84	1.09	1.53	-0.60	-1.01	-1.28	1.87	(0.130)	(0.549)	(0.317)	(0.202)	(0.054)
Jan 24, 2005	0.2-0.1	Overall	1.35	1.67	1.61	1.20	0.98	1.76	2.29	2.44	2.35	-1.83	(0.082)	(0.024)	(0.016)	(0.021)	(0.071)
		Above	1.83	2.23	2.28	1.67	1.13	2.43	3.20	3.73	3.13	1.63	(0.017)	(0.002)	(0.000)	(0.003)	(0.107)
		Below	1.07	1.25	1.24	0.94	0.82	1.21	1.36	1.29	-1.70	-2.25	(0.230)	(0.180)	(0.201)	(0.093)	(0.027)
Apr 24, 2008	0.3-0.1	Overall	1.67	1.44	1.25	0.91	0.63	2.57	2.54	2.14	2.16	-4.15	(0.012)	(0.013)	(0.039)	(0.034)	(0.000)
		Above	2.07	2.05	1.66	1.21	0.78	3.18	3.25	3.09	1.60	-3.10	(0.002)	(0.002)	(0.003)	(0.113)	(0.003)
		Below	1.39	1.18	0.97	0.69	0.49	2.08	1.49	-0.76	-2.86	-5.35	(0.040)	(0.140)	(0.448)	(0.005)	(0.000)
Sep 19, 2008	0.1 Bi-Uni	Overall	1.52	1.31	1.10	1.03	1.01	2.18	1.95	1.73	1.91	1.98	(0.031)	(0.054)	(0.087)	(0.060)	(0.051)
		Above	1.92	1.70	1.49	1.42	1.30	2.48	2.36	2.01	2.33	2.38	(0.015)	(0.021)	(0.047)	(0.026)	(0.020)
		Below	1.03	0.89	0.83	0.82	0.86	1.68	-1.12	-1.09	-1.55	-1.63	(0.096)	(0.265)	(0.280)	(0.124)	(0.106)

Notes:

* The "Overall" values equals to the median corresponding values of all valid individual stocks under investigation.

** In rows titled "Above", the paper first filters all stocks that has a ratio r (where n = 30) which is above the median of all valid individual stocks under investigation. Then it takes the median of corresponding median of the filtered range.

*** In rows titled "Below", the paper first filters all stocks that has a ratio r (where n = 30) which is below the median of all valid individual stocks under investigation. Then it takes the median of corresponding median of the filtered range.

In Panel B, the empirical results show that almost all median of mean trading volume ratios (the means of post-adjustment samples divided by corresponding means of pre-adjustment samples) of all stocks are greater than one, expect the event date on June 12, 1998. As is discussed above in the index level, this abnormal market behavior could due to macroeconomic condition. This result means that the mean trading volume of stocks after the STT rate decreases are generally larger than the mean trading volume before the adjustments. Besides, the results also show that most medians of the mean trading volume ratios, in both the "above" category and the "below" category, are larger than one. This empirical evidence suggests that individual stocks respond to STT rate decrease with generally the same pattern – increase in trading volume. Further, the significance levels of the t-statistics of individual stocks when STT decreases are smaller than the ones when STT increases. Thus, we can conclude that when STT decreases, individual stocks are traded more frequently with almost no discrimination, yet the trading volume of individual stocks respond less significantly to STT rate decreases than STT rate increases.

Therefore, the paper concludes that when STT rate increases, investors trade significantly less frequently in general, yet individual stocks have different performance. On the contrary, when STT rate decreases, stocks are traded more frequently with no discrimination, yet the trading volume are less significantly affected by STT rate decreases than the one affected by STT rate increases.

4.2.2. Results of F Statistics

Tests are performed to investigate whether volatility of each individual stocks contained in the SSE-180 index changes after the STT rate changes. The results are displayed in Table 10. Same as the technique introduced in the previous section, all medians ratios of stock volatility are also divided into two categories, denoted respectively "above" and "below".

Table 10: Summary Results of F-Test for SSE-180 Individual Stocks

Panel A: STT Increases

		r-15	r-20	r-30	r-50	r-75	f-15	f-20	f-30	f-50	f-75	p-15	p-20	p-30	p-50	p-75
May 10, 1997	Overall*	1.26	1.37	1.35	1.24	0.98	0.98	1.20	1.15	1.24	1.24	(0.512)	(0.348)	(0.353)	(0.228)	(0.181)
0.3-0.5	Above**	1.65	1.75	1.73	1.78	1.37	1.22	1.40	1.49	1.62	1.24	(0.358)	(0.234)	(0.146)	(0.047)	(0.178)
	Below***	0.91	0.85	1.02	0.99	0.90	0.87	1.03	1.02	1.11	0.96	(0.599)	(0.471)	(0.474)	(0.360)	(0.561)
May 30, 2007	Overall	2.14	1.97	1.71	1.63	1.22	1.75	1.65	1.53	1.54	1.19	(0.152)	(0.141)	(0.129)	(0.067)	(0.231)
0.1-0.3	Above	2.60	2.56	2.22	2.05	1.48	2.13	2.20	1.98	1.90	1.36	(0.084)	(0.047)	(0.036)	(0.013)	(0.093)
	Below	1.61	1.46	1.34	1.28	0.98	1.24	1.18	1.09	1.15	1.03	(0.347)	(0.361)	(0.405)	(0.313)	(0.451)

Panel B: STT Decreases

		r-15	r-20	r-30	r-50	r-75	f-15	f-20	f-30	f-50	f-75	p-15	p-20	p-30	p-50	p-75
June 12, 1998	Overall	1.01	1.12	1.09	1.24	1.11	1.37	1.50	1.45	1.44	1.31	(0.282)	(0.193)	(0.160)	(0.105)	(0.123)
0.5-0.4	Above	2.04	1.77	1.68	1.81	1.60	1.59	1.41	1.44	1.65	1.57	(0.197)	(0.232)	(0.166)	(0.041)	(0.027)
	Below	0.58	0.54	0.54	0.78	0.84	1.30	1.50	1.61	1.20	1.20	(0.316)	(0.193)	(0.103)	(0.262)	(0.214)
Nov 16, 2001	Overall	0.47	0.20	0.26	0.88	0.95	1.79	4.51	3.54	1.09	1.12	(0.144)	(0.001)	(0.001)	(0.380)	(0.320)
0.4-0.2	Above	0.62	0.29	0.40	1.01	1.04	1.27	3.05	2.27	1.02	1.08	(0.328)	(0.010)	(0.015)	(0.477)	(0.376)
	Below	0.33	0.15	0.22	0.78	0.82	2.50	5.86	4.31	1.19	1.20	(0.049)	(0.000)	(0.000)	(0.273)	(0.222)
Jan 24, 2005	Overall	1.65	1.43	1.44	1.65	1.23	1.33	1.33	1.31	1.52	1.20	(0.299)	(0.269)	(0.233)	(0.072)	(0.218)
0.2-0.1	Above	2.27	2.15	2.05	2.07	1.62	1.82	1.81	1.81	1.91	1.51	(0.138)	(0.104)	(0.057)	(0.013)	(0.040)
	Below	1.06	1.02	0.94	1.17	0.98	0.95	0.91	0.94	1.19	1.06	(0.540)	(0.579)	(0.566)	(0.275)	(0.399)
Apr 24, 2008	Overall	0.80	0.86	0.85	1.09	1.01	0.97	1.05	1.09	0.97	1.00	(0.526)	(0.460)	(0.412)	(0.543)	(0.497)
0.3-0.1	Above	1.11	1.11	1.14	1.23	1.16	0.85	0.88	0.83	1.05	1.03	(0.621)	(0.613)	(0.696)	(0.433)	(0.452)
	Below	0.70	0.64	0.65	0.97	0.91	1.07	1.20	1.30	0.91	0.98	(0.448)	(0.345)	(0.244)	(0.622)	(0.534)
Sep 19, 2008	Overall	2.13	1.68	1.28	1.42	1.06	1.80	1.36	1.04	1.31	1.01	(0.141)	(0.255)	(0.455)	(0.176)	(0.486)
0.1 Bi-Uni	Above	2.33	2.11	1.74	1.77	1.27	2.11	1.76	1.49	1.62	1.13	(0.087)	(0.113)	(0.143)	(0.048)	(0.303)
	Below	1.87	1.35	1.02	1.15	0.95	1.52	1.02	0.80	1.06	0.93	(0.223)	(0.480)	(0.719)	(0.424)	(0.626)

Notes:

* The "Overall" values equals to the median corresponding values of all valid individual stocks under investigation.

** In rows titled "Above", the paper first filters all stocks that has a ratio r (where n = 30) which is above the median of all valid individual stocks under investigation. Then it takes the median of corresponding median of the filtered range.

*** In rows titled "Below", the paper first filters all stocks that has a ratio r (where n = 30) which is below the median of all valid individual stocks under investigation. Then it takes the median of corresponding median of the filtered range.

In Panel A, the empirical results show that all median of standard deviation ratios (the standard deviation of post-adjustment samples divided by the corresponding standard deviation of pre-adjustment samples) of stocks are greater than one, which means that the standard deviation of stocks after the STT rate increases are generally larger than before the event. In other words, individual stocks are more volatile when STT increases, with little discrimination. Further, the significance levels of the f-statistics of individual stocks when STT increases are smaller than 90 percent. Thus, we can conclude that the volatility of individual stocks does not respond to STT rate increases significantly.

In Panel B, the empirical results show the following pattern regarding the median of standard deviation ratios (the standard deviation of post-adjustment samples divided by the corresponding standard deviation of pre-adjustment samples) of all stocks: almost two-fifth of the medians are less than one, and three-fifth of the medians are greater than one. This suggests that the response of standard deviation of individual stocks after the STT rate decreases are mixed. Besides, the significance levels of the f-statistics of individual stocks when STT decreases are smaller than 90 percent. Thus, we can conclude that the volatility of individual stocks does not respond to STT rate increases significantly.

Therefore, the paper concludes that when STT rate increases, individual stocks behave more volatile in general, and individual stocks behave without significant discrimination. On the contrary, when STT rate decreases, stocks' alternation in volatility is mixed. In general, STT fluctuation's impact on individual stocks' volatility is not significant.

4.2.3. Results of linear regressions

In this section, simple linear regression run on selected variables - average turnover, market capitalization, price to book value ratio, price to sales ratio, dividend yield, average

standard deviation, beta, and earnings per share. These variables are taken as independent variables, and the paper investigates their relationship with the ratio of volume after and before the event date in the 15-day sample interval. The equation of the regression is written as:

$$r_t = \beta_0 + \beta_1 x_n \,, n = 1, 2, \dots, k$$

$$r_f = \beta_0 + \beta_1 x_n \,, n = 1, 2, \dots, k$$

where:

r_t is the ratio of the trading volume of post-adjustment 15-day sample interval divided by the trading volume of corresponding pre-adjustment sample interval,

r_f is the ratio of the adjusted return standard deviation of post-adjustment 15-day sample interval divided by the adjusted return standard deviation of corresponding pre-adjustment sample interval, and

x_n is the selected variables including average turnover, market capitalization, price to book value ratio, price to sales ratio, dividend yield, average standard deviation, beta, and earnings per share.

Interaction variables are also included in x_n so as to see if there is some consistent effects with the direction of the STT changes. For example, "Turnover (STT_chg)" in Table 11 denotes an interaction variable that equals to turnover times STT rate change; when turnover = x and STT changes from 0.5% to 0.3%, the interaction variables equals to -0.2x.

The regression results are displayed partially in Table 11 and Table 12.

In Table 11, the empirical results show that all five coefficients of 250-day average turnover prior to the STT rate adjustment on r_t are lower than zero, and recall that individual stocks' trading volume increases when STT rate are lowered. Thus, the results show that, other

things being equal, stocks with lower average turnover prior to the event date increase more in

trading volume after STT decrease. However, only two of the five t statistics are significant at

a 90 percent confidence interval, from which we cannot conclude that the impact of turnover

is significant.

Table 11: Selected Regression Results of Trading Volume Behavior

Pane A: STT Increases							
					Turnover	Price_bv	Price_sales
Event Date		Turnover	Price_bv	Price_sales	(STT_chg)	(STT_chg)	(STT_chg)
05/12/1997	*Beta1*	0.32	0.25	0.20	0.05	0.05	0.003
	T-stat	0.15	0.85	0.80	0.39	0.85	0.16
	P value	(0.884)	(0.400)	(0.567)	(0.701)	(0.400)	(0.871)
05/30/2007	*Beta1*	-0.10	0.001	0.02	-0.22	0.00	0.01
	T-stat	-0.64	0.14	2.31	-1.73	0.15	1.44
	P value	(0.520)	(0.888)	(0.022)	(0.085)	(0.882)	(0.152)
Pane A: STT Decreases							
					Turnover	Price_bv	Price_sales
Event Date		Turnover	Price_bv	Price_sales	(STT_chg)	(TT_chg)	(TT_chg)
06/12/1998	*Beta1*	-0.72	0.01	0.10	1.36	-0.07	-0.25
	T-stat	-1.33	0.97	1.05	1.55	-0.97	-1.66
	P value	(0.190)	(0.336)	(0.300)	(0.127)	(0.336)	(0.102)
11/16/2001	*Beta1*	-215.94	0.001	-7.19	0.06	-0.004	0.02
	T-stat	-1.16	0.93	-0.41	0.07	-0.93	0.27
	P value	(0.250)	(0.354)	(0.682)	(0.944)	(0.354)	(0.786)
01/24/2005	*Beta1*	-2.45	-0.01	0.55	2.43	0.10	-0.34
	T-stat	-1.62	-0.18	2.10	2.25	0.18	-1.75
	P value	(0.107)	(0.858)	(0.038)	(0.027)	(0.858)	(0.084)
04/24/2008	*Beta1*	-0.09	-0.004	-0.24	0.21	0.02	0.19
	T-stat	-0.33	-1.03	-0.56	1.21	1.08	0.65
	P value	(0.740)	(0.304)	(0.574)	(0.228)	(0.281)	(0.519)
09/19/2008	*Beta1*	-0.21	-0.002	-0.003	0.95	0.59	0.27
	T-stat	-0.34	-0.14	-0.18	0.75	2.18	0.84
	P value	(0.733)	0.886	(0.859)	(0.453)	(0.031)	(0.401)

Notes:
Columns "Turnover", "Price_bv", and "Price_sales" displays the slope coefficients of the corresponding simple linear regression; Columns T-stats displays the t value and p value of each regression.
Turnover represents data of the 250-day average turnover until one date before the STT rate adjustment date; Price_bv represents data of the price to book value ratio of individual stocks at the tax adjustment date; Price_sales represents data of the price to sales ratio of individual stocks at the tax adjustment date. In the columes, Turnover (STT_chg), Price_bv (TT_chg), and Price_sales (STT_chg), the variables are re-spectively turnover times STT change rate, price to book value ratio times STT change rate, and price to sales ratio times STT change rate.

Also, we can observe from the results that all four coefficients of price-to-book-value

ratio and price-to-book ratio on r_t are positive. Recall that individual stocks' trading volume

decreases when STT rate are increased. The results suggest that, other things being equal,

stocks with higher price-to-book-value ratio and price-to-book ratio increase more in their trading volume after tax increases. Similar to the previous case, however, we cannot conclude that the impacts of those two variables are significant.

In general, the regression results show that stocks with lower 250-day average turnover prior to the STT rate adjustment are more sensitive to tax decreases, and individual stocks with higher price to book value ratio and price to sales ratio at the event date is more sensitive to tax increases.

Table 12: Selected Regression Results of Return Volatility Behavior

Pane A: STT Increases

Event Date		Stdev	Beta	EPS	Mkt_cap	Stdev* STT_chg	Beta* STT_Chg	EPS* STT_chg	Mkt_cap* STT_chg
05/12/1997	Beta	0.20	0.56		-1.16E-01	0.002	0.07		1.45E-11
	F-stat	0.21	0.55		-0.62	0.52	0.25		1.27
		(0.834)	(0.590)		-(0.537)	(0.604)	(0.806)		(0.215)
06/12/1998	Beta	0.002	0.15	0.39	3.30E-11	0.06	3.12	-3.69	-3.30E-10
	F-stat	0.23	0.36	1.97	2.90	1.90	1.82	-1.93	-2.90
		(0.821)	(0.719)	(0.057)	-(0.006)	(0.064)	(0.075)	(0.060)	(0.006)

Panel B: STT Decreases

Event Date		Stdev	Beta	EPS	Mkt_cap	Stdev* STT_chg	Beta* STT_Chg	EPS* STT_chg	Mkt_cap* STT_chg
11/16/2001	Beta	0.01	0.02	0.03	-9.20E-13	-0.003	0.05	-0.16	4.60E-13
	F-stat	1.29	0.09	0.15	-1.02	-0.34	0.15	-0.15	1.02
		(0.202)	(0.927)	(0.883)	-(0.312)	(0.738)	(0.880)	(0.883)	(0.312)
01/24/2005	Beta	0.004	0.08	-0.28	-8.13E-13	0.07	-0.30	0.29	8.13E-12
	F-stat	0.50	0.29	-0.16	-0.54	1.12	0.15	0.17	0.54
		(0.619)	(0.771)	(0.874)	-(0.589)	(0.263)	(0.878)	(0.867)	(0.589)
05/30/2007	Beta	0.00	0.13	0.23	-1.75E-13	0.04	3.46	1.21	-8.73E-13
	F-stat	0.87	0.68	1.50	-0.42	1.61	2.71	1.58	-0.42
		(0.388)	(0.501)	(0.136)	-(0.674)	(0.110)	(0.008)	(0.117)	(0.674)
04/24/2008	Beta	-0.001	0.20	0.01	2.20E-13	0.29	1.41	-0.05	-1.11E-12
	F-stat	-0.22	0.94	0.22	2.38	5.01	3.74	-0.27	-2.41
		(0.826)	(0.350)	(0.828)	-(0.019)	(0.000)	(0.000)	(0.786)	(0.017)
09/19/2008	Beta	0.001	-0.17	0.42	-7.83E-13	-0.32	-20.43	-8.49	0.0000
	F-stat	0.28	-1.01	2.09	-2.54	-5.24	-5.65	-2.09	2.54
		(0.782)	(0.313)	(0.039)	-(0.012)	(0.000)	(0.000)	(0.039)	(0.000)

Notes:
Columns "Mkt_cap", "stdev", "beta" and "eps" displays the slope coefficients of the corresponding simple linear regression; Columns T-stats displays the t value and p value of each regression.
Mkt_cap represents data of market capitalization of individual stocks; Stdev represents data of the annual volatility of individual stocks; beta represents data of the average beta value of individual stocks 100 weeks before the STT rate adjustment; eps represents data of the earnings per share of individual stocks, the earnings are taken from the financial statement of the previous year of the STT rate adjustment.
In the columes, Stdev*STT_chg, Beta*STT_chg, EPS*STT_chg, and Mkt_cap*STT_chg, the variables are respectively standard deviation times STT change rate, beta value ratio times STT change rate, earning per share value times STT rate change, and market capitalization times STT change rate.

In Table 12, we observe that almost all coefficients of market capitalization of individual stocks to r_f is negative, and almost all coefficients of annual volatility prior to STT adjustments, 100-week average beta, and earnings per share of individual stocks to r_f is positive, except some event dates. Since a larger r_f indicates that a stock becomes more volatile after the tax adjustment, we conclude that stocks with larger market capitalization are less sensitive with STT rate adjustments in terms of volatility, and stocks with larger annual volatility, beta value and earnings per share value are more sensitive with STT rate adjustments in terms of volatility. Notably, however, these conclusions only indicate a directional relationship of r_f with the above-mentioned variables. The t-statistics results from Table 12 suggest the influence are not significant.

5. Conclusion:

The paper contributes to the debate of the impact of Security Transaction Tax on Chinese stock market on both the index and stock level.

In the index level, the empirical results show that STT rate adjustment has negative effect on trading volume and will increase market volatility indiscriminately. That is, an increase in STT rate will result in investor's less frequent trading behavior significantly, and a decrease in STT rate will significantly increase the trading volume in the market. Both STT rate increase and decrease will lead to a more volatile market in the short term.

In the stock level, regarding trading volume, the paper concludes that when STT rate increases, stocks are traded less frequently, yet individual stocks are affected discriminately. When STT rate decreases, stocks are traded more frequently, and individual stocks perform generally the same. Regression results suggest that individual stocks with higher price to book value ratio and price to sales ratio at the event date is more sensitive to tax increases, and stocks with lower average turnover prior to the STT rate adjustment are more sensitive to tax decreases.

In the stock level, regarding return volatility, the paper concludes that when STT rate increases, stocks become more volatile in general. When the STT rate decrease, however, stocks' reaction is trivial. Regression results suggest that stocks with larger market capitalization are less sensitive with STT rate adjustments in terms of volatility, and stocks with larger annual volatility, beta value and earnings per share value are more sensitive with STT rate adjustments in terms of volatility.

Overall, the paper's investigation in the STTs in the Chinese stock market should contribute to show that policy makers could use STT as a tool to steer the trading volume of the securities market in China, so as to correct the market counter-cyclically, yet the manipulation will lead to a more volatile market in the short term. To avoid risk of volatility in the short-term period after STT adjustment, investors could adjust their portfolios to stocks with higher market capitalization, and stocks with lower average volatility prior to the tax adjustments, lower beta, and lower earnings per share.

Further research can be conducted on China's unique data set to further investigate the causal relationship of individual stock's reaction to tax adjustments with a larger sample size than the SSE-180 constituent stocks. They could also investigate the relationship of stocks' reaction to STT adjustments with other factors than the "influence factors" mentioned in this paper, such as dividend yield.

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