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Turnover Tax and Stock Return Volatility: Recent Experiments from Asia Countries

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Abstract: ***Global financial turmoil in recent years has resulted in renewed interest in taxing financial markets. Advocates believe that the tax would penalize noise trading and thus contribute to the stability of the market, while opponents argue that the tax would hurt stability, by penalizing noise traders and rational traders equally. In view of these policy and academic discourses, concentrating on stock trading, this paper empirically examines whether levying a turnover tax would increase or reduce the price return volatility. To do so, given the increasing importance of Asia-Pacific countries in the world economy, we investigate recent tax reform episodes in those countries, using a GARCH and its variant models, as most of the advanced economies already abolished the tax many years ago. Overall, the estimation yields evidence that the turnover tax did not reduce volatility, in line with findings of earlier studies based on more advanced economies.***

Keywords: Financial, Turnover tax, Stock return Volatility, Asia countries

1. Introduction

Global financial turmoil in recent years has resulted in renewed interest in taxing the financial markets. As the world's leaders gathered in summit meetings to discuss how to prevent the recurrence, some have openly talked about the Tobin tax [1]. In response to growing interest at the G20 meetings, in 2010 IMF published a report to suggest a few new taxes for policy consideration [b]. A number of academics echoed these developments, by advocating the introduction of a turnover tax in the securities market [c].

Interest among policymakers and academics in transaction taxes on securities in general, and stock trading in particular, is by no means new; its history dates back to at least the late 1980s. In the aftermath of Black Monday a debate occurred in the United States about whether the country should reintroduce a stock transaction tax (hereinafter, referred to as STT), which had been abolished several years prior. Advocates claimed that the tax would stabilize the market by pushing destabilizing noise traders out of the market due to the increased transaction cost, and that the tax would also raise large revenues [e.g. Stiglitz (1989), Summers and Summers (1989)]. This is referred to as the conventional view. However, those opposing the tax argued that a higher transaction cost would adversely affect rational traders equally or even more than noise traders, thereby destabilizing rather than stabilizing the market, and that the tax elasticity could be large, thereby failing to raise large revenue [e.g. Hakkio (1991), Kupiec (1996)]. This view is referred to as the contrarian view [d]

Naturally, these policy debates prompted empirical research regarding the effect of STTs on return volatility. Roll (1989), for example, examined the issue with cross-country data from 23 countries and found no significant effect. With data from Sweden, Umlauf (1993) concluded that the introduction of a turnover tax in the country did not reduce volatility. Hu (1998) drew similar findings from tax reform episodes of four Asian countries. Lindgren (1994) used data from 14 countries for 11 years and concluded that a turnover tax of above 0.5% increases volatility, while one with a lower rate has no effect. While these studies used the concept of traditional volatility, Saporta and Kan (1997) examined the UK stamp duty in a standard GARCH (generalized auto-regressive conditional heteroskedasticity) model and found no significant effect on volatility [e] Hayashida and Ono (2010) investigated the issue in the context of the Japanese tax reforms and reached a conclusion that the tax cuts had no effect or possibly reduced, rather than increased, volatility.

Although existing studies seem to support the hypothesis that tax cuts have no or possibly a negative effect on volatility, *i.e.* the contrarian view, they predominantly address advanced economies and/or are outdated. However, the 'geography' of the world's economy and finance has dramatically changed in the last two decades or so; now, Asia is praised as a world growth center. Given this, the present paper attempts to improve the literature by taking up recent tax reform episodes in five Asia-Pacific countries that still have STTs or have had them until recently: China, Korea, India, Australia, and Hong Kong. In doing so, the paper takes advantage of recent advancement in modeling stock return volatility in finance literature, and employs a GARCH model and its variant. The paper is organized as follows. The next section explains the STT reforms of the five Asia-Pacific countries. The third section explains the methodology and data. The fourth section reports the results. The final section concludes the paper.

2. STT reforms in Asia-Pacific countries

2.1 China

As China is the world's fastest growing economy, its financial markets, too, have expanded rapidly over the last two decades or so, since a stock exchange was first established in December 1990. [6] As of the end of 2009, its total market value almost paralleled that of the Japanese markets, the second largest in the world (see Figure 1). There are two major stock exchanges in the country, one in

Shanghai and the other in Shenzhen. In both exchanges, two types of shares are traded. Type A shares are traded only by domestic investors, while type B shares are traded by both domestic and foreign investors. The trading volume of type A shares is far greater than that of type B shares. The ratio is roughly one to one hundred as of the end of 2009. China has levied the STT from a very early stage, but has also changed the tax rate quite frequently. Since the mid-1990s, the government changed the rate six times, decreasing it four times and increasing it twice.

2.2 Korea

The Korean security market developed in the late 1960s. At the very first stage, the government took a strong lead in its development; for instance, it forced 47 conglomerate-based firms to list their shares. Due to the political instability and concurrent economic turmoil, however, the market experienced a long period of stagnation until the late 1980s. Since then, despite a short period of disruption due to the Asian currency crisis in 1998, the stock market has steadily grown. The total market value increased 7.3 times from 1990 until 2008. As of the end of 2009, the Korea Stock Exchange ranks the thirteenth in the world (see Figure 1). The STT has been levied since the 1970s. The rate has two layers: a general rate, which has been 0.5% since January 1990, and a temporary rate, which is added onto the general rate and changed from time to time, depending on the market situation. Since the mid 1990s, it was reduced twice (see Table 1).

2.3 India

India's stock market is the oldest in Asia; it dates back to as early as the 1850s. There were more than 20 stock markets in the country, but since the mid-1990s, the transaction has started to concentrate in the largest two markets, the Mumbai (Bombay) and National stock exchanges. Their combined share of the nation's total transactions is now 99.9%. As the Indian economy boomed in the last decade or so, however, its stock market too rapidly expanded. The Bombay Stock Exchange (BSE) now ranks the tenth in the world in total market value as of the end of 2009 (see Figure 1). In order to cool off the market, the government introduced a STT in October, 2004 and raised it in 2006, while many advanced economies had already abolished the STT (see Table 1).

2.4 Australia

A stock market was first established in Melbourne in 1871, some 10 years after the Gold Rush. Since then, many stock exchanges were established all over the country. In 1937, these independent exchanges were unified into the Australian Associated Stock Exchange. After it was reorganized as a limited company, it rigorously promoted online trading. Partly due to such efforts, trading expanded rapidly; as of the end of 2009, its total market value ranks the 11th in the world and the 5th in Asia (see Figure 1). The country abolished its STT altogether in July 2000, following the same actions in other developed countries (see Table 1).

2.5 Hong Kong

As an "entrance" to Asian markets for European traders, Hong Kong's regulations and barriers to trade and investment have long been held minimum, to make it the freest economic entity in Asia. Now, it also plays a role of "entrance" to China in many aspects of its economy. In stock markets, for instance, the total share of China-related stocks in the overall market value now exceeds 60%. Although the freest market in the region, Hong Kong has been levying a STT. However, it has reduced the rate three times since the mid-1990s (see Table 1). It is now only 0.1%.

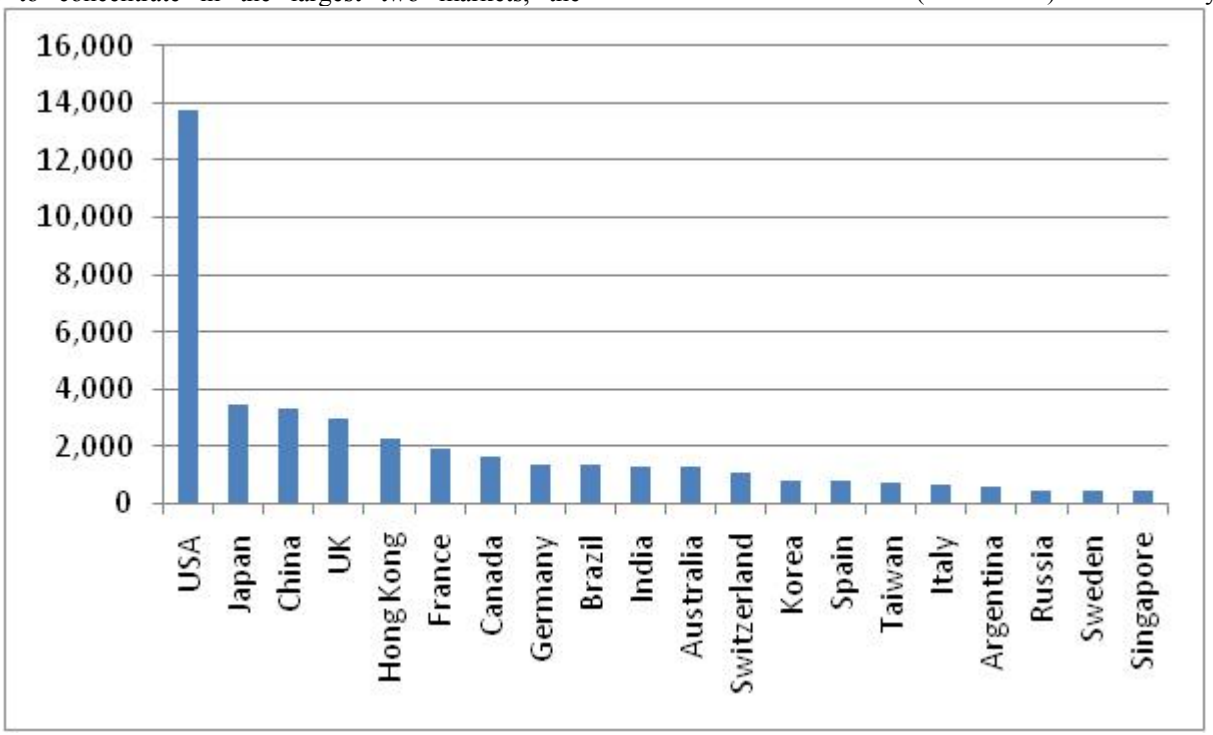

Figure 1: Top 20 ranking of countries in total values of the stock market (billions of USD, as of the end of 2009) (Source) Japan Securities Research Institute (2010)

Table 1: Summary of STT reforms in the five countries (after 1995)

Country	Tax cut	Tax increase
China	June 12, 1998, November 16, 2001; January 24, 2005; April 24, 2008	May 12, 1997; May 30, 2007
Korea	July 14, 1995; March 30, 1996	
India		October 1, 2004 (introduction); June 1, 2006
Australia	July 1, 2000 (abolition)	
Hong Kong	April 1, 1998; April 7, 2000; September 1, 2001	

(Source) Japan Securities Research Institute (2010)

3. Methodology and data

3.1 Time-varying volatility model and GARCH

In empirical investigations of stock return volatility, it is now a standard practice to use a GARCH-type model. In a simple model of historical volatility based on variance and standard deviation calculated from the data, the data-generating process (DGP) of stock return, R_t, is assumed to be unchanged for a certain period of time; so are its mean and variance. However, observed returns are high for quite some time, and then become low for another time. The same is true for observed volatility. This raises doubt about such a simple assumption as a time-invariant DGP.

Assume then that, give the information up to the date t-1, the mean of return at date t, R_t, is no longer constant and varies. Then, R_t can be divided into a part that is forecast able at date $t-1$ $E_{t-1}(R_t)$, and a shock that is not forecast able, ε_t.

$$R_t = E_{t-1}(R_t) + \varepsilon_t$$

This is termed the mean equation. An example of this is the following, which expresses R_t changes over time.

$$R_t = a + \sum_{i=1}^{p} b_i R_{i-p} + \varepsilon_t \quad (1)$$

The un forecast able shock ε_t is expressed as

$$\varepsilon_t = \sigma_t z_t$$
$$\sigma_t > 0$$
$$z_t \sim i.i.d.(0,1)$$

Here, σ_t is assumed to always take a positive value. σ_t^2 is termed as volatility of R_t at date t. Note that σ_t^2 is variable with respect to t.

Further, observed volatility tends to stay high (low) for some time once it becomes high (low). This phenomenon, known as *volatility clustering*, therefore needs to be incorporated into the model. Accordingly, the ARCH(p) model (Engle, 1982) has been invented to consider a long-lasting effect of the shock,

$$\sigma_t^2 = \omega + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}.$$

Bollerslev (1986) generalized ARCH (p) to form the GARCH (p,q) model:

$$\sigma_t^2 = \omega + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}.$$

Here, q represents the length of "memory" of past volatility. Note that, because volatility is non-negative, restrictions $\omega>0$, $\alpha_i > 0$, and $\beta_i>0$ apply.

3.2 Asymmetric Model

It is a well-known fact that bad news, which brings down the price, has a greater impact on volatility than good news. Within the class of GARCH-type models, a number of variants have been proposed to incorporate this generally observed asymmetry of the return volatility, known as the *leverage effect*. The EGARCH (p, q) model, first proposed by Nelson (1991), is one of the most widely used among the asymmetry models. It considers the following model, taking the logarithm of the volatility and imposing a non-negative constraint on its parameter, in the following manner:

$$\log(\sigma_t^2) = \omega + \sum_{j=1}^{q} \beta_j \log(\sigma_{t-j}^2) + \sum_{i=1}^{p} \alpha_i \left(|z_{t-i}| - E(|z_{t-i}|) \right) + \sum_{l=1}^{m} \gamma_l z_{t-l}$$

where $z_{t-1} = \varepsilon_{t-1} / \sigma_{t-1}$ and γ is the parameter for asymmetry. In the simplest form of GARCH (1,1) (and m=1),

$$\log(\sigma_t^2) = \omega + \beta_1 \log(\sigma_{t-1}^2) + \alpha_1 |z_{t-1}| - \alpha_1 E(|z_{t-1}|) + \gamma z_{t-1},$$

if $z_{t-1} \geq 0$,

$$\log(\sigma_t^2) = \omega + \beta_1 \log(\sigma_{t-1}^2) + \gamma z_{t-1} + (\gamma + \alpha_1) z_{t-1} - \alpha_1 E(|z_{t-1}|),$$

and if $z_{t-1} < 0$,

$$\log(\sigma_t^2) = \omega + \beta_1 \log(\sigma_{t-1}^2) + \gamma z_{t-1} + (\gamma - \alpha_1) z_{t-1} - \alpha_1 E(|z_{t-1}|).$$

Therefore, $\gamma<0$ implies the existence of the asymmetry.

In this paper, we employ EGARCH in addition to the GARCH model.

3.3 Estimation details

In what follows, we investigate how the STT reforms discussed in the previous section affected stock return volatility, using the two models discussed above. It is often argued that stock return volatility exhibits a day-of-the-week effect. That is, for example, it is higher on Monday than in the rest of the week. In order to address this possibility, we create day-of-the-week dummies in the following manner, and add them in the regression.

$$WD_t^k = \begin{cases} 0 & if\ t\ falls\ on\ the\ k\,th\ day\ of\ the\ week \\ 1 & if\ otherwise \end{cases},$$
$$k = 1, 2, \ldots 4$$

Here k=1 corresponds to Monday. Note that k is 1 through 4; that is, Friday is the base line of the regression. We will try specifications both with and without the day-of-the week effect.

To examine the effect of tax reforms, we add a dummy variable representing the reform, which takes the values of 0 and 1, respectively, before and after the date when the change was put into effect. To examine the effect of STT, we represent it by:

$$D_t = \begin{cases} 0 & if\ t \leq t_0 \\ 1 & if\ otherwise \end{cases},$$

To summarize, the mean equation with the day-of-the-week effect takes the form:

$$R_t = a + bR_{i-1} + dD_t + \sum_{k=1}^{4} c_k WD_t^k + \varepsilon_t .$$

The variance equation with the day-of-the week effect, in the case of the EGARCH, is

$$\log(\sigma_t^2) = \omega + \sum_{j=1}^{q} \beta_j \log(\sigma_{t-j}^2) + \sum_{i=1}^{p} \alpha_i \left(|z_{t-i}| - E(|z_{t-i}|) \right) + \gamma z_{t-i} + \delta D_t + \sum_{k=1}^{4} \theta_k WD_t^k + \lambda TV_t$$

.

As mentioned earlier, we employ two specifications for each of the tax reforms. In Specification I, we restrict c_k and θ_k, to be zero (k = 1, 2, 3, and 4), whereas these restrictions are relaxed in Specification II.

Specification I: $c_k = \theta_k = 0$ (without day-of-the-week effect)

Specification II: $f_k \neq 0$, $\theta_k \neq 0$ (with day-of-the week effect)

In the analysis below, we select the values of p and q by AIC, changing them each from 1 to 3. The data used are the most popular aggregate price indices for each market: Shanghai Stock Exchange A share (CHASHR) for China, Korea Stock Exchange Composite (KOSPI) for Korea, India BSE (100) National (IBOMBSE) for India, Standard and Poor's/Australian Stock Exchange 200 (ASX201) for Australia, and HANG SENG PRICE INDEX (HNGKNGI) for Hong Kong. All daily closing data are taken from Thompson Reuters' DataStream . For the estimation period, we take 6 months before and after the date of the tax change. Table 2 shows the descriptive statistics of the data used in the estimation below.

Table 2: Descriptive statistics for aggregate price return in the five countries (after 1995)

country	China						Korea
date of tax change	1997/5/12	1998/6/12	2001/11/16	2005/1/24	2007/5/30	2008/4/24	1995/7/14
maximum	0.09481	0.04981	0.093998	0.079014	0.051979	0.08888	0.042278
minimum	−0.104468	−0.08798	−0.065053	−0.0396	−0.092608	−0.08045	−0.039493
mean	0.000924	0.000241	−0.001448	−0.001216	0.003534	−0.004893	−0.000433
standard dev.	0.027775	0.013275	0.016799	0.014573	0.022588	0.026515	0.011393
no. of observations	244	247	239	242	244	224	244
country	Korea	India		Australia	Hong Kong		
date of tax change	1996/3/30	2004/10/1	2006/6/1	2000/7/1	1998/4/1	2000/4/7	2001/9/1
maximum	0.027976	0.137049	0.053373	0.024598	0.172471	0.054342	0.043454
minimum	−0.036648	−0.128047	−0.071731	−0.055498	−0.147347	−0.08939	−0.092854
mean	−0.000911	0.003497	0.00071	0.000111	−0.002618	0.000878	−0.001433
standard dev.	0.011042	0.019138	0.019076	0.008917	0.032968	0.019337	0.017447
no. of observations	245	250	250	252	247	248	244

4. Estimation Results

Table 3 (at the end of this paper) exhibits the results for GARCH. It is clear that, in many cases, the coefficients for the tax dummy, D, are insignificant. This is true whether the change is a tax cut or an increase. When significant, the sign of the coefficient is in the same direction as the change in the tax rate, supporting the contrarian view. This is in line with the existing literature regarding the more advanced economy. The only notable exception is the tax increase in June 2006 in India. The coefficient for D is of the negative sign and significant at the 1% level. This suggests that the tax increase led to a reduction in volatility, in line with the conventional view.

Table 4 (at the end of this paper) exhibits the results for EGARCH. The coefficient of asymmetry, γ, is largely negative, although not uniformly significant, suggesting a leverage effect. The sign of the coefficient for D is largely in the same direction as the change in the tax rate. However, besides the tax increase in 2006 in India, different results are obtained in a few cases: (a) the tax cut in June 2000 in China (specifications I and II) , (b) the tax cut in Korea (specification I) in 1994, and (c) the tax cut in 1996 in Hong Kong (specification II). However, for (b), the coefficient is insignificant in Specification II with the dummy for Monday being significant. In (c), the significance is only at the 10% level. Only (a) may be taken as decent evidence for the conventional view . In 21 other cases out of 28, however, the obtained results are in line with the contrarian view or suggestive that STT has no effect on volatility, as found in GARCH estimations in Table 3 and existing literature based on more advanced economies.

5. Conclusion

While global financial turmoil in recent years has resulted in renewed interest in taxing financial markets, there have been two opposing views on the effect of turnover tax on return volatility. In the conventional view, the tax reduces volatility, whereas it increases volatility in the contrarian view. The existing literature either suggests that the tax has no effect or else supports the contrarian view, but it predominantly addresses advanced economies and/or is outdated. The world's 'geography' of finance has significantly changed since the days when those advanced economies levied STTs; now many countries in the Asia-Pacific region rank among "financial powers." As these countries still have STTs or have had them until recently, this paper took up episodes of STT reform in those countries, and investigated the effects of STTs using GARCH and EGARCH models. The results obtained are in line with the existing literature based on more advanced economies: the STT has no effect or possibly an effect to reduce volatility, but never to increase it.

Table3: Estimation results for GARCH

Notes: *, **, and *** indicate that the reported coefficient is significant at the 10, 5, and 1% level, respectively.

Country		China												Korea	
Date of tax change		1997/5/12		1998/6/12		2001/11/16		2005/1/24		2007/5/30		2008/4/24		1995/7/14	
Nature of tax change		Tax increase		Tax cut		Tax cut		Tax cut		Tax increase		Tax cut		Tax cut	
Specification		I	II	I	II	I	II	I	II	I	II	I	II	I	II
mean equation	c	3.79	4.39	1.44	1.20	-0.44	-2.35	-2.086**	3.88	8.098***	12.82***	-5.259***	-3.42	-0.16	-0.51
	m(-1)	-42.81	-69.39	112.96	65.37	-23.39	53.67	-13.33	-46.60	-85.688*	-24.08	-104.672**	-108.39	139.875***	117.10
	tax	-3.82	-7.488**	-1.82	-1.77	-0.12	0.83	0.33	-2.22	-5.82**	-7.792**	-0.70	-2.71	-0.85	0.41
	mon	-	-0.05	-	0.11	-	0.22	-	-6.918***	-	-8.133*	-	-4.01	-	-0.97
	tue	-	4.99	-	-1.68	-	5.325**	-	-5.83**	-	-0.08	-	-0.71	-	-2.19
	wed	-	5.82	-	-0.17	-	-1.76	-	-4.60	-	-2.15	-	-0.87	-	1.86
	thu	-	-1.47	-	1.74	-	2.42	-	-0.59	-	-8.742*	-	-2.13	-	0.17
variance equation	c	0.215***	0.102**	0.0773***	0.01	0.01	0.123***	0.08	0.15	1.423***	0.381***	1.234***	1.377**	0.161***	0.0759*
	tax	-0.05	-0.01	0.00	0.037*	0.01	0.00	0.05	0.02	0.692***	0.08	0.37	0.10	0.00	0.02
	mon	-	-0.03	-	0.0755**	-	-0.141***	-	-0.168*	-	0.232*	-	-0.24	-	0.12***
	tue	-	-0.237***	-	0.04	-	-0.135***	-	-0.05	-	-0.12	-	-0.583***	-	-0.07
	wed	-	-0.04	-	0.091**	-	-0.122**	-	-0.05	-	0.12	-	-0.365***	-	-0.02
	thu	-	0.05	-	0.124***	-	-0.0783*	-	-0.08	-	0.198*	-	-0.252*	-	-0.03
order	p	1	3	1	1	3	2	3	3	3	3	2	3	3	3
	q	1	2	1	2	3	2	3	1	3	3	1	3	3	1
Adj. r-squared		0	0	0	0	0	0	0	0	0	0	0	0	0	0
AIC		-4.47	-4.51	-5.95	-5.92	-5.59	-5.59	-5.68	-5.65	-4.78	-4.78	-4.42	-4.40	-6.18	-6.17
no. of observation		244	244	247	247	239	239	242	242	244	244	224	224	244	244

Country		Korea		India				Australia		Hong Kong					
Date of tax change		1996/3/30		2004/10/1		2006/6/1		2000/7/1		1998/4/1		2000/4/7		2001/9/1	
Nature of tax change		Tax cut		Tax increase		Tax increase		Tax cut (abolition)		Tax cut		Tax cut		Tax cut	
Specification		I	II	I	II	I	II	I	II	I	II	I	II	I	II
mean equation	c	-0.62	1.57	2.525**	8.491**	0.67	3.831*	1.11	0.33	-0.47	8.38	2.10	0.59	-2.20	-2.51
	m(-1)	174.583**	206.212***	161.364*	190.855**	187.417***	200.069***	24.78	-0.84	54.47	70.12	76.34	96.95	-53.76	18.16
	tax	-0.23	-2.997**	1.74	1.34	1.39	0.22	-1.43	-1.95*	-4.20	-4.49	-1.92	-1.41	3.31	1.38
	mon	-	-5.009***	-	-7.544*	-	-7.805***	-	1.56	-	-7.36	-	3.16	-	1.13
	tue	-	0.68	-	-9.427**	-	-2.00	-	2.284*	-	-9.09	-	0.95	-	2.24
	wed	-	1.75	-	-0.76	-	-5.923**	-	1.00	-	-19.108***	-	0.66	-	-3.40
	thu	-	-3.601*	-	-6.997*	-	0.05	-	-0.23	-	-5.75	-	0.69	-	-1.72
variance equation	c	0.00	0.08	0.0144**	0.354***	0.00714***	0.281***	0.0414**	0.0425***	0.174**	0.627***	0.00772***	0.07	0.02	0.02
	tax	0.00	0.02	0.0418**	0.03	-0.0063***	-0.199***	-0.0244*	-0.0149*	-0.02	-0.01	-0.00478***	-0.01	0.00	-0.0133**
	mon	-	0.00	-	-0.325***	-	0.11		0.00	-	-0.503***	-	0.00	-	-0.09
	tue	-	-0.03	-	-0.27***	-	0.05		-0.0405**	-	-0.703***	-	-0.185***	-	0.01
	wed	-	0.01	-	0.07	-	0.0992*		-0.0503***	-	-0.604***	-	0.11	-	0.168*
	thu	-	-0.04	-	-0.385***	-	0.04		0.00	-	0.05	-	-0.231***	-	0.02
order	p	2	3	2	1	2	1	2	2	3	2	1	2	3	1
	q	2	2	2	1	1	2	2	2	2	2	1	1	1	2
Adj. r-squared		0.02	0.02	-0.09	-0.08	0.02	0.00	-0.01	-0.02	-0.02	0.00	0.00	-0.01	-0.01	-0.01
AIC		-6.18	-6.21	-5.39	-5.42	-5.29	-5.21	-6.75	-6.76	-4.21	-4.21	-5.08	-5.09	-5.31	-5.29
no. of observation		245.00	245	250	250	248	248	252	252	247	247	248	248	244	244

Table 4: Estimation results for EGARCH

Notes: *, **, and *** indicate that the reported coefficient is significant at the 10, 5, and 1% level, respectively

Country		China												Korea	
Date of tax change		1997/5/12		1998/6/12		2001/11/16		2005/1/24		2007/5/30		2008/4/24		1995/7/14	
Nature of tax change		Tax increase		Tax cut		Tax cut		Tax cut		Tax increase		Tax cut		Tax cut	
Specification		I	II	I	II	I	II	I	II	I	II	I	II	I	II
mean equation	c	1	4	0	1	0	-3.504**	-1	-2	8.721***	9.055***	-4.036***	-4	0	0
	r(-1)	75.342*	-132.489**	110.204**	52	75	138.029***	-65	-193.942***	123.949***	73.012***	-89.756***	-61	126.322**	98.776*
	tax	1	-6.704***	-1	-1	-2.459**	-3.528***	-2	2.268*	-10.66***	-7.419***	-2	0	-1.328**	1
	mon	-	0	-	0	-	3	-	-2	-	-4.932**	-	-4	-	-2
	tue	-	4	-	-1	-	4.789*	-	-2	-	0	-	1	-	-3.184*
	wed	-	5	-	-1	-	2	-	0	-	7.948***	-	-4	-	0
	thu	-	1	-	1	-	4	-	-4.133**	-	-5.291**	-	-1	-	0
variance equation	c	-2675.385***	-2148.517***	-3681.554***	-282.5	-342.415***	-77	-34.93	-8837.458***	-6508.95***	-10910.28***	-1723.793***	-1386.466***	-545.997***	-2.434
	tax	-84	-4	16	-24	81.079***	77.084***	51	40	801.963***	986.314***	223	210	37.644***	-9
	mon	-	-1025.189***	-	-82	-	-502	-	-750	-	1547.854***	-	41	-	731.087*
	tue	-	-1016.272***	-	103	-	2.86	-	68	-	438.049***	-	79	-	-465
	wed	-	-1441.905***	-	-15	-	-862	-	-203	-	984.146***	-	25	-	-206
	thu	-	-250	-	-243	-	335	-	-455	-	1149.838***	-	139	-	238
γ		-137.417***	-95	-189.751***	-199.899***	-237.229***	-167.61***	-40	88	-725	-436.366***	176.461***	188	-170.511***	-226.491***
order	p	3	1	1	2	3	3	1	2	2	3	3	3	2	1
	q	1	3	2	2	1	2	3	3	1	3	3	2	2	2
Adj. r-squared		-0.00411	-0.00852	-0.0005	-0.00517	-0.02597	-0.04998	-0.01859	-0.07664	-0.03582	-0.02881	-0.0098	-0.03229	0.003513	-0.00572
AIC		-4.85914	-4.59269	-6.03162	-6.00705	-5.75907	-5.73718	-5.68878	-5.77088	-4.82596	-5.00244	-4.50818	-4.53858	-6.2864	-6.18468
no. of observation		244	244	247	247	239	239	242	242	244	244	224	224	244	244

Country		Korea		India				Australia		Hong Kong					
Date of tax change		1996/3/30		2004/10/1		2006/6/1		2000/7/1		1998/4/1		2000/4/7		2010/9/1	
Nature of tax change		Tax cut		Tax increase		Tax increase		Tax cut (abolition)		Tax cut		Tax cut		Tax cut	
Specification		I	II	I	II	I	II	I	II	I	II	I	II	I	II
mean equation	c	-1.157**	-0.419	5.549***	5.22**	0.584	2.375	0.282	0.401	-3.197	5.991	1.046	-2.026	-2.207***	-1.797
	r(-1)	222.487***	147.731***	-19.853	126.034*	183.507***	199.853***	39.737	72.151	74.765	40.87	128.377***	156.116***	0.331	6.598
	tax	4.33E-01	-8.07E-01	-0.879	0.017	1.385	2.087	-0.319	-0.0423	-4.654*	-7.231**	-2.097	-1.277	1.896	0.93
	mon	-	-3.098*	-	-3.249*	-	-7.977**	-	0.487	-	-5.528	-	4.035	-	0.389
	tue	-	1.436	-	-4.634*	-	-2.11	-	-0.444	-	-8.593**	-	1.186	-	2.227
	wed	-	-0.144	-	-1.125	-	-3.998	-	-0.986	-	-15.814***	-	-1.656	-	-3.208
	thu	-	0.485	-	-4.849**	-	0.466	-	-2.492*	-	-6.202	-	4.796	-	-0.272
variance equation	c	-2404.617*	-2775.804	-760.4.222***	-627.4.097**	-42.178	-271.469	-753.806.3***	-820.345.6*	-145.59***	-180.777	-68.5.156**	-1327.034***	-443.57	-238.631
	tax	456.65	120.16	838.612***	683.769*	-32.823***	-59.966***	-82.3.517***	-0.919593**	38.131*	54.346*	-14.006	-8.354	7.958	9.102
	mon	-	-625.975*	-	-1684.259***	-	107.007	-	45.661	-	316.864	-	1014.681**	-	-286.332
	tue	-	-99.304	-	-447.838**	-	-205.086	-	-38.9.301	-	-772.169**	-	223.853	-	-206.162
	wed	-	-367.902	-	-1142.296***	-	394.661	-	-202.54	-	216.034	-	910.338*	-	391.822
	thu	-	-382.572	-	-1243.885***	-	251.139	-	-74.812	-	182.113	-	960.308*	-	58.512
γ		-157.292	-163.321	-34.615***	38.315	-33.003	-76.076	-89.311***	-57.771	-243.222***	-263.991	-2.85.669***	-2.58.706***	-131.276***	-131.638*
order	p	2	3	3	3	3	3	2	2	1	1	1	1	1	1
	q	3	3	3	3	1	2	2	2	1	1	3	2	2	2
Adj. r-squared		0.013381	0.01631	-0.01138	-0.04929	0.018446	0.011089	-0.00912	-0.01772	-0.03136	-0.00684	0.000451	0.005138	-0.00564	-0.00828
AIC		-6.23324	-6.21873	-5.65691	-5.64203	-5.27069	-5.24253	-6.85001	-6.83112	-4.34882	-4.37616	-5.1445	-5.11663	-5.34119	-5.3298
no. of observation		245	245	250	250	248	248	252	252	247	247	248	248	244	244

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Endnotes

[1] Such leaders include, for example, Angela Merkel, Nicolas Sarközy and Gordon Brown.
[2] *Global Financial Stability Report: Meeting New Challenges to Stability and Building a Safer System*.
[3] For instance, many economists from all over the United States co-signed "An Open Letter from Economists in Support of Financial Transaction Taxes", in December 2009, which was made public through the Center for Economic Policy Research.
[4] The terms "conventional view" and "contrarian view" are borrowed from Song and Zhang (2006).
[5] Baltagi et al. (2006) examined the stock transaction reform in 1997in China. They used a GARCH-type model but only to examine the market efficiency aspect of the tax; for return volatility, however, they use a method based on the concept of historical volatility to conclude that the increase in the tax rate led to greater volatility.
[6] See, for example, Japan Securities Research Institute (2010) for greater details about each country's market.