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Race to the center: competition for the Nikkei 225 futures trade

Takatoshi Ito [a], Wen-Ling Lin [b,*]

[a] *Hitosubashi University, Tokyo, Japan*
[b] *Frank Russel Company, Investment Policy and Research Group, 909 A Street, Tacoma, WA 98402, USA*

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Abstract

This paper examines the impact of changes in margin requirements on returns, transaction volume, and price volatility of the Nikkei 225 futures traded on the Osaka Securities Exchange (OSE) and the Singapore International Monetary Exchange (SIMEX). An increase in margin requirement on one exchange reduces its trading volume and shifts trade to the competing exchange. Both conditional price volatility and returns are not systematically affected by changes in margin requirements. The loss of OSE's market share of the Nikkei futures trade from 1990 to 1993 is partly due to the increased transactions costs (relative to SIMEX), including the margin requirement. © 2001 Elsevier Science B.V. All rights reserved.

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> In 1993, it became clear to traders in Tokyo that [cash-futures] arbitrage could be executed more cheaply in Singapore than in Osaka. Margin requirements on SIMEX were 15 percent of a contract's face value, compared with 30 percent on the Osaka stock exchange.

(Fay, 1996, p. 106)

* Corresponding author.

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1. Introduction

Three futures exchanges—Osaka Securities Exchange (OSE), Singapore International Monetary Exchange (SIMEX), and Chicago Mercantile Exchange (CME)—list and trade Nikkei 225 futures, a Japanese stock index futures.[1] Traditionally, trading volume of the Nikkei 225 futures on the OSE is the highest one of the three. By 1990, more than 95% of Nikkei futures were traded in Osaka. However, in 1991, the OSE increased margin requirements three times while SIMEX lowered them twice in the same year. By 1994, trading volume (in contract values) on SIMEX rose to about half that of the OSE. This case presents an increased trend of exchanges competing for business of the same financial product in the globalized financial markets.

We examine the impact of changes in margin requirements by either the OSE or SIMEX on the returns, price volatility, and trading volume of the two futures exchanges and the cash market. In addition, we analyze the linkage between returns, volatility, and trading volume among the OSE, SIMEX, and the cash market. The contribution of this study to the literature is its pioneering exploration in policy spillovers across global financial markets.

Many regulatory requirements, imposed either by the securities exchanges or the regulatory agency, are intended as prudential measures to reduce systemic risk. For example, a margin, a fraction of the contract values to be deposited at the futures exchange, is a prudential requirement in order to ensure the soundness of the futures exchange as a clearinghouse. However, an increase in margin increases transaction costs and reduces investors' incentives to trade on the futures exchanges. It becomes an empirical question of how a rise in margin requirements can have impacts on trading volume, average returns, and price volatility.

A change in margin requirements in one futures exchange influences trading activities not only in that exchange but also in "related" markets, such as an exchange that lists the same financial products or the underlying cash market. The dual listing of financial products is an obvious example of such a spillover. Because almost identical Nikkei 225 products are traded on the OSE and SIMEX, a change in margin requirements in one market may cause a shift in activities from one market to the other. An increase in margins in one market may increase or decrease the volume of the other market, depending on whether a substitution effect between the two markets more than compensates a decline in combined market activities due to higher costs.

To examine the above issues, we devise an econometric model with event-dummy variables for margin changes and spillover effects from the related

[1] Nikkei 225 futures are the simple average of 225 selected stocks traded on the Tokyo Stock Exchange (TSE). OSE and SIMEX started to trade another futures index—Nikkei 300—along with the Nikkei 225 futures. Nikkei 300 is the value-weighted average of 300 TSE stocks.

markets to analyze the dynamic processes of returns, price volatility, and trading volume. Additionally, we use a generalized autoregressive heteroskedasticity (GARCH) process to capture the time-varying volatility and added a trend component to capture the long-term effect.

The rest of the paper is organized as follows. In Section 2, the relevant literature is surveyed. Section 3 presents the market structure of a Nikkei 225 futures contract in the OSE, SIMEX and CME, as well as a history of margin changes in both the OSE and SIMEX. Section 4 presents the econometric model for our analysis and reports the empirical results. Section 5 discusses the policy implications of our findings and concludes the paper.

2. Literature survey

2.1. Theoretical prediction

2.1.1. Volume effect

Theoretically, an increase in transaction costs, such as margin requirements, is expected to depress the trading volume of the market (the own-market effect is negative). If there are two or more closely related markets (such as cash versus futures and dual listings of the futures) for a financial product, then an increase in transactions costs in one market most likely drives the businesses away from that market to the competing markets. Alternatively, it may cause a net loss of trading volume to the competing markets because of lack of arbitrage opportunities and inactive trading incentives.

If a substitution in trading location—an increase in trading due to the other market implementing higher transactions costs—offsets the loss of the market-wide decline in trading, then the competing market, without changing costs, stands to gain trading activities from an increase in transactions in the implementing market. However, if the increase in the transactions cost depresses trading activities sufficiently and overwhelms the substitution effect, then the trading volume of the competing market may also decline. This substitution hypothesis can be applied to the competition between dual listing futures markets or between the futures market and the cash market.

Arbitrage trading between the futures and cash market can push trading volume up or down together. If the futures transactions are discouraged by an increase in transactions costs, then cash market activities will be depressed through discouragement of arbitrage activities. In sum, an increase in margin requirements in the OSE should depress the trading volume of OSE, whereas the trading volume of the SIMEX may rise (if the substitution effect dominates) or decline (if the arbitrage effect dominates). The effect on the cash market is also expected to be ambiguous.

2.1.2. Volatility, return, and spillover effects

The rational expectations models with noise traders analyzes how the introduction of the futures markets changes the information content on price and volatility. The changes depend on how the composition of informed and uninformed traders are impacted by the new market. Some investors may shift from the cash market to the futures market, and new types of investors may be attracted to the market.[2] If more new noisy speculators enter the cash market, then the information content of prices will be lowered and cash prices become more volatile. In contrast, if the introduction of a futures market can add more informed traders to the cash market, then the cash market becomes more liquid and less volatile.[3]

Similarly, since a change in margin requirement affects the cost of trade between the related markets, the composition of informed and uniformed traders may change and affect the price volatility. For example, if an increase in transaction costs of a futures exchange drives liquidity traders to the related market, then price volatility in the related market increases while the price volatility in the market with higher transaction costs decreases. However, if informed traders shift their trade from the underlying futures market to the related market, then price volatility in the related market decreases while the volatility in the underlying futures market increases.

Finally, the introduction of a new market such as index futures provides another avenue for revealing market-wide information through spillovers of information to the existing markets. For example, if domestic futures markets are closely linked to the cash market or the overseas futures market, we can predict that the information revealed in the domestic futures market can impact the returns, volatility, or trading volume of the other markets.[4]

2.2. Review of stylized facts

There is a long list of work on the analysis of margin requirements, price volatility, and transaction volumes. To name a few, see Hardouvelis (1990), Hardouvelis and Peristiani (1992), Hsieh and Miller (1990) and Sofianos (1988). In both theoretical models and empirical evidence in the literature there is a consensus that high margins dampen market activity (volume of transactions) by increasing the cost of speculation (Hartzmark 1986). However, no agreement is found on the stabilizing effect of margins on futures prices.

Hardouvelis (1990) and Hardouvelis and Peristiani (1992) have shown that an increase in margin requirements for cash market transactions significantly damp-

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[2] See, for example, Danthine (1978), Fremault (1991) and Subrahmanyam (1991).

[3] See Pliska and Shalen (1991).

[4] The theoretic model by Subrahmanyam (1991) also predicts the lead and lag relation between the futures and cash returns.

ens the volatility of cash market prices in both the New York Stock Exchange and the Tokyo Stock Exchange. The results reopened the debate on whether margin requirements can affect price volatility. Hsieh and Miller (1990) reaffirmed that there existed a negative relation between the trading volume and the level of margins. Moreover, the changes in margin requirements by the regulators tended to follow rather than lead changes in market volatility.

The evidence on the futures market presented by Hartzmark (1986), Salinger (1989) and Schwert (1989) is similar to these conclusions on the cash market. The derivative markets, such as the futures market, are often known to have a cheaper transaction cost and to transmit market-wide information faster than the cash market (Chan, 1992; Chan et al., 1991). Moser (1990) and Mayhew et al. (1994) recently analyzed how the impact of changes in margins on futures or options markets affects the volatility of the cash markets.

Board and Sutcliffe (1994) examined the arbitrage between the dual listing of Nikkei 225 futures. Bacha and Vila (1994) examined the Nikkei 225 futures and concluded that adding a new futures market (the OSE and CME) has no effect on volatility in the stock market. They found that effects of tighter regulations with respect to higher margins in 1991 were too weak to detect.

3. Market structures and trading volume

SIMEX first introduced the trading of the Nikkei 225 futures on September 3, 1986. It is somewhat unusual that futures trading was introduced first in a country where the underlying markets were not traded.[5] However, Japan at that time was still unsure about the introduction of futures products and took a "gradualist" approach to the financial innovation. The OSE first began trading a smaller-scale index futures product called Kabusaki 50 before it introduced the more popular Nikkei 225 index. It then launched the Nikkei 225 futures on September 3, 1988, exactly two years after the SIMEX. Although contract details and the organization of the two exchanges are slightly different, the Nikkei futures traded on the SIMEX and the OSE use the identical underlying index, Nikkei 225, and both contracts are denominated in yen. In September 1990, the CME also started to trade Nikkei futures.

Table 1 summarizes the different market structures of the three markets.[6] The OSE contract size is 1000 yen times the index, while the SIMEX contract size is 500 yen times the index. Thus, we divide the SIMEX contracts number by two to make it comparable in yen to OSE. The CME contracts are denominated in US dollars, and the contract size is US$5.00 times the index level. Because arbitrage

[5] See Ngiam (1995) for the development of the Singapore market.

[6] For other features of stock (cash) markets in general, see Huang and Stoll (1991).

Table 1
Summary of Nikkei 225 futures trading

	Osaka (OSE)	Singapore (SIMEX)	Chicago (CME)
First trading	September 3, 1988	September 3, 1986	September 25, 1990
Contract unit	1000 yen × index	500 yen × index	US$5.00 × index
Price change unit	10 points = 10,000 yen	5 points = 2500 yen	5 points = US$25.00
Price limit	900 points	5% for 15 minutes, 10% for 15 minutes, and no limit afterward. No limit for last 30 minutes of the day. No limit on the last trading day of the expiring contract month. (Note 1)	900 points
Maturity months	March, June, September, December	March, June, September, December	March, June, September, December
Last trading day of the contract month	Thursday before the second Friday	Third Wednesday	Thursday before the second Friday
Trading hours	9:00–11:00; 12:30–15:10	8:00–10:15; 11:15–14:15	8:00–15:15
Trading system	Computer trading	Open outcry	Open outcry

Notes: (1) Whenever the price moves by 5%, in either direction, from the previous day's settlement price, trading within the price limit of 5% is allowed for the next 15 min. Thereafter, an expanded price limit of 10% (above or below the previous day's settlement price) shall apply.
Whenever the price moves by 10%, in either direction, from the previous day's settlement price, trading within the price limit of 10% is allowed for the next 15 min. Thereafter, there shall be no price limit for the remainder of the day.
No price limit shall be initiated during the last 30 min before the close of trading on any day.
There shall be no price limits on the last trading day of the expiring contract month.

Table 2
Margin requirements on Nikkei futures, OSE versus SIMEX

Month, Day, Year	OSE[a]		SIMEX[b]		CME[c]	
	Initial	Additional	Initial	Additional	Initial	Additional
Prior to January 5, 1990	9% (3% cash)		¥1,500,000 (9.8%)	¥1,200,000 (7.8%)	no trade	no trade
January 25, 1990			¥2,000,000 (12.3%)	¥1,600,000 (9.8%)	nt	nt
July 30, 1990			¥1,500,000 (12.0%)	¥1,200,000 (9.6%)	nt	nt
August 24, 1990	15% (5% cash)				nt	nt
September 25, 1990					US$12,000 (10.3%)	US$12,000 (10.3%)
January 31, 1991	20% (7% cash)					
March 28, 1991			¥1,250,000 (9.5%)	¥1,000,000 (7.6%)		
May 17, 1991			¥1,000,000 (8.8%)	¥800,000 (7.0%)		
June 27, 1991	25% (8% cash)					
December 18, 1991	30% (13% cash)					
April 9, 1992			¥1,250,000 (14.2%)	¥1,000,000 (11.3%)		
May 12, 1992					US$6000 (7.1%)	US$6000 (7.1%)
January 19, 1993					US$5000 (5.3%)	US$5000 (5.3%)
June 8, 1993					US$3000 (3.1%)	US$3000 (3.1%)
June 14, 1993			¥1,000,000 (10.0%)	¥800,000 (8%)		
August 10, 1993			¥812,500 (8.5%)	¥650,000 (7.7%)		
December 21, 1993					US$3200 (3.4%)	US$3200 (3.4%)

[a] The Osaka Stock Exchange used margin requirements proportional to the contract value. The number in the parentheses indicates the cash requirements on margins.

[b] The Singapore Stock Exchange used a fixed dollar amount of margin requirements. The number in the parentheses indicates the margin requirements as the average proportion of the margin requirement to the contract value.

[c] The Chicago Mercantile exchange used a fixed dollar amount of margin requirements. The number in the parentheses indicates the margin requirements as the average proportion of the margin requirement to the contract value.

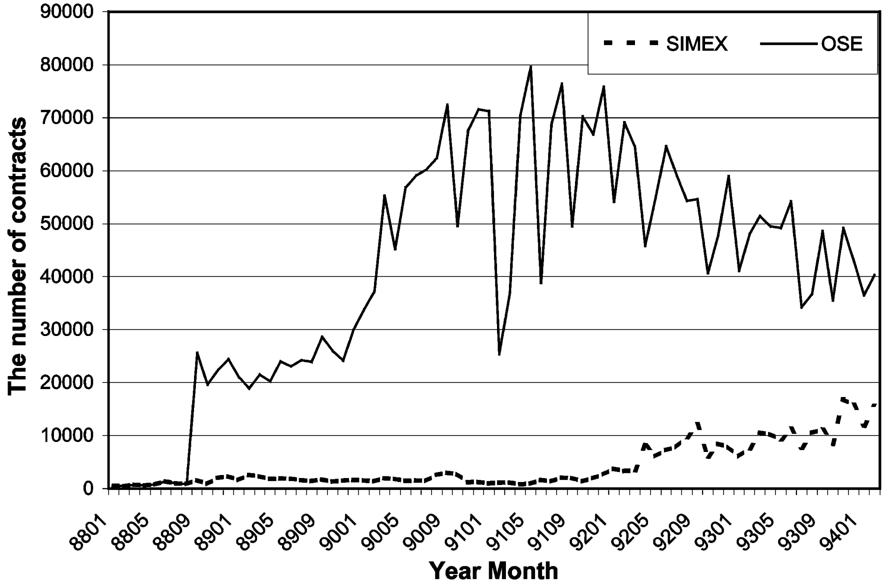

Fig. 1. Trading volume of SIMEX and OSE.

between the OSE and CME is more difficult due to the different currency units and the time difference, the CME becomes a niche market, rather than a market directly competitive to the OSE. Hence, we mainly deal with competition between the OSE and SIMEX in the following analysis.

Table 2 summarizes the history of margin requirement changes in the OSE, SIMEX and CME. In fact, one of the striking differences in trading Nikkei 225 futures between the OSE and SIMEX is the changes in margin requirement: In 1991, the OSE *increased* margin requirements three times, while SIMEX *decreased* its margin requirements twice. Furthermore, in 1993, the margin requirements in SIMEX and the CME decreased, whereas the OSE maintained the same margin requirements. For prudent reasons, the exchange often sets the margin requirement based on price volatility. Because the price volatilities in the two markets were not much different, decisions in the two markets in 1991 were not mutually consistent.

Fig. 1 shows the monthly transaction volume in the OSE and the SIMEX. Fig. 2 shows the market share of the OSE in terms of transaction volume of Nikkei 225 futures on the three markets.[7] It seems striking that the transaction volume in

[7] The CME transaction volume is converted to common units by using 100 yen-per-dollar exchange rate, the contract unit in SIMEX is half of the OSE, and the number of contracts in SIMEX is divided by two to standardize the transaction volume for the yen value in Osaka.

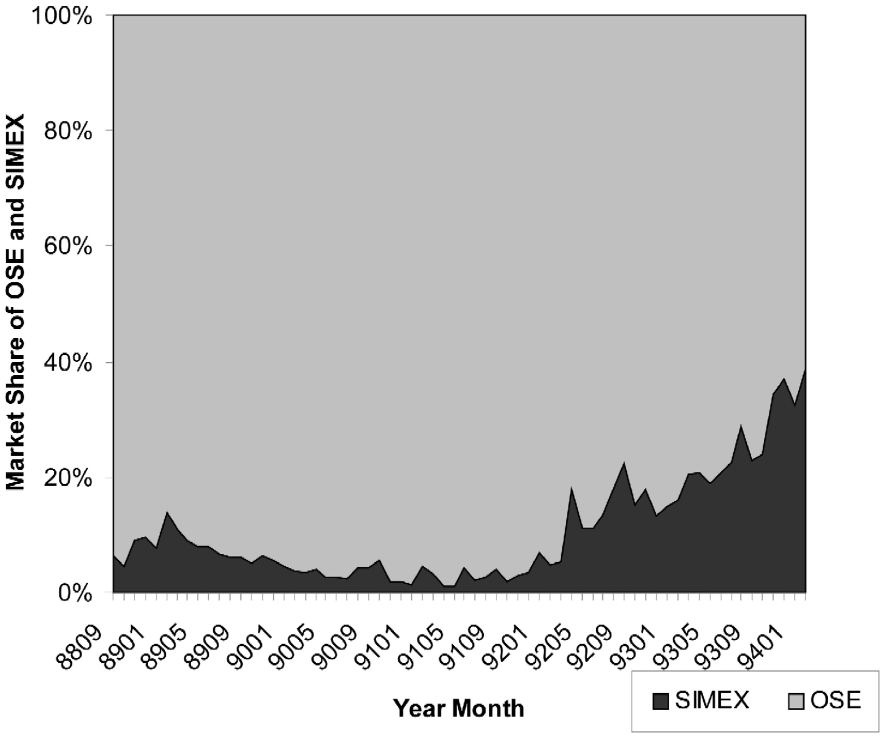

Fig. 2. Market shares of Nikkei 225 contracts.

SIMEX only started to increase to a significant degree in late 1991 after the changes in margin requirements in opposite direction in the two exchanges.

Financial centers have scale economies because a deep market attracts more trading by being a liquid market where price discovery is fast. A deeper market attracts more trade, thus becoming even deeper. The OSE trading volume and market share had been boosted from 0% to 95% of worldwide transactions of Nikkei futures from 1988 to 1990 by this scale economy consideration.

It is possible to attract business away from the leading, deep market only by developing a niche; for example, by offering cheaper transaction costs, reducing the barriers to entry, and other inducements.[8] It turned out that by late 1991, the difference in costs between the OSE and SIMEX more than offset the scale disadvantage for SIMEX, and the tide started to turn. In the following subsection, a formal analysis will be conducted to examine this hypothesis.

[8] The cost comparison is relative. The above statement can apply to a situation where the leading market increases transactions costs, the following market decreases transactions costs, or both.

4. Econometric model and empirical analysis

4.1. Data

The daily data of the Nikkei 225 cash index and the settlement prices of futures contracts on the OSE and the SIMEX from September 3, 1988 to January 28, 1994, are used to construct daily returns, which are defined as the logarithm difference of the price indexes between business days t and $t-1$. The business hours for the two futures exchanges are identical, but the futures markets closes 10 min later than the cash market. The number of contracts traded is used as a measure of trading volume. For the cash market, we use the total number of contracts in the Tokyo Stock Exchange as trading volume. In SIMEX, because the monetary value per contract is half the OSE contract, the number of contracts in SIMEX is divided by two to obtain its trading volume standardized to the OSE unit. There are 11 changes in margins either on the OSE or SIMEX. By using each change in the margin requirement as a breakpoint, we break our sample into twelve regimes.[9]

4.2. Trading volume process

The empirical studies have shown that volume may be nonstationary and have strong day-of-week effects. Panel A in Table 3 investigates the nonstationarity of trading volume by transforming the data into the logarithm and by performing the Dicky-Fuller (1979) tests. To decide the breakpoint, as seen in Fig. 2, March 28, 1991 (the 609th observation), seems to be a structural breakpoint of trend in trading volume. The process is represented as

$$V_{i,t} = \sum_{k=1}^{12} a_{k,i} D_{k,t} + \sum_{k=1}^{3} b_{k,i} M_{k,t} + \sum_{k=1}^{4} c_{k,i} W_{k,t} + d_{1,i} t + d_{2,i} B_t (t-609) + \sum_{k=1}^{5} \lambda_{k,i} \Delta V_{i,t-k} + \delta_i V_{i,t-1} + u_{i,t},$$

where $i = \text{c, o, and s}$, standing for Cash, the OSE, and the SIMEX, respectively. A percentage change in the volume (the log-difference volume) is the dependent variable. Explanatory variables include predetermined variables such as past changes in trading volume (lags one to five), the level of volume (lag one), the day-of-week effects (W), the January, May (for Golden Week), and December dummy variables (M), as well as the dummies for different changes in margin requirements (D).

[9] Ueda (1993) investigated the effect of commissions on trading volume for the Tokyo Stock Exchange.

Table 3
Trading volume process
(A) Test for unit root
Model

$$V_{i,t}=\sum_{k=1}^{12}a_{k,i}D_{k,t}+\sum_{k=1}^{3}b_{k,i}M_{k,t}+\sum_{k=1}^{4}c_{k,i}W_{k,t}+d_{1,i}t+d_{2,i}B_t(t-609)+\sum_{k=1}^{5}\lambda_{k,i}V_{i,t-k}+\delta_i V_{i,t-1}+u_{i,t}$$

for $i=$ c, o, and s, where $V_{i,t}$ is the logarithm of the trading volume in the home market; $D_{k,t}$ is the dummy variable for different event regimes based on margin changes; $W_{k,t}$ is a dummy variable for the day of week; $M_{k,t}$ is a dummy variable for January ($k=1$), May ($k=2$), or December ($k=5$); $V_{c,t}$ is the logarithm of the trading volume in the cash market; $V_{o,t}$ is the logarithm of the trading volume in the OSE futures market; $V_{s,t}$ is the logarithm of the trading volume in the SIMEX futures market; and B_t is the dummy variable whose value equals 1 for t (March 28, 1991, the 609th observation) greater than 609.

(B) Volume process for OSE and SIMEX futures

$$V_{i,t}=\sum_{k=1}^{12}a_{k,i}D_{k,t}+\sum_{k=1}^{3}b_{k,i}M_{k,t}+\sum_{k=1}^{4}c_{k,i}W_{k,t}+d_{1,i}t+d_{2,i}B_t(t-609)+u_{i,t}u_{i,t}=\sum_{k=1}^{5}\alpha_{k,i}u_{c,t-k}+\sum_{k=1}^{5}\beta_{k,i}u_{o,t-k}+\sum_{k=1}^{5}\gamma_{k,i}u_{s,t-k}+\varepsilon_{i,t}$$

where $V_{i,t}$ is the logarithm of the trading volume in the home market; $D_{k,t}$ is the dummy variable for different event regimes based on margin changes; $W_{k,t}$ is a dummy variable for the day of week; $M_{k,t}$ is a dummy variable for January ($k=1$), May ($k=2$), or December ($k=3$); $u_{c,t}$ is the logarithm of the trading volume in the cash market; $u_{o,t}$ is the logarithm of the trading volume in the OSE futures market; and $u_{s,t}$ is the logarithm of the trading volume in the SIMEX futures market. B_t is the dummy variable for a structural break.

(C) Volume process for cash markets and volume difference

$$V_{i,t}=\sum_{k=1}^{12}a_{k,i}D_{k,t}+\sum_{k=1}^{3}b_{k,i}M_{k,t}+\sum_{k=1}^{4}c_{k,i}W_{k,t}+d_{1,i}t+d_{2,i}B_t(t-609)+u_{i,t}u_{i,t}=\sum_{k=1}^{5}\alpha_{k,i}u_{c,t-k}+\sum_{k=1}^{5}\beta_{k,i}u_{o,t-k}+\sum_{k=1}^{5}\gamma_{k,i}u_{s,t-k}+\varepsilon_{i,t}$$

where$V_{i,t}$ is the logarithm of trading volume in the home market; $D_{k,t}$ is the dummy variable for different event regimes based on margin changes; $W_{k,t}$ is a dummy variable for the day of week; $M_{k,t}$ is a dummy variable for January ($k=1$), May ($k=2$), or December ($k=3$); $u_{c,t}$ is the de-trended trading volume in the cash market; $u_{o,t}$ is the de-trended trading volume in the OSE futures market; and $V_{s,t}$ is the de-trended trading volume in the SIMEX futures market. B_t is the dummy variable for a structural break.

(A) Test for unit root

Cash market		OSE futures		SIMEX futures	
δ	t-stat	δ	t-stat	δ	t-stat
−0.161 (0.021)	−7.523*	−0.113 (0.020)	−5.787*	−0.189 (0.026)	−7.346*

Note: The critical values are −3.96, −3.41 and −3.12 for the 1%, 5% and 10% significance levels, respectively.

Table 3 (*continued*)

(B) Volume process for OSE and SIMEX futures

Event dummy variable, $\alpha_{k,i}$	OSE futures			SIMEX futures		
	Coeff. (standard errors)	(actual, predicted change)	Wald Test for $a_{k,i}=a_{k-1,i}$ (prob.)	Coeff. (standard errors)	(actual, predicted change)	Wald Test for $a_{k,i}=a_{k-1,i}$ (prob.)
Prior to margins change 09/3/88–01/25/90	9.514* (0.202)			7.295* (0.210)		
SIMEX increased margins on 01/25/90	9.687* (0.466)	(+,+)	0.406 (0.525)	7.033* (0.441)	(−,−)	1.100 (0.294)
SIMEX decreased margins on 07/30/90	9.705* (0.545)	(+,−)	0.036 (0.848)	7.242* (0.522)	(+,+)	2.760 (0.097)
OSE increased margins on 08/24/90	9.612* (0.607)	(−,−)	0.961 (0.327)	6.944* (0.598)	(−,+)	2.057 (0.151)
OSE increased margins on 01/31/91	9.971* (0.695)	(+,−)	9.159 (0.003)	6.442* (0.656)	(−,+)	6.457 (0.011)
SIMEX decreased margins on 03/28/91	9.420* (0.737)	(−,−)	54.798 (0.000)	6.039* (0.692)	(−,+)	18.322 (0.000)
SIMEX decreased margins on 05/17/91	9.743* (0.781)	(+,−)	12.472 (0.000)	6.548* (0.734)	(+,+)	12.911 (0.000)
OSE increased margins on 06/27/91	9.496* (0.888)	(−,−)	2.966 (0.085)	6.476* (0.816)	(−,+)	0.154 (0.695)
OSE increased margins on 12/18/91	8.982* (1.027)	(−,−)	8.596 (0.003)	6.954* (0.932)	(+,+)	5.538 (0.019)
SIMEX increased margins on 04/9/92	8.489* (1.315)	(−,+)	2.329 (0.126)	7.122* (1.174)	(+,−)	0.285 (0.593)
SIMEX decreased margins on 06/14/93	7.664* (1.743)	(−,−)	3.289 (0.067)	6.426* (1.522)	(−,+)	3.166 (0.075)
SIMEX decreased margins on 08/10/93	7.721* (1.749)	(−,−)	0.132 (0.716)	6.666* (1.548)	(+,+)	2.347 (0.125)
Trend; d_1 (standard error)	0.003* (0.001)			0.0001 (0.001)		
Breaking trend after 03/28/91: d_2 (standard error)	−0.002* (0.001)			0.003* (0.001)		
Test for no spillovers from Cash. H_0: all $\alpha = 0$. (prob)	7.251 (0.203)			4.632 (0.463)		
Test for no spillovers from OSE. H_0: all $\gamma = 0$ (prob)	152.637 (0.000)			6.574 (0.254)		
Test for no spillovers from SIMEX. H_0: all $\gamma = 0$ (prob)	2.473 (0.781)			461.583 (0.000)		

(C) Volume process for cash markets and volume difference

Event dummy variable, $a_{k,i}$	Cash market			OSE volume + SIMEX volume		
	Coeff. (standard errors)	(actual, predicted change)	Wald Test for $a_{k,i} = a_{k-1,i}$ (prob.)	Coeff. (standard errors)	(actual, predicted change)	Wald Test for $a_{k,i} = a_{k-1,i}$ (prob.)
Prior to margins change 09/3/88–01/25/90	13.628 * (0.224)			16.809 * (0.443)		
SIMEX increased margins on 01/25/90	13.084 * (0.562)	(−, +)	2.651 (0.103)	16.720 * (0.944)	(−, −)	0.007 (0.934)
SIMEX decreased margins on 07/30/90	12.727 * (0.661)	(−, −)	8.692 (0.003)	16.947 * (1.118)	(+, +)	0.022 (0.881)
OSE increased margins on 08/24/90	12.803 * (0.731)	(+, +)	0.434 (0.509)	16.556 * (1.269)	(−, −)	0.050 (0.823)
OSE increased margins on 01/31/91	13.218 * (0.848)	(+, +)	5.585 (0.018)	16.413 * (1.405)	(−, −)	0.005 (0.942)
SIMEX decreased margins on 03/28/91	12.507 * (0.905)	(−, −)	10.925 (0.001)	15.459 * (1.483)	(+, −)	0.203 (0.652)
SIMEX decreased margins on 05/17/91	12.201 * (0.943)	(−, −)	3.155 (0.075)	16.291 * (1.568)	(+, +)	0.139 (0.709)
OSE increased margins on 06/27/91	11.910 * (1.078)	(−, +)	2.605 (0.106)	15.972 * (1.750)	(−, −)	0.017 (0.895)
OSE increased margins on 12/18/91	11.323 * (1.241)	(−, +)	7.343 (0.007)	15.936 * (2.008)	(−, −)	0.000 (0.989)
SIMEX increased margins on 04/9/92	10.597 * (1.596)	(−, +)	3.433 (0.064)	15.611 * (2.527)	(−, −)	0.010 (0.921)
SIMEX decreased margins on 06/14/93	9.490 * (2.098)	(−, −)	4.327 (0.037)	14.090 * (3.302)	(+, −)	0.131 (0.717)
SIMEX decreased margins on 08/10/93	9.437 * (2.111)	(−, −)	0.109 (0.741)	14.387 * (3.335)	(+, +)	0.004 (0.950)
Trend; d_1 (standard error)	0.0003 (0.001)			0.003 (0.002)		
Breaking trend after 03/28/91: d_2 (standard error)	0.005 * (0.001)			0.001 (0.002)		
Test for no spillovers from Cash. H_0: all $\alpha = 0$ for all k. (prob)	266.402 (0.000)			16.295 (0.279)		
Test for no spillovers from OSE. H_0: all $\beta = 0$ for all k. (prob)	8.997 (0.109)			85.329 (0.000)		
Test for no spillovers from SIMEX. H_0: all $\gamma = 0$ for all k. (prob)	5.975 (0.308)			269.575 (0.000)		

Panel A in Table 3 shows that the unit root hypothesis is rejected for trading volume in the three markets, suggesting a trend-stationary process for trading volume. Thus, we may first de-trend the volume series and adjust it for the day-of-week and January, Golden week, and December monthly effects:

$$V_{i,t} = \sum_{k=1}^{12} a_{k,i} D_{k,t} + \sum_{k=1}^{3} b_{k,i} M_{k,t} + \sum_{k=1}^{4} c_{k,i} W_{k,t} + d_{1,i} t$$
$$+ d_{2,i} B_t (t - 609) + u_{i,t}.$$

We obtained the de-trended volume series, $u_{i,t}$, for each futures exchange and used it to test spillover effects from one market to the other two related markets

$$u_{i,t} = \sum_{k=1}^{5} \alpha_{k,i} u_{\mathrm{c},t-k} + \sum_{k=1}^{5} \beta_{k,i} u_{\mathrm{o},t-k} + \sum_{k=1}^{5} \gamma_{k,i} u_{\mathrm{s},t-k} + \varepsilon_{i,t}$$

for $i = \mathrm{c}$, o and s.

All estimations are done by using the least square methods, and standard errors are adjusted for heteroskedasticity (and autocorrelations of an order of five in the first regressions). Panels B and C in Table 3 reported the estimated results. The third and sixth columns reported the actual and predicted changes with a " + " sign indicating positive change and " − " sign indicating negative change. The substitution effect is assumed to be the "working" hypothesis. For each regime change (row) of Panel B, the own market effect, as theory predicts, is negative when the margin requirement is raised. The own effect is marked with bold letters.

The own effect is confirmed in 7 out of 11 regime changes. Controlling for other factors, it is definitely confirmed that the three out of the four increase in margin changes on the OSE (three times in 1990–1991) lowered trading volume. Results on the own effects of changes in margin requirement on SIMEX are more mixed. Out of five events of lowering margin requirements on SIMEX, only three resulted in an increase of trading volume.

There is no general conclusion on whether the substitution effect dominates the overall volume effect in the short term. Ambiguous evidence includes (i) the actual sign of change only matches the first of the theoretical predictions in few cases and (ii) a formal test of the absence of spillovers at the bottom of Panel B in Table 3 shows that the null hypothesis cannot be rejected. However, in the long-term effect, we can find that the substitution effect was dominant by looking at the significant coefficient on the trend variable, d_2. When the OSE raised the margin requirements three times in 1990–1991, SIMEX trading volume had an upward trend and OSE trading volume drifted down.

The first three columns of Panel C in Table 3 examine the spillover to cash markets. The first sign in the theoretical prediction row indicates that the substitution effect from the futures market to the cash market is dominant. In general, the substitution of businesses to the cash market was confirmed in 7 out of 11 times. However, those margin changes on the OSE in the second half of 1991 lowered trading on the Cash market. All substitution out of the OSE seems to have gone to SIMEX.

The last three columns of Panel C in Table 4 show the impact on the total volume of the OSE and SIMEX. The theoretical prediction is based on the total effects where trading volume goes up whenever margin requirements in any one of futures exchange goes down. Although the actual changes agree with the theoretical prediction 9 out of 11 times, they are not statistically significant by judging from Wald test statistics in the last column.

In sum, the most significant finding in this subsection is the support of the view that, from 1991 to 1993, the opposite movements in margin requirements in the OSE and SIMEX contributed to both the long-term decline in the trading volume in the OSE and increase of the trading volume in the SIMEX, even controlling for the various factors.

4.3. Returns processes

Next, the returns process is estimated for each market to see whether any measurable changes occurred as a result of the changes in margin requirement. The change in transaction costs alters the band of prices that are neutral from arbitrage. Because the band is not large anyway, we do not expect to find a dramatic difference in the return process between the OSE and SIMEX. A more interesting question is whether the difference in the transaction costs is expected to make a difference in the relationship between the cash market and the futures market. After all, the motivation for a higher margin requirement in the OSE in 1991 seems to have been an attempt to discourage the short-sell speculation that allegedly affected the cash market.

In order to control for the other factors, such as the day-of-week effects and lagged returns from all the three exchanges, we specify the return process as

$$R_{i,t} = \sum_{k=1}^{12} a_{k,i} D_{k,t} + b_{1,i}\mathrm{Mon}_t + b_{2,i}\mathrm{Fri}_t + \sum_{k=1}^{2} c_{k,i} R_{\mathrm{c},t-k} + \sum_{k=1}^{2} d_{k,i} R_{\mathrm{o},t-k} + \sum_{k=1}^{2} f_{k,i} R_{\mathrm{s},t-k} + \varepsilon_{i,t},$$

for $i = \mathrm{c}$ (Cash), o (OSE), and s (SIMEX), where $R_{i,t}$ is the market return of the ith market, $D_{k,t}$ is the dummy variable for different event regimes based on margin changes, and Mon_t and Fri_t are dummy variables for Monday and Friday, respectively; $R_{\mathrm{c},t}$ is the cash market return; $R_{\mathrm{o},t}$ is the OSE futures market return; and $R_{\mathrm{s},t}$ is the SIMEX futures market return.

Our major interest is the sign and significance of the coefficients on the dummy variables $D_{k,t}$. Lead and lag relations between the three markets are also examined. The first null hypothesis of interest is that the constant terms of returns—drift of price index—are not significantly different between before and after a change

Table 4
Returns process
Model

$$R_{i,t} = \sum_{k=1}^{12} a_{k,i} D_{k,t} + b_{1,i}\mathrm{Mon}_t + b_{2,i}\mathrm{Fri}_t + \sum_{k=1}^{2} c_{k,i} R_{\mathrm{c},t-k} + \sum_{k=1}^{2} d_{k,i} R_{\mathrm{o},t-k} + \sum_{k=1}^{2} f_{k,i} R_{\mathrm{s},t-k} + \varepsilon_{i,t}$$

where $R_{i,t}$ is the home market return, $D_{k,t}$ is the dummy variable for different event regimes based on margin changes, Mon is a dummy variable for Monday, Fri is a dummy variable for Friday, $R_{\mathrm{c},t}$ is the cash market return, $R_{\mathrm{o},t}$ is the OSE futures market return, and $R_{\mathrm{s},t}$ is the SIMEX futures market return.

Event dummy variable, $a_{k,i}$	Cash market		OSE futures		SIMEX futures	
	Coeff. (standard errors)	Wald test for $a_{k,i} = a_{k-1,i}$ (prob.)	Coeff. (standard errors)	Wald test for $a_{k,i} = a_{k-1,i}$ (prob.)	Coeff. (standard errors)	Wald test for $a_{k,i} = a_{k-1,i}$ (prob.)
Prior to margins change 09/3/88–01/25/90	0.172* (0.047)		0.162* (0.045)		0.174* (0.047)	
SIMEX increased margins on 01/25/90	−0.043 (0.139)	2.188 (0.139)	−0.051 (0.141)	2.191 (0.139)	−0.052 (0.147)	2.259 (0.132)
SIMEX decreased margins on 07/30/90	−1.110* (0.471)	4.743 (0.029)	−1.148* (0.457)	5.253 (0.022)	−1.256* (0.522)	4.928 (0.132)
OSE increased margins on 08/24/90	0.042 (0.239)	4.765 (0.029)	0.047 (0.235)	5.404 (0.020)	0.052 (0.247)	5.131 (0.023)
OSE increased margins on 01/31/91	0.381* (0.204)	1.212 (0.271)	0.404* (0.187)	1.464 (0.226)	0.429* (0.199)	1.470 (0.225)
SIMEX decreased margins on 03/28/91	0.041 (0.151)	1.857 (0.173)	−0.011 (0.165)	2.891 (0.089)	−0.010 (0.169)	2.942 (0.086)
SIMEX decreased margins on 05/17/91	−0.282 (0.218)	1.555 (0.212)	−0.242 (0.205)	0.794 (0.373)	−0.285 (0.219)	1.012 (0.314)
OSE increased margins on 06/27/91	0.049 (0.128)	1.744 (0.187)	0.025 (0.129)	1.239 (0.265)	0.030 (0.153)	1.384 (0.239)
OSE increased margins on 12/18/91	−0.434* (0.218)	3.013 (0.082)	−0.351 (0.216)	2.288 (0.130)	−0.422 (0.234)	2.646 (0.103)
SIMEX increased margins on 04/9/92	0.158 (0.105)	5.174 (0.023)	0.138 (0.101)	4.328 (0.037)	0.158 (0.109)	5.205 (0.022)
SIMEX decreased margins on 06/14/93	0.102 (0.170)	0.082 (0.774)	0.075 (0.171)	0.103 (0.747)	0.073 (0.172)	0.179 (0.671)
SIMEX decreased margins on 08/10/93	0.026 (0.145)	0.116 (0.734)	0.014 (0.153)	0.072 (0.788)	0.002 (0.155)	0.097 (0.756)
Test for no spillovers from Cash. H_0: $c_1 = c_2 = 0$ (prob)	31.559 (0.000)		3.354 (0.187)		3.214 (0.200)	
Test for no spillovers from OSE. H_0: $d_1 = d_2 = 0$ (prob)	4.824 (0.089)		5.491 (0.064)		5.249 (0.072)	
Test for no spillovers from SIMEX. H_0: $f_1 = f_2 = 0$ (prob)	11.646 (0.003)		13.599 (0.001)		3.479 (0.175)	

in margins. The second hypothesis is that there are no significant spillovers from lagged returns of the cash market ($c_{k,i} = 0.0$, for all k). The third hypothesis tests no spillovers from lagged OSE futures returns ($d_{k,i} = 0.0$, for all of k), while the fourth hypothesis tests no spillovers from lagged SIMEX futures returns ($f_{k,i} = 0.0$, for all of k). To test this, the least square estimation with the standard errors being adjusted for heteroskedasticity is used. The order of lagged returns is chosen to be two.[10]

Results of the estimations and tests of the null hypotheses mentioned above are shown in Table 4. The test statistics for the regime change due to margin requirements for the three markets are reported in columns three, five, and seven of the table. The tests for the second to the fourth hypotheses for the three markets are presented in the last three rows. The Wald test statistics with the p-value in parentheses are reported.

In Table 4, the $a_{k,i}$ columns show the estimates of coefficients on the 12 dummies for changes in margins with the heteroskedasticity-consistent standard errors in parentheses as well as the Wald test statistics and their p-value in parenthesis. First, only two cases show significant effects on the event dummies. The margin requirement decrease of July 30, 1990, in SIMEX lowered returns in all three markets while the margin requirement increase of January 31, 1991, in the OSE increased the returns in the three markets. Note that these results are obtained controlling for influences from the past returns. Because the change in margin requirements does not have a systematic impact on the return process of a market, an increase in margin requirements may not be able to reverse the downward trend in the cash or futures market. The higher transaction costs induced by the higher margins may not always reduce the futures price as the expected return premia increase to compensate such a cost.

Second, from the last three rows of the Cash Market column, we found that futures prices could significantly affect cash market returns, but not vice versa. It suggests that futures prices tended to reveal market-wide information more quickly than the cash markets, so futures prices led cash prices. The magnitude, however, is not large, so exploiting this information may not result in sure profits.

Third, from the last two rows of the OSE and SIMEX columns, the lagged spillover futures from SIMEX to the OSE are statistically significant with a 1% significance level, while from the OSE to SIMEX, it is statistically significant only at the 7% significance level. The two futures markets are mutually linked, and a shock in one market in 1 day quickly spreads to the other market.

[10] To check the validity of this choice, we conducted the Wald tests to examine whether inclusions of the lagged returns of orders three and four significantly affected the returns. Although the results are not reported here, no significant effect of lagged spillovers of an order higher than two was detected from any of the three markets.

4.4. Volatility process

Lastly, the time-varying volatility processes are analyzed with a GARCH specification. The dummy variables that account for the regime changes, the Monday and Friday effects, and spillovers are included into the variance process[11]

$$\varepsilon_{i,t}|I_{t-1} \sim N0,h_{i,t})$$

$$h_{i,t} = \sum_{k=1}^{12} a_{k,i} D_{k,1} + b_{1,i}\mathrm{Mon}_t + b_{2,i}\mathrm{Fri}_t + \sum_{k=1}^{2} \alpha_{k,i}\varepsilon^2_{\mathrm{c},t-k,} + \sum_{k=1}^{2} \beta_{k,i}\varepsilon^2_{\mathrm{o},t-k}$$
$$+ \sum_{k=1}^{2} \gamma_{k,i}\varepsilon^2_{\mathrm{s},t-k} + c_i h_{t-1},$$

for $i = \mathrm{c}$ (Cash), o (OSE), and s (SIMEX), where $\varepsilon^2_{i,t-k}$ is the innovation, an unexpected return of the least square regression residual calculated in the returns regressions in the preceding subsection; $D_{k,t}$, Mon_t and Fri_t are the dummy variables as defined in the return process.

Based on our specification, the two-stage estimation yields consistent estimators although the estimators are not efficient. The first-stage estimation uses the least square method to estimate the returns regressions. The second-stage estimation applies the maximum likelihood method to estimate the conditional variance process of return innovations from the least square regressions in the first stage. The standard errors are robust to the density function. The Wald tests for the four hypotheses, like those in the returns processes, are conducted in the variance processes again.

Table 5 presents the maximum likelihood estimates of coefficients on the variance processes as well as the Wald test statistics for testing equal volatility before and after each change in margin requirements. The results in Table 5 show several interesting points. First, a relationship between the change in margin requirements and the subsequent volatility cannot be established. We found no reliable relationship between the coefficients of the regime dummy variables and a change in margin requirements. More formally, the Wald test of no change across regimes is generally not rejected. This finding is indeed consistent with many studies in the existing literature on the futures market (e.g., Hsieh and Miller, 1990), although it may be in contrast to a popular belief that an increase in margin requirements drives uninformed traders (or speculators) out of the market, so volatility becomes less. The finding also shows that an increase in margin

[11] The specifications of volatility spillover follow the recursive GARCH process proposed by Engle et al. (1990) for the intra-daily foreign exchange markets.

Table 5
Return variance process
Model

$\varepsilon_{i,t}|I_{t-1} \sim N0, h_{i,t})$

$$h_{i,t} = \sum_{k=1}^{12} a_{k,i} D_{k,t} + b_{1,i}\mathrm{Mon}_t + b_{2,i}\mathrm{Fri}_t + \sum_{k=1}^{2} \alpha_{k,i} \varepsilon^2_{c,t-k,} + \sum_{k=1}^{2} \beta_{k,i} \varepsilon^2_{o,t-k} + \sum_{k=1}^{2} \gamma_{k,i} \varepsilon^2_{s,t-k} + c_i h_{t-1}$$

where $\varepsilon_{i,t}$ is the innovation (the OLS regression residual) from the home market return, $D_{k,t}$ is the dummy variable for different event regimes based on margin changes, Mon is a dummy variable for Monday, Fri is a dummy variable for Friday, $\varepsilon_{c,t}$ is the cash market return, $\varepsilon_{o,t}$ is the innovation from the OSE futures market return, and $\varepsilon_{s,t}$ is the innovation from the SIMEX futures market return.

Event dummy variable, $a_{k,i}$	Cash market		OSE futures		SIMEX futures	
	Coeff. (standard errors)	Wald test for $a_{k,i} = a_{k-1,i}$ (prob.)	Coeff. (standard errors)	Wald test for $a_{k,i} = a_{k-1,i}$ (prob.)	Coeff. (standard errors)	Wald test for $a_{k,i} = a_{k-1,i}$ (prob.)
Prior to margins change 09/3/88–01/25/90	−0.020 (0.020)		−0.027 (0.018)		−0.053 (0.014)	
SIMEX increased margins on 01/25/90	0.108 (0.092)	2.401 (0.121)	0.099 (0.073)	3.698 (0.054)	0.056 (0.074)	2.530 (0.112)
SIMEX decreased margins on 07/30/90	0.650* (0.337)	2.721 (0.099)	0.609* (0.282)	3.499 (0.061)	0.747* (0.291)	6.135 (0.013)
OSE increased margins on 08/24/90	0.485* (0.282)	0.187 (0.664)	0.362* (0.195)	0.709 (0.399)	0.323* (0.198)	2.055 (0.152)
OSE increased margins on 01/31/91	0.117 (0.123)	1.933 (0.164)	0.081 (0.097)	2.367 (0.123)	0.014 (0.069)	2.923 (0.087)
SIMEX decreased margins on 03/28/91	0.025 (0.074)	0.462 (0.496)	0.016 (0.058)	0.371 (0.542)	−0.009 (0.056)	0.073 (0.786)
SIMEX decreased margins on 05/17/91	0.161* (0.098)	1.311 (0.252)	0.160 (0.106)	1.436 (0.231)	0.122 (0.101)	1.283 (0.257)
OSE increased margins on 06/27/91	0.178* (0.095)	0.023 (0.879)	0.097* (0.060)	0.356 (0.550)	0.150 (0.098)	0.047 (0.829)
OSE increased margins on 12/18/91	0.270* (0.149)	0.585 (0.445)	0.183 (0.112)	0.772 (0.379)	0.224* (0.135)	0.262 (0.608)
SIMEX increased margins on 04/9/92	0.201* (0.117)	0.407 (0.523)	0.147* (0.078)	0.151 (0.697)	0.102 (0.082)	1.255 (0.263)
SIMEX decreased margins on 06/14/93	0.081 (0.107)	0.924 (0.336)	0.058 (0.086)	0.943 (0.332)	0.011 (0.077)	0.979 (0.322)
SIMEX decreased margins On 08/10/93	0.109* (0.064)	0.064 (0.799)	0.137* (0.062)	0.738 (0.390)	0.082 (0.060)	0.669 (0.413)
Coefficient of lagged conditional variance: c (standard error)	0.781* (0.046)		0.809* (0.037)		0.850* (0.032)	
Coefficient of cash market innovation: α_1 (standard error)	0.137* (0.042)		0.054* (0.031)		0.036 (0.029)	
Coefficient of OSE futures innovation: β_2 (standard error)	0.061* (0.035)		0.085* (0.037)		0.068* (0.043)	
Cofficient of SIMEX futures innovation: γ_3 (standard error)	−0.056* (0.018)		−0.025 (0.019)		−0.012 (0.037)	

requirements in the futures market does not necessarily lead to a reduction in volatility of cash market returns.

Second, a high value (about 0.8 or higher) of coefficient of the lagged conditional variance, c, shows that once volatility becomes higher, it tends to stay that way for a while. This type of volatility clustering is a well-known fact in many financial markets.

Third, the last three rows of Table 5 show the statistical testing of whether the past squared innovations from the cash market, the OSE, and SIMEX futures have no explanatory power of the current volatility. The testing results in the Cash Market column of Table 5 indicate that larger innovations in the cash market and the OSE lead to higher conditional volatility of the cash market, but innovations in SIMEX seem to reduce the conditional volatility of the cash market. The results for the OSE show that innovations in the cash market as well as its own market can increase future OSE conditional volatility. The results for SIMEX show that OSE innovations significantly increase its conditional volatility. Taking all relationships together, we found that surprise movements in OSE futures prices on day $t-1$ do affect conditional volatility of all three markets on day t.

4.5. Volatility and margin requirement

Fig. 3 plots the alternative monthly volatility calculated from daily volatility of price change. We used it as a measure of how the regulatory authority decides the risk of futures and set up the prudent margin requirement.

From the historic volatility shown in Fig. 3, each change in margin requirement is consistent with the movement of volatility preceding the margin change. The only deviation seems to be the increases of the OSE margin requirement in January 1991 (despite the fact that volatility had been coming down) and in December 1991, after only 1 month of rising volatility, which did not exceed the levels of the previous months.[12]

The changes in SIMEX are more consistent with the ups and downs of volatility. For example, the sharp increase in volatility of March and April 1992 prompted SIMEX to increase its margin requirement while a trend reduction in volatility in the second half of 1992 and early 1993 resulted in reductions in the margin requirement in SIMEX in June and August 1993. Thus, there is no evidence to support the argument that SIMEX lowered its margin requirement

[12] Moreover, there is more anecdotal evidence that the increase in margins on OSE in 1991 was motivated more by a questionable attempt to reduce volatility, or even as a futile attempt to stop the decline in the cash market, and not motivated from the standpoint of managing default risk. The loss in trading volume was an unfortunate by-product from the OSE marketing point of view.

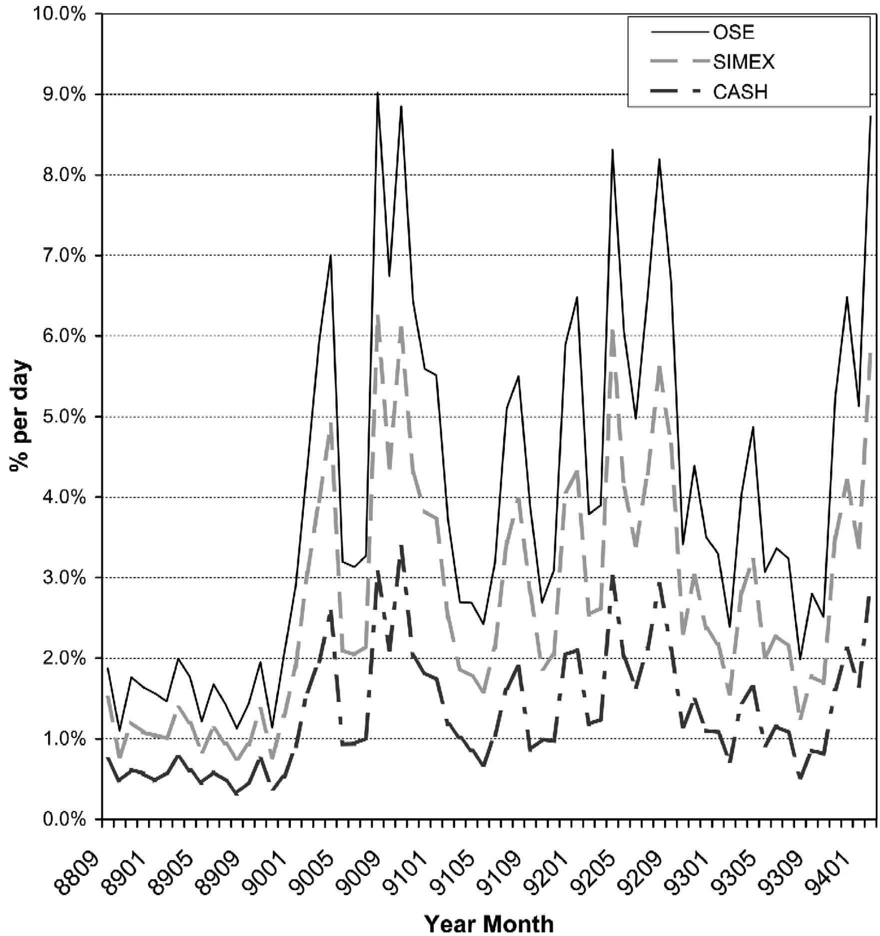

Fig. 3. Standard deviation of daily returns within the month.

solely to attract business, compromising risk management. On the other hand, the OSE raised its margin requirement when volatility increased, but failed to lower it when volatility came down, and thus stood to lose trade to SIMEX.

5. Conclusion and policy implications

This paper examined the effects of changes in margin requirements on trading volume, returns and volatility between the exchanges that trade identical financial products. Three questions are of particular interest. Is it possible for a futures exchange to gain business from a competing futures exchange or cash market by lowering margin requirements? Do higher margin requirements lower price volatility? Were the margin requirements on the OSE and SIMEX changed as they should have been?

For the first question, lowering margin requirements in one market does increase trading volumes on that market, sometimes at the expense of a competing futures exchange. The substitution effect (changing location of trade) seems to dominate the effect of a market-wide reduction in trade in the competing market. Evidence supports a view that the opposite movements in margin requirements on the OSE and SIMEX from 1991 to 1993 contributed to the decline in trading on the OSE and increased trading at SIMEX, even controlling for the various factors.

For the second question, conditional volatility does not seem to be affected in any systematic way by changes in margin requirement. However, we found that surprise movements on OSE futures returns are important in predicting conditional volatility in subsequent days on all three markets.

For the third question, from a policy point of view, lowering the margin requirement should be preceded by a period of lower conditional volatility. We found that each change in margin requirement seems to be consistent with the movement of conditional volatility preceding the margin change with only two exceptional cases of the increase in margin requirement in January and December of 1991 by the OSE. There is no evidence to support the argument that SIMEX lowered its margin requirement solely to attract business or compromise risk management. On the other hand, the OSE raised its margin requirement when (unconditional) volatility increased, but failed to lower it when (unconditional) volatility came down, and thus stood to lose trade to SIMEX.

Although we do not discover any sign of too low margins for the sake of attracting business in the episodes of Nikkei 225 futures from 1988 to 1993, the race to become a financial center has intensified in the rest of the world. The issue of whether the related competing futures exchanges should coordinate margin requirements becomes more important in the future. One argument that favors the coordination asserts that if competitive reduction in the margin requirement presents a problem in this globalization of financial products, then a consistent setting of margins across all related markets can be called for (Estrella, 1988). Contrary to this argument, as the capital bases and market characteristics of futures exchange members are different, resilience to shocks varies among members. Setting a common formula may result in too high a margin requirement because of protecting the weakest member of the most fragile market, which is counterproductive to market development.

The present paper does not argue for the position that the competing exchanges should adopt a common reserve requirement. Rather, it takes the position that the consideration of coordination between related exchanges is necessary. This issue will be left for future research.

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