An Impact of Japan and Korea Exchange Rate Volatilities in Southeast Asia Two Exchange Rate Markets: Empirical Study of Thailand and Philippine Countries

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Abstract

The empirical results show that the dynamic conditional correlation (DCC) and the bivariate AIGARCH (1, 1) model is appropriate in evaluating the relationship of the Thailand's and the Philippine's exchange rate markets. The empirical result also indicates that the Thailand's and the Philippine's exchange rate markets is a positive relation. The average estimation value of correlation coefficient equals to 0.4005, which implies that the two exchange rate markets is synchronized influence. Besides, the empirical result also shows that the Thailand's and the Philippine's exchange rate markets have an asymmetrical effect. The return volatility of the Thailand and the Philippine exchange rate markets receives the influence of the positive and negative values of the Japan and the Korea exchange rate volatilities. Under the good news of Japan and Korea Exchange rate markets, the empirical result also shows that the Thailand and the Philippine exchange rate markets can reduce the fixed variation risk.

Keywords: *Exchange Rate, Asymmetric Effect, IGARCH Model, AIGARCH Model*.

Introduction

We known that Thailand economical physique belongs an island economy, where positive includes to the foreign trade unfolds where ties between Japan and Korea are close. We also know that Thailand is one of Asian four dragons, also Thailand economy of growth in 2006 is 5%, and the forecast value of the grow rate is 4.3% in the future. Thailand has a close relationship with the Japan based on the trade and the circulation of capital, and the Japan is the most powerful global economic nation in the Asian. Besides, Thailand and Korea have a close relationship based on the trade and the circulation of capital. When the investor has an investment in the international stock market, he/she will usually care about the international capital the motion situation, the international politics and the economical situation change, in particular, in the Japan and the Korea exchange rate market change. There is a close relationship for Thailand and Philippine based on the trade and the circulation of capital with the Japan and the Korea, but the Japan and Korea are also powerful area economical nations. Therefore, the relationship between the Thailand and the

Philippine exchange rate markets are worth further discussion with the factors of the Japan and the Korea exchange rate markets.

The purpose of the present paper is to examine the relations of the Thailand and the Philippine exchange rate markets. This paper also further discusses the affect of the Japan and the Korea exchange rates' volatility rate for the Thailand and the Philippine exchange rate market volatilities. And the positive and negative values of Japan and Korea exchange rates' volatility are used as the threshold. The organization of this paper is as follows: Section 2 descibes the data characteristics; Section 3 presents the proposed model; Section 4 presents the empirical results, and finally Section 5 summarizes the conclusions of this study.

Data Characteristics

Data Sources

The data of this research included the Thailand, the Philippine, the Japan and the Korea exchange rate price collected between January, 2010 and December, 2014. The source of the stock data was the Taiwan economic Journal (TEJ), a database in Taiwan. The Thailand's exchange rate price refers to the Thai Baht to US in the New York market, the Philippine's exchange rate price refers to the Philippine Peso to US in the New York market, the Japan's exchange rate price refers to Japanese Yen to US in the New York market, and the Korea exchange rate price refers to the Korean Won to US in the New York market. During the process of data analysis, in case that there was no exchange rate market price available on the side of the Thailand and the Philippine exchange rate market or on the side of the Japan and the Korea exchange rate markets due to holidays, the identical time exchange rate price data from one side was deleted. After this, the four study variables samples are 1,305.

Returns Calculation and Basic Statistics

To compute the volatility rates of the Thailand exchange rate market adopts the natural logarithm difference, rides 100 again. The volatility rates of the Philippine exchange rate market also adopts the natural logarithm difference, rides 100 again. The volatility rates of the Japan and the Korea exchange rate markets also adopts the natural logarithm difference, rides 100 again. In Figure 1, the Thailand, the Philippine, the Japan and the Korea exchange rate volatility shows the clustering phenomenon, so that we may know the four study markets have certain relevance.

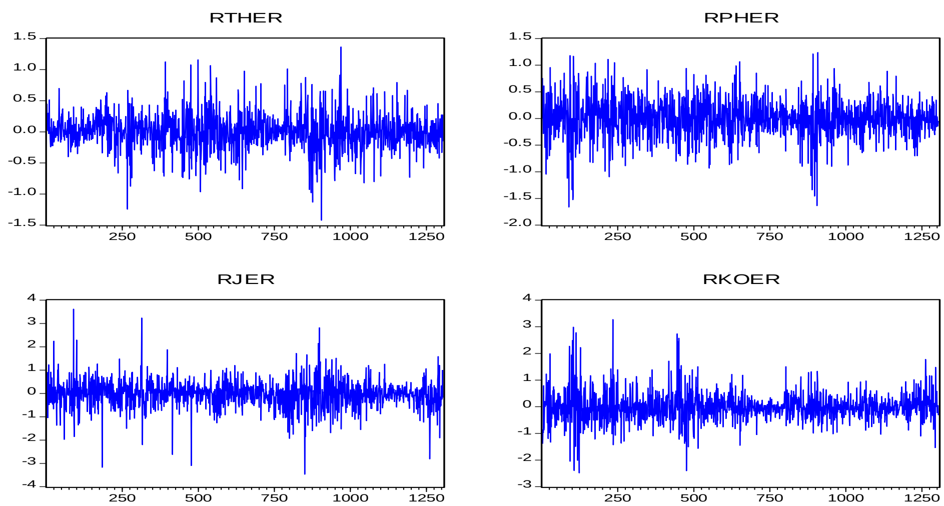

Figure 1. Trend charts of the Thailand, the Philippine, the Japan and the Korea exchange rate market volatility rates.

Table 1 presents the four sequences kurtosis coefficients are all bigger than 3, which this result implies that the normal distribution test of Jarque-Bera is not normal distribution. Therefore, the heavy tails distribution is used in this paper. And the four study markets do have the high correlation in Table 2.

Table 1. Data statistics

Statistics	*RTHER*	*RPHER*	*RJER*	*RKOER*
Mean	0.001042	0.002462	-0.019346	-0.004904
S-D	0.289006	0.359884	0.599547	0.553847
Skew	0.040570	-0.305698	-0.181944	0.642545
Kurtosis	5.323033	4.726649	7.731815	7.910693
J-B N (p-value)	*293.34**** *(0.0000)*	*182.16**** *(0.0000)*	*1222.78**** *(0.0000)*	*1398.90**** *(0.0000)*
Sample	*1304*	*1304*	*1304*	*1304*

Notes: (1) J-B N is the normal distribution test of Jarque-Bera. (2) S-D is denoted the standard deviation. (3) *** denote significance at the level 1%.

Table 2. Unconditional correlation coefficient

Coefficient	*THER*	*PHER*	*JER*	*KOER*
THER	1	0.7468	0.5304	-0.0490
PHER	0.7468	1	0.3269	0.2371
JER	0.5304	0.3269	1	-0.4629
KOER	-0.0490	0.2371	-0.4629	1

Unit Root and Co-Integration Tests

This paper further uses the unit root test of KSS (Kapetanios et. al., 2003) to determine the stability of the time series data. The KSS examination result is listed in Table 3. It shows that the Thailand exchange rate volatility, the Philippine exchange rate volatility, the Japan exchange rate volatility, and the Korea exchange rate volatility do not have the unit root characteristic, this is, the four study markets are stationary series data, under $\alpha = 1\%$ significance level.

Using Johansen's (1991) co-integration test as illustrated in Table 4 at the significance level of 0.05 (α =5%) does not reveal of $\lambda_{\max}$ statistic. This indicated that the Thailand exchange rate market, the Philippine exchange rate market, the Japan exchange rate market and the Korea exchange rate market do not have a co-integration relation. Therefore, we do not need to consider the model of error correction.

Table 3. Unit root test of KSS for the study data

KSS	*RTHER*	*RPHER*	*RJER*	*RKOER*
Statistic	*-20.7368****	*-19.5041****	*-17.8271****	*-19.6847****
Critical value	*-2.82*	*-2.22*	*-1.92*	
Significant level	α *=1%*	α *=5%*	α *=10%*	

Notes: *** denote significance at the level 1%.

Table 4. Co-integration test (Var Lag=4)

H_0	λ_{max}	***Critical value***
None	*28.8243*	*30.8151*
At most 1	*9.7191*	*24.2520*
At most 2	*6.8148*	*17.1477*
At most 3	*1.8834*	*3.8415*

Notes: The lag of VAR is selected by the AIC rule (Akaike, 1973).
The critical value is given under the level 5%.

ARCH Effect Test

Based on the formula (1) and (2) as below, we uses the methods of LM test (Engle, 1982) and F test (Tsay, 2004) to test the conditionally heteroskedasticity phenomenon. In Table 5, the results of the ARCH effect test show that the two study markets have the conditionally heteroskedasticity phenomenon exists. This result suggests that we can use the GARCH model to match and analyze it.

Table 5. ARCH effect test

RTHER	*Engle LM test*	*Tsay F test*
Statistic	*314.406******	*3.1621******
(p-value)	*(0.0000)*	*(0.0000)*
RPHER	***Engle LM test***	***Tsay F test***
Statistic	*363.804******	*5.3805******
(p-value)	*(0.0000)*	*(0.0000)*

Notes：*** denote significance at the level 1%.

Proposed Model

Based on the Japan and the Korea exchange rate markets will affect the volatility of the Thailand and the Philippine exchange rate markets, and the Japan and the Korea exchange rate markets do have the high correlations for the Thailand and the Philippine exchange rate markets. We follows the idea of self-exciting threshold autoregressive (SETAR) model (Tsay, 1989), the idea of double threshold GARCH model (Brooks, 2001), and the ideas of the papers of Engle (2002) and Tse & Tusi (2002), and uses the positive and negative value of Japan and Korea exchange rates' volatility rate is as a threshold. After model process selection, in this paper, we may use the bivariate asymmetric GARCH (called AGARCH) model to construct the relationships of the Thailand and the Philippine exchange rate market returns, the AGARCH(1, 1) model is illustrated as follows:

$$RTHER_t = \phi_{10} + \sum_{j=1}^{2}(\phi_{j1}RTHER_{t-j} + \phi_{j2}RPHER_{t-j}$$
$$+\phi_{j3}RJER_{t-j} + \phi_{j4}RKOER_{t-j}) + a_{1,t} \quad (1)$$

$$RPHER_t = \varphi_{10} + \sum_{j=1}^{2}(\varphi_{j1}RTHER_{t-j} + \varphi_{j2}RPHER_{t-j}$$
$$+\varphi_{j3}RJER_{t-j} + \varphi_{j4}RKOER_{t-j}) + a_{2,t}\,, \quad (2)$$

$$h_{11,t} = \sum_{j=1}^{4} u_{j,t-1}(\alpha_{j0} + \alpha_{j1} a_{1,t-1}^{2} + \beta_{j1} h_{11,t-1}), \quad (3)$$

$$h_{22,t} = \sum_{j=1}^{4} u_{j,t-1}(\alpha'_{j0} + \alpha'_{j1} a_{2,t-1}^{2} + \beta'_{j1} h_{22,t-1}), \quad (4)$$

$$h_{12,t} = \rho_t \sqrt{h_{11,t}} \sqrt{h_{22,t}}\ , \quad (5)$$

$$\rho_t = \exp(q_t)/(\exp(q_t)+1), \quad (6)$$

$$q_t = \gamma_0 + \gamma_1 \rho_{t-1} + \gamma_2 a_{1,t-1} a_{2,t-1} / \sqrt{h_{11,t-1} h_{22,t-1}}\ , \quad (7)$$

$$u_{1,t} = \begin{cases} 1 \ , \ if & RJER_t \le 0; RKOER_t \le 0 \\ 0 \quad if & others \end{cases}, \quad (8)$$

$$u_{2,t} = \begin{cases} 1 \ , \ if & RJER_t \le 0; RKOER_t > 0 \\ 0 \quad if & others \end{cases}, \quad (9)$$

$$u_{3,t} = \begin{cases} 1 \ , \ if & RJER_t > 0; RKOER_t \le 0 \\ 0 \quad if & others \end{cases}, \quad (10)$$

$$u_{4,t} = \begin{cases} 1 \ , \ if & RJER_t > 0; RKOER_t > 0 \\ 0 \quad if & others \end{cases}, \quad (11)$$

with $RJER_t > 0$ and $RKOER_t > 0$ denote good news, $RJER_t \le 0$ and $RKOER_t \le 0$ denote bad news. The white noise of $\bar{a}'_t = (a_{1,t}, a_{2,t})$ is obey the bivariate Student's t distribution, this is,

$$\bar{a}_t \sim T_v(\bar{0}, (v-2)H_t / v), \quad (12)$$

among $\bar{0}' = (0,0)$ and H_t is the covariance matrix of $\bar{a}'_t = (a_{1,t}, a_{2,t})$, and ρ_t is the dynamic conditional correlation coefficient of $a_{1,t}$ and $a_{2,t}$. The maximum likelihood algorithm method of BHHH (Berndt et. al., 1974) is used to estimate the model's unknown parameters. The programs of RATS and EVIEWS are used in this paper.

Empirical Results

From the empirical results, we know that the Thailand and the Philippine exchange rate volatility may be constructed on the DCC and the bivariate AIGARCH (1, 1) model. Its estimate result is stated in Table 6. The empirical results show that the good news and bad news of the Japan and the Korea exchange rates' volatility will produce the different exchange rate volatility rates on the Thailand and the Philippine exchange rate markets. And the exchange rate volatilities of the Japan and the Korea will also affect the variation risks of the Thailand and the Philippine exchange rate markets. The Thailand exchange rate volatility does not receive before two period's impact of the Thailand exchange rate volatility. The Thailand exchange rate volatility does not receive before two period's impact of the Philippine exchange rate volatility. The Thailand exchange rate volatility also receives before 1 period's impact of the Japan exchange rate volatility (ϕ_{13}=0.0204). The Thailand exchange rate volatility also receives before 1 period's impact of the Korea exchange rate volatility (ϕ_{14}=-0.0415). The Thailand exchange rate volatility does not receive 2nd period's impact of the Japan and the Korea exchange rate volatility. The Philippine exchange rate volatility receives first period's impact of the Thailand exchange rate volatility (φ_{11}=0.1528). And the

Philippine exchange rate volatility does not receive 2nd period's impact of the Thailand exchange rate volatility. The Philippine exchange rate volatility also receives before 1 period's impact of the Philippine exchange rate volatility (φ_{12} =-0.1178). The Philippine exchange rate volatility does not receive 2nd period's impact of the Philippine exchange rate volatility. The Philippine exchange rate volatility does not receive before two period's impact of the Korea exchange rate volatility. The Philippine exchange rate volatility does not receive before two period's impact of the Japan exchange rate volatilities. The exchange rate volatilities of the Japan and the Korea are also truly influent the volatility of the Thailand and the Philippine exchange rate markets.

On the other hand, the correlation coefficient average estimation value ($\hat{\bar{\rho}}_t$ =0.4005) of the Thailand and the Philippine exchange rate volatility is significant. This result also shows the Thailand and the Philippine exchange rate's volatility is mutually synchronized influence. In additional, estimated value of the degree of freedom for the Student's t distribution is 4.3577, and is significant under the significance level of 0.01($\alpha = 1\%$). This also demonstrates that this research data has the heavy tailed distribution.

Table 6. Parameter estimation of the DCC and the bivariate AIGARCH(1, 1) model

Parameters	ϕ_{10}	ϕ_{11}	ϕ_{12}	ϕ_{13}	ϕ_{14}
Coefficient	*-0.0031*	*0.0361*	*0.0311*	*0.0204*	*-0.0415*
(p-value)	*(0.6322)*	*(0.2866)*	*(0.1600)*	*(0.0573)*	*(0.0052)*
Parameters	ϕ_{21}	ϕ_{22}	ϕ_{23}	ϕ_{24}	φ_{10}
Coefficient	*0.0238*	*0.0096*	*-0.0093*	*-0.0037*	*-0.0087*
(p-value)	*(0.4443)*	*(0.6581)*	*(0.4109)*	*(0.7931)*	*(0.2935)*
Parameters	φ_{11}	φ_{12}	φ_{13}	φ_{14}	φ_{21}
Coefficient	*0.1528*	*-0.1178*	*0.0067*	*0.0113*	*0.0100*
(p-value)	*(0.0000)*	*(0.0005)*	*(0.6582)*	*(0.5813)*	*(0.7492)*
Parameters	φ_{22}	φ_{23}	φ_{24}	α_{10}	α_{11}
Coefficient	*-0.0012*	*0.0112*	*-0.0021*	*0.0092*	*0.1805*
(p-value)	*(0.9717)*	*(0.4505)*	*(0.9164)*	*(0.0300)*	*(0.0049)*
Parameters	β_{11}	α_{20}	α_{21}	β_{21}	α_{30}
Coefficient	*0.8195*	*0.0243*	*0.5309*	*0.4691*	*-0.0023*
(p-value)	*(0.0000)*	*(0.0001)*	*(0.0000)*	*(0.0000)*	*(0. 4486)*
Parameters	α_{31}	β_{31}	α_{40}	α_{41}	β_{41}
Coefficient	*0.1091*	*0.8909*	*0.0009*	*0.2353*	*0.7647*
(p-value)	*(0.0179)*	*(0.0000)*	*(0.8280)*	*(0.0011)*	*(0.0000)*
Parameters	α'_{10}	α'_{11}	β'_{11}	α'_{20}	α'_{21}
Coefficient	*0.0122*	*0.1877*	*0.8123*	*0.0182*	*0.2419*
(p-value)	*(0.0710)*	*(0.0004)*	*(0.0000)*	*(0.0110)*	*(0.0000)*
Parameters	β'_{21}	α'_{30}	α'_{31}	β'_{31}	α'_{40}
Coefficient	*0.7581*	*-0.0034*	*0.0737*	*0.9263*	*-0.0002*

(p-value)	*(0.0000)*	*(0.5306)*	*(0.1824)*	*(0.0000)*	*(0.9692)*
Parameters	α'_{41}	β'_{41}	γ_0	γ_1	γ_2
Coefficient	*0.1457*	*0.8543*	*-0.5434*	*-0.2722*	*0.0996*
(p-value)	*(0.0024)*	*(0.0000)*	*(0.7893)*	*(0.9571)*	*(0.3119)*
Parameters	v	$\bar{\rho}_t$	**min** ρ_t	**max** ρ_t	
Coefficient	*4.3577*	*0.4005*	*0.3050*	*0.6172*	
(p-value)	*(0.0000)*	*(0.0000)*			

Notes：p-value< α denotes significance. (α =1%, α =5%). min ρ_t denotes the minimum ρ_t and max ρ_t denotes the maximum ρ_t

From the Table 6, the estimated coefficients of the conditional variance equation will produce the different variation risks under the bad news and good news in Thailand and Philippine exchange rate markets. The empirical results show that the Thailand exchange rate market conforms the conditionally supposition of the AIGARCH model. The empirical results also show that the Philippine exchange rate market return is the AIGARCH model. This result also demonstrates the DCC and the bivariate AIGARCH (1, 1) model may catch the Thailand and the Philippine exchange rate volatilities' process. The empirical result shows that the Thailand exchange rate market has the fixed variation risk, and the Philippine exchange rate market has also a fixed variation risk. In Table 6, the Thailand and the Philippine exchange rate markets have the different conditional variation risks. This result demonstrates that the good news and bad news of the Japan and the Korea exchange rate markets will produce the different variation risks on the Thailand and the Philippine exchange rate markets. Under the good news of Japan and Korea exchange rate markets, the variation risk of the Philippine's exchange rate market is larger than the variation risk of Thailand's exchange rate market. Under the $RJER_t \leq 0$ (bad news) and $RKOER_t \leq 0$ (bad news), the empirical result shows that the variation risk of the Philippine exchange rate market is smaller than the variation risk of the Thailand exchange rate market. Besides, under the $RJER_t > 0$ (good news) and $RKOER_t > 0$ (good news), the empirical result also shows that the Thailand and the Philippine exchange rate markets can reduce the fixed variation risk. Under the $RJER_t \leq 0$ (bad news) and $RKOER_t \leq 0$ (bad news), the empirical result also shows that the Thailand and the Philippine exchange rate markets have the fixed variation risk. Therefore, the explanatory ability of the DCC and the bivariate AIGARCH(1, 1) model is better than the traditional model of the bivariate GARCH (1, 1).

To test the inappropriateness of the DCC and the bivariate AIGARCH(1, 1) model, the test method of Ljung & Box (1978) is used to examine autocorrelation of the standard residual error. This proposed model does not show an autocorrelation of the standard residual error. Therefore, the DCC and the bivariate AIGARCH(1, 1) model are more appropriate.

Conclusions

The empirical results show that the Thailand exchange rate market's volatility does have an asymmetric effect and the Philippine exchange rate market's volatility does have the asymmetric effect. The Thailand and the Philippine exchange rate market volatility may construct in the DCC and the bivariate AIGARCH (1, 1) model with a positive (good news) and negative (bad news) threshold of Japan and Korea exchange rate volatility rates.

From the empirical result also obtains that the dynamic conditional correlation coefficients' average estimation value ($\hat{\bar{\rho}}$ =0.4005) of the Thailand and the Philippine exchange rate volatility is positive. The positive and negative value of the Japan and the Korea exchange rate volatility affects the volatility rates of the Thailand and the Philippine exchange rate markets. The Thailand and the Philippine exchange rate markets are truly received the impact of the Japan and the Korea exchange volatility rates. Under the good news of the Japan and the Korea exchange rate markets, the variation risk of the Philippine exchange rate market is larger than the variation risk of the Thailand exchange rate market. Under the $RJER \leq 0$ and $RKOER \leq 0$, the empirical result shows that the variation risk of the Thailand exchange rate market is larger than the variation risk of the Philippine exchange rate market. Besides, under the $RJER > 0$ and the $RKOER > 0$, the empirical result also shows that the Thailand and the Philippine exchange rate markets can reduce the fixed variation risk.

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