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計畫主持人**:** 洪萬吉 **(Wann-Jyi Horng)**

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日圓與歐元匯率波動之門檻模型在兩匯率市場報酬:台灣與韓國匯率市場之實證研究

洪萬吉

嘉南藥理科技大學醫務管理系

E-mail: **hwj7902@mail.chna.edu.tw**

摘要

本文探討台灣與韓國匯率市場之模型建構與其關聯性，同時本文使用日圓與歐元匯率期間之波動當作門檻。 研究資料期間為 2004 年 1 月至 2009 年 12 月，且本文也採用學生 t 分配來分析所提之模型。 實證研究結果顯示這兩匯率市場是相互影響，且用動態條件相關與雙變量非對稱 IGARCH(1，1)模型來評估這兩匯率市場的關聯性是適當的。實證研究結果也顯示台灣與韓國匯率市場之間是呈現正相關， 其動態條件相關係數之平均值為 0.4724，此也顯示台灣與韓國匯率市場報酬波動之間是具同步的影響。此外，實證研究結果也顯示台灣與韓國匯率市場具有不對稱效果。實證研究結果也顯示台灣與韓國匯率市場報酬將會受到日圓與歐元匯率期間之波動的影響，日圓與歐元匯率期間之波動也將影響台灣與韓國匯率市場變異風險。

關鍵字: 匯率市場報酬, DCC, 學生 t 分配, 非對稱效果, 雙變量 IGARCH 模型。.

Threshold Model of Japan and European Dollars' Volatility on Two Exchange Rate Markets: Empirical Study of Taiwan and Korea's Exchange Rate Markets

Wann-Jyi Horng
Department of Hospital and Health Care Administration, Chia Nan University of Pharmacy & Science, 60, Erh-Jen RD., Sec.1, Jen-Te, Tainan, Taiwan.
E-mail: hwj7902@mail.chna.edu.tw

Abstract

This paper uses the Taiwan's exchange rate (US dollar) and the Korea's exchange rates (US dollar) of material from January, 2004 to December, 2009, discussing the model construction and their associations of between Taiwan's and Korea's exchange rate markets, and also uses Student's t distribution to analyze the proposed model. The empirical results show that the mutual affects of the Taiwan's and the Korea's exchange rate markets may construct in bivariate IGARCH (1, 1) model with a DCC. The empirical result also shows that between Taiwan's and Korea's exchange rate market returns exists the positive relations- namely two exchange rate market return's volatility are synchronized influence, the average estimation value of the DCC coefficient of two exchange rate market returns equals to 0.4724. The European's exchange rate return's volatility will also affect the variation risk of the Taiwan's exchange rate market, and the European's exchange rate return's volatility will also affect the variation risk of the Korea's exchange rate market. Also, Taiwan's and Korea's exchange rate markets do not have the asymmetrical effect in the research data period. These evidences may suggest exchange rate market investors or international fund managers- before investing in Korea must consider the Taiwan's and European's exchange rate return's volatility risk and its connection. Therefore, in the exchange rate market, investors and managers may not neglect the influence of the foreign country's exchange rate market return volatility behavior; otherwise, his decision will not achieve the anticipated effect.

Keywords: Exchange rate market returns, DCC, student's t distribution, asymmetrical effect, bivariate IGARCH model.

1. Introduction

In recent years, under the internationalization and a liberalized tidal current, and urging the international investment and the circulation of capital increase, experts also caused between the country and the country the exchange rate market a related ascension. Taiwan's economical physique belongs partly to an island economy. We also know that Korea is one of Asian four dragons, also Korea economy of growth in 2006 is 5%, and the forecast value of the grow rate is 4.3% in the future. Besides, Taiwan is also the Asia main financial center, its foreign exchange market is the fourth big trading market in the world. We also know that Also, Taiwan is geographically close to Korea, therefore the relation between Taiwan and Korea exchange rate markets is worth further discussing.

Between the research stock market the return volatility method has many models, such as autoregressive moving average (ARMA) model, but from scholar Engle (1982) proposes the autoregressive conditionally heteroskedasticity (ARCH) model and Bollerslev (1986) proposes the generalized autoregressive conditionally heteroskedasticity (GARCH) model. Yet where this kind of model comparatively may catch the financial property the variation number is not the fixed characteristic. But afterwards, scholars like Nelson (1990) discovered that negative direction in the markets will have a different influence on the future stock price volatility. But the GARCH model supposes the settled time conditional variance for the preceding issue of conditional variance, with error term a square function; therefore, error terms both the positive and negative did not exist to the conditional variance influence. Therefore, several condition variations can change along with error term size value, but cannot change along with the positive and negative marks. To improve this flaw, Nelson (1991) proposes the so-called exponential GARCH model and Glosten, Jaganathan and Runkle (1993) propose the so-called threshold GARCH model. For the research of asymmetric problems, one may also refer to Horng and Lu (2011), Liu, Zhao and Wang (2010), Poon and Fung (2000), Christie (1982), French, Schwert and Stambaugh (1987), Campell and Hentschel (1992), Koutmos and Booth (1995), and Koutmos (1996). Afterwards, studies of the return volatility method grew vigorously, proposing such things as the multivariate GARCH model. For examples, see Yang (2005), Yang and Doong (2004), Granger, Hung and Yang (2002), and Bollerslev (1990) for the application of bivariate GARCH model.

In this paper, the Student’s t distribution is adopted and 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. Beside, one also discusses the influence of the Japan’s and European’s exchange rate return on the Taiwan’s and Korea’s exchange rate markets. This paper is organized as follows. Section 2 descibes the data characteristics of Taiwan’s and Korea’s exchange rate and the volatility of their returns, and the data characteristics of European’s exchange rate; Section 3 gives the asymmetric test of bivariate GARCH model with a DCC; Section 4 gives the propoded model of bivariate GARCH with a DCC and its estimated parameters, and an analysis of related Taiwan’s and Korea’s exchange rate returns; Section 5 gives the empirical results of the proposed model; Section 6 gives the conclusions.

2. Data characteristics

2.1 Basic statistics and trend charts

The research sample period was from January, 2004 to December, 2009, and the material origin takes from DataStream, a database in Taiwan. Among them, the Taiwan's exchange rate price is the exchange rate of the Taiwan New dollar to US dollar in New York market, the Korea's exchange rate price is the exchange rate of the Korea Won to US dollar in the New York market. The Japan's exchange rate price is the exchange rate of the Japan Yen to US in the New York market. The European's exchange rate price is the exchange rate of the Euro to US in the New York market. In the data processing aspect, the markets do not do business on respective Taiwan's and Korea's holidays; therefore when a exchange rate market is closed, this article deletes the identical time exchange rate price material and conforms to the other exchange rate market's common trading day; therefore two variable samples after processing each will be 1,566 from now on. The Taiwan's exchange rate market return ($RTWER_t$) for every day closing price natural logarithm difference, rides 100 again, this namely

$$RTWER_t = 100 \times (\log(TWER_t \;/\; TWER_{t-1})),$$

in which $TWER_t$ represents the t-th date the Taiwan's exchange rate closing price; The Korea's exchange rate market return ($RKER_t$) for every day closing price natural logarithm difference, rides 100 again, this namely

$$RKER_t = 100 \times (\log(KER_t \;/\; KER_{t-1})),$$

in which KER_t represents the t-th date of the Korea's exchange rate closing price; The Japan's exchange rate market return ($RJER_t$) for every day closing price natural logarithm difference, rides 100 again, this namely

$$RJER_t = 100 \times (\log(JER_t \;/\; JER_{t-1})),$$

in which JER_t represents the t-th date of the Japan's exchange rate closing price. The European's exchange rate market return ($REUER_t$) for every day closing price natural logarithm difference, rides 100 again, this namely

$$REUER_t = 100 \times (\log(EUER_t \;/\; EUER_{t-1})),$$

in which $EUER_t$ represents the t-th date of the European's exchange rate closing price.

In Figure 1, the trend charts of the Taiwan's and Korea's exchange rate volatility, we may know the Taiwan's exchange rate market and Korea's stock market have a relationship. In Figure 2, the Taiwan's and Korea's exchange rate return volatility shows the clustering phenomenon, so that we may know the Taiwan's exchange rate market and Korea's stock market have certain relevance. And return rate of Japan's and European's exchange rate can also affect the exchange rate market. By the unit root test as below, the return rate of the Taiwan's exchange rate, the return rate of the Korea exchange rate, the return rate of the Japan's exchange rate, and the return rate of the European's exchange rate are all stationary sequences. The basic statistics of these sequences are stated in Table 1. According to Table 1, as shown by the Jarque-Bera statistics under the null hypotheses of normal distribution, those four markets do not obey the assumption of normal distribution. Therefore, the heavy tails distribution is used to evaluate the proposed model.

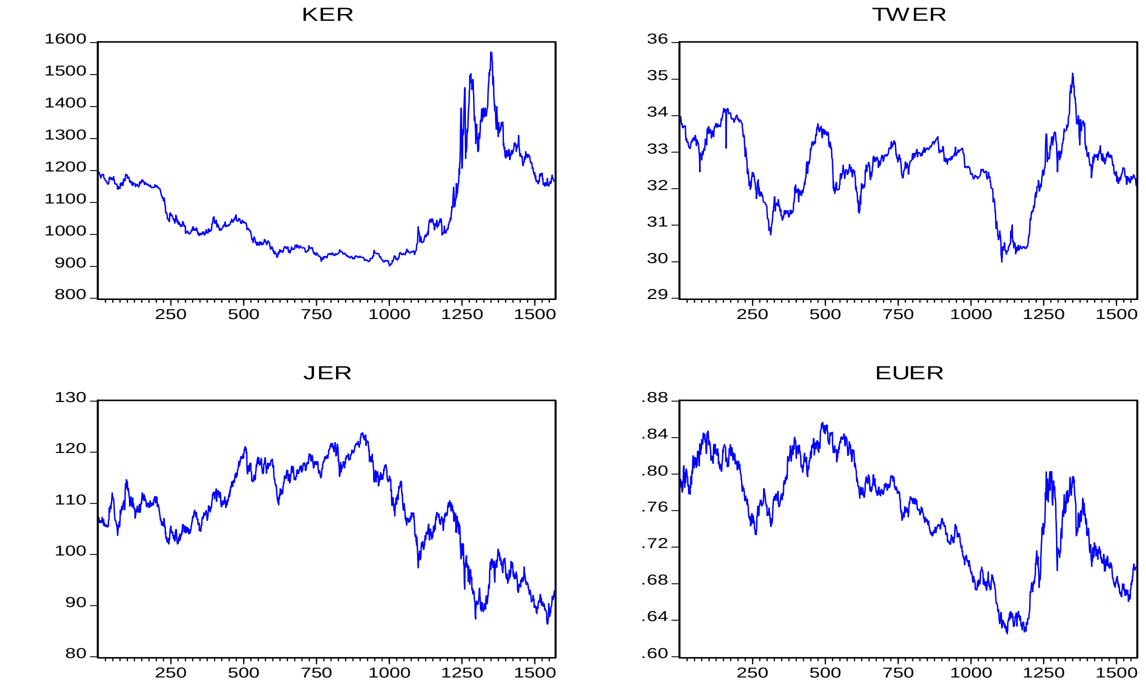

Figure 1. Tend charts of Taiwan's and Korea's exchange rate with the Japan's and the European's exchange rate.

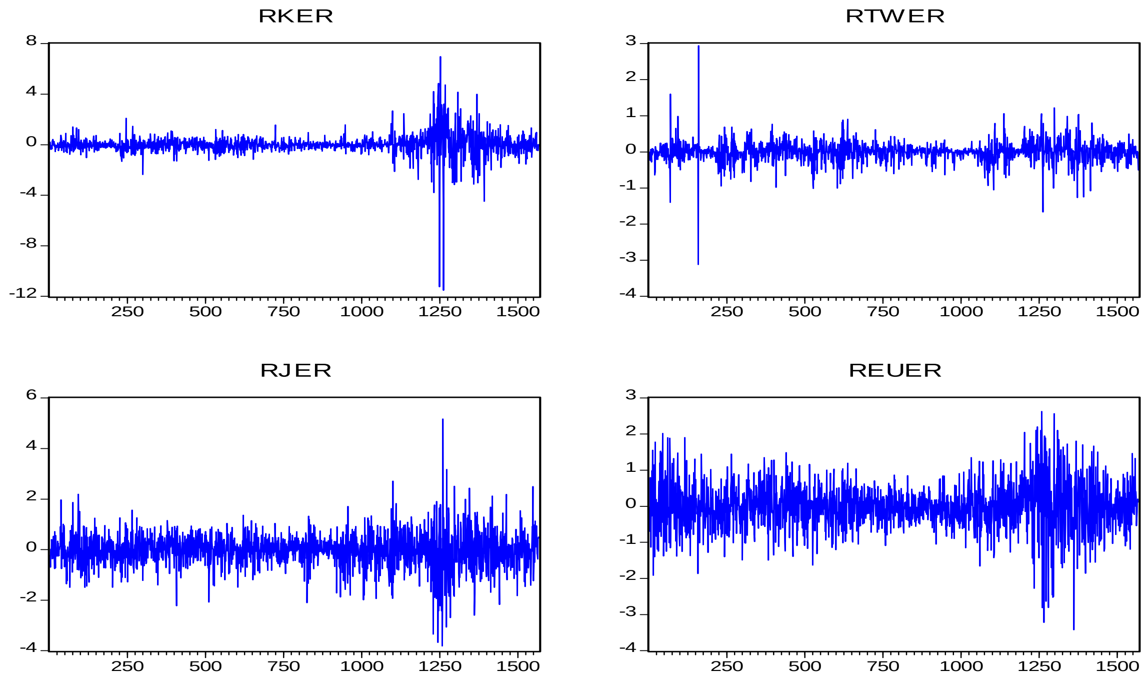

Figure 2. Tend charts of Taiwan's and Korea's exchange rate return rate, and the return rates of Japan's and European's exchange rate.

Table 1. Basic statistics of the research data

Statistics	TWER	RTWER	KER	RKER
Mean	32.590	-0.0037	1071.87	-0.0014
Median	32.753	0.0000	1027.500	0.0000
Standard deviation	0.9376	0.2925	142.78	0.8668
Skewness	-0.5706	-0.3286	1.0438	-2.2118
Kurtosis	3.2128	20.3351	3.4512	48.0748
J-B (p-value)	87.927 (0.000)	19624 *** (0.000)	297.37 (0.000)	133762 *** (0.000)
Sample	1566	1565	1566	1565
Statistics	JER	RJER	EUER	REUER
Mean	108.22	-0.0091	0.7564	-0.0082
Median	109.310	0.0094	0.7669	-0.0223
Standard deviation	9.037	0.7067	0.0589	0.6595
Skewness	-0.5223	-0.1305	-0.4211	-0.1269
Kurtosis	2.3996	7.0841	2.1831	5.1889
J-B (p-value)	94.709 (0.000)	1092.1 *** (0.000)	89.824 (0.000)	316.63 *** (0.000)
Sample	1566	1565	1566	1565

Note: (1) J-B denotes the normal distribution test of Jarque-Bera.
(2) *** denotes significance at level α =1%.

2.2 Unit root test and Co-integration test

This paper further uses the unit root tests of ADF (Dickey and Fuller, 1979 and 1981) and KSS (Kapetanios et al., 2003) to determine the stability of the time series data. The ADF and KSS examination results is listed in Table 2. It shows that the return rate of the Taiwan's exchange rate, the return rate of the Korea's exchange rate, and the return rates of the Japan's and European's exchange rate do not have the unit root characteristic- namely, the three markets are stationary time series data, under $\alpha = 1\%$ significance level.

Table 2. Unit root test of ADF and KSS methods

ADF	RTWER	RKER
Statistic	-39.671 ***	-9.869 ***
Critical value	-3.964 (α =1%), -3.413 (α =5%)	
KSS	RTWER	RKER
Statistic	-22.043 ***	-18.522 ***
Critical value	-2.82 (α =1%), -2.22 (α =5%)	
ADF	RJER	REUER
Statistic	-9.954 ***	-29.434 ***

Critical value	-3.964 (α =1%), -3.413 (α =5%)	
KSS	RJER	REUER
Statistic	-18.145 ***	-19.107 ***
Critical value	-2.82 (α =1%), -2.22 (α =5%)	

Note: *** denotes significance at the 1% level.

By the cointegration test of Johansen (1991), we know that the statistics of $\lambda_{\max}$ is not significant under the level $\alpha = 5\%$ in Table 3.1-2. This demonstrates that those three markets of the the return rate of the Taiwan's exchange rate, the return rate of the Korea's exchange rate, the return rate of the Japan's exchange rate, and the return rate of the European's exchange rate do not have co-integration of their relations. Therefore, we are not considered the model of error correction.

Table 3.1 Johansen co-integration test (VAR lag=1)

Null H_0	$\lambda_{\max}$	Critical value
None	21.8293	32.1183
At most 1	13.1485	25.8232
At most 2	8.0926	19.3870
At most 3	4.1748	12.5180

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

Table 3.2 Johansen co-integration test (VAR lag=5)

Null H_0	$\lambda_{\max}$	Critical value
None	18.9140	32.1183
At most 1	10.1324	25.8232
At most 2	8.0443	19.3870
At most 3	5.2887	12.5180

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

2.3 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 4, the results of the ARCH effect test show that these two markets have the conditionally heteroskedasticity phenomenon exists. This result suggests that we can use the GARCH model to match and analyze it. The detail is omitted here.

Table 4. ARCH effect test

RTWER	Engle LM test	Tsay F test
Statistics	369.9681 ***	15.9235 ***
(p-value)	(0.0000)	(0.0000)
RKER	Engle LM test	Tsay F test
Statistics	516.482 ***	25.430 ***
(p-value)	(0.0000)	(0.0000)

Note： *** denotes significance at level α =1%.

3. Bivariate IGARCH model with a DCC

A dynamic conditional correlation (DCC) and the bivariate IGARCH(1, 1) model with a factor of European's exchange rate return is proposed in this section, its model may be expressed as

$$RKER_t = \phi_{10} + \phi_{11} RKER_{t-1} + \phi_{12} RTWER_{t-1} + \phi_{13} RJER_{t-1} + \phi_{14} REUER_{t-1} + a_{1,t} \quad (1)$$

$$RTWER_t = \varphi_{10} + \varphi_{11} RKER_{t-1} + \varphi_{12} RTWER_{t-1} + \varphi_{13} RJER_{t-1} + \varphi_{14} REUER_{t-1} + a_{2,t} \quad (2)$$

$$\vec{a}_t^{'} = (a_{1,t}, a_{2,t}) \sim T_v(\vec{0}, (v-2)H_t / v) \quad (3)$$

$$h_{11,t} = \alpha_{10} + \alpha_{11} a_{1,t-1}^2 + \beta_{11} h_{11,t-1} + \eta_{11} RJER_{t-1}^2 + \eta_{12} REUER_{t-1}^2 \quad (4)$$

$$h_{22,t} = \alpha_{20} + \alpha_{21} a_{2,t-1}^2 + \beta_{21} h_{22,t-1} + \eta_{21} RJER_{t-1}^2 + \eta_{22} REUER_{t-1}^2 \quad (5)$$

$$q_t = \gamma_0 + \gamma_1 \rho_{t-1} + \gamma_2 a_{1,t-1} a_{2,t-1} / \sqrt{h_{11,t-1} h_{22,t-1}} \quad \rho_t = \exp(q_t)/(\exp(q_t)+1) \quad (6)$$

$$h_{12,t} = \rho_t \sqrt{h_{11,t}} \sqrt{h_{22,t}} \quad (7)$$

Where $T_v(\vec{0}, (v-2)H_t / v)$ denotes the bivariate Student's t distribution, its mean is equal to 0 and its covariance matrix is equal to $(v-2)H_t / v$, and v is the degree of freedom. The DCC and the bivariate GARCH model can also refer to the papers of Engle (2002) and Tse and Tsui (2001).

Table 5. Parameter estimation of the DCC and the bivariate IGARCH(1, 1) model

Parameter	ϕ_{11}	ϕ_{12}	ϕ_{13}
Coefficient	-0.0967	0.1090	-0.0097
(p-value)	(0.0000)	(0.0007)	(0.5777)
Parameter	ϕ_{14}	φ_{11}	φ_{12}
Coefficient	0.1754	0.0037	0.0389
(p-value)	(0.0000)	(0.5959)	(0.1371)
Parameter	φ_{13}	φ_{14}	

Coefficient	0.0345	0.0955	
(p-value)	(0.0000)	(0.0000)	
Parameter	α_{10}	α_{11}	β_{11}
Coefficient	0.0055	0.1620	0.8089
(p-value)	(0.0209)	(0.0000)	(0.0000)
Parameter	η_{11}	η_{12}	
Coefficient	0.0124	0.0167	
(p-value)	(0.0977)	(0.0873)	
Parameter	α_{20}	α_{21}	β_{21}
Coefficient	0.0065	0.4549	0.5337
(p-value)	(0.0000)	(0.0000)	(0.0000)
Parameter	η_{21}	η_{22}	ν
Coefficient	0.0054	0.0060	3.7256
(p-value)	(0.0390)	(0.0566)	(0.0000)
Parameter	γ_0	γ_1	γ_2
Coefficient	-2.0004	3.8943	0.1080
(p-value)	(0.0000)	(0.0000)	(0.0000)
Parameter	$\bar{\rho}_t$	min ρ_t	max ρ_t
Coefficient	0.4661	0.2508	0.9340
(p-value)	(0.0000)		

Note: p-value< α denotes significance. (α =1%, α =5%, α =10%); α is the significance level. min ρ_t denotes the minimum value of ρ_t and max ρ_t denotes the maximum value of ρ_t .

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

4. Proposed model

Based on the IGARCH(1, 1) model, the Japan's and the European's terms exchange rate volatility will affect the exchange rate volatility of the Taiwan and the Korea markets. A dynamic conditional correlation (DCC) and the bivariate asymmetric GARCH(1, 1) model (called AGARCH(1, 1) model) with a Threshold of the terms Japan's and European's exchange rate volatility is proposed in this section, its model may be expressed as

$$RKER_t = \phi_{10} + \phi_{11} RKER_{t-1} + \phi_{12} RTWER_{t-1} + \phi_{13} RJER_{t-1} + \phi_{14} REUER_{t-1} + a_{1,t} \quad (8)$$

$$RTWER_t = \varphi_{10} + \varphi_{11} RKER_{t-1} + \varphi_{12} RTWER_{t-1} + \varphi_{13} RJER_{t-1} + \varphi_{14} REUER_{t-1} + a_{2,t} \quad (9)$$

$$\vec{a}_t' = (a_{1,t}, a_{2,t}) \sim T_v(\vec{0}, (v-2)H_t / v) \quad (10)$$

$$\begin{aligned} h_{11,t} &= u_{1,t-1}(\alpha_{10} + \alpha_{11} a_{1,t-1}^2 + \beta_{11} h_{11,t-1}) \\ &+ u_{2,t-1}(\alpha_{20} + \alpha_{21} a_{1,t-1}^2 + \beta_{21} h_{11,t-1}) \\ &+ u_{3,t-1}(\alpha_{30} + \alpha_{31} a_{1,t-1}^2 + \beta_{31} h_{11,t-1}) \\ &+ u_{4,t-1}(\alpha_{40} + \alpha_{41} a_{1,t-1}^2 + \beta_{41} h_{11,t-1}) \end{aligned} \quad (11)$$

$$\begin{aligned} h_{22,t} &= u_{1,t-1}(\alpha_{10}' + \alpha_{11}' a_{2,t-1}^2 + \beta_{11}' h_{22,t-1}) \\ &+ u_{2,t-1}(\alpha_{20}' + \alpha_{21}' a_{2,t-1}^2 + \beta_{21}' h_{22,t-1}) \\ &+ u_{3,t-1}(\alpha_{30}' + \alpha_{31}' a_{2,t-1}^2 + \beta_{31}' h_{22,t-1}) \\ &+ u_{4,t-1}(\alpha_{40}' + \alpha_{41}' a_{2,t-1}^2 + \beta_{41}' h_{22,t-1}) \end{aligned} \quad (12)$$

$$q_t = \gamma_0 + \gamma_1 \rho_{t-1} + \gamma_2 a_{1,t-1} a_{2,t-1} / \sqrt{h_{11,t-1} h_{22,t-1}} \quad \rho_t = \exp(q_t) / (\exp(q_t) + 1) \quad (13)$$

$$h_{12,t} = \rho_t \sqrt{h_{11,t}} \sqrt{h_{22,t}} \quad (14)$$

$$u_{1,t} = \begin{cases} 1 & , \ if \ \ RJER_t \le 0; REUER_t \le 0 \\ 0 & \ \ if \ \ \ others \end{cases}, \quad (15)$$

$$u_{2,t} = \begin{cases} 1 & , \ if \ \ RJER_t \le 0; REUER_t > 0 \\ 0 & \ \ if \ \ \ others \end{cases}, \quad (16)$$

$$u_{3,t} = \begin{cases} 1 & , \ if \ \ RJER_t > 0; REUER_t \le 0 \\ 0 & \ \ if \ \ \ others \end{cases}, \quad (17)$$

$$u_{4,t} = \begin{cases} 1 & , \ if \ \ RJER_t > 0; REUER_t > 0 \\ 0 & \ \ if \ \ \ others \end{cases}, \quad (18)$$

with $RJER_t > 0$ and $REUER_t > 0$ denote bad news, $RJER_t \le 0$ and $REUER_t \le 0$ denote good news. Where $T_v(\vec{0}, (v-2)H_t / v)$ denotes the bivariate Student's t distribution, its mean is equal to 0 and its covariance matrix is equal to $(v-2)H_t / v$, and v is the degree of freedom. The DCC and the bivariate GARCH model can also refer to the papers of Engle (2002) and Tse and Tsui (2001).

5. Empirical results

Table 6 shows the estimate results for the Taiwan's exchange rate return rate and Korea's exchange rate return rate by the DCC and the bivariate AGARCH(1, 1) model. we know that the estimated value of its coefficient whether remarkable, examines each coefficient significance by the P-value. In selects in sample period, the Korea's exchange rate return receives the previous one periods' impact of the Korea's exchange rate return (ϕ_{11}=-0.1006), the Korea's exchange rate return receives the previous one periods' impact of the Taiwan's exchange rate return

(ϕ_{12}=0.1083), and it receives the previous one periods' impact of the European's exchange rate return (ϕ_{14}=0.1805), but it does not receive the previous one periods' impact of the Japan's exchange rate return; The Taiwan's exchange rate return does not receive the previous one periods' impact of the Korea's exchange rate return, and it does not also receive the previous one periods' impact of the Taiwan's exchange rate return. The Taiwan's exchange rate return also receives the previous one periods' impact of the Japan's exchange rate return (φ_{13}=0.0318). The Taiwan's exchange rate return also receives the previous one periods' impact of the European's exchange rate return (φ_{14}=0.0974). On the other hand, the average estimation value ($\hat{\bar{\rho}}_t$=0.4724) of the DCC coefficient of the Taiwan's exchange rate return and the Korea's exchange rate return volatility is significant, and shows the Taiwan's exchange rate return the volatility is a positive influence on Korea's exchange rate return volatility. The synchronized mutual influence, when variation of risk of the Taiwan's exchange rate return increases, enables the money market investor to see risk of the Korea's exchange rate return also increase; likewise, when variation of risk of the Taiwan's exchange rate return reduces, the investor sees the risk of the Korea's exchange rate return reduce as well. In addition, estimated value of the degree of freedom for the Student's t distribution is 3.6158, under the significance level α =1%. This is remarkable, and shows this research material has the thick tail distribution.

Moreover, Taiwan's exchange rate return conditional variance and the Korea's exchange rate return conditional variance all can affect the Taiwan's and Korea's exchange rate return volatility. Also models seen in Table 6 that, in the conditional variance equation, under $RJER_t \le 0$ and $REUER_t \le 0$, we have $\alpha_{11} + \beta_{11} = 1$ and $\alpha'_{11} + \beta'_{11} = 1$ with both equals to 1, conforms to parameter of the IGARCH model condition supposition. Similarly, for other three cases. And the Japan's and the European's exchange rate return's volatility will also affect the variation risk of the Taiwan's exchange rate market, and the Japan's and the European's exchange rate return's volatility will also affect the variation risk of the Korea's exchange rate market. For example, under $RJER_t \le 0$ and $REUER_t \le 0$, the Korea's exchange rate market does not have the fixed variation risk, the Taiwan's exchange rate market has a fixed variation risk. The variation risk of Taiwan's exchange rate market is lower than that of Korea's exchange rate market. This also demonstrates the bivariate AGARCH(1, 1) model with a DCC may catch between the Taiwan's exchange rate return and the Korea's exchange rate return volatility process.

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

Parameter	ϕ_{11}	ϕ_{12}	ϕ_{13}
Coefficient	-0.1006	0.1083	-0.0133
(p-value)	(0.0000)	(0.0000)	(0.4091)
Parameter	ϕ_{14}	φ_{11}	φ_{12}
Coefficient	0.1805	-0.0014	0.0369
(p-value)	(0.0000)	(0.8288)	(0.1361)
Parameter	φ_{13}	φ_{14}	ν
Coefficient	0.0318	0.0974	3.6158

(p-value)	(0.0000)	(0.0000)	(0.0000)
Parameter	α_{10}	α_{11}	β_{11}
Coefficient	0.0092	0.1562	0.8438
(p-value)	(0.1268)	(0.0000)	(0.0000)
Parameter	α_{20}	α_{21}	β_{21}
Coefficient	6.0803	0.1969	0.8031
(p-value)	(0.0000)	(0.0000)	(0.0000)
Parameter	α_{30}	α_{31}	β_{31}
Coefficient	0.0056	0.0980	0.9020
(p-value)	(0.3535)	(0.0068)	(0.0000)
Parameter	α_{40}	α_{41}	β_{41}
Coefficient	0.0103	0.1149	0.8851
(p-value)	(0.0890)	(0.0000)	(0.0000)
Parameter	α'_{10}	α'_{11}	β'_{11}
Coefficient	0.0085	0.3472	0.6528
(p-value)	(0.0026)	(0.0000)	(0.0000)
Parameter	α'_{20}	α'_{21}	β'_{21}
Coefficient	0.0099	0.5169	0.4831
(p-value)	(0.0067)	(0.0000)	(0.0000)
Parameter	α'_{30}	α'_{31}	β'_{31}
Coefficient	1.1828	0.2313	0.7687
(p-value)	(0.0005)	(0.0008)	(0.0000)
Parameter	α'_{40}	α'_{41}	β'_{41}
Coefficient	0.0076	0.3191	0.6809
(p-value)	(0.0046)	(0.0000)	(0.0000)
Parameter	γ_0	γ_1	γ_2
Coefficient	-2.0025	3.9163	0.0929
(p-value)	(0.0000)	(0.0000)	(0.0003)
Parameter	$\bar{\rho}_t$	$\min \rho_t$	$\max \rho_t$

Coefficient	0.4724	0.2513	0.9261
(p-value)	(0.0000)		

Note: p-value< α denotes significance.(α =1%, α =5%, α =10%);
α is the significance level. min ρ_t denotes the minimum value of ρ_t and
max ρ_t denotes the maximum value of ρ_t .

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

6. Asymmetric test of the bivariate AGARCH model with a DCC

The bivariate AGARCH(1, 1) model with a DCC can be constructed in the next section. The asymmetric test methods (Engle and Ng, 1993) are used the following two methods as: negative size bias test and joint test.

Table 7 asymmetrically examines the result for the Taiwan's exchange rate market as: (1) The positive size bias test does not reveal (α =10%). (2) The joint test does not reveal (α =10%). Table 5 asymmetrically examines the result for the Korea's exchange rate market as: (1) The positive size bias test does not reveal (α =10%). (2) The joint test does not reveal (α =10%). The results of asymmetric test suggest that the proposed model do not already need to use the asymmetric GARCH model.

Table 7. Asymmetric test of the bivariate AGARCH

RTWER	Asymmetric test	Positive size bias test	Joint test
	F statistic	1.2815	1.3130
	(p-value)	(0.2578)	(0.2685)
RKER	Asymmetric test	Positive size bias test	Joint test
	F statistic	0.7974	1.0394
	(p-value)	(0.3720)	(0.3741)

Notes: p-value < α denotes significance. (α =5%)

6. Conclusions

The empirical diagnosis result shows that regarding Taiwan's and Korea's exchange rate return volatility, the reciprocity may construct in the bivariate Student's t distribution and the bivariate AGARCH(1, 1) model with a DCC; this model also passes through a standard residual error relevance and ARCH effect examination showing the use of bivariate AGARCH(1, 1) model with a DCC, which evaluates two exchange rate markets' return the volatility processes is appropriate. The empirical diagnosis result also shows that the average estimation value ($\hat{\bar{\rho}}_t$ =0.4487) of the DCC coefficient of two exchange rate markets' return is the positive relation- the Taiwan's exchange rate return volatility is affecting the Korea's exchange rate return, also the Korea's exchange rate return volatility is affecting the Taiwan's exchange rate return, bringing forth a synchronization. The empirical result also shows that Taiwan's and Korea's exchange rate market return volatility receives the impact of the European's exchange rate return volatility. The empirical results present that the volatility process do not have asymmetrical in the Taiwan's and Korea's exchange rate markets. The empirical results also show that the Taiwan's exchange rate return rate's volatility rate truly has an affect on the Korea's exchange rate market return rate's volatility. And the European's exchange rate return's volatility will also affect the variation risk of the Taiwan's exchange rate market, and the European's exchange rate return's volatility will also affect the variation risk of the Korea's exchange rate market. However, the proposed model is different from the model of the bivariate GARCH with a constant conditional correlation (CCC). Based on the paper of (Engle, 2002), the DCC and the bivariate GARCH model have a better explanatory ability compared to the traditional bivariate GARCH model with a CCC.

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