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Threshold Model of Gold Price Market on the Two Stock Market Returns' Influence: Empirical Study of Thailand and Malaysian Markets

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Abstract

Used the algorithm method of computer program, the empirical results show that the dynamic conditional correlation (DCC) and the bivariate asymmetric IGARCH (1, 2) model is appropriate in evaluating the relationship of the Thailand's and the Malaysian's stock markets. The empirical result also indicates that the Thailand's and the Malaysian's stock markets is a positive relation. The average estimation value of correlation coefficient equals to 0.4781, which implies that the two stock markets is synchronized influence. Besides, the empirical result also shows that the Thailand's and the Malaysian's stock markets do have an asymmetrical effect, and the variation risk of the Thailand's and Malaysian's stock market returns receives the influence of the gold market. Under the good news, the gold price market affects the variation risk of the Malaysian's stock market. And gold price market also affects the variation risk of the Thailand's stock market.

Key Words: *Stock Market Return, Gold Price, Asymmetric Effect, Bivariate IGARCH Model.*

Introduction

We know that Thailand is the major economical financial system in the Association of South-east Asia Nations. We also know that Malaysian is also one of Association of South-east Asian Nations. Based on the Growth Competitiveness Index Rankings in 2003-2004 (it is published in the World Economic Forum), the rank of Malaysia is 29 in the world. Another, also based on the World Competitiveness Yearbook in 2006, the rank of Malaysia is 23 in the world competitiveness. 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 Thailand and the Malaysian stock market change. There is a close relationship for the geographic position based on the trade and the circulation of capital with the Thailand and the Malaysian, but the Thailand and Malaysian may also receive the influence of national gold price market. Therefore, the relation between the Thailand's and the Malaysian's stock markets with a factor of the gold market is worth further discussion. The purpose of the present paper is to examine the relations of the Thailand's and the Malaysian's stock markets with a factor of gold market. This paper also further discusses the affect of the gold market for the Thailand and the Malaysian stock market returns. This paper is also used the volatility value of gold price return as the

threshold. The organization of this paper is as follows: Section 2 describes the data characteristics; Section 3 introduces the asymmetric test of the DCC and the bivariate asymmetric IGARCH(1, 2); Section 4 presents the proposed model and the empirical results, and finally Section 5 summarizes the conclusions of this study.

Data Characteristics

Data Sources

The data of this research included the stock price of Thailand, the stock price of Malaysian and the gold price are collected between January, 2005 and December, 2011. The source of the stock data was the Taiwan economic Journal (TEJ), a database in Taiwan. The Thailand stock price refers to the Bangkok Set stock price index, the Malaysian stock price refers to the Kuala Lumpur stock price index, and the gold price refers to KITCO gold market, a database in London. During the process of data analysis, in case that there was no stock market price available on the side of the Thailand's and the Malaysian's stock markets or on the side of the gold market due to holidays, the identical time stock price data from one side was deleted. After this, the three variables samples are 1534.

Basic Statistics and Trend Charts

To compute the return of the Thailand stock market adopts the natural logarithm difference, rides 100 again. The return of the Malaysian stock market also adopts the natural logarithm difference, rides 100 again. The return of the gold price also adopts the natural logarithm difference, rides 100 again. In Figure 1, the Thailand, the Malaysian and the gold price return rates' volatility shows the clustering phenomenon, so that we may know the Thailand stock market, the Malaysian stock market and the gold price market have certain relevance. And these three markets do have the high correlation in Table II.
Table I presents the three 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.

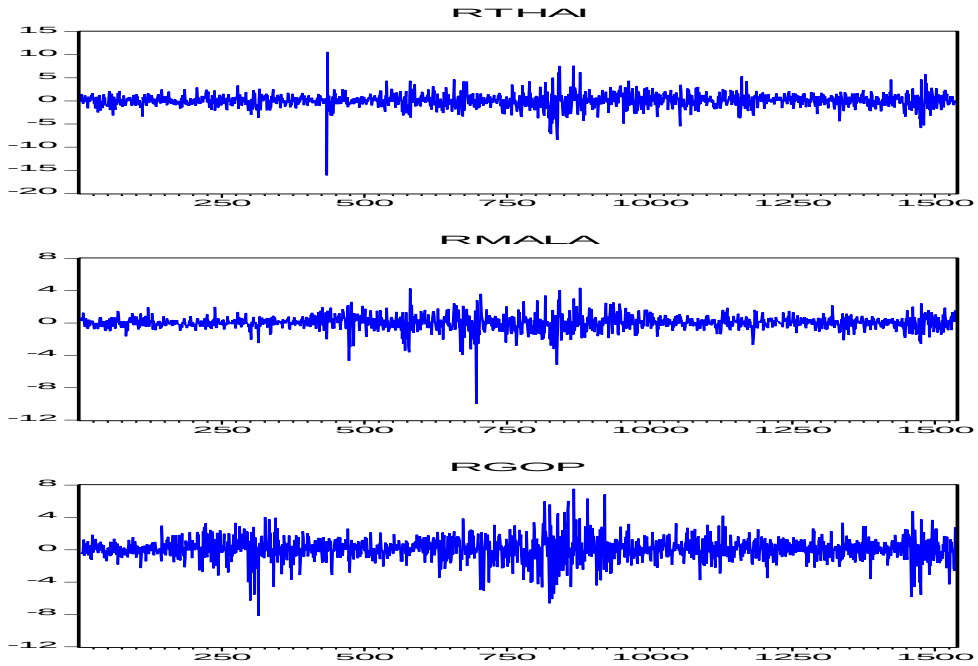

Figure 1. Tend charts of Thailand's, Malaysian's and gold market return rates.

Table I. Data statistics

Statistics	RTHAI	RMALA	RGOP
Mean	0.0264	0.0345	0.0850
S-D	1.5334	0.9118	1.4333
Skewed	-0.6782	-1.0908	-0.2677
Kurtosis	14.7690	15.3797	6.8031
J-B N (p-value)	8964.82*** (0.0000)	10093.33*** (0.0000)	942.198*** (0.0000)
Sample	1533	1533	1533

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 II. Unconditional correlation coefficient

Coefficient	THAI	MALA	GOP
THAI	1	0.8148	0.6435
MALA	0.8148	1	0.7844
GOP	0.6435	0.7844	1

Unit Root and Co-Integration Tests

This paper further uses the unit root tests of ADF (Dickey and Fuller, 1979) 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 III. It shows that Thailand's, the Malaysian's and the gold's return rates do not have the unit root characteristic- namely, the three markets are stationary time series data, under $\alpha = 1\%$ significance level.

Table III. Unit root test of ADF and KSS for the return data

ADF	RTHAI	RMALA	RGOP
Statistic	-9.574***	-34.438***	-39.446***
Critical value	-3.964	-3.413	-3.128
(Significant level)	(α =1%)	(α =5%)	(α =10%)
KSS	**RTHAI**	**RMALA**	**RGOP**
Statistic	-19.343***	-15.470***	-21.916***
Critical value	-2.820	-2.220	-1.920
(Significant level)	(α =1%)	(α =5%)	(α =10%)

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

Using Johansen's (1991) co-integration test as illustrated in Table IV at the significance level of 0.05 (α =5%) does not reveal of $\lambda_{\max}$ and Trace statistics. This indicated that the Thailand stock market, the Malaysian stock market and the gold price market do not have a co-integration relation. Therefore, we do need to consider the model of error correction.

Table IV. Co-integration test (Var lag=5)

H_0	$\lambda_{\max}$	Critical value
None	23.6878	25.8232
At most 1	6.8982	19.3870
At most 2	3.5432	12.5180

H_0	Trace	Critical value
None	34.1292	42.9153
At most 1	10.4414	25.8721
At most 2	3.5432	12.5180

Notes: The lag of VAR is selected by the BIC rule (Schwarz, 1978).
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 V, the results of the ARCH effect test show that the two markets have the conditionally heteroskedasticity phenomenon exists. This result suggests that we can use the GARCH model to match and analyze it.

Table V. ARCH effect test

RTHAI	Engle LM test	Tsay F test
Statistic	279.011***	7.1114***
(p-value)	(0.0000)	(0.0000)
RMALA	**Engle LM test**	**Tsay F test**
Statistic	208.653***	4.2671***
(p-value)	(0.0000)	(0.0000)

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

Asymmetric Test of the Bivariate Asymmetric- IGARCH(1, 2) Model

The DCC and the bivariate asymmetric-IGARCH(1, 2) model with a factor of gold market can be constructed in the next section. The asymmetric test methods (Engle and Ng, 1993) are used the following two methods as: positive size bias test and joint test.

By the positive size bias test and the joint test shows that the Thailand's stock price market does not have the asymmetry effects in Table VI. The Malaysian's stock price market does also not have the asymmetry effects in Table VI.

Table VI. Asymmetric test of the asymmetric-IGARCH(1, 2)

RTHAI	Positive size bias test	Joint test
F statistic	0.0098	0.4637
(p-value)	(0.9210)	(0.7076)
RMALA	**Positive size bias test**	**Joint test**
F statistic	0.7543	1.5132
(p-value)	(0.3853)	(0.2093)

Notes: p-value < α denote significance. (α =1%, α =5%).

Proposed Model and Empirical Results

Based on the results of the high correlation in Table II, and gold market will also affect the Thailand's and the Malaysian's stock markets, we follows the idea of GARCH model (Bollerslev, 1990 and Mgbame and Ikhatua, 2013), and the ideas of Engle (2002) and Tse and Tusi (2002). This idea of GARCH model can also refer the book of Tsay (2004). After model process selection, in this paper, we may use the DCC and the bivariate asymmetric IGARCH (1, 2) model to construct the relationships of the Thailand and the Malaysian stock market returns, the proposed model is illustrated as follows:

$$RTHAI_t = u_{t-1} \times (\phi_{10} + \sum_{j=1}^{2} (\phi_{1j} RTHAI_{t-j} + \phi_{2j} RMALA_{t-j}) + a_{1,t})$$
$$+ (1-u_{t-1}) \times (\phi'_{10} + \sum_{j=1}^{2} (\phi'_{1j} RTHAI_{t-j} + \phi'_{2j} RMALA_{t-j}) + a_{1,t}), \quad (1)$$

$$RMALA_t = u_{t-1} \times (\varphi_{10} + \sum_{j=1}^{2} (\varphi_{1j} RTHAI_{t-j} + \varphi_{2j} RMALA_{t-j}) + a_{2,t})$$
$$+ (1-u_{t-1}) \times (\varphi'_{10} + \sum_{j=1}^{2} (\varphi'_{1j} RTHAI_{t-j} + \varphi'_{2j} RMALA_{t-j}) + a_{2,t}), \quad (2)$$

$$h_{11,t} = u_{t-1}(\alpha_{10} + \alpha_{11} a_{1,t-1}^2 + \alpha_{12} a_{1,t-2}^2 + \beta_{11} h_{11,t-1})$$
$$+ (1-u_{t-1})(\alpha'_{10} + \alpha'_{11} a_{1,t-1}^2 + \alpha'_{12} a_{1,t-2}^2 + \beta'_{11} h_{11,t-1}), \quad (3)$$

$$h_{22,t} = u_{t-1}(\alpha_{20} + \alpha_{21} a_{2,t-1}^2 + \alpha_{22} a_{2,t-2}^2 + \beta_{21} h_{22,t-1})$$
$$+ (1-u_{t-1})(\alpha'_{20} + \alpha'_{21} a_{2,t-1}^2 + \alpha'_{22} a_{2,t-2}^2 + \beta'_{21} h_{22,t-1}), \quad (4)$$

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

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

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

$$u_t = \begin{cases} 1 & if \quad RGOP \le 0 \\ 0 & if \quad others \end{cases}, \quad (8)$$

the white noise of $\vec{a}'_t = (a_{1,t}, a_{2,t})$ is obey the bivariate Student's t distribution, this is, $\vec{a}_t \sim T_v(\vec{0}, (v-2)H_t / v)$, among $\vec{0}' = (0,0)$ and H_t is the covariance matrix of $\vec{a}'_t = (a_{1,t}, a_{2,t})$, and ρ_t is the dynamic conditional correlation coefficient of $a_{1,t}$ and $a_{2,t}$. $RGOP > 0$ denotes the good new and $RGOP \le 0$ denotes the bad new. 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.

From the empirical results, we know that the Thailand's and the Malaysian's stock return volatility with a factor of gold price market may be constructed on the DCC and the bivariate asymmetric IGARCH (1, 1) model. Its estimate result is stated in Table VII.

Empirical result shows that, for examples, under the bad news ($RGOP \le 0$), the Thailand's stock market return receives before first period's impact of the Thailand's stock market return (ϕ_{11}=0.0859). And the Thailand's stock market return does not receive before two period's impact of the Malaysian's stock market return. Under the good news, the Malaysian's stock market return receives before first period's impact of the Thailand's stock market return (φ'_{11}=0.0390). And the Malaysian's stock market return does not receive before two period's impact of the Malaysian's stock market return. Under the bad news ($RGOP \le 0$), the Malaysian's stock market return receives before first period's impact of the Thailand's stock market return (φ_{11}=0.0453). And the Malaysian's stock market return receives before two period's impact of the Malaysian's stock market return (φ_{21}=0.1145 and φ_{22}=0.1003). On the other hand, the correlation coefficient average estimation value ($\bar{\rho}_t$=0.4781) of the Thailand's and the Malaysian's stock return volatility is significant. This result also shows the Thailand's and the Malaysian's stock price return's volatility are mutually synchronized influence. In additional, estimated value of the degree of

freedom for the Student's t distribution is 4.5159, and is significant under the significance level of 0.01(α =1%). This also demonstrates that this research data has the heavy tailed distribution.

From the Table VII, the estimated coefficients of the conditional variance equation will produce the different variation risks under the bad and good news. In Table VII, the empirical results show that the proposed model confirms the condition supposition of the IGARCH model. This result also demonstrates the DCC and the bivariate asymmeyric IGARCH (1, 2) model may catch the Thailand's and the Malaysian's stock market return volatilities' process. Under the bad and good news, the Thailand's and the Malaysian's stock markets do have the different fixed variation risk. And the gold price market affects the variation risk of the Thailand's and Malaysian's stock markets. Under the bad and good news, the Thailand's and the Malaysian's stock markets have the different variation risks (for example, $\beta_{11} = 0.8021$ and $\beta_{21} = 0.6393$). The empirical result also shows that the explanatory ability of the DCC and the bivariate asymmetric IGARCH(1, 2) model is better than the traditional model of the bivariate GARCH (1, 1).

Table VII. Parameter estimation of the DCC and the bivariate asymmetric IGARCH(1, 2) model

Parameters	ϕ_{10}	ϕ_{11}	ϕ_{12}	ϕ_{21}	ϕ_{22}
Coefficient	0.0526	0.0859	-0.0266	-0.0495	0.0906
(p-value)	(0.2046)	(0.0477)	(0.5460)	(0.3782)	(0.1341)
Parameters	ϕ'_{10}	ϕ'_{11}	ϕ'_{12}	ϕ'_{21}	ϕ'_{22}
Coefficient	0.1326	0.0116	0.0347	0.0064	-0.0274
(p-value)	(0.0005)	(0.7637)	(0.3916)	(0.9053)	(0.5889)
Parameters	φ_{10}	φ_{11}	φ_{12}	φ_{21}	φ_{22}
Coefficient	0.0366	0.0453	0.0047	0.1145	0.1003
(p-value)	(0.1074)	(0.0211)	(0.8265)	(0.0033)	(0.0263)
Parameters	φ'_{10}	φ'_{11}	φ'_{12}	φ'_{21}	φ'_{22}
Coefficient	0.0647	0.0390	-0.0006	0.0310	-0.0405
(p-value)	(0.0027)	(0.0165)	(0.9713)	(0.4334)	(0.2959)
Parameters	α_{10}	α_{11}	α_{12}	β_{11}	α'_{10}
Coefficient	0.0620	0.1258	0.0721	0.8021	0.2316
(p-value)	(0.3240)	(0.0171)	(0.2748)	(0.0000)	(0.0014)
Parameters	α'_{11}	α'_{12}	β'_{11}	α_{20}	α_{21}
Coefficient	0.1646	0.1633	0.6721	0.0742	0.1458
(p-value)	(0.0017)	(0.0131)	(0.0000)	(0.0044)	(0.0047)
Parameters	α_{22}	β_{21}	α'_{20}	α'_{21}	α'_{22}
Coefficient	0.2149	0.6393	0. 0610	0.2064	0.1516
(p-value)	(0.0019)	(0.0000)	(0.0048)	(0.0002)	(0.0151)
Parameters	β'_{21}	ν	$\overline{\rho}_t$	min ρ_t	max ρ_t
Coefficient	0.6420	4.5159	0.4781	0.2125	1.0000
(p-value)	(0.0000)	(0.0000)	(0.0000)		
Parameters	γ_0	γ_1	γ_2		
Coefficient	-1.8174	3.4661	0.1867		
(p-value)	(0.0000)	(0.0000)	(0.0001)		

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 .

To test the inappropriateness of the DCC and the bivariate asymmetric IGARCH(1, 2) model, the test method of Ljung & Box (1978) is used to examine autocorrelation of the standard residual error. This model does not show an autocorrelation of the standard residual error. Therefore, the DCC and the bivariate asymmetric IGARCH(1, 2) model are more appropriate.

Conclusions

The empirical results show that the Thailand's and the Malaysian's stock market return's volatility with a factor of the gold price market have an asymmetric effect, and the Thailand's and the Malaysian's stock price return volatility may construct in the DCC and the bivariate asymmetric IGARCH (1, 2) model. From the empirical result also obtains that the dynamic conditional correlation coefficient average estimation value ($\overline{\rho}_t$ =0.4781) of the Thailand's and the Malaysian's stock price return volatility is positive. The gold market price volatilities truly affect the variation risk of the Thailand's stock market. And the gold market price volatilities also truly affect the variation risk of the Malaysian's stock market. Under the good and bad news, the gold price market affects the variation risks of the Thailand's and Malaysian's stock markets. Based on the paper of Engle (2002), the explanation ability of the DCC and the bivariate asymmetric IGARCH(1, 2) is better than the traditional bivariate GARCH (1, 1) model.

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