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The Long Run Relationship of Major Exchange Rate Return Volatility on Sectoral Stock Market Return Volatility: A Case Study of Financial Sectors in Thailand

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Abstract

The main objective of the study is to investigate the relationship of return volatilities of major exchange rates on sectoral stock market return volatilities in Thailand. This study used daily time series data from January 2018 to January 2021. In addition, the study applied the Autoregressive integrated moving average model (ARMA), the Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH), the Threshold Autoregressive Conditional Heteroscedasticity (TARCH), and Granger Causality analysis to measure the long run effect of the volatilities of exchange rates to sectorial stock market indexes. The result of this study shows that the volatility of US Dollar exchange rate has strongly relationship on the volatility of banking sector index. The volatilities of EURO, Japanese Yen have significant relationship on the volatility of Finance & Securities sector. The Insurance sector receives only relationship with US dollar exchange rate volatility. Overall, most of the return volatilities of exchange rates have a significant relationship to Thailand's financial sectors stock market indexes, and those exchange rate volatilities should be concerned when investors make their investment decisions.

Keywords: exchange rate return volatility, sectorial stock market return volatility, ARMA, EGARCH, TARCH, Granger Causality Test

1.Introduction

1.1 Introduction of research

The finance sector is a sector of the economy comprised of businesses and institutions that provide financial services to businesses. A successful economy has a strong financial sector . The stock market is highly meaningful in analyzing the economic state of any country since higher stock returns generally mean more profit to businesses . Volatility in stock return is generally used as a risk measurement and such volatility in stock return is commonly used in areas of asset pricing and portfolio selection. The volatility of an exchange rate is measurement of its fluctuations. Since volatility means how much the exchange rate will change in each period. It is also used as a risk measurement in foreign exchange market. The exchange rate volatility is possibly an important factor that determines the level of volatility in stock return of companies which usually involve with several transactions through international financial flows. The relationship between exchange rate volatility and stock market volatility has been studied in several periods and become more important because of more concern about risk management of investors and firms. The selected finance sector is also one of the important sectors of the Thai stock market comprising of business and institutions that provide financial serviced to business. Risk of stocks in financial sector can also reflect the risk in whole business sector and the whole economic condition of the country. The analysis of these business interrelationships will uncover the opportunities for investors to benefit from their stock market investments. Therefore, it is become interesting to search at these financial market interactions and integration.

1.2 Research Objectives

This study aims to study the long run relationship of exchange rate return volatility on sectoral stock market return volatility in Thailand. The research selected exchange rate return volatilities of Euro, Pound sterling, US dollar, Japanese Yen, and Chinese Yuan (against Thai Baht). The selected sectors of the stock market return volatility are Banking, Finance & securities sector, and Insurance sector of the stock exchange of Thailand. The study used daily data

between January 2018 to January 2021 and employed the Autoregressive integrated moving average model (ARMA), Exponential generalized autoregressive conditional heteroscedastic (EGARCH), and Threshold autoregressive conditional heteroscedastic (TARCH) model for volatility estimation. The Granger Causality test was used to test the long run relationship between the volatility of exchange rates and stock market return.

2. Literature Review

Perera (2016) adopted the daily time series data of stock market ASPI returns of the Colombo stock exchange (CSE) and exchange rates from January 2010 to December 2015. The research also applied the General Autoregressive Conditional Heteroscedasticity (GARCH) model to determine the effect of exchange rate volatility on stock market return volatility. The research found that the volatility of the Euro exchange rate significantly and positively affects ASPI return. In general, the study's findings show that exchange rate volatility is one of the determinants of stock market volatility.

Khan et al. (2016) focused on the volatilities of exchange rate and stock market in India. They applied Phillips Perron (PP) unit root test and GARCH model to measure the volatility of the Bombay Stock Exchange (BES-100 Index) and exchange rate of Indian Rupee to US Dollar. They used monthly time series data from January 1992 to February 2013 and found that the significant relationship between exchange rate volatility and variability of stock market prices in India from Granger causal analysis.

The study of Kennedy & Nourizad (2016) focused on the impact of the volatility of the US dollar against Euro on the stability of the US stock market while controlling for many drivers of stock volatility. They used GARCH (1,1) model and weekly data from 01 January 1999 to January 25, 2010, and they found that the 9/11 terrorist attack, bear markets, fluctuations in jobless claims, and negative equity market returns increase financial volatility. There are no clear results of the impact from the M2 change or changing in federal funding. Finally, they found that the exchange rate volatility has a positive impact on stock returns volatility when controlling the main drivers of financial instability.

The study of Jimoh & Benjamin (2020) focused on the effect of cryptocurrencies (Bitcoin and Ethereum) return volatility on Nigerian stock price and exchange rate return volatility. This research adopted the data from August 2015 to December 2019, and applied GARCH (1,1), EGARCH (1,1), and Granger Cause method to test the response of exchange rate volatility and stock market volatility from cryptocurrency prices. The result of this research indicates that the stock market price is more affected by the volatility of cryptocurrency values than the exchange rate in Nigeria. The Granger Causality test also shows the one-way effect from both cryptocurrencies to stock market index in Nigeria.

Adjasi et al., (2011) studied the relationship between stock market returns and exchange rate movements in seven African countries. The research used vector autoregressive (VAR) cointegration and impulse response model to test the relationships between stock prices and exchange rates in both long-run and short-run. The Cointegration analysis shows the significant long-run relationship between stock prices and the exchange rate in Tunisia, and the short-run relationship is also confirmed by the error correction model. Impulse response analyses show that the exchange rate shocks could increase stock returns in Egypt and South Africa, but reduce the stock returns in Ghana, Kenya, and Mauritius.

The study of Mishra (2004) tested on the relationship between stock market return, exchange rate return, demand for money, and interest by using Granger Causality test and Vector Autoregression model. From the Granger test, there is no relationship between the exchange rate return and stock return. However, the Vector Autoregressive model shows that stock return, exchange rate return, the demand for money and interest rate are related. In addition, the forecast error variance decomposition evidenced that exchange rate return affects the demand for money, interest rate causes exchange rate to change, and exchange rate affects the stock return.

Exchange rate volatility can also affect the currency policy through the impact on the domestic stock market. Subair & Musa Salihu (2018) found that exchange rate volatility has negative impact to the Nigerian Stock market from the analysis of GARCH and Error Correction model. Lawal & Ijirshar (2013) also examined the relationship between exchange rate volatility and stock market performance in Nigeria and found the negative relationship between them. Lim & Sek (2014) found the relationship between exchange rate volatility and stock return in emerging Asian countries and found bi-directional causality between exchange rate volatility and stock return in Indonesia, Korea, and Thailand.

Agrawal et al., (2010) studied about the relationship between Nifty stock market returns and Indian rupee-US Dollar exchange rates The analysis adopted the daily data from October 2007 to March 2009. The result

from the unit root test shows that both exchange rate and the Nifty returns are stationary at the level. The relationship between Nifty returns and exchange rates was found to be negative. The Granger Causality test also found a significant unidirectional relationship between Nifty returns and exchange rate.

3. Research Methodology

3.1 Conceptual Framework

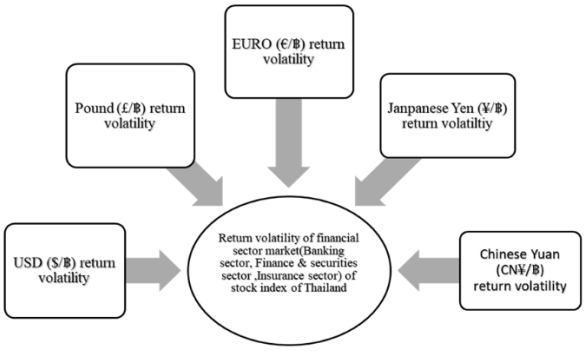

Figure 1: Conceptual Framework of the study

This study tested the impact from exchange rate return volatilities of USD Dollar, Pound, Euro, Japanese Yen and Chinese Yuan (against Thai Baht) to the return volatilities of financial sector indexes, including Banking sector, Finance & securities sector, and Insurance sector, of the Stock Exchange of Thailand.

3.2 Research Model

The effect of exchange rate volatility on stock market return volatility is empirically tested in this paper. This study uses the daily market values of financial sector indexes and daily exchange rate values of US Dollar, Euro, Pound, Japanese Yen, and Chinese Yuan above 37 months beginning in January 2018 and ending in January 2021. Then the data were tested for stationarity by the unit root test (Augmented Dicky-Fuller test). The research used the Granger Causality test to check the long-run effect of exchange rate return volatility to sectorial stock market return volatility. The test model is showed as follow

$$VSR_t = \alpha_0 + \beta_1 VEXR_{t-1} + \ldots + \beta_n VEXR_{t-n} + \alpha_1 VSR_{t-1} + \ldots + \alpha_n VSR_{t-n} + u_t$$

where VSR is the volatility of the selected sector stock market return (estimated from GARCH-typed model), VEXR is the volatility of the selected exchange rate return (estimated from GARCH-typed model), t is day t, and n is selected lag day (1 to 5) for the Granger Causality Test.

3.3 Research Hypotheses

For testing the relationship between exchange return volatility and sectorial stock market return volatility from the Granger Causality test model (as show in previous section), the null hypothesis (Ho) represents the condition that every Beta (β1 to βn) eauals to zero, the althernative hypothesis (Ha) is that at least one of theBetas is not equal to zero. There are 3 independent variables (3 stock market sectors) and 5 dependent variabes (5 exchange rates) In totoal, 15 hypotheses were built to test the causality. The following is the example of the test hypothsis.

Ho: Exchange rate return volatility does not have a significant long-run relationship (or Granger Cause) to the sectorial stock market return volatility.

Ha: Exchange rate return volatility has a significant long-run relationship (or Granger Cause) to the sectorial stock market return volatility.

4 .Data Source, Data Analysis and Discussion of Results

4.1 Data Sources

The Stock Exchange of Thailand (SET) provided the daily market value of the sectorial stock market indexes, while the daily exchange rate values were obtained from the Bank of Thailand. Return volatilites were estimated by using the most fitted ARMA and GARCH typed models (including EGARCH and TARCH model).

4.2 Data Analysis and Discussion of Results

4.2.1 Unit Root Test Result

The Augmented Dickey-Fuller (ADF) test was used for test the stationary conditon of the time serie data. The result from Table 1 shows that all sectorial stock return indexes and exchange rate returns are stationary. They can be used to estimate the return volatilities in the next step.

Variable	t-statistic	p-value	Result
Banking	-8.835989	0.0000	Stationary
Finance & Securities	-28.31155	0.0000	Stationary

Insurance	-17.09049	0.0000	Stationary
US Dollar	-24.32067	0.0000	Stationary
EURO	-26.07907	0.0000	Stationary
Pound	-25.32954	0.0000	Stationary
Chinese Yuan	-23.80889	0.0000	Stationary
Japanese Yen	-25.24964	0.0000	Stationary

Table 1: Result of Unit Root Test

4.2.2 Statistical Treatment

After the unit root test, all stock return indexes and exchange rate returns can be used with ARMA and GARCH-typed models to estimate the conditional variances or volatilities. The Box-Jenkin method, which employs autoregressive moving average (ARMA) model, is widely used in many fileds of time series forecasting. The research estimated and selected the best ARMA model for each varable and used that model to estimate and find the most fitted GARCH-typed model.

The candidate GARCH-typed model used to sestimate the volatility are ARCH (p), GARCH (p,q), TGARCH (p,q) and EGARCH (p,q) models. The best ARMA and GARCH typed model for each variable are reported in Table 2.

Variable	**Best ARMA model**	**Best GARCH-typed model**
Banking Sector Index	MA(5)	EGARCH(4,4)
Finance & Securities Sector Index	MA(5)	EGARCH(2,1)
Insurance Sector Index	MA(1)	EGARCH(2,1)
Exchange Rate Baht/US Dollar	AR(1)	EGARCH(3,1)
Exchange Rate Baht/EURO	ARMA(1,2)	TARCH(1,1)
Exchange Rate Baht/Pound	MA(1)	EGARCH(2,2)
Exchange Rate Baht/Chinese Yuan	AR (1)	TARCH (3,1)
Exchange Rate Baht/Japanese Yen	ARMA(5,5)	EGARCH(1,2)

Table 2: Statistical Treatment

4.2.3 Results of Granger Causality Test

This study used the Granger Causality test to examine the long-run relationship between the exchange rates and the financial sector market indexes in Thailand from January 2018 to January 2021. This paper applied 5 daily lags to examine the time lag or long-run relationship of exchange rate return volatility on Thai financial sector stock market returns. The levels of significance used in this analysis are 0.05 or 5%. When the significance level (or p-value) of at least one lag test is less than 0.05, the null hypothesis will be rejected, and it means that the independent variable has a significant long-run effect on the dependent variable. Under each testing hypothesis, more significant results of lag relationships refer to stronger relationship between variables. Table 3 shows the result of the Granger Causality test, based on the selected 5 daily lag tests.

Hyp.	Null Hypothesis	p-value of Granger Causality Test.					Result
		Lag1	Lag2	Lag3	Lag4	Lag5	
H1o	VEXR(DOLLAR) does not Granger Cause VSX(BANK).	0.00004*	0.0005*	0.0224*	0.0089*	0.0024*	Rejected Ho
H2o	VEXR(DOLLAR) does not Granger Cause VSX(FIN).	0.0003*	0.419	0.1691	0.236	0.3139	Rejected Ho
H3o	VEXR(DOLLAR) does not Granger Cause VSX(INSUR).	0.0052*	0.7206	0.8741	0.7066	0.8024	Rejected Ho
H4o	VEXR(EURO) does not Granger Cause VSX(BANK).	7.00E-24*	9.00E-22*	6.00E-07*	8.00E-11*	2.00E-09*	Rejected Ho
H5o	VEXR(EURO) does not Granger Cause VSX(FIN).	1.00E-21*	1.00E-05*	2.00E-07*	4.00E-06*	9.00E-07*	Rejected Ho
H6o	VEXR(EURO) does not Granger Cause VSX(INSUR).	0.1015	0.8135	0.9364	0.9766	0.9897	No Rejected Ho
H7o	VEXR(POUND) does not Granger Cause VSX(BANK).	0.0571	0.1321	0.6257	0.0381*	0.1215	Rejected Ho
H8o	VEXR(POUND) does not Granger Cause VSX(FIN).	0.1647	0.0007*	0.0009*	0.0031*	0.0063*	Rejected Ho
H9o	VEXR(POUND) does not Granger Cause VSX(INSUR).	0.8228	0.6539	0.5578	0.38	0.8981	No Rejected Ho
H10o	VEXR(YEN) does not Granger Cause VSX(BANK).	3.00E-05*	3.00E-07*	0.0002*	2.00E-09*	2.00E-06*	Rejected Ho
H11o	VEXR(YEN) does not Granger Cause VSX(FIN).	1.00E-08*	4.00E-07*	5.00E-08*	4.00E-08*	3.00E-08*	Rejected Ho
H12o	VEXR(YEN) does not Granger Cause VSX(INSUR).	0.0623	0.7409	0.8684	0.868	0.9474	No Rejected Ho
H13o	VEXR(YUAN) does not Granger Cause VSX(BANK).	2.00E-05*	0.0001*	0.0027*	0.0685	0.0004*	Rejected Ho
H14o	VEXR(YAUN) does not Granger Cause VSX(FIN).	0.0027*	0.4099	0.1356	0.0142*	0.0307*	Rejected Ho
H15o	VEXR(YUAN) does not Granger Cause VSX(INSUR).	0.6928	0.9274	0.984	0.9334	0.9703	No Rejected Ho

The researcher discovered four hypotheses that failed to reject Ho based on the Granger Causality test results. The results show that the return volatility of the Euro, Pound, Japanese Yen, and Chinese Yuan exchange rates has no major log-run relationship with the return volatility of the Insurance sector index of Thailand's stock exchange. In this study, five currencies have a long-run relationship with the return volatility of the Banking sector index, which is the exchange rate return volatility of the US Dollar, Euro, Pound, Japanese Yen, and Chinese Yuan. On the other hand, the exchange rate return volatility of the US Dollar, Euro, Pound, Japanese Yen and Chinese Yuan has a

significant long-run relationship with the return volatility of the Thai stock exchange's Finance & Securities market index.

5. Discussion, Conclusion, and Recommendation

Firstly, the Banking sector has significantly relationship with the volatility of the US Dollar, Euro, Chinese Yuan, and Japanese Yen, but weakly affected by the volatility of the Pound exchange rate. Exchange volatility can influence banking sector both directly and indirectly. Because bank usually involves in exchange related activities, exchange rate volatility will have the direct impact on the bank's performance and its stock price. When the volatility of the exchange rate is changing high rate and the bank sector will also receive high rate. Secondly, the Finance & Securities sector has significantly relationship with the volatility of all exchange rates. The previous research results of Dai et al., (2012) learned that the exchange rate is the significant determinant of the exchange rate risk faced to finance & securities sectors.

Finally, the insurance sector has only relationship with the volatility of the US Dollar exchange rate return, and the relation seems to be weak. Insurance companies may have only small parts of its businesses with the exchange rates. They may involve in some diversified investments that relate to the exchange rate of US Dollar. Therefore, volatilities of US Dollar and other exchange rates didn't have much impact on the insurance business. The overall result from this research shows that the investors who invest in companies listed in the Banking sector and Finance & Securities sector of the Stock Exchange of Thailand must concern on the volatility or the risk level of the major exchange rates with Thai Baht. Investors who want to invest in the Insurance sector may concern only on the US Dollar exchange rate.

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