TRILATERAL RELATIONSHIP AMONG FOREIGN EXCHANGE RATES, OIL PRICES, AND STOCK RETURNS IN THAILAND: A DYNAMIC APPROACH [*]

ความสัมพันธ์ไตรภาคีระหว่างอัตราแลกเปลี่ยน ราคาน้ำมัน และผลตอบแทน ของตลาดหลักทรัพย์ กรณีศึกษาประเทศไทย: วิธีพลวัต

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Abstract

This study examines the trilateral relationship among foreign exchange rates (FX), oil prices (CRUDE), and stock market returns (SET) in Thailand weekly data starts from 2 January 2008 to 31 May 2018 totally 543 observations. This result divided by 3 conclusions. Firstly, the results show that the foreign exchange rate is the only factor with a significant negative impact on stock market returns and oil prices. On the contrary, oil prices are positively correlated to the stock market index. Secondly, Generalised Autoregressive Conditional Heteroscedasticity (GARCH) model provided similar qualitative results with coefficients typically larger for lag volatility than for past shock. Lastly, dynamic conditional correlation (DCC) shows the result that a "CRUDE-SET" pairing is the only positive zone, implying that an increase (decrease) in oil prices creates an increase (decrease) in stock market returns and vice versa. However, a "SET-FX" pairing shows a negative correlation similar to a "CRUDE-FX" pairing. In conclusion, depreciation (appreciation) in local currency impacts on oil prices and stock market returns, creating a decrease (increase).

Keywords: Foreign exchange, Oil price, Stock return, Dynamic conditional correlation

บทคัดย่อ

การศึกษานี้มุ่งวิเคราะห์ความเชื่อมโยงระหว่าง 3 ความสัมพันธ์ของอัตราแลกเปลี่ยน ราคาน้ำมัน และอัตราผลตอบแทนของตลาดหลักทรัพย์แห่งประเทศไทย โดยใช้ข้อมูลรายสัปดาห์ตั้งแต่วันที่ 2 มกราคม 2551 ถึง 31 พฤษภาคม 2561 รวมทั้งสิ้น 543 ข้อมูล ผลการศึกษาแบ่งได้เป็น 3 ส่วน คือ 1) อัตราแลกเปลี่ยนเป็นเพียง ปัจจัยเดียวที่มีความสัมพันธ์เชื่อมโยงในทิศทางตรงกันข้ามกับอัตราผลตอบแทนของตลาดหลักทรัพย์และราคา น้ำมัน ในขณะที่ความสัมพันธ์ระหว่างราคาน้ำมันและผลตอบแทนของตลาดหลักทรัพย์พบว่า มีความสัมพันธ์

ในทิศทางเดียวกัน 2) ผลการทดสอบความผันผวนโดยใช้เครื่องมือทางเศรษฐมิติ (GARCH) พบว่า ค่าสัมประสิทธิ์ของขนาดความผันผวนของข้อมูลที่เกิดขึ้นในอดีตมีผลกระทบต่อการเชื่อมโยงของความสัมพันธ์ของปัจจัยต่าง ๆ มากกว่าการเปลี่ยนแปลงของเหตุการณ์ในอดีตที่ไม่สามารถคาดการณ์ได้ 3) จากการศึกษาด้วยวิธีพลวัตร (DCC) พบว่า คู่ของความสัมพันธ์ระหว่างราคาน้ำมันและผลตอบแทนของตลาดหลักทรัพย์มีค่าสัมประสิทธิ์สหสัมพันธ์ในทิศทางเดียวกัน ดังนั้น หากราคาน้ำมันสูงขึ้น (ลดลง) จะส่งผลทำให้อัตราผลตอบแทนของตลาดหลักทรัพย์เพิ่มขึ้น (ลดลง) ในขณะที่ค่าสัมประสิทธิ์สหสัมพันธ์ระหว่างอัตราแลกเปลี่ยนและผลตอบแทนของตลาดหลักทรัพย์แห่งประเทศไทยพบว่า มีทิศทางตรงกันข้ามเช่นเดียวกับคู่ของค่าสัมประสิทธิ์สหสัมพันธ์ระหว่างอัตราแลกเปลี่ยนและราคาน้ำมัน สรุปได้ว่า หากค่าเงินบาทมีค่าอ่อนลง (แข็งค่า) จะส่งผลทำให้ราคาน้ำมันและผลตอบแทนของตลาดหลักทรัพย์สูงขึ้น (ลดลง)

คำสำคัญ: อัตราแลกเปลี่ยน ราคาน้ำมัน อัตราผลตอบแทนของตลาดหลักทรัพย์ สัมประสิทธิ์สหสัมพันธ์แบบมีเงื่อนไข

Introduction

In the foreign exchange (FX) market, Thailand initiated the managed float system following the Asian financial crisis in 1998. Hence, the movement of FX may have a greater impact on the financial market. The empirical evidence showed that the spread of FX throughout Asia and around the world and increased fears of a worldwide economic collapse due to financial market contagion (Matthaweewongsa, T., Teekasap, P., Tondee, T., & Teekasap, S, 2017). Speculative demand in the FX market often evaporates the profit from export-import trading or investment. Since depreciation facilitates export-oriented firms to enjoy increased exports, profits and share prices will also increase. Conversely, appreciation facilitates damage to export trading firms, decreasing exports and increasing losses and a fall in share prices. Therefore, the link between exchange rates and stock prices is a popular topic for study by policymakers and investors since it plays an important role in financial economics (Bahmani-Oskooee, Saha, et al., 2016, Tule, Dogo, et al., 2018).

Moreover, shock or unexpected movement in foreign exchange rates have a substantial influence on both financial and commodity markets, especially crude oil. Thailand imports an enormous amount of crude oil from foreign countries, and oil prices over the past decade have fluctuated considerably. Thus, it is important to understand how oil price movement relates to economic conditions and financial markets. Previous researchers found oil price dynamics to be a key indicator in the exchange rate fluctuations experienced by oil importers and exporters (Sadorsky 1999, Chen, & Chen 2007, Basher, Haug, et al., 2012, Bai, Koong, et al., 2018, Yang, Cai, et al., 2018). For example, Yang, et al., (2018) reported that an increase in oil prices impacts on the ability of a country's currency to appreciate, decreasing its real value in the long term.

According to popular studies, the fluctuation in oil prices over the last 10 years has impacted on financial markets (Sadorsky 1999, Basher, Haug, et al., 2012, Bai, Koong, et al., 2018). For example, Sadorsky (1999) exhibited that oil prices and oil price volatility are both key impact factors on real stock returns. Hence, understanding the trilateral relationship among the three largest financial markets (Energy, stocks, and currency) is important for the economy in supporting and helping to guide financial and investment decisions, particularly in Thailand.

Meanwhile, most studies examine the linkage among the big three factors in developed countries, i.e. the US and China (Bai, Koong, et al., 2018), G7 countries (Bastianin, Conti, et al., 2016) and emerging markets (Basher, Haug, et al., 2012). In the case of Thailand, there is limited evidence to support the linkage among the big three factors (exchange rate, stock market, and crude). However, Thailand only joined the ASEAN Economic Community (AEC) framework in 2016, so the country's role in this new international group is attracting great interest from investors and policymakers. In this paper studies the trilateral relationship linkage among foreign exchange, oil prices, and stock markets using a dynamic conditional correlation model. The benefits of this study may help investors in adjusting their portfolios either to take advantage of wide margins or withdraw as margins deteriorate. Moreover, this paper may bring to light key policy implications for managing the flow of portfolio capital into Thailand's stock market.

The aim of this paper is to examine the joint of three factors consist of foreign exchange rates, oil prices, and stock returns in Thailand. To expand previous papers, the multivariate GARCH through dynamic conditional correlation generalised autoregressive conditional heteroscedasticity (DCC-GARCH) model of (Engle, 2002) is used in this paper. The advantage of this model is that it allows conditional correlation to vary over time, with the assumption that more than one factor is the source of volatility shock.

The remaining parts of this paper are organised as follows. Section 2 provides the literature review. Data and methodology are reported in sections 3 and 4, respectively. Section 5 presents the empirical results from the dynamic conditional correlation model. Finally, the conclusion and implications are discussed in section 6.

Theory and Literature Review

From the arbitrage pricing theory (Ross 1976) explained that as asset's returns can be predicted using the linear relationship between the required rate of returns and a number of macroeconomic variables such as oil price, interest rate or inflation. Moreover, the famous macroeconomic analysis metric is purchasing power parity (PPP) theory which compared currencies through the price of goods each country (Balassa, 1964) explained that two currencies are in equilibrium. These are economic theories which referred in this paper.

In the literature, previous studies show that the long run relationship between FX and oil price is negatively correlated with currencies such as GBP, CAD, and EUR, although not JPY (Yang, Cai, et al., 2018). The factors affecting long-term correlation are inflation and risk-free interest rates. This research uses dynamic conditional correlation and panel analysis to estimate the data. Moreover, Beckmann and Czudaj (2013) test both the short and long-term relationship between oil prices and FX. They report that in both periods under study, FX affects oil prices, differing in the aspect of exporting and importing oil from foreign countries. Furthermore, former researchers found that an increase in US dollar exchange rates creates a rise in oil prices (Chen, & Chen 2007, Beckmann and Czudaj 2013). For example, (Chen, & Chen 2007) show that real oil price may be a dominant source of change in the real exchange rate.

FX movement affects the value of financial assets for both foreign and domestic investors. Previous researchers have found that the linkage between FX and stock markets differs in countries such as Australia, Canada, France, Hong Kong, Japan, the United Kingdom, and the United States (Developed markets) and Brazil, China, India, Korea, Russia, and South Africa (Emerging markets) (Tudor, & Popescu-Dutaa, 2012). In the US, (Bahmani-Oskooee, Saha, et al., 2016) studied the effect of exchange rate changes on the S&P 500 index, exhibiting that in the short run it has a significant impact but is not unaffected in the long run . However, in the Indian stock market FX volatility does not have any effect due to restriction of trade in the Indian rupee outside the country for the period from April 1992 to March 2002 (Mishra, 2004).

Concerning oil prices and stock markets, (Bastianin, Conti, et al., 2016) studied the effects of crude oil price shocks on stock market volatility. They found that in G7 countries (Canada, France, Germany, Italy, Japan, the UK, and the US) stock market volatility does not respond to oil supply shock although demand shock is affected. However, (Kang, Ratti, et al., 2015) exhibited that demand and supply shocks affected the stock market in the US. Some researchers have investigated the impact of crude prices on stock market volatility such as (Bastianin and Manera 2018) on the US stock market and (Degiannakis, Filis, et al., 2014) on the European. The impact of EU supply and demand shock from oil prices was found to have no impact on stock market volatility.

There is still a lack of empirical studies on the trilateral relationship among FX, oil price, and stock markets. Some researchers exhibit the empirical results for India involving three variables that cause the crude oil price to decrease the value of the Indian Rupee and SENSEX stock market index (Jain, & Biswal, 2016). Moreover, Basher, Haug, and Sadorsky (2012) examine two separate relationships between 1) oil prices and stock markets; and 2) oil prices and exchange rates in emerging markets. They concluded that positive shocks in oil prices reduce stock market prices and the US dollar in the short run. Whereas emerging market stock prices and oil prices increase in unison. Bai, & Koong (2018) investigate the trilateral relationship among three factors in China and the US from February 1991 to December 2015. Their findings indicate that oil prices positively influence the US stock market, while the Chinese stock market responds positively to oil price shock. Moreover, oil price shock leads to a reduction in the trade-weight dollar index.

Since this paper estimates time-varying conditional correlation linkage among three factors in Thailand, a suitable model must be employed to explain the data. Modern research studies tend to choose the multivariate GARCH (MGARCH) model, first proposed by (Bollerslev, Engle, et al., 1988), to explain stock market correlation. One part of MGARCH, namely the DCC-GARCH model introduced by Engle (2002), is used in this paper to explain the direct conditional correlations among stock markets. This model has been widely adopted by researchers (Jain, & Biswal 2016, Tule, Dogo, et al., 2018, Yang, Cai, et al., 2018). Hence, this paper examines the trilateral cross-correlation among foreign exchange rates, oil prices, and the stock market in Thailand.

Data

        In this study, weekly data is included on the three factors of foreign exchange rate (FX), crude oil price (CRUDE), and stock market index (SET). Firstly, data on foreign exchange rates is reported in terms of Thai baht per US dollar (THB/ USD), collected from the Bank of Thailand. Secondly, data on crude oil prices is collected from Bisnews AFE (Thailand) limited, measured as USD/ Barrel using spot market prices. Lastly, data on the stock market index is collected from DataStream. The weekly data from 2 January 2008 to 31 May 2018 totals 543 observations, which started after the global crisis. The price movements of all three factors are plotted in Fig. 1. All price series exhibit both increasing and decreasing time trends over the period of study.

        Fig. 1 shows that the Thai baht exchange rate exhibits highly fluctuating movements with sharp points in 2009 and 2016. The SET index decreased for one period in 2008 as a result of the global financial crisis, subsequently increasing thereafter. The crude oil price shows fluctuating movements over the periods of study.
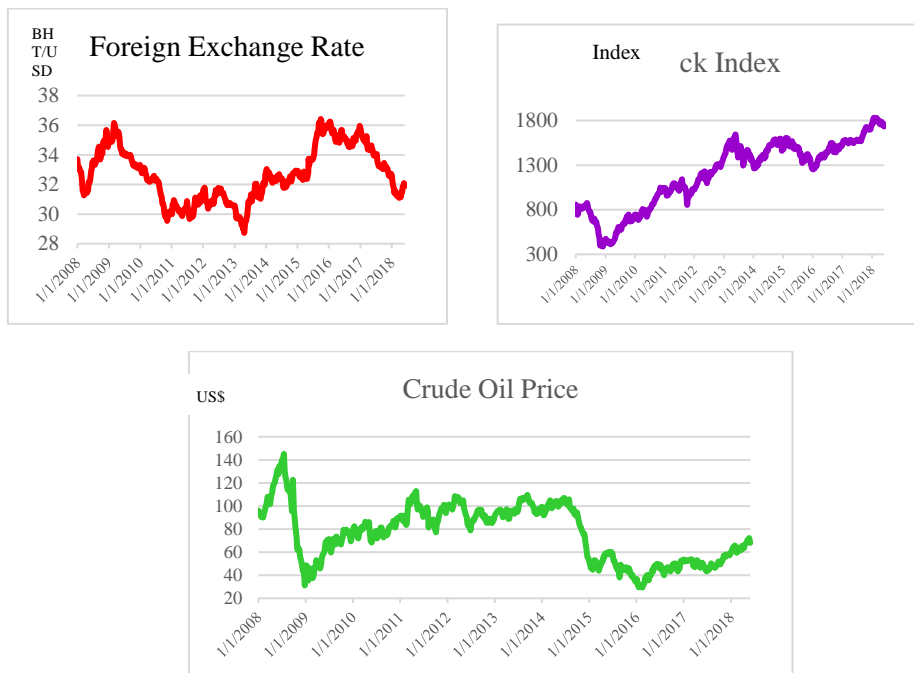

Figure 1 Plot of the data series.

Methodology

        The multivariate GARCH (MGARCH) model is used to estimate volatility in the relationships among foreign exchange rates (FX), oil prices, and the stock market. Model estimation is one of the objectives of this paper to test the co-movement correlation between factors, which may help to reduce risk. The methodology used to estimate the results in this study is the dynamic conditional correlation (DCC) model proposed by Engle (2002). This model has the advantage of being more flexible than

GARCH but not as complex as the conventional MGARCH. The model consists of two steps, the first of which uses the univariate GARCH models proposed by (Bollerslev, 1986). The second step calculates the standardised residuals from the first step to construct the second moment condition based on the likelihood function. In addition, this model tests suitable data by estimating the unit root since it can affect the spuriousness problem.

In the first step, a popular model from the GARCH family is used to indicate time variation in the volatility of FX, oil price, and stock market. In addition, this model is linked by the three factors, taking into account the time-varying properties of the data generation process. By adopting this method, the assumption of homoscedasticity is relaxed in order to describe how the variance in errors evolves. Bollerslev (1987) produced the GARCH (1, 1) to explain the time-varying process, using Maximum Likelihood Estimation (MLE) methods. The standardised residuals are calculated by the following equations:

$$SET_t = \theta_0 + \beta_1 CRUDE_t + \varepsilon_t, \qquad CRUDE_t = \theta_0 + \beta_1 SET_t + \varepsilon_t \qquad (1)$$

$$SET_t = \theta_0 + \beta_1 FX_t + \varepsilon_t, \qquad FX_t = \theta_0 + \beta_1 SET_t + \varepsilon_t \qquad (2)$$

$$FX_t = \theta_0 + \beta_1 CRUDE_t + \varepsilon_t, \qquad CRUDE_t = \theta_0 + \beta_1 FX_1 + \varepsilon_t \qquad (3)$$

$$\varepsilon_t = \nu_t \sqrt{h_t} \qquad (4)$$

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1} \qquad (5)$$

Where other parameters are presented as before, ε_t is the disturbance term with a conditional distribution of $\left(\varepsilon_{j,t} \big| \Omega_{t-1} \sim (0, h_t)\right)$ and ν_t is an $iid\ (0,1)$ process independent of h_t while Ω_{t-1} is the information set available at time t-1. In the conditional variance equation, the ARCH term of the previous period, i.e. ε_{t-1}^2, and the one-period lag of the GARCH effect, i.e. h_{t-1}, are incorporated into the model.

In the second step, the DCC is estimated through the covariance matrix, H_t in accordance with the study by (Engle 2002) as follows:

$$H_t = D_t R_t D_t \qquad (6)$$

Where $R_t = \left[\rho_{ij,t}\right]$ is the conditional correlation of asset matrix. $D_t = diag\left(h_{1t}^{1/2}, h_{2t}^{1/2}\right)$ is a diagonal matrix of time-varying standard deviations from the univariate GARCH (1,1) models, $h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1}$ and R_t is the conditional correlation matrix of standardised returns ε_t, with $\varepsilon_t = D_t^{-1} r_t$.

$$R_t = \begin{bmatrix} 1 & q_{12t} \\ q_{21t} & 1 \end{bmatrix} \tag{7}$$

Stock return residuals from the first stage are divided by their conditional standard deviations to obtain standardised residuals $\mu_{i,t} = \varepsilon_{i,t}/\sqrt{h_{ii,t}}$. $\mu_{i,t}$ is employed to estimate the conditional correlation parameters.

$$R_t = [Q_t]^{-1}Q_t[Q_t]^{-1} \tag{8}$$

Equation (6) represents the time-varying correlation matrix $Q_t = q_{ij,t}$ as the conditional variance-covariance matrix of standardised residuals $\mu_{i,t}$ and $Q_t = q_{ij,t}$ is a diagonal matrix composed of the square root of the diagonal element of Q_t

Where Q_t is the correlation matrix, calculated by:

$$Q_t = (1-a-b)\overline{Q} + a(u_{t-1}u'_{t-1}) + bQ_{t-1} \tag{9}$$
$$q_{ij,t} = (1-a-b)\overline{q}_{ij} + a(u_{t-1}u'_{t-1}) + bq_{ij,t-1}$$

Where $\overline{Q}$ is the unconditional variance matrix of u_{it}, a and b are positive scalars in that $(a+b) < 1$. A typical element of R_t is in the form of a correlation estimator:

The correlation estimator

$$\rho_{ij,t} = \frac{q_{ij,t}}{\sqrt{q_{ii,t}q_{jj,t}}} \tag{10}$$

In equation (8) $\rho_{ij,t}$ and $q_{ij,t}$ represent the time-varying conditional correlation and covariance, respectively. $q_{ii,t}$ and $q_{jj,t}$ are the pair-wise conditional variances.

Empirical Result

Table 1 reports the descriptive statistics for the returns of all factors in this study, calculated by log-returns. Stock market return is the highest mean (0.0013), followed by FX (-0.0001) and crude (-0.0006). Crude equals 0.0564 that is the highest volatility, as represented by standard deviation, followed by stock market returns equals 0.0276 and FX equals 0.0067. Most factors report that the null hypothesis of the Jarque-Bera test is rejected, exhibiting that returns are not normally distributed, which emphasises the need for GARCH testing.

TABLE 1: Descriptive statistics of the variables

	SET	CRUDE	FX
Mean	0.0013	-0.0006	-0.0001
Std. Dev.	0.0276	0.0564	0.0067
Skewness	-0.7335	-0.1719	0.2214
Kurtosis	8.9909	9.7569	3.9956
Jarque-Bera	860.725	1035.645	26.860
	(0.0000)	(0.0000)	(0.0000)

Table 2 exhibits pair-wise correlation coefficients between all factors under the period. All variables are positively correlated, except pair-wise with FX which shows negative correlation under the period of study.

TABLE 2: Correlation Matrix

	SET	CRUDE	FX
SET	1.0000	0.3477	-0.3827
CRUDE		1.0000	-0.2010
FX			1.0000

Before estimation, the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) are employed to check whether the series contains unit roots. Table 3 reports that, regardless of the test method, all variables are stationary since the null hypothesis stating that the series contains a unit root is strongly rejected for all variables. The result reveals that all factors are stationary, and is therefore used in subsequent analysis.

TABLE 3: The results of unit root test using the ADF and PP test

Variable	ADF test (Constant)	ADF test (Constant + trend)	PP test (Constant)	PP test (Constant + trend)
SET	-23.4641*** (0.0000)	-23.4499*** (0.0000)	-23.6327*** (0.0000)	-23.6191*** (0.0000)
CRUDE	-25.3169*** (0.0000)	-25.2986*** (0.0000)	-25.2625*** (0.0000)	-25.2452*** (0.0000)
FX	-20.8627*** (0.0000)	-20.8436*** (0.0000)	-21.1716*** (0.0000)	-21.1548*** (0.0000)

Note: Numbers in parentheses indicate the probability of failing to reject null hypothesis.

***, **, and * indicate the significance level at 10%, 5%, and 1%, respectively.

The GARCH (1,1) is estimated by maximum likelihood for trilateral variables, as presented in Table 4. The results indicate that stock market returns are positively significant for crude oil price but negatively significant for FX. The result means that the oil prices increase 1 percentage effect to the stock returns rise 0.1169 percentage. Additionally, the crude oil price increases in unison with stock market returns. Conversely, an increase in crude oil price decreases FX. The results showed that the oil prices increase 1 percentage impact to the FX change decrease 0.0278 percentage. Moreover, the FX estimation indicates a significant negative impact on stock market returns and crude oil price. For example, FX changings increase 1 percentage impact to stock returns decrease 1.1089 percentage and oil price decrease 0.9663 percentage.

TABLE 4: GARCH (1, 1) statistics

Variable	SET	CRUDE	FX
SET	-	0.4277*** (0.0000)	-0.0930*** (0.0000)
Past shock	-	0.1182*** (0.0000)	0.1500 (0.2700)
Lag volatility	-	0.86444*** (0.0000)	0.6000 (0.1018)
CRUDE	0.1169*** (0.0000)	-	-0.0278*** (0.0000)
Past shock	0.1756*** (0.0000)	-	0.1186*** (0.0002)
Lag volatility	0.8070*** (0.0000)	-	0.8054*** (0.0000)
FX	-1.1089*** (0.0000)	-0.9663*** (0.0001)	-
Past shock	0.1747*** (0.0000)	0.1277*** (0.0000)	-
Lag volatility	0.7954*** (0.0000)	0.8519*** (0.0000)	-

Note: Numbers in parentheses indicate the probability of failing to reject null hypothesis. ***, **, and *
indicate the significance level at 10%, 5%, and 1%, respectively.

Considering the estimated parameters of the conditional variance, determined by the time-invariant component of risk, the ARCH parameter (α_1) and GARCH parameter (β_1) have time-varying components in the general process of conditional return. It can be observed that the sum of coefficients of the lagged squared error and lagged conditional variance is very close to one, implying that shocks to the conditional variance will be highly persistent. Moreover, the ARCH effect is smaller than that of the GARCH, explaining the conditional variance of the factors whereby previous shock is less sensitive than own lagged volatility, except for the effect of stock returns on FX volatility.

Subsequently, the results by estimating with DDC-GARCH (1, 1) model in Table 5 shows parameters and b in the DCC equations. The parameters use the multivariate DCC-GARCH, explained through a pair-wise correlation coefficient of CRUDE-SET, FX-SET, and CRUDE-FX. The low values of "" and the high value of "" indicate that the correlation process is resistant to shocks and reverts quickly to the mean. The result of coefficient b is highest in the pairing of "SET-CRUDE" but lowest in "SET-FX".

TABLE 5: Dynamic Conditional Correlations Statistics

	SET-CRUDE	SET-FX	CRUDE-FX
	0.01543	0.07695*	0.03520
	(0.1930)	(0.0793)	(0.4259)
	0.96379***	0.69301**	0.81549**
	(0.0000)	(0.0025)	(0.0142)

Note: Numbers in parenthesis indicate the standard errors. * indicates the significance level at 10%,
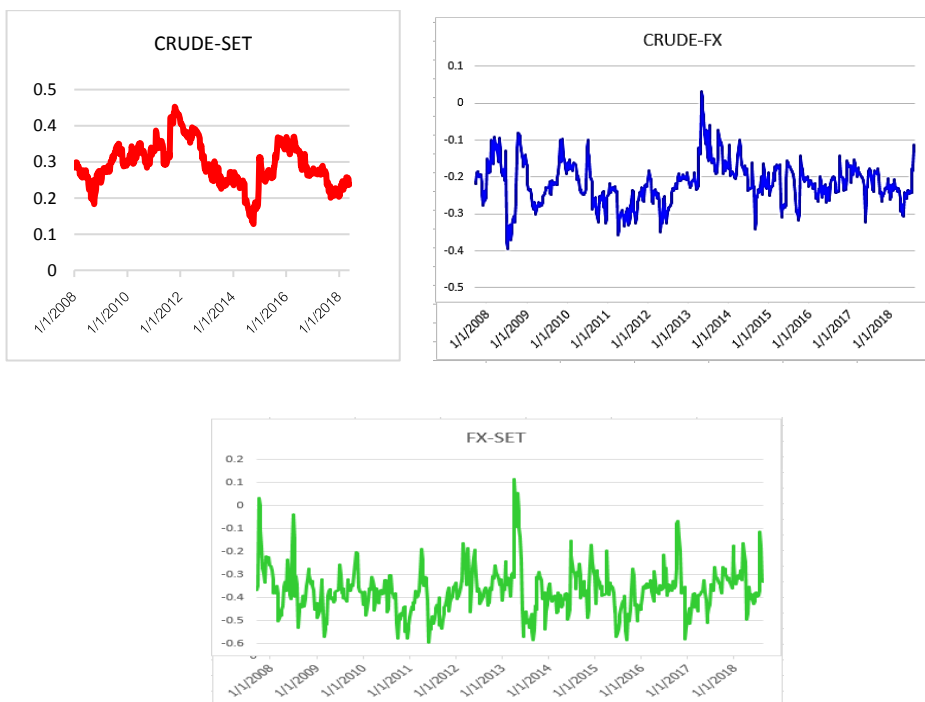**indicates the significance level at 5%, ***indicates the significance level at 1%

Figure 2. Dynamic conditional correlation amongst variables

The time-varying correlation linkages in the trilateral are plotted in Fig. 2. The DCC between CRUDE and SET are in the positive zone, going up to a maximum of 0.45 in October 2011. In 2011, oil prices in Thailand were high because the OPEC reduced production. Stock market returns and FX are negatively correlated, in similarity to the pairing of CRUDE and FX. Therefore, currency depreciation is related to increased stock market returns. Lastly, a decrease in oil price is associated with currency depreciation under the period of study.

Conclusion and Policy Implication

This paper examines the trilateral relationship among oil prices, foreign exchange rates, and the stock market in Thailand from January 2008 to May 2018. Firstly, the GARCH (1,1) estimation shows that provided similar qualitative results with coefficients typically larger for lag volatility than for past shock, explaining that shock is less sensitive than its own lagged volatility. Hence, FX, stock market returns, and oil price are less sensitive to new shocks in the market than long memory shocks in past periods. Secondly, the DCC-GARCH in the pairing of CRUDE-SET is in the positive zone, implying that an increase (Decrease) in oil price increases (Decreases) stock market returns, and vice versa similar to (Sanusi, & Ahmad 2016). Stock market returns and FX are negatively correlated, in similarity to the pairing of CRUDE and FX. In conclusion, local currency depreciation impacts on oil price and decreases stock market returns similar to (Delgado, Delgado, et al., 2018).

The results in this paper have three policy implications. Firstly, the foreign exchange market has a big impact on the commodity and financial markets. Especially, Thailand imports crude oil from

foreign countries, so the policy maker should to focus the movement of FX all the time. Secondly, a negative exchange rate affects the relationship between oil price and the stock market. Hence, investors should continue to hedge the exchange rate to help reduce portfolio risk. Lastly, oil price fluctuations in Thailand have a positive impact on the stock market. Therefore, investors should continue to the oil price movements since it will affect the value of their stocks.

For the suggestion, the trilateral relationship among FX market, crude market and stock market are moving towards and links between segmented markets. The movement of each market affects the opportunities for diversification benefits. Therefore, three indicators are important for policy makers and investors which should be monitored. However, in general, the results lend support to the existence of the relationship. Future research is also recommended to more indicators such forecast the effect relationships.

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