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Commodity Prices and the Stock Market in Thailand

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ABSTRACT

This study aims to investigate the association between Thai stock market and the commodity markets using 20-year historical monthly data from January 2000 to January 2020. Commodity prices used in the research consist of the prices of crude oil, natural gas, liquified natural gas, commodity agricultural raw materials, and gold. The traditional VAR is used in analyzing the relations between the commodity prices and stock index. The findings show how changes in each commodity prices had significant influence on the stock market. Both evidences of a long-run and a short-run impacts are examined to determine if the past values of changes in the prices of energy, agricultural raw materials, and gold are important in predicting the developments in the stock market or not. The results from the study provide the evidence that Thai stock market is responsive to energy-related, precious metal, and commodity-related indicators.

Keywords: Energy Price Commodity Price, Gold Price, Stock Return, Granger Causality, Vector Autoregressive
JEL Classifications: E44, G10, Q43

1. INTRODUCTION

With an increasing demand in terms of consumptions and investments in commodities such as crude oil, gold, and agricultural products, the knowledge about price behavior of commodity prices and the volatility transmission mechanism between commodity markets and the stock markets are important and can be applied in decision making process for different groups of participants including governments, traders, portfolio managers, consumers, and producers. Commodities play a vital role in supporting the economic and social development since they are important resources for the nations. Commodity prices are usually considered key drivers for changes in stock prices and the linkage between stock prices and commodity prices have been studied among researchers in the past decade (Kilian and Park, 2009; Creti et al., 2013; Mensi et al., 2013; Broadstock and Filis, 2014; Caporale et al., 2015; Du and He, 2015; Pan et al., 2016; Degiannakis et al., 2017; Joo and Park, 2017; Reboredo and Ugolini, 2018; Alio et al., 2019; Sun et al., 2019). However, there is no consensus about the association between equity prices and energy prices among researchers (Alio et al., 2019).

Some literatures suggested that oil price risk impacts stock price returns in both developed and emerging markets including Chang et al. (2010), Hamma et al. (2014), Caporale et al. (2015), Gupta (2016), Tian (2016), Ulussever (2017) while others suggested that the results were mixed or there was no significant influence of oil price risk on stock markets. (Alom, 2015; Bastianin et al., 2016; Degiannakis et al., 2018; Yıldırım et al., 2018; Alio et al., 2019; Lv et al., 2019; Singhal et al., 2019) Some evidence regarding the latter case is presented in the following paragraph.

Bastianin et al. (2016) investigated the impact of oil price shocks on the stock market volatility in the G7 countries and found that the stock market volatility did not respond to oil supply shocks, however, demand shocks had significant impact on the stock market volatility. Yıldırım et al. (2018) also reported mixed results in BRICS countries. Singhal et al. (2019) have studied the association between gold prices, oil prices, and equity market in Mexico and found that although both gold prices and energy prices have significant impact on equity markets, gold prices have a more positive effect on equities than oil. Moreover, in the Chinese markets, Lv et al. (2019) employed GARCH-M model to discuss the influence of oil price and stock price in sub-industries such as wind and solar energy. In addition, the spillover effects between oil risk and stock volatility in these sub-industries are also explored. The results showed that there was no statistically significant relationship between the oil prices and the energy stocks in the Chinese equity market.

An extensive review of the theory and empirical evidence between oil prices and stock markets was well summarized in Degiannakis et al. (2018). This paper reviewed related studies on the oil price and stock market relationship and found that the significance of these causal effects depend heavily on several factors including whether the data used were aggregate stock indices or firm-level, whether stock markets were in countries which are oil-importers or exporters, and whether the data of changes in oil price used in the study were symmetric or asymmetric. The following section provides more details about the results and summarizes empirical evidence from related previous literatures.

2. LITERATURE REVIEW

The impact of fluctuations in commodity prices such as oil prices, agricultural prices, and gold prices on stock returns has continued to draw substantial interests and has come under empirical investigation in numerous recent literatures.

Ding et al. (2017) conducted the principal component analysis and SVAR model to analyze the Chinese stock markets and presented evidence of a significant causal relationship between investor emotion in the Chinese stock market and fluctuations in international crude oil prices. The results also revealed that oil price fluctuations significantly Granger cause stock market investor sentiment and crude oil price has negative contagion effects on stock markets. In view of the impact of fluctuations in international oil prices on the sentiment of investors in the Chinese stock market, this study suggested that the government can adopt emergency response measures to stabilize investor sentiment and reduce the risk of stockholders, such as fighting for the pricing power of crude oil to avoid fluctuations in crude oil prices and also to protect the national energy security by striving to independently establish an oil storage system, advocate energy conservation, reduce dependence on oil in the international market, accelerate the development of new energy, and recommend subsidies to purchase new energy vehicles.

The impact of oil price shocks on China's stock market was explored in Wei and Guo (2017) by using the VAR model. They found an unstable relationship between the stock market and oil price shocks in the sample and there was a structural break in December 2006. In particular, the impact of oil price shock was positive during the period before the structural break, but it turned to be negative during the period after the structural break. Moreover, these results were confirmed by the impulse response analysis and variance decomposition analysis.

Yıldırım et al. (2018) investigated the relationship between crude oil prices and stock market prices in five countries including South Africa, China, India, Russia, and Brazil by employing the VAR model The analysis of the impulse response showed that the stock markets response to price of oil shocks varies from country to country. In specific, the unpredicted positive shocks in oil prices led to an increase in stock prices in Brazil and Russia. Overall, the results showed existing relationship between oil prices and stock markets in most countries under study except for China. However, the results also found that Stock market responses to oil prices disappeared within five months in all countries.

The analysis of the co-integration relationship in Wei et al. (2019) suggested that oil prices had a negative significant impact on Chinese stock market. The volatility in oil prices have severely interfered the relationship between crude oil prices and China's oil prices, which has led to the dramatic decline in Chinese stock prices. They also reported two structural breakpoints. The first structural break point was set in March 2008 followed by the second break point in 2012 due to the global financial crisis. This study noted that Brent crude futures prices were significantly co-integrated with the Chinese stock market and there was a significant negative correlation between Chinese stock market and crude oil price. In addition, the correlation was stronger during the crisis time.

Kathiravan et al. (2019) investigated the relationship between crude oil price and airline stock prices by using Granger causality test. Their empirical results showed that crude oil price triggered volatility in most of the airline stock returns. However, the relationship was not significant during a certain subperiod.

The impact of gold, oil price, and their volatilities on stock prices was explored in recent studies such as Raza et al. (2016), Jain and Biswal (2016), Arfaoui and Rejeb (2017), Chen and Wang (2017), Wen and Cheng (2018), and Coronado et al. (2018). The results in Raza et al (2016) concluded that gold price has a significant and positive impact on the stock prices of emerging markets in BRIC and ASEAN while oil price has a significant and negative impact on the stock prices of these markets. In addition, Jain and Biswal (2016) revealed that there existed the dynamic linkages among oil price, gold price, exchange rate, and stock market in India. Arfaoui and Rejeb (2017) reported the significant interdependencies among oil, gold, and stock markets. Chen and Wang (2017) suggested that there were some dynamic relationships between gold and stock markets in China. Their results showed that Chinese investors could use gold as a hedge for stock investment during the periods of bear market. Similarly, Wen and Cheng (2018) also found that in China and Thailand, gold can be used as a hedging tool for stock investment. However, the results showed that US Dollar had more advantage of being the hedging instrument relative to gold. Coronado et al. (2018) studied the direction of causality between gold, oil, and the US stock market. They proposed that the three markets were interrelated.

For the agricultural commodity market, the dependence linkage between commodity and stock fields in China was examined in the study of Hammoudeh et al. (2014). Their findings provided the evidence that there was significant linkage between the two markets. The results for the commodity prices and US stock prices in the water industry revealed similar conclusion in the study conducted by Vandone et al. (2018) for the US markets. Furthermore, Creti et al. (2013) showed that the recent financial crisis of 2007-08 strengthened the link between equity and commodity markets, during the financial turmoil, a high correlation was generally observed between the two markets. Mixed results were found in Nordin et al. (2020) which studied the relationship between commodities and the Malaysian stock market. It was found that the impact of the palm oil prices on the stock market index is positive and significant, both long-term and short-term. However, the impact of oil and gold prices on the stock market performance is not significant.

In conclusion, previous studies showed mixed results although the majority of results support the significant linkage between commodities and stock markets. The following section explains about the data and methodology employed under this study.

3. DATA AND METHODOLOGY

The energy price and stock market dynamics are analyzed using monthly data obtained from the Stock Exchange of Thailand, World Bank, World Gas Intelligence, and International Monetary Fund spanning the period during January 2000 to January 2020. The energy components in the analysis are monthly change in crude oil, average spot price of Brent, Dubai and West Texas Intermediate, equally weighed in US Dollars per Barrel (COP), natural gas price in US dollars per million metric British thermal (NGS), and Indonesian liquified natural gas monthly price in US dollars per million metric British thermal (LNG). The other commodity prices in the analysis are commodity agricultural raw materials index based on timber, cotton, wool, rubber, and hides Price Indices (CAI) and the gold, 99.5% fine, London afternoon fixing, average of daily rates in troy ounce (GP). The response variable is the stock market returns from the Stock Exchange of Thailand index (SET). The Vector Auto Regressive Model (VAR) and Granger's Causality Test are implemented to test the relationships among multiple variables in the time series and to measures precedence and information content among these time series. The analysis is performed in R version 3.6.3 (2020-02-29).

According to a general VAR model, which is employed to analyze the direction of causality energy prices and stock market returns, the multivariate time series can be explained in a VAR of order P:

$$y_t = w + \delta_1 y_{t-1} + \delta_2 y_{t-2} + \ldots + \delta_p y_{t-p} + \mu_t \qquad (1)$$

Where μ_t is an error vector of random variables with zero mean and covariance matrix:

$$w = \begin{bmatrix} w_1 \\ w_2 \\ w_3 \\ \vdots \\ w_k \end{bmatrix} \delta_i = \begin{bmatrix} \delta_{11i} & \delta_{21i} & & \delta_{k1i} \\ \delta_{12i} & \delta_{22i} & \cdots & \delta_{k2i} \\ \delta_{13i} & \delta_{23i} & & \delta_{k3i} \\ \vdots & \vdots & \ddots & \vdots \\ \delta_{1ki} & \delta_{2ki} & \cdots & \delta_{kki} \end{bmatrix} \qquad (2)$$

Consequently, the time series of each variable COP, NGS, LNG, CAI, GP, and SET enter the models endogenously, and the general VAR(P) form of the covariance matrix can be rewrite as:

$$\omega_t = \mu + \sum_{t=1}^{p} \gamma_i \omega_{t-i} + \varepsilon_t \qquad (3)$$

Where ω_t, μ, γ_t, and ε_t denote a vector of jointly determined variables, a vector of constants, a matrix of coefficients to be estimated, and a vector of error terms, respectively.

Equation (2) is expanded to incorporate causal links among variables COP, NGS, LNG, CAI, GP, and SET and the following models are built:

$$SET_t = \beta_{10} + \sum_{i=1}^{p} \beta_{11,i} SET_{t-i} + \sum_{i=1}^{p} \beta_{12,i} COP_{t-i} + \sum_{i=1}^{p} \beta_{13,i} NGS_{t-i}$$
$$+ \sum_{i=1}^{p} \beta_{14,i} LNG_{t-i} + \sum_{i=1}^{p} \beta_{15,i} CAI_{t-i} + \sum_{i=1}^{p} \beta_{16,j} GP_{t-i} + \varepsilon_{1t} \qquad (4)$$

$$COP_t = \beta_{20} + \sum_{i=1}^{p} \beta_{21,i} SET_{t-i} + \sum_{i=1}^{p} \beta_{22,i} COP_{t-i} + \sum_{i=1}^{p} \beta_{23,i} NGS_{t-i} +$$
$$\sum_{i=1}^{p} \beta_{24,i} LNG_{t-i} + \sum_{i=1}^{p} \beta_{25,i} CAI_{t-i} + \sum_{i=1}^{p} \beta_{26,j} GP_{t-i} + \varepsilon_{2t} \qquad (5)$$

$$NGS_t = \beta_{30} + \sum_{i=1}^{p} \beta_{31,i} SET_{t-i} + \sum_{i=1}^{p} \beta_{32,i} COP_{t-i} + \sum_{i=1}^{p} \beta_{33,i} NGS_{t-i}$$
$$+ \sum_{i=1}^{p} \beta_{34,i} LNG_{t-i} + \sum_{i=1}^{p} \beta_{35,i} CAI_{t-i} + \sum_{i=1}^{p} \beta_{36,j} GP_{t-i} + \varepsilon_{3t} \qquad (6)$$

$$LNG_t = \beta_{40} + \sum_{i=1}^{p} \beta_{41,i} SET_{t-i} + \sum_{i=1}^{p} \beta_{42,i} COP_{t-i} + \sum_{i=1}^{p} \beta_{43,i} NGS_{t-i}$$
$$+ \sum_{i=1}^{p} \beta_{44,i} LNG_{t-i} + \sum_{i=1}^{p} \beta_{45,i} CAI_{t-i} + \sum_{i=1}^{p} \beta_{46,j} GP_{t-i} + \varepsilon_{4t} \qquad (7)$$

$$CAI_t = \beta_{50} + \sum_{i=1}^{p} \beta_{51,i} SET_{t-i} + \sum_{i=1}^{p} \beta_{52,i} COP_{t-i} + \sum_{i=1}^{p} \beta_{53,i} NGS_{t-i}$$
$$+ \sum_{i=1}^{p} \beta_{54,i} LNG_{t-i} + \sum_{i=1}^{p} \beta_{55,i} CAI_{t-i} + \sum_{i=1}^{p} \beta_{56,j} GP_{t-i} + \varepsilon_{5t} \qquad (8)$$

$$GP_t = \beta_{60} + \sum_{i=1}^{p} \beta_{61,i} SET_{t-i} + \sum_{i=1}^{p} \beta_{62,i} COP_{t-i} + \sum_{i=1}^{p} \beta_{63,i} NGS_{t-i}$$
$$+ \sum_{i=1}^{p} \beta_{64,i} LNG_{t-i} + \sum_{i=1}^{p} \beta_{65,i} CAI_{t-i} + \sum_{i=1}^{p} \beta_{66,j} GP_{t-i} + \varepsilon_{6t} \qquad (9)$$

In addition, the unit root of each variable is investigated by Augmented Dickey-Fuller (ADF) test in order to ensure the stationarity of each time series employed in the VAR.

Table 1 explains the descriptive statistics of all the time series that has been transformed into the changes in natural logarithm of the series.

4. RESULTS AND DISCUSSIONS

The results of Augmented Dickey-Fuller unit root test were presented in Table 2. It was performed to confirm the stationarity of the monthly dataset and to ensure that the data do not have unit root and are stationary. The alternative hypothesis is that the true delta is less than zero. Since the series are all integrated of order zero [i.e., I(0)], it is more appropriate to employ the unrestricted VAR cointegration rank test method to cointegration than the Johansen method in evaluating the long-run association between variables under study. Consequently, the breakpoint test is employed to analyze the structural break in the stock market returns and the changes in the natural logarithm of all other independent variables.

The breakpoint test revealed that both *SET* and *COP* have structural break in September 2008, while the break date for changes in *NGP* was in December 2005. Besides, changes in *CAI, LNG,* and *GP* were in October 2011, March 2015, and July 2011, respectively. All the series demonstrate strong signs of volatilities over the sample period as illustrated in Figure 1.

In addition, Table 3 reports the analysis on the effect of fluctuations in commodity prices on the stock market. The data were investigated by using the VAR method in order to examine if the energy prices, agricultural prices, and gold price have significant effect on the stock market or not. The VAR estimate suggested that only the LNG had significant effect on the stock market. Other energy prices, agricultural price, and gold price were found to have insignificant effect on the stock market in the sample period.

Since there is no evidence of cointegration, the causal influence is further analyzed using the VAR Granger causality test.

Table 4 presents the results of cointegration rank test. The minimum of 4 cointegrating equations are identified which seem to indicate that there is a long-run association between response variable and commodity prices.

In addition, the null hypothesis of causality that stock prices do not Granger-cause commodity prices was conducted, and the results shown in Table 5 suggests the rejection of null hypothesis which implies that there is significant instantaneous causality between the response variable and commodity prices. Particularly, changes in the prices of crude oil, natural gas, agricultural index, liquefied natural gas, and gold were critical in forecasting the stock market. In the same vein, the stock market was instrumental in anticipating changes in crude oil price, agricultural index price, and gold price, but not for the natural gas and liquefied natural gas, during the period under study.

Table 1: Descriptive statistics

Variables	Mean	Median	Max.	Min.
SET	0.0048	0.0100	0.2120	−0.3592
COP	0.0037	0.0181	0.1851	−0.3156
NGP	−0.0007	−0.0072	0.4779	−0.3931
CAI	0.0013	0.0012	0.0755	−0.0845
LNG	0.0036	0.0066	0.1161	−0.1891
GP	0.0071	0.0044	0.1119	−0.1248

SET: All share index, COP: Crude oil price, NGP: Natural gas price, CAI: Commodity agricultural raw materials index, LNG: Liquefied natural gas, GP: Gold price

Table 2: Results of unit root test

Variables	ADF-statistic	Delta	p-value	Order of integration
SET	−14.4567	−0.9407	1.29E-25	I(0)
COP	−11.6314	−0.7309	8.92E-20	I(0)
NGP	−15.1543	−0.9891	9.47E-27	I(0)
CAI	−7.3978	−0.5488	2.44E-09	I(0)
LNG	−6.9256	−0.4680	3.08E-08	I(0)
GP	−13.4628	−0.8698	9.10E-24	I(0)

SET: All share index, COP: Crude oil price, NGP: Natural gas price, CAI: Commodity agricultural raw materials index, LNG: Liquefied natural gas, GP: Gold price

Table 3: Results of vector autoregressive estimate

Variable	Estimate	Std.Error	t-value	Pr(>|t|)
Intercept	0.0675	0.0556	1.2142	0.2259
SET_-1	1.0225	0.0719	14.2123	<2.20E-16
SET_-2	−0.0318	0.0729	−0.4356	0.6636
COP_-1	0.0006	0.0010	0.6506	0.5160
COP_-2	−0.0007	0.0010	−0.6729	0.5017
NGP_-1	0.0044	0.0070	0.6243	0.5330
NGP_-2	0.0045	0.0068	0.6682	0.5047
CAI_-1	−0.0007	0.0022	−0.3158	0.7524
CAI_-2	−0.0004	0.0023	−0.1934	0.8468
LNG_-1	−0.0051	0.0089	−0.5720	0.5679
LNG_-2	−0.0200	0.0081	−2.4737	0.0141
GP_-1	0.0000	0.0001	0.1462	0.8839
GP_-2	0.0001	0.0001	0.7914	0.4296
Adj. R-squared		0.9875	*F-statistic*	1566
p-value		<2.20E-16		

SET: All share index, COP: Crude oil price, NGP: Natural gas price, CAI: Commodity agricultural raw materials index, LNG: Liquefied natural gas, GP: Gold price

Table 4: Unrestricted (VAR) cointegration rank test results

Test type: Maximal eigenvalue statistic (lambda max), with linear trend in cointegration			
Hypothesized No. of CE (s)	**Eigengalues (lambda)**	**Max-eigen statistic**	**0.05 critical value**
None*	4.06E-01	124.1	43.97
At most 1*	3.53E-01	103.71	37.72
At most 2*	2.93E-01	82.51	31.46
At most 3*	2.20E-01	59.19	25.54
At most 4*	1.57E-01	40.72	18.96
At most 5	2.10E-02	5.06	12.25
Test type: Trace statistic, with linear trend in cointegration			
Hypothesized No. of CE (s)	**Eigengalues (lambda)**	**Trace statistic**	**0.05 critical value**
None*	4.06E-01	415.28	114.9
At most 1*	3.53E-01	291.18	87.31
At most 2*	2.93E-01	187.47	62.99
At most 3*	2.20E-01	104.97	42.44
At most 4*	1.57E-01	45.78	25.32
At most 5	2.10E-02	5.06	12.25

*Denotes rejection of the hypothesis at the 0.05 level

Figure 1: Graphical representation of variable proxies

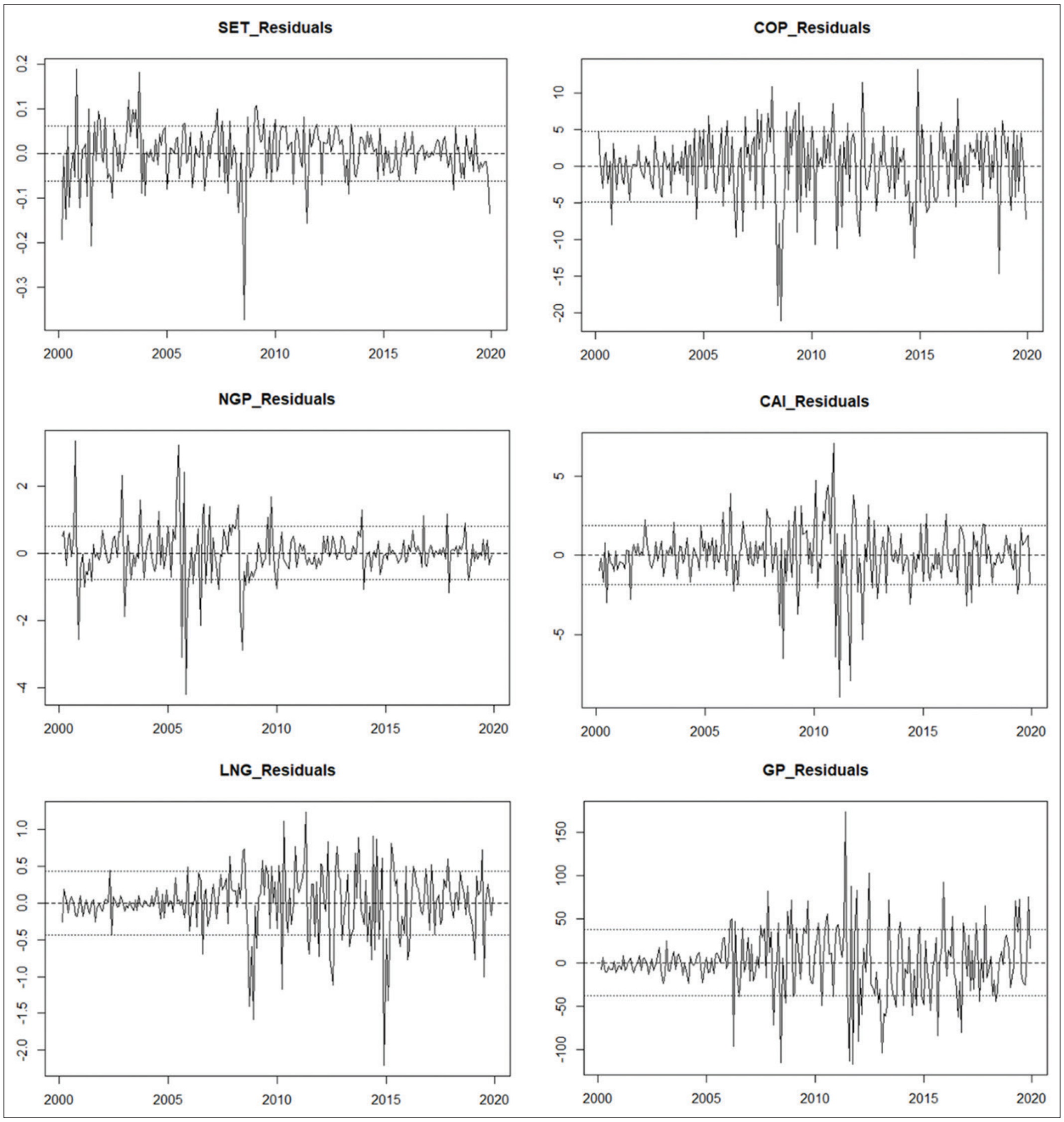

Table 5: VAR granger causality result

Excluded	F-test	p-value	Chi-squared	p-value
COP	1.7623	0.0805	4.0248	0.4027
NGP	3.0142	0.0024*	13.681	0.0084*
CAI	2.8817	0.0035*	13.064	0.0110*
LNG	2.9393	0.0030*	14.103	0.0070*
GP	2.5033	0.0107*	13.188	0.0104*
	Dependent variable: COP			
SET	1.5957	0.1216	31.74	2.16E-06*
	Dependent variable: NGP			
SET	1.0082	0.4278	7.9273	0.09428
	Dependent variable: CAI			
SET	1.244	0.2696	30.369	4.12E-06*
	Dependent variable: LNG			
SET	1.4798	0.1600	4.8627	0.3017
	Dependent variable: GP			
SET	0.93396	0.4872	12.378	0.0148*

SET: All share index, COP: Crude oil price, NGP: Natural gas price, CAI: Commodity agricultural raw materials index, LNG: Liquefied natural gas, GP: Gold price

Figure 2: Roots of characteristic polynomial

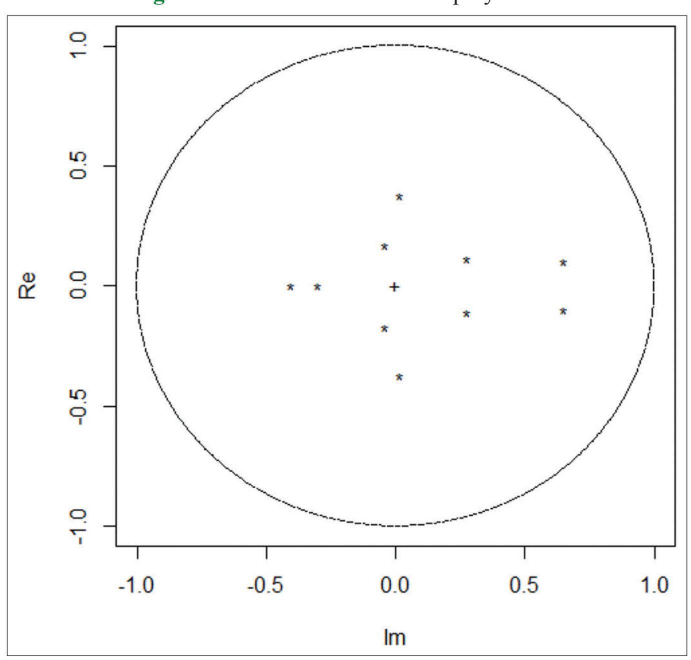

Figure 2 reports the inverse roots of the characteristic polynomial. The estimated VAR is stable (stationary) if all roots have modulus less than one and lie inside the unit circle. If the VAR is not stable, certain results (such as impulse response standard errors) are not valid. The results based on Figure 2 illustrate that no root lies outside the unit circle which imply that the estimated VAR model in this study is stationary.

5. CONCLUSION

In this study, the association between the Thai stock market and the international commodity markets was investigated. Empirical evidence in the prior studies mostly focused on the crude oil price for the commodity markets in countries other than Thailand. For a wider representation of the commodity market, this study included the prices of crude oil, natural gas, commodity agricultural raw materials index, liquefied natural gas, and gold price into the existing models based on the historical monthly data from January 2000 to January 2020.

The findings revealed that changes in commodity prices did not have significant influence on the stock market. However, there was evidence of a significant long-run relationship between the commodity markets and the stock market. In addition, significant causal relationship was found to exist among stock market and some commodity markets. These results conclude that historical prices of crude oil were the most significant factor among other commodities under this study in predicting the fluctuations in the stock market. Furthermore, lagged values of the stock market indices were not influential to the movements in crude oil price, agricultural prices, and gold prices. However, they were vital in the prediction of movements in other energy products namely natural gas price and liquefied natural gas price. The results support previous literatures that the significance of the interrelations among these markets depends on the degree to which the country is the exporter or importer of the commodity and also on how important role the commodity plays on the portfolio of investors and the economy of the country.

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