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Asymmetric Relationship between Exchange Rate Volatility and Oil Price: Case Study of Thai-Baht

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ABSTRACT

This paper aims to investigate asymmetric relationship between exchange rate volatility and oil price using a nonlinear auto-regressive distribution Lag (NARDL) developed by Shin et al. (2014). This technique allow us for estimating asymmetric long-run as well as short-run coefficients in a cointegration framework. For exchange rate volatility measurement, GARCH (1,1) model is applied. We use monthly data from January 2000 to June 2021. The results show that there are asymmetric impacts of oil price shocks on Thailand exchange volatility both in the long run and short run. Moreover, both positive and negative shocks on stock price index increase exchange volatility in the short run.

Keywords: Exchange Rate Volatility, GARCH (1,1), Asymmetric, Non-linear Auto-Regressive Distribution Lag, Oil Price
JEL Classification: A1

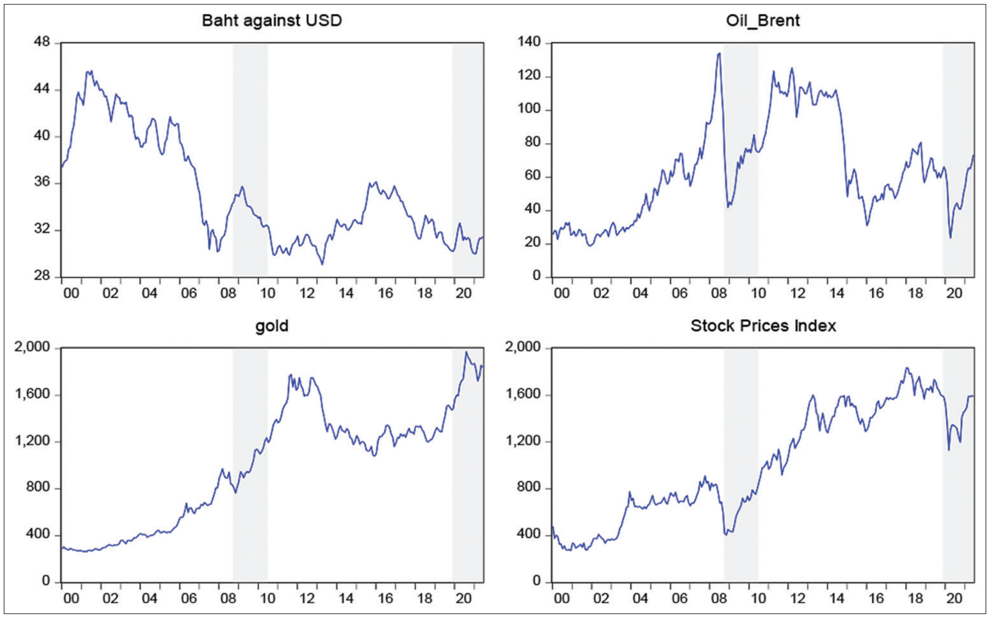
1. INTRODUCTION

After the Asian financial crisis in 1997, Thailand government was forced to float exchange rate due to lack of foreign currency to support Baht peg to the U.S. Dollar. Thailand has adopted the managed float exchange rate regime since July 2, 1997. Even though exchange rate is managed float, it is more volatile relative to among major macroeconomic variables such as consumption investment, etc. Basically, exchange rate is an important variables for international transaction. The exchange rate variations affect the competitiveness of domestic export and import competing sectors especially in small open economy as Thailand.

According to the important of exchange rate, there are many literatures that try to examine exchange rate behavior as well as the factor determining exchange rate. Macroeconomics fundamental models link oil price and exchange rate through the term of trade effect. When oil prices rise, wealth is transferred to oil exporting countries (in US dollar terms) and is reflected as an improvement in exports and the current account balance in domestic currency terms. Buetzer et al., 2016 describes the effects of oil price on exchange rate based on fundamental theory through three direct transmission channels: the terms of trade channel, the wealth effect channel and the portfolio reallocation channel. The wealth channel reflects the resulting short-run effect, while the portfolio channel assesses medium- and long-run impacts. However, the seminal work of Meese and Rogoff (1983) showed that exchange rate models based on economic fundamentals are unable to outperform a simple random walk forecast. The literature, since then, was extended to the oil price-exchange rate nexus (Krugman, 1983; Rogoff, 1991). Additionally, Rossi (2013) argued that the forecasting performance of fundamental exchange rate models, in general, is highly sensitive to the selection of different currencies, sample periods and forecast horizons. Beckmann et al., (2020) reviewed the relationship between oil prices and exchange rates and found that empirical evidence varies substantially depending on sample, country choice and empirical method.

It can be seen from Figure 1 that there are some relationship between selected assets prices (gold, oil, and stock price index) and Thailand exchange rate, especially during the two crises; the financial crisis in 1997 and Covid19 in late of 2019. As the complex and dynamic relationship between exchange rate and assets prices have been

Figure 1: Exchange rate, oil price, gold price and stock price index



attended from of the policymakers, researchers, and the general public, thus, it stays valuable to continue examining the effect of oil price variations on the exchange rate, especially that the empirical findings about the oil price-exchange rate nexus still show mixed results.

As our knowledge now there are limited efforts were made to explore asymmetrical linkages between Thai-Baht exchange rate fluctuations, and oil, stocks, and gold prices. Then, in this research, Nonlinear Autoregressive Distributed Lags (NARDL) proposed by Shin et al. (2014) is applied for investigation the asymmetrical linkages between oil and gold prices, and Thailand stock price index on Thai-Baht exchange rate volatility covering the period from January 2000 to June 2021.

The rest of the paper is organized as followed: Second 2 reviews the relevant literatures. Section 3 provides data set and descriptive statistics, and the methodologies used for estimation have been followed. Section 4 discusses the empirical results. The conclusion and policy implications are presented in Section 5.

2. LITERATURE REVIEW

We review literatures about relationship between exchange rates including exchange rate volatility and oil price, gold price, and stock price index as followings. Since the large amount of literatures, we select some literatures based on methodologies and independent variables. The related literature regarding the impact of oil prices on exchange rates applied various methodologies, such as vector autoregressive (VAR), and vector error correction model (VECM) models, Markov switching model, multivariate GARCH-type models, symmetric and asymmetric bootstrap, wavelet and neural network models, ARDL and NARDL models detailed as followings.

Englama et al. (2010) examined the effects of oil price volatility, demand for foreign exchange, and external reserves on exchange rate volatility in Nigeria using monthly data for the period 1999:1 to 2009:12. The cointegration technique and vector error correction model (VECM) were employed for the long-run and the short-run analysis. The results showed that a 1.0 per cent permanent increase in oil price at the international market increases exchange rate volatility by 0.54 per cent in the long-run, while in the short-run by 0.02 per cent. Also a permanent 1.0 per cent increase in demand for foreign exchange increases exchange rate volatility by 14.8 per cent in the long-run. Pershin et al. (2016) investigated the relationship between oil prices and exchange rates in three African countries (Botswana, Kenya and Tanzania) using a Vector Autoregressive (VAR) model. The results suggest that the exchange rate of the three selected countries behavior is different in the event of an oil price shock, not only before and after the oil peak of July of 2008, but also between each other. The findings show that oil supply shocks have a larger depreciating influence on exchange rates in oil exporters than in importers. Ji et al. (2020) explored the dynamic effects of different oil shocks on real exchange rates in net oil importers and exporters. Utilizing both the SVAR model and finding that real exchange rates' responses to oil price shocks are country-specific and shock-type-specific.

Bal and Rath (2015) showed the persistence in the variance of oil price and exchange rate using a GARCH (1,1) model in case of India and China. Basher and Sadorsky (2016) utilized DCC, ADCC and GO-GARCH models to examine the conditional correlation between gold, oil and the price index presenting emerging stock markets and finding that oil is the best asset to hedge emerging market stock prices. Jain and Biswal (2016) explored the relation between global prices of gold, crude oil, the USD–INR exchange rate, and the stock market in India. The dynamic contemporaneous linkages have been analyzed using DCC-GARCH (standard, exponential and threshold) models and finding that fall in gold prices and crude oil prices cause fall in the value of the Indian Rupee and the benchmark stock index i.e. Sensex. The findings of this study support the emergence of gold as an investment asset class among the investors. Sikhosana and Aye (2018) explored volatility transmission between stock indexes and exchange rate fluctuations through employing the EGARCH modeling approach over the period from 1996 to 2016 in the South African context. Findings indicated the transmission of volatility shocks from exchange rate fluctuations towards stock prices and vice versa. Adenomon et al. (2020) examined the impact of COVID-19 outbreak on the Nigerian stock exchange performance by applying Quadratic GARCH (QGARCH) and Exponential GARCH (EGARCH) models, using daily data from 2 January 2020 to 16 April 2020. The results revealed high volatility in stock returns under the COVID-19 period in Nigeria as against the normal period.

Fan and Xu (2011) characterized weekly international oil price fundamentals since 2000 by analyzing the transformation of the market mechanism based on structural change perspective and found that the link between US dollar exchange rates and oil price has more closely related to macroeconomic fundamentals and financial markets over time. Their findings are based on a wavelet approach. Harnphattananusorn (2020) estimated the relationship between exchange rate, oil price and stock prices in case of Thailand using Artificial Neural Network (ANN).The results showed that the relative important of the variables, from the score of ANN estimation, are gold price, US time deposits rate, oil price, and volatility in the stock market, respectively.

Raza et al. (2016) examined the asymmetric impact of gold prices, oil prices and their associated volatilities on stock markets of emerging economies using NARDL. Monthly data on the top ten emerging stock markets, namely China, India, Brazil, Russia, South Africa, Mexico, Malaysia, Thailand, Chile and Indonesia, Brent crude oil prices, Gold prices, crude oil volatility index and gold volatility index is used from January 2008 to June 2015. Singhal et al. (2019) utilized a linear or symmetrical ARDL approach to estimate symmetrical linkage between currency value fluctuations, gold prices, oil prices, and Mexican stock indexes over the period from January 2006 to 2018. Oil prices negatively influence exchange rate in the long and gold price do not have any significant impact on the exchange rate. Jung et al. (2020) employed the NARDL model and asymmetrical granger causality approach to finding out whether exchange rate fluctuations are granger causing oil price volatility for shorter and longer horizons. Chkir et al. (2020) employed asymmetrical linkages between oil prices, stock indexes, and exchange rates for oil-exporting and importing economies and found weak support for oil price volatilities to be classified as a hedging tool against depreciating local currencies. Umaid et al. (2020) have divided the time-series data into three threshold periods such as before the economic crunch period, after the economic crunch, and over the entire period to investigate the asymmetrical impact of oil price volatility, gold prices, and currency fluctuations on Karachi stock exchange of Pakistan.

3. DATA AND METHODOLOGY

3.1. Data

We use monthly data from International Financial Statistics from Jan2000 to June2021. The exchange rate is defined as Baht/USD. By the definition, it indicates that an increase in exchange rate mean Baht depreciation and vice versa. Oil price (oil) is represented by Brent crude oil price. The assets prices as independent variables are gold price (gold), and stock prices index proxied by Thailand SET index (set). All variables, except for the exchange rate volatility, are in natural logarithm form, and the descriptive statistics of variables are shown in Table 1.

From Table 1, gold price and set are more volatile than other variables. For the skewness, it is a measure of asymmetry distribution. All variables show an asymmetric distribution, oil price, gold price and stock price index are negatively skewed indicating that the size of the left-hand tail will typically be longer than the right-hand tail, while exchange rate volatility is positively skewed. Kurtosis minus 3 is a measure of how the distribution's

Table 1: Summary statistics of data

	Exvol	Brent	Gold	Set
Mean	0.014891	4.037112	6.733103	6.776408
Median	0.014385	4.088593	7.040260	6.845720
Maximum	0.027540	4.896892	7.585093	7.512142
Minimum	0.011933	2.923416	5.562526	5.595417
Std. Dev.	0.002328	0.497426	0.629409	0.557483
Skewness	1.953243	–0.279059	–0.598534	–0.533568
Kurtosis	8.776881	2.112219	1.882187	2.090076
Jarque-Bera	520.7782	11.82124	28.83665	21.14247
Probability	0.000000	0.002711	0.000001	0.000026

Source: Author. Note: Data are in natural logarithm form except for exchange rate volatility

Table 2: Unit root tests

Variables	At level				At 1st difference				Conclusion
	Constant		Constant and trend		Constant		Constant and trend		
	t-statistics	Prob.	t-statistics	Prob.	t-statistics	Prob.	t-statistics	Prob.	
exvol	–4.585510	0.0002	–4.719528	0.0008					I(0)
brent	–2.329521	0.1635	–2.444991	0.3555	–12.03254	0.0000	–12.01507	0.0000	I(1)
gold	–1.232055	0.6610	–0.994244	0.9418	–13.97399	0.0000	–13.97303	0.0000	I(1)
set	–0.947205	0.7719	–2.340801	0.4100	–15.69126	0.0000	–15.6668	0.0000	I(1)

Note: Data are in natural logarithm form except for exchange rate volatility tails compare to the normal. For oil price, gold price and stock price index, Kurtosis statistics are less than three or Kurtosis minus 3 is less than 0, they are platykurtic and they have thinner tails than a normal distribution. In case of exchange rate volatility, Kurtosis is greater than 3 it is leptokurtic or thicker. The Jarque-Bera tests reject the null hypothesis of normality for all variables.

3.2. Methodology

For investigation the relationship between exchange rate volatility and selected assets price, we employs two steps for estimation. First, we calculate exchange rate volatility using GARCH (p,q). Second, we use NARDL to test whether there exists the asymmetry relationships between independent and dependent variables both in short run and long run.

For the exchange rate volatility we specify mean equation of exchange rate as first order autoregressive process, as following Arize (1995), and the forecast variance equation as the lag of squared residuals from the mean equation and the last forecast period as followings:

$$ex_t=\gamma_0+\gamma_1 ex_{t-1}+\varepsilon_t$$

$$h_t^2=\lambda_0+\lambda_1\varepsilon_{t-1}^2+\lambda_2\varepsilon_{t-2}^2+\ldots+\lambda_q\varepsilon_{t-q}^2+\phi_1 h_{t-1}^2+\phi_2 h_{t-2}^2+\ldots+\phi_p h_{t-p}^2$$

where ex_t is exchange rate defined as Baht/USD, ε_t is white noise with $E(\varepsilon)=0$ and $\mathrm{Var}(\varepsilon)=h^2$. The autocorrelation of residual problem of the mean equation is diagnosed by Breusch, and Grodfey test. We employed Lagrange multiplier test to confirm GARCH effect. Then we predict the variance and calculates GARCH conditional standard deviation of the model for exchange rate volatility (*exvol*).

We hypothesize the long run equilibrium relationship between exchange rate volatility and independent variables as following;

$$exvol_t=a_0+a_1 brent_t+a_2 gold_t+a_3 set_t+e_t \quad (1)$$

where a_i, i = 1, 2, 3 denote for the long run coefficient of independent variables (brent, gold, set) on exchange rate volatility. Following Pesaran et al. (2001) the error correction form of the linear ARDL (m,p,q,r) model of eq.1 can be expressed as

$$\Delta exvol_t=b_0+b_1 exvol_{t-1}+b_2 brent_{t-1}+b_3 go1d_{t-1}+b_4 set_{t-1}+\sum_{i=1}^{m-1}d_{1i}\Delta exvol_{t-i}+\sum_{i=0}^{p-1}d_{2i}\Delta brent_{1-i}+\sum_{i=0}^{q-1}d_{3i}\Delta go1d_{t-i}+\sum_{i=0}^{r-1}d_{4i}\Delta set_{t-i}+\varepsilon_t \quad (2)$$

To illustrate NARDL method which is an extensive from linear ARDL, we follow Shin et al. (2014) which develops the autoregressive distributed lags (ARDL) bounds testing approach of Pesaran et al. (2001) to allow for estimating asymmetric long-run as well as short-run coefficients in a cointegration framework.

The asymmetrical NARDL model for estimation is shown in equation 3. This non-linear autoregressive distributed lag model allows us to test whether changing in selected assets prices including oil price have asymmetric or symmetric effects on exchange rate volatility.

Table 3: Non-linear cointegration bounds test

Test Statistic	Value	10%		5%	
		I(0)	I(1)	I(0)	I(1)
F-statistic	4.371	1.99	2.94	2.27	3.28

$$\begin{aligned}\Delta exvol_t&=\beta_0+\beta_1 exvol_{t-1}+\beta_2^+ brent_{t-1}^+ +\beta_2^- brent_{t-1}^- +\beta_3^+ go1d_{t-1}^+\\&+\beta_3^- go1d_{t-1}^- +\beta_4^+ set_{t-1}+\beta_4^- set_{t-1}\\&+\sum_{i=1}^{m-1}\delta_{1i}\Delta exvol_{t-i}+\sum_{i=0}^{r^+-1}\delta_{2i}^+\Delta brent_{t-i}^+\\&+\sum_{i=0}^{r^--1}\delta_{2i}^-\Delta brent_{t-i}^- +\sum_{i=0}^{q^+-1}\delta_{3i}^+\Delta go1d_{t-i}^+\\&+\sum_{i=0}^{q^--1}\delta_{3i}^-\Delta go1d_{t-i}^- +\\&+\sum_{i=0}^{p^+-1}\delta_{4i}^+\Delta set_{t-i}^+ +\sum_{i=0}^{p^--1}\delta_{4i}^-\Delta set_{t-i}^-\varepsilon_t\end{aligned} \quad (3)$$

The "+" and "−" notations of the independent variables, respectively, denote the partial sum of positive and negative shocks to dependent variable, which can be detailed in eq. 4-6

$$brent_t^+=\sum_{i=1}^{t}\Delta brent_i^+=\sum_{i=1}^{t}\max\left(\Delta brent_i,0\right)$$
$$brent_t^-=\sum_{i=1}^{t}\Delta brent_i^-=\sum_{i=1}^{t}\min\left(\Delta brent_i,0\right) \quad (4)$$

$$gold_t^+=\sum_{i=1}^{t}\Delta gold_i^+=\sum_{i=1}^{t}\max\left(\Delta gold_i,0\right)$$
$$gold_t^-=\sum_{i=1}^{t}\Delta gold_i^-=\sum_{i=1}^{t}\min\left(\Delta gold_i,0\right) \quad (5)$$

$$set_t^+=\sum_{i=1}^{t}\Delta set_i^+=\sum_{i=1}^{t}\max\left(\Delta set_i,0\right)$$
$$set_t^-=\sum_{i=1}^{t}\Delta set_i^-=\sum_{i=1}^{t}\min\left(\Delta set_i,0\right) \quad (6)$$

The long run cointegration between variables exists if the null hypothesis of Bound test statistics; Ho: $\beta_1=\beta_i^+=\beta_i^-=0; i=2,3,4$ is rejected. To test whether there are long run asymmetry relationship among variables, we normalized β_i^+,β_i^- ; $i=2,3,4$ by β_1 and test the null hypothesis Ho: $-\frac{\beta_2^+}{\beta_1}=-\frac{\beta_2^-}{\beta_1},-\frac{\beta_3^+}{\beta_1}=-\frac{\beta_3^-}{\beta_1},-\frac{\beta_4^+}{\beta_1}=-\frac{\beta_4^-}{\beta_1}$ which are employed by F-statistic (Wald test). The null hypothesis (Ho) states that the effect is symmetrical in the long-run. If Ho is rejected, there exists long run asymmetrical relationship.

The short-run effects of increasing in gold and oil prices, and stock price index on exchange rate volatility are captured by $\sum_{i=0}^{r}\delta_{2i}^+,\sum_{i=0}^{q}\delta_{3i}^+,$ *and* $\sum_{i=0}^{p}\delta_{4i}^+$ repectively,while $\sum_{i=0}^{r}\delta_{2i}^-,\sum_{i=0}^{q}\delta_{3i}^-,$ *and* $\sum_{i=0}^{p}\delta_{4i}^-$ show the short-run effect of gold and oil prices, and stock price index, respectively, on exchange rate volatility. e_t is the error term

Table 4: Estimation results

Variable	Coefficient	Std. Error	t-Statistic	P-value
C	0.004	0.001	4.683	0.000
$exvol_{t-1}$	–0.233	0.041	–5.701	0.000
$brent^{+}_{t-1}$	0.001*	0.000	1.676	0.095
$brent^{-}_{t-1}$	0.000	0.000	0.855	0.394
$gold^{+}_{t-1}$	0.000	0.001	0.205	0.837
$gold^{-}_{t-1}$	–0.001	0.001	–0.733	0.464
set^{+}_{t-1}	0.000	0.000	–0.223	0.824
set^{-}_{t-1}	0.0014*	0.001	1.825	0.069
$\Delta exvol_{t-1}$	0.160	0.064	2.504	0.013
$\Delta brent^{+}_{t}$	–0.0011	0.002	–0.465	0.642
$\Delta brent^{+}_{t-1}$	0.004**	0.002	2.086	0.038
$\Delta brent^{-}_{t}$	0.001	0.002	0.603	0.547
$\Delta brent^{-}_{t-1}$	–0.002	0.001	–1.104	0.271
$\Delta gold^{+}_{t}$	0.000	0.004	0.135	0.893
$\Delta gold^{+}_{t-1}$	–0.003	0.004	–0.876	0.382
$\Delta gold^{-}_{t}$	0.006	0.005	1.146	0.253
$\Delta gold^{-}_{t-1}$	0.001	0.005	0.230	0.818
Δset^{+}_{t}	–0.003	0.003	–1.219	0.224
Δset^{+}_{t-1}	0.005**	0.002	2.240	0.026
Δset^{-}_{t}	0.001	0.002	0.372	0.710
Δset^{-}_{t-1}	–0.007***	0.002	–2.779	0.006
cointeq(–1)*	–0.233***	0.039	–6.009	0.000
R-square 0.751				

Panel 2: LR Wald Test	F-statistics	P value	Panel 3: SR Wald Test	F-statistics	P value
LR oil; $brent^{+}_{t-1} = brent^{-}_{t-1}$	2.793	0.102*	SR oil; $\sum_{i=0}^{r}\delta^{-}_{2i} = \sum_{i=0}^{r}\delta^{+}_{2i}$	1.133	0.288
LR gold; $gold^{+}_{t-1} = gold^{-}_{t-1}$	0.6757	0.412	SR gold; $\sum_{i=0}^{q}\delta^{-}_{3i} = \sum_{i=0}^{q}\delta^{+}_{3i}$	0.895	0.345
LR set; $set^{+}_{t-1} = set^{-}_{t-1}$	4.146	0.043*	SR set; $\sum_{i=0}^{p}\delta^{-}_{4i} = \sum_{i=0}^{p}\delta^{+}_{4i}$	2.116	0.147

Panel 4: Diagnostic Tests	F-statistics	P-value
Breusch-Godfrey Serial Correlation LM Test:	0.459725	0.6320
Heteroskedasticity Test: Breusch-Pagan-Godfrey	1.167204	0.2842
Ramsey RESET Test	0.360772	0.5487

Source: Author. Note: "+" and "–" denote positive and negative changes of variables, respectively. ***, **, and * indicate significant level of 1%□5% and 10% respectively. LR and SR denote for long run and short run, respectively

which is assumed to distribute normally. To test short run asymmetric relationship we test the null hypothesis; H0: $\sum_{i=0}^{r}\delta^{+}_{2i} = \sum_{i=0}^{r}\delta^{-}_{2i}$, $\sum_{i=0}^{q}\delta^{+}_{3i} = \sum_{i=0}^{q}\delta^{-}_{3i}$, and $\sum_{i=0}^{p}\delta^{+}_{4i} = \sum_{i=0}^{p}\delta^{-}_{4i}$ which require Wald test as well. Rejecting the null hypothesis means that exists short run asymmetric relationship.

4. RESULTS AND DISCUSSION

The first step in the NARDL analysis is the unit root analysis. The NARDL requires that all variables are not cointergrated at order I(2). As shown in Table 2, the augmented Dickey Fuller (ADF) and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) are employed for unit root test and level of cointegrated order of variables. All variables are non-stationary at level I(0) except for that of *exvol*, and they are all stationary at first different I(1) and there are no I(2). The unit root test shows that series of variables are mixed order I(0) and I(1) and there are no I(2). Then, we can investigate the relationship using NARDL.

Next, we prove for asymmetric long run cointegrating of all variables using F- Bound test statistics as shown in Table 3. The F-statistics (4.371) exceed the upper bound critical values I(1) at the 1% and 5% significance level. It can conclude that there is asymmetric long-run cointegration among the variables for the period Jan 2000 to June 2021.

Then, we estimate NARDL model as presented in equation 3. The results are shown in Table 4. Table 4 has four panels; long run relationship, short run relationship, test of asymmetric relationship, and model diagnostics tests. For long run relationship panel, it shows the long run increasing and decreasing effect of independent variable on the dependent variable. For long term relationship, a positive shock on oil price has a positive effect on exchange rate volatility (coefficient of 0.001 with 10% significant). But a negative oil price shock has not significant impact on exchange rate volatility. Additionally, only a negative shock to stock price index increase exchange rate volatility with 10% significant (coefficient of 0.0014 with 10% significant) in a long term. For the short run assessment, only a positive shock on oil price (coefficient of 0.004 with 10% significant, at lag 1) has an impact on the exchange rate volatility in the same direction. Additionally, both positive and negative shocks on stock price index increase exchange rate volatility (coefficient of 0.005 and –0.007 with 5% and 1% significant). The error correction coefficient (ECM) estimate of -0.233 is significant at 1%, with the negative sign. This confirm the long run relationship and implies 23.29% speed of adjustment to long run equilibrium after a shock. The Wald tests confirm that there are 10% significant asymmetry effects of oil price and stock price index on exchange rate volatility in long run. For the short run asymmetric, all variables are accept the null hypothesis, indicating no asymmetric short run relationship.

Finally, we do diagnostics test for autocorrelation, heteroscedasticity, and misspecification problems, and test statistics are Breusch-Godfrey Serial Correlation LM Test, Breusch/Pagan heteroskedasticity test, and Ramsey RESET test, respectively. The result of LM test shows that we accept null hypothesis of no autocorrelation indicating that there is no autocorrelation between exchange rate volatility and independent variables. We also note the absence of heteroscedasticity via Breusch/Pagan test, in which we fail to reject the null hypothesis. The functional form of the empirical model is well-designed and confirmed by the Ramsey Reset test. This finding indicates the reliability and consistency of the empirical results.

5. CONCLUSION

This study analyzes the non-linear relationship between selected assets prices; oil price, gold price, and stock price index and Thai Baht exchange rate volatility by employing NARDL approach during the period from January 2000 to June 2021. We find that there are statistically significant asymmetric effects of oil price and assets price index on Thailand exchange rate volatility especially in the long run. Therefore, under managed float exchange rate regime, Thai policy makers should be consider assets prices such as oil price and stock price index apart from the fundamental macroeconomics variables in order to manage Thailand exchange rate.

REFERENCES

Adenomon, M.O., Maijamaa, B., John, D.O. (2020), On the effects of COVID-19 outbreak on The nigerian stock exchange performance: Evidence from GARCH models. Preprints, 2020, 2020040444.

Arize, A. (1995), The effects of exchange-rate volatility on U.S. exports: An empirical investigation. Southern Economic Journal, 62, 34-43.

Bal, D.P., Rath, B.N. (2015), Nonlinear causality between crude oil price and exchange rate: A comparative study of China and India. Energy Economics, 51, 49-156.

Basher, S.A., Haug, A.A., Sadorsky, P. (2016), The impact of oil shocks on exchange rates: A Markov-switching approach. Energy Economics, 54, 11-23.

Beckmann, J., Czudaj, R., Arora, V. (2020), The relationship between oil prices and exchange rates: Revisiting theory and evidence. Energy Economics, 88(6), 104772.

Buetzer, S., Habib, M.M., Stracca, L. (2016), Global exchange rate configurations: Do oil shocks matter? IMF Economic Review, 64(3), 443-470.

Chkir, I., Guesmi, K., Brayek, A.B., Naoui, K. (2020), Modelling the nonlinear relationship between oil prices, stock markets, and exchange rates in oil-exporting and oil-importing countries. Research in International Business and Finance, 54, 101274.

Englama, A., Duke, O.O., Ogunleye, T.S., Ismail, F.U. (2010), Oil prices and exchange rate volatility in Nigeria: An empirical investigation. Central Bank of Nigeria Economic and Financial Review, 48, 31-48.

Fan, Y., Xu, J.H. (2011), What has driven oil prices since 2000? A structural change perspective. Energy Economics 33(6), 1082-1094.

Harnphattananusorn, S. (2020), Relationship between Thai baht and oil price: Artificial neural network model. International Journal of Energy Economics and Policy, 10(1), 371-376.

Jain, A., Biswal, P.C. (2016), Dynamic linkages among oil price, gold price, exchange rate, and stock market in India. Resources Policy, 49(C), 179-185.

Ji, Q., Shahzad, S.J.H., Bouri, E., Suleman, M.T. (2020), Dynamic structural impacts of oil shocks on exchange rates: Lessons to learn. Economic Structures, 9(20), 20.

Jung, Y.C., Das, A., McFarlane, A. (2020), The asymmetric relationship between the oil price and the US-Canada exchange rate. The Quarterly Review of Economics and Finance, 76(C), 198-206.

Krugman, P. (1983), Oil shocks and exchange rate dynamics. In: Frenkel, J.A., editor. Exchange Rates and International Macroeconomics. United States: University of Chicago Press. p259-284.

Meese, R., Rogoff, K. (1983), Empirical exchange rate models of the seventies: Do they fit out of sample. Journal of International Economics, 14(2), 3-24.

Pesaran, M.H., Shin, Y. (1999), An autoregressive distributed-lag modelling approach to cointegration analysis. In: Strom, S., editor. Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium. Cambridge: Cambridge University. p371-413.

Pesaran, M.H., Shin, Y., Smith, R.J. (2001), Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 16, 289-326.

Raza, N., Shahzad, S.J.H., Tiwari, A.K., Shahbaz, M. (2016), Asymmetric impact of gold, oil prices and their volatilities on stock prices of emerging markets. Resources Policy, 49, 290-301.

Rossi, B. (2013), Exchange Rate Predictability, CAFE Research Paper No. 13.16.

Shin, Y., Yu, B.C., Greenwood-Nimmo, M. (2014), Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In: Sickels, R., Horrace, W., editors. Festschrift in Honor of Peter Schmidt: Econometric Methods and Applications. Berlin: Springer. p281-314.

Sikhosana, A., Aye, G.C. (2018), Asymmetric volatility transmission between the real exchange rate and stock returns in South Africa. Economic Analysis and Policy, 60(C), 1-8.

Singhal, S., Choudhary, S., Biswal, P.C. (2019), Return and volatility linkages among international crude oil price, gold price, exchange rate and stock markets: Evidence from Mexico. Resources Policy, 60, 255-261.

Umaid, A.S., Asad, M., Israr, A., Tabash, M.I., Ahmed, Z., McMillan, D. (2020),Symmetrical cointegrating relationship between money supply, interest rates, consumer price index, terroristic disruptions, and Karachi stock exchange: Does global financial crisis matter? Cogent Economics and Finance, 8, 1.