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Do World Crude Oil Prices, Global Uncertainty and Exchange Rates Influence Palm Oil Prices? Evidence from The Nonlinear ARDL Approach

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Abstract: *This study contributes to the current literature by analysing the asymmetric effects of world crude oil prices, global uncertainty and exchange rates on palm oil prices in Malaysia. It employs the nonlinear Autoregressive Distributed Lags (NARDL) model to examine the nonlinear relationship between the variables. Further, the findings show that world crude oil prices and global uncertainty have a strong asymmetric effect on the palm oil prices in both short and long-run. More specifically, palm oil prices are more sensitive to the increase in world crude oil prices and global uncertainty than a decrease in world crude oil prices and global uncertainty. However, we do not find evidence of a nonlinear relationship between palm oil prices and exchange rate in short-run and long-run. The findings offer meaningful insights into the dynamics of palm oil prices and provide important implications for policymakers and market participants.*

Keywords: Palm Oil Prices; Crude Oil Prices; Exchange Rates; Global Uncertainty; NARDL
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1. Introduction

Palm oil is utilised to produce food and products such as cooking oils, margarine, shampoos, detergents, soaps, biofuels and others. Malaysia has been increasing its sovereignty in oil palm plantation because of the suitable weather condition for oil palm plantation. The Malaysian oil palm plantation industry has developed rapidly since it began to be grown commercially in 1917 (Nambiappan et al., 2018). Palm oil is a major contributor to the gross domestic product (GDP) contributing some 6% of GDP in Malaysia. The total palm oil export revenue increased to RM77.85 billion in 2017 from RM67.92 in 2016 (MPOB, 2017). Hence, the palm oil industry plays a significant role in the Malaysian economy.

In addition, Malaysia is the second-largest producer and exporter of palm oil in the world. Specifically, Malaysia contributes 39% of global palm oil production and 44% of global palm oil exports (MPOC, 2017). Being one of the largest palm oil's producers and exporters in the world, Malaysia is playing a vital role in satisfying an iincreasing global need, particularly in the energy and consumer industries. Therefore, it is essential for the researchers, policymakers, farmers and market players to comprehend how palm oil prices are affected.

Nevertheless, despite the increasing roles of palm oil in both domestic and global markets, there is very little research on palm oil prices. Many researches focus on other commodities, such as world crude oil and other agricultural commodities. Further, studies have attributed the rise in agricultural commodity prices to the impact of world oil prices (Baffes, 2007; Nazlioglu, 2011; Nazlioglu & Soytas, 2012; Gozgor & Kablamaci, 2014). On the other hand, research underlines the roles of volatility in global financial market and exchange rate in explaining commodity prices (Harri et al., 2009; Byrne et al., 2011; Sari et al., 2011; Nazlioglu & Soytas, 2012; among others). Since the Malaysian palm oil market depends on the global market, it is expected that world crude oil prices, global uncertainty and foreign exchange rate may have linkages with the palm oil prices.

Price asymmetry has received growing attention. Earlier literature documents that asymmetry in pricing follows the pattern of rockets and feathers (Bacon, 1991). That is, prices rise faster in response to costs increases than prices drop in response to costs declines. According to Frey and Manera (2007), retail product prices increase more as a result of the rise in input costs, but the prices do not decrease more when input costs fall. Therefore, asymmetric price behaviour is probable in a wide range of markets.

Furthermore, the literature has documented the nonlinearity of various macroeconomic variables over the business cycles (Neftci, 1984; Katrakilidis & Trachanas, 2012; Shin et al., 2014). Crude oil prices and foreign exchange rates have been revealed to asymmetrically influence macroeconomic fundamentals (Atil et al., 2014; Bagnai & Ospina, 2015; Delatte & López-Villavicencio, 2012; Ibrahim, 2015). As palm oil prices are possibly affected by economic activities, they are expected to exhibit nonlinearities. In the existence of nonlinearity, palm oil prices may react differently to the increase and decrease in economic activities. Therefore, this study seeks to shed light on the analysis of pricing asymmetry in the context of palm oil. Specifically, it aims to discover the asymmetric relationship between palm oil prices with world crude oil prices, global uncertainty and exchange rates.

This study contributes to the literature on palm oil prices by offering new evidence on the nonlinear impact of world crude oil prices, global uncertainty and exchange rates on palm oil prices, using more recent data from the period from 2006 to 2017. Unlike research that used the linear regression model to examine the palm oil price behaviour (Gozgor & Kablamaci, 2014), this study addresses the nonlinear issue by using a nonlinear framework. In order to examine the pricing behaviour of palm oil prices, this study employs the recently developed NARDL approach (Shin et al., 2014) by allowing potential asymmetric responses of palm oil prices to world crude oil prices, global uncertainty and exchange rate. The use of NARDL enables the understanding of how palm oil prices response differently when the underlying variables increase and decrease. Primarily, this study aims to offer meaningful insights to policymakers and market participants into how the changes in world crude oil prices, global uncertainty and exchange rates influence palm oil prices.

The remainder of this paper is organised as follows. Section 2 reviews the literature. Sections 3 and 4 present the data and methodology. Section 5 discusses the results, and Section 6 concludes.

2. Literature Review

Researchers have studied the nexus between world crude oil prices and commodity prices. For instance, Baffes (2007) examined the impact of world crude oil prices on the prices of 35 globally traded commodities over the sample period 1960 to 2005. For palm oil commodity, the author finds that an increase in the crude oil price induces intensification in palm oil prices. This is probably because world crude oil plays important roles in transportation and production through the use of various energy-intensive inputs such as fertiliser for agricultural commodities.

Nazlioglu (2011) explored the nonlinear causal relationship between world crude oil prices and three key agricultural commodity prices, namely corn, soybeans and wheat. The empirical results document that nonlinear causality running from the oil prices to most of the agricultural commodity prices. Further, Nazlioglu and Soytas (2012) studied the dynamic relationship between world oil prices, 24 world agricultural commodity prices and exchange rate. In line with Nazlioglu (2011), the findings show that world oil prices have a positive impact on most agricultural commodity prices. Gozgor and Kablamaci (2014) examined the relationship between agricultural commodity prices and world oil prices, exchange rate and perceived risk. Consistent with the earlier studies, the authors provide strong evidence that world oil price positively affects almost all agricultural commodity prices. Particularly, an increase in the world crude oil price escalates the prices of palm oil prices.

Moreover, research on global financial market risk has received increasing attention. Go and Lau (2018) find that prices of the Malaysian crude palm oil market exhibit excess kurtosis and therefore provides a low level of hedging effectiveness during the global financial crisis. Sari et al. (2011) examined whether global risk perception, which is measured by the volatility index (VIX), influence world oil prices. They discover that global risk perceptions exhibit negative impact on oil prices in the long-run. On the other hand, Gozgor and Kablamaci (2014) followed earlier studies (Byrne et al., 2011; Sari et al., 2011) to contemplate the effect of the perceived global risk on the agricultural commodity prices. The findings of Gozgor and Kablamaci (2014) show that the rise of VIX index that presents the increase in risk perceived by investors in the global financial markets have a positive symmetric relationship with the agricultural commodity prices such as palm oil prices.

Furthermore, studies find that exchange rates have an important impact on the price of traded products. Nazlioglu and Soytas (2012) find that there is a positive impact of a weak US dollar on the prices of most agricultural commodities. Similar to Nazlioglu and Soytas (2012), Gozgor and Kablamaci (2014) show that the depreciation of the exchange rate has a positive impact on the prices of almost all agricultural commodity prices including palm oil. This is perhaps due to depreciation in currency tends to increase export. Growing purchasing power, as well as foreign demand, spurs agricultural commodity prices (Harri et al., 2009).

In contrast, there is literature documenting evidence of neutrality of agricultural commodity prices to changes in the exchange rate. Nazlioglu and Soytas (2011) find that agricultural prices do not react to the appreciation or depreciation of the exchange rate in Turkey. Further evidence is provided by Ma et al. (2015). The authors reveal that agricultural prices are not sensitive to the changes in the exchange rate, except for the soybean price. Since previous studies provide mixed results on the link between agricultural commodity prices and exchange rate, this study intends to contribute to the literature by studying the relationship within the NARDL framework.

The presence of price asymmetry has been documented. Delatte and López-Villavicencio (2012) reveal the asymmetric impact of exchange rate variations on prices. Prices respond more to the depreciation in the exchange rate than appreciations in the exchange rate. Atil et al. (2014) investigated the asymmetric responses of gasoline and natural gas prices to oil prices. They found that both prices react more to oil price reduction than to oil price increases. Ibrahim (2015) examined the asymmetric relationship between food and crude oil prices. The author provides evidence that the increase in oil price tends to increase the food price, whereas the reduction in oil price does not have an impact on the food price. These findings support the asymmetric behaviour of prices.

Overall, most of the earlier studies explore the agricultural price behaviour using the linear model. Therefore, this study fills the research gap by examining the asymmetric relationship between Malaysian palm oil prices, world crude oil prices, global uncertainty and exchange rate. We anticipate a significant nonlinear relationship between palm oil prices and the explanatory variables.

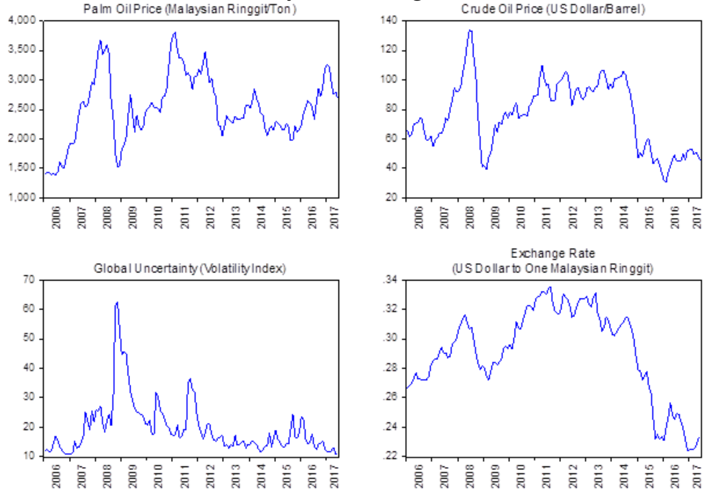
3. Data

Monthly data on Malaysian palm oil prices (PALM) is extracted from the Malaysian Palm Oil Board (MPOB). Due to the availability of all data, the sample covers the periods from January 2006 to June 2017, giving us a total of 138 monthly observations.

The volatility index (VIX) of the Chicago Board Options Exchange Market tracks the implied volatility of the US market and measures the global risk perceptions. Following studies by the World Bank Group (2017), Dimic et al. (2016) and Gozgor and Kablamaci (2014), we use the VIX to capture global financial market uncertainty. The VIX, world crude oil prices of West Texas Intermediate (OIL), and the exchange rate of the US dollar to one Malaysian ringgit (EXR) are retrieved from the Federal Reserve Bank of St. Louis.

The related data are presented in Figure 1. The graphs show that the Malaysian palm oil price fluctuated between MYR1,390 per tonne and MYR3,811 per tonne over the sample period. The world crude oil price changed drastically from USD63.57 per barrel in 2006 to USD46.89 per barrel in 2017. Moreover, the global uncertainty, which is measured by the volatility index, ranged from 10.51 to 62.64. Specifically, the global uncertainty increased to the highest level during the 2008/2009 global financial crisis, signifying that volatility soars during the crisis periods. The Malaysian exchange rate also depreciated from USD0.2665/MYR in 2006 to USD0.2339/MYR in 2017. All variables are then transformed into logarithm terms, except for the exchange rate.

Figure 1: Palm oil price, crude oil price, global uncertainty and the Malaysian exchange rate



4. Methodology

Following Shin et al. (2014), this study employs the recently developed NARDL approach to explore the asymmetric relationship between palm oil prices, world crude oil prices, global uncertainty and exchange rate. There are several benefits of NARDL. First, the NARDL approach allows the examination of the asymmetry and nonlinear link among the variables for both short-run and long-run through positive and negative partial sum decompositions of the explanatory variables. Second, the variables do not need to have the same order of integration and be stationary in the NARDL model.
The nonlinear asymmetric long-run relationship between palm oil prices, world crude oil prices, global uncertainty and exchange rate is examined. The model is specified as:

$$PALM_t = \alpha_0 + \alpha_1^+ OIL_t^+ + \alpha_1^- OIL_t^- + \alpha_2^+ VIX_t^+ + \alpha_2^- VIX_t^- + \alpha_3^+ EXR_t^+ + \alpha_3^- EXR_t^- + \varepsilon_t \quad (1)$$

where PALM is palm oil prices; OIL is world crude oil prices; VIX is global uncertainty; EXR is the Malaysian exchange rate. α_i is vector of long-run parameters to be estimated. x_t^+ and x_t^- are the partial sums of positive and negative changes in x_t:

$$x_t^+ = \sum_{i=1}^{t} \Delta x_i^+ = \sum_{i=1}^{t} \max(\Delta x_i, 0) \tag{2}$$

$$x_t^- = \sum_{i=1}^{t} \Delta x_i^- = \sum_{i=1}^{t} \min(\Delta x_i, 0) \tag{3}$$

To test for the possibility of linear cointegration, the error correction representative of the linear ARDL model is specified as:

$$\begin{aligned}\Delta PALM_t = \rho_0 + \eta_1 PALM_{t-1} + \eta_2 OIL_{t-1} + \eta_3 VIX_{t-1} \\ + \eta_4 EXR_{t-1} + \sum_{i=1}^{p} \lambda_i \Delta PALM_{t-i} \\ + \sum_{i=0}^{q} \theta_i \Delta OIL_{t-i} + \sum_{i=0}^{r} \gamma_i \Delta VIX_{t-i} \\ + \sum_{i=0}^{s} \phi_i \Delta EXR_{t-i} + \varepsilon_t\end{aligned} \tag{4}$$

The terms ηi represent long-run relationship, whereas the terms with summation signs refer to error correction dynamics. The optimal lag structure of the error correction model is selected based on the Akaike Information Criteria. The model in Equation (4) allows for examining the short-run and long-run relationship between the variables when the variables are linear. Nevertheless, the model will be misspecified when they are asymmetric.

To examine the nonlinear relationship, the study proceeds with the estimation of the NARDL model in error correction form, which is described as:

$$\begin{aligned}\Delta PALM_t = \rho_0 + \rho_1 PALM_{t-1} + \; & \beta_1^+ OIL_{t-1}^+ + \beta_1^- OIL_{t-1}^- \\ & + \beta_2^+ VIX_{t-1}^+ + \beta_2^- VIX_{t-1}^- + \; \beta_3^+ EXR_{t-1}^+ \\ & + \beta_3^- EXR_{t-1}^- + \sum_{i=1}^{p} \lambda_i \, \Delta PALM_{t-i} \\ & + \sum_{i=0}^{q} \theta_i^+ \, \Delta OIL_{t-i}^+ + \sum_{i=0}^{r} \theta_i^- \, \Delta OIL_{t-i}^- \\ & + \sum_{i=0}^{s} \gamma_i^+ \, \Delta VIX_{t-i}^+ + \sum_{i=0}^{t} \gamma_i^- \, \Delta VIX_{t-i}^- \\ & + \sum_{i=0}^{u} \phi_i^+ \, \Delta EXR_{t-i}^+ + \sum_{i=0}^{v} \phi_i^- \, \Delta EXR_{t-i}^- + \varepsilon_t \end{aligned} \quad (5)$$

The superscripts (+) and (−) indicate the positive and negative partial sums decomposition as formulated in Equations (2) and (3), respectively. *p*, *q*, *r*, *s*, *t*, *u* and *v* are lag orders. Similar to Fousekis et al. (2016) and Katrakilidis and Trachanas (2012), the empirical analysis follows four steps. Firstly, Equation (5) is estimated by standard Ordinary Least Square (OLS). The general-to-specific approach is applied to remove insignificant lags from the model. Secondly, the existence of the long-run relationship between variables is tested using the *F*-test, *F*pss and *t*-test, *t*BDM, respectively. Thirdly, the presence of long-run and short-run asymmetries is examined. The long-run symmetry with the null hypothesis $\beta_i^+ = \beta_i^-$ is tested. The positive and negative long-run coefficients are denoted by $\alpha_i^+ = -\beta_i^+/\rho_1$ and $\alpha_i^- = -\beta_i^-/\rho_1$, respectively. On the other hand, the short-run symmetry with the null hypothesis of $\sum_{i=0}^{q} \theta_i^+ = \sum_{i=0}^{r} \theta_i^-$ is also tested. To confirm the appropriateness of an asymmetric model, the Wald test for both long-run (WLR) and short-run (WSR) symmetries is applied. The rejection of either the long-run symmetry or short-run symmetry yields the NARDL model with long-run asymmetry or short-run asymmetry.

5. Results

Table 1 reports the descriptive statistics of the PALM, OIL, VIX and EXR. The standard deviation of world crude oil prices is higher than that of palm oil prices. This implies that world crude oil prices have greater fluctuations compared to palm oil prices. With the exception of the VIX, all variables are negatively skewed. In addition, the results of the Jarque-Bera test confirm that the variables have non-normal distributions.

Table 1: Descriptive statistics

	PALM	OIL	VIX	EXR
Unit of measurement	MYR/Tonne	USD/Barrel	Value	USD/MYR
Mean	2519.667	76.214	19.630	0.291
Median	2514.000	76.395	16.915	0.296
Maximum	3811.000	133.930	62.640	0.335
Minimum	1390.000	30.320	10.510	0.224
Standard deviation	565.658	23.058	9.190	0.031
Skewness	0.069	0.031	2.330	-0.635
Kurtosis	2.647	2.179	9.619	2.432
Jarque-Bera	0.825** (0.042)	3.896** (0.019)	376.758*** (0.000)	11.121*** (0.004)

Notes: *All statistics are based on original data values. PALM is palm oil price; OIL is crude oil price; VIX is global uncertainty; EXR is the Malaysian exchange rate. P-values are in parentheses. ***, ** and * denote significance at 1%, 5% and 10%, respectively.*

Table 2: Results for unit root tests

	Level		First difference	
	ADF	PP	ADF	PP
PALM	-3.087 (0.114)	-2.857 (0.180)	-8.401*** (0.000)	-8.395*** (0.000)
OIL	-3.021 (0.131)	-2.289 (0.437)	-6.322*** (0.000)	-7.930*** (0.000)
VIX	-3.082 (0.115)	-3.033 (0.127)	-9.799*** (0.000)	-11.977*** (0.000)
EXR	-1.514 (0.820)	-1.056 (0.932)	-8.084*** (0.000)	-7.794*** (0.000)

Notes*: PALM is palm oil price; OIL is crude oil price; VIX is global uncertainty; EXR is the Malaysian exchange rate. ADF and PP are the Augmented Dickey Fuller and Phillips-Perron tests. P-values are in parentheses. *** denotes significance at 1% level respectively.*

ARDL and NARDL are ideal techniques for estimating variables which are integrated of order zero and one, I(0) and I(1). Prior to testing the ARDL and NARDL, it is necessary to perform the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests to determine the order of integration of each data series. Table 2 presents the results of the unit root test for the variables. The null hypothesis of ADF and PP tests implies that a series has a unit root while the alternative hypothesis suggests that the series is stationary. The results show that we fail to reject the null hypothesis for the levels of all variables. However, the test statistics for the first-order differenced variables strongly reject the null hypothesis, implying that the variables are integrated of order one, I(1). Since none of the variables is integrated of order two, I(2), this study proceeds to estimate the ARDL and NARDL.

Table 3: Results for the Bound test of cointegration in the linear and nonlinear models

	F-statistics	Results
Linear ARDL	$F\text{pss}_{\text{Linear ARDL}} = 0.790$	No cointegration
Nonlinear ARDL	$F\text{pss}_{\text{Nonlinear ARDL}} = 4.360$	Cointegration

Notes: *Pesaran et al. (2001) tabulate the 5% critical values of FPSS as 3.23 to 4.35 for k = 3. The detailed results of the NARDL model is presented in Table 4.*

Table 3 shows the results for the bound tests of cointegration using linear and nonlinear models. The F-statistics of the bound test in the linear ARDL specification is 0.790 and is evidently below the lower bound critical value of 3.23. This indicates that we fail to reject the null hypothesis of no cointegration, suggesting that there is no long-run linear relationship between the variables. In contrast, the F-value of the bound test is 4.360 in the nonlinear ARDL model and exceeds the upper bound critical value of 4.35. We, therefore, conclude the existence of a long-run nonlinear relationship. A potential reason for the non-rejection of the null hypothesis of no long-run relationship in the linear model might be the presence of nonlinearities among the variables. Consequently, the results provide evidence that the regular ARDL model estimation, which ignores the existence of asymmetries may lead to biased results.

Next, Table 4 presents the estimation results of how palm oil prices are asymmetrically affected by world crude oil prices, global uncertainty and exchange rate. The bounds tests show that both the tBDM and FPSS statistics reject the null hypothesis of no cointegration. Thus, there is evidence of asymmetric cointegration. Moreover, the serial correlation test and normality test are insignificant, indicating that the models are correctly specified, have non-autocorrelation and normality.

Table 4: Dynamic Asymmetric Estimations of Variables

Variables	Coefficient	Standard error
Constant	0.668*** (0.000)	0.176
$PALM_{t-1}$	-0.213*** (0.000)	0.054
$OIL+_{t-1}$	0.137 (0.134)	0.091
$OIL-_{t-1}$	-0.095** (0.043)	0.046
$VIX+_{t-1}$	-0.158** (0.011)	0.061
$VIX-_{t-1}$	0.018 (0.779)	0.064
$EXR+_{t-1}$	1.002 (0.101)	0.605
$EXR-_{t-1}$	0.216 (0.436)	0.276
$\Delta PALM_{t-1}$	0.311*** (0.000)	0.093
$\Delta PALM_{t-4}$	0.311*** (0.000)	0.097
$\Delta OIL+_{t-8}$	0.446*** (0.003)	0.144
$\Delta OIL-_{t-12}$	-0.218** (0.024)	0.095
$\Delta VIX+_{t-1}$	0.136* (0.084)	0.078
$\Delta VIX+_{t-2}$	0.190** (0.012)	0.074
$\Delta VIX+_{t-3}$	0.268*** (0.000)	0.072
$\Delta VIX+_{t-5}$	0.201*** (0.002)	0.065
$\Delta VIX+_{t-6}$	0.199*** (0.002)	0.062
$\Delta VIX+_{t-7}$	0.173*** (0.005)	0.061
$\Delta VIX+_{t-8}$	0.193*** (0.003)	0.062
$\Delta VIX+_{t-9}$	-0.038 (0.525)	0.059
$\Delta VIX-_{t-8}$	-0.103 (0.212)	0.082
$\Delta EXR+_{t-3}$	-1.127 (0.319)	1.125
$\Delta EXR+_{t-9}$	-1.483 (0.168)	1.066
$\Delta EXR-_{t-2}$	1.790** (0.037)	0.847
Long-run coefficients		
OIL+ 0.643* (0.077)	OIL− -0.444 (0.111)	
VIX+ -0.741** (0.018)	VIX− 0.084 (0.775)	
EXR+ 4.704 (0.115)	EXR− 1.011 (0.468)	
Asymmetry tests		
$W_{LR, OIL}$ 6.753** (0.011)	$W_{SR, OIL}$ 15.640*** (0.000)	
$W_{LR, VIX}$ 6.212** (0.014)	$W_{SR, VIX}$ 12.490*** (0.001)	
$W_{LR, EXR}$ 1.069 (0.304)	$W_{SR, EXR}$ 2.598 (0.110)	
Bounds tests		
F_{PSS} = 4.360** t_{BDM} = -3.944**		

Diagnostic tests
Serial correlation (χ^2) = 25.950 (0.958) Normality (χ^2) = 1.310(0.519) Adjusted R^2 = 0.537

Notes: *PALM is palm oil price; OIL is crude oil price; VIX is global uncertainty; EXR is the Malaysian exchange rate. "+" and "−" denote positive and negative partial sums. Pesaran et al. (2001) tabulate the 5% critical values of FPSS as 3.23 to 4.35 for k = 3. WLR and WSR refer to the Wald test for the null of long-run symmetry and short-run symmetry, respectively. P-values are in parentheses. ***, ** and * denote significance at 1%, 5% and 10%, respectively.*

Furthermore, the results of the Wald test for detecting the short- and long-run symmetry are reported. The Wald statistics firmly reject the null hypothesis of symmetric long-run dynamics and the null of short-run symmetry for the world crude oil prices and global uncertainty at the 5% and 1% significance levels. We conclude that palm oil prices exhibit strong asymmetric responses to the changes in crude oil prices and global uncertainty. Therefore, the use of a linear model in examining the relationship between crude oil prices, global uncertainty and palm oil prices may provide misleading results.

However, we find that the Wald test fails to reject the null of long-run and short-run dynamic symmetry for the exchange rate. The findings show that there is no evidence of a nonlinear association between palm oil prices and exchange rate in either long-run or short-run.

Next, turning to the analysis of long-run coefficients, we find that the response of palm oil prices to the world crude oil price decrease (OIL−) is statistically insignificant in the long-run. Conversely, the long-run coefficient on the world crude oil price increase (OIL+) is 0.643 and statistically significant at the 10% level. This implies that a 1% increase in the world crude oil prices leads to a 0.643% rise in the palm oil prices. This is consistent with the findings of Nazlioglu (2011), Nazlioglu and Soytas (2012) and Gozgor and Kablamaci (2014) that world oil prices have a positive influence on agricultural commodity prices. Crude oil prices play essential roles in the agricultural industry, especially in transportation and production for the agricultural commodities (Baffes, 2007). Therefore, the increase in crude oil prices results in the rise in palm oil prices.

In addition, the estimated long-run coefficient on the global uncertainty increase (VIX+) and the global uncertainty reduction (VIX−) are -0.741 and 0.084, respectively. This indicates that a 1% intensification in global uncertainty results in a 0.741% significant decrease in the prices of palm oil in the long-run. In contrast, a 1% decline in global uncertainty contributes to only 0.084% decrease in palm oil prices in the long-run. In short, the palm oil prices are more sensitive to the increase in global uncertainty than the decrease in the uncertainty. The finding suggests that increases in global uncertainty create higher market risks which may reduce global palm oil demand and subsequently decrease the prices of palm oil. However, the result is inconsistent with the findings of Gozgor and Kablamaci (2014), who find an increasing effect of the global risk on the agricultural commodity prices.

Contrary to the results of Nazlioglu and Soytas (2012) and Gozgor and Kablamaci (2014), we do not find any significant impact of depreciation and the appreciation of the exchange rate on the palm oil prices. Nevertheless, our findings lend support to the results of Nazlioglu and Soytas (2011) and Ma et al. (2015) who find agricultural prices do not respond to the changes in the exchange rate. This is perhaps due to the changes in the exchange rate may not be large enough to increase or reduce palm oil prices.

6. Conclusion

This study is a novel attempt to employ the NARDL to empirically examine the long-run and short-run asymmetric effect of world crude oil prices, global uncertainty and exchange rates on the palm oil prices for the case of Malaysia. Upon studying monthly data covering the period between January 2006 and June 2017, the bounds tests for cointegration in the nonlinear model document found that the underlying variables have a significant asymmetric long-run relationship with the changes in palm oil prices. Further, we reveal strong evidence supporting nonlinear reactions of the palm oil prices to world crude oil prices and global uncertainty in both short-run as well as long-run. However, we find that the exchange rate does not exhibit an asymmetric impact on palm oil prices.

The findings show that palm oil prices are more sensitive to increases in the world crude oil prices and global uncertainty than decreases in the world crude oil prices and global uncertainty. The increase in world crude oil prices increases the palm oil prices. High world oil prices push up the costs of palm oil production such as diesel fuel which is used for transportation. This, therefore, subsequently increases the palm oil prices. On the other hand, the study finds that escalation in global financial market uncertainty decreases the palm oil prices. Nevertheless, the findings reveal the neutrality of palm oil prices to the appreciation and depreciation of Malaysian ringgit.

The findings provide several important implications for policymakers and market participants. The evidence shows a significant nonlinear relationship between palm oil prices and crude oil prices and global uncertainty. The results suggest that policy attention should be given more on the issues of world crude oil prices and global uncertainty than the exchange rate. The findings also offer insights for policymakers in policy formulation and implementation to help farmers deal with the changes in palm oil price and hence enable Malaysia remains its competitiveness in the international market. Policymakers may seek accord with crude oil exporters and producers to stabilise crude oil prices in order to maintain the movement of palm oil prices. Since the palm oil prices decrease significantly when global uncertainty increases, the results suggest that policymakers can take initiatives to mitigate the negative effect of global uncertainties, particularly from major palm oil importers, on palm oil prices. In addition, the result highlights that agriculture commodity, namely palm oil, is not a haven for the market participants during the high level of uncertainty. By understanding the effect of escalation of global risk on palm oil prices, this study recommends that market participants consider other safer investment amid high global uncertainty.

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