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Asymmetric Impact of World Oil Prices on Marketing Margins: Application of NARDL Model for the Indonesian Coffee

Kamaruddin Kamaruddin[1], Yusri Hazmi[2]*, Raja Masbar[3], Sofyan Syahnur[3], M. Shabri Abd. Majid[3]

[1]Principal of SMAN1 Kutapajang Gayo Lues Aceh, Indonesia, [2]Department of Commerce, Politeknik Negeri Lhokseumawe, Indonesia, [3]Faculty of Economics and Business, Syiah Kuala University, Indonesia. *Email: yusri.poltek@gmail.com

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ABSTRACT

The World oil prices shocks is believed become the main important role to movements marketing margins of agricultural commodities, include coffee. We aim to investigate the impact of world oil prices shocks on coffee marketing margins for Indonesia. We decompose world oil prices into positive and negative shocks to investigate the asymmetric impacts on marketing margins. For this aims, we adopt a NARDL model to capture the asymmetric impacts both in long and short run. We found that a decrease in oil price has a positive and significant impact on marketing margins, while a decrease in oil price has a significant negative impact. An increase in world oil prices lead to reduce marketing margins. Similarly, a decrease in world oil prices, also impact on the reduction of marketing margins. We therefore conclude that impacts of world oil prices shocks on marketing margins not only asymmetric in magnitude but also in direction. Particularly, the result of the NARDL estimation reveal that negative shock in oil prices has more pronounced impact than positive shocks on the reduction of marketing margin. This result implies that Indonesian coffee producers more benefit when the world oil price decreases compare than increases.

Keywords: Oil Prices, Marketing Margin, Coffee Producers, NARDL Model
JEL Classifications: C32, F13, F43, G13

1. INTRODUCTION

Price variations not only can be a positive signals for market players, but also as well as negative signals if the price variations are too large and cannot be anticipated. Domestic and global economic cycles lead to volatility, include agricultural commodities prices. Domestic economic performances such as GDP per capita and exchange rates can influence commodity prices. In particular, the exchange rate can be a determining factor that causes a price gap between the domestic market (producer market) and the international market. If the gap is too large, its can reduce farmers welfare is caused the share of the price received by farmers is too low compared to the price paid by the final consumer at the international market. Many empirical evidence linking changes in exchange rate and the GDP on the commodities prices. Some studies found the strong relationship between the exchange rate and commodity prices (Nazlioglu and Soytas, 2012; Zhang et al., 2016). Other studies, also claim a strong impact of GDP on commodity prices (Ibrahim, 2015; Bekkers et al., 2017). They also found that the changes in exchange rates and GDP affected commodity trade, global and local food prices. In edition Global economic cycles also lead to volatility and persistence over national commodity prices. Changing trends in world food prices endanger food security, worldwide, particularly in developing and underdeveloped countries. The dynamics of the global economy influence the behavior patterns of commodity markets (Ivanic and Martin, 2018). The 2008 global financial crisis and the 2011 European debt crisis have triggered changes in the prices of food commodities and crude oil. Commodity price movements become more volatile after the 2008 global financial turmoil.

The World oil price had believed as a key player in the global economic performance. Jawad (2013) suggested that consumption demand and investment demand are affected by the variation in world oil price. In this decade, some researchers had investigated the relation of oil prices and macroeconomic performance, term of trade, stock market, gold and food prices (Abhyankar et al., 2013; Kumar, 2017; Ju et al., 2016; Echchabi and Azouzi, 2017; Haque and Imran, 2020; Rahman, 2020). But, studies of relation oil and agricultural prices, include food prices still become a long debate among researchers. Some of them claimed that there is no relation of oil prices and food prices. However, a sum researchers stated that there are strong impact of oil prices on agricultural prices include food prices. Some empirical findings documented the absence of relation between oil prices and commodity prices. For examples, provided no relations between oil prices and several agricultural commodities prices namely corn, rice, sugar, soybeans and wheat (Zhang et al., 2018). Reboredo (2012) also notes that food price spikes experienced are not caused by drastic increases in oil price. Similarly, Valcarcel and Wohar (2013) confirmed that oil price changes do not transmit to domestic inflation. Baumeister and Kilian (2014) and Fowowe (2016) also shown that there is no evidence to support a long or short run cointegration relationship between oil and agricultural prices. In contrast, many researchers shown that the presence of relation between oil price and agricultural commodity prices. Chen et al., (2010) found that there is an important relationship between crude oil prices and global food prices. Esmaeili and Shokoohi (2011) also found that the crude oil price index had a certain impact on the food production index. Tofighi and Enders (2008) provided the significant contribution of oil price on agricultural prices. Al-Maadid et al., (2016) again provided strong evidence for an important link between food and energy prices. Rezitis (2015) also found that there is a two-way Granger causal relationship between crude oil price and agricultural product prices. However, in the study of varieties, scholars believe that only some agricultural products and oil prices have a long-term nonlinear relationship. For example, Natanelov et al., (2011) who investigate the dynamic relationship between the crude oil, gold futures markets and the market prices of eight agricultural products such as cocoa, corn, and wheat. The results shown that only cocoa and wheat prices of these products had a long-term close relationship with the price of crude oil futures market. These contrasting findings have continued to excite intense debate and paved ways for further research. From the two groups of findings, it cannot be concluded with certainty the relationship between world oil prices and agricultural commodity prices. This is because the method used is still using a linear approach, while the pattern of world oil price movements is very volatile. Therefore, since the last decade, several researchers have started to use a nonlinear approach to accommodate the oil price fluctuation phenomenon.

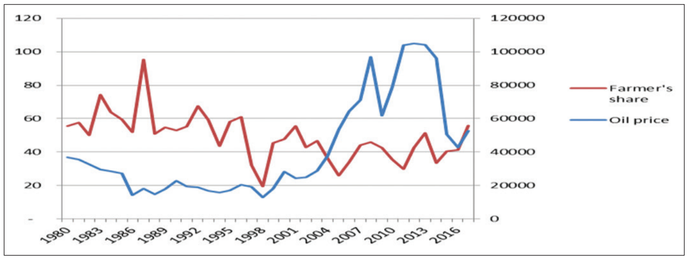
A few studies have shown that there is only one-way nonlinear effect between oil price and food price. For example, by using linear and nonlinear Granger causality tests, Nazlioglu (2011) Granger found that there was no linear feedback between oil price and agricultural product price, but a one-way nonlinear causal relationship from oil price to agricultural product price. Cheng and Cao (2019) explored the dynamic relationship between global crude oil price and food price indices within a nonlinear framework. They used threshold vector autoregressive model (TVAR) and the threshold vector error correction model (TVECM) model. The results shown that there is a nonlinear causal relationship between global crude oil and food price indices. Their findings suggest that the adjustment process of the food price indices towards equilibrium is highly persistent and grows faster than oil price when a threshold is reached.

Ibrahim (2015) used the NARDL model to find that whether in the long-term or short-term, higher crude oil prices would have an impact on food prices, while the decline in oil prices will not affect food prices. Pal and Mitra (2017) used the monthly price data from January 1990 to February 2016, using the QVARDL model combined with wavelet analysis to find that global oil prices are co-movement with food prices and other sub-indicators such as grains, sugar and vegetable oils and only have one-way Granger causality from crude oil to food prices. Lacheheb and Sirag (2019) also studied the relationship between oil prices and inflation in Algeria and concluded that the relation is asymmetric. An increase in oil prices leads to increase in price level whereas the impact of decrease in oil price is insignificant. These results clearly indicate the presence of market power.

Apart indicates of the presence of market power is marketing margins of commodities is very large that shows the gap between consumer prices in a global and producer prices in domestic market. If the gap is too large, its can reduce farmer's welfare is caused the share of the price received by farmers is too low compared to the price paid by the end consumer. The economic variable that show the ratio of farmer gate and end consumer pay prices, is called the farmer's share. In contrast, marketing margins is gap between end consumer prices and farmer gate prices. The large in farmer's share indicates the small in marketing margins and vice versa. while decrease in marketing margins of agricultural commodities include food, its means increase in welfare of producers. As part of food, prices of coffee in global and producer market is predicted influenced by oil prices. Some studies found that there are an asymmetric prices transmission between global and producer market (Subervie, 2011; Mofya-Mukuka and Abdulai, 2013) due to the presence of market power by agent so that would reduce in coffee producer welfare (Meyer and Von Cramon-Taubadel, 2004). The case of Indonesia, as one of the four main producers of coffee, there is no study Thatto investigate relation of world oil prices and the gap of coffee prices in the global and producer market. Therefore, the study will explore the impact of world oil prices on the two prices. If the gap of coffee prices between global and producer market is too large, its can reduce farmer's share Indonesian coffee. Figure 1 show world oil prices and farmer's share for Indonesian coffee. Based on Figure 1, relation between world oil prices and farmer's share is predicted nonlinear, so that strong possibility to use nonlinear and asymmetric approaches to explore this performance.

As mention above, marketing margins and farmer's share are related conceptually, so that by analyzing one of these variables is sufficient to describe the research results. Therefore, in this study we only will use marketing margins as a target. In the context of separate world oil price shocks into positive and negative shock is still rarely in studies that relate to the marketing margins

Figure 1: World oil price and Indonesian coffee farmer's share



of agricultural commodities, including coffee. By analyzing marketing margins, it means implicitly analyzing price volatility in international markets (as end consumers) and price volatility in producer markets (as farmers) simultaneously. As part of food, coffee is also predicted to experience price movements due to world oil price shocks.

Most of Previous studies only investigate about relationships between oil and agricultural prices in the global and producer markets. The main contribution of this study is the first time to analyze asymmetric impact of world oil prices on marketing margins, to incorporate the prices gap of the two markets. For this purpose, we will use the NARDL model to get the best conclusion. There are three main focus of this research, namely (1) to investigate co-integration relationships among marketing margins, GDP, exchange rate, and world oil prices shocks by decompose world oil price shocks into positive and negative shocks; (2) to analyze the impact of positive and negative shocks in world oil prices on the marketing margins of Indonesian coffee, whether symmetric or an asymmetric? and (3) to explore its implication on welfare of Indonesian coffee producers. The next section of this paper summarizes a number of literature reviews with respect to previous relevant research. In the third part, the empirical model used is described. The data and research results are presented in section 4. Finally, in section 5 the main conclusions and recommendations from the findings of this study will be summarized.

2. RESEARCH FRAMEWORK

The study of impact world oil prices shocks on marketing margins of agricultural commodity prices still rarely. But, the increasing co-movements between the world oil and agricultural commodity prices have renewed interest in determining price transmission from oil prices to those of agricultural commodities. There are some recent studies that investigate the relation between world oil price and agricultural commodity prices, include food prices. Some empirical findings documented the absence of relation between oil prices and commodity prices (Du et al., 2010; Nazlioglu and Soytas, 2011; Reboredo, 2012; Fowowe, 2016; Mukhlis et al., 2020).

Du et al., (2010) examined the extent to which oil price volatility is transmitted to agricultural commodity markets. The authors employed weekly data from November 16, 1998 to January 26, 2009. Structural change tests showed the existence of 1 structural change in corn and wheat prices. The authors then divided the sample into 2 sub-periods and estimations were done separately for the 2 sub-periods. Estimation results also showed that oil prices and agricultural commodity prices had contrasting behavior, thus suggesting no evidence of correlation or volatility spillover between these prices. Nazlioglu and Soytas (2011) examined the relationship between global crude oil prices and agricultural commodity prices in Turkey. The authors employed monthly data over the period January 1994 to March 2010 and the variables examined were world crude oil prices, Turkish lira/US dollar exchange rate, and prices of wheat, maize, cotton, soybeans, and sunflower. Testing for long run causality shown that neither the exchange rate nor world oil prices cause prices of wheat, cotton and soybeans. However, it was found that the exchange rate Granger causes maize and sunflower prices, and oil prices Granger cause sunflower prices. Short run causality was examined using impulse response functions and the results show no statistical significant transmission from oil price shocks to agricultural prices and the exchange rate. The authors concluded that oil prices do not play an important role in determining the behaviors of agricultural prices in Turkey in both the short and long run. Reboredo (2012) used weekly data over the period January 9, 1998 to April 15, 2011 to examine co-movements between world oil prices and prices of corn, soybeans, and wheat. Using copula models, empirical results showed the oil-food dependence is weak and there is no extreme market dependence between oil and food prices. The authors identified that the dependence relationship between oil and food prices changed after 2007. Structural break tests identified 1 structural break and the author then re-estimated the copulas for the periods before and after the identified structural break. The results still showed weak oil-food dependence. The author concluded that the results support the neutrality hypothesis that oil prices do not have a significant effect on agricultural commodity prices.

Furthermore, Fowowe (2016) also investigated to get answer about do oil prices drive agricultural commodity prices in South Africa? His findings confirm previous assertions that local agricultural prices are generally neutral to oil price changes. This owes largely to the fact that oil prices are determined in global markets while local agricultural prices are affected by stabilization policies such as price controls, import barrier reductions, and food export restrictions. The neutrality results indicate that changes in global oil prices are not transmitted to agricultural commodity prices in South Africa, and that other factors are responsible for the recent surge in agricultural commodity prices. Mukhlis et al., (2020) also investigated impact of world oil price and exchange rate on cocoa prices in Indonesian domestic market. Based on the VECM approach the study found disequilibrium in the Indonesian cocoa markets due to shocks in the world cocoa market, exchange rate, and world oil prices were corrected in realizing long-run equilibrium conditions. The exchange rate affected Indonesian cocoa prices but fluctuations in world oil prices was independent to cocoa prices. In contrast, many researchers shown that there is strong impact of oil price on agricultural commodity prices (Saghaian, 2010; Chen et al., 2010; Esmaeili and Shokoohi, 2011; Nazlioglu and Soytas, 2011; Rezitis, 2015; Zhang et al., 2018; Ibrahim, 2015; Sek, 2017; Cheng and Cao, 2019). Some of them claimed the impact is linear and symmetric. However, other researchers in recent stated the impact of oil prices on agricultural prices is nonlinear and asymmetric.

Most of researchers, who claimed that crude oil prices have a significant impact on agricultural commodity prices, used linear regression models such as VAR, VEC, ARDL, and the corresponding co-integration and causality tests to investigate the relationships of the two prices. Saghaian (2010) found the co-integration relationships between crude oil and corn, soybean and wheat prices and the causality running from oil prices to these agricultural commodity prices. Using the principle component analysis and causality test, Esmaeili and Shokoohi (2011) found that crude oil prices had influenced on food production index and consequently had indirect effects on food prices. Chen et al., (2010) use an autoregressive distributed lag model (ARDL) to reveal that each grain price is significantly affected by crude oil and other grain prices. Rezitis (2015) used panel VAR and Granger causality test to study the relationship between crude oil price and the price of 30 kinds of agricultural products and found that there is a two-way Granger causal relationship between crude oil price and agricultural product price.

In addition, a few researches used several approaches and found a nonlinear and asymmetric relation between oil prices and agricultural prices. Nazlioglu and Soytas (2011) extends the literature on the oil–agricultural commodity prices nexus, which particularly concentrates on nonlinear causal relationships between the world oil and three key agricultural commodity prices (corn, soybeans, and wheat). To this end, the linear causality approach of Toda–Yamamoto and the nonparametric causality method of Diks–Panchenko are applied. The linear causality analysis indicated that the oil prices and the agricultural commodity prices did not influenced each other, which supports evidence on the neutrality hypothesis. In contrast, the nonlinear causality analysis shows that there is a persistent unidirectional nonlinear causality running from the oil prices to the corn and to the soybeans prices. Cheng and Cao (2019) explored the dynamic relationship between global crude oil price and food price indices within a nonlinear framework. They used threshold vector autoregressive model (TVAR) and the threshold vector error correction model (TVECM) model. The results shown that there is a nonlinear causal relationship between global crude oil and food price indices. Their findings suggest that the adjustment process of the food price indices towards equilibrium is highly persistent and grows faster than oil price when a threshold is reached.

Furthermore, in recent years some scholars used nonlinear autoregressive distributive lag (NARDL) model to investigate impact of the one to other prices. Using the model, Long and Liang (2018) studied pass-through effects of crude oil prices on consumer and producer price indices in China. They found that the impact is nonlinear, greater when oil prices go up and smaller when they go down however, symmetric ARDL fails to establish long run relation. Lacheheb and Sirag (2019) also studied the relationship between oil prices and inflation in Algeria and concluded that the relation is asymmetric. An increase in oil prices leads to increase in price level whereas the impact of decrease in oil price is insignificant. The recent study, Sarwar et al., (2020) examined the pass-through effect of crude oil prices on food and non-food prices in Pakistan using this model for 1990 Q3 to 2019 Q4 period. Their finding show that oil prices effect both food and non-food inflation, but effect is more pronounced in non-food inflation. It is also found that the impact is asymmetric, that is, effect is positive and significant only when oil price in crease. Some years before, Ibrahim (2015) and Sek (2017), especially have investigated the asymmetric impact of oil prices on food prices and consumer prices. Ibrahim (2015) found that presence an asymmetric impact of oil prices shocks on food prices. His findings, shown that only positive shock in oil price had significant impact on food price. Meanwhile, negative shock did not occur. Similarly, in the short term, only the presence a significant impact of positive shocks in oil prices. Sek (2017) concluded that oil price changes have limited effect on consumer prices in the long run. The results also indicate the nonlinearity of the impact of oil price on consumer prices. These results clearly indicate the presence of market power.

Apart indicates of the presence of market power is a large in marketing margins of commodities. A few studies about marketing margin smatter for assessing welfare impacts of food price increases through prices transmission. Following the surge in world food prices of 2007-2008, Dawe and Maltsoglou (2014) investigated whether food price increases are beneficial or detrimental for households. They found that most of marketing margins are fixed, not proportional, and further that assuming proportional marketing costs leads to a bias towards finding negative impacts of higher food prices. The study of Mandizvidza (2017) attempted to fill the knowledge gap on the performance of Limpopo Province's tomato markets by examining prices at successive marketing levels. The gross marketing margins constitute about 85.1 percent of the consumer's South African Rand. There exists a large gap between what consumers pay for each unit of tomatoes purchased from retailers, and the amount farmers receive for the same quantity from retailers in Limpopo Province. The other researchers, Bekkers et al., (2017) estimated the food prices pass through from global to local consumer prices in 147 countries. The findings shown that income per capita is the dominant factor explaining cross-country variation in pass through of food prices. This means, greater price transmission of food price shocks at the commodity level to final consumers in low-income countries than in high-income countries.

3. RESEARCH METHOD

Based on the previous description, it can be stated that food prices in producer markets and global markets are influenced by world oil prices (Ibrahim, 2015; Dillon and Barrett, 2016). Especially in the domestic market, GDP and the exchange rate are also can affect agricultural commodity prices. The gap between the prices in the global market and the producer market is expressed as a marketing margins. Therefore, the initial framework model can be constructed as equation (1).

$$M = W(O) - P(O,Y,K) \quad (1)$$

In equation (1), W and P are the price of coffee in the international market and in the producer market, O is world oil prices, and K is rupiah-USD exchange rate. Based on equation (1) marketing margins M is influenced by three exogenous variables, namely the world oil prices, GDP and the exchange rate. In more complete form it is expressed in equation (2).

$$M = Y^{\beta} K^{\omega} O^{\gamma} \tag{2}$$

Since the values of all these variables are very diverse, these variables are transformed into logarithmic form so that equation (2) can be expressed as:

$$LM = \alpha_0 + \beta LY + \omega LK + \gamma LO \tag{3}$$

In equation (3), L states symbol logarithms. Due to the phenomenon that some data are not stationary at the level, the initial framework of the model refers to the ARDL co-integration model Pesaran and Shin (1999) and Pesaran et al., (2001) which is also used by Haque and Imran (2020) with the formula in equation (4):

$$\Delta LM_t = a_0 + \alpha LM_{t-1} + \beta LY_{t-1} + \omega LK_{t-1} + \gamma LO_{t-1} + \sum_{j=0}^{p-1}\alpha_j \Delta LM_{t-j} + \sum_{j=0}^{p-1}\beta_j \Delta LY_{t-j} + \sum_{j=0}^{p-1}\omega_j \Delta LK_{t-j} + \sum_{j=0}^{p-1}\gamma_j \Delta LO_{t-j} + e_t \tag{4}$$

Equation (4) assumes that all the independent variables affect the dependent variable symmetrically as studied by (Haque and Imran, 2020). In this equation, coefficients of first differenced variables, α_j, β_j, ω_j and γ_j represent short run while oefficients of level form variables, α, β, ω and γ represent long run relation. The long run relation can be stated as equation (5).

$$LM_t = \rho_0 + \rho Ly_{t-1} + \chi LK_{t-1} + \tau LO_{t-1} \tag{5}$$

Where:. $\rho_0 = {}^{\alpha_0}/_{\alpha}$, $\rho = {}^{\beta}/_{\alpha}$, $\chi = {}^{\omega}/_{\alpha}$, and $\tau = {}^{\gamma}/_{\alpha}$

Bases on data (Figures 1 and 2), there is strong possibility relation of world oil prices and marketing margins is likely to be asymmetric and nonlinear. To incorporate asymmetric behavior, Shin et al. (2014) has construct to build a nonlinear ARDL (NARDL) model which is widely used in literature to incorporate asymmetric and nonlinear relationship between variables. The advantage of this model, we can investigate the asymmetric relationship in both the short and long run. We use this model to analyze nonlinear and asymmetric impact of oil price on coffee marketing margins in Indonesia. For this purpose, LO_t is decomposed into positive and negative partial sums, as:

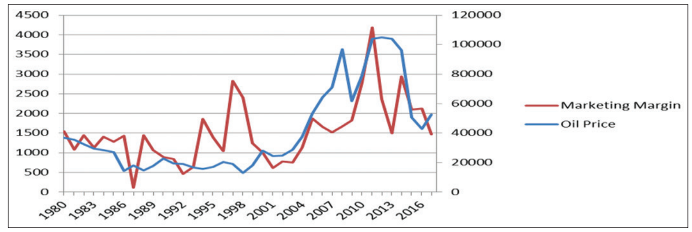
$$LO_t = LO_0 + LO_t^+ + LO_t^- \tag{6}$$

Where LO_t^+ and LO_t^- are the partial sums of positive and negative chnges in oil price, LO_t as:

$$LO_t^+ = \sum_{i=1}^{t}\Delta LO_t^+ = \sum_{i=1}^{t}\max\left(\Delta LO_i, 0\right) \tag{7}$$

$$LO_t^- = \sum_{i=1}^{t}\Delta LO_t^- = \sum_{i=1}^{t}\min\left(\Delta LO_i, 0\right) \tag{8}$$

Figure 2: World oil prices and Indonesian coffee marketing margins



Furthermore, by combine equation (4) and equation (5) we get new NARDL model as shown in equation (9).

$$\Delta LM_t = \delta_0 + \delta LM_{t-1} + \pi LY_{t-1} + \mu LK_{t-1} + \theta LO_{t-1}^+ + \upsilon LO_{t-1}^- + \sum_{j=0}^{p-1}\delta_j \Delta LM_{t-j} + \sum_{j=0}^{q-1}\pi_j \Delta LY_{t-j} + \sum_{j=0}^{q-1}\mu_j \Delta LK_{t-j} + \sum_{j=0}^{r-1}\theta_j \Delta LO_{t-j}^+ + \sum_{j=0}^{s-1}\upsilon_j \Delta LO_{t-j}^- + e_t \tag{9}$$

In Equation (9), the response of changes in marketing margins to world oil prices is decomposed into responses when there is an increase (positive shocks) and a decrease (negative shocks) in world oil prices.

To get the best conclusion in this study, there are several step will be done. The firstly, stationary test. To avoid spurious regression, Augmented Dickey-Fuller test (ADF) and Phillips-Perron (PP) unit root test are employed. This stationary test does not require all stationary data to be at level I (0) or in first difference I (1), but it may be that one or both of them are important not in second difference I (2). The next step, we estimate the NARDL model in equation (9). In this model we do not to interpret the long run coefficient. The next step is to carry out co-integration tests between variables. In this respect we follow the approach of bounds (Pesaran et al., 2001). Based on Equation (9), there is a nonlinear co-integration relationship between the marketing margins of Indonesian coffee and world oil prices if we reject the null hypothesis $\delta = \pi = \mu = \theta = \upsilon = 0$. Furthermore, the model stability test is carried out by using the CUSUM and CUSUMQ tests which are expressed in graphical form in Figure 3. The next step, we determine the formulation of a long-run relationship based on the estimation results equation (9). It is shown in equation (10).

$$LM_t = \lambda_0 + \lambda Ly_{t-1} + \eta LK_{t-1} + \sigma LO_{t-1}^+ + \varepsilon LO_{t-1}^- \tag{10}$$

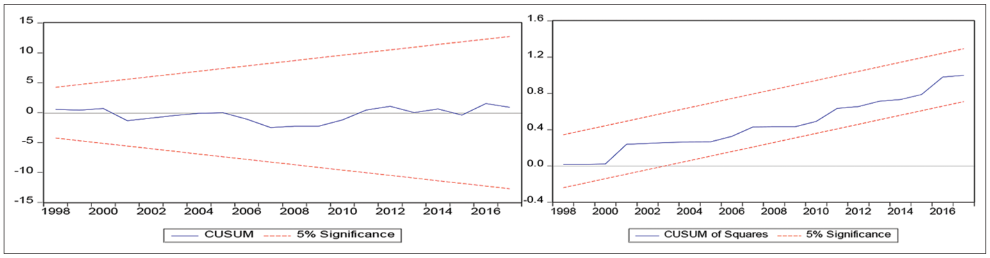
where: $\lambda_0 = {}^{-\delta_0}/_{\delta}$, $\lambda = {}^{-\pi}/_{\delta}$, $\eta = {}^{-\mu}/_{\delta}$, $\sigma = {}^{-\theta}/_{\delta}$, dan $\varepsilon = -{}^{\upsilon}/_{\delta}$

Finally, an asymmetric test was performed using the Wald test. To prove an asymmetric impact of world oil prices shocks on the marketing margins of Indonesian coffee, an asymmetric test is also carried out if we reject the null hypothesis symmetric impact $\theta_j = \upsilon_j$ in equation (10) for long run and $\theta_j = \upsilon_j$ in equation (10) for short run.

4. ANALYSIS RESULT

Agricultural commodity data used is coffee prices during the period 1980 to 2017. Producer price data are obtained from the

Figure 3: Result for model stability test



Food and Agricultural Organization (FAO), international prices are sourced from the World Trade Organization (WTO), while per capita income and exchange rates use World Bank data. Farmer's share data is obtained by calculating the ratio of coffee prices in the producer market and the coffee price in the international market multiplied by 100 percent. Meanwhile, the marketing margins data is obtained by calculating the difference between the coffee price in the international market and the Indonesian producer market. The movement of world oil prices, the farmer's share, and marketing margins Indonesian coffee is expressed as in Figure 1.

Based on the research data shown in Figure 2, there is very little chance of forming a linear relationship between world oil price movements and farmer share. Marketing margins and world oil prices data also did not have the same movements during the study period. It shows that there is a strong probability of the formation of a nonlinear relationship between world oil prices and marketing margins. As a solution, it is very appropriate to use nonlinear models to analyze these relationships. Framer's share is expressed as a percentage so that it is impossible to transform into a logarithmic form. However, because farmers share and marketing margins are very related conceptually, so that by analyzing one of these variables is sufficient to describe the research results. Therefore, in the next analysis only marketing margins is used as the dependent variable in this study.

The marketing margins for Indonesian coffee during the study period (1980-2017) was very volatile with an average value of 1522 USD/tone. The maximum value of 4189 USD/ton occurred in 2011 along with the increase in world oil prices from 79,041 USD/barrel in 2010 to 104,009 USD/barrel in 2011. The lowest value of the marketing margins of 110 USD/ton occurred in 1987. Similarly, the oil prices also fluctuated between 13.064 and 105.010 with a mean value of 41.147 USD/barrel. Meanwhile, the exchange rate has continued to depreciate for 38 years with an average value of Rp. 6054 per 1 USD. Likewise, Indonesia's GDP, in general, has continued to increase for 38 years with an average value of 335 billion USD. In detail, Table 1 shows the descriptive statistics of the research data.

As first stage, the data have to pass stationery test. The data stationery test using the ADF test and Phillips-Perron (PP) test. The null hypothesis of ADF and PP tests are that the variable has unit root. The results of all the tests are reported in Table 2. The results of ADF and PP test show that only marketing margins (LM) stationery level. However, at first difference, all the time series become stationary. Because ADF has lower power in case when stationary process is near unit root, especially when sample size is small, we also applied Phillips-Perron (PP) test. PP test corrects for any serial correlation and heteroscedasticity issues. Moreover, there is no need to specify the lag length while applying PP test (Enders, 2008). Results of PP test are also in line with the results of ADF test.

Table 1: Descriptive Statistics of Marketing Margins, Oil Price, Exchange Rate, and Indonesian GDP

Statistic indicators	Marketing Margins	Oil price	Exchange rate	GDP
Max	4189	105010	13389	1015423
Min	110	13064	627	72482
Std. Dev.	791	29004	4462	316975
No. Obs	38	38	38	38

The absence of I (2) variables in the model allows us to apply the nonlinear Bounds test approach to investigate co-integration among these variables. The null hypothesis of no long run co-integration between the variables is rejected if Bound test F-statistics value is above the upper bound value given by (Narayan, 2005). The results confirm the presence of nonlinear co-integration between the world oil prices and marketing margins by using the IDR-USD exchange rate and Indonesia's GDP as control variables.

Since the bounds test presented above in Table 3 provides an evidence of non-linear co-integration, the next step is to estimate the non-linear ARDL model as described in Equation (8) and check the long- and the short-run asymmetries. The non-linear ARDL model is based on the general to specific analysis that allows to avoid any imprecisions in the estimation and obtains the right dynamic multipliers by dropping all insignificant lags. The result of NARDL model estimation is shown in Table 4. Before we explore interdependence among variables which is expressed in the estimation result, we prove that the model is robust and stability.

To prove the stability of the model is done by CUSUM and CUSUMQ test. The results of this test prove that the movement of blue line always in between the red lines (Figure 3) so that the model is stable and robust.

The next step, based on the estimated results in Table 4, we compute the co-integrating and long-run equations. These are presented in Table 5. The long run coefficients of real income are positive and significant. They suggest that a 1% increase in real income is related to the increase in the expected marketing margins by roughly 1.39%, holding the oil price and IDR-USD exchange is constant. Similarly, the long run coefficients of

Table 2: Stationery test results

Variables	Level		First Difference	
	ADF	PP	ADF	PP
LM	−4.206343***	−4.2729978***	−6.426103***	−-18.06863***
LY	−0.067087	−0.052727	−6.006694***	−6.00673***
LK	−1.411.778	−1.411.778	−6.318037***	−6.31983***
LO	−1.080.512	−1.083.685	−5.803475***	−5.80319***

***Indicate significant at 1%

Table 3: Co-integration test results

F-Statistic	95% lower bound	95% upper bound	Conclusion
17.327674	4.4286	6.250	Nonlinear co-integration

The critical values are from Narayan (2005), given the small sample size

Table 4: Result for NARDL model estimation

Variables	Coefficient	Std. Error	t-Statistic	Prob. Value
C	−9.006.153	1.604.973	−5.611.404	0.0000
LM(−1)	−2.984.841	0.382650	−7.800.453	0.0000
LO_P(−1)	−1.152.960	0.392252	−2.939.337	0.0081
LO_N(−1)	2.219.505	0.383479	5.787.808	0.0000
LK(−1)	0.965324	0.328814	2.935.778	0.0082
LY(−1)	4.148.484	0.635626	6.526.611	0.0000
DLO_N(−2)	−1.378.215	0.554163	−2.487.022	0.0218
DLK(−1)	2.748.239	0.525099	5.233.753	0.0000
DLM(−1)	1.503.147	0.290213	5.179.455	0.0000
DLM(−3)	0.347029	0.127623	2.719.182	0.0132
DLK(−2)	2.095.565	0.525923	3.984.549	0.0007
DLM(−2)	0.922331	0.212137	4.347.808	0.0003
DLY(−3)	−1.534.824	0.480858	−3.191.847	0.0046
DLO_P(−2)	2.277.080	0.732627	3.108.102	0.0055
R-squared	0.859718			
Adjusted R-squared	0.768535			

Table 5: Long run relation

Variables	Coefficient	P-value
Constant	−3.017.298	0.0000
LY	1.389851	0.0000
LK	0.323409	0.0117
LO_P	−0.386272	0.0103
LO_N	0.743592	0.0000

IDR-USD exchange rate also positive, its means an increase by 1 percent leads to increase marketing margins 0.32%, holding the other variables are constant. Turning to our main theme, we note the asymmetric long run relation between the marketing margins and world oil price.

The estimated long-run coefficients of positive and negative shocks in world oil prices, LO_P and LO_N are −0.386272 and 0.743592 respectively. It means 1 percent increase in oil prices lead to 0.39% decrease in marketing margins, while 1% decrease in oil prices lead to 0.74% decrease in marketing margins. Furthermore, the Wald statistic suggests the rejection of long and short run symmetry impact of positive and negative shocks in oil prices on marketing margins. The results show that the null hypothesis of symmetric impact of oil prices on marketing margins is rejected both in the long and short run (Table 6). This result implies that both in the long and short run there are asymmetric impact of positive and negative shocks in world oil prices on marketing margins of Indonesian coffee.

Table 6: Result for asymmetric test

Variables	F-statistic	P-value
W_{LR}	26.71777	0.0000
W_{SR}	11.78662	0.0026

In the long run, based on long-run coefficients of positive and negative shocks in world oil prices in Table 5, not only presence an asymmetric impact in magnitude, but also in direction. In direction, based on the results in Table 5, it is clear that the sign of the positive shock coefficient of world oil prices is negative, while the sign of the negative shocks coefficient is positive. It means that when the world oil price increases, the marketing margins will decline. While the sign of the response direction of the marketing margins due to the negative shocks in world oil prices is positive, Its means when the world oil price decreases, the marketing margins continue to decline. This condition is a positive signal and very beneficial for Indonesian coffee farmers because both when an increase and decrease in world oil prices, it will cause reduction in the marketing margins for Indonesia coffee producers.

In magnitude, it is also clear that there is an asymmetric impact of world oil price shocks on the marketing margins. The positive shock coefficient is smaller (−0.39) than the negative shock coefficient (0.74). This means that in terms of magnitude, if it is explored more deeply, Indonesian coffee producers will benefit more when negative shock (go down) than positive shocks (go up) in world oil prices. An increase in world oil prices in the international market by 1percent will only reduce the marketing margins for Indonesian coffee by 0.39%. However, the decline in world oil prices by 1percent, will reduce the marketing margins of Indonesian coffee is becoming increasingly large, which is 0.74%. It's clear that this situation to impact on increase in welfare of Indonesia coffee producers. This indicates also show that implicitly Indonesia's domestic coffee market conditions are still not competitive and presence an asymmetrical transmission of coffee prices from the international market to the Indonesian producer market (Meyer and Von Cramon-Taubadel, 2004).

Unlike previous researchers (Ibrahim, 2015; Sarwar et al., 2020) who found only positive change (increase) in oil prices to impact on food prices, our results show that not only positive shocks in oil prices impact on marketing margins but also negative shocks. In addition, our findings prove that the impact of world oil prices shocks on marketing margins not only asymmetric in magnitude but also in direction. The results also suggest that world oil prices shocks become important role to assert on the reduction the coffee agent's welfare at Indonesian domestic markets. Based on response of marketing margins to world oil prices shocks, welfare of agent is empirically go down and implicitly reduce the market power. The implication of this finding, Indonesian coffee producers are more prosperous when the world oil price decreases than its prices increase. Furthermore, the Indonesian government needs to support an international economic program that is oriented towards reducing world oil prices.

5. CONCLUSIONS AND POLICY IMPLICATION

One of indicates increasing in coffee producer's welfare is a little in marketing margins as show by small in the prices gap between global and producers markets. The World oil prices shocks is believed become the main important role on movement marketing margins of agricultural commodities, include coffee. The present study aims to investigate the impact of world oil prices shocks on coffee marketing margins for Indonesia. We decompose world oil prices into positive and negative shocks to investigate the asymmetric impacts on marketing margins. For this aims, we adopt a NARDL model to capture the asymmetric impacts both in long and short run. The Bound test results show that the presence of nonlinear co-integration relationship between world oil prices and marketing margins. The Wald test result suggest the presence asymmetric impacts of world oil prices on coffee marketing margins both in long and short run. We found that a decrease in oil price has a positive and significant impact on marketing margins, while a increase in oil price has a significant negative impact. An increase in world oil prices lead to reduce marketing margins. Similarly, a decrease in world oil prices, also impact on the reduction of marketing margins.

We therefore conclude that impacts of world oil prices shocks on marketing margins not only asymmetry in magnitude, but also in direction. Particularly, the negative shock in oil prices has more pronounced impact than positive shocks on the reduction of marketing margin. This result implies that Indonesian coffee producers more benefit when the world oil price decreases compare than increases, therefore it needs stimulus to support the international policies are maintained to world oil prices reduction.

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