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Article

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Symmetric and Asymmetric Effect of Crude Oil Prices and Exchange Rate on Bond Yields in Indonesia

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ABSTRACT

This study aims to examine the symmetric and asymmetric effects of crude oil prices and exchange rate on bond yields in Indonesia. Dubai crude oil prices are used as a proxy for crude oil price data and the IDR/USD exchange rate is used as a proxy for exchange rate. Meanwhile, the 10-year Indonesian bond yields are used as a proxy for bond yields. Data on Dubai crude oil prices, the IDR/USD exchange rate, and the 10-year Indonesian government bond yields are time-series data from January 2007 to April 2019. The results of the test using the autoregressive distributed lag and nonlinear autoregressive distributed lag models show that (1) in the long-run, neither the crude oil prices nor the exchange rate has symmetric and asymmetric effects on the bond yields, and (2) in the short-run, both of them have symmetric and asymmetric effects on the bond yields.

Keywords: Crude Oil Prices, Exchange Rates, Bond Yields, Autoregressive Distributed Lag Model, Nonlinear Autoregressive Distributed Lag Model
JEL Classifications: C120, C130, E310, G150

1. INTRODUCTION

Crude oil is an important commodity for all countries in the world as they need it as an industrial raw material in all sectors of the economy. For this reason, changes in crude oil prices can cause changes in prices of manufactured goods, both in the goods sector and in the financial sector. On the other hand, foreign currencies serve as transaction instruments in international trade both for Import in good market activities and trading activities in the financial markets. Therefore, as exchange rates changes, prices of goods can also change and similarly the prices of financial market instruments.

Furthermore, bonds are one of the financial market instruments issued by government and companies that are sold to the public to raise long-run funds with the aim of financing government spending in the public sector for a country and developing business for a company. Government and corporate bonds in Indonesia are ones that have been liberalized so that foreign investors can buy and resell them. Therefore, the exchange rate will be a determining factor of foreign investors' attitude in buying bonds and also selling them back, particularly if their sales can provide a return.

From a theoretical point of view, the effect of crude oil prices and the exchange rate can be explained through the interest rate channel. Crude oil is an industrial raw material so that rising oil prices can increase production costs. The increased cost of production can make the prices of manufactured goods become higher which eventually triggers inflation. The government of a country through its monetary policy then raises interest rates to suppress inflation (Saidi et al., 2019). Furthermore, according to the theory of uncovered interest parity, appreciation (depreciation) of foreign exchange rates (assuming international interest rates do not change) can increase (decrease) domestic interest rates (Pilbeam, 2006; Adam, 2016; Morrison, 2019; Rosnawintang, 2019). Since bond prices respond negatively to changes in interest rates, an increase in domestic interest rates can raise bond yields (Choudhry, 2001).

On the other hand, from the empirical point of view, studies on the effect of oil prices on bond yields have been carried out, among others, by Jiang (2019) and Morrison (2019) and both of whom separately found that oil prices affect bond yields. Similarly, studies on the effect of exchange rates on bond yields have also been carried out such as Lace et al. (2015) and Pramana and Nachrowi (2016) who discovered that exchange rates affect bond yields. Furthermore, according to the best of our knowledge, none of the previous studies have been focused on the asymmetric effect of crude oil prices and exchange rates on bond yields in the case of Indonesia. The aim of this study, therefore, is to examine the asymmetric effect of crude oil prices on bond yields in Indonesia. For the purpose of testing the asymmetric effect, we use a model of nonlinear autoregressive distributed lag (NARDL). In addition, this study is to investigate the impact of crude oil prices and exchange rates on bond yields using the ARDL model. In several studies, such an impact is referred to as the symmetry effect (Shin et al., 2014; Bahmani-Oskooee and Saha, 2016; Meo et al., 2018).

This paper is divided into four sections. The following section provides a review of literature as well as previous empirical studies. The third section presents the methodology used in this study. The fourth section describes and discusses the findings, and finally, the fifth section comes up with the conclusions.

2. LITERATURE REVIEW

From the theoretical viewpoint, we have briefly described the one-way relationship from the price of crude oil to bond yields earlier in the introduction. We have also reviewed the related previous empirical studies. In this section, we provide some additional literature reviews of several empirical studies and grouped them into three groups. The first group covers studies on the effect of oil prices on bond yields, while the second group includes studies related to the effects of exchange rates on bond yields. Lastly, the third group consists of several studies that involve both variables of oil prices and exchange rates.

In the first group, there are among others, Kang et al. (2014), Apergis (2019) and Chuffart and Hooper (2019). Kang et al. (2014) examined the effect of global oil prices on bond returns in the United States. By applying the Structural Vector Autoregressive model on monthly data from January 1982 to December 2012, they found that there is a positive effect of oil prices on bond returns. Tule et al. (2017) investigated the effect of oil prices on bond market returns in Nigeria using the Vector Autoregressive Moving Average - Asymmetric Generalized Autoregressive Conditional Heteroscedasticity model. The test results on daily data over the period of March 22, 2011 to April 14, 2016, show the impact of oil prices on bond market returns to exist. Another study was conducted by Apergis (2019) who explored the impact of oil prices on government bond yields in 14 European countries (Germany, France, the Netherlands, the UK, Italy, Spain, Ireland, Austria, Belgium, Finland, Denmark, Norway, Sweden, and Portugal) using annual data from 2000 to 2016. The results of the analysis using the panel regression model show that there is a positive effect of oil prices on bond yields in non-energy-producing countries, while in energy-producing countries the effect is found to be negative. The other, Chuffart and Hooper (2019) studied the effect of oil prices on bond yields in such countries as Russia and Venezuela using daily data that span from October 14, 2008 to April 20, 2015. Using the Markov Switching Autoregressive model in their analysis, they found that oil prices affected bond yields in Russia and Venezuela. Based on this finding, they made two policy recommendations, namely, in the first place, economic reform needs to be done by developing new sectors other than oil to increase state revenues, and in the second place, falling oil prices should be seen as an opportunity to reduce subsidies because oil subsidy forms a large expenditure in the government budget.

The second research group includes among others, Hui et al. (2018), Gadanecz et al. (2018) and Cepni and Güney (2019). Hui et al. (2017) investigated the effect of the exchange rate on sovereign bond yields such countries as Brazil, Colombia, Mexico, the Philippines, Russia, and Turkey. They used the ARDL panel model to analyze daily data from June 1, 2003, through September 29, 2014. They found that the exchange rate affected sovereign bond yield. Gadanecz et al. (2018) explored the role of exchange rate risk on sovereign bond yields in emerging market economies countries. Analysis of monthly data over the period of January 2005 to May 2014 shows that the exchange rate affects the yield of sovereign bonds. Furthermore, the most recent study carried out by Cepni and Güney (2019) investigated the effect of exchange rates, inflation and credit rating on bond returns in such countries as Brazil, Chile, China, Hungary, India, Indonesia, Malaysia, Mexico, Peru, Poland, South Africa, Russia, Thailand, and Turkey. They used a panel regression model and monthly data that stretched from January 2010 to June 2018 to test these effects. The results of the test indicate that the three variables affect bond returns.

Furthermore, some other studies belong to the third group such as Min (1998) and also Arshad et al. (2018). Min (1998) looked into the impact of oil prices, exchange rates, inflation, liquidity, exports, imports, and international interest rates as well as terms of trade in a number of countries; Argentina, Brazil, Colombia, Ecuador, Greece, Indonesia, Ivory Coast, Korea, Malaysia, Mexico, Panama, Philippines, Portugal, Spain, Thailand, Uruguay, Venezuela, and Yugoslavia. The test results for data from 1951 to 1995 using multiple regression models showed that liquidity, exchange rates, inflation, exports, imports, and terms of trade affect bond yields. However, the two other variables, international oil prices, and also interest rate are found to have no impact on bond yield. Meanwhile, Arshad et al. (2018) analyzed the effect of oil prices and the exchange rate on sovereign bond yields and sukuk in Malaysia using annual data from 2006 to 2015. Applying a multiple regression model, they found the exchange rate and oil prices to affect the yield of sovereign bonds and sukuk. They argued that their findings are in line with public policy in Malaysia.

3. DATA AND METHODOLOGY

3.1. Data

The data used are monthly time-series data that span from January 2007 to April 2019 comprising data on the crude oil prices, the exchange rate, and the bond yields. Dubai crude oil (in USD/per barrel) is used as a proxy for the price of crude oil. The IDR/USD exchange rate (in IDR) is used as a proxy for the exchange rate for reason being the United States currency (USD) is commonly used in international trade. The 10-year Indonesian government bond yield (in percent) is used as a proxy for bond yields.

The source of the data on Dubai crude oil price is the Bank of St. Louis, the United States and the IDR/USD exchange rate data are obtained from the Central Bank of the Republic of Indonesia. Meanwhile, data on the 10-year Indonesian government bond yields are from Fusion Media Limited.

3.2. Methodology

For the purposes of analysis, we use notations that represent each research variable. The crude oil prices, the exchange rate, and the bond yield are represented by OIL, ERA, and BON respectively. OIL, ERA and BON variables are natural logarithms. To test the effect of oil prices and the exchange rate on the bond yields, we use the ARDL model. The ARDL(p, q, r) model formula (Heij et al., 2004) is as follows:

$$BON_t = C_1 + \sum_{i=1}^{p} \theta_i BON_{t-i} + \sum_{j=0}^{q} \vartheta_j OIL_{t-j} + \sum_{k=0}^{r} \gamma_k ERA_{t-k} + \varepsilon_{1t} \quad (1)$$

In equation (1), C_1, θ_i ($i = 1,2,\ldots p$), ϑ_j ($j = 0,1.,q$), and γ_k ($k = 0,1.,r$) are the parameters of the regression equation, while ε_{1t} is an error that is assumed to have no autocorrelation, homoscedastic, and follows the normal distribution. Shin et al. (2014), Bahmani-Oskooee and Saha (2016) and Meo et al. (2018) states that the effect of the independent variables (crude oil prices and the exchange rate) on the dependent variable (bond yield) represented by equation (1) is the symmetric effect.

Furthermore, equation (1) can be changed to the error correction equation form as follows:

$$D(BON_t) = \Pi_1 EC_{1(t-1)} + \vartheta_0 D(OIL_t) + \gamma_0 D(ERA_t) + \sum_{i=1}^{p-1} \theta_i^{*} BON_{t-i} + \sum_{j=1}^{q-1} \vartheta_j^{*} OIL_{t-j} + \sum_{k=1}^{r-1} \gamma_k^{*} ERA_{t-k} + \varepsilon_{1t} \quad (2)$$

Where Π_1 is the error correction coefficient leading to a balanced state (equilibrium), while $EC_{1(t-1)}$ is the error correction variable at time t−1. The variable $EC_{1(t-1)}$ satisfies the equation

$$EC_{1(t-1)} = BON_{t-1} - \frac{\sum_{j=0}^{q} \vartheta_j}{1-\sum_{i=1}^{p} \theta_i,} OIL_{t-1} - \frac{\sum_{j=0}^{r} \gamma_j}{1-\sum_{i=1}^{p} \theta_i,} ERA_{t-1} - \frac{C_1}{1-\sum_{i=1}^{p} \theta_i} \quad (3)$$

where $\left(\frac{\sum_{j=0}^{q} \vartheta_j}{1-\sum_{i=1}^{p} \theta_i,}, \frac{\sum_{j=0}^{r} \gamma_j}{1-\sum_{i=1}^{p} \theta_i,} \right)$ is a cointegration vector between the price of crude oil, the exchange rate and the bond yields or the long-run coefficient vector (multiplier) of the crude oil prices and the exchange rate against bond yields. If the prices of crude oil, the exchange rate, and the bond yields are not co-integrated, the effect will be a short-run effect. In the case of equation (2) becomes the ARDL equation at first difference by removing the term $\Pi_1 EC_{1(t-1)}$.

The steps carried out to test the effect of symmetry using the ARDL model (p, q, r) consist of two steps. The first step is to test the stationarity of all research variables. In this step, we apply the Augmented Dickey-Fuller test (ADF) (Dickey and Fuller, 1979). We also use the Phillips-Perron (PP) (Phillips and Perron, 1988). The hypothesis formulation of these two tests is H_0: time series has a unit root (not stationary) versus an alternative hypothesis H_1: time series has no unit root (stationary). The second step is to test the cointegration between the crude oil prices, the exchange rate, and the bond yields (if all of the time series are stationary on the first difference). We use the Engle-Granger test (Engle and Granger, 1987) and also the Phillips-Ouliaris (Phillips and Ouliaris, 1990) to test the stationarity of EC_1 in equation (3). The hypothesis formulation of the test is H_0: the price of crude oil, the exchange rate, and the bond yields are not cointegrated (EC_1 has a unit root) versus the alternative hypothesis H_1: the price of crude oil, the exchange rate and the bond yields are co-integrate (EC_1 has no a unit root).

To test the asymmetric effect of the crude oil prices, the exchange rate on the bond yields, we use the NARDL model developed by Shin et al. (2014). The NARDL model involves variables: positive oil price shock (OIP), negative crude oil price shock (OIN), positive exchange rate shock (ERP), and negative exchange rate shock (ERN). In the literature, ERP is also called the depreciation of the IDR currency, and the ERN is called the appreciation of the IDR currency. The OIP, OIN, ERP, and ERN variables are defined as the partial sum of positive changes or negative changes as follows:

$$OIP_t = \sum_{i=1}^{t} \max[\Delta OIL_i, 0] = \sum_{i=1}^{t} \max[D(OIL_i), 0]$$

$$OIN_t = \sum_{i=1}^{t} \min[\Delta OIL_i, 0] = \sum_{i=1}^{t} \min[D(OIL_i), 0]$$

$$ERP_t = \sum_{i=1}^{t} \max[\Delta ERA_i, 0] = \sum_{i=1}^{t} \max[D(ERA_i), 0]$$

$$ERN_t = \sum_{i=1}^{t} \min[\Delta ERA_i, 0] = \sum_{i=1}^{t} \min[D(ERA_i), 0]$$

Where $D(OIP_i) = \Delta OIL_i = OIP_i - OIP_{i-1} = OIP - OIP(-1)$, $i = 1,2,\ldots t$ is a positive change of the crude oil prices. The NARDL(p, q, r) model which states the one-way asymmetric relationship from the crude oil prices and the exchange rate to the bond yields is as follows:

$$BON_t = C_2 + \sum_{i=1}^{p} \alpha_i BON_{t-i} + \sum_{j=0}^{q} (\beta_j OIP_{t-j} + \varphi_j OIN_{t-j}) + \sum_{k=1}^{r} (\phi_k ERP_{t-k} + \psi_k ERN_{t-k}) + \varepsilon_{2t} \quad (4)$$

where C_2, α_i $(i = 1,2,\ldots,p)$, β_j, ϕ_j $(j = 0,1,\ldots,q)$, φ_k, Ψ_k $(k = 0,1,\ldots,r)$, are the parameters of the regression equation and ε_{2t} are errors. Equation (4) can be changed to the error correction model as follows:

$$\begin{aligned} D(BON_t) &= \Pi_2 EC_{2(t-1)} + \beta_0 D(OIP_t) + \varphi_0 D(OIN_t) \\ &+ \phi_0 D(ERP_t) + \psi_0 D(ERN_t) + \sum_{i=1}^{p-1} \alpha_i^* D(BON_{t-i}) \\ &+ \sum_{j=1}^{q-1} [\beta_j^* D(OIP_{t-j}) + \varphi_j^* D(OIN_{t-j})] \\ &+ \sum_{k=1}^{r-1} [\phi_k^* D(ERP_{t-k}) + \psi_k^* D(ERN_{t-k})] + \varepsilon_{2t} \end{aligned} \quad (5)$$

where Π_2 is the error correction coefficient and EC_2 is the error correction variable that satisfies the equation

$$\begin{aligned} EC_{2(t-1)} &= BON_{t-1} - \frac{\sum_{j=0}^{q} \beta_j}{1 - \sum_{i=1}^{p} \alpha_i,} OIP_{t-1} \\ &- \frac{\sum_{j=0}^{q} \varphi_j}{1 - \sum_{i=1}^{p} \alpha_i,} OIN_{t-1} - \frac{\sum_{k=0}^{r} \phi_k}{1 - \sum_{i=1}^{p} \alpha_i,} ERP_{t-1} \\ &- \frac{\sum_{k=0}^{r} \psi_k}{1 - \sum_{i=1}^{p} \alpha_i,} ERN_{t-1} - \frac{C_2}{1 - \sum_{i=1}^{p} \alpha_i} \end{aligned} \quad (6)$$

where $\left(\frac{\sum_{j=0}^{q} \beta_j}{1 - \sum_{i=1}^{p} \alpha_i,}, \frac{\sum_{j=0}^{q} \varphi_j}{1 - \sum_{i=1}^{p} \alpha_i,}, \frac{\sum_{k=0}^{r} \phi_k}{1 - \sum_{i=1}^{p} \alpha_i,}, \frac{\sum_{k=0}^{r} \psi_k}{1 - \sum_{i=1}^{p} \alpha_i,} \right)$ is the cointegration vector or the long-run multiplier vector if the positive crude oil price shock, the negative crude oil price shock, the positive exchange rate shock, the negative exchange rate shock and the bond yields cointegrate. The cointegration test is done by testing the stationarity of the variable EC_2 in equation (6). In equations (5) and (6), (a) if $\beta_0 \neq \phi_0$ and $\beta_j^* \neq \varphi_j^*$ $(j = 1,2,\ldots, p-1)$, it is said that there is an asymmetric short-run effect of the crude oil prices on the bond yield, also, if $\phi_0 \neq \psi_0$ and $\varphi_k^* \neq \psi_k^*$ (k=1,2,…,r-1), it is said that there is an asymmetric short-run effect of the exchange rate on the bond yields, and (b) if $\frac{\sum_{j=0}^{q} \beta_j}{1 - \sum_{i=1}^{p} \alpha_i,} \neq \frac{\sum_{j=0}^{q} \varphi_j}{1 - \sum_{i=1}^{p} \alpha_i,}$, it is said that there is a long-run asymmetric effect of the crude oil prices on the bond yields, also if $\frac{\sum_{k=0}^{r} \phi_k}{1 - \sum_{i=1}^{p} \alpha_i,} \neq \frac{\sum_{k=0}^{r} \psi_k}{1 - \sum_{i=1}^{p} \alpha_i,}$), it is said that there is a long-run asymmetric effect of the exchange rate on the bond yields, as long as the prices of crude oil, the exchange rate, and the bond yield are cointegrated (Shin, et al., 2014). The procedure for testing the asymmetric effect of the crude oil prices and the exchange rate on the bond yields using model (4) or (5) is similar to that for testing the symmetric effect using model (1) or (2).

4. FINDINGS AND DISCUSSION

4.1. Findings

The first step in testing the symmetric and asymmetric effect of the crude oil prices and the exchange rates on the bond yields is to test the integration order (unit root test) of variables: crude oil price (OIL), exchange rate (ERA), bond yield (BON), positive crude oil price shock (OIP), negative crude oil price (OIN) shock, positive exchange rate shock (ERP), and negative exchange rate shock (ERN). The results of the ADF test and also the PP tests are summarized in Table 1. It can be seen from Table 1 that all variables were integrated of order one, I(1) or stationary at first difference.

The second step is to test the cointegration between the crude oil prices, the exchange rate, and the bond yields. It is also to test the cointegration between the positive crude oil price shock, the negative crude oil price shock, the positive exchange rate shock, the negative exchange rate shock, and the bond yields. In this cointegration test, we test the integration order of the residual variables EC_1 in equation (3) and EC_2 in equation (6). The results of the Engle-Granger and the Phillips-Ouliaris cointegration test are presented in Table 2. The results show both variables EC_1 dan EC_2 are integrated of order 1, I(1). Thus, it is obtained: (1) the prices of crude oil, the exchange rate, and the bond yields are not co-integrated. In other words, in the long run, there is no symmetric influence of the crude oil prices, the exchange rates on the bond yields; (2) similarly, the positive crude oil price shock, the negative crude oil price shock, the positive exchange rate positive shock, the negative exchange rate shock and the bond yields are also not co-integrated. So, the crude oil prices and the exchange rates do not have a long-run asymmetric effect on the bond yields.

The third step is to test the short-run symmetric and asymmetric effects of the crude oil prices and the exchange rate on the bond yields. We carry out this test by estimating the parameters of the ARDL model and the NARDL model at first difference. For this purpose, we first determine the length of the time lag based on the Akaike Information Criteria. Having determined the length of

Table 1: Estimation results of unit root test

Variables	ADF test statistics		PP test statistics	
	Intercept	Intercept and trend	Intercept	Intercept and trend
BON	−1.9347	−2.0837	−1.9189	−2.0267
D (BON)	−11.6127*	−11.5826*	−11.6043*	−11.5729*
OIL	−2.5425	−2.8036	−2.2339	−2.5249
D (OIL)	−7.6721*	−7.6474*	−7.5745*	−7.5481*
ERA	−0.6498	−1.8787	−0.7614	−2.0923
D (ERA)	−10.7828*	−10.7543*	−10.7721*	−10.7418*
OIP	−0.9512	−2.1192	−1.1450	−2.0531
D (OIP)	−9.4485*	−9.4480*	−9.5374*	−9.5501*
OIN	−0.6186	−2.6301	−0.3636	−2.0687
D (OIN)	−6.1767*	−6.1535*	−5.9554*	−5.9298*
ERP	−1.1304	−2.2732	−1.0183	−2.1463
D (ERP)	−8.1219*	−8.1455*	−8.2240*	−8.2333*
ERN	−2.2081	−1.5798	−1.9553	−1.7388
D (ERN)	−11.2209*	−11.4543*	−11.5895*	−11.6566*

*Mean significant at 1% level. ADF: Augmented Dickey Fuller, PP: Phillips–Perron the time lag, we estimate the parameters of the ARDL (1,2,1) and NARDL (1,0,1) models. The estimation results of the parameters of the regression equation are presented in Table 3.

It can be seen from panel A of Table 3 that the coefficients D(EXC(−2)) and D(OIL(−1)) are significant at the 10% significance level. Thus, in the short-run, there is (but weak) an symmetric effect of the crude oil prices and the exchange rate on the bond yields. Also, it appears that the coefficient of the positive crude oil price shock [D(OIP)] is not significant, while the coefficient of the negative crude oil price shock [D(OIN)] is significant at the 5% significance level. This indicates the short-run asymmetric effect of the crude oil prices on the bond yields. Furthermore, the both coefficients of the positive exchange rate shock, [D(ERP)) and D(ERP(−1))] are significant at the 1% significance level, while the coefficients of the negative exchange rate shock, [D(ERN) and D(ERN(−1))] are significant 1% and 5% respectively. If we compare the coefficients of negative and

Table 2: Estimation results of the cointegration test

Variables	Engle-Granger test/ADF test statistics		Phillips-Ouliaris test/PP test statistics	
	Intercept	Intercept and trend	Intercept	Intercept and trend
EC_1	−2.2596*	−2.8084*	−2.2664*	−3.1089*
EC_2	−2.5718*	−3.3462*	−2.7635*	−3.7042*

*Mean insignificant (or the null hypothesis of cointegration test is accepted).
ADF: Augmented Dickey Fuller, PP: Phillips–Perron

Table 3: The estimation results of ARDL (1,2,1) and NARDL (1,0,1) models

Independent variables	Coefficient	t-statistic or χ_2-statistic	Prob.
A. ARDL (1,2,1) Model. Dependent variable: D (BON)			
D (BON(−1))	0.0286	0.3473	0.7289
D (EXC)	1.6141*	9.9354	0.0000
D (EXC(−1))	−0.3199	−1.5144	0.1322
D (EXC(−2))	−0.3133***	−1.8758	0.0628
D (OIL)	0.0615	1.1306	0.2602
D (OIL(−1))	0.0923***	1.6567	0.0998
Breusch-Godfrey serial correlation LM test (χ^2-statistic)		1.4065	0.5129
Breusch-Pagan-Godfrey test (χ^2-statistic)		8.9701	0.1753
Jarque-Bera test		0.9784	0.613130
B. NARDL (1,0,1) model. Dependent variable: D (BON)			
D (BON(−1))	0.0504	0.6680	0.5052
D (OIP)	0.0647	0.7268	0.4686
D (OIN)	0.1568**	2.1582	0.0326
D (ERP)	2.3436*	8.9588	0.0000
D (ERP(−1))	−1.4053*	−4.9761	0.0000
D (ERN)	0.9250*	3.1663	0.0019
D (ERN(−1))	0.6147**	1.9828	0.0494
Breusch-Godfrey serial correlation LM test (χ^2-statistic)		1.5086	0.4703
Breusch-Pagan-Godfrey test (χ^2-statistic)		3.7687	0.8060
Jarque-Bera test		0.8492	0,654022

Sign *, ** or *** means significant at 1%, 5% or 10% level. ADF: Augmented Dickey Fuller, PP: Phillips–Perron, NARDL: Nonlinear autoregressive distributed lag

positive of both crude oil price shock and exchange rate shock, they appear to be different. This indicates a short-run asymmetric effect of the crude oil prices and the exchange rate on the bond yield. In other words, the crude oil prices and the exchange rate affect the bond yields in the short-run. This conclusion is valid as the statistical values of Breusch-Godfrey Serial Correlation LM Test, Breusch-Pagan-Godfrey Test and Jarque-Bera Test, residual models of ARDL (1,2,1) and NARDL (1,0,1) fulfill the assumptions: do not have autocorrelation, homoscedastic and normally distributed.

4.2. Discussion

This study finds that there is an effect of the crude oil prices on the bond yields. The effect is weak though. The finding is therefore in line with those of Kang et al. (2014), Tule et al. (2017), Apergis (2019), Chuffart and Hooper (2019), and Arshad et al. (2018). On the other hand, this study provides evidence for the existence of an effect of the exchange rate on the bond yields. This finding is different from that of Min (1998) which suggests the absence of exchange rate on bond yields. The characteristics of the country where the study is conducted (cultural and social-political) may account for such a difference in finding (Ozturk, 2010) and the difference in data periods used (Adam, 2016). This finding, however, agrees with those of Hui et al. (2018), Gadanecz et al. (2018), Arshad et al. (2018) and Cepni and Güney (2019).

By translating the prices of crude oil and the exchange rate into the form of a positive and negative shock, the impact of the crude oil prices and the exchange rate on the bond yields becomes strong. This impact is asymmetrical but only occurs in the short-run. The reason for this can be the phenomenon of demand and supply of bond instruments occurring amongst investors. The investors' speculative attitude in buying and reselling these instruments is based on their view of changes in the crude oil prices and the exchange rate, meanwhile, crude oil is a derivative commodity and foreign currency is a financial market instrument.

5. CONCLUSION

Most previous studies have investigated the influence of crude oil prices and exchange rate on bond yields. However, according to the best of our knowledge, none of these studies has seen the asymmetric effects of crude oil prices and exchange rate. This study aims to make an additional contribution by looking not only at the symmetric effect but also the asymmetric effects of crude oil prices on bond yields in Indonesia.

To test the effect, we gather time-series data on crude oil prices, exchange rate and bond yields covering Dubai crude oil prices, the IDR/USD exchange rate and the 10-year Indonesian government bond yields. For the purpose of analysis, we employ the ARDL and NARDL models.

The results of the unit root and cointegration test show that the prices of crude oil, the exchange rate, and the bond yields are integrated of order one, I(1) and not cointegrated. Based on the results of the cointegration test and the estimation results of the parameters of both the ARDL and NARDL models, we come to conclusion that (1) in the long run, there is no symmetric and asymmetric effects of crude oil prices and exchange rates on bond yields, (2) in the short term, there are symmetric and asymmetric effects of crude oil prices and exchange rate on bond yields.

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