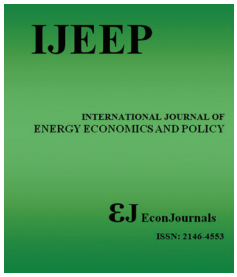

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Indonesia's Bank Response of Interest Rates to the Prices of World Crude Oil and Foreign Rates of Interest

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ABSTRACT

This paper focused to examine the interest-rates response specified by the Bank of Indonesia's (BI) to the world crude oil prices and foreign rate of interest. It examined monthly data which ranged from the period of August 2004 to November 2019. The difference equation model was employed for this estimation. The test findings indicated that there was a direct response of the rate of interest specified by BI to the world crude oil price and foreign rate of interest. The rate of interest retained by BI rose (fell) by 0.124% in response to each 1% rise (decline) in the world crude oil price. Moreover, the rate of interest rose (fall) by 0.073% in response to each 1% rise (decline) in the foreign rate of interest.

Keywords: Prices of World Crude Oil, Domestic-Interest Rate, Foreign-Interest Rate, Difference Equation Model
JEL Classifications: E3, E4

1. INTRODUCTION

In a process of production, oil is one of the major raw materials. Oil is required to operate power plants, transport, and machines (Adam et al., 2015; Rafiq et al., 2009). In derivative trading, oil is also the main product, that is, as a fundamental worth. Therefore, variations in prices of oil can influence all operations of economics (Nazarian and Amiri, 2014). The researchers have investigated the connections of the association among prices of oil and macro-economic variables, particularly rates of interest. In the literature, that can-be determined among the channels are real balance effects of supply, monetary policy effect, shock effect, and Wealth effect. In the case of supply-shock effect, the increase in prices of oil is a sign of oil scarceness which can decrease output in the process of production. The decrease in output in production decreases the growth of real wage and raises the unemployment level, which can then assist the inflation appearance. If consumers wait for an impermanent increase in prices of oil, and if they imagine that its impact on the productivity is greater in the short-run than it is in the long-run, in that case, they will be optimistic to raise their spending, and this will depressingly influence their willingness to save. This will increase the equilibrium level in the real-rate of interest (Brown and Yücel, 2002; Rasche and Tatom, 1977).

In respect of assets impacts, an oil price shock can influence interest-rates as a result of wealth transfers from oil-importing economies to oil-exporting economies (Cologni and Manera, 2008; Sotoudeh and Worthington, 2015). An increase in the prosperity of oil-exporting economies will raise the spending of household, resulting savings to decline, and ultimately raises rates of interest (Abel et al., 2014; Cologni and Manera, 2008; Dohner, 1981). The contrary employs to oil-importing economies. Through the channels of money demand, the balance real effect can be described, in which the increase in rates of oil can raise the money demand. In case the maker's of monetary-policy unsuccessful to increase the supply for money, the rise in demand for money may increase rates of interest (Brown and Yücel, 2002; Doğrul and Soytas, 2010; Pierce et al., 1974).

Internal markets of countries can be influenced by external markets. A raise in foreign rates of interest, in an open economy, for instance, can affect the exchange rate of internal currencies to be devalued beside the external currency, which eventually formulates in the foreign market domestic-goods extremely competitive, causing in a decrease of imports and an increase of exports. In the domestic market, a rise in exports will bring to a scarcity of commodities supply which in return can increase the goods-price. For maintenance of price stability, a central bank of countries may struggle to increase rates interest (Çelik and Deniz, 2009). Interest rate parity theory is a different channel that can describe the association among foreign rates of interest and domestic rate of interest. This theory reveals that domestic nominal rates of interest in a country are the total of the global interest-rate, risk premium, and exchange rate. Moreover, the real rate of interest is equivalent to a global rate of interest (Levi, 2009). Therefore, rates of interest are correlated directly with high domestic rates of interest; a high rate of interest will assist capital outflows, which in return affect internal rates of interest to increase (Dua and Pandit, 2002).

There have been several types of research on the association among foreign rates of interest, oil prices, and domestic rates of interest. For e.g., a study on the association among rates of interest and oil prices and different variables of macro-economic have been performed through, along with others, (Alom et al., 2013; Balke et al., 2002; Khan and Ahmed, 2014; Kilian and Lewis, 2011; Malhotra and Krishna, 2015; Papapetrou, 2001; Ratti and Vespignani, 2015; Zhou and Wang, 2014). Moreover, researches on the association among the internal rate of interest and external rates of interest have been conducted through, along with others, (Alawin and Al-As'ad, 2013; Bhattacharya et al., 2008; Hartman, 1984; Kneeshaw and Van den Bergh, 1985; Oguanobi et al., 2015). Amusingly, these researches show dissimilar findings. For e.g., while (Malhotra and Krishna, 2015) identified no relationship between prices of oil and rates of interest, Khan and Ahmed (2014) stated that similar association does occur. Moreover, Kneeshaw and Van den Bergh (1985) identified that there is a correlation among prices of oil and rates of interest, where Alawin and Al-As'ad (2013) identified no relationship among such two variables. This study is usually conducted in advanced economies, and researchers usually employ the vector-autoregressive (VAR) methodology to examine the association among variables of economics. Therefore, they are paying remain low interest in how huge the effect of prices of oil and foreign rates of interest on domestic rates of interest.

Fundamentally, monetary policy is carried out through governments to prices stabilization and to attain economic growth sustainability. Thus, monetary policy instrument employed by the government should be able to role accurately to defend the economy of countries from external-shocks, for instance, price of oil (Razmi et al., 2015). While a crude oil net-importer since 2005 (Wang et al., 2013) Indonesia's has expanded an instrument of monetary policy to defend the economy of a country never just as of extern shocks but also domestic impacts. Bank of Indonesia (BI) rate is one of the instruments of Indonesia's monetary policy, with its major aim becoming to exchange-rates and prices stabilization. Hence, during occurrence when an external or internal shock appears and can cause rising prices, BI should react to similar raises through increasing rates of interest. The rates of Interest are also intended to react to variations in global rates of interest. A rise in the rate of BI, for e.g., will push up the distinction among rates of interest and international rates of interest of Indonesia. Through the expending distinction in the rates of interest, investors at the international level will be encouraged to spend in Indonesia's financial instrument like they will assume to obtain high rates of return. The foreign capital flow will ultimately affect the rupee currencies of exchange-rate to be valued (BI, 2015). Though the rise in BI rate can also decrease the investment, thus the rate of inflation is considered to have become stabilized when foreign interest-rates decline, BI may lower its rates of interest concerning attracting Indonesia's investment. In History, the rate of interest fixing is reflected in the tendency of BI rate (or BI interest-rates) expansion, where at the starting of the 2005 to 2015 period, the trend of BI-rate rose from 8.5% on July 2005 to 12.75% on April 2006. The BI rate varied and ultimately cut down to 7.5% in October 2015, in the next period. The trend of BI-rate was never a lot distinct from the foreign interest-rates and crude oil prices trend. For e.g., the rising trend of Brent crude price from 2005:7 to 2006:4 to attain per barrel $70.26 on April 2005, after that, in the future time period, on October 2015 the foreign rate of interest varied prior ultimately declined to per-barrel $48.43. Correspondingly, the interest rate of funds rate in US rose in the period of starting and then dropped to 0.12% in October 2015.

The purpose of this study is estimating the BI-rates response to variations in international crude oil prices and foreign rate of interest, besides, to evaluate the level of the response. This study also targets to determine how large the BI-rates response to variations in foreign interest rates and variations in prices of crude oil. For this investigation, the research examined monthly data from July 2005:7 to 2015:10. The econometric methodology employed to examine the rates of BI response to variations in foreign interest rates and variations in prices of crude oil is the differential equation method projected via (Enders, 2015). This method was employed enacted on a presumption that a specific time interval is needed by a domestic rate of interest to react to variations in foreign interest rates and prices of world crude oil.

2. LITERATURE REVIEW

The study on the effect of foreign-rates of interest, oil prices, and different variables of macroeconomic on domestic rates of interest has been ended through economic researchers, equally in the case of empirical and theoretical. The effect of foreign-rates of interest and oil prices on domestic rates of interest, in theory, has been explained in the introduction section. The subsequent review of literature is a review of the result of different experimental researches carried out in different periods and different economies.

Sen (1991) examined the impact of raised prices of oil on the rate of interest of several economies in which it was presumed that there was no capital flow. The findings of the test stated that the increase in prices of oil declined the interest rates, and also the current account. Lowinger et al. (1985) investigated the impact of

OPEC prices of oil on rate of interest in financial-markets of world. They identified that high prices of oil influenced foreign-rates of interest. Cologni and Manera (2008) studied the association among inflation, prices of oil and rate of interest in G7 economies containing the UK, France, Germany, Italy, Canada, the USA, and Japan. The finding of VAR test showed that prices of oil influenced inflation shock, and inflation raised rate of interest. Reicher and Utlaut (2010) studied the association among prices of oil and the long-term rates of interest in the United States of America from 1955:1-2009:3. To test the relationship by employing VAR models, the research shows that prices of oil had an extremely powerful impact on the rates of interest. (Eryiğit, 2012) conducted a study on the causative association among the crude oil prices, exchange rate, stock prices, and rates of interest in Turkey from 07.01.2005-10.31.2008. The results of VAR test showed that the market oil price influenced rates of interest, exchange rates, and stock prices.

Orr et al. (1995) investigated the determinants of long term rates of interest of OECD member economies. The findings of this examination indicated that rates of interest are affected by balance of current account, inflation, and deficit of government. Knot (1995) examined the interest-rates determinants in European Community economies from 1959 to 1990 with a presumption that in the European capital markets, the capital flow was high. Findings showed that the European countries interest rates were driven through movements of oil-price, investment, expectations of inflation, temporary income and growth of money.

Blejer and Diaz (1986) investigated the real-interest rate determinants in Uruguay as revaluated from external factors and domestic factors from 1997 to 1981. The research concentrated on the interest-rates and price determinants where the flow of capital inside and outside without restraint, and financial internal market were liberalized. Thus, in their research, the outside variables incorporated global rate of interest and the prices of the imported products that can be exchanged, while the inside factors were the domestic goods price and the exchange-rates. They discovered that the rates of interest were affected by foreign rates of interest and the prices of the imported products. Moreover, the impact of exchange rate on internal rate of interest was incredibly feeble.

Several researchers' have examined the association among prices of oil and monetary-policy. Bernanke et al. (1997) investigated this matter in the United State from 1965 to 1995. For testing the impacts oil price shocks in on rates of interest, GDP deflator, real-GDP, and the spot-commodity-price index, they employed VAR model. The results of this research showed that shocks of oil influenced total of these variables of economic. Kormilitsina (2011) estimated the association among shock in oil prices and the monetary policy optimally from 1954:3-2006:4. The researcher establishes that both inflation and interest rates affected by oil prices shock by using the structural VAR (SVAR) model. Bleich et al. (2012) examined the impacts of expectations of oil prices on the rate of interest rigid by the England Bank, Bank of Canadian, and the European Central Bank. Findings indicated that ambitions of price influenced every part of the rate of interest specified through the 3 banks, where anyone per cent raises in the expectations of oil price raised the rate of interest through concerning eleven base point. (Liu et al., 2015) investigated the monetary policy response to shock of oil price in China. They found that when prices of oil increased through 100% and the inflation aim were <2%, the government raised interest-rates by 2.5%.

Grenade and Moore (2008) investigated the co-movement among the rate interest in the Eastern Caribbean Currency Union (ECCU) and the foreign interest rates on a regime of the fixed exchange rate that is starting March 1980 to December 2005 period. In the ECCU countries, the internal rate of interest data was employed the weighted lending average rate, whereas foreign rates of interest stated to the United State ninety days Treasury bill rate and the Federal fund-rate. Quarterly data were the same as the time-series data. The researchers employed the VAR estimation to test the co-movement. The Empirical findings indicated that interest rate parity status was met in the long term. Moreover, in ECCU economies, the short-term rate of interest retorted to the US interest-rates.

Cumby and Mishkin (1986) examined the association among the interest rate of US and the rate of interest in various developed economies containing the UK, Canada, West Germany, France, Netherlands, Italy, and Switzerland from June 1973 to December 1983. The findings of the test indicated a direct link between the rate of interest in the United State and the nations of Europe under-examination. Kim and Sheen (2000) studied the association of rate of interest between the United State and Australia from 1987-1995. The interest rates of Australia were proxied with a ten years government bonds, while the United State interest rate with a three months treasury bills. The research daily data investigated employing the bi-variate generalized exponential autoregressive conditional hetero-scedasticity methodology. Frankel et al. (2004) estimated the association among the rate of interest in forty-eight economies, including of eighteen industrial economies and twenty-eight developing economies, and the international rates of interest used as a proxy of interest rates of United State. Examining data from 1975 to 1996, the research found that long term rate of interest in whole advanced economies, excluding Australia, did not respond to the global rate of interest. Contrarily, in some economies where the regime of floating exchange-rate appeared, internal rate of interest were extremely reactant to the United State interest rate.

Goczek (2015) examined the association among the foreign rate of interest and monetary-policy in Romania. The foreign rate of interest variable was the England EURIBOR, although monetary-policy Roman stated to LIBOR. These two rates of interest performed an extremely vital part in the system of finance, particularly on the derivative contracts in the interest rate and rate of interest. In this research, it was discovered that a one on one association consisted of these two rates of interest. The association among United States interest rates and the German state interest rate has been investigated by Frankel et al. (2004). They also investigated the association among European rate of interest and German rate of interest in the economies that are in a Deutsche mark European-Monetary-Union (EMUDM) zone. United States rate of interest and German rate of interest was proxied by International interest rates, whereas the domestic rate of interest

is applied as a proxy of the European interest rate. Implying some capacity for monetary independence, dynamic estimates indicate that countries rate of interest with extra regimes flexibility amends very steadily to variations in global rate of interest.

Eruygur (2004) analyzed the impact of foreign rate of interest on the efficiency of various variables of macroeconomic containing domestic interest, consumer price index, real exchange rate, and the capacity utilization rate in private-sectors in Turkey from the period of 1991:2-2004:12. The London Interbank Offer Rates (LIBOR) and the funds rate of United State were used as a proxy of the foreign rate of interest. The period of research was alienated into 2 different periods, specifically a sub-period earlier to 2001:6, and a sub-period later than 2001:6. The test findings employing the SVAR methodology indicated that in the sub period later then 2001:6, however, a foreign rate of interest shock encouraged the inflation rates, exchange-rate, domestic income to fall, and interest rates, although this impact was extremely minute. In sub period earlier to 2001:6, a favorable shock in the foreign rate of interest influenced the domestic interest rates, real exchange rate, lower inflation rates, and rise in earnings. Berument and Ceylan (2010) estimated the impacts of the American-Federal both unanticipated and anticipated rate of funds on the domestic rate of interest in Australia, Sweden, Switzerland, Spain, the UK, France, Norway, Portugal, Italy, New Zealand, and Austria. The test findings indicated that the bank rate of the United State had a direct effect on the rate determined through the banks of the economies underestimation. Çelik and Deniz (2009) investigated the impact of federal funds-rates of the United State on the rate of interest established by the England Bank and the Bank of European Central from January 1991 to December 2008. The finding of test employing the auto regressive-distributed lag methodology showed that the interest rate determined by Bank of England and Bank of European Central was extremely dependent on the rate of funds specified by the US.

3. DATA AND ESTIMATION METHOD

3.1. Data

The current research investigated 3 forms of annual data containing the world crude oil prices, foreign rate of interest, and domestic rate of interest. The world crude oil prices were indicated to the price of crude oil in Europe, which was the future price of Brent oil in Europe, per barrel units dollar is its measurement. The prices of Brent-crude-oil data were collecting from the Energy Information Administration (EIA), (www.tonto.eia.gov). Foreign rate of interest was mentioned to the rate of interest determined through the US Bank, which was the rate of funds in per cent point. The rate of funds has been selected depend on an examination that the rate of interest of the United State indicate the global rate of interest (Ratti and Vespignani, 2015). The Federal Reserve was the data source of the fund rate, which is the US Central Bank (www.federalreserve.gov). Internal rate of interest was indicated to rate of BI and BI was a data source of this variable (www.bi.go.id).

The complete annual data were monthly annual data covering the period of August 2004 to November 20119. The annual crude oil price data is indicated as OIL, the annual foreign interest-rates data as FRI, and the annual BI rate data as DRI. The annual data of these three variables, for example, OIL, FRI, and DRI, were in a logarithm set up of main data and source of this data were mentioned above.

3.2. Estimation Method

The goal of this study is to examine the interest-rate response specified through BI, which was BI rate (DIR), to the variation in prices of world crude oil (OIL), in addition to the foreign rate of interest (FRI). In data examining, the research presumed that the domestic rate of interest (DRI) need a specific lag of time to react to variation in world crude oil prices (OIL) and foreign rate of interest (FRI). It used the difference equation model for estimation projected via Enders (2015). This following form of the model is as:

$$⟦DIR⟧_t=a_o \sum_{(i=1)}^{n} a_i \, ⟦DIR⟧_{(t-i)}+⟦bOIL⟧_{(t-p)}+⟦cFIR⟧_{(t-q)}+\epsilon_t \quad (1)$$

where a_i (i=1,2,3,…..n),b,and c are the parameters of regression with |a_i |<1. After that, time lag indicates by n, p and q, whereas ϵ_t is white-noise where E(ε_ti ϵ_tj)=0 for i≠j,E(⟦OIL⟧_t ε_(t-i))=0 and E(⟦FIR⟧_t ε_(t-i))=0. The three annual data of OIL, FIR, and DIR are stationary in Model (1). Though, if the complete annual data OIL, FIR, and DIR stationary at the first difference, I (1), and not co-integrated then the following model is employed as:

$$D(⟦DIR⟧_t)=a_o \sum_{(i=1)}^{n} a_i \, D(⟦DIR⟧_{(t-i)})+bD(⟦OIL⟧_{(t-p)})+cD(⟦FIR⟧_{((t-q))})+\epsilon_{(t)} \quad (2)$$

where D⟦DIR⟧_t)=⟦DIR⟧_t-⟦DIR⟧_t is the 1st-difference form of OIL. Enders (2015) describes that the model (1) Difference Equation is a particular type of the ARDL method, exactly the autoregressive distributed lag method. However, Agung (2011) estimates model (1) as a particular type of the LVAR method, exactly the lagged variable autoregressive method.

In Model (1), in a condition of equilibrium, the domestic interest-rates variable meets the condition of ⟦DIR⟧_t=⟦DIR⟧_(t-1)=⟦DIR⟧_(t-2)=..=⟦DIR⟧_(t-n) therefore Equation.1 becomes:

$$⟦DIR⟧_t=\alpha+⟦\beta OIL⟧_{(t-p)}+⟦\gamma FIR⟧_{(t-q)}+\epsilon_t$$

a_o/((1-∑_(i=1)^n a_i)),β=b/(1-∑_(i=1)^n a_i) and γ=c/(1-∑_(i=1)^n a_i)

Where the β and γ parameters are indicated the multiplier effect in the long term (Heij et al., 2004). The negative coefficient of multiplier effect shows a negative impact, whereas a positive coefficient indicates a positive impact.

While several conditions must be satisfied through the 3 annual data in the model (1), first of all, it is essential to run a stationary test and the co-integration of the annual data. The ADF test is employed as a tool of determination to study the annual data stationary. To test the annual data stationary regarding foreign rate of interest (OIL), e.g., we have to study the parameter ρ significance in equation (3).

D(⟦OIL⟧_t)=δ_o+δ_1 t+⟦ρOIL⟧_(t-1)+∑_(i=1)^n▒θ_i D(⟦OIL⟧_(t-i))+ε_t (3)

Hypo-thesis H_o: ρ=0 indicates that the annual data of OIL have a unit-root, representing that it is non-stationary. Moreover, if the absolute value of ADF statistics is greater than the absolute value of ADF critic then OIL is said to be stationary. The level of significance employed is irrespective to 1% or 5%.

Two-step test of Engle granger is conducted to estimate the co-integration of the 3 annual data of OIL, FIR, and DIR. In the 1st phase, the multiple regressions are evaluated and after that develop the following Equation (4).

$$RES=DIR-\tau_o-\tau_1 OIL-\tau_2 FIR \quad (4)$$

where τ_o, τ_1, and τ_2 shows the regression parameters, whereas RES denotes residual. RES is an annual data that is compiled from equation (4). The 2nd phase is to test the integration order of RES. The three annual data of OIL, FIR, and DIR are said to be co-integrated If RES is stationary.

We should evaluate model one or two and investigate the significant parameters of regression for testing the response. In this case, if the statistical tests P-value (t-test or F-test) is lesser than 5% or 1% than a regression parameter is significant at 1% or 5% level. The value of time lag n, p and q are examined through employing AIC (Akaike information criteria). In this examination, the statistical value of Durbin Watson (DW) test and value of R^2 are also required to verify that the gained methodology is nor a spurious regression. Regarding (Rosadi, 2012) if the value of the statistic of R^2 is lesser than value of statistic of DW then a regression methodology is named to be non-spurious.

4. FINDINGS AND DISCUSSION

4.1. Stationary Test

Table 1 shows the findings summary of examining the ADF critics and the ADF statistics of the 3 annual data's of the world crude oil prices (OIL), the domestic rate of interest (DRI), and foreign rate of interest (FRI), follows as:

The results of Table 1 indicated that all of the annual data of D(OIL), D(FRI), and D(DRI) are all stationary, because, at a significance level of 1% and 5%, the ADF absolute-value statistic's is greater than the ADF absolute-value of the critic's. However, OIL, FIR, and DIR are unit root, because, at a significance level of 1% and 5%, the ADF absolute-value of the statistic's is lesser than the ADF absolute-value of the critic's. Therefore, all the annual data of world crude oil prices, foreign rate of interest and domestic rate of interest are stationary at first difference.

4.2. Test of Co-integration

RES is the annual data that are formed depend on the Equation.4. The findings of examining the ADF statistics value and the ADF critic's value are outlined in Table 2. The absolute value of ADF statistic's is 2.45870, which is lesser than the absolute-value of ADF critic's at the 1% level of significance, which is 3.37603. Therefore, RES is non-stationary. Thus, the complete 3 annual data of world-crude oil prices, domestic rate of interest and foreign rate of interest are none co-integrated.

4.3. Response Test

Whereas the 3 annual data of world-crude oil prices, foreign rate of interest and domestic rate of interest are none co-integrated, it is compulsory to employ Model 2 to check the domestic rate of interest response to the foreign rate of interest and prices of world crude oil. The findings of Table 3 show the significant parameters of regression and the P-value of t-statistics.

As can be seen in Table 3, the D(FIRt−7) coefficient is statistically significant at 1%, while the D(OILt−1) coefficient is statistically significant at 5%. This shows that the rate of interest specified by BI did indicate several responses to the prices of world crude oil and foreign rate of interest. The rates of BI needed a one-month time interval to react to the variation in the prices of world crude oil, and a seven month time interval to react to variation in the foreign rate of interest.

Moreover, the multiplier-effect in the long term of the world-crude oil prices on the rate of interest is 0.124. This implies that later than a phase of one month, the world crude oil prices varied, the BI rates of interest rose (fell) by 0.124% to react to each 1% rise (decline) in world crude oil prices. The multiplier effect in the long term of the foreign rate of interest is 0.073. Therefore, the foreign rate of interest varied later than a period of seven months, where BI rate of interest increased (decreased) by 0.073% to react to each 1% rise (decline) in the foreign rate of interest.

Table 1: Findings of stationarity-test

Variables	*ADF*-statistics	Critical-value at 1%	Critical-value at 5%	Prob.
OIL	−2.43020	−3.37411	−2.77434	0.2722
D (OIL)	−7.51245	−3.37354	−2.77413	0.0000
	−1.17850	−3.37354	−2.77413	0.5218
D (FRI)	−7.17651	−3.37354	−2.77413	0.0000
DRI	−2.022576	−3.37354	−2.77413	0.1086
D (DRI)	−4.31510	−3.37354	−2.77413	0.0003

*One-sided p values by MacKinnon (1996), ADF indicates that Augmented Dickey-Fuller test

Table 2: Co-integration test

Variables	*ADF*-statistics	Critical-value at 1%	Critical-value at 5%	Prob.
RES	−2.45870	−3.37603	−2.77518 0.2012	

*One-sided p values by MacKinnon (1996), ADF indicates that Augmented Dickey-Fuller test

Table 3: Findings of response test

Variables	Coefficients	Standard errors statistic	T statistic	Prob.	Other
$D(DRI_{t-1})$	0.60575	0.05329	11.0246	0.0000	R_2 : 0.61463
$D(OIL_{t-1})$	0.02833	0.02961	2.21321	0.0128	*DW*: 2.02476
$D(FRI_{t-7})$	0.01258	0.00741	2.66762	0.0053	*AIC*: −4.21627

AIC: Akaike information criterion, DW: Durbin Watson

The judgment to establish the domestic rate of interest in response to varies prices of world crude oil and foreign rate of interest, the BI remain to the prior rate of interest, due to the investigation of the domestic rate of interest will also affect other activities of economic. It can be observed from the findings of the parameters of regression evaluates as revealed in the Table 3. In the previous month, the BI rates still an indication for the BI to specify the domestic rate of interest in the coming month. In summary, the BI response amount to previous rates of BI, prices of crude oil and foreign rate of interest is R2×100%=61.463 percent of everyone per cent rise (decline) in all of these variables of economic. The direct domestic rate of interest response on prices of world crude oil and foreign rate of interest is 0.60575% of everyone per cent rise (decline) in all of the world crude oil prices and foreign rate of interest. Therefore, the decline in the rate of BI from 2004:7 to 2019:10 is the decision maker's response from the BI to the decreased in prices of world-crude oil and rate of interest of United State in that period.

The findings according to the above evaluation; the subsequent model of a differential equation is formed, follows as:

$$D(⟦DIR⟧\_t)=0.60575D(⟦DIR⟧\_(t-1))+0.02833D(⟦OIL⟧\_(t-1))+0.01258D(⟦FIR⟧\_(t-7)) \quad (5)$$

Because of, $D(⟦DIR⟧\_t)=⟦DIR⟧\_t-⟦DIR⟧\_(t-1)$ then Equation 5 can be varied into the Equation from 6, which is:

$$ED(⟦DIR⟧\_t)=⟦DIR⟧\_(t-1)+0.60575D(⟦DIR⟧\_(t-1))+0.02833D(⟦OIL⟧\_(t-1))+001258D(⟦FIR⟧\_(t-7)) \quad (6)$$

The estimated domestic interest-rates value of $E(⟦DIR⟧\_t)$ in the period of 2004:7 to 2019:10 can be determined from Equation-6.

5. CONCLUSION

The stability of rupee currency and the prices of the goods comparative to foreign currencies is the major aim of Indonesia's monetary policy. For achieving this target, one of the Indonesian governments of the monetary policy instruments has been applying since 2005 is *BI* rate employ to establish the domestic rate of interest. The *BI* rate is specified through *BI* and is expected to react to variations in the goods prices, or variation in inflation, due to the shocks that happen in duo internal and external factors. The goal of this research is to explore the *BI* interest rates response to variations that happened in external factors, mainly in the prices of world crude oil and variations in the foreign rate of interest.

To attain the goals of this research, the paper examined annual data of world-crude oil prices, foreign rate of interest, and *BI* rate of interest from July 2004 to October 2019 period. The prices of crude oil were applied as a proxy of the crude oil price in Europe which was Futures Price of Brent Crude Oil. The foreign interest rate was applied as a proxy of interest rates of United State bank, namely, the fund's rate. A model of Difference Equation was employed to check the response indicated by *BI* rate of interest to the variations in the world-crude oil prices and foreign rate of interest.

The findings of the Statistical inference test indicated that the complete annual data of prices of world crude oil, foreign rate of interest and the *BI* rate of interest are stationary at first-difference and also none co-integrated. Moreover, by the response of testing, shows that *BI* rate of interest response significantly to the world crude oil prices and also to the foreign rate of interest. The rate of interest specifies through *BI* increased by 0.124% in reacting to each 1% rise in the world crude oil prices. It also raised by 0.073% in reacting to each one-per-cent increase in the foreign rate of interest.

These research findings can provide details for *BI* that it can employ to sustain the prices of merchandise production stability. The findings of this study can also provide details to the *BI* to stabilize the rupee exchange rate against foreign currencies.

REFERENCES

Abel, A., Bernanke, B., Croushore, D. (2014), Macroeconomics. Baski: Pearson, Essex. p672.

Adam, P., Rianse, U., Cahyono, E., Rahim, M. (2015), Market in Indonesia. Modeling of the dynamics relationship between world crude oil prices and the stock. International Journal of Energy Economics and Policy, 5(2), 550-557.

Agung, I.G.N. (2011), Time Series Data Analysis Using EViews. United States: John Wiley & Sons.

Alawin, M., Al-As'ad, Y. (2013), Joint movement between Jordanian and foreign interest rates under fixed exchange rate. European Scientific Journal, 9(25), 25.

Alom, F., Ward, B.D., Hu, B. (2013), Macroeconomic effects of world oil and food price shocks in Asia and pacific economies: Application of SVAR models. OPEC Energy Review, 37(3), 327-372.

Balke, N., Brown, S.A., Yucel, M. (2002), Oil price shocks and the US economy: Where does the asymmetry originate? The Energy Journal Cambridge, 23(3), 27-52.

Bernanke, B.S., Gertler, M., Watson, M., Sims, C.A., Friedman, B.M. (1997), Systematic monetary policy and the effects of oil price shocks. Brookings Papers on Economic Activity, 1997(1), 91-157.

Berument, H., Ceylan, N.B. (2010), The effects of anticipated and unanticipated federal funds target rate changes on domestic interest rates: International evidence. International Review of Applied Financial Issues and Economics, 2(2), 328-340.

Bhattacharya, B., Bhanumurthy, N., Mallick, H. (2008), Modeling interest rate cycles in India. Journal of Policy Modeling, 30(5), 899-915.

BI. (2015), Policy Transmission Moneter Indonesia. Available from: http://www.bi.go.id/id/moneter/transmisi-kebijakan/Contents/Default.aspx.

Bleich, D., Fendel, R., Rülke, J.C. (2012), Monetary policy and oil price expectations. Applied Economics Letters, 19(10), 969-973.

Blejer, M.I., Diaz, J.G. (1986), Domestic and external factors in the determination of the real interest rate: The case of Uruguay. Economic Development and Cultural Change, 34(3), 589-606.

Brown, S.P., Yücel, M.K. (2002), Energy prices and aggregate economic activity: An interpretative survey. The Quarterly Review of Economics and Finance, 42(2), 193-208.

Çelik, S., Deniz, P. (2009), Does fed funds target interest rate lead bank of England's bank rate and European central bank's key interest rate? Available from: https://www.ssrn.com/abstract=1381021.

Cologni, A., Manera, M. (2008), Oil prices, inflation and interest rates in a structural cointegrated VAR model for the G-7 countries. Energy Economics, 30(3), 856-888.

Cumby, R.E., Mishkin, F.S. (1986), The international linkage of real interest rates: The European-US connection. Journal of International Money and Finance, 5(1), 5-23.
Doğrul, H.G., Soytas, U. (2010), Relationship between oil prices, interest rate, and unemployment: Evidence from an emerging market. Energy Economics, 32(6), 1523-1528.
Dohner, R.S. (1981), Energy prices, economic activity and inflation: Survey of issues and results. In: Energy Prices, Inflation and Economic Activity. Cambridge, MA: Ballinger.
Dua, P., Pandit, B. (2002), Interest rate determination in India: Domestic and external factors. Journal of Policy Modeling, 24(9), 853-875.
Enders, W. (2015), Applied Econometric Time Series. 4th ed. United States: Wiley.
Eruygur, A. (2004), The Impact of Foreign Interest Rate on the Macroeconomic Performance of Turkey. Germany: University Library of Munich. p12493.
Eryiğit, M. (2012), The dynamical relationship between oil price shocks and selected macroeconomic variables in Turkey. Economic Research, 25(2), 263-276.
Frankel, J., Schmukler, S.L., Serven, L. (2004), Global transmission of interest rates: Monetary independence and currency regime. Journal of International Money and Finance, 23(5), 701-733.
Goczek, L. (2015), Disinflation and monetary independence in Romania. Baltic Journal of Economics, 15(1), 65-79.
Grenade, K.H., Moore, W. (2008), Co-movements between foreign and domestic interest rates in a fixed exchange rate regime: The case of the eccu and the us. Applied Econometrics and International Development, 8(1), 119-130.
Hartman, D.G. (1984), The international financial market and US interest rates. Journal of International Money and Finance, 3(1), 91-103.
Heij, C., Heij, C., Boer, P., Franses, P.H., Kloek, T., Van Dijk, H.K. (2004), Econometric Methods with Applications in Business and Economics. Oxford: Oxford University Press.
Khan, M.A., Ahmed, A. (2014), Revisiting the macroeconomic effects of oil and food price shocks to Pakistan economy: A structural vector autoregressive analysis. OPEC Energy Review, 38(2), 184-215.
Kilian, L., Lewis, L.T. (2011), Does the fed respond to oil price shocks? The Economic Journal, 121(555), 1047-1072.
Kim, S.J., Sheen, J. (2000), International linkages and macroeconomic news effects on interest rate volatility-Australia and the US. Pacific Basin Finance Journal, 8(1), 85-113.
Kneeshaw, J.T., Van den Bergh, P. (1985), International Interest Rate Relationships: Policy Choices and Constraints. Bank for International Settlements, Monetary and Economic Department. BIS Economic Papers, No. 13.
Knot, K. (1995), On the determination of real interest rates in Europe. Empirical Economics, 20(3), 479-500.
Kormilitsina, A. (2011), Oil price shocks and the optimality of monetary policy. Review of Economic Dynamics, 14(1), 199-223.
Levi, M.D. (2009), International Finance. 5th ed. United Kingdom: Routledge.
Liu, J.Y., Lin, S.M., Xia, Y., Fan, Y., Wu, J. (2015), A financial CGE model analysis: Oil price shocks and monetary policy responses in China. Economic Modelling, 51, 534-543.
Lowinger, T.C., Wihlborg, C., Willman, E.S. (1985), OPEC in world financial markets: Oil prices and interest rates. Journal of International Money and Finance, 4(2), 253-266.
Malhotra, A., Krishna, S. (2015), The Effect of Crude Oil Prices on Inflation and Interest Rates in India: Evidence from DCC-GARCH Model. Available from: https://www.ssrn.com/abstract=2472558.
Nazarian, R., Amiri, A. (2014), Asymmetry of the oil price pass-through to inflation in Iran. International Journal of Energy Economics and Policy, 4(3), 457-464.
Oguanobi, C.R., Akamobi, A.A., Ifebi, O.E., Maduka, A.C. (2015), Does interest rate shocks transmit from United States to Ghana? Evidence from vector autoregression. The Journal of Developing Areas, 49(3), 1-12.
Orr, A., Edey, M., Kennedy, M. (1995), The Determinants of Real Long-term Interest Rates: 17 Country Pooled-time-series Evidence (No. 155). Paris, France: OECD Publishing.
Papapetrou, E. (2001), Oil price shocks, stock market, economic activity and employment in Greece. Energy Economics, 23(5), 511-532.
Pierce, J.L., Enzler, J.J., Fand, D.I., Gordon, R. (1974), The effects of external inflationary shocks. Brookings Papers on Economic Activity, 1974(1), 13-61.
Rafiq, S., Salim, R., Bloch, H. (2009), Impact of crude oil price volatility on economic activities: An empirical investigation in the Thai economy. Resources Policy, 34(3), 121-132.
Rasche, R.H., Tatom, J.A. (1977), The effects of the new energy regime on economic capacity, production, and prices. Federal Reserve Bank of St. Louis Review, 59(4), 2-12.
Ratti, R.A., Vespignani, J. (2015), What Drives the Global Interest Rate. Karnataka: Globalization and Monetary Policy Institute Working Paper (241).
Razmi, F., Mohamed, A., Chin, L., Habibullah, M.S. (2015), The role of monetary policy in macroeconomic volatility of association of southeast asian nations-4 countries against oil price shock over time. International Journal of Energy Economics and Policy, 5(3), 731-737.
Reicher, C.P., Utlaut, J.F. (2010), The Relationship Between Oil Prices and Long-term Interest Rates. Kiel: Kiel Institute for the World Economy, Kiel Working Paper.
Rosadi, D. (2012), Econometric Analysis and Applied Time Series with Eviews. Yogyakarta: ANDI.
Sen, P. (1991), Imported input price and the current account in an optimizing model without capital mobility. Journal of Economic Dynamics and Control, 15(1), 91-101.
Sotoudeh, M.A., Worthington, A.C. (2015), Nonlinear interest rate effects of global oil price changes: The comparison of net oil-consuming and net oil-producing countries. Applied Economics Letters, 22(9), 693-699.
Wang, Y., Wu, C., Yang, L. (2013), Oil price shocks and stock market activities: Evidence from oil-importing and oil-exporting countries. Journal of Comparative Economics, 41(4), 1220-1239.
Zhou, S., Wang, D. (2014), The macroeconomic and financial effects of oil price shocks. In: Paper Presented at the Paper Presented at the Proceedings of the Eighth International Conference on Management Science and Engineering Management. Berlin, Germany: Springer.