Iranian Economic Review 2021, 25(1), 167-178
DOI: 10.22059/IER.2020.74551

RESEARCH PAPER

The Causal Relationship between Exchange Rates and Bond Yield in Indonesia

Rosnawintang [a,*], Muh. Syarif[b], Aini Indrijawati[c], Pasrun Adam[d], La Ode Saidi[e]

a, b, d, e. Department of Economics, Universitas Halu Oleo, Kendari 93232, Indonesia
c. Department of Accounting, Universitas Hasanuddin, Makassar 90245, Indonesia

Received: 24 January 2019, Revised: 4 June 2019, Accepted: 2 July 2019

Abstract
The aim of this study was to examine the causal relationship between exchange rate and bond yield in Indonesia using monthly time series data from January 2006 to December 2018. The exchange rate was proxied by IDR/USD, while the bond yield was proxied by a 10-year government bond yield. The VAR model and Granger causality test were used to test the relationship. The results of the test revealed that in the short-run, there is a two-way relationship between IDR/USD exchange rate and government bond yield. In the short term, the response of the government bond yield to the IDR/USD exchange rate was very strong (significant1%) and also positive in the first three months period. Meanwhile, the response of the IDR/USD exchange rate against the government bond yield was weak (significant 10%). In addition, it was negative in the first 3.5 month period. Furthermore, the study revealed that there is no long-term relationship between the IDR/USD exchange rate and the government bond yield.
Keywords: Exchange Rate, Bond Yield, VAR Model, Granger Causality.
JEL Classifications: C320, G120, G150, M210.

Introduction

Foreign currency is a financial market instrument. Besides, it is also one of the transaction tools in international trade for both real sector and financial sector. Investors will include foreign currency in their investment portfolio, if the sale of this instrument in their portfolio can give a return in the future time. Besides, the investors and importers will buy foreign currency to use it as transaction tool in international trading activity. The purchase of foreign currency can cause changes in the currency exchange rates of a country (Saidi et al., 2015; 2017) which later can influence the prices of exported and imported goods (Šimáková and Stavárek, 2015; Adam et al., 2017b) and the prices of financial market instruments (Melvin and Norrbin, 2013).

Bond is a long-term investment instrument in financial market, and is a long-term source of fund for bond issuer. The issuance and sale of bonds by a company is intended to raise funds for the development of the company. For government of a country, the issuance and sale of bonds is to finance government expenditure in the field of development, particularly public sector development. Foreign investor can purchase the bond in a country if the bond instrument has been deliberated. Government bond and corporate bond which are recorded in Indonesian Stock Exchange are deliberated bonds. This liberalization policy is launched by the Indonesian government in order for foreign investors to be able include Indonesian bond

∗. Corresponding author email: rosnawintang@uho.ac.id

instruments in their portfolios. The involvement of foreign investor in bond trading activity can increase the bond instrument purchase in Indonesia in which Indonesian currency is the transaction tool. The increased bond purchase at the end of the day leads to change in bond prices

The relationship between exchange rate and bond yield may happen in two-way relationship through interest rate channel. According to uncovered interest rate parity theory (UIRP), domestic interest rate is the sum of international interest rate and expectation of depreciation (or appreciation) of domestic currency exchange rate against foreign currency (Copeland, 2005; Pilbeam, 2006). Meanwhile, UIRP theory with risk premium states that domestic interest rate is the sum of international interest rate, expectation of domestic currency exchange rate depreciation, and risk premium (Levi, 2009; Adam, 2016; Gandolfo, 2016; Adam et al., 2017a). Therefore, based on the UIRP theory, depreciation (appreciation) domestic currency exchange rate may cause domestic interest rate to rise (decrease) (Morrison, 1993). This is because bond yield and bond price have negative relationship, and the bond price responds negatively toward the interest rate change (Choudry, 2001). Thus, interest rate rise may cause bond price to fall. In the other words, interest rate rise may cause bond yield to rise. Hence, domestic currency exchange rate depreciation can cause bond yield to increase (Pilbeam, 2005; Patton, 2013). On the contrary, can be explained using the balanced portfolio model, a model which is assumed to fulfil the UIRP theory. The conclusion from this model derivation is that the rise in domestic bond demand lowers the domestic interest rate, and as a result the domestic currency exchange rate is appreciated (Pilbeam, 2006; Wang, 2009).

Quantitatively, studies on the relationship between macroeconomic variables (including exchange rates and bond yields) have not much been carried out in developing countries (including Indonesia) compared to those in developed countries (Caporale et al., 2017). In addition, most of those studies only focus on determinants of bond yield (Sax, 2006; Rahman and Sam'ani, 2013; Che-Yahya et al., 2016; Rizal and Rawindadefi, 2016; Paramita and Pangesti, 2016). So far, in Indonesia, there have been several studies on this particular issue such as Rahman and Sam'ani (2013), Rizal and Rawindadefi (2016) as well as Paramita and Pangesti (2016). These studies showed that exchange rate affects bond yield. However, none of them have involved analysis of long-term and short-term influence of exchange rate and other macroeconomic variables on bond yield.

The purpose of this study is to examine the long-term and short-term causal relationship between exchange rate and bond yield in Indonesia using data from the period of January 2006 to December 2018. The model used to test the causal relationship is a vector autoregressive (VAR) model.

Literature Review

This subsection provides the review of empirical research results about relationship between exchange rate and bond yield in some countries. There are two groups of research to be reviewed. The first group concerns the influence or determinants of exchange rate or bond yield and the second group concerns the two-way relationship between exchange rate and bond yield. Those research studied not only the relationship between exchange rate and bond yield but also between exchange rate, bond yield, and other macroeconomic variable such as inflation, interest rate, oil price, and gold price.

A study on the influence of exchange rate on bond yield was carried out by researchers such as Hui et al. (2017) who studied the influence of exchange rate toward sovereign bond yield in several countries including Brazil, Colombia, Mexico, Philippines, Russia, and Turkey. The result of regression test of the daily data from June 1, 2003 to September 29,

2014 showed that exchange rate affects sovereign bond yield. Another study by Eckhold (1998) looked at the influence of exchange rate, inflation, and interest rate on bond yield of New Zealand government. The test result showed that in long and short-term, those three variables affect the bond yield. Agnihotri (2015) studied the influence of inflation, exchange rate, oil price, and interest rate on bond yield. The result of multiple regression test showed that all macroeconomic variables affect the bond yield. Meanwhile, Hsing (2015) examined the determinants of Spanish government bond yield. The economic variables which were considered to affect the bond yield are government debt/GDP ratio, short term Treasury bill rate, expected inflation rate, and expected nominal exchange rate. The result of EGARCH test showed that government debt/GDP ratio, the short term Treasury bill rate, and the expected inflation rate positively affect the government bond yield. Whereas the expected nominal exchange rate negatively affects the government bond yield. Naidu-A et al. (2016) identified some economic variables which were assumed to influence bond yield in some countries: Argentina, Brazil, Dominican Republic, Ecuador, India, Panama, Paraguay, Peru, Philippines, Turkey, Nigeria, and Venezuela. Those variables are exchange rate, Federal Reserve rate, oil prices; US bond yield, gold price, and real interest rate. The result of regression panel test showed that the Federal Reserve rate negatively affects the bond yield, while the other variables positively affect the bond yield. Longei and Ali (2017) evaluated the determinants of bond market. Macroeconomic variables which were assumed to influence the bond price are interest rate, inflation, and exchange rate. The result of multiple regression test showed that those four variables affect the bond price. However, the influence is negative.

The influence of bond yield and other macroeconomic variables on the exchange rate has been studied by researchers such as Lace et al. (2015) and Hsing (2016). Lace et al. (2015) studied the influence of the Germany and the United Sates (US) government bond yield on the EUR/USD exchange rate. They used the multiple regressions to analyse the data ranging from 2009 to 2015. They found that bond yield of Germany and US government bond yield affect the EUR/USD exchange rate. The influence of Germany government bond yield is positive while the influence of the United States government bond yield is negative. Hsing (2016) examined the influence of South Africa government's bond yield, US GDP, US stock price, as well as South Africa inflation and US inflation on ZAR/USD exchange rate. The result of EGARCH test of the quarterly data from 1983Q1 to 2014Q2 showed that ZAR/USD exchange rate is positively affected by South Africa government bond yield, US real GDP, US stock price, and South Africa inflation. Furthermore, ZAR/USD exchange rate is negatively affected by US government bond yield, South Africa real GDP, South Africa stock price, and US inflation.

Meanwhile, researchers also have studied the two-way relationship between exchange rate and bond yield and also other economic variables. Alexius and Sellin (2002) examined the relationship between exchange rate and bond yield. The result of the test showed that there is a one-way relationship from exchange rate to bond yield. Raza and Wu (2018) examined the relationship between bond yield, stock price and exchange rate. The results of the copula test showed that there is a weak relationship between bond yield, stock price and exchange rate. Pericoli and Taboga (2012) analysed the dynamic relationship between exchange rate, interest rate, and bond yield. They found that there is a one-way relationship from exchange rate to bond yield and from interest rate to exchange rate. Philippas (2014) studied the co-integration relationship between government bond market and money. Government bond market is represented by government EMU bond yield, and money is represented by exchange rate. The result of the test showed that there is a one-way relation from exchange rate to bond yield. Kal et al. (2015) examined the relationship between exchange rates (the Australian Dollar, the Canadian Dollar, the Japanese Yen, and the British Pound), bond yield and stock price. The test result of the Markov-Switching Vector autoregressive (MS-VAR) model indicated that

there is a relationship between exchange rate, stock price and bond yield, and this relationship depends on the evaluation condition of over or under of those exchange rates. Hui and Edward-T (2017) examined the interaction between exchange rate and bond yield in countries: US, Japan, and Germany. The result of the test showed that in long-term, there is a one-way relation from bond yield to exchange rate. Wu (2017) studied the relationship between local bond market and exchange rate in G10 countries (Australia, Canada, Germany, Japan, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, and US). Bond market is represented by bond yield. She found that there is a one-way relation from bond yield to exchange rate.

The above studies show several different findings. While some studies reveal that there is only a one-way relationship (Pericoli and Taboga, 2012; Philippas, 2014; Wu, 2017; Hui and Edward-T, 2017), some others reveal the existence of a two-way relationship (Raza and Wu, 2018; Kal et al., 2015). The difference in these findings occur due to the social, cultural, political and economy situation of the countries where the research were conducted differs one another in a certain period of time (Novita and Nachrowi, 2005; Ozturk, 2010). Therefore, the contributions of this study are (1) to give knowledge about the two-way relationship between IDR/USD exchange rate and bond yield of the government for the period of January 2006 to December 2018, and (2) to show whether or not the portfolio balance theory of exchange rate determinants prevail in terms of government bond yields in Indonesia.

Data and Methodology

Data

There were two types of data time series used in this study which are exchange rate and bond yield. The exchange rate was represented by IDR/USD exchange rate (USD was expressed in Indonesian Rupiah unit or IDR). This is simply because in general, foreign currency used as transaction tool in international market is currency of US which is USD. Meanwhile, bond yield was represented by Indonesian government bond yield for 10 years (expressed in % unit).

The time sample used in this study was a monthly time series that spanned from January 2006 to December 2018. Thus, there were 156 observations from each IDR/USD exchange rate and bond yield. The data were obtained from Fussion Media Limited.

Methodology

The selection of model specification in this research refers to the theory and results of empirical research which have been mentioned in the introduction and literature review subsections, where the relationship between bond yield and IDR/USD exchange rate may occur in two-way relationship. Therefore, to test the causal relationship between bond yield and the IDR/USD exchange rate, the VAR model and the Granger causality test were used.

The VAR model of order p is expressed as VAR(p) in the form of matrix equation (Johansen, 1995; Lutkepohl, 2004; Heij et al., 2004) as follows:

$$X_t = C + \sum_{i=1}^{p} \Phi_i X_{t-i} + \varepsilon_t \quad (1)$$

where X_t is the endogen variable vector, C is the constant vector, Φ_i $(i = 1, 2, \dots, p)$ are the coefficient matrices, and ε_t is the white noise vector which cannot be observed. Further, ε_t is assumed as independent and identically distributed with mean $E(\varepsilon_t) = 0$, and covariance matrix $E(\varepsilon_t \varepsilon_t') = \Sigma_u$ is definite positive. In other words, ε_t is an independent stochastic vector with $\varepsilon_t \sim i.i.d(0, \Sigma_u)$.

With an algebra manipulation, the VAR(p) model in the equation (1) can be changed into equation form

$$D(X_t) = C + \Pi X_{t-1} + \sum_{i=1}^{p-1} \Gamma_i D(X_{t-i}) + \varepsilon_t \quad (2)$$

where $\Pi = \sum_{i=1}^{p} \Phi_i - I$ with I is identity matrix, and $\Gamma_i = -\sum_{j=i+1}^{p} \Phi_j, (i = 1, 2, \dots, p-1)$. In this study, the vector components of X_t are BON and EXC. Notation of BON is a form of natural algorithm of the government bond yield variable, while EXC is the form of natural algorithm of the IDR/USD exchange rate variable. So, $X_t = (BON_t, EXC_t)'$ and $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t})'$ are the vectors, and Φ_i $(i = 1, 2, \dots, p)$ are the coefficient matrices.

If matrix rank Π is 0, then the equation (2) expresses an equation of the VAR(p-1) model in the first difference, where $D(X_t) = (D(BON_t),\ D(EXC_t))'$ and $D(EXC_t) = EXC - EXC(-1)$ is the form of the first difference of EXC (IDR/USD exchange rate). In this case, both government bond yield and IDR/USD exchange rate variables are not cointegrated, and both the government bond yield and IDR/USD exchange rate variables are stationary in the first difference or integrated of order one, I(1). However, if there is a natural number r such way that the rank of matrix Π is $r, (1 \leq r < 2, \text{ so } r = 1)$, then the both variables of government bond yield and IDR/USD exchange rate are cointegrated, and it is said that both the government bond yield and IDR/USD exchange ratevariables have a long-term relationship. Further, the equation (2) is called model of error correction vector (VECM) with time lag length is p-1. Matrix Γ_i $(i = 1, 2, \dots, p-1)$ are known as short-term coefficient matrices and matrix Π is called long-term coefficient matrix. It is also said that statistical significance of coefficient Π whose elements are negative, gives evidence of error correction mechanism which pushes every variable to get back to its long-term equilibrium (Rafiq et al., 2014).

Based on the VAR model conditions or the VECM model, then, there were some steps of test carried out related to test the causal relationship between IDR/USD exchange rate and goverment bond yield. They consisted of (1) variable stationarity test; (2) co-integration test (if the government bond yield and IDR/USD exchange rate are I(1) process), and (3) estimation of the VAR model or the VECM model along with residual diagnostic test residual and Granger causality test.

Stationerity test used was the Augmented Dickey-Fuller (ADF) test developed by Dickey and Fuller (1981) and Phillips-Perron test (PP) developed by Phillips and Perron (1988). Null hypothesis of these two tests is H_0 : time series has unit root against alternative hypothesis, H_1: time series does not have unit root (time series is stationary).

Co-integration test was the following step, if the government bond yield and exchange rate are not stationary in the level, but stationary in the difference, for instance stationary in the first difference or I(1) process or integrated of order one. If both variables are I(1) process, then the co-integration test used is the Johansen co-integration test developed by Johansen (1988). There were two types of test used covering trace test and max-eigen test. The trace test is,

$$\lambda_{\text{trace}}(r) = -T \sum_{i=r+1}^{g} \ln(1 - \lambda_i),\ r = 0, 1, \dots, g-1$$

where T is the number of observation data pair, and $\lambda_i, (i = r+1, r+2, \dots, g)$ are the biggest eigen value from matrix Π in the equation (2). Null hypothesis of trace test is H_0: the number of cointegrating vectors are less or equal to r against alternative hypothesis, H_1 : there are more than r cointegrating vectors. Further, max-eigen statistical test is

$$\lambda_{\max}(r, r+1) = -T\ln(1 - \lambda_{r+1}), r = 0, 1, \dots, g-1$$

Null hypothesis of max-eigen test is H_0 : the number of cointegrating vectors are r, against alternative hypothesis is H_1: the number of cointegrating vectors are $r+1$ (Brooks, 2014).

If the government bond yield and IDR/USD exchange rate are not cointegrated, then the VAR(p-1) model in first difference is estimated. However, if the government bond yield and

IDR/USD exchange rate are cointegrated, then the VECM model is estimated. The VAR(p) model estimation is accompanied by inpulse response function (IRF) check, variance decomposition (VD), and residual diagnostic test.

The VAR model in the equation (1) can be expressed as follows

$$BON_t = C_1 + \sum_{i=1}^{p} \alpha_{1i} BON_{t-i} + \sum_{j=1}^{p} \beta_{1j} EXC_{t-j} + \varepsilon_{1t} \quad (3)$$

$$EXC_t = C_2 + \sum_{i=1}^{p} \alpha_{2i} EXC_{t-i} + \sum_{j=1}^{p} \beta_{2j} BON_{t-j} + \varepsilon_{2t} \quad (4)$$

Equations (3) and (4) are the simple form of autoregressive distributed lag model. The equation (3) expresses the causal relationship from IDR/USD exchange rate to government bond yield, while the equation (4) expresses the causal relationship from the government bond yield to IDR/USD exchange rate. To test the causal relationship from IDR/USD exchange rate to government bond yield for instance, the hypothesis formula of Granger causality test is $H_0 : \beta_{11} = \beta_{12} = \cdots = \beta_{1p} = 0$ (there is no causal relationship) against alternative hypothesis $H_1 :$ there is j $(j = 1, 2, \ldots, p)$ with $\beta_{1j} \neq 0$ (there is causal relationship). To test this hypothesis, t-test can be used (Koop, 2013).

In addition to t-test, as a comparison F-test was also employed to test the casual relationship between government bond yield and IDR/USD exchange rate. The hypothesis formulation used to test the causal relationship from IDR/USD exchange rate to government bond yield in the equation (3) for example is $H_0 :$ EXC does not Granger cause BON against alternative hypothesis $H_1 :$ EXC Granger cause BON (Granger, 1969; IHS, 2017).

Empirical Results and Discussion

Empirical Results

In the first place, stationary test or unit root test was carried out for both the government bond yield and IDR/USD exchange rate variables using ADF test and PP test. Statistical values related to these two tests are summarized in Table 1. The result of the test shows that both the government bond yield and IDR/USD exchange rate variables are not stationary in the level, but stationary in the first difference with a significance level of 1%.

Table 1. Unit Root Test

Variable	ADF test statistics		PP test statistics	
	Constant	Constant and trend	Constant	Constant and trend
BON	-2.249	-2.209	-2.238	-2.160
D(BON)	-11.931[a]	-11,932[a]	-11.932[a]	-11.924[a]
EXC	-0.428	-2.023	-0.540	-2.190
D(EXC)	-11.302[a]	-11.292[a]	-11.289[a]	-11.274[a]

Source: Research findings.
Note: [a] Null hypothesis is rejected at 1% of significant level.

Since the government bond yield and IDR/USD exchange rate are stationary in the first difference, then the next step was to test for co-integration using Johansen co-integration test (Johansen, 1988). This co-integration test used two types of tests, trace test and max-eigen test. The statistical values and critical values of the both tests can be seen in Table2. The result of the test shows that government bond yield and IDR/USD exchange rate are not cointegrated or have no cointegration relationship. In other words, the government bond yield and IDR/USD exchange rate do not have long-term relationship.

Table 2. Johansen Cointegration Test

Null hypothesis (H_o)	Trace test		Max-eigen test	
	Statistic value	5% Critical value	Statistic value	5% Critical value
$r = 0$	6.317	15.495	4.803	14.265
$r \leq 1$	1.514	3.841	1.514	3.841

Source: Research findings.

To estimate the VAR model in the first difference, the minimum time lag length was determined first based on the information criteria. The estimation result of time lag length is shown in Table 3. Based on the information criteria AIC, it can be concluded that the time leg length is 7.

Table 3. Information Criterias Statististical Values

Lag	AIC	SC	HQ
0	-7.326	-7.285*	-7.309*
1	-7.343	-7.220	-7.293
2	-7.358	-7.154	-7.275
3	-7.349	-7.064	-7.233
4	-7.349	-6.983	-7.200
5	-7.369	-6.922	-7.187
6	-7.354	-6.825	-7.139
7	-7.389*	-6.779	-7.141
8	-7.343	-6.651	-7.062

Source: Research findings.
Note: the * sign shows the minimum statistical values of AIC, SC, and HQ.

Based on the determination of the length of time lag, the estimated VAR model is VAR(7) model in the first difference. The result of the VAR(7) model will also be used to evaluate the casual relationship between the government bond yield and IDR/USD exchange rate. The estimation result of the VAR(7) model and Granger causality test is shown in Table4 and Table 5.

Table 4. VAR(7) Model and Granger Causality Test

Independent variable and Constant	Dependent variable			
	D(BON)		D(EXC)	
	Coeffi cient	t-statistic	Coeffi cient	t-statis tic
C	0.001	0.195	0.004[c]	1.851
D(BON(-1))	0.219[b]	2.003	0.049	1.081
D(BON(-2))	0.190	0.835	0.017	0.388
D(BON(-3))	-0.177	-1.656	-0.041	-0.934
D(BON(-4))	0.110	1.035	0.074[c]	1.693
D(BON(-5))	0.147	1.395	0.081[c]	1.865
D(BON(-6))	0.182[c]	1.721	-0.003	0.073
D(BON(-7))	-0.199[c]	-1.685	0.021	0.491
D(EXC(-1))	-0.643[b]	-2.399	0.018	0.161
D(EXC(-2))	-0.712[b]	-2.547	-0.140	-1.216
D(EXC(-3))	0.840[a]	2.993	0.195[c]	1.689
D(EXC(-4))	-0.240	-0.886	0.074[c]	1.693
D(EXC(-5))	0.011	0.042	0.081[c]	1.865
D(EXC(-6))	-0.160	-0.581	-0.003	-0.073
D(EXC(-7))	0.021	0.079	-0.021	-0.491

Source: Research findings.
Note: the [a],[b],[c] signs express the coefficient of significance variable in significant level of 1%, 5%, 10%. P-values of Portmanteau statistic test until lag 8[th], and joint statistic of White test are 0.1581and 0.0398.

Based on statistical p-value of White test and Portmanteau test as shown in the bottom side of the Table 4, a residual of the VAR(7) model is homoscedastic and does not have autocorrelation as the probability values (p-value) are greater than significance level 1%. Furthermore, based on t-test in Table 4 in column 1, it is shown that coefficients of variables D(EXC(-1)), D(EXC(-2)), and D(EXC(-2)) are significant at a significance level of 5%, and coefficient of variable D(EXC(-3)) is significant at the significance level of 1%. These mean that in short term, there is a one-way relationship from IDR/USD exchange rate to the government bond yield. In column 4 of the Table 4 is also shown that coefficients of variable D(BON(-4) and D(BON(-5)) are significant at the significance level of 10%. This shows that in short term, there is a one-way relationship from the government bond yield to IDR/USD exchange rate. So, in short term, there is a two-way causal relationship between the government bond yield and IDR/USD exchange rate.

Statistical values of the Granger causality test using the F-test or Wald test (Pairwise Granger Causality Tests) are presented in Table 5. In Table 5, it appears that probability values (p-value) of F-statistic are 0.005 and 0.089. These p-values are smaller than 1% and 10%. Thus, the null hypothesis is rejected. In other words, IDR/USD exchange rate and government bond yield have two-way short-run relationship. The result of F-test is in line with that of prior t-test.

Table 5. Pairwise Granger Causality Tests

Null Hypothesis	F-Statistic	Prob.
D(EXC) does not Granger Cause D(BON)	3.480	0.005
D(BON) does not Granger Cause D(EXC)	1.953	0.089

Source: Research findings.

Furthermore, the result of Granger causality test was evaluated through IRF and VD. IRF graphic is shown in Figure 1, while the result of VD calculation until 12 monthly period is shown in Table 6. It can be seen in the Figure 1 that IDR/USD exchange rate response to the government bond yield is positive or negative within the first period of the 12-month, and this response is positive within the first 3-month period. Meanwhile, the government bond yield response to the IDR/USD exchange rate is also positive or negative within the first period of the 12-month, and this response is negative within the first 3.5-month period.

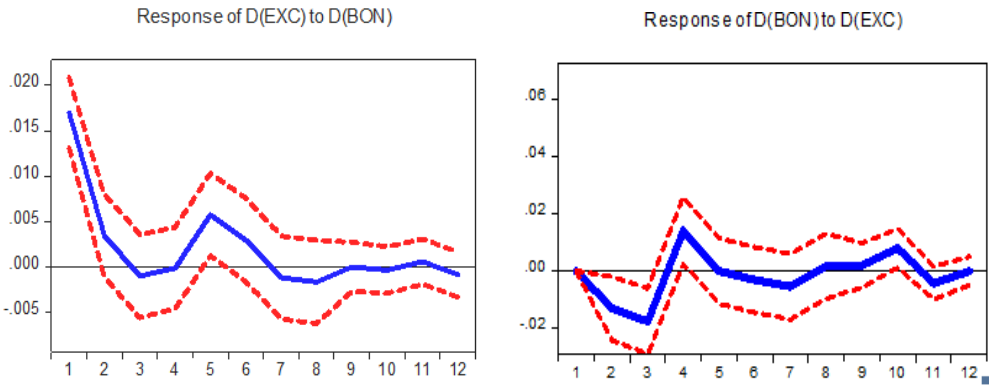

Figure 1. Response of Government BondYield to IDR/USD Exchange Rate and Response of IDR/USD Exchange Rate to Government BondYield
Source: Research findings.

Furthermore, in the 12th month period, there are 1.369% of VD of the government bond yield sourced from the IDR/USD exchange rate. Meanwhile, there are 42.014% VD of IDR/USD exchange rate sourced from the government bond yield.

Table 6. Variace Decomposition

Month period	Variance Decomposition of D(BON)		Variance Decomposition of D(EXC)	
	D(EXC)	D(BON)	D(EXC)	D(BON)
6	13.746	86.254	57.463	42.537
12	15.369	84.631	57.986	42.014

Source: Research findings.

Discussion

The aim of this study is to examine the causal relationship between the government bond yield and IDR/USD exchange rate. The result of VAR test and Granger causality test show that the causal relationship between those two macroeconomic variables only occurs in short term, and it is a two-way relationship.

The relationship that occurs from the IDR/USD exchange rate to the government bond yield is line with the theory developed by Morrison (1993), Choudhry (2001), Pilbeam (2005), Patton (2013) which stated that exchange rate deviation may cause bond yield to change. This finding is also in harmony with the findings of Eckhold (1998), Peticoli and Tabolga (2012), Philippas (2014), Agnihotri (2015), Hsing (2015), Naidu-A et al. (2016), Longei and Ali (2017), and Hui et al. (2017) who found that the exchange rates affects the bond yield.

The finding in this study which states that there is a relationship from the government bond yield to the IDR/USD exchange rate is also in line with the balanced portfolio theory reported by Pilbeam (2006) and Wang (2009). In addition, from the empirical side, this finding agrees with some other researches: Alexius and Sellin (2002), Lace et al. (2015), Hsing (2016), Hui and Edward-T (2017), and Wu (2017). Furthermore, the result of the study which states that there is a two-way relationship between the IDR/USD exchange rate and the government bond yield firms the findings of Raza and Wu (2018), and Kat et al. (2015).

Conclusions

This study is to examine the causal relationship between bond yield and exchange rate in Indonesia using two types of time series data that spanned from January 2006 to December 2018. The bond yield is represented by Indonesian government bond yield for 10 years, while the exchange rate is represented by IDR/USD exchange rate.

The result of co-integration test shows that there is no long-term co-integration relation between the government bond yield and IDR/USD exchange rate. The result of VAR test and Granger causality test show that the causal relationship between the government bond yield and IDR/USD exchange rate is only a short-term relationship, and this relationship is a two-way relationship.

Based on the significance test in the Granger causality test and the responses check of one variable to another through the IRF, it was found that in short term, the response of the government bond yield against the IDR/USD rate was very strong (significant 1%), and it was positive in the first three month period. Meanwhile, the response of IDR/USD to the government bond yield is weak (significant 10%) and this response is negative in the first 3.5 months period. Furthermore, it was found that there is no long-term relationship between the IDR/USD exchange rate and the government bond yield

References

Adam, P. (2016). The Response of Bank of Indonesia's Interest Rates to the Prices of World Crude Oil and Foreign Interest Rates. *International Journal of Energy Economics and Policy*, *6*(2), 266-27.

Adam, P., Nusantara, A. W., & Muthalib. A. A. (2017). Foreign Interest Rates and the Islamic Stock Market Integration between Indonesia and Malaysia. *Iranian Economic Review, 21*(3), 639-659.

Adam, P., Rosnawintang., Nusantara, A. W., & Muthalib, A. A. (2017). A Model of the Dynamic of the Relationship between Exchange Rate and Indonesia's Export. *International Journal of Economics and Financial Issues*, *7*(1), 255-261.

Agnihotri, A. (2015). Study of Various Factor Affecting Return in Bond Market: A Cases Study of India. *AIMA Journal of Management & Research, 9(2/4),* Retrieved from https://apps.aima.in/ejournal_new/articlesPDF/ 10%20Dr.%20Anurag%20Agnihotri.pdf.

Alexius, A., & Sellin, P. (2002). Exchange Rates and Long-Term Bonds. *Uppsala University Publication,* Retrieved from http://uu.diva-portal.org/smash/get/ diva2:128488/ FULLTEXT01.pdf

Brooks, C. (2014). *Introductory Econometrics for Finance* (3rd Ed.). Cambridge: Cambridge University Press.

Caporale, G. M., Ali, F. M., Spagnolo, F., & Spagnolo, N. (2017). International Portfolio Flows and Exchange Rate Volatility in Emerging Asian Markets. *Journal of International Money and Finance*, *76*, 1-15.

Che-Yahya, N., Abdul-Rahim, R., & Mohd-Rashid, R. (2016). Determinants of Corporate Bond Yield: The Case of Malaysian Bond Market. *International Journal of Business and Society*, *17*(2), 245-258.

Copeland, L. S. (2005). *Exchange Rates and International Finance*. London: Prentice Hall.

Choudhry, M. (2001). *The Bond and Money Markets: Strategy, Trading, Analysis*. London: Moorad Choudhry.

Dickey, D. A., & Fuller, W. A. (1981). Likelihood Ratio Statistics for Autoregressive time Series with a Unit Root. *Econometrica: Journal of the Econometric Society*, *49*(9), 1057-1072.

Eckhold, K. R. (1998). Determinants of New Zealand Bond Yields. *Reserve Bank of New Zealand, Discussion Paper, G98/1,* Retrieved from https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.200.2469&rep=rep1&type=pdf

Gandolfo, G. (2016). *International Finance and Open-Economy Macroeconomics* (2nd Ed.). Berlin: Springer-Verlag.

Granger, C. W. J. (1969). Investigating Causal Relations by Econometric Models and Cross-Spectral Methods. *Econometrica, 37,* 424–438.

Heij, C., De-Boer, P., Franses, P. H., Kloek, T., & Van-Dijk, H. K. (2004). *Econometric Methods with Application in Business and Economics*. New York: Oxford University Press.

Hsing, Y. (2016). Determinants of the ZAR/USD Exchange Rate and Policy Implications: A Simultaneous-Equation Model. *Cogent Economics and Finance*, *4*, 1-7.

---------- (2015). Determinants of the Government Bond Yield in Spain: A Loanable Funds Model. *International Journal of Financial Study*, *3*, 342-350.

Hui, C-H., & Tan, E. (2017). Dynamic Interactions between Government Bonds and Exchange Rate Expectations in Currency Options. *HKIMR Working Paper, 18/2016*, Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2844663

----------, Lo, C-F., & Chau, P-H. (2017). Exchange Rate Dynamics and US Dollar-Denominated Sovereign Bond Prices in Emerging Markets. *North American Journal of Economics and Finance.* Retrieved from https://doi.org/10.1016/ j.najef.2017.11.005

IHS. (2017). *EViews 10 User's Guide I*. Irvine: IHS Global Inc.

Johansen, S. (1995). *Likelihood-Based Inference in Cointegrated Vector Autoregressive Models*. New York: Oxford University Press Inc.

---------- (1988). Statistical Analysis of Cointegration Vectors. *Journal of Economic Dynamics and Control*, *12*, 231-254.

Kal, S. H., Arslaner, F., & Arslaner, N. (2015). The Dynamic Relationship between Stock, Bond and Foreign Exchange Markets. *Economic System*, Retrieved from https://doi.org/ 10.1016/j.ecosys.2015.03.002

Koop. G. (2013). *Analysis of Economic Data*. Chichester: John Wiley & Sons, Ltd.

Lace, N., Macerinskiene, I., & Balciunas, A. (2015). Determining the EUR/USD Exchange Rate with U.S. and German Government Bond Yields in the Post-Crisis Period. *Intellectual Economics*, *9*, 150–155.

Levi, M. D. (2009*). International Finance* (5th Ed.). New York: Routledge.

Longei, H., & Ali, A. (2017). Determinant of Bond Market Index at the Nairobi Securities Exchange in Kenya. *Journal of Management, 4*(4), 189–206.

Lutkepohl, H. (2004). Vector Autoregressive and Vector Error Correction Model (86-158). In H. Lutkepohl and M. Kratzig (Eds), *Applied Time Series Econometrics*. Cambridge: Cambridge Press.

Melvin, M., & Norrbin, S. C. (2013). *International Money and Finance*. Oxford: Elsevier Inc.

Morrison, D. (1993). Decision-Making in the Foreign Exchange and Bond Markets (190-201). In G. A. Collenteur and C. J. Jepma, *Economic Decision-Making in a Changing World*. New York: Palgrave Macmillan.

Naidu-A, S. H., Goyari, P., & Kamaiah, B. (2016). Determinants of Sovereign Bond Yields in Emerging Economies: Some Panel Inferences. *Theoretical and Applied Economics*, *XXIII*(3), 101-118.

Novita, M., & Nachrowi, N. D. (2005). Dynamic Analysis of Stock Price Index and Exchange Rate Using Vector Autoregression (VAR) Empirical Study of the Jakarta Stock Exchange, 2001-2004. *Economics and Finance in Indonesia*, *53*(3), 263-278.

Ozturk, I. (2010). A Literature Survey on Energy–Growth Nexus. *Energy Policy*, *38*(1), 340-349.

Paramita, R. P., & Pangesti, I. R. (2016). Determinant of the Yield of 5-Year Government Bonds Using the EGARCH Model in Indonesia, Malaysia, Thailand and the Philippines. *Diponegoro Journal of Manajement*, *5*(3), 1-14.

Patton, M. (2013). Why Rising Interest Rates are Bad for Bonds and What You Can Do about It. *Forbes*, Aug 30, Retrieved from https://www.forbes.com/sites/mikepatton/2013/08/30/why-rising-interest-rates-are-bad-for-bonds-and-what-you-can-do-about-it/#2159143d6308

Pericoli, M., & Taboga, M. (2012). Bond Risk Premia, Macroeconomic Fundamentals and the Exchange Rate. *International Review of Economics and Finance*, *22*(1), 42–65.

Philippas, D. (2014). Money Factors and EMU Government Bond Markets'Convergence. *Studies in Economics and Finance*, *31*(2), 156–167.

Phillips, P. C. B., & Perron P. (1998), Testing for a Unit Root in Time Series Regression. *Biometrika*, *75*(2), 335-346.

Pilbeam, K. (2006). *International Finance* (3rd Ed.). New York: Palgrave Macmillan.

---------- (2005). *Finance and Financial Markets* (2nd Ed.). New York: Palgrave Macmillan.

Rafiq, S., Bloch, H., & Salim, R. (2014). Determinants of Renewable Energy Adoption in China and India: A Comparative Analysis. *Applied Economics*, *4*6(22),2700-2710.

Rahman, A. A., & Sam'aini. (2013). Analysis of Factors Affecting Government Bond Yields for 2010-2012. *Jurnal Ekonomi Manajemen Akuntansi*, *35*, 1-16.

Raza, H., & Wu, W. (2018). Quantile Dependence between the Stock, Bond and Foreign Exchange Markets: Evidence from the UK. *The Quarterly Review of Economics and Finance.*

Rizal, N. A., & Rawindadefi, N. (2016). The Influence of Rupiah Exchange Rate and Interest Rate on Bond Credit Spreads Rate in Indonesia 2011-2015. *Jurnal Manajemen Indonesia*, *16*(3), 214-225.

Saidi, L., Adam, P., Rostin., Saenong, Z., Balaka. M. Y., Gamsir., Asmuddin., & Salwiah. (2017). The Effect of Stock Prices and Exchange Rates on Economic Growth in Indonesia. *International Journal of Economics and Financial Issues*, *7*(3), 527-5.

Saidi, L. D., Kamaluddin, M., Rostin., Adam, P., & Cahyono, E. (2015). The Effect of the Interaction between US Dollar and Euro Exchange Rates on Indonesia's Nasional Income. *Wseas Transactions on Business and Economics*, *12*, 131-137.

Sax, C. (2006). Interest Rates and Exchange Rate Movements: Analyzing Short-Term Investments in Long-Term Bonds. *Fiancial Markets and Portfolio Management*, *20*, 205-220.

Šimáková, J., & Stavárek, D. (2015). The Effect of the Exchange Rate on Industry-Level Trade Flows in Czechia. *Ekonomie a Management*, *XVIII*(4), 150-165.

Wang, P. (2009). *The Economics of Foreign Exchange Market and Global Finance* (2nd Ed.). Berlin: Springer-Verlag.

Wu, M. (2017). FX Risk Premia from the Bond Markets. *Simon Business School Working Paper*, Retrieved from http://www.simon.rochester.edu/programs/phd/phd-students/mi-wu/download.aspx?id=16472