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MACROECONOMIC INDICATORS AND YIELD CURVE OF INDONESIAN GOVERNMENT BOND

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Abstract. *Purposes* – Indonesian government bond (known as SUN) plays an essential role in financing sustainable development in Indonesia and is a fixed income investment vehicle that attracts foreign investors. This study aims to examine the effect of macroeconomic factors or macro-risk on the yield curve of the SUN bond.

Methodology – The type of data used in this study is secondary data in the form of BI Rate, Inflation, Exchange Rate, Foreign Exchange Reserves, Current Account Deficit, and crude oil prices in the 2010–2019 period. This study used the error correction model (ECM) method. The primary sources of data are some government bodies such as the Bank Indonesia website (www.bi.go.id) and the Indonesian site Bond Market Directory (www.idx.co.id).

Findings – The results showed that the exchange rate had a positive effect in the long run, while the foreign exchange reserves effect inversely on the yield curve. The BI rate, inflation rate, and oil price have a positive effect on yield significantly. Furthermore, the current account deficit has no significant impact on the yield curve for the long term and short term.

Implications – There are some managerial and policy implications to maintain an efficient, fixed income market. The authorities need to promote GDP growth, pursue fiscal efficiency, keep up the credit rating and risk of current account deficit, keep a relatively low BI rate and expected inflation rate. The yield curve fluctuation is influenced by changes in some macro-monetary factors above, which should consider in making SUN investment decisions.

Limitations – This study has two limitations. Firstly, the future model could use a re-specification analysis that employs the VECM method that can result in impulse response function with a shock and period study; secondly, this study could be adding some variables including budget policy and political dynamics.

Originality – This study contributes to the literature by examining the yield curve using the current account deficit related to government debt and macroeconomic factors that affect the bond yield curve. These findings can arrange a strategy to develop the bond market and obtain funding with a low cost of debt funds.

Keywords: investment, fixed income, yield, government bond, macro-risk, monetary, Indonesia.

JEL Classification: E43, E44.

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Introduction

One of the most critical Indonesian domestic financing by issuing government bonds (SUN). With the issuance of bonds, the government has helped shape and advance Indonesia's bond market significantly so far (Pitoyo & Afriany, 2019). The government considers it necessary to continuously develop the bond market in Indonesia through the Directorate General of Debt Management and OJK. This policy is reflected in the government's efforts to gradually expand the bond market by preparing the rule of law and supporting infrastructure for the market to achieve liquid and efficient bond market conditions. The government annually issues bonds for funding that impact increasing government bonds' outstanding bonds in the domestic bond market (Santosa & Sihombing, 2015).

The bond market is an alternative source of state funding, especially for emerging markets that need debt in the current economic growth era. After the 1997 Asian financial crisis and the subprime mortgage financial market crisis, the government has neutralized bonds as the primary source of long-term financing to strengthen the national financial system and reduce the risk of future financial crisis shocks (Santosa & Sihombing, 2015; Sihombing et al., 2014). At present, the Indonesian government's attitude is increasingly intense and sees the need to cover the budget deficit through loans sourced from within and outside the country through the SUN's issuance. However, due to high levels of flexibility and dependencies on foreign donor countries, the Indonesian government has begun to shift to domestic financing (Apriadi et al., 2016; Utama & Agesy, 2016).

Meanwhile, in terms of the foreign exchange rate, a factor that can increase the risk of default from government bonds is the liquidity crisis, where foreign exchange reserves measure the level of liquidity (Huang et al., 2019; Paramita & Pangestuti, 2016). Regarding world oil prices, if world oil prices rise, there will be an increase in funding requirements for the procurement of oil for importing countries, encouraging an increase in interest rates. Based on these explanations, that soaring oil prices will cause inflation and increasing interest rates. Therefore, the bond market responds to this by lowering bond prices and rising bond yields (Sihombing et al., 2013). The current account deficit (CAD) is one indicator that can project rupiah exchange rate movements and investment risk. So far, the risk of investing in the Indonesian debt market is still high. This risk can be seen from the level of default risk or credit default swap (CDS). Bond yields reflect the government's default risk or debt issuing country in paying interest and principal debt at a predetermined time (Santosa & Sihombing, 2015).

A yield curve is formed from the bond yield relationship with different maturity periods that can move parallel or not parallel, up or down (Simu, 2017; Utama & Agesy, 2016). The yield curve movement is influenced by changes in bond yields that are contributors to the influence of macroeconomic factors that occur. The development financing policy, which uses treasury bills, causes the government bond market to grow significantly throughout the research period (Sihombing et al., 2013). This circumstance also increases the bond market's liquidity and makes domestic and foreign investors invest in government bonds. The Indonesian economic condition that continues to grow causes government bonds' yield curve trend to decrease periodically (Kahlert, 2017; Kurniasih & Restika, 2015). This condition shows that investors already see the Indonesian economic fundamentals as better and investment risks in Indonesia, decreasing over time.

This paper purposes of generalizing the statistics and experts' opinions about the government yield curve in Indonesia. Besides, this study fulfills the research gap explained above; especially macroeconomic indicators included the two controlling variables. The macro indicators involved monetary factors, such as the BI-7 day Repo rate, inflation rate, exchange rates, reserved assets, controlling variables, global variables like world oil prices, and fiscal factors such as CAD. The reason applied CAD is that it becomes a more critical variable because it increases year-on-year continuously and one of the fiscal weaknesses. This paper provides some guidance as to which criteria should be used and users of the yield curve belong to Indonesia, and so they address different issues and have different goals. Compared to other time series analysis, the advantage of the used method is the short-term effect and long-term effect on the yield curve.

1. Literature and hypothesis

Yield curves are usually estimated using annualized discount bond yields, calculated using the continuously compounded interest rate method. The yield curve cannot be directly observed due to the absence of discount bonds with a sustainable maturity date. Consequently, the yield curve is usually estimated by applying the time structure method that forms bonds that have coupons with different maturities. There are 4 (four) theories that explain the formation of the yield curve (Fabozzi, 2016; Brigham & Houston, 2016; Elton et al., 2014), namely: The Pure Expectations Theory (short-term fluctuations), The Pure Risk Premium Theory, and there are two versions in describing the form of premium risk namely The Liquidity Premium and The Preferred Habitat. The Liquidity Premium states that investors are more interested in maintaining bonds with a more extended maturity period hoping that the bonds provide a high rate of return (at a particular risk level premium) to balance the high volatility of the bonds.

The Preferred habitat stated that the conditions of investor liabilities influence investors in liquidating their investments. Furthermore, in the Market Segmentation Theory, there are several categories of investors in the market with the condition that each investor invests in specific segments under their liabilities without ever moving to another segment. Furthermore, the biased expectations theory is a combination of pure expectations theory and risk premium theory. This theory concludes that the yield curve reflects market expectations of future interest rates with variable levels of liquidity over time (Fabozzi, 2016; Bodie et al., 2019; Elton et al., 2014; Ross et al., 2013).

Previous studies discussed the determinants of yield spread in developing countries and foreign debt (Favero et al., 2010; Santosa & Sihombing, 2015; Verner & Herbrink, 2017). Yield spreads, which reflect risk premiums, are needed to encourage debtors to lend to borrowers, usually modeled as a function of default probabilities and anticipated losses. This yield, in turn, will relate to fundamental conditions that can be classified into three categories, such as macroeconomic, external shocks, and capital flows. In general, previous literature found support for each determinant of yield spread (Simu, 2017; Arshada et al., 2018). Moreover, Kurniasih and Restika (2015) and Sihombing et al. (2013) analyzes the determinants of bond yield spreads in Indonesia period 2005 to 2012. They conclude that domestic and external fundamental factors largely determine access to foreign markets (Khan et al., 2017).

Some previous research has been conducted to test the yield curve, banking industry, and monetary policy, such as by (Sihombing et al., 2013, 2014; Santosa & Sihombing, 2015; Tjandrasa, 2017; Strassberger, 2012). The results show that the yield curve was affected by some macroeconomic indicators at various levels of significance depending on the coupon and maturity term (Sihombing et al., 2014). They concluded that yield curve fluctuation in the government bonds (SUN) has a relationship with liquidity, solvency, macro-monetary indicators, external shock, and market risk factors (Apriadi et al., 2016).

When linked to bond yields, rising interest rates encourage investors to ask for higher yields on the risk of uncertainty in the future, so bond yields will increase and trigger a decline in bond prices (Siklos, 2011). The inflation rate is one of the crucial factors determining the benchmark interest rate's determination, which has a close relationship with SUN coupons (Huang et al., 2019). These events will cause price increases in general and continuously. Fluctuating inflation will affect investment in various other securities, including bonds. Inflation continues to increase, causing overall price increases, so investment in securities such as bonds will be felt increasingly risky. As a result, investors will expect higher yields on their investments (Kurniasih & Restika, 2015; Santosa & Sihombing, 2015).

Therefore, it is recommended that developing countries wishing to seek greater access to the international bond market must improve their macroeconomic fundamentals, especially monetary stability and fiscal discipline (Pramana & Nachrowi, 2016). Santosa and Sihombing (2015) conducted a study of Indonesian government bonds (SUN) using data from 2003 to 2012. The study found a down-trend in Indonesian government bonds' yield spread during the study period due to well-preserved Indonesian economic fundamentals. Macroeconomic factors of the consumer price index (CPI) have a positive effect on the yield spread of Indonesian government bonds, and Bank Indonesia's interest rates (BI-7 day RR) effect negatively on the yield spread (Pramana & Nachrowi, 2016). Moreover, Siklos (2011) emphasized the importance of external factors in addition to the fundamental elements in market sentiment analysis.

1.1. Hypothesis development

1.1.1. Influence of BI rate on bond yields

The interest rate is an attraction for investors to invest their investments in deposits or SBI so that investments in other forms such as shares will be competed (Sundoro, 2018). An increase in the SBI interest rate will increase the commercial interest rate and positively impact yield curve movements for long-term and short-term bonds (Sihombing et al., 2013). This finding is in line with research conducted by Kurniasih and Restika (2015) and Sundoro (2018), which state that a tight monetary policy that causes a decrease in the BI rate can cause bond yields also to fall. Also, Yuliawati and Suarjaya (2017) and Tjandrasa (2017) stated that the interest rate has a positive and significant effect on government bond yield (SUN). In their research, Pramana and Nachrowi (2016) and Santosa & Sihombing (2015) concluded interest rates have a positive and significant effect on government bond yields on the Indonesia Stock Exchange because the higher interest rates will offer large yields to attract investors to invest in their funds on bonds.

H1: BI rate has a positive effect on government bond yields (+).

1.1.2. Influence of inflation on bond yields

The bond market will generally be attractive if economic conditions tend to decline because a declining economy is usually triggered by rising inflation. In economic conditions that have increased inflation, interest rates will tend to increase. So when investors estimate an increase in inflation, they will ask for compensation in the form of a higher yield (Fabozzi, 2016). Hsing and Hsieh (2012) stated that inflation is one of the essential factors affecting bond yields. Inflation has a positive effect on bond yields, supported by Tjandrasa (2017), which states that inflation in the percentage of CPI has a positive and significant impact on changes in the yield of 10-year government bonds. Sihombing, Siregar, Manurung, and Santosa (2014) state that the CPI will increase consumer spending and slow down the pace of economic improvement. This increases the risk premium and yield curve.

H2: Inflation has a positive effect on government bond yields (+).

1.1.3. Effect of exchange rate on bond yields

Several previous studies support the suggestion that the real exchange rate has a positive and significant effect on bond yield in the long run. Pramana and Nachrowi (2016) stated similarly that the exchange rate positively and significantly affected government bond yields in US Dollars. The results of research from Paramita and Pangestuti (2016) found that the exchange rate had a significant positive effect on government bond yields. Sihombing et al. (2013) also said that the nominal exchange rate was responded positively by a 1-year tenor yield and yield on a 5-year tenor. However, Kurniasih and Restika (2015) suggested that the USD-IDR exchange rate, in the long run, affects SBN yield negatively. They also stated the same thing that the exchange rate has a negative and significant effect on government bond yields

H3: The Exchange rate has a positive effect on government bond yields (+/-).

1.1.4. Effect of reserved assets on bond yields

The risk of default is reflected in the ability of bond issuers to pay coupons for their investors. One indicator used to determine bond investments' security is through liquidity ratios (Brigham & Houston, 2016). Sihombing et al. (2014) explain that a factor that increases the risk of default on government bonds is the liquidity crisis, where foreign exchange reserves are critical measures of liquidity. The explanation stated in the Bank of Indonesia newsletter also states that when the amount of foreign exchange reserves is adequate, investors will not be in a hurry to transfer their funds abroad. Utama and Agesy (2016) research states that foreign exchange reserves negative effect on bond yields received in Indonesia and Thailand but were rejected in Malaysia and the Philippines. Simu (2017) and Sihombing et al. (2014) predict the movement of bond yields with several indicators. Their findings conclude that the bond market does take into account macroeconomic fundamentals when determining bond yields. However, other factors, such as external and liquidity factors, in this case, foreign exchange reserves, also play an important role in bond yield changes.

H4: Reserved assets negatively affect government bond yields (-).

1.1.5. The relationship between crude oil price with bond yields

The increase in world crude oil prices also affects interest rates, making investment more attractive to bonds. Sihombing et al. (2014) and Arshada et al. (2018) found that world oil prices significantly affect government bond yields. Paramita and Pangestuti (2016) also state that world oil prices positively affect bond yields received in the four countries studied, both Indonesia, Malaysia, Thailand, and the Philippines. Moreover, Siklos (2011) and Sundoro (2018), in his research on the determinant model of bond yields, concluded that the world oil price significantly affected government bond yield. The association between oil prices and stock returns in China relies on policy uncertainty. It is necessary for policymakers to organize such strategies to reduce oil shocks' harmfulness on the financial market (Khan et al., 2019). *H5: Crude oil prices have a significant positive effect on bond yields (+).*

1.1.6. Effect of current account deficit on bond yields

The current account balance is one indicator that measures the direction and magnitude of international loans. The large current account deficit shows that the economy is very dependent on funds from abroad (Sihombing et al., 2013). The persistent current account deficit causes growth in foreign debt, leading to financial instability in the long run. It also causes a higher risk of default that increases the bond yield. According to Pramana and Nachrowi (2016) and Kahlert (2017), the lower the current account deficit, the lower the bond yield. This result indicates that the CAD has a positive effect on government bond yield. Meanwhile, Huang et al. (2019) and Maltritz and Molchanov (2013) found that the current GDP account had a significant effect on the bond index spread. *H6: CAD has a positive effect on government bond yields (+).*

2. Data and methodology

2.1. Data collecting and sources

First of all, this study collected data from the main sources. The type of data used in this study is secondary data in the form of BI Rate, Inflation, Exchange Rate, Foreign Exchange Reserves, Current Account Deficit, and crude oil prices in 2010–2019, quarterly period. Sources of data were obtained from the Central Statistics Agency (BPS), Indonesia Central Securities Depository (KSEI), Indonesia Bond Pricing Agency (IBPA), Bank Indonesia (BI) website, and The Indonesia Capital Market Institute (TICMI). Data collection uses documentation techniques from the Bank Indonesia website (www.bi.go.id), the Central Statistics Agency website (www.bps.go.id), the Indonesia Bond Pricing Agency website (www.ibpa.co.id), the Indonesian site Bond Market Directory (www.idx.co.id), Bloomberg website (www.bloomberg.com) and the Indonesian Ministry of Finance website (www.djppr.kemenkeu.go.id). The used datasets were collected in a legitimate manner, completely obeying all sources' terms of service.

2.2. Variables description

The second step to prepare all variables in this study, several measurement scales can be used as follows (see Table 1).

Table 1. Variables description

Name of Variable	Notation	Measurement	Unit	Expected
Dependent:				
Bond yield	YTM	Yield to maturity (SUN)	Percent	
Independent:				
The BI rate	BIR	BI-7 day Reverse Repo	Percent	+
Inflation rate	INF	CPI Inflation rate	Percent	+
Exchange rate	EXR	JISDOR (IDR-USD)	IDR	+/-
Reserved assets	DEV	Reserved assets	USD	-
Control variable:				
Current account deficit	CAD	Amount of CAD	IDR	+
Oil prices	OIL	World crude oil price	USD	+

2.3. Long-term regression model

The long-term equation model used in this model as the third step, as follow (Pramana & Nachrowi, 2016; Santosa & Sihombing, 2015; Simu, 2017; Maltritz & Molchanov, 2013; Ijaz et al., 2020):

$$YTM_t = \beta_0 + \beta_1 BIR_t + \beta_2 INF_t + \beta_3 EXR_t + \beta_4 DEV_t + \beta_5 OIL_t + \beta_6 CAD_t + e_t, \quad (1)$$

where YTM – Government Bond Yield (SUN); BIR – BI rate; INF – inflation; EXR – Ln Exchange Rate; DEV – Ln Reserved assets; CAD – Ln Current account deficit; OIL – Ln Crude oil price; t – period (quarterly); and e – error term.

To test the cointegration for all variables in this study, we used the residual-based test method. This method was conducted using the ADF statistical test by looking at the stationary cointegration regression residual. If the ADF value is smaller than the critical value, then the equation model above was cointegrated. Conversely, if not, the equation model was not cointegrated (Gujarati & Porter, 2013).

2.4. Error Correction Model (ECM) specification

Finally, this research is a time-series data study using the Error Correction Model (ECM) approach. ECM is a model used to correct the regression equation of variables that are individually not stationary in order to return to its equilibrium value in the long run, with the primary condition in the form of a cointegration relationship between its constituent variables (Santosa & Hidayat, 2014). ECM uses residuals from the cointegrated equation, where the residual is used as an error correction term that affects the short-term equation. ECM specification as follow (Utama & Agesy, 2016; Sihombing et al., 2014; Che-Yahya et al., 2017; Maltritz & Molchanov, 2013):

$$D(YTM)_t = \alpha_0 + \alpha_1 D(BIR)_t + \alpha_2 D(INF)_t + \alpha_3 D(EXR)_t + \alpha_4 D(DEV)_t + \alpha_5 D(OIL)_t + \alpha_6 D(CAD)_t + ECT_t, \quad (2)$$

where $D(YTM) - \Delta YTM$ (SUN); $D(BIR) - \Delta BI-7$ days RR; $D(INF) - \Delta$ Inflation rate; $D(EXR) - \Delta$ Exchange rate; $D(DEV) - \Delta$ Reserved assets; $D(OIL) - \Delta$ world crude oil price; $D(CAD) - \Delta$ Current account deficit; α_0 – constant; $\alpha_1, \alpha_2, \dots, \alpha_6$ – ECM coefficient (short-term); ECT – Error correction term (ECT), the representation of actual adjustments to go to equilibrium when an imbalance condition occurs; t – period (quarterly).

The Error Correction Model (ECM) approach is used in time-series data to be able to find out short-term and long-term dynamic movements. Meanwhile, to identify the existence of a long-term relationship between the dependent variable and the independent variable, the cointegration approach is used. The ECM model can help researchers solve the problem of spurious regression and time-series data that is not stationary (Santosa & Hidayat, 2014).

3. Empirical results

3.1. Statistics description

Descriptive statistical results in this study are shown in Table 2, with the sample characteristics used in this study include: the number of samples ($N = 280$), the mean, the maximum value (max), the minimum value (min), as well as the standard deviation for each variable. Data of observations on Fixed Rate series of Government Bonds registered on the Indonesian Bond Market from 2010 to 2019, quarterly.

Table 2. Statistics description

Variables	Mean	Max	Min	Std.Dev.
BIR	2.7800	3.1582	2.5682	0.1940
INF	1.9018	2.4001	1.3547	0.3172
EXR	9.3774	9.5495	9.1116	0.1482
DEV	11.607	11.764	11.448	0.0762
OIL	4.9762	5.5924	4.2239	0.5361
CAD	8.5438	9.2228	7.4899	0.4128
YTM	7.6057	9.7991	5.5803	1.0342

3.2. Estimation of Error Correction Model

3.2.1. Test of stationarity data

Testing the stationarity of data to avoid Spurious Regression caused by false regression makes the statistical testing of each coefficient invalid and challenging to be used as a guideline. The EMC formation can be done if the dependent variable is not stationary. The study uses a unit root test to test whether the time series data is stationary or not. The stationary Test Results are as follows.

Table 3. Unit root test

Variables	Level		1st Difference		2nd Difference	
	ADF	Prob	ADF	Prob	ADF	Prob
YTM	-2.2976	0.1813	-4.2321	0.0038	-3.5504	0.0203
BIR	-0.7962	0.8004	-2.3638	0.1626	-4.5289	0.0021
INF	-1.5257	0.5030	-3.8601	0.0094	-5.0557	0.0009
EXR	-1.9537	0.3032	-1.9755	0.3032	-4.8790	0.0016
DEV	-1.2435	0.6361	-3.3591	0.0240	-7.2208	0.0000
OIL	-0.7716	0.8088	-4.5395	0.0019	-8.3642	0.0000
CAD	-3.1942	0.0382	-4.2640	0.0044	-5.4467	0.0003

Table 3 shows the Unit Root Test results that at the level of all variables are not stationary, which indicates that all variables have a root unit. To prove whether the data is stationary, then the degree of integration test is then performed at the 1st Difference level. In Table 3, the BI Rate, Inflation, and Exchange Rate variables are not stationary. Next, the test is repeated at the 2nd Difference level. From these tests, it was found that all variables were stationary, with a significant probability level at $\alpha = 5\%$.

3.2.2. Cointegration test

A cointegration test is a test conducted to detect the stability of long-term relationships between variables. This test to identify scenarios that two or more non-stationary time series are integrated together in the long term, and they cannot deviate from equilibrium (Gujarati & Porter, 2013). Before conducting this test, the first thing to do is to create a long-term regression equation model. Here are the results of the long term regression equation.

Table 4. Results of Long-term regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.1080	28.495	-0.1090	0.9174
BIR	-0.1819	1.1002	-0.1653	0.8726
INF	-0.1984	0.6045	-0.3283	0.7566
EXR	8.0246	2.0876	3.8438	0.0043
DEV	-5.8827	2.3936	-2.4576	0.0250
OIL	1.1880	0.6381	1.8617	0.0800
CAD	-0.1499	0.3041	-0.4931	0.6287
R-squared	0.8615	Prob(F-statistic)		0.0015
Adjusted R-squared	0.7885	S.D. dependent var		1.0842

Table 4 shows that in the long-term estimation, the exchange rate variable has a significant positive effect; the variable reserved assets have a significant adverse effect on government bond yield (SUN). After conducting a long-term regression estimation test, the next is

the formation of residuals must be stationary at the level. From the data processing results obtained in Table 5 as follows:

Table 5. Cointegration Test

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.5482	0.0000
Test critical values:	1% level	-3.7897	
	5% level	-3.0045	
	10% level	-2.6742	

Note: *MacKinnon (1996) one.sided p-values.

3.3. Error Correction Model

A good and valid ECM model must have a significant ECT (Error Correction Term) can be seen beside the t-statistic value, which is then compared with the t-table, it can also be seen from the probability. If the t-statistic value is higher than the t-table, the coefficient is significant. If the ECT probability is smaller than 0.05, then the ECT coefficient is significant.

Table 6 presents the model's ECT coefficient values that are significant for the estimation of Government bond yields (SUN). The ECT coefficient value of 0.9838 means that the difference between the value of the Government Bond Yield (SUN) and the balance value is 0.9983, which will be adjusted within one year.

The following ECM (short-term estimates) results.

Table 6. Results of Error Correction Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	18.785	26.732	0.7028	0.4899
D(BIR)	5.9923	2.7735	2.1607	0.0492
D(INF)	2.0310	0.6904	2.9431	0.0167
D(EXR)	-0.7323	4.7106	-0.1554	0.8739
D(DEV)	-5.0892	3.9829	-1.2779	0.2372
D(OIL)	1.7586	0.7138	2.4637	0.0339
D(CAD)	-0.0273	0.3447	-0.0793	0.7552
ECT	0.9838	0.2161	4.5490	0.0016
R-squared	0.7221			
Adjusted R-squared	0.7018			
Prob(F-statistic)	0.0091			

The above equation can be said to be valid by proven by a significant probability at the 5% test level of 0.0005 and a coefficient value of λ of 0.9591 ($0 < \lambda < 1$). With the results of R^2 of 0.7221, or other words the independent variables BI rate, inflation, exchange rate, foreign exchange reserves, world oil prices, and current account deficits explain 72.21 percent variations in the government bonds yield (SUN).

4. Discussion

4.1. BI rate and government bond yield

The first hypothesis states that the BI rate has a positive and significant relationship to acceptable government bond yields because the probability of t in the estimated short-term ECM regression is $0.0490 < 0.05$. If the BI Rate has increased, then in the short-term, Government bond yield will increase. This study's results are consistent with the results of research from Sundoro (2018) and Tjandrasa (2017), who stated that when government bond yields on all tenors have increased, the BI rate will also increase. Yulawati and Suarjaya (2017) found interest rates to positively and significantly affect government bond yields because the higher interest rates, bond issuers will offer larger coupons to attract investors to invest or invest their funds in bonds. Moreover, in their research, Santosa and Sihombing (2015) also stated that interest rates have a positive impact on the yield of government bonds with different tenors. To further strengthen the results of this study,

4.2. Inflation and government bond yield

The hypothesis states that inflation has a positive and significant effect on the yield of government bonds (SUN) is rejected because the probability of t in the estimated short-term ECM regression is $0.0164 < 0.05$ with a negative effect. If inflation has decreased, then in the short term, government bond yields will increase. Pramana and Nachrowi (2016) and Strassberger (2012) state that inflation in the percentage of CPI has a positive and significant effect on bond yield changes. Moreover, Kurniasih and Restika (2015) and Santosa and Sihombing (2015) also stated the similar thing that inflation affects the yield of government bonds. The CPI would increase consumer spending and slow the rate of economic improvement. This condition will increase the risk premium, which will increase the yield curve that confirmed that inflation had a significant positive effect on government bond yield (Bernoth & Erdogan, 2012; Klepsch, 2011).

4.3. Exchange rate and government bond yield

The third hypothesis proposed states that the exchange rate has a positive and significant effect on government bond yields that can be accepted because the probability of t in the long-term regression estimation is $0.0013 < 0.05$. If the Exchange Rate has increased, in the short term, Government bond yield will increase. These results are consistent with Paramita and Pangestuti (2016) findings and Arshada et al. (2018) that suggest the exchange rate has a positive and significant effect on the bond yield curve in the long run. Pramana and Nachrowi (2016) and Paramita and Pangestuti (2016) stated similarly that the exchange rate positively and significantly affected government bond yields in US Dollars. Santosa and Sihombing (2015) also say that an increase in the exchange rate or depreciation of the domestic currency against foreign currencies (in this case, the IDR against the USD) will cause inflation. The inflation will be responded positively by the yield curve.

4.4. Reserved assets and government bond yield

The fourth hypothesis proposed states that foreign exchange reserves negatively affect government bond yields acceptable because the probability of t in the long-term regression estimation is $0.0250 < 0.05$. If foreign exchange reserves decline, in the long-term, government bond yields will increase. Some previous study state also supports this finding that foreign exchange reserves inversely effect on bond yields. The research results in Indonesia and Thailand proved that foreign exchange reserves have a negative and significant effect on government bond yields (Sihombing et al., 2014; Hsing & Hsieh, 2012). Strassberger (2012) and Huang et al. (2019), in their research, also said that foreign exchange reserves or foreign reserves negatively affect on bond yield and proved that a significant adverse effect between foreign exchange reserves on government bond yields.

4.5. Crude oil prices and government bond yield

The fifth hypothesis states that world oil prices have a positive and significant effect on acceptable government bond yields because the probability of t in the estimation of the short-term ECM regression is $0.0359 < 0.05$, then the hypothesis is not rejected. If world crude oil prices increase, in the short term, government bond yield will increase. This study's results are consistent with some previous research that stated crude oil prices have a significant positive effect on government bond yields. Besides, the result shows that when world oil prices increase, it will be followed by an increase in government bond yields in emerging countries (Sultan et al., 2019; Utama & Agesy, 2016; Kurniasih & Restika, 2015). Moreover, Santosa and Sihombing (2015) also stated that high oil prices would increase government bond yield. This statement proved the determinant model of government bond yields resulting in the conclusion the world oil prices had a significant positive effect on government bond yields.

4.6. Current account deficit and government bond yield

The sixth hypothesis states that the current account deficit (CAD) has a positive and significant effect on government bond yield; the hypothesis is rejected. From the research results, the probability of t in the short term is $0.9385 > 0.05$. The CAD has a negative but insignificant effect in the long run and short run on the yield of government bonds (SUN). The research results from Favero et al. (2010) and Simu (2017) found that the current account balance of GDP has a negative influence on government bond yields. However, these results contradict the findings of Naidhu, Goyari, and Kamaiah (2016) and Utz, Weber, and Wimmer (2016) that the CAD has a positive effect on government bond yield.

Conclusions and recommendation

This paper has analyzed the macroeconomic determinants of the yield curve of Indonesian government bonds (SUN) based on the sample during 2010-Q1–2019-Q4. The ECM model is employed in empirical estimation. The main findings can be summarized as follows. First, a more BI rate, inflation, foreign exchange, and crude oil price, a higher yield curve of SUN in

the short-term. Second, whereas the reserved assets negatively affect on yield curve of SUN. This insignificant result of the relationship between CAD and yield curve indicates that the government's bonds have not sufficiently reduced the CAD deficit. Third, in general, the findings presented in this study suggest that the government bond, macroeconomic indicators, and the issuer bond rating quality are the major issuer characteristics that differentiate the yield curve from one another. Whereas, government bond yield is the main issue characteristic that plays a significant role in pricing the corporate bond in Indonesia.

There are some managerial and policy implications to maintain a robust fixed income market. The authorities need to promote GDP growth, pursue fiscal efficiency, keep up the credit rating, risk current account deficit, keep a relatively low BI rate and expected inflation rate. In conducting fiscal policy and monetary control, the ministry of finance and the central bank need to aware of the significant positive relationship between the yield curve and interest rate, inflation rate, exchange rate, reserved asset, and crude oil price. However, if CAD continues to rise beyond a specific critical level, its effect will become positive on SUN's yield because of budget risks.

A practical guideline used by investors and market participants to monitor the development of the value of the portfolio of government bonds owned is to watch the shift in term structure interest rate. Then, an analysis of the shift in term structure interest rate or the yield curve becomes vital to be understood by investors and market participants to improve their investment portfolios' performance.

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