

The Influence of Inflation, Exchange Rate and Foreign Exchange Reserves on Indonesian Government Bond Yield with the Bank Indonesia Rate as Moderation



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ABSTRACT: The purpose of this study was to analyze and examine the effect of inflation, exchange rates, foreign exchange reserves on the yield to maturity (YTM) of fixed rate series bonds denominated in rupiah with a tenor of 10 years during the period 2015 - 2021. The statistical analysis method used in the preparation of this research is quantitative with descriptive explanations. Data collection techniques were obtained from secondary data through library research. Secondary data obtained through the internet sites of Bank Indonesia, Central Statistics Agency, Ministry of Finance, and Bloomberg in the form of information, research data, and macroeconomic variables in the 2015-2021 period. The analytical method used in this study is moderated regression analysis (MRA). The study type was an explanatory study with data processing using the IBM SPSS Statistics 25 application. The study results showed that the determinant of inflation had no effect on YTM, exchange rate had a significant negative effect on YTM, foreign exchange reserves had a negative effect on YTM. The result of BI rate as moderating factor is able to moderate the relationship between both of exchange rate and foreign exchange reserves against YTM. It is believed that the BI rate has force power as a determinant of the yield to maturity of rupiah-denominated fixed rate government bonds.

KEYWORDS: inflation, exchange rate, foreign exchange reserves, BI rate, government bond yield, yield to maturity

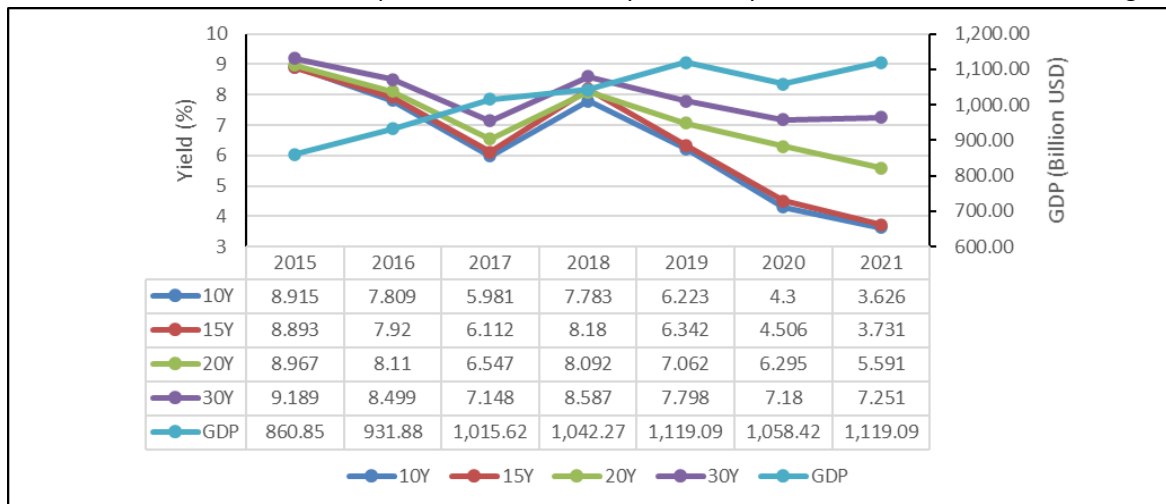
I. INTRODUCTION

Investing is a tool for investors to increase the value of their wealth by involving in business activity with the hope of generating additional funds in the future. Investment can be divided into two types, investment in real assets and securities (including bond). Bonds as a financial instrument are seen the suitable way of raising funds for government, institutions and companies. The issuer can be a company, a state-owned enterprise, or government either the central or regional government. The issuance of bonds is important because the government and companies need cheap financing components to drive the economic and corporate business scales. Government bonds are an alternative financing in the development of the country's economy. As a way to cover the deficit, the issuance of bond has enormous potential to be developed. The purpose of issuing government bond is as a financial, investment, and fiscal market instrument. Bond's investors get benefits such as yields. The movement of yield is used by investors as a benchmark to see the movement of the portofolio value they have. In the financial market, the role of government bond yield is very strategic as a risk-free financial instrument and a reference for market players to be making investment decisions. The changes in investment risk can be seen on the yield curve which illustrates the relationship between interest rates and time until maturity.

The movement of yield to maturity is caused by many influencing factors that include macroeconomic. The economic condition is an important indicator on influencing investment decisions in a country. Foreign investors will look at a country's economic situation before making investment decisions in Indonesia. One of the most important macroeconomic indicator is fluctuations on inflation, interest rates, the rupiah exchange rate and the Gross Domestic Product. On Graph 1 that show the movement of Yield to maturity and Gross Domestic Product (GDP) during research period. GDP could represent country economics. It could be seen that there was a relationship between GDP and yield to maturity. When GDP is low or falls at USD 860.85 Billion on 2015, on the other hand, the movement the yield to maturity of government bonds is quite high at 8.915% for government

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bond 10Y. This condition could occur due to pressure on the country's economy. Both of internal factor such as high inflation



Graph 1. Relation Between Yield and GDP
Source: Bloomberg

and an increase in The Fed's interest rate from external factor make macroeconomics condition quite uneasy. However, when GDP was high or increasing quite a lot to USD 1.015 billion, on the contrary, the movement of the yield to maturity dropped to around 5.981% as in 2017. The decline of yield on 2017 was due to Bank Indonesia's decision to provide monetary concessions by cutting the BI 7-Day Reverse Repo Rate (RRR) and external influences which contributed to the inflow of foreign funds due to the low US Treasury yield and the increase of Indonesia's investment rating by Standard & Poor's (S&P). During the pandemic, yields were quite depressed, especially during the initial period of the pandemic which is the first 6 months. This case happened because the Covid-19 pandemic had a broad and global impact including the financial sector. The real impact of the pandemic has caused a decline of the country's economy. After the yield was corrected at the start of the pandemic period, the further movement in yields was quite stable in 2020. An anomaly occurred in 2018, when GDP rose slightly to USD 1.042 billion, that was followed by an increase in YTM to 7.783%. This condition was an oddity why when GDP rises and follow by rising of yield. The yield rising was caused by state revenues running smoothly and improving the quality of the economy that was pushes yields up. A stable economy should encourage investors to be more confident in making investments which will make yields tend to fall. The trend of declining GDP at the beginning of the pandemic was followed by a decrease in YTM. This condition becomes an oddity because when GDP falls and the government needs financing sources, including through the issuance of bonds, this should be followed by an increase of YTM to encourage capital owners to invest including in government bonds.

The existence of inconsistencies on the above conditions needs to be examined and analyzed more deeply in order to find out the reasons why these happened. This research empirically examines the yield to maturity of government bonds. This study hoped that this research can provide empirical evidence, contribute ideas for analyzing event studies of market reactions under normal conditions and the global economic crisis due to the Covid-19 pandemic, and as well as, being a scientific reference in making bond investment decisions. The finding of this research will contribute to development of financial management knowledge. In addition, this research will be very useful for scholars/academicians, policy makers, investors and the general public.

II. LITERATURE REVIEW

Yield to Maturity (YTM) is a calculation shown the income level that investors will get from securities investment until the maturity period. Its calculation can be used as a reference for predicting the percentage of investor profit level for long period until investors want to sell their assets. YTM serves as a reference for comparison between the ideal condition of a securities product and actual condition. This is related to the term structure of interest rate theory which is a series of interest rate sorted into several structures based on a certain maturity [1]. The structure of interest rate is depicted in a yield curve which shows the relationship between yield and investment maturity. These fluctuations on yield are influenced by several macroeconomic factors. Macroeconomic conditions are important influencing indicators for investment decisions on specific country. Its conditions can be the main basis for determining of the government bond yield. The yield of domestic bond in developing countries influenced by macroeconomic indicators [2]. This study uses macroeconomic indicators such as inflation, exchange

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rates, foreign exchange reserves and the Bank Indonesia's rates. Inflation is a value where the price level of goods and services generally increases [3]. An increase of these goods and services price means a decrease of the value of money. A price increase for one or two goods can not be called inflation unless the increase is widespread or impacting increase of other goods price. The exchange rate is the price of money for specific country measured or stated in the currency of other country [4]. The importance of exchange rate for a country is an indicator of a country's competitive level of the global economy and trade. When the foreign exchange rate increases too high, it will cause the economic growth to be slow down. Foreign exchange reserves are all foreign assets controlled by the monetary authority and could be used at any time to finance balance of payments needs or intervene the monetary stability on the foreign exchange market and other purposes [5]. It is claimed that foreign exchange reserves must be able to be used whenever needed, so in general foreign exchange reserves are in the form of foreign currency, gold, or short-term claims to non-residents which are liquid, can be disbursed within one year, or easily traded. Meanwhile, Bank Indonesia reference interest rate is a policy interest rate that reflects the attitude or monetary policy stance set by Bank Indonesia and announced to the public. Monetary policy conducted by BI relates to development of interest rates in the financial sector which could affect inflation rate and real output.

III. METHOD

This methodology of research is the quantitative explorative using IBM SPSS Statistics 25. The research data is monthly secondary data from January 2015 to December 2021, so the total number of observations at this study is 84. The data source was obtained based on information published by the relevant institutions. These institutions include Bloomberg, Bank Indonesia, the Central Bureau of Statistics, and the Directorate General of Financing and Risk Management of the Ministry of Finance. The purpose of this study was to test, obtain empirical evidence and analyze the effect of inflation (X1), exchange rate (X2), foreign exchange reserve (X3) on the yield to maturity of the 10 years government bonds with a fixed rate (Y) which are influenced by the BI reference rate (Z) as a moderating factor.

IV. RESEARCH RESULT

The following tables show data on the dependent and moderating variables:

Table 1. Inflation on 2015 to 2021

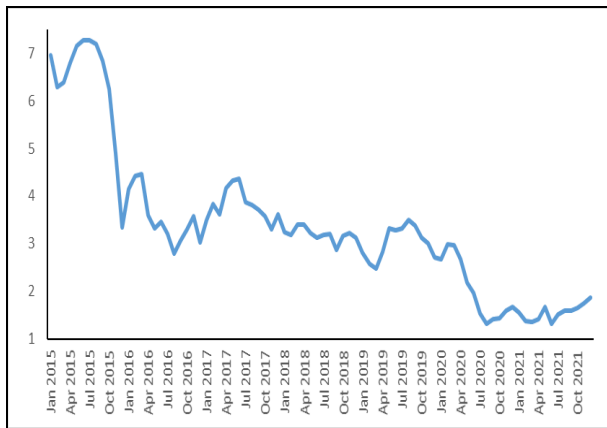


Table 2. Exchange rate on 2015 to 2021

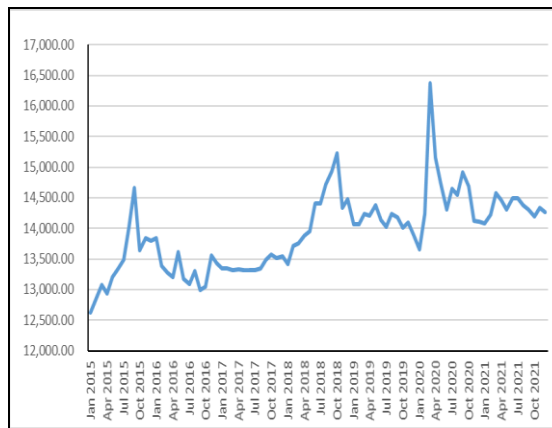


Table 3. Foreign exchange reserves on 2015 to 2021 (Million USD)

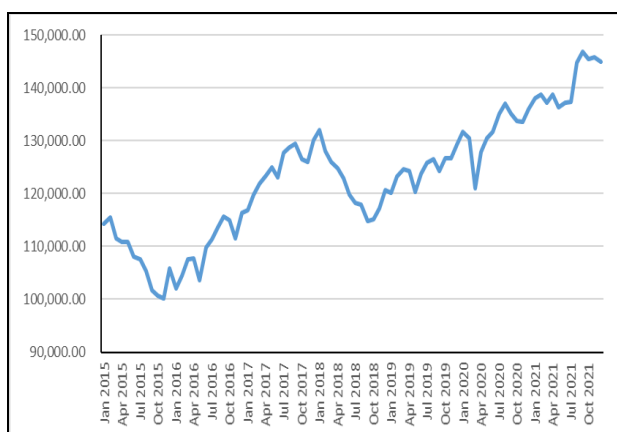
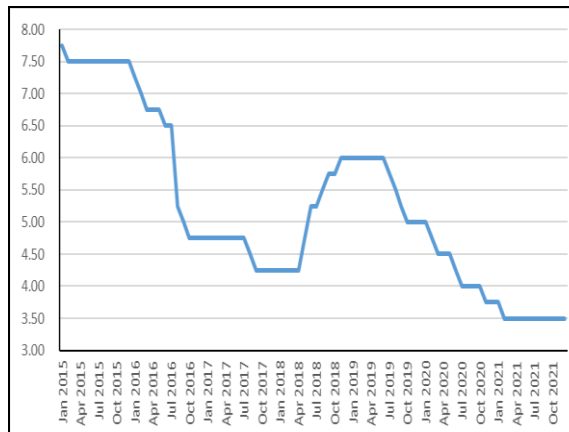


Table 4. BI rate on 2015 to 2021



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4.1 Classic Assumption Test

These tests are intended to produce a regression model that meet the BLUE (Best Linear Unbiased Estimator) criteria. Its model can be used as reliable estimators where the estimators are stated to be unbiased, consistent, normally distributed and also efficient.

4.1.1 Normality Test

One-Sample Kolmogorov-Smirnov is used to test the normality using a significance level of $\alpha = 5\%$. If the significance is greater than $\alpha = 5\%$, it means that the data is normal distributed. Conversely, if it is less than $\alpha = 5\%$, it means that the data is not normal distributed.

Table 5. The results of normality test

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		84
Normal Parameters ^{a,b}	Mean	0.000000
	Std. Deviation	0.41564016
Most Extreme Differences	Absolute	0.045
	Positive	0.043
	Negative	-0.045
Test Statistic		0.045
Asymp. Sig. (2-tailed)		.200 ^{c,d}
a. Test distribution is Normal.		
b. Calculated from data.		
c. Lilliefors Significance Correction.		
d. This is a lower bound of the true significance.		

From the normality test in table 5, the results of the K-S values based on the Asymtotic method, the Asymp. Sig. (2-tailed) is 0.200 which is greater than 0.05 ($\alpha > 0.05$). From the results of the normality test, it can be concluded that all data is normal distributed.

4.1.2 Multicollinearity Test

To find out whether multicollinearity occurs, it can be seen from the VIF (Variance Inflation Factor) and the tolerance value of each independent variable. To find out whether the research data contain multicollinearity or not, it can be based on the following assumptions:

1. If the VIF > 10 and the Tolerance < 0.1, then the data has multicollinearity problem
2. If the VIF < 10 and the Tolerance > 0.1, so the data is free from multicollinearity problems.

Table 6. The results of multicollinearity test

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	11.719	1.973		5.940	0.000		
	Inflation	0.947	0.206	0.319	4.589	0.000	0.249	4.016
	Exchange rate	0.000	0.000	0.215	5.081	0.000	0.673	1.486
	Foreign exchange reserves	-9.728E-05	0.000	-0.842	-10.842	0.000	0.199	5.019
	BI rate	-0.095	0.081	-0.093	-1.178	0.242	0.191	5.224
a. Dependent Variable: Yield								

Based on the test result of tolerance and VIF values, it can be seen that all tolerance values for inflation (X1), exchange rates (X2), foreign exchange reserves (X3), and BI interest rates (Z) are more than 0.1. And, the VIF value of all dependent and moderating variables are less than 10. Thus, the model does not have a multicollinearity problem.

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4.1.3 Heteroscedasticity Test

This test is carried out using the Glejser test which is conducting a regression analysis of all variable including moderating as the independent variables with absolute residuals as the dependent variable.

Table 7. The result of heteroscedasticity test

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-0.466	1.093		-0.427	0.671
	Inflation	-0.188	0.114	-0.352	-1.643	0.104
	Exchange rate	6.447E-05	0.000	0.168	1.293	0.200
	Foreign exchange reserves	-1.788E-06	0.000	-0.086	-0.360	0.720
	BI rate	0.064	0.045	0.347	1.422	0.159
a. Dependent Variable: ABS						

Based on the test result of significance value, it can be seen that all of these values from Inflation (X1), Exchange Rate (X2), Foreign Exchange Reserves (X3) and BI Interest Rate (Z) are greater than 0.05. Thus, the result shows no symptoms of heteroscedasticity.

4.1.4 Autocorrelation Test

This test is performed using the Durbin-Watson test (D-W) with a confidence level = 5%.

Table 8. The result of Autocorrelation test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.951 ^a	0.905	0.900	0.42603	2.094
a. Predictors: (Constant), BI Rate, Kurs, Inflasi, Cadev					
b. Dependent Variable: Yield					

With $\alpha = 0.05$, the number of independent variables ($k = 4$), and the total data ($n = 84$), then the $dL = 1.5472$, $dU = 1.7462$, $4-dL = 2.4528$, and $4-dU = 2.2538$. The value of the DW-test is in the range of $dU < DW < 4-dU$ ($1.7462 < DW < 2.2538$). Because of that, so there are no autocorrelation problems. To see in more detail whether there are a correlation symptom, a Run Test will be carried out.

Table 9. The result of Run test

Runs Test	
	Unstandardized Residual
Test Value ^a	-0.01442
Cases < Test Value	42
Cases >= Test Value	42
Total Cases	84
Number of Runs	43
Z	0.000
Asymp. Sig. (2-tailed)	1.000
a. Median	

The results of test obtain the Asymp value. Sig (2-tailed) is 1.000 which more than 0.05 so it can be concluded that all data variables are free from autocorrelation symptoms.

4.2 Moderation Regression Analysis

Moderated Regression Analysis (MRA) is conducted to determine the relationship between independent variables and moderating effect on the dependent variable.

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Table 10. The result of Moderation Regression Analysis

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.
		B	Std. Error	Beta			
1	(Constant)	40.153	6.572			6.110	0.000
	Inflation	0.305	0.602	0.103		0.507	0.614
	Exchange rate	-0.001	0.000	-0.552		-3.369	0.001
	Foreign exchange reserves	-0.000	0.000	-1.286		-6.616	0.000
	BI rate	-5.599	1.176	-5.492		-4.761	0.000
	Inflation*BI rate	0.049	0.104	0.140		0.475	0.636
	Exchange rate*BI rate	0.000	0.000	3.789		4.707	0.000
	Foreign exchange reserves*BI rate	1.338E-05	0.000	1.077		3.403	0.001

a. Dependent Variable: Yield

From table 10, the results of data processing obtain the model equation as follows :

$$Y = 40.15263 + 0.30542 * X_1 - 0.00118 * X_2 - 0.00015 * X_3 - 5.59906 * Z + 0.04929 * X_1 * Z + 0.00029 * X_2 * Z + 0.00001 * X_3 * Z + \epsilon$$

From these equation, the result can be explained as follows:

1. A constant value is 40.15263 means, if all the independent variables are zero, the yield to maturity (YTM) will be 40.15263.
2. The inflation coefficient and significance value are 0.30542 and 0.614 that more than 0.05 which mean the inflation variable is not significant.
3. The exchange rate coefficient and significance value are -0.00118 and 0.001 that more than 0.05), thus the exchange rate has a significant negative effect on YTM.
4. The foreign exchange reserve coefficient and significance value are -0.00015 and 0.000 that more than 0.05, thus the foreign exchange reserve has a significant negative effect.
5. The coefficient value of the BI interest rate and significance value are -5.59906 and 0.000 that more than 0.05, thus the interest rate has a significant negative effect.
6. The coefficient of interaction between inflation and the BI interest rate is 0.04929 with a significance amounting to 0.636 that more than 0.05. This means there is a positive influence but not significant.
7. The coefficient of interaction between the exchange rate and the BI interest rate is 0.00029 with a significance amounting to 0.00 that more than < 0.05. This shows that there is a positive and significant influence.
8. The value of the interaction coefficient of foreign exchange reserves with the BI interest rate is 0.00001 with a significance amounting to 0.001 that more than 0.05. This shows that there is a positive and significant influence.

4.3 Hypothesis Test

Test of the hypothesis in this study is using the F test, t test, and the coefficient of determination.

4.3.1 F Statistical Test

Table 11. The results of F test.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	143.635	7	20.519	207.016	.000 ^b
	Residual	7.533	76	0.099		
	Total	151.168	83			

a. Dependent Variable: Yield

b. Predictors: (Constant), Foreign exchange reserves*BI rate, Exchange rate, Foreign exchange reserves, Inflation, Inflation*BI rate, Exchange rate*BI rate, BI rate

The F test is conducted to determine whether the dependent variable is simultaneously affected by the independent variable by looking at the F significance level. The result of ANOVA model with a significance level of 5% shows that the calculated F value is 207.016 which greater than the F table value (3; 81) = 2.717 and the probability Sig. is 0.000 that much smaller than 0.05. This means that all independent variables together have a significant effect on Yield.

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4.3.2 T Statistical Test

This test is conducted to determine whether there is influence of each independent variable individually on the dependent variable using a significance level of 5%. The t table value is $t(\alpha/2; n-k-1) = 1.99167$.

As the results of the study on table 10 above, the calculated t value that smaller than the t table are inflation and inflation influenced by the BI rate. Both of variable have significance more than 0.05 so the two has no significant effect on the yield on maturity. While 5 other variables, the calculated t value is greater than t table and the significant level is less than 0.05 so the five has a significant effect on the government bond yield.

4.3.3 Coefficient of Determination

Table 13. The results of the coefficient of determination.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.975 ^a	0.950	0.946	0.31483
a. Predictors: (Constant), Foreign exchange reserves*BI Rate, Exchange rate, Foreign exchange reserves, Inflation, Inflation*BI Rate, Exchange rate *BI Rate, BI Rate				
b. Dependent Variable: Yield				

The value of the coefficient of determination (R²) is 0.950. This means that 95% change of the government bond yield to maturity is influenced by inflation, exchange rates, foreign exchange reserves, BI rate, inflation influenced by BI Rate, exchange rate influenced by BI rate, and foreign exchange reserves influenced by BI rate. Thus, it can be concluded that the BI rate has moderated by strengthening the influence of all independent variables on government bond yields.

V. DISCUSSION

The constant value of the regression result shows that if there is no inflation, exchange rate, foreign exchange reserves, BI rate, inflation moderated BI rate, exchange rate moderated BI rate, and foreign exchange reserves moderated BI rate then the yield will be high. This is underpinned by the following results: R Square = 0.95 and F = 207.016 with Sig. = 0.000 less than 0.05. This indicates that the constant factor collectively with the independent and moderating variables have a significant effect on the yield to maturity.

Based on the results of the hypothesis research, it is found that inflation has no significant effect on the YTM government Bonds. That condition occurs because the increase of inflation affects bond trading in the secondary market where investors will tend to take profits due to their old low yields. The selling action increased the supply side of bond instruments causing the overall yield movement to be relatively stable. The study results are in line with research [6], [7] and [8] which stated the exchange rate has a negative effect on government bond yields.

The exchange rate has a negative and significant effect on YTM bonds. This can be explained using demand and supply analysis. When there is Rupiah deflation, foreign investors will invest a lot in government bonds so that demand is greater than supply which will encourage an increase in yield. The results of this study are in line with research [9] which stated the exchange rate has a negative effect on government bond yields.

The foreign exchange reserves have a negative significant effect on bond yields. That occurs because increasing foreign exchange reserves can reduce the country's debt level which impacts on a decrease of the government bond yield. The foreign exchange reserves can reflect the risk level that investors will accept on foreign currency investment. The results of this study are supported by research [10] which stated the exchange rate has a negative effect on government bond yields. [10] stated the shock of foreign exchange reserves from the beginning to longer period gave a negative response to the yield for all tenors.

The BI rate has a negative significant effect on government bond yield. An increase on the BI rate will affect the public's preference for holding liquidity. An increase on the BI rate provides an incentive for the public to buy certain investments that are safer on long term period. Investment selection with low risk is safe and appropriate choice for investors.

The BI rate as an independent variable has a significant effect while the inflation interaction influenced by the BI rate as a moderator does not have a significant effect, so the BI rate variable functions as a Predictor Moderator. It means this moderating variable only has role as a predictor variable in the relationship model formed. The BI rate is a tool for the government in conducting monetary policy. This monetary policy objective is to maintain the stability of goods and services prices as reflected on the development of inflation rate. Apart from referring to domestic and foreign economic conditions, the movement of common interest rate is also influenced by the inflation. If the inflation is increasing, the BI rate will also enlarge and it also vice versa. In other words, if the inflation in society is high enough, the government will use the interest rate effect to

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be controlling it by raising BI rates. Because of monetary policy, if the BI rate increase happened, so the inflation rate will tend to decrease. This means that inflation and BI rates have an opposite relationship in terms of their effect on yield movements. This is also due to the fact that information of an increasing or decreasing on the BI rate cannot be directly responded by market because there are some banks still want to keep their funds at Bank Indonesia expected interest profits. So, the implementation of monetary policy requires time in order to get the aims and objectives of the monetary policy can be achieved.

Both of the BI rate as an independent variable and the exchange rate interaction variable influenced by the BI rate as a moderator have a significant effect. So, the function of BI rate as a moderating variable on the exchange rate is alike Quasi Moderator which means the BI rate variable moderates the relationship between the independent and dependent variable as well as being the independent variable. BI rate has strengthened the effect of the exchange rate on the yield of government bonds. The stability of the Rupiah against other country currencies is influenced by the exchange rate management system that implemented. The managing of exchange rate by BI applies a floating exchange rate system. The role of central bank on exchange rate is very important to maintain its stability because it can affect the price fluctuation and the financial system in Indonesia. The Central Bank uses the BI rate as a monetary policy tool that encourages exchange rate stability.

Both of the BI rate as an independent variable and the foreign exchange reserve interaction variable influenced by the BI rate as a moderator have a significant effect so it can be concluded that the BI rate as a moderating variable on foreign exchange reserves has function like Quasi Moderator. The BI rate affects the trade balance through the income mechanism. The policy of providing high interest rates can have a negative impact on economic activity. High interest rate can cause the investment cost to be expensive. The increase of the interest rate will encourage a decrease on domestic investment. The investment will decline and investors tend to save their money in the bank because the profit that they received from saving money are greater than making direct investment.

VI. CONCLUSION

The yield to maturity movement of Indonesian government bonds is quite fluctuating. The fluctuation happened such as the worsening global economic conditions in the beginning period of the Covid 19 pandemic which turned out to have an influence on the yield movement. The yield to maturity fluctuations is strongly influenced by the components of inflation, exchange rates, foreign exchange reserves, and the BI rate as a moderation. That influence is indicated by the R square value which reaches 95%. The issuance of government bonds is not affected by inflation. BI rate as a moderating variable is proven to strengthen the effect of all independent variable on government bond yields. The amount of the BI rate needs to be considered on estimating the government bond yield because the BI rate can simultaneously act as an independent and moderating variable. Movement sensitivity of inflation, exchange rates, foreign exchange reserves and BI rates need to be considered in estimating the yield of government bonds and, of course, also elaborate with the factor of financing needs and macroeconomic conditions whether global and domestic. Exchange rate movements greatly fluctuate due to global sentiment are quite vulnerable to providing financing allocations, so the government needs to mitigate budget exposure.

Suggestions that can be given for further research are (1) exchange rates and foreign exchange reserves can be the focus in estimating yield to maturity, (2) BI rate can moderate the yield to maturity level so it needs attention to estimate yield with addition of both domestic and global macroeconomic information, and (3) the increasing of variable such as other economic, political, or social conditions and sample of other government bond series needs to be done to obtain research results closed to actual conditions.

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