

## EFFECT OF BONDS MATURITY DATE, INTEREST RATES, INFLATION, EXCHANGE RATES AND FOREIGN EXCHANGE RESERVES ON YIELD TO MATURITY OF GOVERNMENT BONDS 2014-2020

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| ARTICLE INFO   | ABSTRACT   |
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| Received<br>25 January 2022<br>Revised<br>05 February 2022<br>Approved<br>15 February 2022                         | This study aims to analyze the effect of maturity date, interest rate, exchange rate, inflation and foreign exchange reserves on the yield to maturity of Indonesian government bonds for the period 2014-2020. The analysis is using panel data analysis. The results showed that the maturity level of bonds (X1), interest rates (X2), had a positive and statistically significant effect on yield to maturity. The inflation (X3) and has a negative and significant effect, while the exchange rate (X4) has no significant effect but has a positive relationship. Foreign exchange reserves (X5) have a negative and significant effect. The exchange rate does not have a significant effect. This is not in accordance with the previous theory, because the sample limitation in this study only uses bonds with Rupiah currency. |
| <b>Keywords:</b> maturity date; interest rate; inflation; exchange rate; exchange rate and Yield To Maturity (YTM) |  |

### Introduction

The policy of the State Revenue and Expenditure Budget as known as APBN is always directed to maintain and maintain macroeconomic stability as well as to encourage economic growth. Nowadays, debt is still the main source of APBN financing to cover the deficit and to repay the principal debt that has matured (refinancing). In subsequent developments since 1999, in addition to foreign loans which are still needed given the soft loans and fixed interest rates, the other main fiscal instrument is Government Bonds (SUN), which are also financial market instruments, namely the money market and capital market. Investments in bonds also provide benefits in the form of yields. Bond yields are also an important factor taken into account by investors in purchasing bonds AS an investment instrument.

There are several types of yields that can be used by investors, one of which is the Yield to Maturity (YTM) which is the rate of return that investors get if they buy bonds at the current market price and hold them until maturity. Changes in YTM are influenced by changes in interest rates and inflation. In relation to a number of these concepts, if interest rates increase, bond prices will decrease, then bond YTM will

increase. This is also supported by the results of research conducted by Ihda (2019) and Pardomuan (2017) which state that interest rates and inflation have a significant positive relationship to YTM.

Then in this study also examines the variable maturity date, namely the maturity time of the refund according to the nominal value of the bond issuer to the bond holder. The maturities of these bonds vary, some are every 12 months, 5 years, 10 years, and others. Usually, the longer the maturity, the higher the coupon (interest). This is because the difference in the value of money from time to time is accompanied by uncertainty in the next few years. This is an advantage for bondholders, so the yield is higher or at a premium, to compensate for the risk of uncertainty itself. (bareksa.com, 2019). This has also been investigated by Daryono (2016) and Mega Ayu (2019) which state that maturity date has a positive and significant relationship with YTM. According to World Government Bonds data on May 2, 2021, the YTM of Indonesian government bonds with a tenor of 10 years is the highest in ASEAN-6. Government bonds with a tenor of 10 years are often used as a benchmark for investors to make investment decisions.

According to the Center for Education and Central Banking Studies (PPSK) of Bank Indonesia (2006), the debt management strategy must also consider the foreign exchange reserve management strategy. The integration between foreign exchange reserve management strategies and debt management strategies is an important element to prevent the emergence of a crisis (crisis prevention). Therefore, this study also analyzes the effect of foreign exchange reserves on YTM, where the explanation contained in the Bank Indonesia newsletter also states that when the foreign exchange reserves are adequate, investors will not rush to divert their funds abroad. This is supported by research conducted by Pardouman (2017), (Gill, 2018), Nurlia (2019) which states that foreign exchange reserves have a negative and significant effect on YTM.

In addition, the risk of government debt is also related to fluctuations in the rupiah exchange rate. As has been explained by Samuelson and Nordhaus (2015) that when the dollar exchange rate is too high it causes high interest rates so that it slows down the rate of economic growth. High interest rates tend to reduce investment. The local currency of a country is depreciating, meaning that the local currency weakens against other currencies). US Dollar currency, pushing high interest rates and subsequently lowering bond prices and increasing yields. This is supported by research conducted by Deandra (2019), (Aulia, 2019), (Adiwibowo & Sihombing, 2019), Faoruq Widya (2016), Nurlia (2019) which states that the exchange rate has a positive and significant effect on YTM.

Based on the research gap from the previous studies and the expansion of research that is supported by the background and the underlying theory, the problem of influencing factors is proposed where there are 5 (five) variables that are thought to affect the yield to maturity of government bonds, maturity date, interest rates, inflation, exchange rates and foreign exchange reserves. Based on the description presented, it can be concluded that there is a research gap and theoretical gap, so further research is

needed on the analysis of the determinants that affect the YTM of bonds, especially Indonesian government bonds. This research is expected to contribute to the enrichment of literature both theoretically and empirically. Another thing that can be contributed to this research is the selection of a different research locus with a fairly long time span, namely 2014-2020 so that it can describe a more comprehensive relationship so that it is expected to be able to answer the gap.

### **Research Methods**

The population in this study are all government bonds traded on the Indonesia Stock Exchange (IDX) from 2014 to 2020. While the method used to determine the sample is foreign exchange reserves that are reserved at the central bank which are used for development financing and transactions. foreign countries such as imports, payment of foreign debt, investment and other financing. The purposive sampling method is a method of selecting samples with certain criteria (Sugiyono, 2008). The sample criteria are as follows:

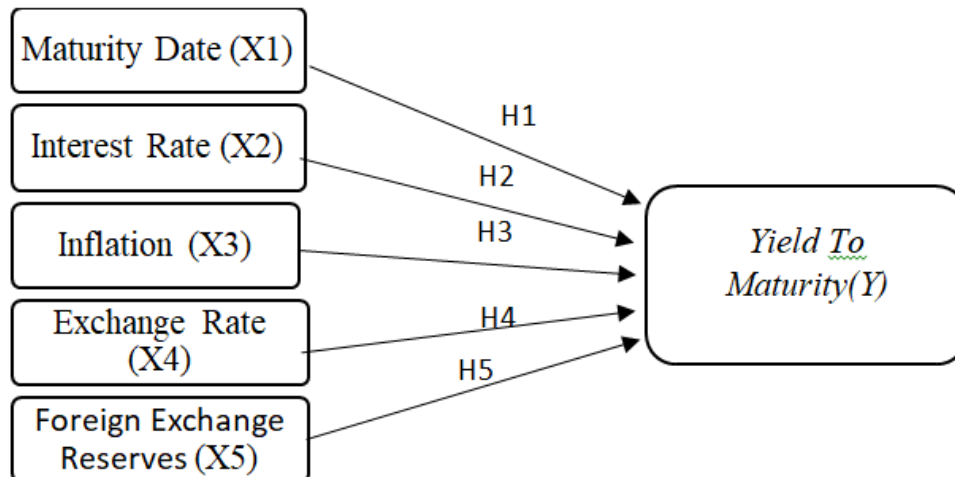
- 1) Government bonds traded during 2014 – 2020
- 2) Non-Sharia government bonds
- 3) Government bonds denominated in Rupiah
- 4) Government bonds that have a fixed coupon
- 5) Government bonds with a tenor of 10 years

The population of this study amounted to 48 government bonds traded in the 2014-2020 period, in which there are 8 Islamic bonds, 12 government bonds in foreign currencies, government bonds with a tenor of more than 10 years as many as 25 bonds. So that included in this research category as many as 3 bonds. The research time span was 84 months, therefore the number of research data taken was 252 data. The bonds included in the sample of this research are FR0061, FR0063, FR0070.

This study will analyze the effect of bond maturity, interest rates, exchange rates, inflation and foreign exchange reserves on Yield To Maturity, which can be explained by Figure 1 as a Hypothesis Model. Based on theoretical explanations from experts and previous research, a hypothesis formulation can be made as follows:

- H1 : Maturity Date (X1) has a significant and positive effect on Yield To Maturity (Y)
- H2 : Interest Rate (X2) has a significant and positive effect on Yield To Maturity (Y)
- H3 : Inflation (X3) has a significant and positive effect on Yield To Maturity (Y)
- H4 : Exchange Rate (X4) has a significant and negative effect on Yield To Maturity (Y)
- H5: Foreign Exchange Reserves (X5) have a significant and negative effect on Yield To Maturity (Y)

Framework of the research can be explained by picture as follows :



The operational definition of each research variable is as follows: Yield To Maturity (YTM) is the rate of return that investors will get on bonds if they are kept to maturity. YTM is calculated by the following formula :

$$\frac{C + \frac{F - P_{\text{bond}}}{n}}{\frac{F + P_{\text{bond}}}{2}} \times 100\%$$

keterangan:

C (Coupon)

F (Face value)

P<sub>bond</sub> (price)

n (remaining due time)

Maturity date (X1) The maturity date of the refund is in accordance with the nominal value of the bond issuer to the bond holder. Interest Rate (X2) The cost of borrowing or the price paid for borrowed funds. Inflation (X3) An increase in the prices of goods and services in general and continuously within a certain period of time. Exchange Rate (X4) The price of one currency against another, in this study the exchange rate in question is the value of 1USD when converted to Rupiah, where a positive value means that the rupiah weakens, and if the value is negative, the Rupiah increases. Foreign Exchange Reserves (X5) are foreign currencies that are reserved at the central bank which are used for the purposes of financing development and foreign transactions such as imports, foreign debt payments, investments and other financing.

$YTM = a + b_1 \text{ MATURITY} + b_2 \text{ BIRATE} + b_3 \text{ INF} + b_4 \text{ NTUKAR} + b_5 \text{ CDEVISA} + \epsilon$  Description :

YTM = Yield To Maturity (YTM) Doverment bonds, A = constanta, b1 – b5 = Kcoefficients of regression, MATURITY = Maturity date, BIRATE = Interest Rate, INF = Inflation, NTUKAR = Exchange rate, CDEVISA = Foreign Exchange Reserves, E = Residual.

The multiple linear regression equation shows the direction of each independent variable to the dependent variable, where the regression coefficient of the independent variable which is positive means that it has a unidirectional effect on Yield To Maturity (YTM).

To estimate the model parameters using panel data, several techniques are offered, including: Ordinary Least Square (OLS) This technique is similar to making a regression using cross section data as previously studied. However, for panel data, before making a regression we must combine the cross-section data with the time-series data (pooled data). Then this combined data is treated as a unified observation which is used to estimate the model using the OLS method.

1. Fixed Effect

The existence of variables that are not all included in the model equation allows for an intercept that is not constant. Or in other words, this intercept may change for each individual and time. This thinking is the basis for the formation of the model.

2. Random Effect

If in the Fixed Effects Model, differences between individuals and/or time are reflected through intercepts, then in the Random Effects Model, these differences are accommodated through errors. This technique also takes into account that errors may be correlated across time series and cross sections. In this model, to select the most appropriate model to use in managing panel data, there are several tests that can be carried out:

3. Chow test

Chow test, is testing to determine the most appropriate OLS or Fixed Effect model used in estimating panel data. The hypotheses in the chow test are H0: Common Effect Model or pooled OLS; H1: Fixed Effect Model.

4. Hausmann test

Hausmann test, is testing to determine the most appropriate Fixed Effect or Random Effect model used in estimating panel data. The hypothesis in the Hausmann test is H0: Random Effect Model; H1: Fixed Effect Model.

**Results and Discussion**

**1. Descriptive Analysis**

**Table 1**  
**Statistik Descriptive**

|           | YTM (%)  | MATURITYBI (Bulan) | RATEINFLASINTUKAR (%) | DEVISASINTUKAR (%) | DEVISASINTUKAR (%) | DEVISASINTUKAR (%) |
|-----------|----------|--------------------|-----------------------|--------------------|--------------------|--------------------|
| Mean      | 7.104664 | 69.50000           | 5.796627              | 4.059365           | 0.195516           | 0.644246           |
| Maximum   | 9.610578 | 120.0000           | 7.750000              | 8.360000           | 14.99000           | 5.640000           |
| Minimum   | 5.468457 | 16.00000           | 3.750000              | 1.320000           | -7.890000          | -7.830000          |
| Std. Dev. | 0.923314 | 26.06298           | 1.328907              | 1.760126           | 2.829174           | 2.333791           |

Based on the descriptive statistical table, it is known that the number of observations observed is 252 data, the minimum value of YTM is 5.468457. The maximum value is 9.610578. The average value is 7.104664 with a standard

deviation of 0.923314. This shows that the YTM data distribution is good because the deviation value is smaller than the average value.

The minimum value of the maturity date is 16. The maximum value is 120. The average value is 69.5 with a standard deviation of 26,06298. This shows that the distribution of maturity date data is good because the deviation value is smaller than the average value.

The minimum interest rate is 3.750000 The maximum value is 7.750000. The average value is 5.796627 with a standard deviation of 1.328907. This shows that the distribution of interest rate data is good because the deviation value is smaller than the average value.

The minimum inflation rate is 1.320000. The maximum value is 8.360000. The average value is 4.059365 with a standard deviation of 1.760126. This shows that the distribution of inflation data is good because the deviation value is smaller than the average value.

The minimum exchange rate is -7.890000. The maximum value is 14.99000. The average value is 0.195516 with a standard deviation of 2.829174. This shows that the distribution of exchange rate data is not good because the deviation value is greater than the average value.

The minimum value of foreign exchange reserves is -7.830000. The maximum value is 5.640000. The average value is 0.644246 with a standard deviation of 2.333791. This shows that the distribution of foreign exchange reserve data is not good because the deviation value is greater than the average value.

**2. Model Test**

Chow test determine the most appropriate OLS or Fixed Effect model used in estimating panel data.

**Table 2**  
**Uji Chow**

| <b>Effects Test</b>      | <b>Statistic</b> | <b>d.f.</b> | <b>Prob.</b> |
|--------------------------|------------------|-------------|--------------|
| Cross-section F          | 1.574433         | (3,243)     | 0.1962       |
| Cross-section Chi-square | 4.851238         | 3           | 0.1830       |

Source: processed data by Eviews, 2021

From the results of the Chow test, it can be seen that the probability value is 0.18 is more than 0.05. the appropriate model is the Common Effect Model rather than the Fixed Effect Model. Then next, will be tested between the Common Effect Model with the Random Effect Model. However, according to Widarjono (2009) the panel data analysis method with the random effect model must meet the requirements, the number of cross sections must be greater than the number of research variables, so that in this study it does not meet these requirements where the cross section only uses 3 (three) bonds with 5 (five) independent variables and 1 (one) dependent variable. So the model that is considered the most appropriate is the common effect.

### 3. Hypothesis Test

The estimation of panel data regression with the Common Effect Model is shown as follows :

**Table 3**  
**Estimation Of Panel Data Regression**

| Dependent Variable: YTM                    |             |            |                   |
|--|-------------|------------|-------------------|
| Method: Panel Least Squares                |             |            |                   |
| Date: 10/08/21 Time: 15:33                 |             |            |                   |
| Sample: 2014M01 2020M12                    |             |            |                   |
| Periods included: 84                       |             |            |                   |
| Cross-sections included: 4                 |             |            |                   |
| Total panel (unbalanced) observations: 252 |             |            |                   |
|  |             |            |                   |
| Variable                                   | Coefficient | Std. Error | t-Statistic Prob. |
| C  | 3.809820    | 0.173333   | 21.979770.0000    |
| Umur                                       | 0.006449    | 0.002371   | 2.7195600.0070    |
| Suku_Bunga                                 | 0.597189    | 0.046157   | 12.938300.0000    |
| Inflasi                                    | -0.098828   | 0.037840   | -2.6117260.0096   |
| Nilai_Tukar                                | 0.008145    | 0.014926   | 0.5456930.5858    |
| Cadangan_Devisa                            | -0.053779   | 0.018279   | -2.9421070.0036   |

Sumber: Processed Data By Eviews, 2021

Based on the table 4.9, the regression equation can be built as follows:

Regression equation  $Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \varepsilon$

$Y = 3.809 + 0.006X_1 + 0.597X_2 - 0.098X_3 + 0.008X_4 - 0.053X_5 + 0.173$

Description :

$Y$  = Yield To Maturity (YTM),  $X_1$  = Maturity Date,  $X_2$  = Interest Rate,  $X_3$  = Inflation,  $X_4$  = Exchange Rate,  $X_5$  = Foreign Exchange reserves,  $a$  = constanta dari Unstandardized Coefficients,  $b$  = coefficients of regression

a) H1: Maturity date is suspected to have a positive effect on Yield To Maturity.

It can be seen from table 4.7 that the significance value of the t test on the maturity date variable is 0.007 that the significance value of  $t < 0.05$ . This means that the hypothesis is accepted, that there is a significant positive effect between the maturity date on the Yield To Maturity. This is in line with previous research conducted by (Soebagyo, 2016) and (Ayu, 2019) which state that maturity date has a positive and significant effect on Yield To Maturity.

b) H2: Interest rates are suspected to have a positive effect on Yield To Maturity

On the table 3 the significance value of the t-test on the interest rate variable is 0.000. So the significance value of  $t < 0.05$ . This means that the hypothesis is accepted, that there is a significant positive effect between the interest rate variables on Yield To Maturity. This is in line with previous

research conducted by (Yuliawati, 2017) and (Aulia, 2019) which state that interest rates have a positive and significant effect on Yield To Maturity.

- c) H3: Inflation is suspected to have a positive effect on Yield To Maturity

Based on table 4.7 that the significance value of the t-test on the inflation variable is 0.009. So the significance value of  $t < 0.05$ . This means that the hypothesis is accepted, that there is a significant influence between the inflation variables on Yield To Maturity. However, in this study, the effect is negative. So that the accepted hypothesis is that there is a negative and significant effect between the inflation variable on Yield To Maturity. This is in line with previous research conducted by (Hsing, 2015) which states that inflation has a negative and significant effect on Yield To Maturity.

- d) H4: The exchange rate is suspected to have a negative effect on Yield To Maturity

Based on table 4.7 that the significance value of the t-test on the exchange rate variable is 0.585. So, the significance value of  $t > 0.05$ . This means that the hypothesis is rejected, there is no influence between the exchange rate variables on Yield To Maturity. This is in line with previous research conducted by (Paramita, 2016) and (Adiwibowo & Sihombing, 2019) which stated that the exchange rate had no effect on Yield To Maturity.

- e) H5: Foreign exchange reserves are suspected to have a negative effect on Yield To Maturity

Based on table 3 that the significance value of the t-test on the foreign exchange reserve variable is 0.003. So the significance value of  $t < 0.05$ . This means that the hypothesis is accepted, that is, there is a negative and significant effect between the interest rate variables on Yield To Maturity. This is in line with previous research conducted by (Paramita, 2016) which stated that foreign exchange reserves had a negative and significant effect on Yield To Maturity.

#### **4. Manajerial at Implication**

##### **a) Effect Of Maturity Date On Yield To Maturity**

The results of the partial test (t-test) show that the maturity date has a positive and significant effect on Yield To Maturity. This means that the higher the maturity value of the bonds, the higher the Yield To Maturity. This shows that when the maturity date increases it will be followed by an increase in Yield To Maturity, on the contrary when the maturity date decreases it will be followed by a decrease in the Yield To Maturity as well. Bonds that have a longer maturity period will have a higher level of risk so that the yield obtained is also different from bonds with a fairly short maturity period. The longer the maturity level of a bond, the bond price will fall more sharply if there is an increase in YTM and will rise more sharply if there is a decrease in YTM (Aisah, 2014). Maturity is the difference between the issue date and the maturity date of the bond. The longer the bond's life, the greater the risk investors take. Therefore, investors prefer bonds with shorter maturities because issuers are considered to be more able to pay bond



interest and repay the loan principal. Short-lived bonds have a small risk, so the yields are also getting smaller, while long-lived bonds have big risks and provide large bond yields as well. Therefore, maturity has a positive effect on bond yields. This is in line with the results of research conducted by [Siti Hatanti and Mulyo \(2012\)](#) who found that maturity has a significant effect on bond yields. According to [Tandelilin \(2010\)](#), if there is an increase (decrease) in interest rates, the price of bonds with longer maturities will experience a greater decrease (increase) in price when compared to bonds with shorter maturities. Long or short maturity will have an impact on the difference in returns received by investors. Therefore, it can be concluded that bonds with long maturities will provide lower bond prices and increased bond yields, while bonds with short maturities will provide high bond prices and low bond yields. Thus, maturity has a positive effect on yield to maturity.

#### **b) The Effect of Interest Rates on Yield To Maturity**

Partial test results (t-test) show that interest rates have a positive and significant effect on Yield To Maturity. This shows that when interest rates increase it will be followed by an increase in Yield To Maturity, and vice versa when interest rates decrease it will be followed by a decrease in Yield To Maturity as well. [Hartono \(2009\)](#) states that with increasing interest rates, savings will be more attractive because they provide high savings interest, so investors will sell their bonds and shift the results to savings with higher interest, as a result the supply of bonds will increase. The increase in the SBI interest rate causes investors to demand higher returns on future risks, so that the yields on bonds offered will increase and be followed by a decrease in bond prices ([Purnamawati, 2013](#)). Interest rates affect the high and low bond yields. If interest rates increase, investors will flock to move their investment to deposits or to Bank Indonesia Certificates (SBI) which provide risk-free interest so that it is very easy and safe. Meanwhile, bonds have a default risk where the company is unable to pay off the principal and cannot pay the interest on the bonds. Therefore, if interest rates rise, investors expect the yield to maturity to rise. This is in accordance with research conducted by [Tiyas Ardian \(2014\)](#) which states that interest rates have a positive effect on bond yields and is not in line with research by [Lady and Dina \(2015\)](#) which states that interest rates have a negative effect on bond yields.

#### **c) The Effect of Inflation on Yield To Maturity**

Partial test results The t-test shows that inflation has a significant but negative effect. This means that the higher the inflation rate, the lower the Yield To Maturity (YTM) value. Inflation will have a major impact on investment activities, especially bonds. High inflation will cause prices to increase, so investment in bonds will be more risky. As a result, investors will expect higher yields. [Lidya Kristina \(2010\)](#) says that changes in the highly volatile inflation rate have an impact on investment in securities because rising inflation means investing in securities such as bonds is considered to be more risky, high risk in

investment will result in higher yields (yield). expected by investors. However, in this study the relationship between the two variables was negative. The research was conducted in the period 2014-2020, in which inflation tends to decrease from year to year, however the YTM provided by the government tends to increase and is stable, unless there is a decline in 2020 which is possible due to the Covid-19 pandemic. This is possible because the government is still able to control the country's inflation, but the government wants to attract more investors so that the YTM value increases and is quite stable.

**d) Effect of exchange rate on Yield To Maturity**

The results of the partial test (t-test) show that the exchange rate has no significant effect on Yield To Maturity, although the relationship between these variables is positive. This shows that when the exchange rate increases it will be followed by an increase in Yield To Maturity, and vice versa when the exchange rate decreases it will not be followed by a decrease in Yield To Maturity as well but the effect is not significant. In theory, for investors the depreciation of the rupiah against the dollar indicates that the outlook for the Indonesian economy is bleak. When the value of the rupiah depreciates, investors will switch to investing in money markets such as the foreign exchange market. Of course, this will result in a decrease in the demand for bonds. when the demand for bonds falls, bond issuers must attract investors again by increasing the yield on these bonds, in other words the exchange rate has a negative effect on bond yields, when the exchange rate depreciates, bond yields will increase and vice versa. However, in this study the results were not significant. This study only takes a sample of bonds that use the rupiah currency, so the exchange rate does not have a significant effect.

**e) Effect Of Foreign Exchange Reserves On Yield To Maturity**

Partial test results (t-test) show that foreign exchange reserves have a negative and significant effect. That is, the greater the foreign exchange reserves, the smaller the YTM. This is because foreign exchange reserves can reflect how big the level of risk that will be accepted by investors. The risk of default (default risk) can be reflected in the ability of bond issuers to pay yields for their investors. One of the indicators used to determine the security of bond investments is through the liquidity ratio. The explanation contained in the Bank Indonesia newsletter also states that when the foreign exchange reserves are adequate, investors will not rush to divert their funds abroad. Bond yields decrease when a country has good economic liquidity (large foreign exchange reserves) because good liquidity represents a low risk of default. Conversely, small foreign exchange reserves can indicate a high risk of default, so investors tend to demand higher yields. The results of this study are in line with research by [Harjum Muharam \(2011\)](#) and [Jacob, et al \(2011\)](#). [Muharam \(2011\)](#) in his research proves that there is a significant negative effect between foreign exchange reserves on government bond yields. Furthermore, research by [Jacobs, et al. \(2011\)](#) also shows that the

percentage change in foreign reserves has a negative effect on global sovereign bond yields.

### **Conclusion**

Based on the results of the t-test analysis and discussion, it can be concluded as follows: Maturity date has a significant effect on YTM and has a positive relationship. Interest rates have a significant effect on YTM and have a positive relationship. Inflation has a significant effect on YTM and has a negative relationship. The exchange rate has no significant effect on YTM and has a positive relationship. Foreign exchange reserves have a significant effect on YTM and has a negative relationship.

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