

INDONESIAN BOND YIELDS: INFLATION, FED RATES, AND EXCHANGE RATE EFFECTS

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Abstract: *This research aims to analyze the effects of Indonesian inflation, the rise of the US Fed rate, and the exchange rate on the yield of Indonesian government bonds. This study employs a quantitative approach using secondary data obtained from reliable sources, such as the Bloomberg database, the official website of Bank Indonesia, and the official website of the Federal Reserve. The sample comprises 132 months of macroeconomic rates and prices, covering 10 years from 2012 to 2022. Data analysis included descriptive statistics, classical assumption tests, and stationarity testing. While previous studies have analysed the effects of these factors on government bond prices, this study investigates explicitly their impact on government bond yield in Indonesia. The results show that inflation and the exchange rate positively affect the Indonesian government bond yield. However, the rise in the US Federal Reserve rate does not significantly drive changes in the Indonesian government bond yield.*

Keywords: *Exchange Rate; Government Bond Yield; Inflation; US Fed Rate*



INTRODUCTION

Macroeconomic factors like interest rates, inflation, gross domestic product (GDP), and exchange rates play a significant role in a country's economy. This research incorporates the US Federal Reserve's interest rate (US Fed) and inflation in Indonesia as independent variables. Recently, there has been high inflation in the US. Based on the USA inflation summary, it is shown that the inflation rate in the USA in June was 9.060%, which marked the highest rate over the decade (Trading Economics, n.d.). To respond to this issue, the Federal Reserve/ the Fed had decided to increase the interest rates by 75 bps or 1.5%-1.75%. These conditions weakened the economy globally, including developing countries such as Indonesia. The Indonesian inflation rate reached its highest in July 2022, at 4.94% (Bank Indonesia, n.d.-b). That rate is more than expected, although it is still above the central bank's target rate. The high rate existed due to the difficulties in obtaining imported raw materials after the war between Russia and Ukraine and the rise in fuel costs. Not only the cost of vehicle fuel, but also the cost of airfares and household fuel because of the oil scarcity (Bank Indonesia, n.d). Because of these conditions, some investors worry about bond yield, which is the return to an investor.

A bond is a form of debt instrument that the investor uses to lend money to the issuer. The issuers of bonds can be the government or a company. The issuers use the bonds to fund the operations and offer returns as coupon payments (Chiesa & Barua, 2019). Before selling bonds, investors should understand the bond yield and price. Bond yield often signals to investors regarding the condition of the economy. The rise in bond yield can cause a short-term drop in the value of the bond because investors are willing to buy bonds with higher yields. Investors need to consider how much compensation they will get. The higher the yield, the higher they get. Bond yield is also as important as bond price. Bond yield is the return on the bond of investments that is expressed as a percentage.

Meanwhile, the bond price is the present value received from the discounted value of future cash flows. Bond yield and bond price have opposite relationships. The bond yield will increase if the price decreases (Vayanos & Vila, 2023). There are many types of bonds in the economy. One of them is the government bond. Government bonds are considered less risky than others because the government guarantees they will meet the obligation. The government considered bonds to be the cost of issuing new bonds. Investors pay attention to the government bond yield since this represents the return and risks that must be evaluated (Trinh et al., 2020). This is perfect for the uncertain conditions that are happening in Indonesia right now.

As the US Fed increases the interest rates, the value of the rupiah decreases, which causes a decrease in bond prices. If the bond prices decline, the bond yield rises because this situation increases the government's borrowing. In addition, inflation positively affects government bond yield (Tjandrasa, Ariwibowo, et al., 2020). During inflation, the market condition is erratic. So, the investors need to be careful when they want to invest. However, despite the uncertain conditions, inflation still positively affects the yield of Indonesian government bonds. Since the risk is higher, the investors will demand higher returns. Therefore, it will increase the Indonesian government bond yield (Permanasari & Kurniasih, 2021; Siahaan & Panahatan, 2020; Yusuf & Prasetyo, 2019).

This study examines the impact of inflation, exchange rates, and the US Fed rate on the Indonesian government bond. This report contributes to various users, particularly investors and the government, and provides the theoretical background. Investors can gain information regarding the current economic issues, which might differ from previous years, and the impact of those issues on the yield of Indonesian government bonds. In addition, this report can also become a valuable consideration

when investors want to make investment decisions. Afterwards, this research can be helpful when the government wants to decide on the funds for the operation and the required policy in this uncertain situation. Finally, this paper also contributes to the Fisher effect theory and the macroeconomic and monetary policy by connecting the related macroeconomic factors in Indonesia. The research gap between this study and previous studies is emphasised in the factors. This study uses three macroeconomic factors, while other studies use more elements. Furthermore, the last research analysed the impact on the government bond prices. This study analyzes the effect on the government bond yield in Indonesia.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Fisher Effect Theory

The Fisher Effect Theory is a theory that elucidates the relationship between interest rates and inflation. This hypothesis posits that the real interest rate is derived by subtracting the expected inflation rate from the nominal interest rate (Yusuf & Prasetyo, 2019). The nominal interest rate refers to the rate that excludes consideration of inflation. Conversely, the real interest rate encompasses inflation (Zhong, 2022); therefore, the interest rate falls when inflation increases. Fisher found that variations in anticipated inflation influence the nominal interest rate (Ongan & Gocer, 2020). This theory pertains to the macroeconomic issues, specifically interest rate and inflation. This is aligned with the current situation, which is high inflation in the world, with the policy applied by the US Fed. The increase in the US Fed rate can influence Indonesia's economy. This theory will help the government or related institutions implement monetary policy and help investors measure the return.

Macroeconomy is an overall study that covers the country's economic system. Several factors influence the economy of a nation. Those factors are inflation, interest rates, exchange rates, and many more. For example, if inflation happens, prices will increase, which will decrease. Next, if the interest rate rises, borrowing money will be harder because the amount will be more expensive. Fedorova & Meshkova (2021) maintain that financial stability is an essential objective of macroeconomics. Therefore, the government or the authority must implement monetary or fiscal policies.

Monetary policy is a policy that controls the country's money supply and economic growth to manage demand. This usually relates to the interest rate. Meanwhile, fiscal policy is a policy that uses government spending and taxation to manage the economic situation. It usually refers to tax (Afonso et al., 2019). However, the macroeconomic policy will be used in this study. Mehar (2023) stated that monetary policy is helpful for economic development. Therefore, the changes in the macroeconomy and the policy will affect the economy of a nation. For example, the policy that the US Fed has implemented in setting the interest rate. Through this theory, the investor can be aware of the policy in the country, which will influence the decision-making process. Besides, this theory can help the government manage the stability of the country's economy to provide welfare for society.

Inflation

Inflation is a situation where the price of goods and services increases. When the price level rises, the demand to buy goods and services decreases due to a reduction in the purchasing power of money (Ilmas et al., 2022). Inflation is mainly influenced by three factors, which are 1) Demand-pull effect, 2) Cost-Push Effect, and 3) Built-in Inflation. The demand-pull effect occurs when there is an increase in aggregate demand, which causes the prices of goods and services to rise faster than the economy's ability to produce them. This can be a rise in the money supply or the government's purchases.



The Cost-push effect occurs due to increased market power or decreased aggregate supply. This phenomenon is marked by increasing unit labor costs, elevated prices of imported intermediate inputs, and temporary or systemic shortages or productive resources, potentially resulting from droughts, conflicts, or other disruptions (Wollie, 2018). Lastly, built-in inflation is the idea that society thinks inflation rates are expected to persist. Since the price of goods and services rises, individuals may anticipate a continued increase (Roncaglia de Carvalho et al., 2018). Aside from those three main factors, inflation can happen due to structural factors, such as the weather conditions and the protective policies that protect the industry from the government (Opolot & Mpagi, 2017).

The US Federal Reserve, serving as the central banking system of the United States, is responsible for carrying out five primary functions. Firstly, conduct the monetary policy for maximum employment and stable prices. Secondly, the financial system's stability must be managed to minimise risk through active monitoring in the United States and other nations. Thirdly, encourage the safety of the individual financial institutions and evaluate the impact on the financial system. Next, the efficiency of the payment and settlement system should be maintained through services to the banking industry. Lastly, strengthen consumer protection and community development (The Federal Reserve, 2023).

Since one of the Fed's duties is to manage the financial system's stability, the Fed has the right to set the interest rates. Central banks such as the US Fed have concentrated on the interest rate as an instrument (Taylor, 2019). Several conditions can affect the interest rates. First, the supply and demand for money. When the demand for money increases, the interest rates tend to rise. Conversely, interest rates will likely decline when the money supply expands. Second, inflation. If inflation occurs, the Fed might decide to increase interest rates to reduce the purchasing power of society and maintain financial stability. Third, there is the fiscal deficit and government borrowing. A fiscal deficit is the condition in which government expenditure exceeds government revenue. Therefore, government borrowing exists to fund the deficit. The higher the fiscal deficit, the higher the government borrowing and interest rates.

Government Bond Yield

A bond is a form of debt instrument that the investor uses to lend money to the issuer. The issuers of bonds can be the government or a company (Nneka et al., 2022). The issuers use the bonds to fund the operations and offer returns as coupon payments. Bonds have several advantages over stocks, such as being less risky and less volatile (Shahzad et al., 2017). Bonds can be in the form of short-term, medium-term, or long-term bonds.

Bonds are generally categorized into four types: government bonds, corporate bonds, mortgage bonds, and municipal bonds. Firstly, Government bonds. Government bonds are the government's debt to third parties, which are used to fund operations and construction. The interest rate in government bonds is considered a risk-free rate. Government bonds are considered less risky because the government guarantees payment (Robiyanto, 2018). Secondly, Corporate bonds. A corporate bond is a debt security that the company issues and, later, is traded in the market. Thirdly, mortgage bonds. A mortgage bond is a debt security that companies issue using real estate and municipal bonds as collateral. A municipal bond is a debt issued by the local government. Therefore, the risk depends on the bond guarantees from the state government-owned corporation (Tjandrasa, Siagian, et al., 2020).

Bond yield is a measurement of the return of a bond to investors (Pratiwi & Mustafa, 2021). Although Bond Yield and Bond price are related, they have an opposite

relationship. When the cost of a bond rises, its yield declines; conversely, when the price falls, the yield increases (Qisthina et al., 2022). Bond yield has two basic concepts, namely coupon yield and current yield. Coupon yield (rate) is the annual interest rate formed when an issued bond does not change during the bond's life cycle. Next, the current yield is the yield that changes when the bond price changes. Based on the previous study, it was stated that a bond's yield could be different from that of another due to default risk, the value of the coupon rate, the ability of the government to pay the debt before maturity, and so forth.

Gross Domestic Product (GDP)

Gross Domestic Product (GDP) is a primary macroeconomic metric that quantifies the aggregate monetary worth of all final goods and services generated within a country's borders over a designated period. GDP can be a good indicator for measuring whether monetary policy works well. In other words, GDP can be an indicator for evaluating the country's economy (Gonzalez et al., 2022). The positive real rate of GDP is a sign that the monetary policy is effective (Nababan, 2019). GDP is the added value that results from the business units in a specific period.

GDP can be calculated using two primary methods: the expenditure approach and the income approach. The expenditure approach measures GDP by accounting for all goods and services purchased and consumed (Nababan, 2019). For example, consumers spend their income to acquire goods, investors use their money to invest in business activities, the government spends its money to purchase equipment, and so on. On the one hand, the latter approach considers all the factors of production, such as the wages/compensation of the labour, rent, return on capital in the form of interest rate, and many more.

Exchange Rate

Bank Indonesia (BI) is Indonesia's central banking system. BI has the duty to maintain rupiah stability by managing the monetary sector and maintaining the stability of the financial system (Bank Indonesia, n.d.-a). Just like the US Fed, since the duty of the BI is to manage the financial system's resilience, the BI also has the right to set interest rates. BI Rate is the base rate. The Central Bank of Indonesia uses the base rate to establish the monetary policy and represents the rise or fall of the interbank rate. The rate set by the bank usually changes after a period. The changes in the BI Rate affect the interest rates in loans or savings accounts.

An exchange rate represents the price of one currency in terms of another currency. The exchange rate helps manage trade and money movements. The rate is divided into two components, which are the domestic currency and foreign currency. In this paper, the domestic currency is the rupiah, and the foreign currency is the USD (Jamil et al., 2023). The appreciation and depreciation of a currency against foreign currencies show that country's vital condition and market sentiment. The fall in the exchange rate is good for the domestic economy because exports look cheaper to foreign buyers, while imports look more expensive. Conversely, a rise in the exchange rate results in higher import costs, which increases the domestic inflation rate (Erdal & Pinar, 2019). The exchange rate can be in the form of a free-floating or fixed exchange rate. Free-floating exchange rate increase and decreases because of the changes in the foreign exchange market.

Meanwhile, the fixed exchange rate is wedged to the value of another currency. Regimes with fixed exchange rates are less volatile. As a result, this condition encourages the inflow of foreign direct investment. Conversely, regimes with free-floating exchange



rates limit the external imbalance to boost the growth of the economy (Cushman & De Vita, 2017).

US Fed Rate and Indonesian Government Bond Yield

Based on the Fisher effect theory, the real interest rate is determined by subtracting the inflation rate from the nominal interest rate. This implies that when inflation increases, the nominal interest rate typically rises in the long run to maintain a relatively stable real interest rate. Similarly, interest rate falls when inflation increases. Therefore, the interest rate declines when inflation rises. This corresponds with the situation in the US, where the country had the highest inflation rate last July. The government can implement a monetary policy during inflation to solve the problem. In addition, Nakamura & Steinsson (2018) stated that monetary policy is active when the monetary authority has a strong reaction towards inflation. In the case of the US, the FED applied the policy by increasing the interest rates to push inflation. The Fed based the policy on an enormous amount of data.

Therefore, the FED's policy influences other countries' policies and economies at different times. For example, sharp changes in commodity prices and the financial crisis (Nakamura & Steinsson, 2018). As a result, that condition worsens in countries with low currency values, like Indonesia. A decrease in the rupiah's value leads to a fall in Indonesian government bond prices. Bond yield and bond prices have opposite relationships. If the bond prices decrease, the bond yield increases because this situation increases the risk of the government's borrowing. Higher government borrowing will affect the economy. In this situation, the government must sell at higher rates to sell the bonds.

H1: The rise of the US Fed Rate affects the Indonesian government bond yield positively.

Indonesian Inflation and Indonesian Government Bond Yield

Inflation is one of the macroeconomic factors that influences Indonesian government bonds. Inflation is everywhere and will always be the monetary symptom (Sharma et al., 2023). Many studies state that inflation harms economies, especially when the rate is high. Based on the Bank of Indonesia's official website, Indonesian inflation is increasing. High inflation can cause a redistribution of income and wealth, uncertainty about the value of money and prices, changes in the cost of resources, and so on. In Indonesia, high inflation is due to supply-side factors and shocks (Bank Indonesia, n.d.-c). For example, the war between Russia and Ukraine made it hard to get oil resources since the source of oil was in Ukraine. The market is struggling to produce oil. Consequently, the price of oil has increased worldwide, including in Indonesia. According to the Fisher effect theory, the real interest rate is calculated by subtracting the inflation rate from the nominal interest rate. Interest rate falls when inflation increases. This condition raises questions among the investors. They will be confused about whether they want to invest. They will become worried about the return on bonds. Since the condition is risky, investors will expect a higher return rate on bonds from the government because they consider the inflation rate that can reduce their return. Therefore, this situation will increase Indonesian government bond yields.

H2: Indonesian inflation positively affects the Indonesian government bond yield.

Exchange Rate and Indonesian Government Bond Yield

The conceptual theories state that the Exchange rate helps manage trade and money movements. The domestic currency is the rupiah. The foreign currency is USD. Yusuf & Prasetyo (2019) and Qisthina et al. (2022) stated that the exchange rate is the main factor influencing government bond yield. The appreciation and depreciation of a

currency against foreign currencies show that country's vital condition and market sentiment. Fisher's effect theory states that inflation will influence changes in interest rates. In 2022, high inflation happened everywhere. Then, the US Fed responds to inflation by increasing the interest rate. Due to the monetary policy implemented by the US Fed, the financial stability in Indonesia is disrupted because the value of the rupiah against the USD is decreasing. Consequently, some investors will take down their investment in rupiah-denominated assets and request higher returns from the government. This situation will reduce the bond price and increase the bond yield.

H3: The exchange rate positively affects the Indonesian government bond yield.

Based on the previous hypothesis development, the conceptual framework can be formulated as follows:

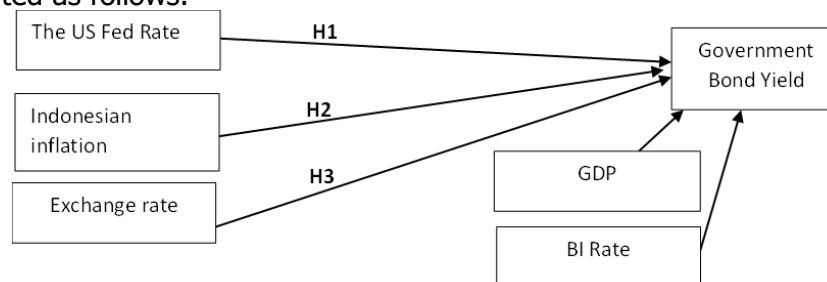


Figure 1. Research model

RESEARCH METHOD

This study employs a quantitative research approach to examine Indonesia's macroeconomic determinants of government bond yields. The dependent variable in this study is the government bond yield, while the independent variables consist of the US Federal Reserve (FED) rate and the Indonesian inflation rate. In addition, the exchange rate of IDR to USD, the Bank Indonesia (BI) rate, and GDP are included as control variables to account for other macroeconomic influences. The research model is demonstrated in Figure 1.

The study utilizes secondary data collected from reliable sources, including Bloomberg, the official website of Bank Indonesia, and the official website of the United States Federal Reserve. The sample comprises monthly data over 11 years, spanning from 2012 to 2022, resulting in 132 monthly observations for each variable. This time frame was selected to capture both long-term trends and short-term fluctuations in macroeconomic conditions and their impact on bond yields.

All data were compiled and processed using spreadsheet software before being analyzed using appropriate econometric techniques, as described in the subsequent section. Monthly data enables a higher analysis resolution, allowing the study to more precisely identify the dynamic relationships between the variables.

Data sources are a way of gathering data for research purposes. Two types of data sources are primary and secondary data. This study used secondary data obtained from reliable sources, such as the official websites of Bank Indonesia, the Federal Reserve website, and datasets from Bloomberg.

This study presents the following research equation, which illustrates the relationship among the examined variables:

$$GBY = \alpha + \beta_1 USFR + \beta_2 IINF + \beta_3 ER + \beta_4 GDP + \beta_5 BIRT + \varepsilon \quad (1)$$

GBY	= Indonesian Government Bond Yield
α	= The intercept (Constant)
$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$	= Regression coefficient
USFR	= US Fed Rate



IINF	= Indonesian inflation
ER	= Exchange rate
GDP	= Gross Domestic Product
BIRT	= BI Rate

Population is the whole group of study that is used in the research. The population in this research is Indonesia. The sample is a part of the population selected according to the research's criteria and used to represent the whole population. The sample for this research is the monthly rate and price of macroeconomic data within 12 months for each year, from 2012 to 2022. Unit analysis is the number of observations that become the smallest object in the study. The total unit analysis in this research is 132 units at a monthly rate.

Table 1. Variable Operationalism

Variable	Variable Definition	Source of data
Government Bond Yield (GBY)	It is the return of a bond to investors	Bloomberg
US Fed Rate (USFR)	The interest rate set by the US Federal Reserve Bank was used to lend reserve balances to others.	Federal Reserve official website
Indonesian Inflation (IINF)	This condition is characterized by rising prices of goods and services, leading to a decline in purchasing power.	BI official website
Exchange Rate (ER)	The value of a currency that is exchanged for another currency (Rupiah towards USD).	Bloomberg
GDP	A financial indicator that quantifies the overall market value of goods and services produced and transacted within a defined period.	Bloomberg
BI Rate (BIRT)	The Central Bank of Indonesia uses the base rate to establish the monetary policy.	BI official website

As for the data analysis techniques, this study uses the Gretl software to examine the time series data. Firstly, the study used the classical assumption tests through 3 tests: the normality test, the multicollinearity test, and the heteroscedasticity test. The normality test examines whether the variables used in the regression model are normally distributed. A normality test is conducted by applying a statistical test or graphical analysis. The condition is considered best if the data is normally distributed, indicating that the P value is more than 5%. Secondly, the multicollinearity test is conducted to show whether the independent variables used in this research strongly correlate. The condition is considered best if the independent variables do not comprise the other independent variables. If the Variance Inflation Factors (VIF) are more than 10, the data is not multicollinear, which may indicate a multicollinearity problem. Thirdly, this study performed the heteroscedasticity test. This test is used to check if the data has an error or residual variance that is normally distributed. The condition is considered best if homoscedasticity exists in the residual or error term variance. The test is performed with the help of the white test option to detect the existence of any heteroscedasticity in the model. The data is homoscedastic if the significance level is more than 5%. However, if the result indicates any heteroscedasticity, the Autoregressive Conditional

Heteroskedasticity test (ARCH) will be performed to see any ARCH effect in the model. The Generalized Autoregressive Conditional Heteroskedasticity model (GARCH) should be implemented if there is any ARCH indication.

Secondly, this study conducted stationary testing, which was performed to determine whether the data used was stationary or not. The study results from the stationary data test can be used to predict the future and prevent counterfeit regression. In this test, this study will do the unit test root by utilising the Augmented Dickey-Fuller Testing method (ADF-Test). The best condition for the ADF Test is if the significance value exceeds 5%. That means the data is non-stationary. Next, this study continued to use cointegration testing. The non-stationary variables must be tested with cointegration testing to see if there is a long-term connection between the independent variables. If there is a problem with the stationary testing, data transformation needs to be performed by utilising the Engle-Granger test. The criterion for this test is that the probability value should be less than 5%, which means that the variable has a high level of cointegration.

After conducting all the tests above, this study tested the hypothesis to determine whether the analysed hypothesis is accepted through three phases. Firstly, this study should use the F-statistic test. This test aims to assess the aggregate effect of every independent variable on the variation in the dependent variable. Then, a T-statistic test is conducted to estimate the impact of each independent variable on the variation in the dependent variable.

For prediction purposes, this study used the ARMA model. ARMA combines Auto-Regressive (AR) and moving average (MA). ARMA can only be used if the time series is stationary. Several steps are needed to build the ARMA model. The first one is identifying the most appropriate specification from PACF and ACF. The next step is to estimate the ARMA model from the identification process. The model should be free from serial correlation and heteroscedasticity problems. Finally, the Schwarz Information Criterion (SIC) is compared, and the smallest value is chosen (Hatane, 2012).

RESEARCH RESULTS AND DISCUSSION

This study employs a quantitative research approach to examine Indonesia's macroeconomic determinants of government bond yields. The dependent variable in this study is the government bond yield, while the independent variables consist of the US Federal Reserve (FED) rate and the domestic inflation rate. In addition, the exchange rate (IDR/USD), Bank Indonesia (BI) rate, and gross domestic product (GDP) are included as control variables to account for other macroeconomic influences.

The descriptive statistic includes five key aspects: mean, median, minimum, maximum, and standard deviation. Table 2 presents summary statistics of the raw data, while Table 3 displays the summary statistics after applying differencing to the variable. The differencing was employed in this study to enhance the visibility of the volatility effect. Initially,

Before using the difference, all variables in this study do not have a volatility effect. The volatility will be shown through the time series plot of the variables. Here, this study shows the time series plot of the dependent variable, the log government bond yield. The plot looks less volatile before this study, which adds a difference.

In Figure 3, after this study adds the difference, the plot of the dependent variable looks more volatile. This means that the data is not constant. Aside from this, the descriptive statistic shows better results in the variables that use differences. Table 2 shows that the dependent variable's mean value (government bond yield) is 0.8536. At the same time, the maximum and minimum values are 0.9864 and 0.7153.

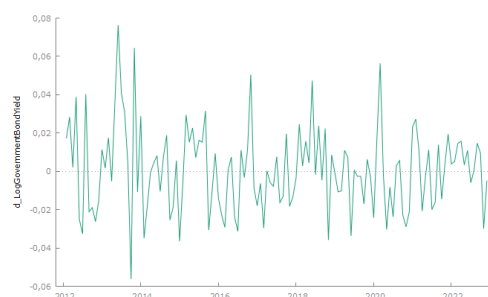
Table 2. Summary Statistics (Without Difference)

Variable	Mean	Median	Minimum	Maximum	Standard Deviation
US FED Rate	0.7268	0.1600	0.0500	4,1000	0.9034
Indonesian Inflation	0.0411	0.0359	0.0030	0.0879	0.0195
Government Bond Yield	0.8536	0.8524	0.7153	0.9864	0.0578
Ind Exchange Rate	4,1132	4,1339	3,9540	4,2125	0.0633
BI Rate	0.0549	0.0563	0.0350	0.0775	0.0139
GDP	0.0431	0.0506	-0.0700	0.0707	0.0291

Table 3. Summary Statistics (With Difference)

Variable	Mean	Median	Min	Max	Standard Deviation
US FED Rate	0.0307	0.0100	-0.9300	0.7000	0.1661
Indonesian Inflation	0.0001	0.0001	-0.0283	0.0271	0.0064
Government Bond Yield	0.0009	0.0005	-0.0562	0.0763	0.0222
Ind Exchange Rate	0.0018	0.0013	-0.0398	0.0566	0.0106
BI Rate	-3,8E-05	0.0000	-0.0125	0.0050	0.0020
GDP	-4,8E-05	0.0000	-0.0829	0.1407	0.0156

Meanwhile, in Table 3, the mean of the government bond yield is 0.0009. The maximum and minimum values of this variable are 0.0763 and 0.0562. As presented in Table 2, the mean value of the Indonesian inflation rate is 0.0411, while the highest recorded value is 0.0879, and the lowest is 0.0030. In Table 3, the mean value of the Indonesian inflation rate is 0.0001, and the maximum and minimum values are 0.0271 and -0.0283, respectively. In addition, the mean value of the control variable (BI Rate) is 0.0549 in Table 2 and -3.82E-05 in Table 4. Most of the results from Table 3 show a smaller percentage than those in Table 2. The smaller the percentage, the better the result because this indicates that the data prediction is close to the real one.

**Figure 2. Log Of Government Bond Yield (Without Difference)***Source: Researcher Analysis***Figure 3. Log Government Bond Yield (With Difference)***Source: Researcher Analysis*

Classical assumption aims to ensure the reliability of hypothesis testing by performing various tests, such as normality, multicollinearity, and heteroskedasticity tests. The results of these tests were obtained using the GRETL software.

Table 4. Classical Assumption Test Result

Test	Variable	P-Value	VIF
Normality		0.0910	
Multicollinearity			
	US Fed rate		1.1400
	Indonesian inflation		1.0360
	Exchange rate		1.0470
	BI rate		1.1530
	GDP		1.0080
Heteroskedasticity		0.5232	

Table 4 shows the result of the classical assumption test. Based on the table, the normality test result is 0.0910, above 5%. As a result, the data is normally distributed. A multicollinearity test is performed to determine whether the independent variables strongly correlate. In this test, the VIF (Variance Inflation Factor) should not be more than 10; otherwise, it will indicate a problem. Based on the result from Table 4, the VIF of the independent and control variables (US Fed Rate, Indonesian inflation, Indonesian exchange rate, BI Rate, and GDP) is less than 10. This indicates that there is no sign of multicollinearity. A heteroskedasticity test is conducted to examine whether the data has an error or residual variance that is normally distributed. This study used the white test method to test the heteroskedasticity. Table 4 presents that the significance value is 0.5232 greater than 5%, indicating no heteroskedasticity issue, and the data is homoscedastic.

The stationary test aims to investigate whether the data is stationary or not. This study used an augmented Dickey-Fuller test (ADF Test). A stationary time series means that our time series data does not have a trend or seasonality or a constant variance. Because of that, the best result for this test is for the data to be non-stationary. As shown in Table 5, the value of most variables is below 5%, except for the US Fed rate, which means that all the variables other than the US Fed Rate are stationary. Therefore, we need to do the cointegration testing.

Table 5. Stationary Testing Result

Variables	With constant	With a constant trend
Government Bond Yield	4.21E-21	2.91E-22
US Fed Rate	0.4055	0.2768
Indonesian Inflation	1.56E-21	1.34E-22
Exchange Rate	1.25E-25	1.09E-28
BI Rate	0.0001533	0.00128
GDP	1.26E-18	5.54E-19

Cointegration testing examines whether there is a long-term connection between the variables. The data is investigated through the Engle-Granger test with a significance value of 5% in this test.

**Table 6. Cointegration Testing Result**

Cointegration	Value
US FED Rate	0.04698
Indonesian Inflation	0.01707
Exchange Rate	0.01024
BI Rate	0.003813
GDP	0.02491

As portrayed in Table 6, the value of the independent variables (US Fed rate and Indonesian inflation) is less than 5%. This indicates that the independent variables have a long-term effect on the dependent variable.

Table 7. Summary of ARMA Models

ARMA MODEL	AR (1) MA (1)	AR (2) MA (2)	AR (3) MA (3)	AR (4) MA (4)	AR (7) MA (7)
Adjusted R-squared	0.3626	0.3996	0.4569	0.4507	0.4904
Akaike criterion	-674.3850	-676.5269	-687.1881	-683.8597	-681.0207
Hannan-Quinn	-663.8701	-663.6754	-671.9999	-666.3348	-656.4859

This study uses 1.1 to 7.7 for the AR and MA period. Then, the result from the adjusted R-squared, Akaike Criterion, and Hannan-Quinn should be assessed. For the adjusted R-squared, the most significant value will be selected. Meanwhile, the smallest value will be chosen for the Akaike criterion and Hannan-Quinn. Based on the result from Table 7, the best ARMA model is 3.3 because it fulfils most of the requirements. The adjusted R-squared of ARMA 3.3 is 0.4569. Meanwhile, the Akaike criterion and Hannan Quinn results are -687,1881 and -671.9999. Although the adjusted R-squared is smaller than Arma 7.7, the Akaike Criterion and Hannan Quinn results are still smaller than the others.

Table 8. ARMA 3,3 Progression result

Arma 3,3	Coefficient	Std. Error	z	p-value
USFedrate	- 0.00531	0.0054	-0.9831	0.3255
Indonesian Inflation	0.46889	0.20457	2.292	0.0219**
Exchange rate	1.11346	0.11845	9.400	<0.0001***
BI Rate	1.86301	0.47877	3.891	<0.0001***
GDP	0.06531	0.09636	0.6777	0.498

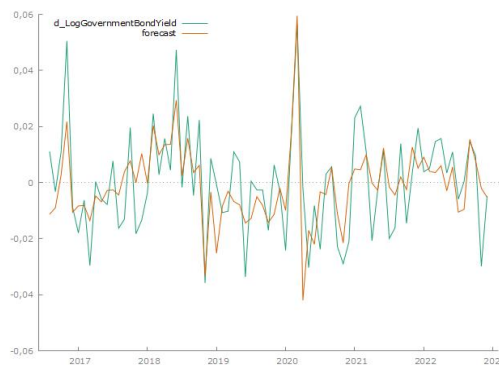
Notes: *significant at 10% level of error; ** significant at 5% level of error; ***significant at 1% level of error

Table 8 shows the hypothesis results from the best ARMA model. The US Fed Rate is insignificant to the Indonesian Government bond yield, as the P-value exceeds 10%. In addition, Indonesian inflation and exchange rate are positively significant towards the government bond yield, since the P Value > 5% and > 1%. The BI rate is a considerable control variable, increasing the government bond yield.

Table 9. Forecast Evaluation Statistics

Mean Error	0.0014
Root Mean Squared Error	0.0100
Mean Absolute Error	0.0070
Mean Percentage Error	248.78
dMean Absolute Percentage Error	286.70

Based on Table 8, ARMA model 3.3 is the best model. Therefore, this study analyses the forecast of that model. Table 9 shows that the mean error is 0.0014, and the root mean squared error is 0.0100. As for the mean absolute error, the result is 0.0070. From the forecast evaluation statistics, the mean error, root mean squared error, and mean absolute error are small. This indicates that the values of the forecast are close to the actual value. Therefore, the forecasting model is good. This is also portrayed in the graph of Figure 4.

**Figure 4. Forecasting graph**

Source: Researcher Analysis

The US FED rate is the rate set by the US Fed. The US Fed is the central banking system of the United States, which has the duty to manage the money supply and financial system stability (aligned with one of the macroeconomic goals), including setting the interest rate. The policy made by the US Fed influenced the world economy. According to the Fisher Effect theory, the real interest rate equals the nominal interest rate minus the inflation rate. Interest rate falls when inflation increases. Therefore, the interest rate declines when inflation rises. This corresponds with the situation in the US, where the country had the highest inflation rate last July. The government/ institution can implement a monetary policy during inflation to solve the problem. However, the result from the software shows that the rise of the US Fed Rate does not affect the Indonesian government bond yield positively. The coefficient value of the US Fed rate is -0.0053. This means that the US Fed has an adverse effect on the Indonesian Government Bond Yield. After that, as shown in Table 9, the US Fed Rate is insignificant to the dependent variable because the P-value is higher than 10%. Furthermore, the plot of the time series of the US Fed rate tends to be constant, meaning that there is only a slight change within the period, which does not affect the government bond yield significantly.

The analysis shows that the result for hypothesis 1 contradicts several studies. For example, Rosanti & Sihombing (2021) state that the US Fed rate positively affects the Indonesian government bond yield. The reason is that the increased Fed rate with government intervention globally will cause government bonds. According to a study by Siahaan & Panahatan (2020), the US Fed rate has an adverse effect on Indonesian

government bond prices. This means that the rise of the US Fed rate will lead to the fall of the bond price. Bond yield and Bond price have the opposite relationship. If the bond price decreases, then the bond yield increases. Therefore, based on this study, the US Fed rate affects the Indonesian government bond yield positively, which contradicts the result from the test. In addition, the result contradicts Permanasari & Kurniasih (2021) which stated that the interest rate has a positive effect on the Indonesian government bond yield. As a result, the first hypothesis in this research is dismissed.

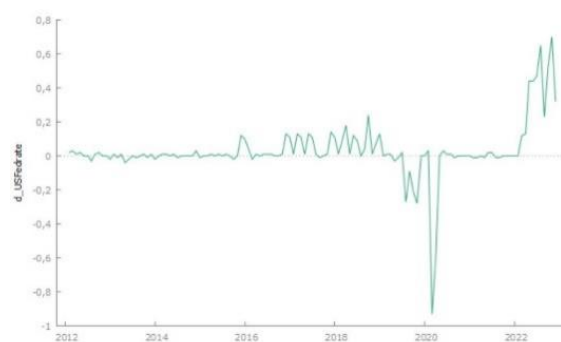


Figure 5. US Fed Plot Time Series

Source: Researcher Analysis

Inflation is one of the macroeconomic factors that influences a country's economy. The test result shows that inflation positively affects the Indonesian Government Bond Yield. The coefficient value of the inflation is 0.468892. This value indicates a positive relationship between Indonesian inflation and the government's bond yield. This is because of the risky conditions during inflation, which cause uncertainty. For example, the war between Russia and Ukraine was discussed in the previous chapter. As a result, the oil price in Indonesia increased, followed by the cost of gasoline. Fisher's effect theory assumes that the real interest rate equals the nominal interest rate minus the expected inflation rate. According to the theory above, one of the macroeconomic goals is financial stability. If inflation increases, it will influence financial stability and cause economic uncertainty. The uncertainty in the risky condition raises questions among investors about what will impact their investment decisions. So, the investors will demand a higher rate of return. This is aligned with the result of Tjandrasa, Ariwibowo, et al. (2020), where investors will expect a higher return rate on bonds from the government because they consider the inflation rate that can reduce their return. This also corresponds to Siahaan & Panahatan (2020), who maintain that the government bond yield will rise if the current rate and expected inflation rates are higher. Then, the bond investors will demand higher yields to offset the inflation risk. Furthermore, the study results also align with (Ehling et al., 2016; Tjandrasa, Siagian, et al., 2020) Koroleva & Kopeykin (2022), and Wicaksono & Syarif (2022). However, the hypothesis's result contradicts Permanasari & Kurniasih's (2021) study, which found that inflation does not positively affect the Indonesian 10-year government bond yield.

On the other hand, based on the results from Bank Indonesia's official website, Indonesian inflation is rising each year. The higher the inflation rate, the higher the government bond yield. For example, In July 2022, the inflation rate was 4.94%, and the Indonesian government bond yield value was 0.07122. Next, in September 2022, the inflation rate rose to 5.95%. Here, the Indonesian government bond yield also increases, resulting in 0.07373. Therefore, Indonesian inflation positively affects the Indonesian government bond yield. So, the second hypothesis is accepted.

The exchange rate is the value of a currency exchanged with another currency,

which is useful for managing trade and money movements. According to the outcome investigated earlier, the coefficient value of the exchange rate is 1.1135. This outcome shows that the exchange rate positively affects Indonesian government bond yields. Nowadays, the value of the rupiah in Indonesia is declining compared to the USD. This phenomenon is due to the increase in the US Fed rate (monetary policy carried out by the US Fed) as a response to inflation. Fisher's effect theory found that inflation impacts the changes in interest rates. The depreciation of the rupiah leads to a decrease in bond prices. As a result, investors demand higher returns since the risk is higher. Therefore, this circumstance increases the government bond yield. The result of this hypothesis is aligned with the study from Qisthina et al. (2022), which claimed that the exchange rate positively and significantly affects the Indonesian government bond yield. Yusuf & Prasetyo (2019) also supported this view by stating that the exchange rate is the main factor influencing government bond yield. Furthermore, Adiwibowo & Sihombing (2019) noted that the exchange rate does affect the Indonesian government bond yield positively because the weakening of the rupiah leads to a decline in bond price and a rise in bond yield. Therefore, the third hypothesis is accepted.

However, there is one study that contradicts this result. Meyer & Hassan (2020) stated that the exchange rate affects the government bond yield negatively because the exchange rate volatility does not encourage investment in the bond market.

After knowing the result, the investors can see that the current economic condition is uncertain, such as the rise of the US Fed rate, the higher inflation rate in Indonesia, and the depreciation of the exchange rate. Therefore, investors should make their investment decisions carefully. Investors need to pay attention to their portfolio by checking the average duration, interest rate sensitivity, and how much return they will get for the benefit in the long term. Investors should also be able to invest in a more liquid investment. In addition, the government should attract more investors to issue government bonds to increase the economy and provide welfare for society.

CONCLUSION

This research is established to test the impact of the rise of the US Fed rates, Indonesian inflation, and the exchange rate on the government bond yield of Indonesia. Some of the macroeconomic factors in Indonesia are used in this study to test the goal. Those macroeconomic factors are the Indonesian inflation rate, BI Rate, gross domestic product, exchange rate, and the US Fed interest rate. The population used in this study is Indonesia. The samples used in this study are the monthly rate and price of macroeconomic data for 12 months each year from 2010 to 2012. This research uses 131 units of observation to conclude with systematic sampling. The research uses the US Fed rate, Indonesian inflation, and exchange rate as the independent variables and the Indonesian government bond yield as the dependent variable. In addition, the BI rate and GDP are chosen as the control variables. This study used the ARMA model since the data is a time series.

According to the outcome of the test, two of the independent variables, Indonesian inflation and exchange rate, have a significant relationship to the dependent variables. One control variable has a meaningful relationship, which is the BI rate. On the other hand, GDP has no impact on the dependent variables. In conclusion, the rise of the US Fed rate does not affect the Indonesian government bond yield positively. Meanwhile, the Indonesian inflation and exchange rate positively impact the government bond yield.

Although the purpose of this study is to assess the impact of the rise of the US Fed rate, Indonesian inflation, and exchange rate on the yield on Indonesian government bonds, the macroeconomic factors are limited to these three factors because, according to the ARMA model, the adjusted R-Square value is around 46%. So, 54% of other



factors, such as credit default swaps or volatility index, can still be used aside from these two elements. Next, the population used in this research is only Indonesian. Every country has its characteristics. Therefore, this study is only applicable to Indonesia as the object. Future researchers can sample other countries or compare Indonesia's data with other countries.

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