

## DETERMINANTS OF INDONESIAN GOVERNMENT BOND YIELDS

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**Abstract:** An important factor that becomes a consideration for investors in purchasing bonds as an investment instrument is the bond yield. Bond yields are used to calculate how much income the investors will get in a certain period of time. The yield movement can be influenced by various factors. This study aims to analyze the effect of bond prices, BI rate, inflation, and exchange rates on medium-term (10 years) and long term (30 years) Indonesian government bond yields. Data used in this research were monthly time series data from January 2015 to December 2019. The time-series data were analyzed by VAR/VECM. The results of the study found that bond price had a significant negative effect on medium term and long term government bond yields. The interest rate had a significant positive effect on long term government bond yields and the exchange rate had a significant positive effect on medium term government bond yields. Inflation had no significant effect on medium and long term government bonds yields. The exchange rate made the greatest contribution to medium term government bond yield changes while long term government bond made the greatest contribution to bond prices.

**Keywords:** BI rate, bond prices, exchange rates, inflation, bond yields

**Abstrak:** Faktor penting yang menjadi pertimbangan bagi para investor dalam melakukan pembelian obligasi sebagai instrumen investasinya adalah yield obligasi. Yield obligasi digunakan oleh para investor untuk menghitung seberapa besar pendapatan yang mereka peroleh dalam jangka waktu tertentu. Pergerakan yield dapat dipengaruhi oleh berbagai faktor. Penelitian ini bertujuan untuk menganalisis pengaruh harga obligasi, suku bunga BI, inflasi, dan nilai tukar terhadap yield obligasi pemerintah Indonesia jangka menengah (10 tahun) dan jangka panjang (30 tahun). Penelitian ini menggunakan data sekunder bulanan dari bulan Januari 2015 hingga Desember 2019. Data yang terkumpul dianalisis menggunakan Vector Autoregressive/Vector Error Correction Model (VAR/VECM). Hasil penelitian menunjukkan harga obligasi berpengaruh secara signifikan negatif terhadap yield obligasi pemerintah jangka menengah dan jangka panjang. Suku bunga BI memiliki hubungan yang positif signifikan terhadap yield obligasi pemerintah jangka panjang dan variabel nilai tukar memiliki hubungan yang positif signifikan terhadap yield obligasi pemerintah jangka menengah. Inflasi tidak signifikan berpengaruh terhadap yield obligasi pemerintah jangka menengah dan panjang. Nilai tukar memiliki pengaruh dominan pada perubahan yield obligasi pemerintah jangka menengah sedangkan harga obligasi berpengaruh secara dominan terhadap perubahan yield obligasi jangka panjang.

**Kata kunci:** harga obligasi, inflasi, nilai tukar, suku bunga BI, yield obligasi

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## INTRODUCTION

By trading securities, the capital market acts as an intermediary institution, connecting parties in need of funds with parties over above funds (investors). One of the securities that are commonly traded on the capital market is bonds. Bonds in Indonesia are classified as either government bonds or corporate bonds with two types of bonds available, conventional bonds and Islamic bonds (*sukuk*). Corporate bonds are debt securities issued by Indonesian corporations, both BUMN and other corporations, whereas government bonds are Surat Utang Negara (SUN) issued by the government of the Republic of Indonesia. According to Rahardjo (2003), SUN is securities in the form of debt instruments denominated in rupiah or foreign currency that the payment of interest and principal is guaranteed by the Republic of Indonesia for the duration of the validity period.

According to the debt securities transactions for corporate debt securities and SUN (government) from 2015 to 2019, as published in the Annual Report of Otoritas Jasa Keuangan, government bonds have a higher trading volume and outstanding than corporate bonds. The transaction volume of government bonds increased from 2015 to 2019, indicating that investors are still interested in government bonds.

An important factor that becomes a consideration for investors in purchasing bonds as an investment instrument is the bond yield (Jamillah, 2012). Yield is the return on investment income which refers to the interest received and is usually expressed annually as a percentage based on investment costs, current market value or nominal value. According to Bareksa (2020), government bonds have a lower yield to maturity value than corporate bonds from 2015 until 2019. Despite their lower yield to maturity value, government bonds remain popular among investors. This is supported by data from the Annual Report of Otoritas Jasa Keuangan which shows that the volume of government bond trading transactions is greater than the volume of corporate bond trading transactions. Another reason why investors prefer government bonds over corporate bonds, despite the lower yields, is the risk factor that makes investors feel safer because government bonds are considered to be less risky. This risk is associated with default risk by the government.

Bonds become an investment and financial instrument that is classified as debt securities if they meet the conditions determined and regulated in the bond structure. Price is one of the bond structures. Bond prices always fluctuate in response to market conditions and are influenced by interest rates (Rahardjo, 2003). Bond yields obtained by investors can change over time which can be influenced by the market price of these bonds, so fluctuations or changes in bond prices are important factors that investors must consider (Surya and Nasher, 2011). Furthermore, bond prices can change as a result of changes in interest rates, when interest rates rise, bond prices in the market adjust to falling, affecting changes in bond yields. Another factor that investors should consider is the inflation rate. When there is inflation, investing in bonds is considered risky due to uncertain market conditions (Nurfauziah and Setyarini, 2004). According to Jogiyanto (2009), the condition or performance of the bond market can be influenced by the performance of the foreign exchange market, where an increase in foreign exchange performance as indicated by the strengthening of the domestic currency exchange rate (Rupiah) will be followed by an increase in bond market performance as indicated by an increase in bond prices, as well as otherwise.

Based on the background description above, it is necessary to research the yields of Indonesian government bonds to provide an overview in making investment decisions for investors and policy decisions for the government. The purpose of this study is to examine the impact of bond prices as bond structure and macroeconomic variables on changes in Indonesian government bond yields.

## METHODS

The data used in this study are secondary data obtained from Bank Indonesia (BI), Badan Pusat Statistik (BPS), and The Indonesian Capital Market Institute (TICMI). Bond prices are used as bond structure variables in this study, while Bank Indonesia interest rates, inflation, and exchange rates are used as macroeconomic variables. Observations were made from 1 January 2015 to 31 December 2019. The bond series to be studied is a series of bonds issued by the Indonesian government maximum in January 2015 and in a fixed coupon rate (FR series) with medium and long maturities as a comparison, which is series FR0050 with a maturity of 30 years and FR0063 with a maturity of 10 years.

The Vector Autoregressive (VAR) model was used in this study. VAR can be used to forecast interconnected time series variables and to analyze the dynamic impact of random disturbances in the VAR system (Ansofino et al. 2016). The following is the equation model for the impact of bond structure and macroeconomic variables on bond yields (Ahmad et al. 2009; Pramana & Nachrowi, 2016).

$$Y_t = \mu + \sum_{i=1}^k \beta_i X_{1t-i} + \sum_{i=1}^k \theta_i SB_{t-i} + \sum_{i=1}^k \sigma_i INF_{t-i} + \sum_{i=1}^k \varphi_i ER_{t-i}$$

where:  $Y_t$  (yield to maturity);  $t$  (observation time);  $X_{1t}$  (bond prices);  $SB_t$  (BI rate);  $INF_t$  (inflation);  $ER_t$  (exchange rates);  $\mu$  (constant parameters vector);  $\beta, \theta, \sigma, \varphi$  (parameters matrix);  $i$  (lag).

Hypothesis:

- H<sub>1</sub>: Government bond yields are negatively affected by bond price.
- H<sub>2</sub>: Government bond yields are positively affected by BI rate.
- H<sub>3</sub>: Government bond yields are positively affected by inflation.
- H<sub>4</sub>: Government bond yields are positively affected by exchange rates.

The reason for this study was the fluctuation in bond yields, which was influenced by the bond structure and macroeconomic conditions. According to several studies, bond structure and macroeconomic conditions have different effects on government bond yields. As a result, a VAR/VECM analysis is required to analyze the effect of bond structure and macroeconomic conditions on government bond yields to assist investors in forming an investment portfolio that investors will choose. Research framework in Figure 1.

## RESULTS

### Unit Root Test

This test was performed using the Augmented Dicky Fuller (ADF) test. The criteria in ADF test is to compare the ADF statistical value with the MacKinnon Critical Value. If the statistical value is less than the MacKinnon Critical Value, then the data is stationary.

Based on the results of the unit root test (Table 1), the variable yield FR0050 (long term) and the price of FR0050 are stationary at a level with a significance level of 5%. Meanwhile, the variable yield FR0063 (medium-term), price FR0063, BI interest rate, inflation, and stationary  $\ln\_NT$  in the first difference with a significance level of 5%. According to Abitur (2018), these results indicate an imbalance in the short-term relationship so that a cointegration test is needed to determine the equilibrium relationship in the short and long term. If there is a cointegration relationship, the model used is VECM. However, before performing the cointegration test, the optimal lag on the VAR system must be tested.

### VAR Stability Test

The VAR stability test is done by calculating the roots of the polynomial function. If all the roots of the polynomial function are in the unit circle or the absolute value is less than one, then the VAR model is considered stable so that the impulse response and variance decomposition analysis becomes valid. The VAR stability test results showed that the VAR system on long-term bonds has a modulus range of 0,1736-0,9599 and medium-term bonds with a modulus of 0,2049-0,9866. The modulus range of the two bonds has a value less than one so that the VAR model is said to be stable.

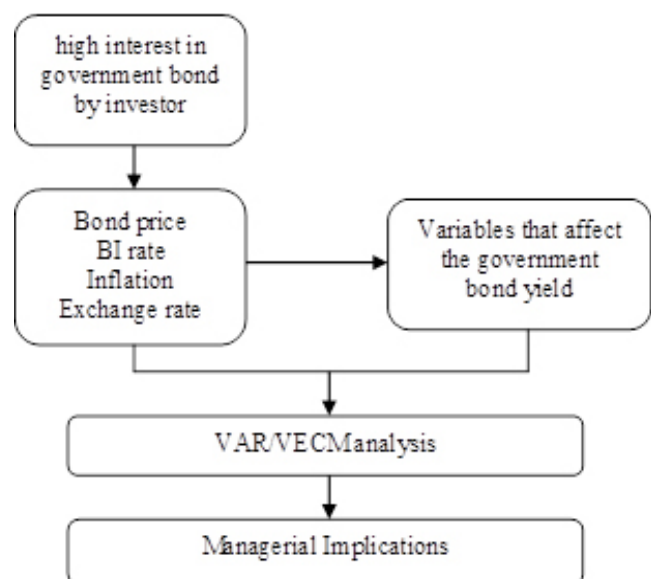


Figure 1. Research framework

Table 1. Unit root test results

Variable	Level		Description	First difference		Description
	t-stat	Critical values (5%)		t-stat	Critical values (5%)	
yield FR0050	-3,8457	-2,9117	Stationary	-	-	-
yield FR0063	-1,4413	-2,9117	Not stationary	-7,0344	-2,9126	Stationary
hargaFR0050	-3,0370	-2,9126	Stationary	-	-	-
hargaFR0063	-0,9827	-2,9117	Not stationary	-6,3491	-2,9126	Stationary
BI7DRR	-1,4621	-2,9126	Not stationary	-5,4006	-2,9126	Stationary
Inflasi	-2,0452	-2,9117	Not stationary	-5,5515	-2,9135	Stationary
ln_NT	-2,5726	-2,9117	Not stationary	-8,7542	-2,9126	Stationary

The next step in using the VAR model is determining the amount of lag. Determination of the optimal lag is one of the important stages in model formation because the cointegration test stage is very sensitive to lag length (Enders, 2014). The optimal lag test results suggested for the long-term bond model are lag 1 based on SC and HQ criteria and the optimal lag suggested for the medium-term bond model is lag 1 based on the FPE, AIC, SC, and HQ criteria. After the optimal lag is known, the next step is to carry out the cointegration test. The cointegration test is carried out to determine whether there is a long-term effect on the variable under study.

### Cointegration Test

The cointegration test aims to determine whether the variables that are not stationary are cointegrated or not. The cointegration test was carried out using the Johansen Cointegration test. If the variables are co-integrated, the VECM model is used. Based on the results of the cointegration test on the long-term and medium-term bond models, there are five cointegration equations at the 5% level. This is based on the trace statistic value which is greater than the 5% significance level, where if the trace statistic is greater than the 5% significance level, it means that there is cointegration. These results indicated that there is a long-term relationship between the bond structure and the macroeconomic variables used on long-term and medium-term bond yields. Thus, the model used is the VECM model.

### VECM Estimation

The VECM model as a whole consists of the lag variable, the cointegration equation (CointEq1), and the constant C. The cointegration equation is often referred to as the long-term equation, while the VECM equation as a whole is called the short-term equation. In the long term, the BI interest rate variable has a positive and significant effect on long-term bond yields, while the bond price variable

has a significant negative effect and the exchange rate has a significant positive effect on medium-term bond yields. In the short term, only the bond price variable has a negative and significant effect on long-term bond yields, while the BI interest rate variable, inflation and exchange rates have no effect. Similar results were obtained for medium-term bond yields where the BI interest rate variables, inflation, exchange rates, and bond prices didn't effect on yield.

Bond price variables have a significant negative effect on medium-term bond yields and long-term bond yields. The results obtained are in line with the theory which states that bond prices and bond yield rates are inversely related, where if the bond price increases, the yield rate will decrease. Likewise, if the bond price decreases, the bond yield will increase. Bond prices can fluctuate according to investors supply and demand mechanisms. According to Kusumaningrum et al. (2019), concerning maturity, the longer the maturity of a bond, the bond price becomes more sensitive to bond yields changes. According to Astari and Badjra (2018), the longer the maturity period of a bond, the higher the interest demanded by investors. This is because the longer a bond's maturity period, the greater the risk of the bond's market price fluctuation due to fluctuating interest rates.

Changes in interest rates are directly proportional to changes in bond yields, while market interest rates and bond prices move in the opposite direction. If market interest rates increase, bond prices will decrease and make bond yields increase. Based on research conducted by Chang et al. (2011), Saputra and Prasetyono (2014), and Hsing (2015), BI interest rates have a significant effect on bond yields. There are different data of interest rate that used in this study which is BI rate (before August 2016) and BI 7 days repo rate (August 2016 to December 2019). This was related to the monetary operation policy implemented by Bank Indonesia which changed the BI rate to BI 7 days repo rate. Interest rates only have a



positive and significant effect on long-term bond yields. The results of this study are in line with the results of research conducted by Soebagiyo and Panjawa (2016) which states that there is a positive influence between the movement of interest rates and bond yields. Concerning tenor or maturity, bond yields with long tenors tend to be more sensitive to changes in interest rates compared to bond yields with short tenors. This is consistent with the results of research where long-term bonds with a tenor of 30 years are more sensitive to interest rates than medium-term bonds with a tenor of 10 years. The longer the tenor of a bond, the greater the risk that must be faced by investors so that the yield for long tenor bonds is generally higher than that of short tenor bonds. The lack of a significant effect of BI rate on medium term bond yields could be caused by differences in BI rate data used in the study which requires further study.

According to Chionis et al. (2015); Urrahman et al. (2016); Akbari and Sentosa (2019), inflation has a positive effect on bond yields because when inflation rises in an economy, it tends to raise interest rates in general causing investors to seek higher yield compensation. However, this study found that inflation had no effect on the yield of medium-term bonds and long-term bonds. The same results were obtained by Rahma (2014), Rahman and Sam'ani (2013) which proved that there was no influence between inflation and yields on Indonesian government bonds. According to Widajati (2009), inflation had no effect can be caused by even though inflation fluctuates, the government is trying to maintain economic stability by convincing investors that economic conditions are still good enough so as not to trigger the market to make market conditions negative. However, this must be studied further to ascertain whether public confidence in the strong government is the main reason that keep people investing in bonds despite rising inflation.

The exchange rate had no effect on long-term government bond yields but had a positive and significant effect on medium-term government bond yields. The results of this study are in line with research conducted by Chee and Fah (2013); Sari and Abundanti (2015); Paramita and Pangestuti (2016) which states that the exchange rate has a significant positive effect on government bond yields. This shows that when the local currency exchange rate weakens against the US Dollar, it will be followed by an increase in government bond yields. Yuliani (2016) adds that investors who buy or choose

long-term bonds as their investment instrument tend to aim as a long-term investment instrument so that when there is an increase or decrease in the exchange rate, investors will not immediately sell their bonds. Meanwhile, investors who buy medium-term bonds tend to sell their bonds when the exchange rate weakens. Therefore, when there is an increase or decrease in the exchange rate, medium-term investors immediately take action to sell on the secondary market to obtain capital gains.

### **Impulse Response Function (IRF) Analysis**

IRF analysis is used to see the response of the main variable to shock that occurs in one of the endogenous variables. Short-term responses are generally significant dynamically fluctuating, while long-term responses tend to be more static. Based on the results of the IRF test in Figure 2, long-term bond yields began to respond negatively to shocks in the second period. Long-term bond yield response increased in the third and fourth periods negatively. In the fifth period, long-term bond yields respond positively to bond price shocks and a positive response persists after the fifth period. The response given by long-term bonds to variable shocks in bond prices began to stabilize and reached the equilibrium point in the tenth period. Responses on long-term bond yields to the BI rate were introduced in the second period. After the second period, the response given by long-term bond yields increased until the fourth period. However, in the fifth period, the response to long-term bond yields decreased positively and stably in the fifteenth period with a positive response.

The inflation variable's shock to long-term bond yields began to respond positively in the second period and decreased to negative in the third period. Another positive response was shown by long-term bond yields in the fourth period and the positive response lasted until the end of the period. Long-term bond yields show a positive stable response to inflation shocks in the tenth period. In the exchange rate variable, long-term bond yields responded negatively to shocks in the second period. Long-term bond yields still gave a negative response in the third period, but in the third period, long-term bond yields responded positively. The response given by long-term bond yields to inflation shocks continued to increase positively until the sixth period. In the seventh period, the response to long-term bond yields began to decline positively until the end of the period and reached the equilibrium point in the tenth period.

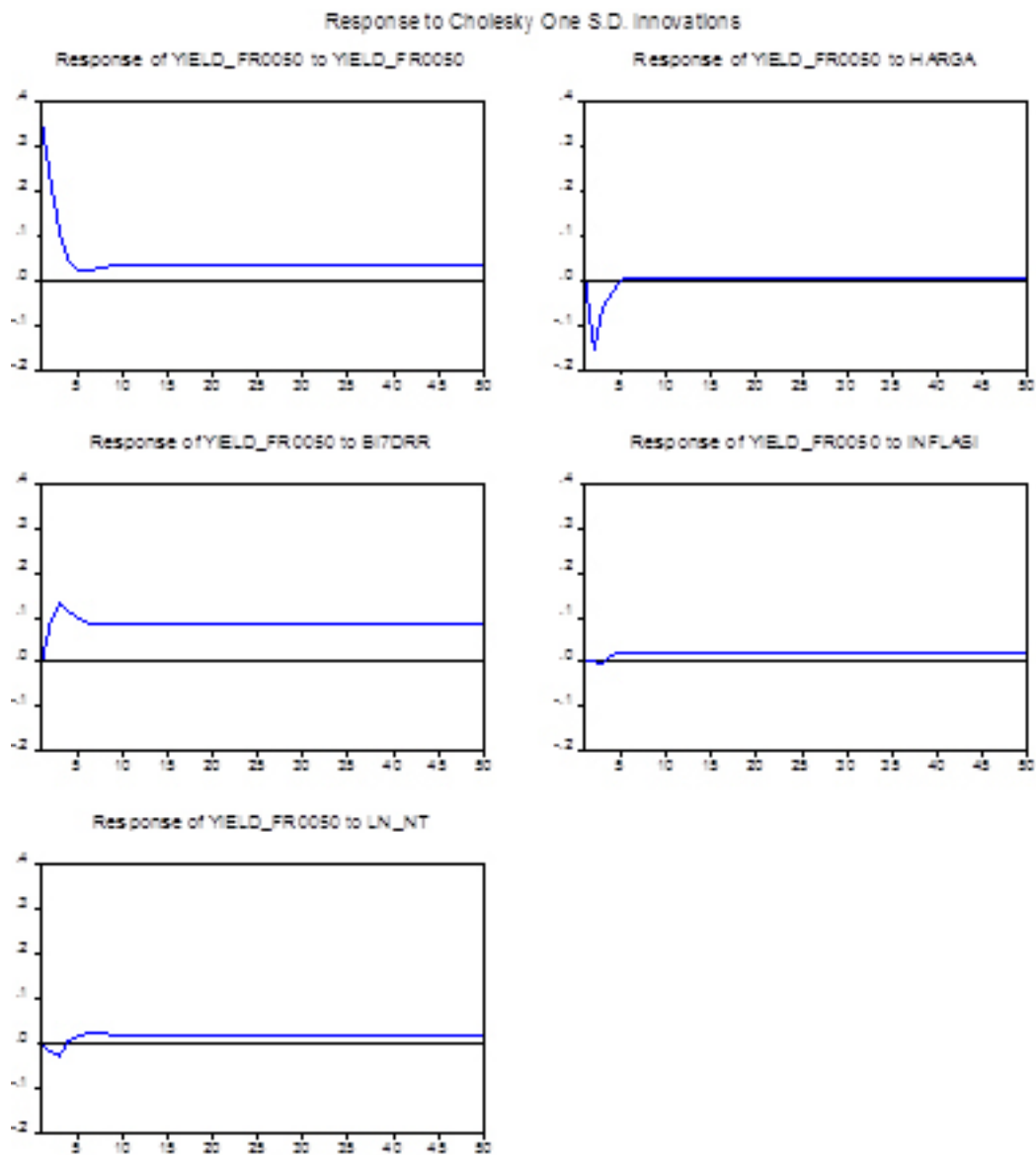


Figure 2. The results of IRF analysis of long term bond

The IRF test results for medium-term bonds can be seen in Figure 3. Based on the results of the IRF test, the response of medium-term bond yields to variable shocks in bond prices began to be given in the second period negatively. The response of medium-term bond yields to bond price shocks decreased in the third period negatively and negative responses continued to be given by medium-term bond yields to bond price shocks until the end of the period. The response of medium-term bond yields to volatile shocks in the tenth period was negative. In the BI rate variable, medium-term bond yields began to respond positively in the second period. Medium-term bond yield response increased positively to shocks in the third period. The positive response of medium-term bond yields to the BI rate continued until the tenth period, when it reached its equilibrium point. The shock to the medium-term bond yield by the

inflation variable began to respond negatively to the inflation shock in the second period. Medium-term bond yield response decreased negatively in the third period. Medium-term bond yields responded negatively again in the third period and the negative response to medium-term bond yields persisted until the end of the period. Medium-term bond yields showed a stable response to inflation shocks negatively in the tenth period. The response to medium-term bond yields to exchange rate shocks began in the second period and the response increased positively until the fourth period. In the fifth and sixth periods, the response of medium-term bond yields to exchange rate shocks decreased positively. After the sixth period, the response given by medium-term bond yields to exchange rate shocks increased positively until the end of the period and stabilized in the tenth period with a positive response.

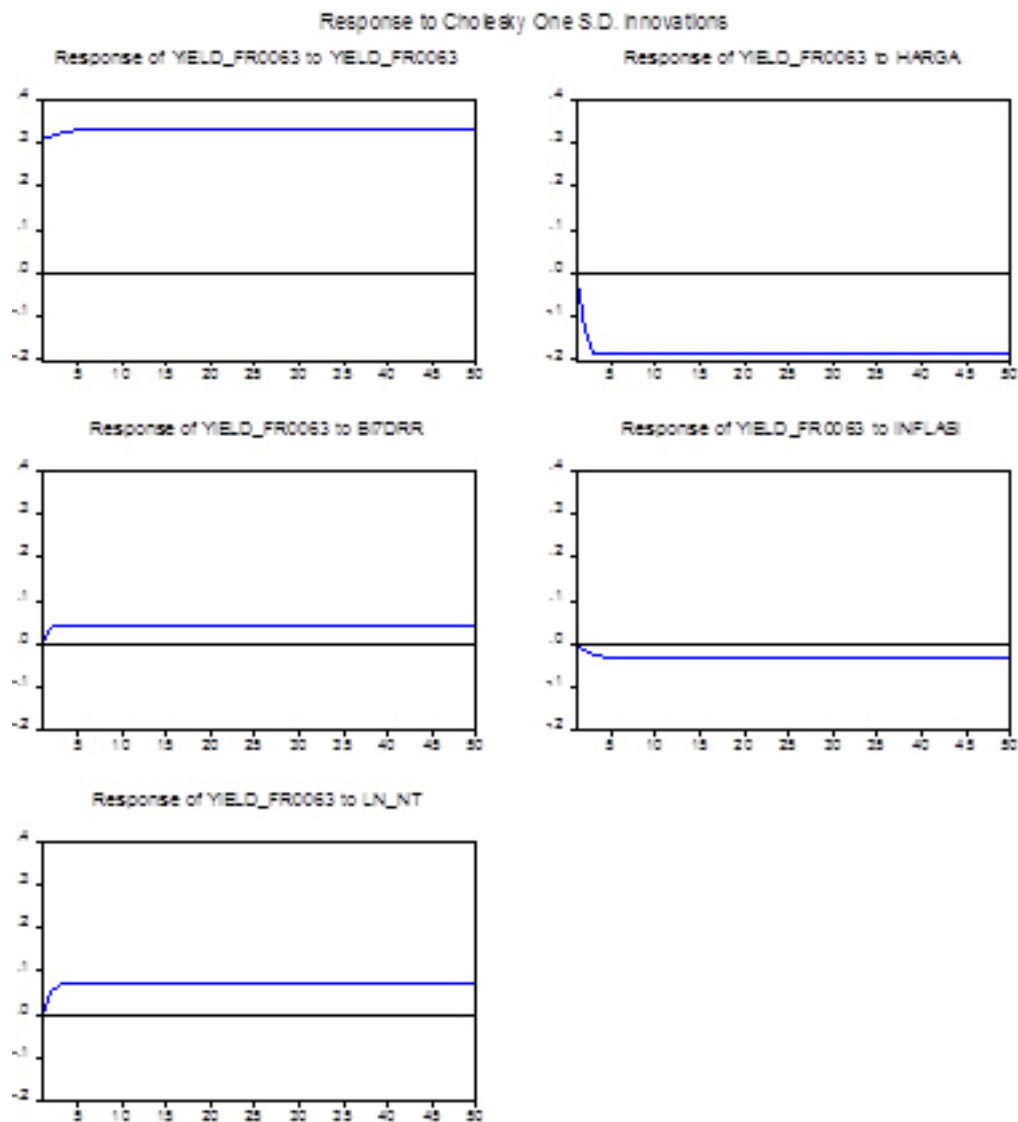


Figure 3. The results of IRF analysis of medium term bond

### Forecasting Error Variance Decomposition Analysis (FEVD)

FEVD analysis in the VAR model aims to predict the percentage contribution of the variance of each variable due to changes in certain variables in the VAR system. In the previous impulse response analysis used to see the impact of shocks from one variable on another, in the FEVD analysis it was used to describe the relative importance of each variable in the VAR system due to shock.

The long term period simulated in the FEVD analysis of long term bonds is a projection of the next 50 months.

Based on the results of the FEVD analysis on long-term bonds in Figure 4, it can be seen that the change in yield is more influenced by itself by 100% in the first period. Furthermore, its contribution decreased gradually over the long term up to the fiftieth period. In the long term (50 months), fluctuations in long term bond yields are increasingly dominant, as explained by BI rate of 54,51%, followed by bond prices of 4,21%, exchange rate of 2,86%, and inflation of 2,48%. This indicates that, in the long run, bond prices, exchange rates, and inflation have little influence on long term bond yield fluctuations in the projections for the next 50 months.

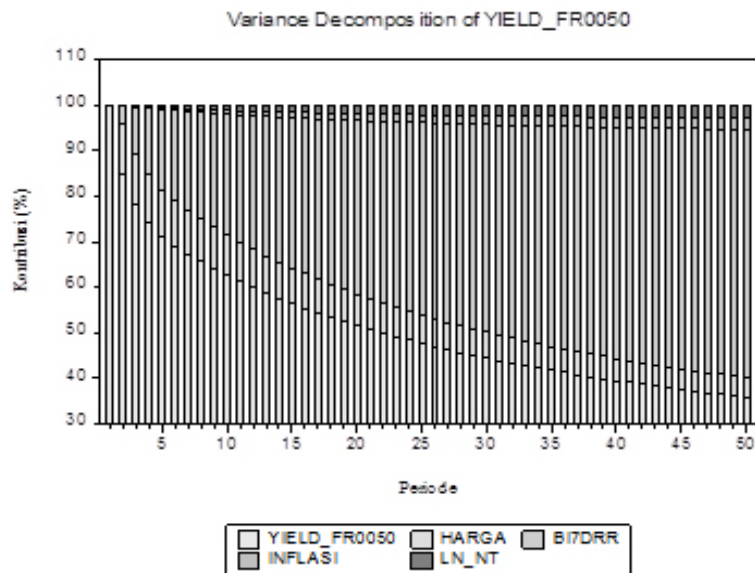


Figure 4 The results of FEVD analysis of long term bond

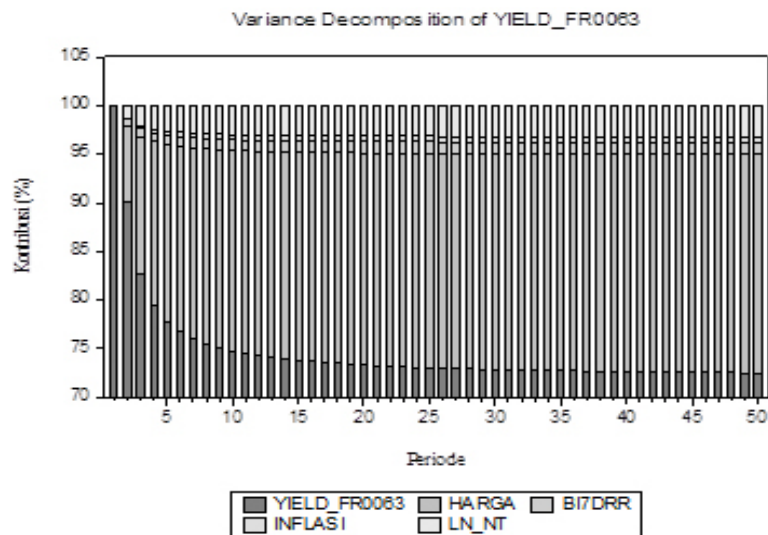


Figure 5. The results of FEVD analysis of medium term bond

The FEVD analysis on medium term government bonds simulates a long term period of 50 months. Based on the results of the FEVD analysis on medium-term bonds in Figure 5, the change in yield is more influenced by itself by 100% in the first period and its contribution continues to decline until the fiftieth period. Bond yield fluctuations are most dominantly influenced by bond prices with a proportion of 22,46%, and the rest is explained by exchange rates, BI rate, and inflation in small proportions of 3,21%; 1,21%; 0.60%, respectively. In other words, the exchange rate, BI rate, and inflation variables will not have a significant impact on the fluctuation of medium term bond yields over the next 50 months.

### Managerial Implications

This study recommends that investors who invest in medium-term government bonds should pay attention to bond prices and exchange rates, as these can affect changes in bond yields. Medium-term bonds can be an option for investors who want to keep bonds as an investment instrument until maturity or investors who want to seek capital gains by selling bonds before maturity. Long-term government bond investors need to pay attention to bond prices and interest rates. Investors can choose long-term government bonds as their investment instrument if they are intended as a long-term investment instrument or hold bonds until maturity because long-term bonds have a fairly high



coupon value. For the government as the party issuing bonds and policy makers, the factors that affect bond yields can be used as a benchmark for the government in making policies that can reduce risk in the bond market. In issuing the next bond, the government can determine by looking at the type of investor so that it can be tailored to the needs of each investor by offering attractive coupons so that the bond market is in great demand by investors.

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

Bond prices have a significant negative effect on the yield on medium and long term government bonds. The interest rate variable has a significant positive relationship to the long-term government bond yield and the exchange rate variable has a significant positive relationship with the medium-term government bond yield. Inflation does not significantly affect the yield on medium and long term government bonds. The influence of variable bond prices, BI interest rates, inflation, and exchange rates on medium-term government bond yields will last for the next 10 months. For long-term bonds, the influence of the variable bond price, inflation and exchange rate will last for the next 10 months, while the effect of the BI interest rate will last for the next 15 months. The largest contribution of medium-term government bonds to yield changes is the exchange rate, while long-term government bonds have the largest contribution to bond prices.

### Recommendations

The bond series used in this study are only 2 types of bond series with two types of maturity, which is 10 years and 30 years. Bond prices and exchange rates can affect changes in the yield of medium term government bonds, so medium term government bonds can be an option for investors who want to hold bonds until maturity or for investors who want to seek capital gains by selling bonds before maturity. While bond yields for long term government bonds are influenced by bond prices and interest rates, investors can choose long term government bonds as their investment instrument if it is intended as a long term investment or holds bonds until maturity because long term bonds have a relatively high coupon value.

The results of the research will be more interesting if the bond series used includes all types of maturity (1 year, 3 years, 5 years, 15 years) but due to limited research data, it can only be examined bond series with maturities of 10 years and 30 years. In relation to variables, there needs to be further research on the BI interest rate variable and inflation. There are differences in the interest rate data used in this study (BI rate and BI7drr) so that treatment is needed for the two interest rate data (conversion of BI rate data to BI7drr). In addition, the influence of the inflation variable on government bond yields (medium and long term) needs to be studied further because the results obtained are not in line with theory (no effect).

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