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Analysis the Influence of Internal Factor and External Factor on Yield Bonds Government in 2011-2014

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Abstract: ***The decline of growth Indonesian economy caused investors to diversify their investment, therefore, the Indonesian government bond market has grown so rapidly. This study aims to analyze the relationship and influence of internal factor and external factor on yield bonds government. Bond yields in this study using a long-term government bonds (>10 years) with fixed coupon bond and short term with zero coupon bond (< 1 year). The study examines the internal factors consist of coupon bond, maturity and duration, while external factors consist of interest rate, inflation and the exchange rate to U.S dollar, for the period 2010 to 2014 . The research shows that yield influenced by all factors except exchange rate, beside of that FEDV results showed that external factors had more contribution in bonds with long term tenors and internal factors had more contribution in bonds with short term tenor.***

Keywords: Bonds, VAR, macroeconomic

1. Introduction

Indonesia's economic growth which is decreasing since 2011 until 2014, is one fo the reason for doing diversification of investing their portfolio. Bonds is one of long-term capital market instruments that started to demand by investors. In 2011 - 2014 the growth of the bond market showed a positive trend and the percentage of bonds market capitalization had a percentage increase. Government bonds represent bonds of the most in demand by investors aiming to diversify its investments. Investors prefer government bonds have less default risk compared to corporate bonds, while government bond yields were not as large as yield corporate bonds. Factors that can affect yields, namely internal factors consist of the characteristics of the bond coupon and maturity. In addition, investors need to know the risks other than default risk which may affect changes in bond yields that risks to price sensitivity. The risk of price sensitivity shown in the calculation of the duration.

Bond is one of the capital market instruments that will gain influence and impact on monetary policy of the government. Every day, every month and every year bond yield fluctuated. Fluctuation in bond yields might be caused by changes in bond prices. Based on previous studies that fluctuation in bond yields may be affected by external factors, called macroeconomic variables including interest rates, inflation and exchange rates. Previous research such as, studied by Herlambang (2015), Tyas (2012), Aswan (2012) states that the interest rate has positive effect on bond yields, and other research suggested that inflation and exchange rate can influence bond yields.

1.1 Relations between yield with duration, maturity and coupon

In theory, the longer life of the bond, the higher yield is given, it is consequence of the potential risks that may arise due to the lengthy period of maturity bonds (Raharjo, 2003). High coupon rate has less declines of price if there is a change in interest rates, and vice versa. Research conducted Ajlouni (2012) and Herlambang (2015), namely how the duration could measure the sensitivity of bond prices and the duration can be calculated as maturity risk, the longer the duration, the risk sensitivity of bond prices will be higher, the risk of changes in the yield would be higher. Moreover, that the shorter of duration it will be inversely proportional to the value of the coupon, and if the duration shorter, it will make yield have bigger value. Additionally, the longer maturity bonds and the higher coupon bonds will lead to shorter duration compared with the maturity value and the higher yield.

1.2 Relations between yield with interest rate, inflation and exchange rate

Integration of government's monetary policy framework for macro-economic stability, the government conduct monetary policy by intervening the exchange rate or interest rate, with the intervention of the exchange rate changes will occur and the aggregate demand will cause a change in the ability of people on the purchasing power, as well as by intervening on the value BIrate, it will be a change in interest rate and aggregate demand, and led to a change in expected inflation by the government can keep inflation low and stable (Juda Agung, 2010). If the commercial interest rate showed a downward trend, the rising bond prices move this matter because investors tend to prefer investments in bonds, otherwise when commercial interest rates tend to increase the price of the bond will decline because investors are more interested in saving their money in banks (Bapepam, 2003). Bond yields will be affected by interest rates, when interest rates increase, bond prices will decline, causing bond yields to gain. As researched by Wiener (2006) states that inflation can affect the value of bond yields, and clarified by Saputra (2013) in his research on the analysis of the factors that affect conventional bond yields in Indonesia, stating that inflation significantly influence changes of bond yields. If inflation has increased the circulation of money in the community and the overflow will cause the price to be high, then the public will choose to invest in a long term and

secure with the expected future value of money return will be higher and still benefit with a fixed coupon paid periodically so that bond prices will rise and cause the yield will decrease. According, Edward (2007) in the macro-economic system in case of increase the exchange rate of USD/$ means that there is supply of dollars in an amount larger than the previous period. This occurs because the value (Export - Import) of goods and services, foreign exchange reserves, the flow of investment (both in the form of foreign direct investment or financial asset / the Securities) have increased. According Maju (2008), the economic fundamentals and the company and also the exchange rate and inflation have a significant influence on the bond return. So, if an increase in the exchange rate (appreciation), the government will do the reduction of interest rates, so the investor would prefer to invest in bonds and will cause bond prices rise, so the value of bond yields will decline.

2. Data

The data used in this research is secondary data obtained from various relevant agencies in Indonesia**.** The data that have been published and can be verified. The data used is the bond trading data such as price, yield, coupon and maturity sources from Indonesia Stock Exchange, in addition to the data of interest rates, inflation and the exchange rate sources froem Bank Indonesia. The period of data used was in 2011 to 2014. The sample data used consists of four types of bonds,which are 18 series of bonds.

3. Methodology

VAR models (Vector Autoregression) Effect of internal factors and external factors fluctuation of bonds to the yield of government bonds can be analyzed using the Vector model Autoregression (VAR). This analysis is done with the help of software Eviews 6. According Widarjono (2009), if the data in the VAR model is stationary at the current level then only need to use ordinary VAR models (unrestricted VAR). Conversely, if the data is not stationary in levels but stationary in the differentiation process, it must examine whether the data have a relationship in the long run or not to test the cointegration. If there is cointegration, the model is used the model of Vector Error Correction Model (VECM). VECM model is a model that used be restricted (restricted VAR) for their cointegration indicate a long-term relationship between the variables in the VAR system.

For analyze the relationship between macroeconomic variables and variable internal characteristics of the bond yield bonds, and each type of bond will be analysis using the following models:

$$\begin{bmatrix} Y_t \\ X_{1t} \\ X_{2t} \\ X_{3t} \\ SB_t \\ I_t \\ ER_t \end{bmatrix} = \begin{bmatrix} a_{10} \\ a_{20} \\ a_{30} \\ a_{40} \\ a_{50} \\ a_{60} \\ a_{70} \end{bmatrix} + \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} & a_{16} & a_{17} \\ a_{21} & a_{22} & a_{23} & a_{24} & a_{25} & a_{26} & a_{27} \\ a_{31} & a_{32} & a_{33} & a_{34} & a_{35} & a_{36} & a_{37} \\ a_{41} & a_{42} & a_{43} & a_{44} & a_{45} & a_{46} & a_{47} \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & a_{56} & a_{57} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} & a_{67} \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & a_{77} \end{bmatrix} \begin{bmatrix} Y_{t-i} \\ X_{1t-i} \\ X_{2t-i} \\ X_{3t-i} \\ SB_{t-i} \\ I_{t-i} \\ ER_{t-i} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \\ \varepsilon_{7t} \end{bmatrix} \quad \ldots\ldots\ldots (1)$$

Where :
Y1t = yield to maturity
t = time of observation
X1t = coupon / interest received value bondholders
X2t = maturity, the time bondholders will receive principal payment or Par Value
X3t = duration
SBT = Interest Rates
It = Inflation
ERT = exchange rate
εt = error term (residual)
i = inaction (lag)

4. Empirical Result

The stages in the analysis of the VAR model is:

1) **Stationarity Test Data**
How that can be used to determine the stationarity of data is testing unit roots. The results of the four types of bonds, which is stationary at the first difference level.
2) **Stability Test VAR Model**
VAR model stability test is used by calculating the roots of a polynomial function or known by the roots of characteristic polynomial. Based on the test results of four models of stability bonds, each bonds have a modulus range <1 and are in the circle of their unit, then the VAR model on each model is stable.
3) **Determination of Optimal Lag**
Optimal lag length variables needed to counteract the effect of each variable to another variable in the VAR system. In the FR series on the optimal lag is lag-2, series ORI optimal lag is lag to-1. Series IFR optimal lag is lag-2 and series SPN optimal lag is lag-1
4) **Cointegration test**
The concept of cointegration is a linear combination of two or more variables that are not stationary variables will produce stationary. Linear combination is known as cointegration equation and can be interpreted as a long-term equilibrium relationship between variables. Cointegration test results on the four types of bonds that there is a contegration relationship.
5) **VECM Analysis Results**
Based on test results, the four types of bonds stationary at first difference level and have cointegration relationship which showed that the fourth model of bond yields for internal factors and external factors can be analyzed using Vector Error Correction Model analysis. All models are cointegrated and analyzed using analysis of Impulse Response Function (IRF) and Forecasting Error Variance Decompositon (FEDV). VECM estimation results shown in Table 3.

Table 3: VECM Estimation Results

Long Term				
Variable	*Bond series FR*	*Bond series ORI*	*Bond series IFR*	*Bond series SPN*
Log Duration(-1)	-0.009169	**-6.526568**	**-0.408367**	
Log Maturity(-1)	**0.011936**	**6.078673**	**0.38753**	**0.019431**
Coupon(-1)	-0.254808	**-40.01674**	**5.512344**	
Interest Rate (-1)	**2.508846**	2.050234	**2.110041**	**1.376728**
Inflation(-1)	**-0.990240**	-0.479413	**-1.316624**	-0.230469
Exchange Rate(-1)	-0.020172	-0.033175	0.013781	0.003803

Note: Bold text indicates the significance of variables on the level of α = 5%

4.1 Relationship of Duration and Government Bond Yield

In this study indicate the duration of the relationship of the government bond yield in the long term. The duration has a significant influence negatively on the type of bond series ORI and IFR. On SPN types of bonds, there are no results because the duration of the analysis is a type of bond SPN zero coupon bond. Duration value has a negative relationship, it shows that the value of the longer duration then make sensitivity of the value of the price changes is higher. In accordance with the theory that the relationship between duration and yield is negative, so were mentioned by Kane (2008) that the lower yield with the longer maturity would have a greater present value than the total value of bonds.

4.1.1 Impulse Response Function

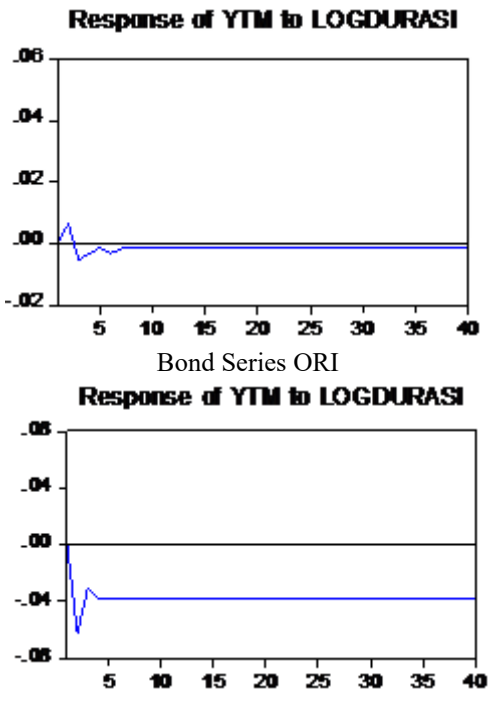


Figure 2: IRF chart bond yield response ORI bond and IFR bond to shock duration

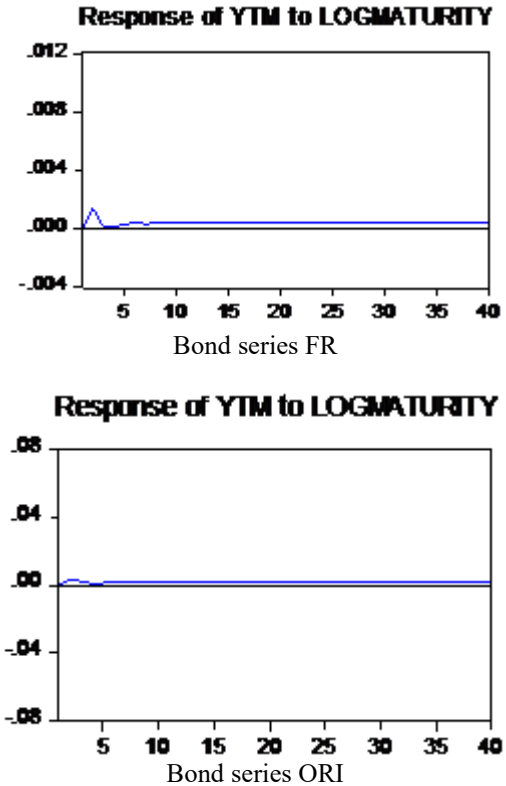
Graph IRF (Impulse Response Function) in Figure 2. Shows the yield response to shock the duration of IFR and ORI bonds which has a significant relationship to the VECM analysis.Response to both bond yields shows that the response given is negative. Additionally, IRF chart shows no movement toward equilibrium, so it can be interpreted that the shock duration provides a permanent impact in the long term is negative, that is when the longer duration will make of the bond yield be smaller, nor vice versa

4.1.2 Relationship of Maturity and Government Bond Yield

In this study by using VECM analysis found that maturity has a positive significant effect on yield of four types government bonds in the long term. This analysis explains that, in the long-term maturity has a positive effect: the longer time maturity of bonds will give the effect of yield increasing value. As research by Kusuma (2005) and Gitman (2009) that the longer time maturity of a bond, so it will be higher interest demanded by investors, because of the bonds get more risk and the interest paid by issuer will be more and more, then the value of bond yield will be higher.

4.1.3 Impulse Response Function

Graph IRF (Impulse Response Function) in figure 3. shows the response of yield to maturity of the bond stock FR, ORI, IFR and SPN that has a significant relationship to the VECM analysis. Response yield on the four bond indicates that the response given is positive. Fourth bonds shows that fluctuations in response to shock maturity period lasted less than 10, and stable in the long term. Additionally, IRF chart shows no movement toward equilibrium, so that it can be interpreted that the shock duration provides a permanent impact in the long term is positive, than if the longer the maturity, the bond yield will be higher, nor vice versa.



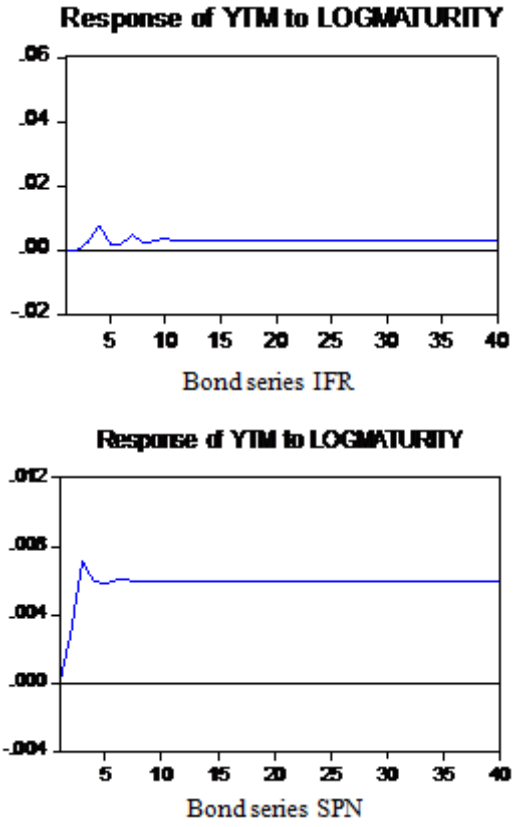


Figure 3: IRF graph bond yield response FR series, ORI series, IFR series and SPN to shock maturity

4.1.4 Relationship of Coupon an Government Bond Yield

In this study examined type of coupon is fixed couponand zero coupon. ORI series have short term maturity, causing the value of the coupon give effect to yield changes. In VECM analysis results on the long term shows that the effect had a negative direction of the coupon yield bonds. As has been explained by Rahardjo (2013) that the higher coupon rate which offered on a bond and the coupon has shorter maturities, bond prices tend to higher and bond prices increasingly sensitive to yield changes. Therefore, If coupon rate higher of the bonds owned by the value. it will make the bond yield will be smaller for the ORI series bonds case, because if the coupon rate of the bond is higher, it will make the growing demand by investors, and cause the price of the bonds will be high and makes the value of bond yields declined. Coupons have an impact on bond yields in the series IFR, which is kind of sharia bonds or sukuk. Coupons on the type of Islamic bond yields that have a system that paid out every month, in the long term have a positive significant relationship. Consistent with the hypothesis that the higher coupon given, it will make the value of series IFR bond yields higher, because it will be higher value of the investment obtained by the investor.

4.1.5 Impulse Response Function

Graph of IRF (Impulse Response Function) in Figure 4. shows the response the shock of coupon bonds to yield of series IFR and ORI and which has a significant relationship to the VECM analysis. Response to both bond yields shows that different responses. ORI bond yields give a negative response from the initial period to 40 period ahead, the yield response showed that when the higher coupon yield given so the yield increasingly smaller, the same as the results of the analysis VECM relations. While bond yields IFR showed at the beginning of the period give a negative response, but in the long term yield positive response, so if the greater the coupon applied, itwill give higher yield, nor vice versa.

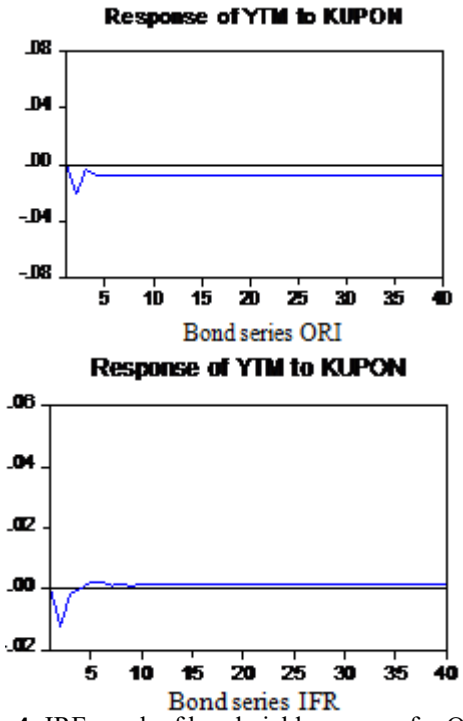


Figure 4: IRF graph of bond yield response for ORI series and IFR series to shock of coupons

4.1.6 Relationship of Interest rate and Government Bond yield

Variable interest rates have significant positive effect in the long term on all four types of bonds, except bond series ORI. Based on capital market information written by Satriani in 2013 stated that based analyst bonds Ariawan Sucorinvest Central Gani, that in the study period investors still prefer to invest ORI although BI rate increase (decrease), because the coupon offered on ORI bonds greater than the value of deposit rates, and besides that investors assume that ORI 100% guaranteed by the government than save the money to the deposit that the guarantee has a limit. Based on these facts and the analysis VECM results then the value does not affect the macroeconomic ORI bonds at the time of observation. Based on statistical analysis using VECM analysis, in accordance with the theory that the interest rate has an influence and positively related to bond yields, thus the higher the interest rate applied by the government will result in increasing the value of the bond yield, because it will cause a decline in bond prices. It is caused when the government made a policy by raising interest rates, then the public will tend to do a portfolio funds in the form of deposits or savings, then bond prices to decrease.

4.1.7 Impulse Response Function

IRF (Impulse Response Function) graph in Figure 5. shows the response of yield to shock the interest rate on the bonds FR, IFR and SPN that has a significant relationship to the VECM analysis. Response for thress of bond yields shows that the response given is positive. Moreover, the graph represents the movement of IRF chart that shows no movement toward equilibrium, so that it can be interpreted

that the interest rate shock provide a permanent impact in the long term is positive, then if the greater interest rates, bond yields will be even greater, nor vice versa.

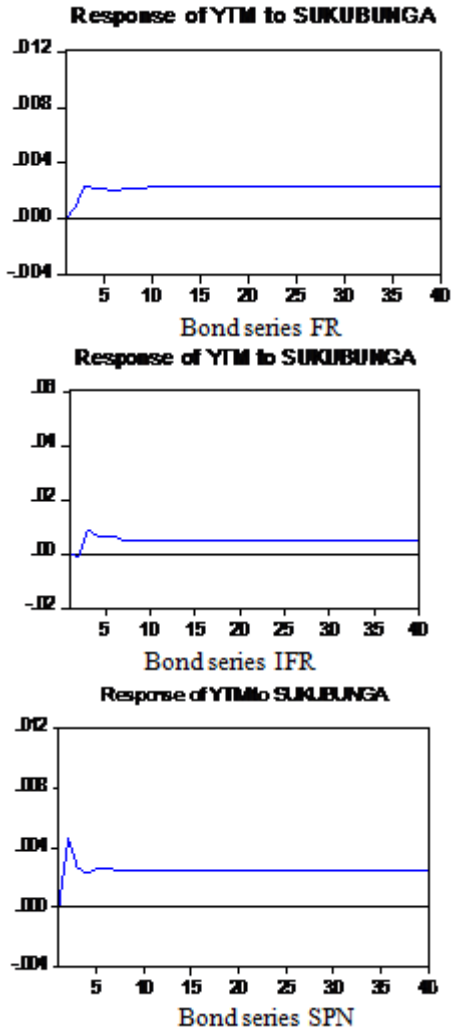


Figure 5: IRF graph of bond yield response of FR series, IFR series and SPN series to interest rate shock

4.4 Relationship of Inflation and Government Bond yield

Inflation variables in this study have significant negative effect on bond yields IFR and FR series in the long term. Thus, if the inflation rate increase impact on government bond yields declined. The situation is due to the current inflation then there is a high circulation of money in the community, causing all prices to rise, so does the price of the bonds will increase as well, because many investors who purchase the bonds, the value of bond yields to decrease. The influence of inflation on bond yields occur only in bonds series IFR and FR series because in this series, the nominal value of the bonds is quite large and has a long term maturity that so that the risk of price changes will be higher, it will have an impact on changes in inflation as compared to short-term bonds such as bonds ORI and SPN.

4.5 Impulse Response Function

IRF (Impulse Response Function) graph in Figure 6. shows the response of yield bonds to the shock inflation of IFR bonds and FR bonds which has a significant relationship to the VECM analysis. Response to both bond yields shows that the response is negative. Moreover, the graph represents the movement IRF chart and shows no movement toward equilibrium, so that it can be interpreted that the inflation shock provide a permanent impact in the long term is negative, ie, if the greater the inflation that bond yields will be even greater, nor vice versa.

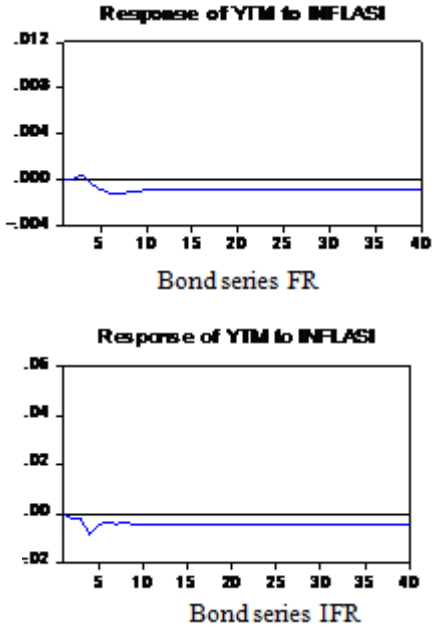


Figure 6: IRF graph bond yield response FR series and series IFR to inflation shock

4.6 Relationship of Exchange Rate and Government Bond yield

At the exchange rate variable IDR to USD in this study had a result on VECM analysis that does not have a significant effect on the yield of government bonds on the long term and short term, because if there is an increase or decrease of the exchange rate, the investor will not immediately make transactions of bonds on the secondary market, due to the mechanism of bond transactions on the secondary market bonds were difficult. To be able to trade in government bonds through the stock exchange, investors should contact the members of the exchange because investors can not transact directly through an exchange. The transaction process will be more complicated and investors have to pay brokerage services, as well as the time required will be longer if there is no meeting point between the offer price and the purchase price of the bonds, so in case of depreciation IDR to USD, investors can not directly attract investment in bonds and resell the bond, because of that the sensitivity of bond prices change very little if any change in the exchange rate.

4.7 Forecast Error Variance Decomposition

Forecast Error Variance Decomposition (FEVD) is used to determine the predictive variance percentage contribution of each variable to change a particular variable.

1. FR Series

In bonds FR series, the variable yield is a variable that has

most contributed to the change between the variable that is equal to 60%, in addition to the variable interest rate has a substantial contribution, namely 23.6%, then the next contribution is by inflation of 5.6%, duration 4.2%, coupon 3.8% and an exchange rate of 3.4%

2. ORI Series

On the bond series ORI variable yield is a variable that has contributed most to the change between the variable that is equal to 55%, in addition to the variable duration has a substantial contribution, namely 27.6%, then the next contribution is by the exchange rate of 8%, inflation is 4%, 3% coupon and a maturity of 0.5%

3. IFR Series

On the bond series IFR variable yield is a variable that has contributed most to the change between the variable that is equal to 52%, in addition to variable interest rates have a substantial contribution is 19%, then the next contribution is by inflation of 15%, maturity 7.5%, coupon 4.5%, by 3.4% and the duration of the exchange rate is only equal to 2:23%

4. SPN Series

SPN series maturity is a variable that has the most dominant contribution to the change between the variable that is equal to 43% and yield variables have a second contribution that is equal to 32%, in addition to variable interest rates have a substantial contribution of 20%. Other variables contribute to the exchange rate amounted to 5.5% and inflation 4.2%.

FEDV results showed that the type of long-term bonds are bonds series FR and IFR variables more affect are the external factor, while on the type of short-term bonds are bonds ORI series and series SPN variables more affected by internal factors.

5. Conclusion

VAR models provide information on how the relationship between the government bond yield to internal factors and external factors. VECM analysis results show that internal factors which have a long-term relationship to the yield of government bonds, such as the duration of which has a significant negative relationship: the longer duration, will give smaller yield value on bonds ORI series and IFR, maturity had a significant positive relationship: the longer maturity will give higher yield on bonds of series FR, ORI series, IFR series and SPN series. The coupon has a significant negative relationship of bond yield series ORI and significantly positive for bond yield series IFR. The coupon has a significant negative relationship bond yield of series ORI, that is the higher of coupon, will make yield smaller and significantly positive for bond yield series IFR that is the higher of yield, it will make the higher coupon. External factors which have a long-term relationship to the yield of government bonds are the interest rate has a significant positive relationship: the higher the interest rate will give high yields on bonds of FR series, IFR series and SPN series. Inflation has significantly negative relationship: that the higher inflation have impact on the less of yield value for FR series and IFR series, while the exchange rate has no effect and relation to government bond yields.

Shocks internal factors and external factors give a different response to the yield of government bonds, the characteristics of the different bond will respond differently to the factors - internal and external factors bonds. Yield response to internal factors and external factors shocks is fluctuated during the period 2 to period 10-15, after a period of 15 to 40 periods, the yield response to shocks is stable, and provide a permanent impact on the long term. FEVD results showed that the greatest contribution to the FR series and the IFR series bonds to changes yield is the interest rate, on bonds ORI series greatest contribution is the duration and the largest contribution to the bond yields changes for SPN series is maturity. This FEDV results showed that external factors had more contribution in bonds with longer tenors and internal factors had more contribution in bonds with shorter tenor.

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