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Analysis Responses of Exchange Rates, Interest Rates and Money Supply against Shock of Inflation before and After ITF Policies in Indonesia

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ABSTRACT : This study aims to analyze how the response of the exchange rate, interest rate and money supply due to shocks that occurred in inflation in the period before and after the implementation of the ITF policy in Indonesia. The data used are time series from 1994Q1-2018Q4. The data analysis method used structural vector autoregression (SVAR) model analysis tool by including retrictions. The results of the study conclude that in the period before the implementation of the ITF using the Impulse Response Function test (IRF), which illustrates that at the beginning of the shock period caused by inflation, it was responded positively by the exchange rate, interest rate and money supply variables. In the Forecast Error Variance Decomposition test(FEVD), it is also seen that the contribution of the inflation variable variant is also very large to the variable variance of the exchange rate, interest rate and money supply. In the period after the implementation of the ITF, only the money supply variable at the beginning of the period responded negatively due to changes in inflation. In the Forecast Error Variance Decomposition test (FEVD), it can be seen that the contribution of variance is dominated by the variable it self.

KEYWORDS -*Inflation Targeting Framework, SVAR, Inflation Shock, Exchange Rate, Interest Rate, Money supply*

I. INTRODUCTION

The Inflation Targeting Framework (ITF) is a monetary policy marked by announcements to the public regarding the inflation target to be achieved in the next several periods. Low and controlled inflation is the main objective of this policy (Bank Indonesia). Inflation must be maintained so that the value remains low and stable. Unstable inflation will disrupt people's economic activities. High inflation will have a negative impact on the people's economy, because the price of goods is high and will affect public consumption. For that, Bank Indonesia has developed a policy framework for an inflation targeting framework which is expected to be able to control low and stable inflation rates.

Indonesia has been using the inflation targeting framework (ITF) policy formally since July 1, 2005, after previously using a monetary policy that applies base money as the target of monetary policy. In contrast to the current implementation, the operational target for monetary control is the BI Rate.

[1] Changes in the inflation rate that are fast and take place over a long period will affect the strength or weakness of the domestic exchange rate against the exchange rates of other countries. [2] Central banks in developing countries make exchange rate and interest rate policies to reduce and control the movement of the inflation rate. [3] Policy makers often use monetary instruments to stabilize the economy by using interest rates as a monetary policy tool chosen by the monetary authority by considering the inflation rate, money supply, investment rates and exchange rate changes. [4] According to the monetary approach, exchange rate depreciation comes from the large demand for money as a result of the high inflation rate in the country, while appreciation comes from the insufficient growth of the currency in that country.

Inflation and interest rates tend to move together. When inflation rises, the increase is also followed by interest rates. For example, when there was a crisis in 1998 where inflation rose to 77.60%, this increase was also followed by an increase in interest rates to 35.52%. During the crisis that occurred in 1998, where the depreciation of the exchange rate was always followed by an increase in interest rates, the objective was to stabilize the value of the US dollar so that the rupiah did not depreciate even further.

In 2008, there was a negative relationship between interest rates and inflation on the exchange rate, where interest rates increased to 10.83% and inflation increased by 10.23%. The increase in interest rates and inflation resulted in depreciation of the exchange rate to Rp 10,950.00 / US$. The depreciation of the exchange rate was the result of the global crisis that hit Indonesia. This is the same as what happened during the crisis that occurred in 1998, where the depreciation of the exchange rate was always followed by increases in inflation and interest rates. The aim of raising interest rates is to suppress rising inflation and to stabilize the value of the US dollar so that the rupiah does not depreciate even further.

[5] Al-Hajj comparing the two regimes namely the flexible exchange rate regime and the Inflation Targeting Framework (ITF) in countries in sub-Saharan Africa. The inflation targeting regime is more dominant and successfully used than the flexible exchange rate regime as a strategy in responding to changes or shocks caused by inflation.

[6] Fratzscher examines inflation targeting used as shock absorbers or shocks that are detrimental to the economy The ITF framework is moving the economy into a better direction. Under the ITF regime, inflation is easier to control and the variability of inflation is much lower. The ITF framework that focuses on price stability is also followed by a stronger fiscal policy orientation towards output stability.

[7] Barlow Looking at the relationship between the exchange rate and inflation during the policy transition period in Hungary, it is found that in the early 1990s there was a depreciation of the currency due to inflation. During the period 1995-2001 the trend shows that the effects of inflation are not immediately felt, when inflation can be reduced, the exchange rate depreciation rate can also be suppressed and reduced from time to time. Prior to this period the inflation rate appears to have a stronger direct effect on exchange rate depreciation.

[8] Research concluded by Fair (2002), imply that a positive inflation shock has a negative effect on aggregate demand even if the nominal interest rate is held constant. Not only does the Fed not have to increase the nominal interest rate more than the increase in inflation for there to be a contraction, it does not have to increase the nominal rate at all.

The purpose of this study is to analyze and see how the response of the exchange rate, interest rate and money supply is caused by the inflation shock in Indonesia before and after the ITF policy.

II. BACKGROUND ON THE ECONOMIC THEORY

The objective of the ITF, which is more focused on one target, namely inflation, will avoid the possibility of the central bank taking inconsistencies in policies because it can reduce political pressure to undertake expansionary monetary policy [9] (Pohan, 2008).There are three causes of inflation; first, inflation occurs as a result of pressure from the supply side (cosh-push inflation); second, inflation occurs as a result of the demand side (demand-pull inflation) and third, inflation occurs as a result of inflation expectations.

The relationship between inflation and exchange rates can be seen in the purchasing power parity theory, Purchasing Power Parity theory or purchasing power parity put forward by Gustav Cassel in 1920 which states that the ratio of the value of one currency to another is determined by the purchasing power of money. in their respective countries. The theoretical basis is a comparison of the exchange rate using the price level in each country. The exchange rate of a currency will change as a reaction to differences in inflation between the two countries and the purchasing power of consumers when buying domestic products will be the same as the purchasing power when importing from other countries [10].

In macro theory, inflation and interest rates have a strong relationship. Inflation refers to the rate at which prices for goods and services increase. Meanwhile, the interest rate in Indonesia refers to the interest rate regulated by Bank Indonesia, known as the BI rate or the BI interest rate. When interest rates are low, the effect that arises is that more people borrow money and there is less public interest in saving or investing. If the interest rate is high, there are fewer borrowers. The result is that more people withhold spending, they choose to save and invest because of the greater “feedback” received by the community.

According to Friedman's view, the demand for money is determined by factors such as the price level or inflation, bond interest rates and others [11]. When the price level increases, the increase will be followed by a high demand for money because people will need money to meet their needs. An explanation that describes how the price level is determined and changes with changes in the money supply is called the quantity theory of money.

III. METHODS

This research uses time series data from the years 1994Q1-2018Q4. The data used were sourced from World Bank and Bank Indonesia. This study uses the structural VAR method by sign restrictions on econometric models.

The assumption of innovation is orthonormal to ensure that the restrictions on A and B are A Σ A '= B B'. matrix A is a matrix of lower triangles and matrix B is a diagonal matrix which is illustrated as follows:

$$A = \begin{bmatrix} e_{y1} \\ e_{y2} \\ e_{y3} \\ e_{y4} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ a_{12} & 1 & 0 & 0 \\ a_{13} & a_{23} & 1 & 0 \\ a_{14} & a_{24} & a_{34} & 1 \end{bmatrix} \begin{bmatrix} u_{y1} \\ u_{y2} \\ u_{y3} \\ u_{y4} \end{bmatrix}$$

$$B = \begin{bmatrix} e_{y1} \\ e_{y2} \\ e_{y3} \\ e_{y4} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 \\ 0 & 0 & b_{33} & 0 \\ 0 & 0 & 0 & b_{44} \end{bmatrix} \begin{bmatrix} u_{y1} \\ u_{y2} \\ u_{y3} \\ u_{y4} \end{bmatrix}$$

In the model above, the order of the equations shows the level of endogeneity of the variables. The second line shows the exchange rate is affected by inflation. The third row shows that interest rates are affected by inflation shocks and exchange rate shocks. The fourth row shows that the money supply is affected by the inflation shock, also influenced by the exchange rate and interest rates. In matrix B, the equation in the first row shows that the inflation shock is influenced by inflation itself. The second line shows that the exchange rate shock is influenced by the exchange rate itself. The third line shows that the interest rate shock is influenced by the interest rate itself. The fourth line shows that the money supply shock is influenced by the money supply itself.

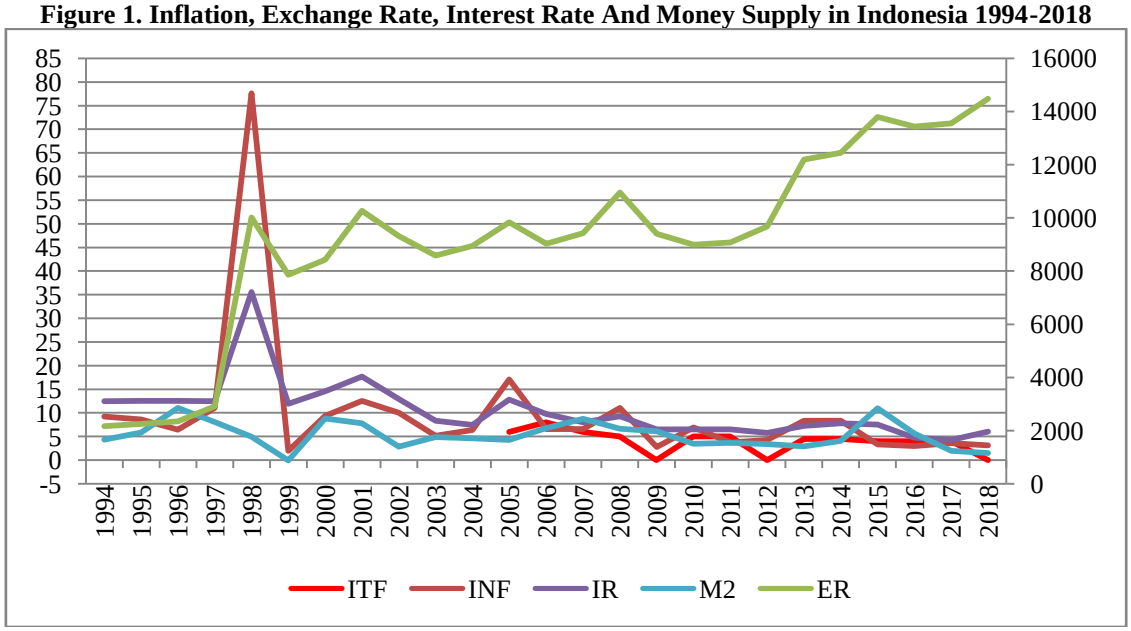
Adding restrictions does not require an order on the variables to identify shocks to the variables to which the response will be seen. The SVAR method can also be used in long-term and short-term restrictions. Short-term restriction is formulated if one variable cannot immediately respond to changes or shocks in other variables. Long-term restrictions can be made if there is a cointegration or long-term relationship between the variables used. If there is a cointegration relationship, the restriction used is to include the cointegration effect in the restriction [12].

Vector Auto regression accompanies several analyzes that are useful for answering questions related to the effect of a shock and its important role in a certain time period, namely the Impulse Response Function (IRF) and Variance Decomposition.

IV. RESULT AND DISCUSSION

One of Indonesia's macroeconomic goals is to keep inflation low and stable. Low and stable inflation is a prerequisite for sustainable economic growth that will have an impact on people's welfare. To achieve low and stable inflation, Bank Indonesia has implemented a policy known as the Inflation Targeting Framework (ITF) since 2005.

Figure 1. Inflation, Exchange Rate, Interest Rate And Money Supply in Indonesia 1994-2018



From the graph above, it can be seen that Indonesia's inflation had experienced a significant impact on the crisis that occurred in 1998. Not only inflation, the exchange rate and interest rates also experienced an increase in that year. Meanwhile, the money supply only increased by 4.9%.

After implementing the ITF, it appears that Indonesia's inflation is more stable and the inflation rate is below 10%. There was an increase in 2008 by 10.8% due to the global economic crisis, but it did not have a significant impact on the Indonesian economy. Exchange rate growth tends to increase and interest rate growth and the money supply are below 10%.

1. STATIONARY TEST

Stationarity testfor time series data is important because data instability can lead to false regression and cannot be generalized for different periods. In this study, the unit root test was carried out using the Augmented Dickey-Fuller (ADF), Dickey-Fuller and Philipps-Peron methods. The reason for using the Dickey-Fuller test and Philipps-Peron is that a slightly loose test is needed in determining whether a variable is stationary or not.

Table 2. Unit root tests

Variable	Before ITF Dickey-Fuller (T-Stat) 1st different		After ITF Philipps-Peron 1st different
	t-stat	t-stat 5%	Prob
INF	-2.591540	-1.949319	0.0002
ER	-2.876832	-1.948495	0.0334
IR	-5.677652	-1.948495	0.0000
M2	-9.836030	-1.948495	0.0001

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2. LAG OPTIMAL

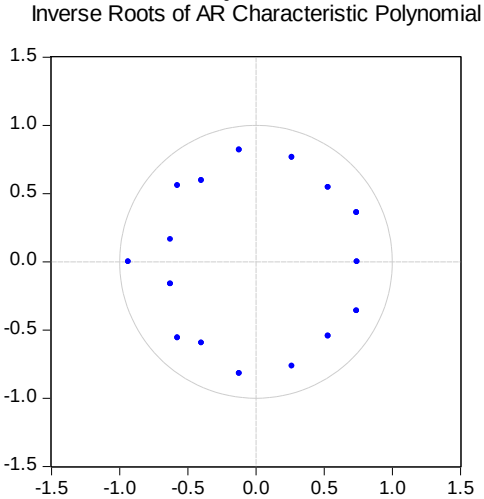
The optimum lag test is useful for determining the optimum lag amount that will be used in the study. determining the amount of lag is determined by several criteria, namely: Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criteria (AIC), Schwars Information Criterion (SIC), and Hanna Quinn Information Criterion (HQ). that the (*) sign is the most in lag 4 for data before ITF and lag 5 for data after ITF.

3. STABILITY TEST

Stability test is carried out to see the unit circuit Inverse Roots of Autoregressive Characteristic Polynomial. Stability test is performed to see the stability of the SVAR model to test the Structural Impluse Response Function and Structural Variance Decomposition analysis. If in this test the results are stable, the results of the analysis of Structural Impluse Response Function and Structural Variance Decomposition can be said to be valid.

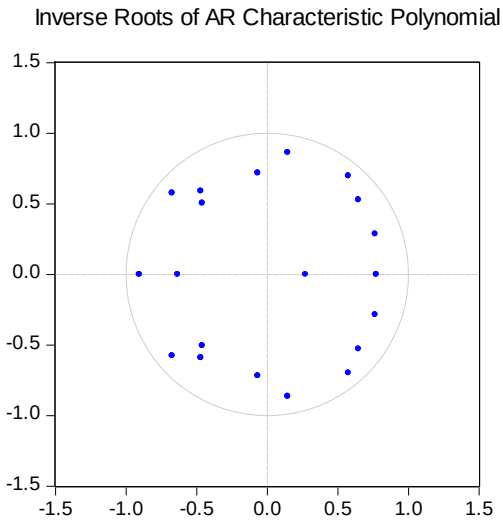
Stability test can be done using the VAR Stability Condition Check. In this result, it is said to be stable or unstable if the Inverse Root Of AR Characteristic Polynomial value is in all circles or all roots are less than one or are in unit circle.

Figure 2. SVAR Stability Test for 1994Q1: 2005Q2



Based on the picture above shows that all roots are less than one or all roots are in cirle units. So that the SVAR model used can be declared stable.

Figure 3. SVAR Stability Test for 2005Q3: 2018Q4



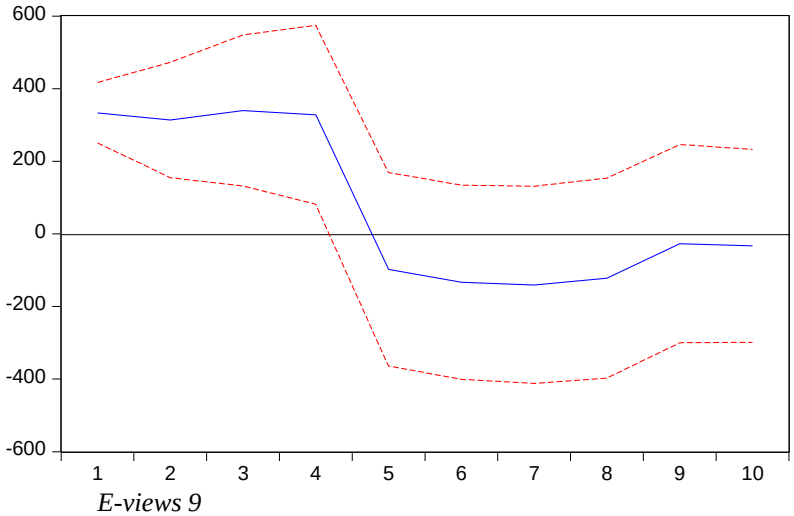
Based on the picture above, it can be said that the SVAR model is in stable condition, because all roots are inside the unit circle or in simple language all points are inside the circle.

4. IMPULSE RESPONSES FUNCTIONS

The Structural Impulse Response Function is based on IRF coefficient values that describe information and is used to see the responses that occur to endogenous variables due to shocks or shocks experienced by other endogenous variables or in other words how big the long-term and short-term impacts are caused by changes 1 standard deviation of one endogenous variable against all endogenous variables in the SVAR model. Because in fact the shock of a first variable does not only affect that one variable, but is also transmitted to all other endogenous variables through the dynamic structure or lag structure in SVAR.

4.1. Impulse Response Function Prior to the Implementation of the Inflation Targeting Framework

Figure 4



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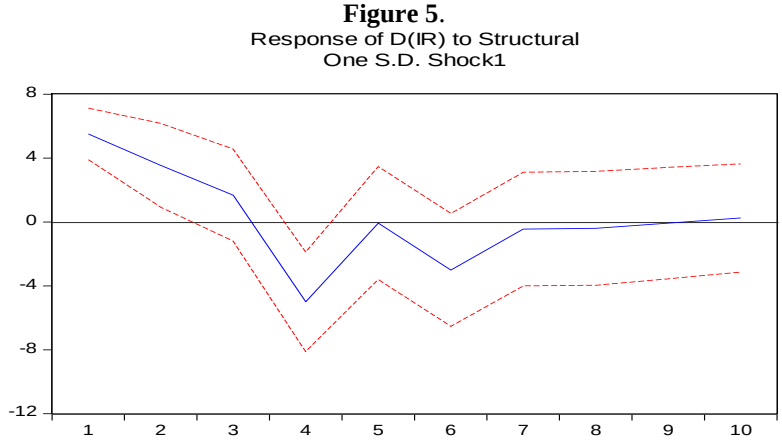
The IRF results of the exchange rate on the increase in the rate of inflation indicate that an increase in the exchange rate, in other words, has a positive impact on the exchange rate, meaning that an increase in inflation will also be followed by an increase in the exchange rate. The shock to inflation does not have a permanent impact on the exchange rate. This is in accordance with the purchasing power parity theory, the exchange rate will adjust from time to time to reflect the difference in inflation between two countries, as a result, the purchasing power of consumers to buy domestic products will be the same as their purchasing power to buy products-Overseas products. An increase in the price of goods causes the exchange rate to depreciate which will cause less goods and services to be purchased and the currency to be obtained will be reduced.

Figure 5.



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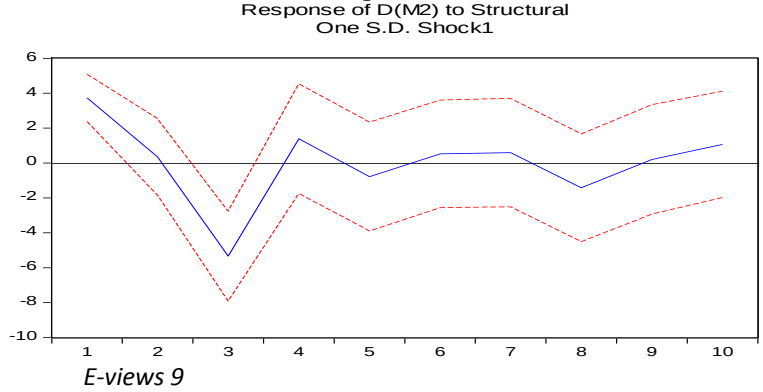
The results of the IRF interest rate on an increase in the inflation rate indicate that an increase in interest rates, in other words, has a positive impact on interest rates, meaning that an increase in inflation will also be followed by an increase in interest rates. The shock to inflation has no permanent or temporary impact on interest rates. This is in accordance with the theory which states that when inflation has increased, which indicates an increase in the general price of goods and services, the central bank will make a policy to reduce inflation. To control a high inflation rate, the central bank will raise interest rates so that inflation falls. So, the interest rate function here can be used as a tool in controlling the inflation rate.

Figure 6

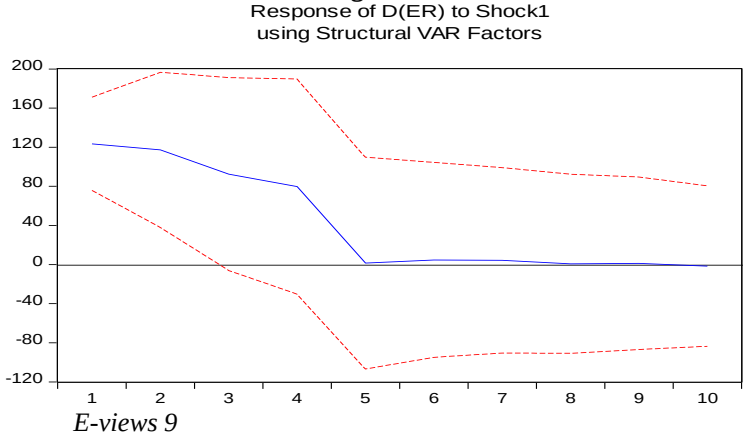


E-views 9

The results of the IRF in the money supply to the increase in the inflation rate show a positive response, meaning that an increase in inflation will be responded to by an increase in the money supply, in other words, it has a positive impact on the money supply. In the second period the response of the money supply is negative, which indicates that there is a decrease in the money supply. This can be caused by an increase in the interest rate variable. The purpose of raising interest rates is to attract an increased money supply.

4.2. Impulse Response Function After Implementation of the Inflation Targeting Framework

Figure 7



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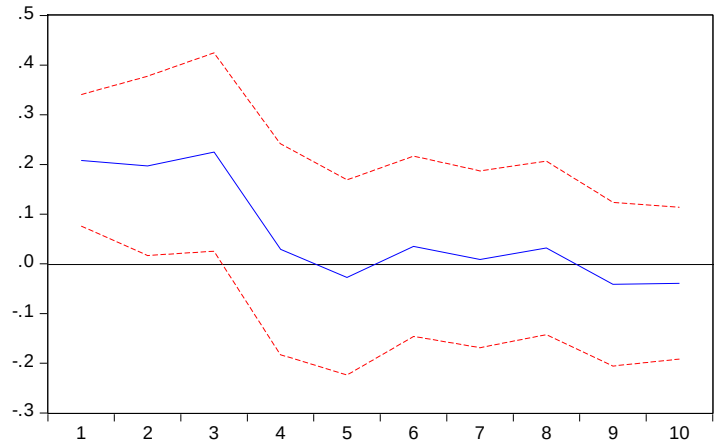
In the picture above, changes in inflation are responded positively by the exchange rate (response of D (ER) to shock 1) at the beginning of the period and tends to decline until the 5th period. Furthermore, after the fifth period the impact of changes in inflation is no longer felt by the exchange rate or has approached the equilibrium point. This indicates that an increase in inflation will cause an increase in the exchange rate at the beginning of the shock period. Nor does the inflation shock have a permanent impact on the exchange rate in the long-term.

The Inflation Targeting Framework (ITF) policy framework implemented by Bank Indonesia can be said to be successful in maintaining the stability of the inflation rate and is on the target set by Bank Indonesia as the monetary authority. Monetary policy taken by Bank Indonesia to keep inflation stable in dealing with inflation shocks will also reduce the impact of the inflation shock on the exchange rate.

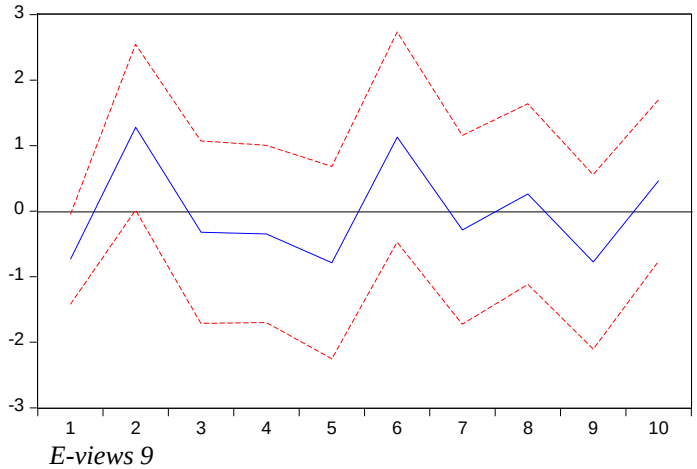
Figure 8



E-views 9

Changes in inflation are responded positively by interest rates (response of D (IR) to shock 1) in the 1st to 3rd period and after the 3rd period there is a decrease in response and go to equilibrium or near zero until the end of the period. or the 10th period. The results of this IRF indicate that changes in inflation will be responded to, followed by an increase in interest rates in the initial period. Nor does the inflation shock have a permanent impact on interest rates.

Figure 9



E-views 9

Based on the picture above, it can be concluded that the money supply is very vulnerable to shocks caused by inflation. It can also be seen that the relationship between inflation and the money supply is quite strong. According to research conducted by Grauwe and Polan (2005), inflation and the money supply have a strong relationship in countries with high inflation rates. The two variables can influence each other or there is a two-way causality in the variable [13].

V. CONCLUSION

Before the implementation of the Inflation Targeting Framework policy Shock that occur in inflation will be responded positively by the exchange rate, interest rate and money supply variables. This can be seen in the Impulse Response Function (IRF) test, which illustrates that at the beginning of the shock period caused by inflation, it is directly responded positively by the exchange rate, interest rate and money supply variables. In the Forecast Error Variance Decomposition (FEVD) test, it is also seen that the contribution of the variance of the inflation variable is also very large to the variable variants of exchange rates, interest rates and the money supply.

After the implementation of the Inflation Targeting Framework (ITF), shock that occur in inflation will be responded positively by variable exchange rates and interest rates during the period policy. Only the money supply variable at the beginning of the period responded negatively due to changes in inflation. After the implementation of the inflation targeting framework (ITF) policy, the relative inflation rate can be suppressed. So that changes in the inflation rate do not really affect the exchange rate, interest rate and money supply variables. In the Impulse Response Function (IRF) test, which illustrates that when a shock occurs in inflation, the impact of the shock will only be felt at the beginning of the period. However, from the middle of the period to the end of the period the impact of the shock has reached the equilibrium point or the exchange rate and interest rate variables are no longer felt, except for the money supply, which requires a longer period to respond to the shock that occurs in inflation. In the Forecast Error Variance Decomposition (FEVD) test, it can be seen that the variance contribution is dominated by the variable itself.

Based on the results of this study, the policies that can be recommended to the government to be able to take a policy by controlling inflation so that the inflation rate remains reduced to the targeted level because changes in inflation can affect the stability of the Indonesian economy.

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