Analysis Of Investment, Foreign Investment, Workforce, And Exchange Rate Influence For Economic Growth In North Sumatera

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Analysis of the Monetary Transmission Mechanism Channels in Indonesia and Effect in Regional Economics North Sumatera
(A Projection with Stochastis Simulation-VAR Model)

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Abstract
This paper analyses the monetary transmission mechanism in Indonesia. Transmission channels can be classified into five sections, namely interest rate channel, assets price channel, exchange rate channel, credit channel and expectation channel. It tries to answer to the question: how is the behavior and effectiveness of the exchange rate and interest rate channel of the monetary policy transmission mechanism in influencing on the performance of the regional economics north Sumatera. Time series analysis such as unit root test, VAR, impulse response function and variance decomposition, are used to estimate the influence of exchange rate and interest rate on the real economic activity. The results of econometric analysis with VAR model suggest that monetary policy in Indonesia had a significant influence on the real economic activity through the interest rate and exchange rate channel. The results represent that interest rate and exchange rate channel are effective in influencing on the performance of the Regional Economic North Sumatera. Moreover findings indicate that interest rate and exchange rate have any influence on the real economy activity

***Keywords**: monetary policy , interest rate, exchange rate,VAR model*

Introduction

Monetary policy is consistently directed towards maintaining macro-economic stability. Bank Indonesia pursued monetary policy stability in an effort to maintain inflation within its target range and control the current account deficit at a safe level. In line with the maintenance of macroeconomic and financial system stability, Bank Indonesia loosened monetary policy prudently and measured. The ability of monetary policy to influence output and prices in the short term-run is widely accepted in economic theory and well documented by a number of time series analysis of monetary policy transmission. In the long-run, monetary policy cannot affect supply, but monetary policy can affect demand, mainly through interest and exchange rates. The monetary transmission mechanism is a process in which monetary policy decisions are transmitted to real GDP and inflation (Taylor, 1995). The monetary transmission mechanism describes the ways in which monetary policy impacts aggregate demand and prices by influencing the investment and consumption decisions of firms, households, and financial intermediaries. Various channels through which monetary policy can affect inflation or prices and output are identified and their relative importance is assessed.

The investigation of transmission mechanism of monetary policy in transition economies such as of Indonesia, appears to both a crucially important and challenging task. First, it is importance since under circumstances of uncertainty in economic environment and underdevelopment of markets institutions. The successfulness of economic transformation, depends on how good policymakers are being able to predict the consequences of their actions can effect to macroeconomics stabilization. In this research it It tries to answer to the question: how is the behavior and effectiveness of the exchange rate and interest rate channel of the monetary policy transmission mechanism in influencing on the performance of the Regional economic North

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Sumatera. The main objective of this study is to examine the relative effectiveness of monetary policies in macroeconomic stabilization measured in terms of national income and inflation, in Indonnesia. More specifically, the study seeks to establish the channels of monetary policy transmission in Indonesia and how is the behavior and effectiveness of the exchange rate and interest rate channel of the monetary policy transmission mechanism in influencing on the performance of the Regional Economics North Sumatera.

In the literature, theoretical discussion on monetary transmission, A number of international studies have analysed the effectiveness of monetary policy by testing the different channels of monetary transmission. In Gumata, Kabundi and Ndou (2013) stated in his paper that Boivin, Kiley, and Mishkin (2010) identify two basic types of monetary transmission mechanism: neoclassical channels in which financial markets are perfect and non-neoclassical channels that involve financial market imperfections, which ara usually referred to as the credit view. The neoclassical channels of monetary policy, also known as the traditional channels, are based on the permanent income models of consumption developed by Brumberg and Modigliani (1954), Ando and Modigliani (1963), and Friedman (1957), the ISLM models of Mundell (1963) and Fleming (1962) and the neoclassical models of investment proposed by Jorgenson (1963) and Tobin (1969). The main channel of transmission is the interest rate channel which is described under the Keynesian IS-LM model. Under the interest rate channel, changes in monetary policy are eventually reflected in the real long-term interest rates which influence aggregate demand by altering business investment and durable consumption decisions.

Many researchers, for example Smets and Wouters (2002) found that monetary policy shock via the interest rate channel affected real output, consumption and investment demand. Angeloni et al (2003) also found the interest rate channel to be the completely dominant channel of transmission in a few euro area countries, while being an important channel in almost all of them. Taylor (1995), Boivin, Kiley, and Mishkin (2010), conclude that the interest rate channel remains the most important channel for the transmission of monetary policy.

Besides the interest rate, The exchange rate channel operates through international trade. An expansionary monetary policy which decreases the short-term interest rate makes domestic goods cheaper relative to foreign goods. Obstfeld and Rogoff (1995) emphasised the importance of exchange rate channel of monetary policy transmission. The rise in net exports translates directly into an increase in aggregate demand. Taylor (1993) coclude that changes in the instruments of monetary and fiscal policy have powerful effects on real economic activity and Smets (1995) show evidence of the importance of this channel in small and open economies with flexible exchange-rate regimes. Furthermore, the exchange rate channel depends on the sensitivity of the exchange rate to changes in the interest rate, but Meltzer [1995] argued for monetarist emphasis on monetary policy transmission through multiple asset prices extending beyond interest rates, exchange rate and equity prices. The second type of transmission channel identified by Boivin, Kiley, and Mishkin (2010) is the non-neoclassical channel proposed by Bernanke and Gertler (1995), whichis commonly referred to as the credit channel.

Mmonetary transmission channels can be broadly divided into two lines of thought such as (i) money view, and (ii) credit view. Money view can be traced back to Keynesian IS-LM analysis. IS-LM model is widely used in gauging monetary and fiscal policy effectiveness. This model was invented by Hicks in 1937. The money view places emphasis on the changes in the monetary aggregate affecting the output via interest rate channel. This view has been a standard feature in the traditional Keynesian model. The mechanism can be traced by using the following schematic diagram (Mishkin, 1995):

$$M\downarrow \Rightarrow r\uparrow \Rightarrow I\downarrow \Rightarrow Y\downarrow$$

This diagram states that a contractionary monetary policy (M) leads to a rise in real interest rate (r), which raises the cost of capital, thereby causing a decline in investment goods (I). Further, this leads to a decline in aggregate demand and hence, a fall in output (Y). Generally, this argument can be presented in a simple IS-LM framework. The framework to determine the rate of intererst, focuses on the equilibrium between money demand and money supply.

Money Demand :

$$M^d = L(y,r); \frac{\partial L}{\partial y} = L_y > 0; \frac{\partial L}{\partial r} = L_r < 0 \quad (1)$$

The demand for real money balances (M/P) depends on the level of real income and interest rate. Thus $M^d = L(y,r)$. Demand for real money balances increases with the rise in level of income and decreases with rise in rate of interest. Let us assume that money demand function is linear. Then:

$$L(y,r) = kY - hr; k,h > 0 \quad (2)$$

Parameter k represents how much demand for real money balances increases when level of income rises. Parameter h represents Low much demand for real money balances decreases when rate of interest rises.

Money Supply

$$M^s = M / P \quad (3)$$

Money supply (M) is set by the central bank of a country and we assume it to remain constant for a period. Besides, we assume the price level (P) to remain constant.

Equlibrium as LM Curve

$$M^d = M^s = L(y,r) = M / P \quad (4)$$

The equilibrium in the money market is established where demand for real money balances equals supply of real money balances and is given by :

$$M / P = kY - hr \quad (5)$$

where y is real income, and r is the domestic rate of interest. Solving the equation (5) for interest rate we have the LM curve that :

$$r = \frac{1}{h}\left(kY - \frac{M}{P}\right) \quad (6)$$

This equation gives us the interest rate that equilibrates the money market for any values of income and real money balances.

For the IS Curve, derived from goods market equilibrium. The IS curve shows the combinations of levels of income and interest at which goods market is in equilibrium, that is, at which aggregate demand equals income. Aggregate demand consists of consumption demand, investment demand, government expenditure on goods and services and net exports. If equation for aggregate demand (AD) are :

$$AD = C + I + G + NX \quad (7)$$

Where :

Consumption function : $C = a + bY$

Investment function : $I = \bar{I} - dr$; $\bar{I}$ is autonomoues investment

G is goverment expenditure on goods and services and NX is net exports. Product market is equlibrium when :

$$Y = AD = C(Y) + I(r) + G + NX \quad (8)$$

Solving the equation (8) for product market is in equliblirum we have the IS curve that :

$$Y = \frac{1}{1-b}\left(a + \bar{I} + G + NX\right) - \frac{dr}{1-b} \quad (9)$$

The above equaton (9) describes IS curve aand terms in the brackets are all autonomous expenditur and are independent of both income and rate of interest. If we denote all thes auttonomues items by $\bar{A}$, then equation (9) for IS can be writtens as :

$$Y = \frac{1}{1-b}\left(\bar{A} - dr\right) \quad (10)$$

$\frac{1}{1-b}$ is the income multiplier and b is marginal propensity to consume.

The intersection of IS and LM curves determines joint equilibrium of income and interest rate. Mathematically, we can obtain the equilibrium values by using the equations of IS and LM curves derived above. Thus,

Equation for LM Curve : $r = \frac{1}{h}\left(kY - \frac{M}{P}\right)$

Equation for IS Curve : $Y = \frac{1}{1-b}\left(\bar{A} - dr\right)$

Joint determination of equilibrium values of income and interest rate requires that both the IS and LM equations hold good. In this way both the goods market and money market equilibrium will be achieved at the same interest and income levels in the two markets. To find such equilibrium values we substitute the interest rate from the LM equation (6) into the IS equation (10). Doing so we have :

$$Y = \frac{1}{1-b}\left(\bar{A} - \frac{d}{h}\left(kY - \frac{M}{P}\right)\right)$$
$$Y = \frac{1}{1-b}\left(\bar{A} - \frac{d}{h}(kY) + \frac{d}{h}\left(\frac{M}{P}\right)\right) \qquad (11)$$

The equation (11) shows that the equilibrium level of income depends on exogenously given autonomous variables $(\bar{A})$ such as autonomous consumption, autonomous investment, government expenditure on goods and services, and the real money supply (M/P) and further on the size of multiplier $\frac{1}{1-b}$. It will be noticed from equation (11) that higher the autonomous expenditure, the higher the level of equilibrium income. Further, the greater the real money supply, the higher the level of national income. Based on equation (11) it is clear that the interest rate channel or the cost of capital channel operates through the following schematic diagram:

$$M \downarrow \Rightarrow r \uparrow \Rightarrow I \downarrow \Rightarrow Y \downarrow$$

it means that $\Delta M \Rightarrow \Delta r$; $\Delta r \Rightarrow \Delta I$; $\Delta I \Rightarrow \Delta y$ with $\Delta y \Rightarrow \Delta M^d$ acting as a feedback effect.

In The Credit View, mechanism by which monetary policy is transmitted to the real economy remains a central topic in macroeconomics. The bank lending channel represents the credit view of this mechanism. Therefore in addition to the money supply, bank credit is also important in affecting the aggregate spending level. According to this view, monetary policy works by affecting bank assets (loans) as well as banks' liabilities (deposits). The key point is that monetary policy besides shifting the supply of deposits also shifts the supply of bank loans.

Bernanke and Gertler (1995) describe two possible linkages of the credit channel theory. The first one is the balance-sheet channel which places emphasis on the impact of changes in monetary policy on the borrower's balance-sheet. The second linkage is the bank lending channel which focuses on the possible effect of monetary policy actions on the supply of loans by the banking system (Walsh and Wilcox, 1995; Bernanke, 1993). The schematic presentation of the resulting monetary policy effects is given by the following:

$$M \downarrow \Rightarrow \text{bank deposit} \downarrow \Rightarrow \text{bank loans} \downarrow \Rightarrow I \downarrow \Rightarrow Y \downarrow$$

Thus, contractionary monetary policy leads to a fall in bank reserves and bank deposits, subsequently this results in a decline in bank loans in turn leading to a decline in investment spending and a fall in output.

$$M \uparrow \Rightarrow \text{bank deposit} \uparrow \Rightarrow \text{bank loans} \uparrow \Rightarrow I \uparrow \Rightarrow Y \uparrow$$

in this schematic M indicates an expansionary monetary policy leading to an increase in bank deposits and bank loans, thereby raising the level of aggregate investment spending,I, and aggregate demand and output, Y.

Based on the background and theoretical framework and conceptual framework of thinking, the hypothesis that can be expressed are :

The process of the monetary policy transmission mechanism influencing the economic performance of North Sumatra Province and had a significant influence on the real economic activity reginonal economics north sumatera through the interest rate and exchange rate channel. So Interest rate and exchange rate channel are effective in influencing on the performance of the Regional economics North Sumatera.

Methods

This paper used the econometric method of unrestricted vector autoregression (unrestricted VAR) to analyze the transmission mechanism of the monetary policy . Basic VAR model that we use to analyze the impacts of the monetary policy shock of the Indonesian as specially North Sumatera economy is as follows:

$$Y_t = A[L]Y_{t-1} + B(L)X_t + \varepsilon_t \tag{12}$$

Where Y_t Y is a vector of endogenous variables and X_t is a vector of exogenous variables, and ε_t is an error vector for a normal distribution. Given these considerations, we select the ordering [EXCR, PINA, SBIR, PDBR, PDRB,PISU,MONO, LIBR] and investigate Indonesian's monetary transmission mechanism by using the following VAR system:

$$EXCR_t = \sum_{j=1}^{p} a_{11j} PINA_{t-j} + \sum_{j=1}^{p} a_{12j} SBIR_{t-j} + \sum_{j=1}^{p} a_{13j} PDBR_{t-j} + \sum_{j=1}^{p} a_{14j} PDRB_{t-j} + \sum_{j=1}^{p} a_{15j} PISU_{t-j} + \sum_{j=1}^{p} a_{16} MONO + \sum_{j=1}^{p} a_{147} LIBR_{t-j} + \sum_{j=1}^{p} a_{15j} EXCR_{t-j} + \varepsilon_{tj} \tag{13}$$

$$PINA_t = \sum_{j=1}^{p} a_{11j} PINA_{t-j} + \sum_{j=1}^{p} a_{12j} SBIR_{t-j} + \sum_{j=1}^{p} a_{13j} PDBR_{t-j} + \sum_{j=1}^{p} a_{14j} PDRB_{t-j} + \sum_{j=1}^{p} a_{15j} PISU_{t-j} + \sum_{j=1}^{p} a_{16} MONO + \sum_{j=1}^{p} a_{147} LIBR_{t-j} + \sum_{j=1}^{p} a_{15j} EXCR_{t-j} + \varepsilon_{tj} \tag{14}$$

$$SBIR_t = \sum_{j=1}^{p} a_{11j} PINA_{t-j} + \sum_{j=1}^{p} a_{12j} SBIR_{t-j} + \sum_{j=1}^{p} a_{13j} PDBR_{t-j} + \sum_{j=1}^{p} a_{14j} PDRB_{t-j} + \sum_{j=1}^{p} a_{15j} PISU_{t-j} + \sum_{j=1}^{p} a_{16} MONO + \sum_{j=1}^{p} a_{147} LIBR_{t-j} + \sum_{j=1}^{p} a_{15j} EXCR_{t-j} + \varepsilon_{tj} \tag{15}$$

$$PDBR_t = \sum_{j=1}^{p} a_{11j} PINA_{t-j} + \sum_{j=1}^{p} a_{12j} SBIR_{t-j} + \sum_{j=1}^{p} a_{13j} PDBR_{t-j} + \sum_{j=1}^{p} a_{14j} PDRB_{t-j} + \sum_{j=1}^{p} a_{15j} PISU_{t-j} + \sum_{j=1}^{p} a_{16} MONO + \sum_{j=1}^{p} a_{147} LIBR_{t-j} + \sum_{j=1}^{p} a_{15j} EXCR_{t-j} + \varepsilon_{tj} \tag{16}$$

$$PDRB_t = \sum_{j=1}^{p} a_{11j} PINA_{t-j} + \sum_{j=1}^{p} a_{12j} SBIR_{t-j} + \sum_{j=1}^{p} a_{13j} PDBR_{t-j} + \sum_{j=1}^{p} a_{14j} PDRB_{t-j} + \sum_{j=1}^{p} a_{15j} PISU_{t-j} + \sum_{j=1}^{p} a_{16} MONO + \sum_{j=1}^{p} a_{147} LIBR_{t-j} + \sum_{j=1}^{p} a_{15j} EXCR_{t-j} + \varepsilon_{tj} \tag{17}$$

$$PISU_t = \sum_{j=1}^{p} a_{11j} PINA_{t-j} + \sum_{j=1}^{p} a_{12j} SBIR_{t-j} + \sum_{j=1}^{p} a_{13j} PDBR_{t-j} + \sum_{j=1}^{p} a_{14j} PDRB_{t-j} + \sum_{j=1}^{p} a_{15j} PISU_{t-j} + \sum_{j=1}^{p} a_{16} MONO + \sum_{j=1}^{p} a_{147} LIBR_{t-j} + \sum_{j=1}^{p} a_{15j} EXCR_{t-j} + \varepsilon_{tj} \tag{18}$$

$$MONO_t = \sum_{j=1}^{p} a_{11j} PINA_{t-j} + \sum_{j=1}^{p} a_{12j} SBIR_{t-j} + \sum_{j=1}^{p} a_{13j} PDBR_{t-j} + \sum_{j=1}^{p} a_{14j} PDRB_{t-j} + \sum_{j=1}^{p} a_{15j} PISU_{t-j} + \sum_{j=1}^{p} a_{16} MONO + \sum_{j=1}^{p} a_{147} LIBR_{t-j} + \sum_{j=1}^{p} a_{15j} EXCR_{t-j} + \varepsilon_{tj} \tag{19}$$

$$LIBR_t = \sum_{j=1}^{p} a_{11j} PINA_{t-j} + \sum_{j=1}^{p} a_{12j} SBIR_{t-j} + \sum_{j=1}^{p} a_{13j} PDBR_{t-j} + \sum_{j=1}^{p} a_{14j} PDRB_{t-j} + \sum_{j=1}^{p} a_{15j} PISU_{t-j} + \sum_{j=1}^{p} a_{16} MONO + \sum_{j=1}^{p} a_{147} LIBR_{t-j} + \sum_{j=1}^{p} a_{15j} EXCR_{t-j} + \varepsilon_{tj} \tag{20}$$

The material to be used in this research for this analysis is the annual series of the selected relevant macroeconomic variables from 2000S1 to 2017S2. The data for SBI interest rate (SBIR), exchange rate (EXCR) and monetary policy rate will be used as monetary policy variables. Data for National Consumer Price Index (PINA), Indonesian Real Gross Domestic Product (PDBR), Regional Real GDP North Sumatera (GRDP) and, Regional Consumer Price Index (PISU), Rupiah Currency Circulation (MONO) and interest rate (LIBOR (LIBR) will be used in this research. The data used is obtained from Indonesian banks, BPS and other data that support this research . At the outset, we examine if it is reasonable to interpret the exchange rate (EXCR) and SBI interest rate (SBIR) as an innovations in the estimated VAR model as monetary policy shocks.

Results and Discussion

Firstly, unit root test have been done in order to determine whether the series are stationary used in the study, after that stationary analysis of all series was performed using Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root test methods logarithmic transformations were performed used for this research.

Table 1 ADF and PP Unit root test result with 2nd difference

Variable	ADF test-(t-statistics)			PP test-(t-statistics)			Status
	i	i,t	N	i	i,t	N	
EXCR	-6.4623	-6.4596	-6.5704	-16.3762	-17.8193	-16.6532	Stasionary
PINA	-5.5445	-6.0800	-5.5723	-10.178	-18.313	-9.5501	Stasionary
SBIR	-7.3585	-7.3731	-7.4645	-7.3560	-7.5005	-7.4564	Stasionary
PDBR	-5.0933	-5.0722	-5.1865	-23.457	-25.1088	-24.251	Stasionary
PDRB	-6.5376	-7.1811	-6.3696	-14.3435	-13.0496	-13.1339	Stasionary
PISU	-6.0936	-6.0613	-6.0873	-19.4736	-20.3228	-15.429	Stasionary
MONO	-3.4606	-3.4265	-5.6521	-36.8368	-37.059	-35.561	Stasionary
LIBR	-9.2955	-5.0087	-9.4441	-18.4449	-17.3024	-18.724	Stasionary

Resource: Data Processed, 2019
Note: i, t, n : stationary test with used intersep, tren, or none (without intersep and tren)

Second, In this paper, we used were determined based on informational criteria - *the Akaike information criterion (AIC), Hannan-Quinn (HQ), and Schwarz information criterion (SC)*, taking into consideration that if the number of lags is too small then the model does not capture all the information while if there are too many lags then the degree of freedom are wasted.

Table 2 VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: DLOG(EXCR,2) DLOG(PINA,2) DLOG(SBIR,2) DLOG(PDBR,2) DLOG(PDRB,2) DLOG(PISU,2) DLOG(MON0,2) DLOG(LIBR,2)
Exogenous variables: C

Lag	LogL	LR	FPE	AIC	SC	HQ
0	506.2459	NA	4.13e-24	-31.14037	-30.77394	-31.01891
1	621.8938	166.2439	1.85e-25	-34.36836	-31.07046*	-33.27520
2	715.7730	88.01176*	6.68e-26*	-36.23582*	-30.00644	-34.17095*

Resource: Data Processed, 2019
** indicates lag order selected by the criterion*

Information:
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

As shown in table 2, the standard information criteria of Hannan-Quinn (HQ) shows an optimal lag length of 2. However, the lag length identified by the information criteria is found to be adequate to capture the underlying dynamics of the system. Therefore, a common VAR(2) could be used in this analysis the Akaike information criterion (AIC) shows an optimal lag length of 2 too.. The model with lag length of three has not root lies outside the unit circle. So the VAR(3) satisfies the stability condition. This is showed on the Figure 1.

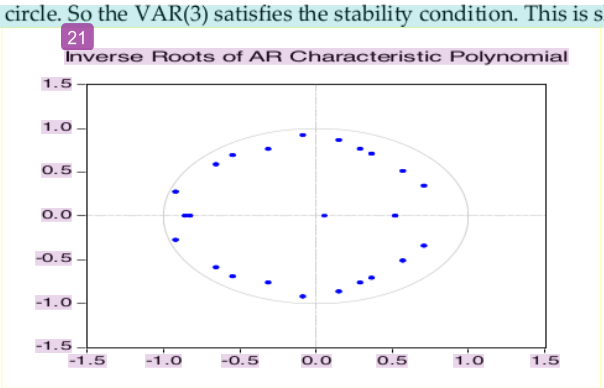

Figure 1 AR roots graph with 03 lag length

The process of the monetary policy transmission mechanism influencing the economic performance of North Sumatra Province, researchers used the first VAR analysis tool, the impulse response function (IRF). A monetary transmission line is considered effective in influencing the Indonesian Real Gross Domestic Product (PDBR) and the National Consumer Price Index (PINA) and if the pathway significantly influences the analysis IRF. The impulse response function (IRF) is often obtained by the difference of the h-steps-ahead forecast of the series with a current shock of a unit size from the same forecast without a shock. The shock response function presents the results on the effects of monetary policy shock on the economic variables of exchange rate (EXCR) and interest rate of SBI (SBIR) for the monetary authority. The confidence interval is 95%, the shock is a standard deviation, and the time on the horizontal axis is expressed in semi annual..

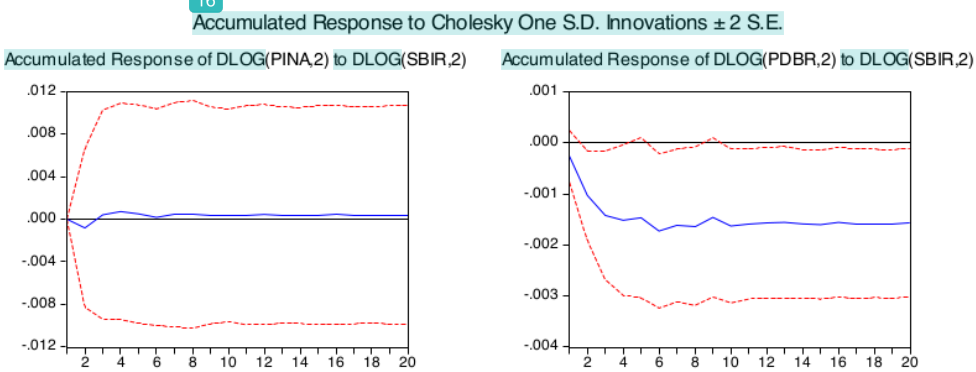

Figure 2 Impulse Response Functions PDBR and PINA to SBIR

The figure 2 shows the impulse-response function for considered recursive VAR in the cumulative results of the IRF Indonesia Real Gross Domestic Product (PDBR), National Consumer Price Index (PINA) against unanticipated shocks for each monetary transmission line [exchange rate (EXCR) figure 2 and SBI interest rate (SBIR) figure 3

Figures 3 plot the impulse response functions of the macroeconomic variables included in the VAR model for an innovation to the SBI Interest rate (SBIR). The SBI interest rate (SBIR) channel has a statistically significant effect on PDBR, this is indicated by the two red line ranges as the confidence interval on one side (all positive or all negative), so the most effective is the SBI interest rate (SBIR) starting from period 10 to period 20. The results of this study show that the transmission mechanism of interest rates can be explained as follows: First, the transmission in the monetary sector starts from the change in the SBI interest rate (SBIR) responded by changes in the interbank rates, time deposit rates and lending rates. Second, the transmission from the financial sector to the real sector depends on the influence of interest rates (deposit rates, lending rates) on consumption and investment. It affects the aggregate demand and the aggregate supply (output gap). Then, the output gap pressure will affect the inflation rate. These results are in line with Warjiyo's (2004) study which suggests that the monetary policy transmission mechanism through the interest rate channel emphasizes that monetary policy can affect aggregate demand through interest rate changes.

The previous research in Indonesia has been conducted by Nuryati (2004), using the Impulse Response Function and Forecasting Error Variance Decomposition analysis of the VAR approach, the results show that monetary policy only affects short-term economic policies, and little effect on prices in the long run. The study conducted by Kusmiarso, et. al (2001) states that the monetary mechanism in Indonesia to manage inflation mainly through interest rates but still has not found a dominant channel that affects economic growth. For the other country, Aktas et al (2009) examine the traditional transmission mechanism in Turkey. According to the finding, a change in Central Bank's interest rate decision is effective in financial markets.

Figures 3 plot the impulse response functions of the macroeconomic variables included in the VAR model for an innovation to the exchange rate shock. Exchange rate stability becomes an important aspect in maintaining sustainability in the economy, in particular, when looking at its relationship with the other variables. We use the rate of the US dollar against the rupiah (USD/Rp) as a measure for the nominal effective exchange rate. The long-term relationships indicate that exchange rates cointegrated against the Indonesian Real Gross Domestic Product (PDBR) and the National Consumer Price Index (PINA). Cointegration of exchange rate based on mechanism of foreign exchange market in response to demand for foreign exchange is not only at the time of the entry of foreign direct investment, but also at the time of the reversal of risk to the stability of the exchange rate.

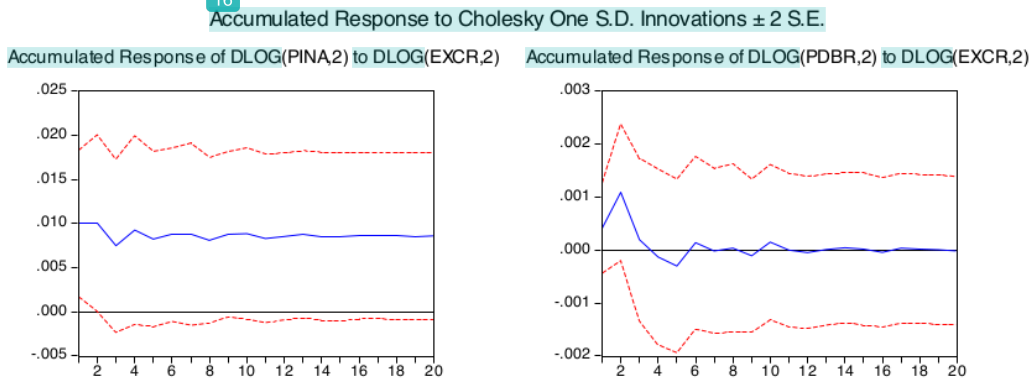

Figure 3 Impulse Response Functions PDBR and PINA to EXCR

In figure 3 show that exchange rate shock (EXCR) has an impact on the increase of output, Indonesian Real Gross Domestic Product (PDBR). When there is an impact, then the increase in the domestic currency causes a decline in exports so that domestic output is down and the output gap increases. The exchange rate shock has a negative impact (decrease) from the beginning and steady on the price and interest rate. The increase in unexpected exchange rate encourages the price level and the interest rate falls. The exchange rate shock increases the value of the exchange rate itself. The increase in unexpected exchange rate encourages the rise in the further exchange rate.

VAR Results for Forecast Error Variance Decomposition

Forecast Error Variance Decomposition (FEVD) or Variance decomposition (VD) is part of the VAR analysis that functions to support the results of previous analyzes. The FEVD provides an estimate of how much a variable contributes to changes in the variable itself and other variables in the next several periods, the value of which is measured as a percentage, shown in table 3.

Based on table 3, it can be observed that all variables of the Regional Real GDP of North Sumatra Province (GDP), Indonesian Real Gross Domestic Product (PDBR), Regional Consumer Price Index (PISU), National Consumer Price Index (PINA), SBI interest rates (SBIR) , Rupiah Currency Circulation (MONO) and LIBOR (LIBR) interest rate in period 1 (short term) against unanticipated shocks from the monetary transmission line of the rupiah exchange rate (EXCR) are fully determined by the behavior of the exchange rate itself, while for the medium term (Period 5), The Regional Consumer Price Index (PISU) has contributed 9.87% and the National Consumer Price Index (PINA) of 9.68%. Likewise for the long term period (period 20) is influenced by these two variables, but the more effective is the National Consumer Price Index (PINA) variable which is 12.66% higher than the Regional Consumer Price Index (PISU) which only contributes 10.89% .

Table 3 Interaction of Monetary Policy on Macro Economic Variables

Variable	Period		EXCR	PINA	SIBR	PDBR	PDRB	PISU	MONO	LIBR
EXCR	Short run	1	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
	Middle	5	60,10%	9,68%	3,04%	0,45%	4,76%	9,87%	7,41%	4,69%
	Long run	20	53,24%	12,66%	2,86%	0,95%	7,82%	10,89%	7,27%	4,31%
PINA	Short run	1	58,52%	41,48%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
	Middle	5	60,10%	9,68%	3,04%	0,45%	4,76%	9,87%	7,41%	4,69%
	Long run	20	53,24%	12,66%	2,86%	0,95%	7,82%	10,89%	7,27%	4,31%
SIBR	Short run	1	17,83%	0,59%	81,57%	0,00%	0,00%	0,00%	0,00%	0,00%
	Middle	5	30,00%	11,54%	32,97%	4,77%	1,54%	6,58%	3,58%	9,00%
	Long run	20	26,15%	15,42%	28,53%	4,65%	6,89%	6,88%	3,43%	8,04%
PDBR	Short run	1	12,46%	15,47%	2,40%	69,67%	0,00%	0,00%	0,00%	0,00%
	Middle	5	14,55%	15,72%	3,59%	17,50%	21,40%	10,45%	6,15%	10,65%
	Long run	20	14,59%	14,90%	3,46%	16,92%	22,03%	10,40%	6,53%	11,17%
PDRB	Short run	1	0,37%	23,12%	0,55%	13,26%	62,71%	0,00%	0,00%	0,00%
	Middle	5	5,97%	29,49%	0,56%	11,32%	41,61%	7,75%	0,29%	3,01%
	Long run	20	6,20%	29,23%	0,69%	11,13%	40,37%	8,64%	0,51%	3,24%
PISU	Short run	1	7,04%	8,45%	11,41%	7,70%	34,52%	30,88%	0,00%	0,00%
	Middle	5	25,46%	9,03%	4,70%	4,87%	27,30%	19,99%	5,54%	3,12%
	Long run	20	22,41%	9,70%	4,15%	5,46%	28,44%	20,10%	6,30%	3,45%
MONO	Short run	1	21,28%	0,07%	0,86%	10,19%	7,95%	4,56%	55,10%	0,00%
	Middle	5	24,74%	7,49%	8,00%	13,84%	7,49%	15,01%	23,39%	0,04%
	Long run	20	18,96%	10,38%	6,26%	11,70%	16,54%	16,71%	18,27%	1,18%
LIBR	Short run	1	22,04%	3,23%	7,06%	0,08%	2,22%	8,64%	18,27%	38,46%
	Middle	5	22,20%	5,24%	6,57%	3,13%	5,42%	14,58%	18,05%	24,81%
	Long run	20	21,02%	6,57%	6,05%	3,17%	8,23%	14,38%	17,60%	22,97%
Note										
	Biggest 1									
	Biggest 2									

Conclusion

The results of econometric analysis with VAR model suggest that monetary policy in Indonesia had a significant influence on the real economic activity through the interest rate and exchange rate channel. The results represent that interest rate and exchange rate channel are effective in influencing on the performance of the Indonesian economy. Moreover findings indicate that interesr rate and exchange rate have any influence on the real economy activity.

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