The Determinants of Inflation in North Sumatra Error Correction Model

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Keyword: Inflation, Government Spending, Money Supply, Exchange Rate, Economic Growth, Error Correction Model (ECM)

Abstract: The stability of inflation is a requirement for economic growth and benefit the improvement of community welfare. This research aims to analyze the effect of government spending, the money supply, exchange rates and economic growth against inflation in North Sumatra. The analysis uses equations by the method of Error Correction Model (ECM). This study analyzed the relationship between the dependent and independent variables in both the short term and long term. Estimation results show that in the long term and the short term, the variable amount of the money supply and economic growth was a negative and significant effect against inflation in North Sumatra. While the variables do not affect government spending significantly to inflation in North Sumatra. ECM model is considered valid because the value of the Error Correction Term (ECT) is significant and in the long term and the short term only the variable exchange rate that has a significant influence against inflation in North Sumatra. These results show that the exchange rate played an important role in controlling the level of inflation in North Sumatra.

1 INTRODUCTION

A variety of macroeconomic indicators, inflation is one of the important indicators for the economy of a country. Inflation gives considerable influence towards the achievement of some goals of macroeconomic policy, such as economic growth, employment, income distribution and the balance of payments (Aulia Pohan, 2008).

North Sumatra also have experienced high inflation that is at the moment the Government of the old order and the last in 1998. Inflation occurs when the old order caused by uncontrolled money printing. In 1997-1998 have made the economy of the North Sumatra is at an unstable state. Its impact is the increase in the inflation amounted to 83.56 percent higher than the national figure of 77.63 percent. The condition of the rising inflation due to rising prices of imported commodities and rising foreign debt due to the weakening of the exchange rate of the rupiah against the U.S. dollar and other foreign currencies.

For it required an effort in keeping inflation at a low and stable level. Based on Act No. 23 of the year 1999, Bank Indonesia focuses its policy on achieving the stability of rupiah value by placing inflation as a cornerstone in monetary policy. Since July 2005 the Bank Indonesia has implemented monetary policy framework and consistent with the Inflation Targeting Framework (ITF), which includes four fundamental elements, namely the use of the interest rate target as operational Bank Indonesia (BI), the process of the formulation of monetary policy, the communication strategy of the anticipatory more transparent and strengthening coordination with government policy. These steps are intended to enhance the effectiveness of monetary policy and governance in achieving the target of the end of price stability to support sustained economic growth and social welfare (Endri, 2008).

Based on the data of inflation in North Sumatra during the 1997-2017 inflation rate trend shows up and down from year to year. The highest inflation in 1998 reached 83.56 percent and the lowest the year 1999 reached 1.37 percent. Inflation in 2000 increased by 5.73 percent compared to the previous period. This increase is due to rising freight rates on 1 September 2000, the increase in fuel oil as of October 2000. With the increase in fuel oil in 2002, 2005, 2008, and the year 2013 be a contributor to inflation are quite high in that year (Bank Indonesia, 2014).

Inflation in 2015 also belongs to a low of 3.14 percent. As one of the factors suppressing inflation rate years 2015, this is the weakening of purchasing

power due to the decline in jobs, as the unemployment rate in February 2015 rise 428,794 people when compared with February 2014, bringing the total reached 7.45 million people. Inflation in 2016 exceeded the targets set by Bank Indonesia at the beginning of the year that is 6.34 percent and also speeding the Government's inflation target of 5.3 percent. While the year 2017 the inflation rate decreased by 3.20 percent.
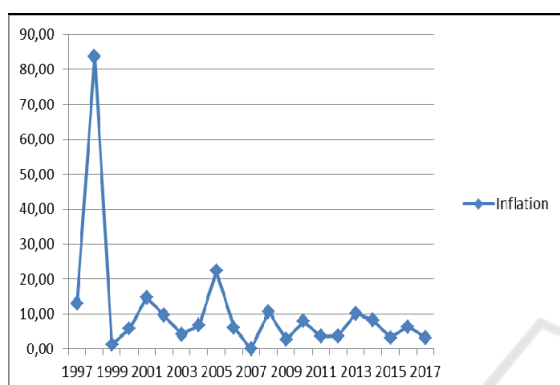

Figure 1: The Trend of inflation in North Sumatra Years 1997-2017

Based on the classical view that the main factors affecting inflation is the money supply and credit. View of keynes then add some variables such as interest rates, government spending and investment (Ackley,1983:543).

Table 1: The Development of the inflation (INF), government spending (GS), the money supply (MS), exchange rate (EXC) and economic growth (GDP) in North Sumatra.

Years	INF (%)	GS (billion rupiah)	MS (billion rupiah)	EXC (Rp/ US$)	GDP (%)
1997	13.10	771	355.643	4.650	5.70
1998	83.56	342	577.381	8.025	-10.90
1999	1.37	449	646.205	7.100	2.59
2000	5.73	416	747.027	9.595	4.83
2001	14.79	916	844.054	10.400	3.72
2002	9.59	1.021	883.903	8.940	4.07
2003	4.23	1.352	955.692	8.465	4.48
2004	6.80	1.501	1.033.877	9.290	5.74
2005	22.41	1.830	1.202.762	9.830	5.48
2006	6.11	2.184	1.382.493	9.020	6.20
2007	6.60	2.560	1.649.662	9.419	6.90
2008	10.72	2.967	1.895.839	10.950	6.39
2009	2.61	3.444	2.141.384	9.400	5.07
2010	8.00	3.666	2.471.206	8.991	6.42
2011	3.67	4.611	2.877.220	9.068	6.66
2012	3.68	7.633	3.307.508	9.670	6.45
2013	10.18	7.260	3.730.409	12.189	6.07
2014	8.17	7.808	4.173.327	12.440	5.23
2015	3.24	7.959	4.548.800	13.795	5.20
2016	6.34	9.476	5.003.300	13.307	5.18
2017	3.20	13.034	5.126.200	13.548	5.12

Source: Central Bureau of Statistics (BPS), Bank Indonesia

Based on the data in table 1 that in 2005 the inflation rate up from 6.80 percent to 22.41 percent, the inflation rate is rising. Bank Indonesia attempted to embody a high economic growth target but still maintaining a relatively low inflation rate and stable, but in the same year, the economic growth experienced a decline from 5.74 percent to 5.48 percent. It is known that in the year 2009 the money supply increased from 1,895,839 billion rupiahs into 2,141,384 billion rupiahs. Table 1 known also in the same year the rupiah depreciates from Rp 10.950/US dollar to Rp 9400/US dollar, which with increasing money supply in the community and the occurrence of the depreciation of the rupiah should have an impact on high inflation. But inflation in 2009 experienced a drastic decline from 10.72 percent to 2.61 percent. While government spending has increased from 2,967 billion rupiahs be 3,444 billion rupiahs. This data does not match the theory. The phenomenon certainly became one of appeal to conduct research related to inflation. In addition, the discovery of the difference results from earlier studies where results are in accordance with the theory and results that contradict the theory. This fact certainly is questions about how big the influence of government spending, the money supply, exchange rates and economic growth in

increasing the inflation rate and push in North Sumatra.

Because inflation is a long-term phenomenon. So it's interesting to do further research about inflation in North Sumatra. In General, this research examines the relationship between the independent variable and the dependent variable in the short and long term. The purpose of this research is to analyze the effect of government spending (GS), the money supply (MS), the exchange rate (EXC) and economic growth (GDP) against inflation (INF) in North Sumatra.

2 THEORETICAL FRAMEWORK

Inflation is a process of rising prices of General goods continuously (Nopirin, 2009:25). In the short term, fiscal policy affects aggregate demand side, while in the long run fiscal policy will affect the supply side. Fiscal policy-oriented to improve the supply side can overcome the problem of limited production capacity and therefore its impact is a more long term in nature. The impact of fiscal policy on the economy through the approach of aggregate demand is explained through the Keynesian approach. The keynesian approach assumes the existence of price rigidity and excess capacity so that the output is determined by aggregate demand. Keynes stated that the recession, the economy-based market mechanisms will not be able to recover without intervention from the Government. (Nanga, 2005). According to research conducted by Berto Muharman (2013), the influence of fiscal instruments against inflation found that State spending and taxes the positive effect in the short term while the negative effect in the long term.

The growth of the money supply happened reasonably will provide a positive influence on the economy in the short term, Indonesia is another case with significant growth will trigger inflation which would of course give negative influences. The quantity theory of money is the oldest theories concerning inflation, the theory highlights the role of the addition of the money supply and expectations about the price increase. It means that inflation can only happen if there are additions to the money supply. With the increase of the money supply continuously, the community would feel rich so it will raise consumption and this will raise prices. In addition, the inflation rate is determined by society's expectations about rising prices in the future. Theoretically, there is a positive relationship between the money supply and the inflation rate.

Increasing the money supply will increase inflation rate. Research conducted by Ferdiansyah (2011) shows the results that the money supply a positive effect against inflation and Maggi and Saraswati (2013) shows that the amount of money in circulation a significant and positive effect in the long term. However, research conducted by the Issuance, et.al. (2014), Sipayung and Budhi (2013), Symbolic (2010) shows the results that the money supply is negative and not significant effect against the inflation rate in Indonesia.

The occurrence of inflation triggered by the weakening of the exchange rate of the rupiah against the U.S. dollar since August 14, 1997, the rupiah's exchange rate system is practiced in Indonesia is a free-floating exchange rate system which means that the exchange rate of the rupiah will be formed and submitted fully to market mechanisms or based on the laws of supply and demand of the market. The weakening of the exchange rate of rupiah against foreign currencies results in increasing the value of exports. The price of domestic goods cheaper overseas parties draws to increase the amount of demand for the goods so that the price will go up slowly and causes inflation (Sipayung, 2013).

According to the Keynesian Theory explaining the relationship between inflation and economic growth which in the short term (short-run) aggregate offer curve is positive. The next long-term relationships (long-run relationships) between inflation and economic growth in which inflation rises but economic growth down. These circumstances justify empirically prove of some related research between inflation and economic growth that high inflation causes economic growth down (Mankiw, 2003).

3 RESEARCH METHOD

This study uses secondary data in the form of time series during the years 1997-2017. The calculation of the inflation rate in this study uses the concept of inflation CPI gained from the Central Bureau of Statistics (BPS). Government spending (GS) in units of billions of rupiah, the money supply used is money in the broad sense in units of billions of rupiah were sourced from publications of Bank Indonesia. As for the data exchange rate of rupiah against the U.S. dollar using the Middle rate set by Bank Indonesia in units of thousands of rupiah. Economic growth data and in units of a percent is obtained from the Central Bureau of Statistics (BPS).

The estimation model used in this study is the analysis of the dynamic model with the regression that is by using the model of error correction (Error Correction Model/ECM) Domowitz and Elbadawi. In the context of Economics, the dynamic model specification is very important because it deals with the establishment of the model of an economic system that is associated with the change of time of both short term and long term. This study uses statistics programs help E-Views version 7.

4 ANALYSIS

4.1 Stationeritas Test

The first thing to do is to examine whether the data is stationary or not. This Stasioneritas test needs to be done because a regression analysis should not be did when the data used is not stationary and normally if it still done the resulting equations then are a spurious regression.

4.1.1 Unit Root Test

The unit root test is normal testing was introduced by David Dickey and Wayne Fuller. The root test is done to find out whether the data used stationary or not. Data testing performed using test Augmented Dickey-Fuller (ADF) was the count of an ADF when the variable is greater than the critical value of MacKinnon, means the variable is stationary, and vice versa. Based on table II that Government spending variables (GS) and exchange rate (EXC) is not significant at the α = 5%. Because not stationary at the zero degrees, then it needs to be done again using stationeritas test the degree of integration of the single.

Table 2: Unit Root Test Results

Variables	Value ADF	Critical Value McKinnon (α = 5%)	Description
INF	-4.961814	-3.020686	Stationary
GS	0.034233	-3.020686	Non Stationary
MS	-1.429649	-3.065585	Non Stationary
EXC	-3.570159	-3.020686	Stationary
GDP	-3.917664	-3.020686	Stationary

4.1.2 Integration Test

A test of the degree of integration is a test done to measure at the level of difference to how data all the variables are stationary. The taking of decision is when the count of an ADF variable is greater than the critical value of MacKinnon, means the variable is stationary, and vice versa. Based on table III that variable inflation (INF), government spending (GS), the money supply (MS), the exchange rate (EXC) and economic growth (GDP) has been stationary at the same degree, that is one degree, shown from the ADF value calculate more than the value of the critical (Mackinnon critical values) at α = 5%. Thus, the Granger test requires a stationary data at the same degree can be used.

Table 3: Integration Test Results

Variables	Value ADF	Critical Value McKinnon (α = 5%)	Description
INF	-8.791213	0.0008	Stationary
GS	-7.992085	0.9514	Stationary
MS	-8.984249	0.5417	Stationary
EXC	-7.395489	0.0165	Stationary
GDP	-12.84830	0.0079	Stationary

4.1.3 Cointegration Test

In this research to test the residual method based cointegration test. Residual-based test method using statistical tests Augmented Dickey-Fuller (ADF) by observing the regression residual cointegration stationary or not. Then this residual value will be tested using the test Augmented Dickey-Fuller (ADF) to find out if the residual value of the stationary or not. The results of this research show that the estimated value of the ADF test > Critical Value α = 5% (-5.310626 >-3.020686). So it could be inferred that the empirical model used in this study to qualify for the cointegration test.

Table 4: Cointegration Test Results

Variables	Value ADF	Critical Value McKinnon (α = 5%)	Description
ECT	-5.310626	0.0004	Stasionary

4.2 Estimation Error Correction Model (ECM)

Estimation model of inflation using the model of Error Correction Model (ECM) Domowitz and Elbadawi aims to seek short-term balance or correct an imbalance towards short-term long-term balance. To know that a used Error Correction Model (ECM) is valid or not can be seen from the value of the Error Correction Term (ECT) are significant or not. Equation Error Correction Model (ECM) for short-term period are as follows:

$$D\,\mathrm{LINF} = 0.335769 + 0{,}683037\,GS - 5.089649\,MS$$
$$+ 3.658554\,\mathrm{EXC} - 0.493542\,GDP + 1.287258\,ECT$$

The results of estimation Error Correction Model (ECM) that short-term variable changes the money supply (MS) and economic growth (GDP) had a negative influence against inflation in North Sumatra. While the Government spending variables (GS) and exchange rate (EXC) have a positive influence against inflation in North Sumatra. The magnitude of the balance and changes the previous inflation against the period now is 128 percent. These adjustments are obtained from coefficients the Error Correction Term (ECT) of 1.287258 while the t-statistics is 6.002274 with probability 0.0000 so significant at 5% and means that the model can be used.

Table 5: The Results of The Estimation of the Error Correction Model (ECM) Short-Term

Independent Variables	Coefficient	t-Statistic	Prob
D(LnGS)	0.683037	1.417959	0.1781
D(LnMS)	-5.089649	-2.752699	0.0156
D(LnEXC)	3.658554	4.032125	0.0012
D(LnGDP)	-0.493542	-4.528430	0.0005
ECT	1.287258	6.002274	0.0000
C	0.335769	1.166629	0.2628
squared R-squared Adjusted R-squared F-statistic Prob(F-statistic) Durbin-Watson stat	0.904034 0.869760 26.37686 0.000001 2.179223		

Equation Error Correction Model (ECM) for long-term periods are as follows:

$$\mathrm{L}\,n\,\mathrm{INF} = 5.575499 + 1.445744\,GS - 2.505213\,MS$$
$$+ 2.429970\,\mathrm{EXC} - 00.663565\,GDP$$

The results of estimation Error Correction Model (ECM) that long-term variable changes the money supply (MS) and economic growth (GDP) prior periods have a negative influence against inflation in North Sumatra. While the Government spending variables (GS) and exchange rate (EXC) previous period have a positive influence against inflation in North Sumatra.

Table 6: The Results of The Estimation of Error Correction Model (ECM) Long-Term.

Independent Variables	Coefficient	t-Statistic	Prob
LnGS(-1)	1.445744	2.986111	0.0092
LnMS(-1)	-2.505213	-3.236568	0.0055
LnEXC(-1)	2.429970	2.498143	0.0246
LnGDP(-1)	-0.663565	-4.533170	0.0004
C	5.575499	1.033033	0.3180
squared R-squared Adjusted R-squared F-statistic Prob(F-statistic) Durbin-Watson stat	0.671479 0.583874 7.664799 0.001429 2.572411		

4.3 Test Determination (R^2)

4.3.1 F-Test (Simultaneous Test)

F test or simultaneous test is performed to see the effect of free variables simultaneously or together to the dependent variable. From the results of the estimation model for inflation in the short term is obtained a value of F count of 26.37686 with the level of probability of 0.000001. Then the variable is Government spending (GS), the money supply (MS), exchange rates (EXC) and economic growth (GDP) in the short term significant effect simultaneously against inflation (INF) in North Sumatra.

From the results of the estimation model for inflation in the long-term is obtained a value of F count of 7.664799 with the level of probability of 0.001429. Then the variable is Government spending (GS), the money supply (MS), exchange rates (EXC) and economic growth (GDP) in the long

term significant effect simultaneously against inflation (INF) in North Sumatra.

4.3.2 T-Test (Partial Test)

a. The Government Spending

Based on the results of the study showed that the change in government spending in the short term does not influence the change of inflation in North Sumatra with a coefficient of 0.683037. This means if a change of government spending rose by 1 billion rupiahs, then inflation will change up by 0.683037 percent.

While in the long-term government spending has a positive influence and significantly to inflation in North Sumatra. If change is Government spending rose by 1 billion rupiahs, then change the inflation went up by 1.445744 percent.

b. The Money Supply

Based on the results of the study showed that the percentage of change in the money supply in the short term to change the percentage of inflation in North Sumatra with a coefficient of-5.089649. If changes in the money supply rose by 1 billion rupiahs, then change the percentage of inflation will come down of 5.089649 percent.

While in the long-term the money supply has a negative and significant effect against inflation in Indonesia with a coefficient of -2.505213. This means if the money supply rose by 1 billion rupiahs, then inflation will be down by 2.505213 percent.

c. The Exchange Rate

Based on the results of the study showed that changes in exchange rates in the short term to change the percentage of inflation in North Sumatra with the coefficient of 3.658554. If changes in the money supply rose by Rp 1/US dollar, then change the percentage of inflation going up by 3.658554 percent.

While in the long run Exchange rates had a positive and significant influence against inflation in North Sumatra. If the exchange rate rose by Rp 1/US dollar, then change the percentage of inflation going up by 2.429970 percent.

d. The Economic Growth

Based on the results of the study showed that the change of the economic growth in the short term to

change the percentage of inflation in North Sumatra with a coefficient of-0.493542. If the change of economic growth rose by 1 percent, then change the percentage of inflation will be down by 0.493542 percent.

While in the long run economic growth has a negative influence and significantly to inflation in North Sumatra. If the change of economic growth rose by 1 percent, then the change in inflation down by-0.663565 percent

4.3.3 Goodness of Fit Test

Test coefficient determination (R^2) is used to see how big the variation of free variables may explain the variables bound. Adjusted R-squared value of 0.904034 can be explained that Government spending variable precision (GS), the money supply (MS), the exchange rate (EXC) and economic growth (GDP) explains the variations change inflation rate amounted to 90.40 percent. While the rest of 9.60 percent described other factors outside the model.

5 RESULTS

5.1 Influence Government Spending against Inflation in North Sumatra

Based on the results of the study showed that the change in government spending in the short term does not influence the change of inflation in North Sumatra with a coefficient of 0.683037. This means if a change of government spending rose by 1 billion rupiahs, then inflation will change up by 0.683037 percent. Due to North Sumatra Government spending comes from shopping the employees, operational expenditure and capital expenditure because of increased demand for goods and services could not be anticipated by the side deals. Inflation occurred in North Sumatra due to the increasing demand for a hand. These results can be explained by the theory of Keynes that in the short term fiscal policy affects aggregate demand side. Rising prices of goods due to the increase in aggregate demand due to rising production costs (Nanga, 2005). And not in line with the research conducted by Berto Muharman (2013) that influence the fiscal instrument against inflation in Indonesia found the country's tax and spending the positive effect in the short term.

While in the long-term government spending has a positive influence and significantly to inflation in North Sumatra. If change is Government spending rose by 1 billion rupiahs, then change the inflation went up by 1.445744 percent. This is in accordance with the theories of keynes. In the long run fiscal policy will affect the supply side. Fiscal policy-oriented to improve the supply side can overcome the problem of limited production capacity. Keynes stated that the recession, the economy-based market mechanisms will not be able to recover without intervention from the Government (Nanga, 2005). This is in line with research conducted by Marius Masri (2010) using OLS that employee shopping model, positive and influential operating expenditures significantly to inflation in East Nusa Tenggara Province.

5.2 Influence the Money Supply against Inflation in North Sumatra

Based on the results of the study showed that the percentage of change in the money supply in the short term to change the percentage of inflation in North Sumatra with a coefficient of -5.089649. If changes in the money supply rose by 1 billion rupiahs, then change the percentage of inflation will come down of 5.089649 percent. Because government policy to change the money supply has not been effective in controlling the rate of inflation and the money supply has not been sufficiently lowered inflation rates in North Sumatra. These results can be explained by the theory of Keynes that the increase in the money supply can raise prices, but the increase in the money supply is not always proportional to the increase in the price of goods. In the short ride down the amount of money circulating in the economy does not quickly addressed by the community, for example by changing consumption patterns. And in line with the research conducted by Annisa Tri Utami and Soebiyo Daryono (2013) using OLS model is that the money supply a negative and significant effect against inflation in Indonesia.

While in the long-term the money supply has a negative and significant effect against inflation in Indonesia with a coefficient of -2.505213. This means if the money supply rose by 1 billion rupiah, then inflation will be down by 2.505213 percent. Due to the money supply consists of cash in circulation, money giral and quasi money. Although the value is high but not enough to affect the inflation increase in North Sumatra. This result does not match the quantity theory that fluctuations that

occur at the price caused by the ups and downs of the volume of money supply in the economy (Mankiw, 2003). So it was concluded that the money supply has a positive influence against inflation. And in line with the research conducted by Nugroho and Basuki (2012) stated that the money supply a negative and significant effect against inflation in Indonesia.

5.3 Influence Exchange Rate against Inflation in North Sumatra

Based on the results of the study showed that changes in exchange rates in the short term to change the percentage of inflation in North Sumatra with the coefficient of 3.658554. If changes in the money supply rose by Rp 1/US dollar, then change the percentage of inflation going up by 3.658554 percent. This is in accordance with the Purchasing Power Parity approach in case of inflation then to maintain the balance of the Law of One Price, the exchange rate must depreciate. The theory of Purchasing Power Parity also said that the country that its currency is experiencing high inflation rates should reduce the value of its currency against other currencies with lower inflation rates (Mishkin,2009). This is in accordance with the research done Oktavia, Lakshmi, et al that the exchange rate of a positive and significant effect against inflation in Indonesia.

While in the long-term Exchange rates had a positive and significant influence against inflation in North Sumatra. If the exchange rate rose by Rp 1/US dollar, then change the percentage of inflation going up by 2.429970 percent. Due to the depreciating rupiah exchange rate against the United States dollar then inflation increased. But despite the more price increases or inflation will not reduce the purchasing power of money. Because of the exchange rate of the dollar has intrinsic value that is steeper than in foreign currency exchange rates. This is in accordance with the research conducted by Priyono and Setiasih (2009), the relationship of inflation with Exchange rate is positive.

5.4 Influence Economic Growth against Inflation in North Sumatra

Based on the results of the study showed that the change of the economic growth in the short term to change the percentage of inflation in North Sumatra with a coefficient of-0.493542. If the change of economic growth rose by 1 percent, then change the percentage of inflation will be down by 0.493542

percent. This is not in accordance with the theories of keynes explained the relationship between inflation as economic growth in the short-run aggregate supply curve is positive. Inflation in North Sumatra on research is due to the increase in the price of Fuel. The rising prices of fuel oil which was followed by rising prices of goods and services will make the price is not affordable by the people who earn it anyway. The high price levels that cause declining purchasing power it will make producers suffered losses so will lower economic growth in Northern Sumatra. This is in accordance with the research done Izzah (2015) stated that the negative effect of inflation towards economic growth of Riau.

While in the long run economic growth has a negative influence and significantly to inflation in North Sumatra. If the change of economic growth rose by 1 percent, then the change in inflation down by-0.663565 percent. This is in accordance with the theories of keynes in the long-term relationship between inflation and economic growth in which inflation rises but economic growth down (Mankiw,2003).

6 CONCLUSIONS

Only the variable exchange rate (EXC) that have significant influence towards inflation in North Sumatra in both short term and long term. The variable amount of the money supply (MS) and economic growth (GDP) has a negative influence and significantly to inflation in North Sumatra. While the Government spending variables (GS) in the short term is not significant effect against inflation in North Sumatra.

Because of the exchange rate (EXC) is the main determining factor affecting inflation in North Sumatra in both short term and long term so that Bank Indonesia is expected to maintain the stability of the exchange rate of the rupiah. The system of exchange rates used for Bank Indonesia's current exchange rate system is the right of free use for keeping the stability of the instrument's value by open market operations in the money markets either rupiah or foreign currency.

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