

Analysis of Inflation Determination in Indonesia, 2001-2015

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Abstract— The achievement of a low inflation target is a big agenda that is currently being carried by Bank Indonesia. This target is certainly not apart from the Central Bank's monetary policy strategy that implements Inflation Targeting (IT). This research aims to analyze the effect of the money supply, BI Rate, and exchange rate to inflation in Indonesia. The analysis is using the equation of cointegration by Error Correction Model (ECM) method. This study analyzes the relationship between the dependent and independent variables in both short terms or in the long term. The estimation results show that in the short term, there is a significant effect of BI Rate and exchange rate to inflation in Indonesia. ECM model is considered to be valid because of the significance value of Error Correction Term (ECT). However, in the long term, it is the variable BI Rate has a significant influence on the inflation in Indonesia. These results indicate that the importance of the role of the BI Rate in controlling the inflation rate for the stable of the economic condition.

Keywords—*Inflation, Money Supply, BI Rate, Exchange Rate, Error Correction Model (ECM)*

I. INTRODUCTION

Inflation is an economic phenomenon that is very interesting to be discussed especially regarding their impact on macroeconomic aggregates. The economy has always been the most important concern because when the economy is unstable conditions it will emerge the economic problems such as the low of economic growth, high rates of unemployment and high rates of inflation. The stability of economic measurement depends on the growth of the economy; There are no high unemployment as well as the price level of goods and services changes are not too mean from the reflected of inflation rate [3].

The difficulty of making policy in controlling the inflation rate in Indonesia is the critical issues in monetary policy. The higher inflation rate can disrupt the Government efforts to improve the welfare of society. Likewise, the lower of inflation rate resulting the production sector does not have the propulsion to spur production. This fact encourages the Government to pay attention to the rate of inflation that

occurred to build sustainable economies. The achievement of a low inflation target is a big agenda that is currently being carried by Bank Indonesia. The target is certainly not apart from the monetary policy strategy implemented by the Central Bank, called Inflation Targeting (IT).

Based on the laws, UU No. 23 the year 1999, Bank Indonesia focuses its policy on achieving the stability of rupiah value by placing inflation as a cornerstone of its monetary policy. Since July of 2005, Bank Indonesia has implemented the new and consistent framework of monetary policy framework by Inflation Targeting Framework (ITF). The ITF includes four fundamental elements, the use of the BI Rate as the operational target, the process of the formulation of anticipatory monetary policy, the communication strategy which is more transparent and strengthening coordination policy with the government. These steps are intended to enhance the effectiveness and governance of monetary policy in achieving the final target of price stability to support sustained economic growth and the welfare of society [1].

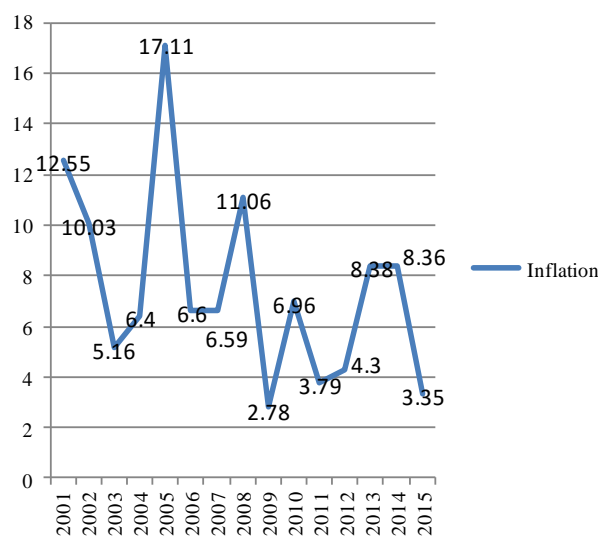


Fig. 1. The trends of inflation in Indonesia in 2001-2015

Based on inflation data during 2001-2015, it shows that the inflation rate has fluctuated from years to years. The highest inflation occurred in 2005 reached 17,11%, it was caused dominantly by the increasing of the world oil prices that impacted the rise of fuel oil 126 % from the normal price. The lowest inflation was in 2009 or 2,78 %. This data shows the lowest inflation achievement throughout the history of Indonesia. Inflation in 2015 is also categorized low as it was only 3,35%. One of the factors suppressing inflation rate in 2015 was the weakening of purchasing power due to the reduced employment, such as the unemployment in February 2015 according to the Badan Pusat Statistik (BPS) increased 300.000 people compared in February 2014, the total reached 7,45 million people.

Reviewed from previous research, the factors that influence the formation of inflation in many countries, including Indonesia, comes from domestic and external variables. These variables include gross domestic product, currency exchange rates, interest rates, money supply and change or economic shocks in other countries [6].

The growth of the money supply in a reasonable context will provide a positive influence on the Indonesian economy in the short term. Otherwise, the significant growth will trigger inflation in negative influences. The quantity theory of money is the oldest theories related to inflation; it highlighted the role of the addition of the money supply and the expectations of the public regarding the price increases. It means that inflation can only happen if there are additions to the money supply. By the increasing of the money supply continuously, the community would feel rich so it would raise the consumption, and it will raise the prices. In another hand, societies expectations of the rising of the prices in the future also determine the inflation.

A classic inflationary theory argues that the money supply highly determines the price level, classic explains through the relation between the value of money with that amount of money, as well as the value of money and the price. If the amount of money grows faster than the value of the goods, the value of money will fall and it same as the uptrend. In another word, classically, inflation show too much money supply and credit compared to the volume of transactions, then it has to limit the money supply and credit. Theoretically, there is a positive relationship between the money supply and inflation rate. Increasing the money supply will increase inflation rate. In previous research, Ferdiansyah [2] the results showed that the money supply a positive effect on inflation. Maggi and Saraswati [4] derive the conclusion that the money supply had a significant and positive effect in the long term. Meanwhile, Langi, et al. [3], Sipayung and Budhi [6], Perlambang [5] showed the results that the money supply influential negative and insignificant against the inflation rate in Indonesia.

The changes in the interest rates of Bank Indonesia or BI Rate will affect some variables of macro-economy forwarded to inflation. The changes of an increasing BI Rate level aims to reduce the rate of economic activity that capable of triggering inflation. At the time of the BI Rate level rises then the credit interest rates and deposits will be increased. When the interest rates on deposits rose, the public will tend to keep

their money in the bank that caused the amount of money in circulation will be reduced. The increase in credit interest rates will stimulate the perpetrators to attempt to reduce its investments because of the higher cost of capital. Those things dampen the economic activity and reduce inflationary pressures ultimately [3].

Keynes argued that the quantity of money does not affect the level of demand for the total economy because the other one can make the inflation even though the rate of money quantity remains constant. If the money supply increases then prices will rise. It will lead to the increase in the demand for money transactions thus will raise the interest rates. This will prevent the increase of demand for investment and soften the pressure of inflation. Analysis of Keynes about inflation the request formulated based on the concept of the inflationary gap [2]. A theory explains that interest rate and inflation rates have a negative relationship. The higher interest rates would depress the rate of inflation. Maggi dan Saraswati [4] in their research shows the results that BI Rate is significantly and negatively affected the inflation in short or long term. Contrastly, Langi, et al. [3] show results that BI Rate is a significantly and positively affected by inflation in either the short term or in the long term.

In addition to the factor of money supply and the BI Rate, inflation also occurs due to pressure from outside, the depreciation of the rupiah value and also because of the foreign goods prices (Imported Inflation). Prices tend to increase easily due to the influence of the weakening rupiah exchange rates and vice versa where prices tend to be difficult to drop in the exchange rate of the rupiah strengthened.

TABLE I. INFLATION RATE, MONEY SUPPLY AND BI RATE IN INDONESIA AND EXCHANGE RATE OF RUPIAH TOWARD US\$ IN 2001-2015

Years	Inflation (%)	Money Supply (billion rupiahs)	BI Rate (%)	Exchange Rate (Rp/US\$)
2001	12,55	844.054	17,62	10.299
2002	10,03	883.903	12,93	9.318
2003	5,16	955.692	8,31	8.573
2004	6,40	1.033.877	7,43	8.935
2005	17,11	1.202.762	12,75	9.711
2006	6,60	1.382.493	9,75	9.167
2007	6,59	1.649.662	8,00	9.136
2008	11,06	1.895.839	9,25	9.680
2009	2,78	2.141.384	6,50	10.398
2010	6,96	2.471.206	6,50	9.085
2011	3,79	2.877.220	6,00	8.779
2012	4,30	3.307.508	5,75	9.380
2013	8,38	3.730.409	7,50	10.451
2014	8,36	4.173.327	7,75	11.878
2015	3,35	4.548.800	7,50	13.392

Source: Statistik Ekonomi dan Keuangan Indonesia (SEKI), Bank Indonesia

The occurrence of depreciation of the value of a country's currency to the currencies of other countries will have an impact on increasing the cost of imported goods for the production process. As for the actions of domestic manufacturers to cover the costs of the import price increase be expensive goods production. The rise in the prices of production goods led to increases in prices on domestic price levels and the impact on the inflation. It shows that there is a positive relationship between the exchange rate (depreciation) and the inflation rate. Sipayung and Budhi [6] conducts the research and get results that the exchange rate effect is significant and positive towards inflation. Meanwhile, Perlambang [5] shows that the exchange rate is not significant effect on inflation.

Observe the data on table I, in 2005 inflation rate increases from 6,40 % to 17,11 %, the inflation rate rises drastically. It supposed to suppress such high inflation the Bank Indonesia took the policy by lowering interest rates, but in the same year, the interest rates of Bank Indonesia (BI Rate) rose from 7,43 % to 12,75 %. The data show in 2009 the money supply increased from 1.895.839 billion rupiahs to 2.141.384 billion rupiahs. In the same year, the rupiah depreciates from Rp 9.680/US\$ to Rp 10.398/US\$. The increase in the money supply in the community and the occurrence of the depreciation of the rupiah will have an impact on the high inflation. But it was the contrast where the inflation in 2009 decreased drastically to be 2,78 %. This data is not appropriate with the theory. The phenomenon certainly became one of appeal to conduct research related to inflation. Also, the difference results from previous studies in which the existence of the results corresponding to the theory and the existence of conflicting results with theory. This fact certainly became a question of how much the influence of the money supply, interest rates and exchange rates in raising and pressing the inflation rate in Indonesia.

Since the inflation is one of the development indicators that capable of delivering a broad impact on the Indonesian, the study of related variables which affected the levels of inflation become an important and interesting field to be studied. In General, this research examines the relationship between the independent variable and the dependent variable in the short term and long term. The research aims to analyze the effect of money supply (MS), interest rates of Bank Indonesia (BI Rate), and exchange rate (EXC) to inflation (INF) in Indonesia in short or long term. Based on theory and empirical studies from the previous researchers, the hypotheses from this research are:

- The money supply effects positively to the inflation in Indonesia in the short term or the long term.
- BI Rate effects negatively to the inflation in Indonesia in the short term or the long term.
- The Exchange rate effects positively to the inflation in Indonesia in the short term or the long term.

II. RESEARCH METHOD

The type of research data is secondary data from time series during 2001-2015. The calculation of the inflation rate in this study uses the concept of inflation Consumer Price Index (CPI) gained from BPS and Statistik Ekonomi dan Keuangan Indonesia (SEKI) published by Bank Indonesia. The BI Rate in units of percent, rupiah exchange rate to US\$ using the middle rate set by Bank Indonesia in units of thousands of rupiah derived from SEKI. As for the money supply data used is money in the broad sense (M2) in units of billions of rupiah gained from SEKI and Laporan Perekonomian Indonesia (LPI) issue of Bank Indonesia.

The estimation model used in this study is the analysis of dynamic model with regression, i.e., by using the Error Correction Model (ECM). In the context of economics, the dynamic model specification is highly important because it deals with the establishment of the model of an economic system that explains relationship the change of time both in the short term and long term. This study uses statistics programs help E-Views version 9.

III. RESULTS AND DISCUSSION

A. Stationary Test

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

1) Roots Unit Test

The roots unit test function to test the behavior of research data. This test uses the Dickey-Fuller (DF). The determination is when the count of a DF variable is greater than the critical value of MacKinnon, the variable is stationary, and vice versa. Based on table II that not all variables used in this study have the value of DF greater than the value of the critical (Mackinnon critical values). On the test variable DF, the exchange rate (EXC.) is not significant at the $\alpha = 1\%$, 5% , and 10% . Because it is not stationary at the zero degrees, it needs to be done again using stationary test by using the degree of single integration test.

2) Degree Integration Test

It is a continuation of the unit root test and only required when all the data has not been stationary at zero degrees or 1. It is used to know the degree of how data will be stationary. When the data have not been stationary at one, the testing must remain until each variable is stationary. To do this test used DF test. The determination is when the count of a DF variable is greater than the critical value of MacKinnon, the variable is stationary, and vice versa. Based on table III all research variables have the same degree of stationary, i.e., first difference, which demonstrated the value of DF greater than the value of the critical (Mackinnon critical values) at $\alpha = 5\%$. Thus, this study uses the cointegration test requires stationary data on the same degree.

TABLE II. RESULT OF ROOTS UNIT TEST

Variables	Value DF	Critical Value Mc-Kinnon			Information
		1%	5%	10%	
INF	-3.891171	-2.740613	-1.968430	-1.604392	Stationary
MS	-2.418727	-2.771926	-1.974028	-1.602922	Stationary
BI_Rate	-2.435849	-2.740613	-1.968430	-1.604392	Stationary
EXC	-1.383113	-2.754993	-1.970978	-1.603693	Non-Stationary

TABLE III. RESULT OF DEGREE INTEGRATION TEST IN FIRST DIFFERENCE

Variables	Value DF	Critical Value Mc-Kinnon			Information
		1%	5%	10%	
INF	-4.441062	-2.771926	-1.974028	-1.602922	Stationary
MS	-2.096745	-2.754993	-1.970978	-1.603693	Stationary
BI_Rate	-3.828400	-2.754993	-1.970978	-1.603693	Stationary
EXC	-2.343593	-2.754993	-1.970978	-1.603693	Stationary

3) Cointegration test

Cointegration test is an advanced test of unit root test and degree of integration. Cointegration test is meant to know the behavior of the data in the long term between related variables whether it is cointegrated or not as in economic theory. This test used cointegration test by Johansen. The determination is when the value of the Trace Statistic > Critical Value and the value of Max-Eigen Statistics > Critical Value; it means that between these variables in longterm relations equilibrium (cointegrated), as well as Instead. The results of this research show that the estimated value of the Trace Statistic > Critical Value i.e. 131,6320 > 47,85613 and Max-value Statistics Eigen > Critical Value i.e. 100,7574 > 27,58434. Therefore, the empirical model used in this study qualified for cointegration test, so this result indicates that the regression model was consistent in the short and long term.

B. Estimation Error Correction Model (ECM)

Estimation model of inflation using the ECM model aims to find a balance of short-term or correct the short term imbalance toward long-term balance. Decision making that a used ECM model is valid or not, based on from the value of the Error Correction Term (ECT) are significant or not. If it is significant then the specification model, ECT inflation in Indonesia, can be justified by either using a model of ECM. The results of the ECM equation for the short-term period are as follows:

$$DLINF = 0,290617 - 1,128390DLMS + 2,937882DLBI_RATE - 2,530729DLEXC - 1,318219ECT$$

The value of the Error Correction Term (ECT) coefficients is worth negative (convergent), i.e., -1.318219 and significant at the $\alpha = 1\%$. So it could be concluded that the analysis of ECM on this research is valid for use. The value of the coefficient of 1,3182 ECT had the meaning that the difference between the inflation rate with the value balance of 1,3182 that will require adjustment within one year. As for the equation of Error Correction Model (ECM) for the long-term period are as follows:

$$LINF = 11,19757 + 0,722382LMS + 2,188066LBI_RATE - 2,655423LEXC$$

TABLE IV. RESULT OF ESTIMATION OF SHORT-TERM ECM

Independent Variables	Coefficient	t-Statistic	Probability
DLMS	-1.128390	-0.567687	0.5841
DLEXC	-2.530729	-2.722622	0.0235
DLBI_RATE	2.937882	9.147346	0.0000
ECT	-1.318219	-5.100662	0.0006
C	0.290617	1.123132	0.2904
R-squared		0.927328	
Adjusted R-squared		0.895029	
F-statistic		28.71094	
Prob(F-statistic)		0.000039	
Durbin-Watson stat		1.750533	

TABLE V. RESULT OF ESTIMATION OF LONG-TERM ECM

Independent Variables	Coefficient	t-Statistic	Probability
LMS	0.722382	2.173444	0.0525
LEXC	2.188066	4.294674	0.0013
LBI_RATE	-2.655423	-2.252659	0.0457
C	11.19757	1.600176	0.1379
R-squared		0.714975	
Adjusted R-squared		0.637241	
F-statistic		9.197708	
Prob(F-statistic)		0.002468	
Durbin-Watson stat		2.165050	

1) The effect of money supply on the inflation

From the results of research show that the percentage of change in the money supply in the short term does not influence on the percentage change in inflation in Indonesia with a coefficient of -1,128390. This negative relationship is incompatible with the Classical theory of inflation that states more money supply will be higher the percentage of inflation in Indonesia. It means if a change in the money supply rose by 1 billion rupiahs, then the change the percentage of inflation will be down to 1,128390 percent. The theory of Keynes can explain these findings that the increase in the money supply raises the prices, but the increase in the money supply is not always proportional to the increase in the price of goods. In the short term, the up-down of money supply in the economy is not responded quickly by the community, for example by changing their consumption. Whereas, in the long term the

money supply has a positive influence but not significantly to inflation in Indonesia with 0,722382 coefficients. This positive influence shows if the money supply rose by 1 billion rupiahs, then inflation will be up by 0,722382 percent. These results are in line with the Classical theory, in which the money supply is the main determinant of inflation. The results of this research are consistent with the research conducted by Rio Maggi and Birgitta Dian Saraswati [4] examines various the factors affecting Inflation using the Demand Pull Inflation model. This study was conducted in Indonesia with the result that in the long term the variable money supply has a positive effect on the inflation rate. Thus the rise in the money supply, in the long run, will cause inflation.

2) *The Effects of BI Rate to the Inflation*

The results of the study show that the change percentage of BI Rate in the short term and long term has a positive and significant effect toward inflation percentage change in Indonesia with the respective coefficients of 2,937882 and 2,188066. This result is incompatible with the theories of Keynes that the higher the level of the BI Rate will be lower inflation in Indonesia. It means that if there is a change in the percentage of BI Rate rose by 1 percent, then the change in inflation in Indonesia will be up by 2,937882 percent in the short term and rise of 2,188066 percent in the long run. The equation of Fisher can explain these findings that states a rise of one percent in inflation led to a rise of one percent in the nominal interest rate. It is estimated to occur due to the increasing price of Fuel (BBM) made by the Government caused a rise in the price level, so that the goods and service trigger the inflation pressures in Indonesia. On the other hand, the increase in the BI Rate that is aimed to decrease the inflation has not occurred. The results of this research are consistent with the research done by Theodores Manuela Langi, Vecky Masinambow, and Hanly Siwu [3] that stated the BI Rate is positive and significant effect toward the inflation rate in Indonesia.

3) *The Effect of Exchange Rate on Inflation*

This research explains the finding that the percentage changes of the exchange rate in the short term have a negative and significant effect of inflation percentage change in Indonesia with a coefficient of -2,530729. It means that if the exchange rate rose by Rp 1/US\$, then inflation in Indonesia will be down by 2,530729 percent. Meanwhile, there is no effect of exchange rate toward the inflation in Indonesia. Heru Perlambang [5] conducted a research entitled The Analysis of the influence of the money supply, the SBI interest rates and exchange rates toward inflation. The results of his research also show that the exchange rate does not effect on inflation.

The estimation result of ECM showed the value of Adjusted R-squared of 0,895029; then it could be explained that the precision of a variable money supply, interest rates Bank Indonesia and exchange rates describe variations change inflation rate amounted to 89,50 percent, while the rest of 10,50 percent described other factors outside the model.

IV. CONCLUSION AND RECOMMENDATIONS

BI Rate Variable has a significant influence toward inflation in Indonesia both in the short-term and long-term.

Exchange rate variables have a significant influence in Indonesia against inflation in the short-term. While the money supply variable has no influence toward inflation in Indonesia is good in the short-term and long-term. Correction Error Term value (ECT) is very small -1,318219 shows the process of proofreading toward long-term balance is increasingly slowing down.

Because BI Rate variable is effected toward the inflation in Indonesia in the short-term and long-term, it means that Bank Indonesia has used the interest rates as an instrument of its monetary policy accurately. Also, Bank Indonesia should be more focused and careful in setting the percentage change of BI Rate as interest rate reference. Improved cooperation between Bank Indonesia and Government in making policy for demanding and supplying sides in achieving the inflation target that is considered good and stable for Indonesian economy.

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