CHAPTER V

RESEARCH AND ANALYSIS

A. Research Result.

Here are the following step of analysis and the result.

1. Descriptive statistics.

Descriptive statistics provide a brief summary through descriptive coefficient that represents the given data set. Eviews 8 is used as the econometrics tool to analyze the data in this paper and gave result for the descriptive statistics as follows:

Table 5-1 Descriptive Statistics

	INF	LOG_M2	LOG_ER	BIR	LOG_GDP
Mean	0.444375	15.09452	9.318436	6.335938	14.54602
Median	0.435000	15.12148	9.374978	6.500000	14.54834
Maximum	2.460000	15.50545	9.592673	7.750000	14.75247
Minimum	-0.350000	14.56319	9.059169	4.250000	14.31164

Source:Data Processing, Appendix 1

The table above show the descriptive statistics of all variable with regards to changes in inflation, money supply, exchange rates, interest rate, and gross domestic product with result based on the table as follows: First, the inflation's mean, median, maximum, and minimum value respectively are 0.444375, 0.435000, 2.460000, -0.350000. Secondly, the money supply's mean, median, maximum, and minimum value respectively are 15.09452, 15.12148, 15.50545, 14.56319. Thirdly, the exchange rate's mean, median, maximum, and minimum value respectively are 9.318436,

9.374978, 9.592673, 9.059169. Fourthly, the interest rate or BI rate's mean, median, maximum, and minimum value respectively are 6.335938, 6.500000, 7.750000, 4.250000. Lastly, the gross domestic product's mean, median, maximum, and minimum value respectively are 14.54602, 14.54834, 14.75247, 14.31164. The results indicate that all variables have a positive mean, median, and maximum value where the inflation is the only variable which has a negative minimum value.

2.   **Unit Root Test.**

Before running an Error Correction Model regression, the first thing that has to be done is checking the stationary status, because if the data is not stationary the result will be spurious, and having an autocorrelation problem.

Augmented-Dickey-Fuller Test (ADF-test) is used to check whether the data is stationary or not, also called unit root test or integration test $I(d)$. If the data is stationary which when the t-statistics absolute value is bigger than the absolute critical value, it means that the data generating process will show an average characteristic, constant variances, and free from autocorrelation problem. After all, variables are stationary on certain levels then the ECM research can be run.

Table 5-2 Unit Root Test of Variables

Variable	Test on Level		Test on First Difference		Test on Second Difference	
	t-statistic	Prob	t-statistic	Prob	t-statistic	Prob
INF	-8.28614	0.0000	-4.939303	0.0005	-5.014597	0.0005
LOG_M2	-2.565694	0.1111	-8.216332	0.0000	-8.918942	0.0000
LOG_ER	-0.657782	0.8429	-5.069467	0.0003	-6.797523	0.0000
BIR	-0.19986	0.9284	-4.112724	0.0033	-8.63597	0.0000
LOG_GDP	-0.409794	0.8939	-2.246901	0.1955	-96.38622	0.0001

Source: Data Processing, Appendix 2

From the data it is can be concluded that all of the variables except Exchange rate are not stationary on level, but then, the money supply, exchange rate which are in natural logarithm form, plus variable interest rate or Bank Indonesia rate are turned out to be stationary on first difference level I(1) except the Gross Domestic Product which in natural logarithm form is still not stationary. The differencing can go on multiple times and has to be continued until all of the variables are stationary on the same level, but many analyst very rarely need to go beyond second order of differencing. Therefore, the test is continued with the second difference level, and finally with the results shows that all variables are stationary on the same level which is in the second difference level.

3. **Cointegration Test.**

After finding out that the data is non-stationary on the level, then the next step is identifying whether the data are cointegrated. The cointegration

test gives an early indication that the model has a long-term relationship (cointegration relation).

The result of the cointegration test is obtained by forming the residual obtained by regressing the independent variable to the dependent variable by OLS. The residual must be stationary at the level to be said to have cointegration. Below is the step to get the result of unit root test of the residual:

i. Long-run Estimation

Table 5-3 Long-run Estimation Result

Dependent Variable: INF				
Method: Least Squares				
Date: 12/19/18 Time: 11:54				
Sample: 2010Q1 2017Q4				
Included observations: 32				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	23.17607	41.57091	0.557507	0.5818
LOG_M2	2.979706	2.188045	1.361812	0.1845
LOG_ER	-2.130555	2.041301	-1.043724	0.3059
BIR	0.131634	0.132679	0.992125	0.3299
LOG_GDP	-3.347274	5.013626	-0.667635	0.5100
R-squared	0.097419	Mean dependent var		0.444375
Adjusted R-squared	-0.036297	S.D. dependent var		0.517512
S.E. of regression	0.526821	Akaike info criterion		1.698688
Sum squared resid	7.493578	Schwarz criterion		1.927709
Log likelihood	-22.17900	Hannan-Quinn criter.		1.774602
F-statistic	0.728552	Durbin-Watson stat		2.604005
Prob(F-statistic)	0.580289			

Source: Data Processing, Appendix 3

From the Ordinary Least Square above we can construct the residual which is the Error Correction Term. However, from the result above we also can see that there are no single variables of independent that significantly influence towards inflation in the long-term from the probability which is none of them are less than 0.05 values. Shown from the R squared also, that the model or the variables actually only explained 9.7 percent of the change in inflation in the long-term form.

ii. ECT Generating and Testing

Table 5-4 Unit Root Test on ECT

Null Hypothesis: ECT has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=7)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-7.458587	0.0000
Test critical values:	1% level		-3.661661	
	5% level		-2.960411	
	10% level		-2.619160	
*MacKinnon (1996) one-sided p-values.				

Source: Data Processing, Appendix 4

Based on (Basuki and Yuliadi, 2015)The residuals must be stationer on the level to be said having a co-integration relationship. From the data above the result of unit root test of the residual shown that the p-value is 0.0000 which means that the

residual of the data which is the error correction term is stationary
and there is co-integration between variables because the p-value is
significant at level 5% even in 1% significance level.

4. ECM Regression.

Table 5-5 Short-run Estimation Result

Dependent Variable: D(INF)				
Method: Least Squares				
Date: 12/19/18 Time: 11:55				
Sample (adjusted): 2010Q2 2017Q4				
Included observations: 31 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.221456	0.159706	-1.386647	0.1778
D(LOG_M2)	12.95818	4.265355	3.038008	0.0055
D(LOG_ER)	-7.532157	2.705584	-2.78393	0.0101
D(BIR)	0.229182	0.231186	0.991329	0.3310
D(LOG_GDP)	-3.328303	3.546982	-0.938348	0.3570
ECT(-1)	-1.136458	0.184933	-6.145252	0.0000
R-squared	0.769591	Mean dependent var		0.027419
Adjusted R-squared	0.723509	S.D. dependent var		0.867571
S.E. of regression	0.456190	Akaike info criterion		1.440170
Sum squared resid	5.202731	Schwarz criterion		1.717716
Log likelihood	-16.32264	Hannan-Quinn criter.		1.530643
F-statistic	16.70052	Durbin-Watson stat		1.759600
Prob(F-statistic)	0.000000			

Source: Data Processing, Appendix 5

From the error correction model estimation above shows that in the
short-term the variables independent that used are significantly influence
towards the change of inflation in Indonesia. With R squared 0.769591 or

around 77 percent is can be concluded that the independent variables used for the model are quite good because of only around 23 percent diversity of dependent variable that is influenced by other independent variables outside the model.

5.   Classical Assumption.

    i.   Autocorrelation test

This test is to find out whether there is any autocorrelation in the model or not, the Lagrange Multiplier test (LM Test) is used. If the model has autocorrelation problem then the estimated parameter become bias and the variance is no longer minimum which makes the model is no longer efficient. The procedure on the LM test is: if the value of obs*R-Squared is smaller than the value of the table then the model is free from autocorrelation. On the other hand, it also can be seen through the probability value of chi-square (2), if the probability value of chi-square is greater than the α value that has been selected then it can be concluded that the model is free from autocorrelation problem.

Table 5-6 Autocorrelation Test Result

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.06791	Prob. F(2,23)	0.3602
Obs*R-squared	2.6341	Prob. Chi-Square(2)	0.2679

Source: Data Processing, Appendix 6

From the test result shows that the value of prob. Chi-Square (2) is $0.2679 > \alpha = 5\%$ or 0.05 than it can be concluded that the data is free from autocorrelation problem.

ii. Linearity test

The linearity test used in this research is done through Ramsey Reset test. Suppose the value of F-count is greater than the F-critical value at the certain level of α than it means that the model is not precise. In purpose to check the linearity problem also can be done by checking the p-value of statistics. If the p-value of F-statistic is greater than selected α for example 0.05 (five percent), then we have to accept the null hypothesis which states the model is linear or the model is precise.

Based on the linearity test using Ramsey Reset test with the result as shown below, the probability of F-Statistic's value is greater than the $\alpha = 5$ percent: $0.7948 > 0.05$ means that the model is free from linearity problem.

Table 5-7 Linearity Test Result

Ramsey RESET Test			
Equation: DEQ01			
Specification: D(INF) C D(LOG_M2) D(LOG_ER) D(BIR) D(LOG_GDP)			
ECT(-1)			
Omitted Variables: Squares of fitted values			
	Value	df	Probability
t-statistic	0.263015	24	0.7948
F-statistic	0.069177	(1, 24)	0.7948
Likelihood ratio	0.089225	1	0.7652

Source: Data Processing, Appendix 7

iii.   Multicollinearity test

Table 5-8 Multicollinearity Test Result

	LOG_M2	LOG_ER	BIR	LOG_GDP
LOG_M2	0.0774	0.04647	-0.068175	0.033458
LOG_ER	0.04647	0.03161	-0.002877	0.020073
BIR	-0.068175	-0.002877	1.060974	-0.036721
LOG_GDP	0.033458	0.020073	-0.036721	0.014891

Source: Data Processing, Appendix 8

Based on Basuki and Yuliadi(2015), multicollinearity is the existence of a linear relationship between the independent variable in the regression model. The impact of having multicollinearity within the model are: first, the coefficient of the regression variance become huge which make the confidence interval become wider, influencing the t-test. Second, the coefficient value of estimation regression is not fitted to be interpreted. The rule of the thumb to pass the multicollinearity test is none of the variables has

a greater value than 0.85 towards another variable, it means that the data above is free from multicollinearity problem.

iv.   Heteroscedasticity test

Table5-9Heteroscedastcity Test Result

Heteroskedasticity Test: White			
F-statistic	1.024053	Prob. F(20,10)	0.5075
Obs*R-squared	20.82975	Prob. Chi-Square(20)	0.4072
Scaled explained SS	50.13741	Prob. Chi-Square(20)	0.0002

Source: Data Processing, Appendix 9

Heteroscedasticity is a problem on the regression model for having unconstant variable or not a similar variable that can make the interpretation on OLS bias, based on (Basuki and Yuliadi, 2015). On this research, the test is used *Breush-Pagan* (White's heteroscedasticity test) to detect the existence of heteroscedasticity whether present or not on the regression model. The requirement to pass the test is, if the Probability of Obs* R-squared is greater than the selected α, for example,α = 0.05 then we should accept the H_0: residual is in homoscedasticity condition, in conclusion, free from heteroscedasticity problem. From the results above show that the Probability of Obs* R-squared is 0.4072 is bigger than 5% means that the Error Correction model is free from heteroscedasticity problem.

6. Statistics Test.

Bellow, are the analysis results of long-run and short-run estimation.

i. T-test

The t-test has summarized the result whether the every each independent variable has significant influence or not towards inflation in the long-run and short-run. The method in t-test is if the absolute value of t-statistic is greater than the t-table value than it means that the corresponding variable individually is significant affecting inflation.

Table 5-10 T-Test Result

Long-Run Estimation				
Variable	t-Statistic	t-table (df:32 , α:0.05)	Prob.	significant Effect
C	0.557507	2.042	0.5818	
LOG_M2	1.361812	2.042	0.1845	No
LOG_ER	-1.04372	2.042	0.3059	No
BIR	0.992125	2.042	0.3299	No
GDP	-0.66764	2.042	0.5100	No
Short-Run Estimation				
Variable	t-Statistic	t-table (df:32 , α:0.05)	Prob.	significant Effect
C	-1.38665	2.042	0.1778	
D(LOG_M2)	3.038008	2.042	0.0055	Yes
D(LOG_ER)	-2.78393	2.042	0.0101	Yes
D(BIR)	0.991329	2.042	0.3310	No
D(GDP)	-0.93835	2.042	0.3570	No
ECT(-1)	-6.14525		0.0000	

Source: Data Processing, Appendix 3, Appendix 5, Appendix 10

In long-run estimation, all independent variables, individually, are not significantly affecting the change of inflation (absolute value of t statistic < t-table value).

In short-run estimation, BI rate and gross domestic product are not significantly affecting inflation (absolute value of t statistic < t-table value). While, money supply, and exchange rate individually, are significantly affecting the inflation (absolute value of t statistic > t-table value).

ii.   **F-test**

The F-Test is a summarization of the result whether all independent variables together in the model simultaneously have significant influence towards dependent variable, separately in long-run and short-run estimation.

This test uses significance level $\alpha = 5\%$ and compares F-Statistic with F-table values. This process needs to determine the degree of freedom of numerator (dfn) and degree of freedom of denumerator (dfd).

$$dfd = n - k$$

$$dfn = k - 1$$

where:

n = number of observations.

k = number of variables (both dependent and independent)

H0: Independent variables jointly together are NOT significant affecting inflation.

H1: Independent variables jointly together are significant affecting inflation.

It also can be seen from the probability of F-statistics on the regression model, if the probability value of F-statistics is less than 0,05 then the estimation is passed the test.

Table 5-11 F-Test Result

Estimation Period	F-Statistic	F-Table α , dfn , dfd	F-Table Value	p-value	Effect is Significant?
Long-Run	0.728552	0.05 , 4 , 32	2.67	0.580289	No
Short-Run	16.70052	0.05 , 5 , 32	2.51	0.000000	Yes

Source: Data Processing, Appendix 3, Appendix 5, Appendix 11

From the table above, the F-statistic value on the long-run is 0.728552where the f table value is 2.67, since the F-statistic is less than the F value it means that the estimation is accepting H0 and rejecting the H1 meaning that all the variables are not influencing the dependent variable together. It also can simply be seen through the p-value of long-run estimation 0.580289 is greater than 0.05 also means that through the estimation of all the variables jointly together does not influence the inflation.

On the short-run estimation, the F-statistic value is 16.70052where the f table value is 2.51, since the F-statistic is greater than the F value it means that the estimation is accepting H1 and rejecting the H0. It also can simply be seen through the p-value of long-run estimation 0.000000 is less than 0.05 also means that through the estimation of all the variables jointly together is influencing the inflation significantly.

iii. **R^2 Interpretation.**

R^2 is a determination coefficient, this show how much all of the independent variables on the model can explain the dependent variables.

Table 5-12 Determination Coefficient Result

Estimation Period	R^2
Long-Run	0.097419
Short-Run	0.769591

Source: Data Processing, Appendix 3, Appendix 5

From the long-run estimation, the determination coefficient is 0.0974 means that in this regression model, the independent variables on the model only can explain or predict the variance of the dependent variable by 9.7 percent in the long-run. While the rest, 90.3 percent is probably affected by other variables outside of this model.

However, in the short-run estimation the determination coefficient is 0.769 means that in this regression model, the independent variables on the model only can explained or predict the variance of the dependent variable by 77 percent in the short-run. While the rest, 23 percent is probably affected by other variables outside of this model.

B.   Discussion.

Below is the summary table of significance status of each independent variables towards dependent variable both in long-run and short-run estimation.

Table 5-13 Coefficient Estimation Summary

Long-run Estimation			
Variable	**Coefficient**	**Significant Effect?**	**Relationship towards INF**
C	23.17607		
LOG_M2	2.979706	No	Positive
LOG_ER	-2.130555	No	Negative
BIR	0.131634	No	Positive
LOG_GDP	-3.347274	No	Negative
Short-run Estimation			
Variable	**Coefficient**	**Significant Effect?**	**Relationship towards INF**
C	-0.221456		
D(LOG_M2)	12.95818	Yes	Positive
D(LOG_ER)	-7.532157	Yes	Negative
D(BIR)	0.229182	No	Positive
D(LOG_GDP)	-3.328303	No	Negative
ECT(-1)	-1.136458	Yes	Negative

Source: Data Processing, Appendix 3, Appendix 5

1. **Money Supply.**

   - **Coefficient Interpretation**

     Based on the analysis result, the money supply has a positive influence towards inflation, but it is only significantly influenced towards inflation on the short-run estimation. On long-run estimation, when money supply increase by 1 point the inflation will increase 2.979706 points. On the short-run, when the money supply increase by 1point than the inflation will also increase by 12.95818 points.

   - **Economic Analysis**

     The analysis result is supported with some previous research that has been conducted by Langi, Masinambow and Siwu (2014), Kalalo, Rostinsulu and Maramis (2016), Odusanya and Atanda (2010), Munepapa and Sheefeni (2017), Wulan and Nurfaiza (2014), and Hartarto (2014), which concluded that the variable money supply has positive relationship towards inflation. Same with Langi, Masinambow and Siwu (2014) and Hartarto, (2014) opinions, although in the long-run variable money supply is not significantly influence towards inflation but we have to keep monitor the fluctuation of money supply considering the theory of quantity or Fisher theory that says inflation is closely related to the money supply. The theory of Fisher is reflected on this short-run

estimation analysis result that the quantity on the variable money supply is significantly influenced towards the change of inflation, where every one point that increases in money supply will increase the inflation by 12.95818 significantly.

2. Exchange rate.

- **Coefficient Interpretation**

    Based on the analysis result, the exchange rate has a negative influence towards inflation, but it is only significantly influenced towards inflation on the short-run estimation. On long-run estimation, when the exchange rate increase by 1 point the inflation will decrease by 2.130555 points. On the short-run, when the exchange rate increase by 1points than the inflation will decrease by 7.532157 points.

- **Economic Analysis**

    The analysis result is supported with some previous research that has been conducted by Krisnaldy (2017), Odusanya and Atanda (2010), and Hartarto (2014), which concluded that the variable exchange rate has negative relationship towards inflation. When the exchange rate is appreciating means the domestic currency buys less foreign exchange. Although based on the theory, appreciate in the exchange rate might increase the inflation because of imported inflation, it seems that in this case the fall of domestic

currency value actually decrease the inflation rate in the long-run by 2.130555, and in the short-run 7.532157, because the fall in the domestic currency value also could provide a competitive boost to an economy, and can lead to positive multiplier and accelerator effect within the circular flow of income and spending. Although on the long-run the variable exchange rate is not significantly influence towards inflation because in the long-run people probably used to it, but the exchange rate should keep it in the radar considering that any shock in it could change the economic status depend on the elasticity of demand and supply in the imports and exports and any other possibilities.

3. **Bank Indonesia Rate.**

   - **Coefficient Interpretation**

       Based on the analysis result, even though the Bank Indonesia rate has a positive influenced towards inflation, and both in the long-run and short-run estimation but they are not significantly influence towards inflation. On long-run estimation, when the Bank Indonesia rate increase by 1 point the inflation will also increase by 0.131634 points. On the short-run, when the Bank Indonesia rate is increased by 1 point than the inflation will increase by 0.229182 points with status not significantly influence towards inflation is should keep it in mind.

- **Economic Analysis**

    The analysis result is supported with some previous research that has been conducted by Langi, Masinambow and Siwu (2014), Kalalo, Rostinsulu and Maramis (2016), and Odusanya and Atanda (2010), which concluded that the variable Bank Indonesia rate has a positive relationship towards inflation. However, looking at the long-run and short-run estimation the results both are not significantly influenced towards inflation, meaning that the increase in the Bank Indonesia rate is not always followed by the increase of inflation.

    The not significance of interest rate influencing inflation in this result study is probably because the use of variables on this study is on a quarterly basis which it is quite too long to be in the act to correct the inflation dynamics or the time lag problem in monetary policy to adjust the speed that has been increase during great moderation. The not significance also can caused by 'decoupling', a condition when economic pass through complexities even though in the short-term interest rate may encounter significant difficulties performa in monetary policy.

    However, On August 2016 Bank Indonesia announce and introduce a new policy rate known as the BI 7-Day (Reverse) Repo Rate to strengthen the monetary operation and also in order to accelerate the transmission of policy rate to the money market,

banking industry, and real sector which later will influence the country's economic performance.

Based on Sanica *et al.* (2018), or another researcher beside from Bank Indonesia also has been conduct some research that the strengthening of monetary policy through BI 7-Day (Reverse) Repo Rate is a best decision and considered an international best practice when implementing monetary operation, while the using of BI rates when there is any shock provides tend to be a permanent effect that leads to an increase in inflation. In brief, the use of BI rate as the interest rate reference on operational monetary policy is less effective than the BI 7-Day (Reverse) Repo Rate.

4. **Gross Domestic Product.**

    -   **Coefficient Interpretation**

        Based on the analysis result, even though the gross domestic product has a negative influenced towards inflation both in the long-run and short-run estimation but they are not significantly influence towards inflation. On long-run estimation, when the gross domestic product increase by 1 point the inflation will decrease by 3.347274 points. On the short-run, when the gross domestic product is increases by 1 point than the inflation will decrease by 1.136458 points with status not significantly influence towards inflation is should keep it in mind.

- **Economic Analysis**

    The analysis result is supported with some previous research that has been conducted by Odusanya and Atanda (2010), Likukela (2007), and Hartarto (2014), which concluded that the variable gross domestic product has a negative relationship towards inflation. The negative sign of influence between gross domestics product towards inflation indicates that the increase in gross domestic product or total output will decrease the inflation. The total output on agricultural sectors, for instance, could reduce or calm down the inflation rate. But on the other hand, looking at the non-significance influence's status of the gross domestic product towards inflation in this study indicates that every increase degrees of gross domestic product are not always followed by the increase of inflation rate or the number of gross domestic product does not really matter in controlling the inflation.