

The Relationship of Economic Growth, Export Value and Inflation with The Autoregressive Distributed Lag (ArDL) Approach

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Abstract

Economic growth is one of the benchmarks for the success of a country in running the economy along with the factors that influence it, so this is important to observe. Many previous studies have proven the influence of export value and inflation on economic growth. This study chooses the Autoregressive Distributed Lag (ARDL) model approach to see the dynamics of long-term and short-term relationships for the variables of export value, inflation and economic growth. The research period is quarterly, starting from 2011:Q1 – 2019:Q4 with the type of time series data. The results of this study, through the ARDL model, the variables of export value and inflation are proven to have long-term cointegration or move together in the long term towards economic growth. This study also succeeded in revealing that the variables of export value and inflation have a short-term relationship with a relatively fast adjustment time, which is 2-3 months to return to balance.

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INTRODUCTION

Indonesia's economic growth in recent years has shown a downward trend. Economic growth is one of the benchmarks for the economic condition of a country, so this will greatly affect the interest of investors to invest in a country. According to Prof. Simon Smith Kuznets, the notion of economic growth is a long-term increase in the ability of a country to provide various types of economic goods to its people.

Table 1. Indonesia's Economic Growth Rate in 2011:Q1-2019:Q4 (in percent)

	Quarter I	Quarter II	Quarter III	Quarter IV
2011	6.48	6.27	6.01	5.94
2012	6.11	6.21	5.94	5.87
2013	5.61	5.59	5.50	5.61
2014	5.12	4.94	4.93	5.05
2015	4.83	4.74	4.78	5.15
2016	4.94	5.21	5.03	4.94
2017	5.01	5.01	5.06	5.19
2018	5.06	5.27	5.17	5.18
2019	5.07	5.05	5.02	4.97

Source: Data from BPS processed

Since the third quarter of 2012, Indonesia's economic growth is no longer familiar with numbers 6 and above. In the era of free trade as it is today, the exchange of goods between countries is a necessity for a country in meeting its domestic needs. Exports and imports play an important role in the economy of a country. A country when conducting export or import transactions will be recorded in the export value balance (current account), this is part of a country's balance of payments (balance of payment). Transactions between countries in order to meet domestic needs are very important, because the economic condition of a country is determined by one of the transaction activities that run in that country. If a country has adequate human resources, sophisticated technology and a good work ethic, it will have an impact on the country being able to efficiently produce its own needs. so that it can suppress imports from other countries, this causes the export value balance to experience a surplus. On the other hand, if there are many factors that cause the adequacy of domestic goods to be low, this will certainly cause imports to soar and a deficit in the export value balance occurs.

Table. 2 Indonesia's Export Value Balance 2011:Q1-2019:Q4 in million USD

Year	Quarter I	Quarter II	Quarter III	Quarter IV
2011	45,387	53,288	53,609	51,270
2012	48,517	48,444	46,035	47,034
2013	45,415	45,653	42,878	48,604
2014	44,299	44,525	43,881	43,273
2015	39,051	39,373	36,780	35,161
2016	33,710	36,413	34,983	40,079
2017	40,732	39,264	43,379	45,451
2018	44,219	43,636	47,106	45,050
2019	40,605	39,731	43,835	43,324

Source: Data from BPS processed

The table above shows the value of exports in Indonesia for the period 2011:Q1 to 2019:Q4. From this data, it can be seen that in 2011:Q1 to 2011:Q3 the balance of transactions in Indonesia experienced a surplus, with the highest surplus in 2011:Q1 of 2,947 million USD. After the third quarter to the fourth quarter of 2019, Indonesia has always experienced a deficit in the value of exports. This is due to the increase in consumption goods but not enough supplies from within the country, so they have to go through an import mechanism from abroad to fulfill these goods.

Table 3. Indonesia's Inflation Year 2011:Q1-2019:Q4 in percent

Year	Quarter I	Quarter II	Quarter III	Quarter IV
2011	6.65	5.54	4.61	3.79
2012	3.97	4.53	4.31	4.30
2013	5.90	5.90	8.40	8.38
2014	7.32	6.70	4.53	8.36
2015	6.38	7.26	6.83	3.35
2016	4.45	3.45	3.07	3.02
2017	3.61	4.37	3.72	3.61
2018	3.40	3.12	2.88	3.13
2019	2.48	3.28	3.39	2.72

Source: Data from BPS processed

In table 3 above, the increase in inflation throughout 2013 indicates that the price of domestic goods/services has increased, so that the enthusiasm of entrepreneurs for the production process is increasing. Mild inflation is theoretically good for economic growth, but if inflation reaches moderate or severe levels, it is dangerous for a country's economy. Inflation fluctuations in Indonesia are getting more and more stable, so the economic ecosystem should be controlled and maintained.

By looking at the data above with Indonesia's economic growth tending to decline, the authors are interested in examining how much influence inflation and the value of exports have on Indonesia's economic growth in the short and long term and to determine the nature of this relationship by using an autoregressive distributed lag approach (ARDL).

Prof. Simon Kuznet, defines economic growth as a long-term increase in the ability of a country to provide more and more types of economic goods to its population, this ability grows according to its technological progress and the necessary institutional and ideological adjustments. According to Mudrajat Kuncoro (2004) an economy is said to experience growth or development if the level of economic activity is higher than what was achieved in the previous period.

Mankiw (2006) said that export is a production activity in various types of products to be traded to other countries. The export value balance (current account) is a report that contains records of transactions of goods and services of a country with other countries during a certain period (Murni, 2013: 241). The export value balance will be in a surplus if exports are greater than imports plus net transfers abroad, that is, if the receipts from trade in goods and services and transfers are greater than the payments. On the other hand, the export value balance will experience a deficit if exports are lower than imports and receipts from trade in goods and services and transfers are smaller than payments (Dornbusch & Fischer, 2004).

Inflation is a tendency to increase the general price level of goods or services that occurs continuously. An increase that occurs only once (albeit by a large percentage) is not inflation. Milton Friedman said inflation is everywhere and is always a monetary phenomenon that reflects the existence of excessive and unstable monetary growth (Friedman, 1963)

METHOD

Data Types and Sources

The type of data used in this study is secondary data in the form of a time series with the research period from 2011:Q1-2018:Q4. The independent variables used in this study are the export value balance (CA), Indonesia's inflation rate (INF), the rupiah exchange rate (BI-RATE), and the dependent variable is

economic growth (Growth). Sources of data obtained from Bank Indonesia and the Central Statistics Agency (BPS).

It consists of the research design (the method, the data, the data source, the data collecting technique, the data analysis technique, the variables measurement) that written in the form of a paragraph.

Autoregressive Distributed Lag (ARDL) Model

One of the estimation models that will be used in this study is the Autoregressive Distributed Lag (ARDL) approach. This ARDL approach is a relatively new approach compared to the Engle-Granger Test, or the Maximum Likelihood Johansen Test when it is used to test cointegration between variables for the sake of long-term analysis. The basic difference between the ARDL approach from other approaches is due to its flexibility, although the existing variables have different levels of integration, either I(0), I(1) or the same level, this approach can be used (Pesaran & Smith 1998; Pesaran & Pesaran 1997; Pesaran et al. al., 2001). This ARDL model is a combination of Autoregressive (AR) and Distributed Lag (DL) models. According to Gujarati and Porter (2013) the AR model is a model that uses one or more past data from the dependent variable among the explanatory variables. The DL model is a regression model that involves data on the present and the past (lagged) of the explanatory variables.

The advantage of the ARDL model is that it is unbiased and efficient because it can be used with a small sample. By using ARDL, long-term and short-term estimates can be obtained simultaneously, which will avoid autocorrelation problems. In addition, the ARDL method is also able to distinguish between independent and dependent variables (Zaretta and Yovita, 2019).

The relationship between economic growth, export value, inflation and the rupiah exchange rate can be explained in this study using the Autoregressive Distributed Lag (ARDL) model. The general model of ARDL is as follows:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^n \beta_1 \Delta Y_{t-1} + \sum_{i=0}^n \delta_2 \Delta X_{t-1} + \varphi_1 Y_{t-1} + \varphi_2 X_{t-1} + \mu_t$$

Information:

- t, t : Short term coefficient
- 1, 2 : Long term ARDL coefficient
- t : *Disturbance error* (white noise)

As mentioned above, the ARDL model is able to detect long-term and short-term relationships.

As already mentioned, the advantage of ARDL is its ability to detect both long-term and short-term dynamics. In the general ARDL model in the above equation which is the equation for the short-term relationship is:

$$\sum_{i=1}^n \beta_1 \Delta Y_{t-1} + \sum_{i=0}^n \delta_2 \Delta X_{t-1}$$

As for the long-term relationship, it is shown by $1Y_{t-1} + 1X_{t-1}$.

In this study, to see the effect of Y and X from time to time, as well as the influence of the past Y variable on the present Y, the Autoregressive Distributed Lag (ARDL) estimation method was used.

The stages for data analysis using the ARDL approach in research are as follows (Salomo and Hutabarat 2007):

- a) Testing the stationarity of the data on the variables in the research model, both at the level and the first difference level.
- b) Testing the existence of cointegration in the Model with the Bounds Testing Cointegration Method.
- c) If cointegration occurs, the research model can be estimated using the ARDL method
- d) Estimating the ARDL model, including model selection and conducting diagnostic tests to test whether there is a violation of basic econometric assumptions, before proceeding to the next procedure. The ARDL model selected was based on the Schwarz Bayesian Criterion (SBC/SIC) which was able to select the smallest lag length or based on the Akaike Information Criterion (AIC) to select the relevant maximum lag length.
- e) Analyzing the output results from the estimation of the ARDL Model.
- f) Estimating ECM (Error Correction Model) based on the selected ARDL model.
- g) Analyzing the output results of the ECM estimation to find out the short-term dynamics.
- h) Estimating the long-term relationship coefficient of the selected ARDL Model.
- i) Analyzing the long-term coefficient of the ARDL model.

RESULT AND DISCUSSION

Data Description

This study uses quarterly data from economic growth, inflation and exports. The data period which is also the research period is 2011:Q1 – 2019:Q4, so the total number of observations is 36 observations.

Date: 02/14/20 Time: 11:01			
Sample: 2011Q1 2019Q4			
	PE	INFLASI	EKSPOR
Mean	5.329444	4.741944	43444.28
Median	5.135000	4.305000	43858.00
Maximum	6.480000	8.400000	53609.00
Minimum	4.740000	2.480000	33710.00
Std. Dev.	0.475400	1.767859	4831.167
Skewness	0.937759	0.766650	-0.017553
Kurtosis	2.622604	2.336758	2.745802
Jarque-Bera	5.489996	4.186343	0.098773
Probability	0.064248	0.123295	0.951813
Sum	191.8600	170.7100	1563994.
Sum Sq. Dev.	7.910189	109.3864	8.17E+08
Observations	36	36	36

Figure. 1 Descriptive Statistical Data

Source : Output of Eviews 9.0

From the data that has been displayed above through a visual graph, it can be seen that the trend is roughly the development of economic growth, inflation and the value of exports. Indonesia's economic growth in the period from 2011 to 2019 experienced a sharp downward trend, many factors were expressed by economists related to this phenomenon. Global economic conditions are often the scapegoat for the decline in economic growth in Indonesia, the protracted trade war between China and the United States and national geopolitics which have contributed to negative sentiment.

Inflation has experienced steep fluctuations since Q1 of 2011 to Q4 of 2015 and started to stabilize below 4 since Q1 of 2016 until Q4 of 2019. Maintaining inflation at the end of this year has indeed become a benchmark for controlling prices in the market, but it also needs to be considered Is there any indication that people's purchasing power has started to decline which will hamper economic growth.

Unit Root Test

The unit root test or Unit Root Test is a data test that is intended to determine if the data used in a study is stationary or not. A collection of data is said to be stationary if the average value and variance of the time series data do not change systematically over time or are constant (Nachrowi and Hardius Usman, 2006). In this research, the Phillips-Perron (PP) unit root test will be used. In this test, the existence of a unit root is a null hypothesis. The results of the unit root test with Eviews 9.0 are as shown in figure 2.

Unit Root Level Level

Method	Statistic	Prob.**
PP - Fisher Chi-square	5.17619	0.5214
PP - Choi Z-stat	-0.20904	0.4172

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Intermediate Phillips-Perron test results UNTITLED

Series	Prob.	Bandwidth	Obs
PE	0.5721	6.0	35
INFLASI	0.2251	3.0	35
EKSPOR	0.5837	1.0	35

Unit Root Level First Different

Method	Statistic	Prob.**
PP - Fisher Chi-square	91.0399	0.0000
PP - Choi Z-stat	-8.69436	0.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Intermediate Phillips-Perron test results D(UNTITLED)

Series	Prob.	Bandwidth	Obs
D(PE)	0.0000	12.0	34
D(INFLASI)	0.0000	1.0	34
D(EKSPOR)	0.0000	0.0	34

Figure. 2 Unit Root Test
Source : Output of Eviews 9.0

Based on the results of the unit root test with PP, of the three variables in this study, there is no variable that is stationary at the level, which is indicated by a probability greater than 5%. After that, a unit root test was carried out at the first difference level, from the probability significance, all variables were stationary.

ARDL Model Diagnostic Test

This test is used to test whether the resulting ARDL model is suitable and perfect. This test uses the Bounds Test. Bounds Test was conducted to test the existence of long-run association in the selected ARDL model. The results of this Bounds test will focus more on the value of the F statistic. The F-statistic value will be compared with the critical value Pesaran at the 5% level, which has also been provided by Eviews 9. If the F-statistic has a value that exceeds the upper Bounds value, the null hypothesis which states that there is no long-run association is rejected, which means the variables in the study move together in the long term.

Test Statistic	Value	k
F-statistic	16.85043	2

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	3.17	4.14
5%	3.79	4.85
2.5%	4.41	5.52
1%	5.15	6.36

Figure.3 Bound Test
Source : Output of Eviews 9.0

Based on the results of the Bounds Test for the ARDL model in figure 3, it can be seen that the value of the F-statistic model is 16.85 which is greater than the upper bound value at the 5% level, even higher than the upper bound at the level of 2.5% or 1. %. This proves that the three variables in this study, namely economic growth, export value and inflation, cointegrate in the long term or it can be said that the three variables move together in the long term, so that later error correction can be estimated.

Short-Term and Long-Term Estimates

After conducting the Bounds test, the results showed that the four variables moved together in the long term, so that error correction could be estimated. Based on the Schwarz information criterion (SIC), the best ARDL model selected was (1,4,0).

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
D(PE(-1))	-0.129703	0.174179	-0.744657	0.4640
D(INFLASI)	0.009470	0.024610	0.384793	0.7039
D(INFLASI(-1))	-0.011259	0.023681	-0.475444	0.6390
D(INFLASI(-2))	-0.055438	0.023498	-2.359296	0.0272
D(INFLASI(-3))	-0.029871	0.024693	-1.209679	0.2387
D(INFLASI(-4))	0.049255	0.025223	1.952760	0.0631
D(EKSPOR)	2.63E-05	1.07E-05	2.455791	0.0220
C	-0.035720	0.027915	-1.279630	0.2134

Figure.4 ARDL Models
Source : Output of Eviews 9.0

From the table above, the ARDL (1,4,0) model can be formed as follows:
 $D(PE) = -0.129 \cdot D(PE(-1)) + 0.009 \cdot D(INFLATION) - 0.011 \cdot D(INFLATION(-1)) - 0.055 \cdot D(INFLATION(-2)) - 0.029 \cdot D(INFLATION(-3)) + 0.049 \cdot D(INFLATION(-4)) + 0.0000262 \cdot D(EXPORTS) - 0.035$.

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFLASI)	-0.033499	0.061718	-0.542771	0.5925
D(EKSPOR)	0.000023	0.000011	2.117989	0.0452
C	-0.031619	0.023841	-1.326249	0.1978

Figure.5 Long-Term Coefficients
Source : Output of Eviews 9.0

The relationship between inflation and economic growth

In short-term testing, based on the test results figure 5 it can be obtained information and findings that the inflation variable has a significant negative effect in the t-2 period. The coefficient value is 0.055 with a negative sign. This means that every 1% increase in the inflation rate in the t-2 period, it will result in a decrease in economic growth of 0.055% with the assumption that the export value is fixed or ceteris paribus. In the long-term estimation test results, the inflation variable has no significant effect on economic growth. This answers the phenomenon in the period 2011 to 2019 inflation fluctuations in 2013 to 2015 did not affect economic growth which was in a downward trend, and in early 2016 to 2019 where inflation was stable and tended to fall, economic growth was also in a downward trend. This phenomenon could be caused by factors other than inflation that also affect economic growth.

The relationship between export value and economic growth

The effect of export value on economic growth, in the short term in period t, the value of the export coefficient is positive at 0.0000262. This shows that every time there is an increase in the value of exports by 1 million US dollars, economic growth will increase by 0.262% in period t with the assumption that the inflation variable is fixed or ceteris paribus. Likewise, when the long-term test of the export value variable has a significant positive effect at the 5% level, the export coefficient value is positive at 0.000023. Thus, an increase in export value of 1 million US dollars will increase economic growth by 0.23%. The results of this study are in line with one of the hypotheses proposed by Jung & Marshall (1985), namely the ELG

(Export Led Growth) hypothesis that exports encourage economic growth. With increasing exports, of course the utilization of natural resources, human resources and technology will be optimized, exploration into new markets both at home and abroad will also help national production. With more vigorous exports, economic growth will be pushed up even more, this will also have an impact on the flow of funds from abroad to enter the country. This research is in line with research conducted by Ari Mulianta (2017) and Adrian (2010) which state that exports have a significant positive effect on economic growth. then economic growth will be pushed up, this will also have an impact on the flow of funds from abroad to enter the country.

Estimation Result of Short-Term Equilibrium Towards Long-Run Equilibrium

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFLASI, 2)	0.009470	0.024610	0.384793	0.7039
D(INFLASI(-1), 2)	0.055438	0.023498	2.359296	0.0272
D(INFLASI(-2), 2)	0.029871	0.024693	1.209679	0.2387
D(INFLASI(-3), 2)	-0.049255	0.025223	-1.952760	0.0631
D(EKSPOR, 2)	0.000026	0.000011	2.455791	0.0220
CointEq(-1)	-1.129703	0.174179	-6.485890	0.0000
Cointeq = D(PE) - (-0.0335*D(INFLASI) + 0.0000*D(EKSPOR) -0.0316)				

Figure.6 Error Correction Term (ECT)

Source : Output of Eviews 9.0

Figure 6 above shows that the ECT (error correction term) or CointEq probability is $0.0000 < 0.05$. The ECT variable shows significant results at $\alpha=5\%$ and negative means that the cointegration model is valid and there is an adjustment in the short-term model to achieve long-term equilibrium. The ECT value can be interpreted that the adjustment process to the imbalance of changes in economic growth in Indonesia in the 2011:Q1-2019:Q4 period is relatively fast. In this study, the ARDL (1,4,0) model has met the validity requirements, so in this study we can conclude that the model will go to equilibrium at a rate of 112.9% per quarter or 37.6% per month.

ARDL Model Suitability Test(1,4,0)

Testing the suitability of the selected ARDL model is carried out so that the model chosen in this study does not violate the econometrics rules. Testing the suitability of the ARDL (1,4,0) model in this study to detect autocorrelation, heteroscedasticity and model stability. The autocorrelation test on the ARDL (1,4,0) model in this study used the Breusch-Godfrey Lagrange Multiplier (BGLM) test, by proposing the following hypotheses:

H0 : there is no autocorrelation in the residual ARDL model (1,4,0)

H1: there is an autocorrelation in the residual ARDL model (1,4,0)

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.776838	Prob. F(2,21)	0.4726
Obs*R-squared	2.135526	Prob. Chi-Square(2)	0.3438

Figure.7 Autocorrelation Test Results

Source : Output of Eviews 9.0

Based on the results of data processing as shown in figure 7, it is known that the statistical p-value for the BG-LM test is 0.34. These results indicate that at the 95% confidence level the null hypothesis cannot be rejected, which means that there is no autocorrelation in the ARDL model residuals (1,4,0).

Heteroskedasticity Test: ARCH			
F-statistic	0.342953	Prob. F(1,28)	0.5628
Obs*R-squared	0.363004	Prob. Chi-Square(1)	0.5468

Figure.8 Heteroscedasticity Test Results
Source : Output of Eviews 9.0

The ARDL model stability test (1,4,0) in this study used the CUSUM test with a 95% confidence level. The results of the CUSUM test for the ARDL (1,4,0) model in this study are as shown in Figure 9. The stability of the model is determined from the position of the blue CUSUM line, which is between the two red 5% significance lines. For the ARDL (1,4,0) model, the CUSUM line is between the significance line which proves that the ARDL (1,4,0) model is stable.

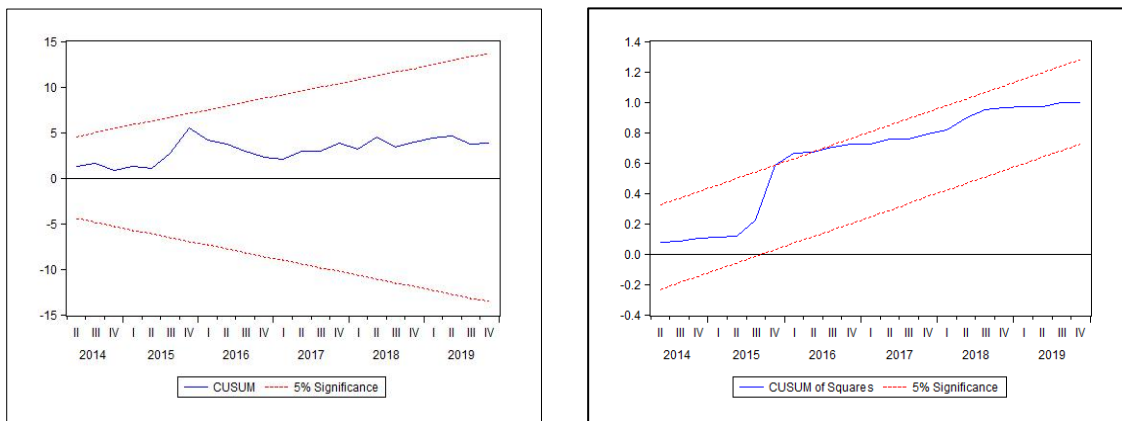


Figure.9 Stability Test Chart
Source : Output of Eviews 9.0

CONCLUSSION AND RECOMMENDATION

This study aims to see the dynamics of the relationship between the value of exports, inflation and economic growth, using the Autoregressive Distributed Lag (ARDL) approach. The research period is from 2011Q1 to 2019Q4. The Indonesian government is trying to take policies to achieve the target in the APBN, the Indonesian government must try to control inflation so that people's purchasing power is maintained, in addition the Government has taken steps to control imports, and stimulate exports by increasing industry and opening markets in other countries to reduce the deficit. export value.

Through the ARDL approach, in this study it is known that in the period 2011Q1 – 2019Q4 the movement of the export value variable and inflation has an effect on economic growth. The value of exports and inflation on economic growth are proven to have long-term cointegration or move together in the long run. The three research variables are also the dynamics of short-term relationships which have a fairly high speed of adjustment towards balance, up to 112.9% per quarter or 37.6% per month. If there is a shock in the value of exports and inflation, it will be adjusted in the next 2-3 months. Based on the results of this study, the government should be more careful in taking monetary policies to pursue and increase economic growth to a higher level. This study still has many limitations, so it is hoped that further research will add macroeconomic variables that are not used in this study.

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