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Long-Term Analysis of Import Export on Economic Growth in Indonesia(Error Correction Model Approach)

Nia Dewinta Kartika Puteri[1], Nunung Nurastuti Utami[2]
[1](STIE Malangkucecwara, Indonesia)
[2](STIE Malangkucecwara, Indonesia)
Corresponding Author; Nia Dewinta Kartika Puteri

Abstract:
Background*: International trade becomes the basic activity in which a country establishes economic relations with other countries. The fact stated that exports and imports a major part of the balance of payments in a country, so the existence of a long-term relationship between exports and imports desired by the countries and become the subject of intensive research in developed and developing countries. This study aims to determine the long-term effects of exports and imports on economic growth in Indonesia.*
Materials and Methods*: This research consists of secondary data in the form of time series data, starting from the period 1967-2018 (51 years). The method used is the cointegration method and the Error Correction Model (ECM) approach.*
Results*: The results in this study stated that the number of exports had a positive and significant effect on economic growth while the number of imports was negative and had significant effect on economic growth*
Conclusion:*In line with international trade theory, if the amount of goods or services exported abroad is increasing, the more goods and services that must be produced domestically, on the contrary the increase in imported goods will increase production goods from abroad, so that domestic productivity will decrease and will lower economic growth in the country.*
Key Word*: Ekspor, Impor, PDB, Cointegration, Error Correction Model.*

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I. Introduction

The cointegration relationship between exports and imports indicates the phenomenon of trade deficits that are only short-term. This means that a country will not face a balance of payments problem because there is a macroeconomic policy that is effectively able to create a long-term balance between exports and imports (Herzer and Nowak-Lehman, 2006). Exports and imports play an important role in each country. Monitoring the current account is very important especially when monitoring economic performance. Several studies were conducted to determine the relationship between imports and exports. Knowledge about the cointegration between exports and imports is one of the important methods in designing and evaluating macro policies in achieving trade balance targets (Arize, 2002). The researcher analyzes the long-term effect between exports and imports on economic growth in Indonesia using cointegration and error correction modeling techniques for the period 1967-2018.

II. Material And Methods

This prospective comparative study was carried out on exports, imports, and economic growth in Indonesia. Annual data for the periods between 1967 and 2018.A total 51data observationsin this study.
Study Design: This type of research is quantitative research that investigated the long-term relationship between exports and imports of Indonesian economy.
Study Location: All data set are taken from World Bank 2019.
Study Duration:annual time series of 1967 to 2018.
Sample size: 51data observations.
Sample size calculation: The population in this study is data exports of goods and services (current US $), imports of goods and services (current US $) and the GDP of Indonesia issued by the World Bank (World Bank). The sample observed in this study was 51 export and import data from 1967 to 2018.
Subjects & selection method: Data export of goods and services (current US $), imports of goods and services (current US $) and the GDP of Indonesia. The export and import functions are stated as follows:
GDPt = f (export, import)
This function is represented in a log-linear econometric format, so that:

$\log (PDB)t = \beta 0 + \beta 1 \log(export)t + \beta 2 \log(import)t + \varepsilon t$
where:
- $\beta 0$:Constant term- $\beta 2$: variable coefficient (import)
- $\beta 1$: variable coefficient (export) - t: time trend
- ε: The term random error is assumed to be normally distributed, identical and independent

Inclusion criteria:
1. Exports of Indonesian goods and services (current US $) 1967-2018
2. Imports of Indonesian goods and services (current US $) 1967-2018
3. Indonesian GDP 1967-2018

Exclusion criteria:
1. Data transformation (logarithmic transformation)
2. Unit root test
3. Test the degree of integration
4. Cointegration Test
5. Error Correction Model (ECM)
6. Test classic assumptions

Procedure methodology

Data transformation is changing the scale of the data into another form so that the data has the expected distribution. Each data is carried out the same mathematical operation on the original data. Logarithmic transformation, which operates the original data to form the logarithm. Used for data distributed with Positive Skewness and Unequal Variance.

The unit root test can be seen as a stationarity test. The test is intended to observe certain coefficients of the authoregressive model which are estimated to have a value of one or not. The step taken in testing is to estimate the authoritative model of each variable to be used in research, with OLS. The procedure that is often used is the Dickey-Fuller (DF) and Augmented Dickey-Fuller test (ADF).

The equation model is as follows:

$DYt = \alpha_0 + \alpha_1 BY_t + \sum_{i=1}^{k} bi\, B^1\, DY_t$

$DYt = c_0 + c_1 T + c_2 BY_t + \sum_{i=1}^{k} di\, B^1\, DY_t$

where:

Dy = Yt - Yt
BYt = Yt – 1
T = Time Trend
Yt = the variables observed in periods t and K, i.e. the amount of lag time are calculated by the formula K = N 1/3, where N is the number of samples

If the unit root test above the time series data observed is not stationary, then the next step is to test the degree of integration to find out at what degree of integration the data will be stationary.

The equation model is as follows:

$D2Yt = \beta_0 + \beta_1 BDY_t + \sum_{i=1}^{k} fiB^1\, D2Yt$

$DYt = d_0 + d_1 T + d_2 BDY_t + \sum_{i=1}^{k} hiB^1\, D2Yt$

where:

D2Yt = DYt – DYt-1
BDYt = DYt – 1

After the prerequisites of the cointegration test are carried out, it can be seen that the observed data is stationary at what degree. The cointegration test used is the Johansen Cointegration test. To get the Johansen value calculated, the data to be used must have been integrated to the same degree.

If it passes the cointegration test, it will then be tested by using a dynamic linear model to find out the possibility of structural changes, because the long-term equilibrium relationship between the independent variable and the dependent variable from the results of the cointegration test will not apply at any time.

The form of ECM is as follows:

(I-B)yt = g0 + g1 (1-B) xt + g2 (1-B) xt* + g3 (1-B) xt + g4 (1-B) xt*+ g5 B (xt + xt* - yt) + et
DYt = g0 + g1 Dxt + g2 Dxt* + g3 Bxt + g4 Bxt*+ g5 B ECT + et

After the above stages are carried out, the next step is to test classical assumptions, namely to find out whether there are any deviations from the classical assumptions from the results of the research in the regression equation which includes multicollinearity test, heteroscedasticity test and autocorrelation test

Statistical analysis

The Analysis Method uses Eviews 3.1, while the data analysis is carried out using the Error Correction Model (ECM) approach as an econometric calculation tool and also uses a descriptive analysis method aimed at identifying long-term relationships that occur due to the cointegration between research variables. Before carrying out ECM estimation and descriptive analysis, several stages must be carried out such as data transformation (logarithmic transformation), unit root test, integration test, cointegration test. After the data is estimated using ECM, the analysis can be done with a classic assumption test.

III. Result

Data Transformation (Lograrithmic Transformation)

Table no 1: Regresi Linier Berganda

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.62E+11	2.63E+11	0.614905	0.5415
EKSPOR	-9.89E+09	1.42E+10	-0.697552	0.4888
IMPOR	1.53E+10	2.28E+10	0.671584	0.5050
R-squared	0.010000	Mean dependent var		2.71E+11
Adjusted R-squared	-0.030408	S.D. dependent var		3.21E+11
S.E. of regression	3.26E+11	Akaike info criterion		55.91514
Sum squared resid	5.21E+24	Schwarz criterion		56.02771
Log likelihood	-1450.794	F-statistic		0.247481
Durbin-Watson stat	0.032898	Prob(F-statistic)		0.781735

Source: Eviews 3.1

The probability of multiple linear regression shows a number> 5% is 0.7817 so that the data can reach a significance value, then the model is made double log. The results are as follows:

Table no 2: Multiple Linear Regression in Logarithms

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	17.48206	3.372209	5.184155	0.0000
LOGEKSPOR	1.822938	1.149382	1.586015	0.1192
LOGIMPOR	0.705576	1.970961	0.357986	0.7219
R-squared	0.266801	Mean dependent var		25.52530
Adjusted R-squared	0.236874	S.D. dependent var		1.431032
S.E. of regression	1.250108	Akaike info criterion		3.340298
Sum squared resid	76.57569	Schwarz criterion		3.452869
Log likelihood	-83.84774	F-statistic		8.915202
Durbin-Watson stat	0.160175	Prob(F-statistic)		0.000499

Source: Eviews 3.1

In table 2, multiple linear regression transformations in the logarithm, showing a probability number <5% is 0.00499, the next step can be done.

Unit Root Test (unit root test)

Table no 3: LogEkspor Unit Root Test Dickey-Fuller 1st Difference.

ADF Test Statistic	-5.528607	1% Critical Value*	-3.5682
		5% Critical Value	-2.9215
		10% Critical Value	-2.5983

Source: Eviews 3.1

Table no 3:the critical value at α = 5% is -2.9215 which is smaller than the t-value of -5.528607, indicating that the data is stationary.

Table no 4: LogImportUnit Root Test Dickey-Fuller 1st Difference.

ADF Test Statistic	-6.923875	1% Critical Value*	-3.5682
		5% Critical Value	-2.9215
		10% Critical Value	-2.5983

Souce: Eviews 3.1

Table no 4: The critical value at α = 5% is -2.9215 which is smaller than the statistical value of ADF test statistic which is -6.923875, indicating that the data is stationary.

Table no 5: LogPDBUnit Root Test Dickey-Fuller 1st Difference.

ADF Test Statistic	-4.844173	1% Critical Value*	-3.5682
		5% Critical Value	-2.9215
		10% Critical Value	-2.5983

Souce: Eviews 3.1

Table no 5: The critical value at α = 5% is -2.9215 which is smaller than the statistical value of ADF test statistic which is -4.844173, indicating that the data is stationary.

Integration Test

Table no6: Integration Test

Variable	**Unit Root Test**					
	Level		1st Difference		2nd Difference	
	ADF	Prob	ADF	Prob	ADF	Prob
LogEkspor	-2.992203	0.004140	-5.528607	0.000000	-9.699205	0.000000
LogImpor	-2.617678	0.007255	-6.923875	0.000000	-10.19976	0.000000
LogPDB	-1.626371	0.215827	-4.844173	0.000001	-8.854495	0.000000

Table no 6: This test is carried out to determine at what degree of integration the data observed is stationary and in this study stationary data at the first degree (1st Difference).

Cointegration Test

Table no 7: Johansen Cointegration Test

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.337914	33.84691	29.68	35.65	None *
0.194105	13.22894	15.41	20.04	At most 1
0.047607	2.438862	3.76	6.65	At most 2

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Source: Eviews 3.1

Table no 7: "L.R. test indicates 1 cointegrating equation (s) at 5% significance level "which states there is cointegration at the 5% level.

Error Correction Term (ECT)

Table no 8: Error Correction Term (ECT)

ADF Test Statistic	-6.523216	1% Critical Value*	-3.5682
		5% Critical Value	-2.9215
		10% Critical Value	-2.5983

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ECT,2)
Method: Least Squares
Date: 12/03/19 Time: 11:08
Sample(adjusted): 1970 2018
Included observations: 49 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ECT(-1))	-1.505142	0.230736	-6.523216	0.0000
D(ECT(-1),2)	0.184332	0.144625	1.274550	0.2089
C	-0.116264	0.058901	-1.973906	0.0544

R-squared	0.649216	Mean dependent var	0.011271
Adjusted R-squared	0.633965	S.D. dependent var	0.642096
S.E. of regression	0.388474	Akaike info criterion	1.006087
Sum squared resid	6.941942	Schwarz criterion	1.121913
Log likelihood	-21.64914	F-statistic	42.56745
Durbin-Watson stat	1.951231	Prob(F-statistic)	0.000000

Source: Eviews 3.1

Table no 8: After testing the DF to test the residuals produced, it was found that the stationary results on the data level were seen from the t-statistically significant value at the critical value of 1% (Prob 0.000). Thus it can be said that the data is cointegrated.

Error Correction Model (ECM)

Table no 9: Error Correction Model Test (ECM)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.258075	0.511051	4.418491	0.0001
D(LOGEKSPOR)	0.060120	0.203159	0.295924	0.7686
D(LOGIMPOR)	-0.894829	0.267055	-3.350733	0.0016
BLOGEKSPOR	0.436559	0.166572	2.620843	0.0119
BLOGIMPOR	-0.924387	0.279950	-3.301970	0.0019
BECT	0.033341	0.017203	1.938113	0.0589

R-squared	0.436008	Mean dependent var	0.102241
Adjusted R-squared	0.373342	S.D. dependent var	0.178490
S.E. of regression	0.141295	Akaike info criterion	-0.965797
Sum squared resid	0.898398	Schwarz criterion	-0.738523
Log likelihood	30.62782	F-statistic	6.957676
Durbin-Watson stat	1.534778	Prob(F-statistic)	0.000069

Source: Eviews 3.1

Table no 9: Because the value of t on BECT (ECT-1) is significant at 10%, the model estimated 'TRUE'

Classic Assumption Test Results

Table no 10: Multicollinearity Test

	D(LOGPDB)	D(LOGEKSP	D(LOGIMPO	BLOGEKSP	BLOGIMPO	BECT
D(LOGPDB)	1.000000	-0.377363	-0.450141	-0.003381	-0.092519	0.283510
D(LOGEKSP	-0.377363	1.000000	0.696927	-0.433239	-0.359249	0.098520
D(LOGIMPO	-0.450141	0.696927	1.000000	-0.228894	-0.376541	-0.073508
BLOGEKSP	-0.003381	-0.433239	-0.228894	1.000000	0.891623	-0.205627
BLOGIMPO	-0.092519	-0.359249	-0.376541	0.891623	1.000000	-0.168146
BECT	0.283510	0.098520	-0.073508	-0.205627	-0.168146	1.000000

Source: Eviews 3.1

Table no 10: From the output above there are variables that have a value of more than 0.8 so that it can be concluded that multicollinearity occurs in the regression model

Table no 11: Heteroscedasticity Test

Dependent Variable: RESABS
Method: Least Squares
Date: 12/07/19 Time: 12:02
Sample(adjusted): 1968 2018
Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.086776	0.320432	0.270811	0.7878
D(LOGEKSPOR)	0.281043	0.127382	2.206301	0.0325
D(LOGIMPOR)	-0.101500	0.167445	-0.606169	0.5474
BLOGEKSPOR	0.103583	0.104442	0.991780	0.3266
BLOGIMPOR	-0.088670	0.175531	-0.505155	0.6159
BECT	0.002400	0.010786	0.222515	0.8249

R-squared	0.152814	Mean dependent var	0.097165
Adjusted R-squared	0.058682	S.D. dependent var	0.091313
S.E. of regression	0.088593	Akaike info criterion	-1.899395
Sum squared resid	0.353193	Schwarz criterion	-1.672122
Log likelihood	54.43458	F-statistic	1.623406
Durbin-Watson stat	1.532858	Prob(F-statistic)	0.173274

Source: Eviews 3.1

Table no 11: at the significance level $\alpha = 5\%$, the result is that the residual variant is homogeneous (there is no heteroscedasticity)

If the normality test shows that the one used in this study tends to be abnormal then the Central Limit Theorem assumption can be used is if the number of observations is large enough (n> 30), then the assumption of normality can be ignored (Gujarati, 2003).

IV. Discussion

Long-term Export effects = (koef BLogexport + BECT)/koef BECT
= (0.436559 + 0.033341)/ 0.033341
= 14.093758

That is, in the long run one unit increase in exports will raise GDP by 14.093758. in line with international trade theory, if the number of goods or services exported abroad is increasing, the more goods and services must be produced domestically.

Long-term Imports effects = (koef BLogimport + BECT)/koef BECT
= (-0.924387 + 0.033341)/ 0.033341
= -26.725023

It means, in the long run, increasing one unit of imports will reduce GDP by -26.725023. The number of imports has significant effect on economic growth. The increase in imported goods will increase production goods from abroad, so that domestic productivity will decrease and will reduce domestic economic growth.

V. Conclusion

The amount of exports has a positive and significant effect on economic growth. This is in line with the theory of international trade, if the number of goods or services exported abroad is increasing, the more goods and services must be produced domestically. Conversely, the number of imports is negative and have a significant effect on economic growth. The increase in imported goods will increase production goods from abroad, so that domestic productivity will decrease and will reduce domestic economic growth.

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