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

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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.

Date of Submission: 08-01-2020  
Date of Acceptance: 23-01-2020

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 51 data observations in 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: 51 data 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:

DOI: 10.9790/5933-1101021015  
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Long-term Analysis of Import Exports on Economic Growth in Indonesia (ECM) (11 Italic)

\[ \log (PDB)_t = \beta_0 + \beta_1 \log(\text{export})_t + \beta_2 \log(\text{import})_t + \epsilon_t \]

where:
- \( \beta_0 \): Constant term
- \( \beta_1 \): variable coefficient (import)
- \( \beta_2 \): variable coefficient (export)
- \( t \): time trend
- \( \epsilon \): 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 autoregressive 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:

\[ DY_t = \alpha_0 + \alpha_1 BY_t + \sum_{i=1}^{k} b_i B^i DY_t \]

\[ D^2Y_t = \beta_0 + \beta_1 BDSY_t + \sum_{i=1}^{k} d_i B^i D^2Y_t \]

where:
- \( Dy \) = \( Y_t - Y_{t-1} \)
- \( BY_t \) = \( Y_t - Y_{t-1} \)
- \( T \) = Time Trend
- \( Y_t \) = 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:

\[ D2Y_t = \beta_0 + \beta_1 BDSY_t + \sum_{i=1}^{k} d_i B^i D^2Y_t \]

\[ DY_t = \alpha_0 + \alpha_1 D_{BY_t} + \sum_{i=1}^{k} c_i B^i DY_t \]

where:
- \( D2Y_t \) = \( DY_t - DY_{t-1} \)
- \( BDSY_t \) = \( DY_t - 1 \)

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:

\[ (I-B)yt = g_0 + g_1 (1-B) xt + g_2 (1-B) xt^* + g_3 (1-B) xt + g_4 (1-B) xt^* + g_5 B (xt + xt^* - yt) + et \]

\[ DY_t = g_0 + g_1 Dxt + g_2 Dxt^* + g_3 Bxt + g_4 Bxt^* + g_5 B ECT + et \]

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 (Logarithmic Transformation)

**Table no 1:** Regresi Linier Berganda

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.62E+11</td>
<td>2.6E+11</td>
<td>0.614565</td>
<td>0.5415</td>
</tr>
<tr>
<td>EKSPOR</td>
<td>9.98E+09</td>
<td>1.42E+10</td>
<td>-0.6975562</td>
<td>0.4888</td>
</tr>
<tr>
<td>IMPOR</td>
<td>1.53E+10</td>
<td>2.26E+10</td>
<td>0.671564</td>
<td>0.5050</td>
</tr>
</tbody>
</table>

R-squared: 0.610000
Adjusted R-squared: 0.630498
S.E. of regression: 3.20E+11
Sum squared resid: 5.21E+24
Log likelihood: -1450.794
Durbin-Watson stat: 0.652989

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>17.48296</td>
<td>3.732205</td>
<td>5.164155</td>
<td>0.0000</td>
</tr>
<tr>
<td>LOGEKSPOR</td>
<td>1.022938</td>
<td>1.143382</td>
<td>0.556015</td>
<td>0.1192</td>
</tr>
<tr>
<td>LOGIMPOR</td>
<td>0.706676</td>
<td>1.970981</td>
<td>0.357964</td>
<td>0.7219</td>
</tr>
</tbody>
</table>

R-squared: 0.256891
Adjusted R-squared: 0.236874
S.E. of regression: 1.430322
Sum squared resid: 76.57569
Log likelihood: -61.84174
Durbin-Watson stat: 0.169175

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

<table>
<thead>
<tr>
<th>ADF Test Statistic</th>
<th>1% Critical Value*</th>
<th>5% Critical Value</th>
<th>10% Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5.528607</td>
<td>-3.5582</td>
<td>-2.9215</td>
<td>-2.5938</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>ADF Test Statistic</th>
<th>1% Critical Value*</th>
<th>5% Critical Value</th>
<th>10% Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>-6.923875</td>
<td>-3.5582</td>
<td>-2.9215</td>
<td>-2.5938</td>
</tr>
</tbody>
</table>

Source: 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: LogPDB Unit Root Test Dickey-Fuller 1st Difference.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unit Root Test</th>
<th>1st Difference</th>
<th>2nd Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ADF Test Statistic</td>
<td>1% Critical Value</td>
<td>5% Critical Value</td>
</tr>
<tr>
<td>LogEkspor</td>
<td>-2.992203</td>
<td>0.004140</td>
<td>-5.528607</td>
</tr>
<tr>
<td>LogImpor</td>
<td>-2.617678</td>
<td>0.007255</td>
<td>-6.923875</td>
</tr>
<tr>
<td>LogPDB</td>
<td>-1.626371</td>
<td>0.215827</td>
<td>-4.844173</td>
</tr>
</tbody>
</table>

Source: 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 no 6: Integration Test

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unit Root Test</th>
<th>1st Difference</th>
<th>2nd Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ADF Test Statistic</td>
<td>1% Critical Value</td>
<td>5% Critical Value</td>
</tr>
<tr>
<td>LogEkspor</td>
<td>-2.992203</td>
<td>0.004140</td>
<td>-5.528607</td>
</tr>
<tr>
<td>LogImpor</td>
<td>-2.617678</td>
<td>0.007255</td>
<td>-6.923875</td>
</tr>
<tr>
<td>LogPDB</td>
<td>-1.626371</td>
<td>0.215827</td>
<td>-4.844173</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Eigenvalue</th>
<th>Likelihood Ratio</th>
<th>5 Percent Critical Value</th>
<th>1 Percent Critical Value</th>
<th>Hypothesized No. of CE(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.337914</td>
<td>33.84691</td>
<td>29.68</td>
<td>35.65</td>
<td>None</td>
</tr>
<tr>
<td>0.194105</td>
<td>13.22894</td>
<td>15.41</td>
<td>20.04</td>
<td>At most 1</td>
</tr>
<tr>
<td>0.047607</td>
<td>2.438626</td>
<td>3.76</td>
<td>6.65</td>
<td>At most 2</td>
</tr>
</tbody>
</table>

*(*) denotes rejection of the hypothesis at 5% (1%) significance level. 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)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(ECT(1))</td>
<td>-1.565142</td>
<td>0.239736</td>
<td>-6.523216</td>
<td>0.0000</td>
</tr>
<tr>
<td>D(ECT(1),2)</td>
<td>0.184332</td>
<td>0.184625</td>
<td>1.27456</td>
<td>0.2089</td>
</tr>
</tbody>
</table>

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.
Long-term Analysis of Import Exports on Economic Growth in Indonesia (ECM)

Error Correction Model (ECM)

Table no 9: Error Correction Model Test (ECM)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>2.58875</td>
<td>0.511051</td>
<td>4.148491</td>
<td>0.0001</td>
</tr>
<tr>
<td>LOGIMPORT</td>
<td>0.060120</td>
<td>0.020159</td>
<td>0.299524</td>
<td>0.7686</td>
</tr>
<tr>
<td>LOGEXPORT</td>
<td>-0.398429</td>
<td>0.267055</td>
<td>-0.350733</td>
<td>0.0016</td>
</tr>
<tr>
<td>LOGKSP</td>
<td>0.068359</td>
<td>0.016659</td>
<td>2.620843</td>
<td>0.0119</td>
</tr>
<tr>
<td>LOGIMPOR</td>
<td>-0.293487</td>
<td>0.279950</td>
<td>-0.301970</td>
<td>0.0019</td>
</tr>
<tr>
<td>BECT</td>
<td>0.003341</td>
<td>0.017723</td>
<td>0.193113</td>
<td>0.0589</td>
</tr>
</tbody>
</table>

R-squared: 0.463068
Adjusted R-squared: 0.373342
S.E. of regression: 0.142925
Sum squared resid: 0.893938
Log likelihood: 30.62782
Durbin-Watson stat: 1.534778

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>DLOGGDPB</th>
<th>DLOGKSP</th>
<th>DLOGIMPO</th>
<th>BLOGKSP</th>
<th>BLOGIMPOR</th>
<th>BECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLOGGDPB</td>
<td>1.00000</td>
<td>-0.377363</td>
<td>-0.450141</td>
<td>-0.003381</td>
<td>-0.092519</td>
<td>0.283510</td>
</tr>
<tr>
<td>DLOGKSP</td>
<td>-0.377363</td>
<td>1.00000</td>
<td>0.696627</td>
<td>-0.433239</td>
<td>-0.359249</td>
<td>0.998520</td>
</tr>
<tr>
<td>DLOGIMPOR</td>
<td>-0.450141</td>
<td>0.696627</td>
<td>1.00000</td>
<td>-0.228984</td>
<td>-0.376541</td>
<td>-0.975608</td>
</tr>
<tr>
<td>BLOGKSP</td>
<td>-0.003381</td>
<td>-0.433239</td>
<td>-0.228984</td>
<td>1.000000</td>
<td>0.931623</td>
<td>-0.295627</td>
</tr>
<tr>
<td>BLOGIMPOR</td>
<td>-0.092519</td>
<td>-0.359249</td>
<td>-0.376541</td>
<td>0.931623</td>
<td>1.000000</td>
<td>-0.168146</td>
</tr>
<tr>
<td>BECT</td>
<td>0.283510</td>
<td>0.696627</td>
<td>0.228984</td>
<td>-0.295627</td>
<td>-0.168146</td>
<td>1.000000</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.085776</td>
<td>0.326432</td>
<td>0.270811</td>
<td>0.7878</td>
</tr>
<tr>
<td>DLOGGDPB</td>
<td>0.281043</td>
<td>0.127332</td>
<td>2.263501</td>
<td>0.0235</td>
</tr>
<tr>
<td>DLOGKSP</td>
<td>-0.101667</td>
<td>0.187446</td>
<td>-0.540639</td>
<td>0.5874</td>
</tr>
<tr>
<td>DLOGIMPO</td>
<td>0.103583</td>
<td>0.194442</td>
<td>0.919690</td>
<td>0.3666</td>
</tr>
<tr>
<td>BLOGKSP</td>
<td>-0.086670</td>
<td>0.176531</td>
<td>-0.505555</td>
<td>0.6459</td>
</tr>
<tr>
<td>BLOGIMPOR</td>
<td>0.023400</td>
<td>0.016736</td>
<td>0.222515</td>
<td>0.8249</td>
</tr>
<tr>
<td>BECT</td>
<td>1.052814</td>
<td>0.057965</td>
<td>0.091313</td>
<td>0.9131</td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>0.888153</td>
<td>0.888153</td>
<td>1.000000</td>
<td>0.30995</td>
</tr>
<tr>
<td>Sum squared resid</td>
<td>0.353193</td>
<td>0.353193</td>
<td>1.000000</td>
<td>0.353193</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>6.434658</td>
<td>6.434658</td>
<td>1.000000</td>
<td>6.434658</td>
</tr>
<tr>
<td>Durbin-Watson stat</td>
<td>1.532958</td>
<td>1.532958</td>
<td>0.09724</td>
<td>1.532958</td>
</tr>
</tbody>
</table>

R-squared: 0.152814
Adjusted R-squared: 0.057965
S.E. of regression: 0.888153
Sum squared resid: 0.353193
Log likelihood: 6.434658
Durbin-Watson stat: 1.532958

Source: Eviews 3.1

Table no 11: at the significance level α = 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 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 = \((\text{koef } B \text{Logimport } + \text{BECT})/\text{koef BECT}\)

\[
= (-0.924387 + 0.033341)/ 0.033341
= -26.725023
\]

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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