



# AICEDC

*4<sup>th</sup> Annual International Conference on Economic  
in Developing Countries*

*“Economy for Sustainable Development”*

October 5<sup>th</sup> - 6<sup>th</sup> 2018

# PROCEEDINGS



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# Relationship of International Trade and Energy Consumption to Economic Growth in Indonesia 1980 – 2014

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## Abstract

International trade and energy consumption are factors that can increase economic growth. Indonesia's exports decreased while Indonesian imports increased. In addition, Indonesia's primary energy consumption is increasing every year causing the availability of primary energy to decline. The purpose of the research is to know the relationship between exports and energy consumption to Indonesia's economic growth in the long term and short term. This research use Error Correction Model (ECM) with period 1980 to 2014. The result of this research is that export has a significant positive relationship to economic growth on long-term and short-term. Energy consumption has a significant positive relationship to economic growth on long-term and short-term.

*Keywords: Export, Energy Consumption, Error Correction Model (ECM)*

## 1. Introduction

Economic growth indicates the successful country development. According to Kuznetz, country development is defined as the capacity increasing at the long term periode of a country to provide various economic things (Todaro and Smith, 2004:99). The economic growth improvement will also improve the society's life. However, not all country are able to fulfill their societies' needs that they need an assist from other countries in the form of international trade.

Haberler (in Jhingan, 2014:447) said that international trade provides significant contribution for country development in the future and the good or deviated free trade was the best policy considered from the economic development point of view. In line with the statement, trade can be the main activator and contributor in improving economic growth (Awokuse, 2005; Halicioglu, 2009; Gries dan Redlin, 2012). Haberler's statement was argued by several economic experts, one of them was Myrdal (in Jhingan, 2014:450), the impact of international trade between two countries was the beginning of poverty accumulation and country's stagnation called retardation. International trade is the export and import activities, because both activities are the cores of the international trade (Ningsih, no year).

Indonesia performs international trade as the result of implementing the open trade system. The oil and nature gas and other commodities are exported and imported based the needs of Indonesian society's needs. However the export proportion on Indonesia's GDP tends to increase. The 1998 and 2008 economy crisis phenomena had an impact on Indonesia's trade.

Other factor that can affect the economic growth is consumption (Kuncoro, 2003:26). Economic growth did not include energy as variable, but energy is important in the modern economic activity to improve the growth. The country's economic growth is inline with the societies' income that the demand on energy will also increase. Energy consumption takes a role in a country such as country's revenue source, industrial fuel and material, economic activity driver (TD, 2009). The energy consumption may be used as the economic growth stimulus (Chebbi 2009 and Ozturk, 2010).

During 1980 until 2014, the energy consumption in Indonesia tend to increase. In 1980, the energy consumption in Indonesia was 377 kg, and the significant increase on energy consumption was 543 kg in 1990. In 2014, the energy consumption was 883 KG. Energy consumption affects the economic growth, however, the constant increase on the energy consumption has negative impact such as increasing the carbondioxides which can damage the ozon layer and environment. (Kazman and Duman, 2014). Industrial, transportation, and electricity are the sectors that caused global warming as the result of primary energy consumption (World Bank, 2017).

International trade and energy consumption in Indonesia affect the internal economic growth. The economic growth of Indonesia tend to be fluctuative as the result of economic crisi in 1998 and monetary crisis in 2008.

International trade is one of factors in increasing the economic growth, however the export sector that was expected to support the economic growth tend to decrease while the import tend to increase as the result of various phenomena that caused the trade balance deficiency in Indonesia. Meanwhile, the main problem of the energy sector in Indonesia is the efficiency because the energy consumption in Indonesia was considered as wasteful (Sekretariat Jendral Dewan Energi Nasional, 2014: 2).

Various opinions from several theories, empirical studies, and phenomena in Indonesia such as export, energy consumption, and economic growth attract the writer on the relation of export and energy consumption on the economic growth of Indonesia.

## 2. Method

### Research Type

The research approach in this study is the quantitative research. According to Arikunto (2006:12), the quantitative research tend to use numbers, started from data collection, data interpretation, and result interpretation. An opinion from Nasution (2008:4) stated that the quantitative research showed the relation of variables and providing the clear description based on the current situation with the descriptive method.

### Research Location and Time

This research was conducted in Indonesia. The research data used were the 1980 until 2014 in the form of annual data.

### Data Type and Source

The data source in this research was the secondary data. Secondary data was data that indirectly gave data to the data collector (Sugiyono, 2008:402). The secondary data used in this research is in the form of times series from the World Bank.

### Model Specification

The model formation of export and energy consumption relation on economic growth was modified from Ginting's research (2017). Economic growth is a dependent variable while export and energy consumption are independent. The model used was:

$$GDP = f(\text{Export}, \text{Energy}) \quad (1)$$

The mathematic model (1) above was changed into the econometrics model, would be:

$$GDP_t = \beta_0 + \beta_1 \text{EXPORT}_t + \beta_2 \text{ENERGY}_t + e \quad (2)$$

Where GDP was Gross Domestic Product (%), EXPORT was the total export (Million US\$), ENERGY was primary energy consumption (kg),  $\beta_0$  was constanta,  $\beta_1$ ,  $\beta_2$ , were coefficients, and e was error term.



**Data Analysis Method**

ECM method was one of methods applied in the time series research to see the dynamic motion in short-term, that will also showed the relation among variables in the short-term. The long-term time series can be proved through cointegration regression or the existance of relation in the long-term. However, in the short term, the time series model did not reach the balance as the result of error term ( $\epsilon_t$ ). There were several stages in performing estimation by using ECM model such as Data Stationarity Test, Integration Degree Test, Cointegration Test, Estimation with ECM Model, and Classical Assumption Test.

The basic model of ECM are:

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 EC_t + e_t \tag{3}$$

$$EC_t = (Y_{t-1} - \beta_0 - \beta_1 X_{t-1})$$

The short term ECM model equation is:

$$\Delta GDP_t = \beta_0 + \beta_1 EKSPOR_t + \beta_2 ENERGI_t + ECT_{t-1} \tag{4}$$

The long term ECM model equation is:

$$\Delta GDP_t = \beta_0 + \beta_1 EKSPOR_t + \beta_2 ENERGI_t \tag{5}$$

**3. Result and Discussion**

**Data Analysis Result**

1. Stationarity Test

Stationarity test or test of unit roots was the first step before estimating the time series data model. Stationarity test was used to test the variable stationarity in a research. The stationarity test in this research used Augmented Dicky Fuller (ADF) method by comparing the ADF probability value with the determined  $\alpha$  (alpha) in the research.

**Table 1. Stationarity Test Result**

Indonesia	Prob. GDP	Prob. Export	Prob. Energy
Level	1,0000	0,9959	0,8417
1st	0,0289	0,0000	0,0000
2nd	0,0000	0,0000	0,0000

Table 1 described the data used in this research were generally stationary at the level 1st difference. The energy consumption variable was not stationary at the level stage which could be seen from its probability value of 0,8417 which was higher than the  $\alpha$  (5% = 0,05). Then the economic growth variable was not stationary at the level stage because the probability value was 1,0000, which was higher than  $\alpha$  value (5%). Besides, the international trade variable was not stationary at the level stage because the probability value was 0,9959 higher than  $\alpha$  (5%).

Therefore, the stationarity test was descended to the 1st difference level that the three variables which included economic growth, international trade, and energy consumption had probability value lower than 0,05 such as the economic growth probability was 0,0289, the international trade probability was 0,000, and the energy consumption probability was 0,000. This result indicated that the three stationary data were at level 1st difference and the next ECM step could be performed.



## 2. Cointegration Test

If all data has been stationary, then the next step in ECM estimation is the cointegration test to determine the existence of long term relation among variables. ECT was defined as the residual of simple linear regression equation between  $Y_t$  and  $X_t$ , that  $ect = Y_t - \alpha - \beta X_t$ . If there was a cointegration, then there will not be a false regression problem and ECT will put the short term relation of  $Y_t$  and  $X_t$  in balance state by using the residual of the long term relation. Besides, in the cointegration condition, then the regression equation  $Y_t = \alpha + \beta X_t + ECT$ , the cointegration regression equation and parameter  $\beta$  could be interpreted as long-run multiplier which measured the long term effect permanently from  $X_t$  on  $Y_t$ .

Cointegration test had two steps, first, by performing dependent and independent variables equation regression with OLS (Ordinary Least Square) estimation method. Second, obtaining long term ECM estimation result from the OLS estimation result. Besides, there would be residual which would be used for the cointegration test.

**Table 2. Cointegration Test Result**

Variable	ADF	Mac Kinnon Critical value			Proba.s ADF
		1%	5%	10%	
ECT	-4,40	-3,63	-2,95	2,62	0,0013

Table 2 explained residual had ADF statistic value of 4,405777 higher than the ADF critical value of 1%, 5%, and 10%. The ADF probability value from ECT was 0,0013 lower than  $\alpha$  (5%) that it could be stated that ECT was stationary. So the ECT variable can be used in the short term ECM estimation and it can be stated that there was a long term relation among variables in the research.

## 3. Long Term ECM Estimation Result

**Table 3. Long Term Error Correction Model Estimation Result**

	C	Export <sub>t</sub>	Energy <sub>t</sub>
Coefficient	7.650.000.000	2,85	2.600.000.000
t-Statistic	0,308840	16,33	4,266990
Prob.	0,7594x	0,0000*	0,0002*
R-Square	0,986056		
Prob. F Statistic	0,000000		

\*) significant on  $\alpha=5\%$ , x) insignificant on  $\alpha=5\%$ ,

The result showed the R-Square value was 0,986056 with  $\alpha$  (5%) which means the accuration level of this research is 0,986% while the rest 2% were affected by other variable outside the model. Constanta had a long term and insignificant relation on economic growth, which can be seen from the C probability value of 0,7594 higher than  $\alpha$  (5%).

International trade had a long term and significant relation on economic growth in Indonesia which was proved by the EXPORT probability value of 0,0000 lower than  $\alpha$  (5%). International trade had positive effect on economic growth which was proved by the coefficient value of 2,853191. When the international trade increase US\$ 1, it will increase US\$ 2,85391 for the economic growth in Indonesia.

Energy consumption had a significant relation with economic growth in Indonesia in the long term which can be seen from the ENERGY probability value of 0,0002 lower than  $\alpha$  (5%), energy consumption had a positive effect on economic growth in Indonesia with coefficient value of 2.600.000.000, which means that when there was an increase in energy consumption of 1 kg equal to oil will increase US\$ 2.600.000.000 for economic growth in Indonesia.

The independent variables in this research, the international trade and energy consumption may simultaneously affect the economic growth in Indonesia in the long term which can be seen from the F-Statistic probability value of 0,0000.

#### 4. Short Term Estimation Result

**Table 4. Short Term Error Correction Model Estimation**

	<b>C</b>	<b>Export<sub>t</sub></b>	<b>Energy<sub>t</sub></b>	<b>ECT<sub>t-1</sub></b>
<b>Coefficient</b>	<b>10.800.000.000</b>	<b>1,070548</b>	<b>337.000.000</b>	<b>-0,37</b>
t-Statistic	2,253292	-2,821331	2,34	-2,13
Prob.	0,0317*	0,0063*	0,0261*	0,04*
R-Square	0,254146			
Prob. F Statistic	0,030129			

\*) significant on  $\alpha=5\%$

The test result showed R-Square value was only 0,251969 with  $\alpha$  (5%) which means the accuracy level of this research is 25% while the 75% affect by other variables outside the model. The constanta had a sort term and significant relation on the economic growth in Indonesia which was proved by the EXPORT probability value of 0,0063 lower than  $\alpha$  (5%). The international trade had a positive effect on economic growth which was proved by the coefficient value of 1,070548, means when the international trade increase by US\$ 1 will increase US\$ 1,070548 for the economic growth in Indonesia.

Energy consumption had a significant relation with economic growth in Indonesia in the short term which can be seen from the ENERGY probability value of 0,0261 higher than  $\alpha$  (5%). Energy consumption had a positive effect on economic growth in Indonesia with coefficient value of 377.000.000, means when the energy consumption increase by 1kg equal to oil will increase US\$ 377.000.000 for the economic growth in Indonesia.

International trade and energy consumption simultaneously affect the economic growth of Indonesia in the short term which can be seen from the F-Statistic probability value of 0,030129. On the short term ECM estimation there was the ECT value which showed the speed of the balance in the long term. The ECT negative value explained that last year's disequilibrium has been corrected at the current year and shows the balance in the long term. That the ECT value (-1) of -0,368044 explained that the speed to re-reach the long term was 37% which is considered as slow.

## Discussion

### 1. The relation between Export and Economic Growth

The estimation result using Error Correlation Model (ECM) showed that export had positive effect on economic growth of Indonesia in the long term and short term. Indonesian Trade was suitable with the production factor proportion theory, where Indonesia which has a great number of workers will be specialized in producing labor intensive goods to be exported to the needing country to increase Indonesia's foreign exchange or generally called Labor Intensity.

The research result by using ECM showed that export has significant effect on economic growth of Indonesia. The result was in line with the research of Ginting (2017) stated that there was a positive effect of export on the economic growth of Indonesia during the Quartal 1 2001 until Quartal 4 2015 in the long and short term that support the ELG hypothesis. Rahmaddi and Ichihashi (2011) who researched the export and economic growth of Indonesia year 1971 until 2008 by using VAR found that there was a relation between export and economic growth in the long and short term that support the long term ELG hypothesis.

This research result was different with Mustika et al (2015) research that export had no significant effect on economic growth of Indonesia because export considered to have small contribution on the economic growth. This was because Indonesia still exported the primary industrial commodities with low productivity value and the commodity produced was from imported capital goods that insignificantly affect the economy. The country economic change and social factors may caused export affect negatively on the economic growth (Gibba and Molnar, 2016).

Based on the research result, export was considered as the economic growth activator in Indonesia because it can increase national income. However government of Indonesia should keep maintaining the export condition, because based on Alhayat and Muslim (2016) projection, the export growth of Indonesia in 2019 will only be 1,56%, while the import growth is projected to be 7,8% in 2019 will trigger Indonesian trade balance deficiency.

## 2. The relation between Energy Consumption and Economic Growth

The estimation result by using Error Correction Model (ECM) showed that energy consumption had a positive effect on economic growth of Indonesia in the long and short term. The research result was in line with the research of Adyajel (no Year), which stated that there was an effect of energy consumption on economic growth in Indonesia. Belke (2010) who researched the energy consumption on economic growth in 25 OECD countries also found the relation between energy consumption on economic growth in the long term. The research result was different with Noor and Siddiqi (2010) who said that energy consumption had a negative effect on the GDP of five Asian countries (Pakistan, Bangladesh, Nepal, Sri Lanka, and India).

Based on the research result, the energy consumption was one of factors to increase economic growth of Indonesia because it can increase the national income. Khan and Qayyum (2006) said that energy consumption had a vital role in accelerating the country's economic activities. According to Kabede et al (2010) and Sekretariat Jendral Dewan Energi Nasional (2016:6) energy consumption can be affected by the number of residents, when the number of resident increase, the energy consumption will also increase each year that will affect the economic growth of Indonesia.

## 4. Conclusion

This research concluded that export had positive significant effect on economic growth of Indonesia in the long and short term. Energy consumption had positive significant effect on economic growth of Indonesia in the long and short term. Some suggestions which can be applied by Indonesian Government are:

1. Improving export performance especially strengthen offers, such as strengthen the commodities competitiveness, developing infrastructures, conducting research and developing potential product to create an innovation for Indonesian exports.
2. Government of Indonesia may try to find a renewable energy and energy conservation that the energy consumption keep contributing for the economic growth.
- 3.



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