

THE GRAVITY MODEL OF INDONESIAN BILATERAL TRADE

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Abstract

This study aims to examine the trade of Indonesia with 10 top export partner using the gravity model of trade. The panel regression analysis with fixed effect model was conducted in order to acknowledge the relationship among the variables Constant Gross Domestic Product, Per Capita Gross Domestic Product, transportation cost, and Real Effective Exchange Rate on export of Indonesia with 10 partners. This study used secondary data with panel regression analysis and research instruments which tested using chow test, hausman test and classical assumption test. The panel regression result showed that simultaneously and partially Constant Gross Domestic Product, Per Capita Gross Domestic Product, transportation cost and Real Effective Exchange Rate had significant effect on export of Indonesia.

Keywords: gravity model, export

1. BACKGROUND

Export in a country is one of variable that shows how strong the country position on international trade between countries. Saimul (2013) explained that export is also important for a country because export is an engine for growth. Several important of export for country as stated by Saimul (2013), first, exports lead to the utilization of the full resources for a country's comparative advantage. Second, export is one of the keys to expand the domestic market and the international market. Third, exports are the keys to develop new ideas and new technologies. Fourth, exports encourage the flow of capital from developed countries to developing countries. Fifth, export is an effective way to eliminate monopoly behavior. Lastly, export will increase foreign exchange to allow the import of capital good. Further, Chintia (2008) explained that exports can generate exchange that can be used to finance imports and finance the construction sectors in a country.

Indonesia's export trade plays an important role in the success of Indonesia's economy. Export of Indonesia (2003-2013) had increased by an average of 10% annually. Export in 2003 valued at US\$6.10 billion. It inclined in 2004 to US\$7.15 billion to US\$13.7 billion in 2008. When the economic crisis came, the export of Indonesia decreased to US\$11.6 billion but a year after it climbed again into US\$15.7 billion in 2010 respectively. In 2013, total export amounted to US\$16.98 billion. The high of role of exports to Indonesia, also can be shown from effort export to GDP of Indonesia. Based on World Bank data (2014), the consumption component of GDP has the biggest contribution which is around 60% each year, followed by export which is around 25% on second position and investment on third position in 2003-2013.

The strength of Indonesia's exports is supported by its export partners. In fact, Indonesia has improved cooperation with other countries since the 1980s to the present and it has increased the levels of trust with export partners, developing good relationships with partner countries. The export market has been growing not only in Asia, but also in Africa, Europe and America. The main destinations for exports of Indonesia are Japan, China, India, Korea, Malaysia, Netherland, Philippines, Singapore, United States and Thailand. In order to fulfill the potential partner for Indonesia export, estimate potential market for export were investigated. By knowing the potential partner, the number of export can be predicted to anticipate the sustainability of export. In order to find out potential partner for Indonesia, this study using gravity model to analyze the trade potential of Indonesia with its major partners.

2. THE GRAVITY MODEL

The gravity model states that the bilateral trade flows are positively related to the product of the two countries' economic sizes and negatively related to the distance between them. The simplest version of the gravity model takes the following form Deardoff (1998).

$$T_{ij} = A \cdot \left(\frac{Y_i Y_j}{D_{ij}} \right)$$

T_{ij} = bilateral trade flows (=exports+ imports) between country i and j

Y_i = GDP of country i

Y_j = GDP of country j

D_{ij} = distance between country i and j

A = constant of proportionality

The gravity model is an empirical model widely used in the research of international trade and become more popular as a method for analyze decision of economic integration. Some issues about economic

integration also can be identified by using gravity model. The model was inspired by Newton's "Law of Universal Gravitation", which explains the attractive force between countries: the international trade flows between countries. Chaney (2011) believed that the trade flow between two countries is determined by the economies of scale and the distance between two countries. The trade flow should be positively related to the economy of scales, which can be measured by the GDP or GDP per capita. Also, it is negatively related to the distance between the two countries.

Gravity model has been used in some studies about international trade especially for export in many countries. Syahnaz (2007) has done a research to explain the effect of Indonesia's trade structure for bilateral trade flow. Using data on 21 biggest trade partner of Indonesia, it could be found that gravity model can explain bilateral trade of Indonesia because GDP and distance has significant effect to Indonesia's bilateral trade flow. Sekarini (2007) used gravity model to explain potential trade of Indonesia's trade with 10 biggest partner of Indonesia. Sekarini found that GDP and openness index has significant effect to Indonesia's trade but distance has no effect to influence Indonesia's trade. This study has same result with Yuniarti (2007) and Telaumbanua (2007) which states that distance has no effect for North Sumatra's and Indonesia's export.

3. METHODS AND MATERIALS

Based on characteristics of the problem that will be examined, the type of research is quantitative using panel regression model. The variables used in this research are Constant Gross Domestic Product (CGDP), Per Capita Gross Domestic Product (PGDP), Transportation cost (TCOST) and Real Effective Exchange Rate (REER). Meanwhile, the 10 partner of Indonesia trade are China, India, Japan, Korea, Malaysia, Netherland, Philipine, Singapore, Thailand and United States.

Table 1. The Definition of Variables

No	Variables	Definition
1	Export Value	Export value is the current value of exports (f.o.b) converted to U.S dollars and expressed as a percentage of the average for the base period (2000)
2	Constant Gross Domestic Product	Constant of GDP serves as a proxy for the two countries' economic size, both in terms of production capacity and size of the market
3	Per capita Gross Domestic Product	Per capita GDP is the result of Gross Domestic Product in a country divided by the population of that country.
4	Transportation Cost	The distance variable in this study is economic distance between Indonesia and its trading partner. Economic distance is geographic

		distance between countries and put GDP of partner (Li et al., 2008). The formula is: $Economic\ Distance = Geographic\ distance \times \frac{(\sum GDP_j)}{GDP_i}$
5	Real Effective Exchange Rate	REER indicates the purchasing power of domestic output by trading partners. $REER_t = NEER_t \frac{CPI_t^{foreign}}{CPI_t^{domestic}}$

Source: Data processed, 2015

The general panel regression model of analysis is given as:

$$E_{ijt} = \beta_0 + \beta_1(CGDP_{it}) + \beta_2(PGDP_{it}) + \beta_3(TCOST_{it}) + \beta_4(REER_{it}) + \varepsilon_{ijt}$$

where:

E_{ijt} : Export value country i to country j in year t

$CGDP_{it}$: Gross Domestic Product constant country i in year t

$PGDP_{it}$: Gross Domestic Product per capita country i in year t

$TCOST_{it}$: Transportation cost from country i to country j

$REER_{it}$: Real Effective Exchange Rate country i in year t

β_0 : Constanta;

β_n : Regression coefficient;

ε_{ijt} : Error.

4. FINDING AND DISCUSSIONS

The study aims to examine and analyze the trade of Indonesia with 10 top export partner using the gravity model of trade based on panel regression model. The step of estimation is begin with using chow test to check whether pooled OLS or fixed effect as the fit model. Then, it is followed with hausman test to check the appropriate model based on fixed and random effects model.

The result for chow test in Table 2 shows that rejecting the null hypothesis means the fixed effect model can better explain the model compared to pooled least square because the probability is accepted at 95% level of confidence. It indicates that fixed effect is more compatible than pooled model.

Table 2. Chow Test Result

<i>Effects Test</i>	<i>Statistics</i>	<i>d.f.</i>	<i>Prob.</i>
<i>Cross-section F</i>	58.463464	(9,96)	0.0000

Source: Data processed, 2015

Since the conclusion of the first test shows that fixed effects as the best model compare to pooled, then the procedure is continuing. The second test is checking the hausman test, whether fixed effect or random effect more preferable. Based on hausman test in table 3, the results show that rejecting the null hypothesis and stating that fixed effect model is better than compared to random effect model.

Table 3. Hausman Test Result

Test Summary	Chi-sq statistic	Chi-sq d.f.	Prob.
<i>Cross-section random</i>	250.419654	5	0.000

Source : Data processed, 2015

Based on the comparison test using chow test and hausman test, the fixed effect is the best model to explain the effect of independent variables on dependent. The result of panel regression model using fixed effect is illustrated in Table 4.

Table 4. Panel Data Regression Result

Dependent Variable: Export				
Variables	Coefficient t (β)	Std.Error	t statistic	Prob.
Constanta	90.02767	229.2948	0.392629	0.0001
CGDP _{it}	-3.609561	10.66100	-0.338576	0.0000
PGDP _{it}	1.787866	0.275484	6.489905	0.0455
TCOST _{it}	3.616561	10.62661	0.340331	0.0357
REER _{it}	1.366473	0.333099	-4.102302	0.0344
China	3.25E+10			
Japan	-4.07E+10			
India	4.21E+10			
Malaysia	-1.52E+09			
Korea	1.32E+10			
Singapore	-2.34E+08			
Thailand	2.05E+09			
United states	2.9E+10			
Netherland	-5.7E+10			
Philippines	-3.4E+09			
R-square	0.957590			
Observations	110			
F statistik	166.7379			
Prob (F statistik)	0,0000			

Source: Data processed, 2015

The result of panel regression model in Table 4 shows that the bilateral trade between Indonesia and partners can be explained by gravity model. It can be seen from the GDP of Indonesia's trade partner and export of Indonesia which has positive effect, meanwhile the distance between Indonesia and its partners has negative effect to export of Indonesia. The GDP of Indonesia and 10 trade partners has positive effect to export of Indonesia. Based on the

estimation results, the role of economic size in the gravity model is relatively straightforward and in essence similar to the role of size in existing trade models. If an exporting country doubles in size, it has twice as many firms (each with its own foreign contracts) and aggregate exports double. At the same time, if an importing country doubles in size, it aggregates imports double.

GDP per capita can be used to demonstrate the purchasing power of a country. GDP per capita is the result of the country's GDP divided with population. The higher per capita income in a country then the higher its capacity to trade with other countries, especially to finance imports. As for Indonesia, when export partners increase their GDP per capita, Indonesia can increase its exports. Therefore, it is also expected that the coefficient for this variable will be positive (Gu, 2008; Telaumbanua, 2007; Suryanta, 2012; and Gul, 2011).

Per Capita GDP in Indonesia's export countries also has positive significant effect towards Indonesia's export. This variable measures demand in Indonesia's export countries that also can be used to demonstrate the purchasing power of a country. GDP per capita has often been used in gravity model estimation since it is also a good proxy for level of development. A higher level of income in the exporting country indicates a high level of production of which increases the availability of a product for export, while a high level of income in the importing country suggests higher imports.

Table 5 shows per capita GDP of 5 selected countries from 10 Indonesia's export partners compared with export from Indonesia to those 5 countries (India, Malaysia, Netherland, Philippines and Thailand). Based on the Table 5, we can see that when there is increasing percentage of per capita GDP in export partners, this will result increased of Indonesia exports as shown with Malaysia, Philippines and Thailand. On the contrary, when there is a decreasing percentage of per capita GDP in export partner, this will result in decreasing Indonesia's export as with India and the Netherlands.

Table 5. The annual percent change of per capita GDP compared with percent change of Indonesia's export

Countries	2012	
	Per capita GDP	Export from Indonesia
India	-3.7	-6.3
Malaysia	3.7	2.6
Netherland	-7.8	-9.1
Philippines	9.7	9.1
Thailand	5.4	12.5

Source: UN COMTRADE, BPS, processed 2015

The results of Table 5 are consistent with economic theory which states that import from a country is closely connected with the country's national income, where the higher the income then the

higher the ability to import from other countries (Sukirno, 2006; Boediono, 2008).

The distance between two countries is expressed as distance (in km) between the capital cities. The Gravity model assumes that distance has a negative impact on exports because when the distance between the exporting and importing country becomes larger, exports will be costly because the transport and logistic services become expensive. Based on gravity model, the result of transportation in this study found negative effect to export, which means the transportation cost has the effect to Indonesia to decide which the best partner for trade with efficiency cost. But in modern era, the transportation cost can be reduced by modern transportation and minimum transaction cost include logistic and services.

Real Effective Exchange Rate (REER) indicates if the purchasing power of domestic output by trading partners. Real Effective Exchange Rate results in a positive relationship towards export and found significant in this study means that when REER getting down, it will stimulate. These findings imply that increasing Real Effective Exchange Rate (REER) or rupiah depreciation will stimulate export from Indonesia.

5. CONCLUSION

This study tested the export value of Indonesia to its 10 partners from 2003 to 2013 using gravity model. It was concluded that gravity model can explain the trade between Indonesia and 10 partners which showed by positive effect of constant gross domestic product, per capita gross domestic product and real effective exchange rate. Meanwhile the transportation cost showed negative effect.

This research has some limitation about data and sample of trade partner because each year the trade partner become bigger and 10 trade partner was not enough to explain the whole trade between Indonesia and its partner. For the next study, the writers hope can add more samples of country to explain Indonesia's trade.

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