

# Determinants of Indonesian Bilateral Trade: Gravity Model Approach (2005-2019)

Siska Setiya Dewi\*, Liu Xia\*\*

\* School of Business, Zhengzhou University

\*\* School of Business, Zhengzhou University

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**Abstract-** International trade cannot be separated from the Indonesian economy, trade is used as an engine of economic growth for Indonesia, this study aims to analyze the determinants of Indonesia's bilateral trade with a gravity model approach, this research explores the relationship between Indonesia and 35 major trading partner countries, from the period 2005-2019, using a random effect model to determine the relationship between GDP of Indonesia (GDPi), GDP of major trading partners (GDPj), Inflation of Indonesia (INFi), Inflation of major trading partners (INFj), Trade openness of Indonesia (TOPi), Trade Openness of major trading partners (TOPj), economic distance (ECODISij) and the population of the major trading partners (POPj), whether they have an influence on Indonesian bilateral trade, this study uses secondary data from several international data and national data sources. The results of this study indicate that the Gross domestic product of Indonesia (GDPi) and the Gross domestic product of the major trading partners (GDPj) have a positive and significant effect, inflation of Indonesia (INFi) has a negative and insignificant effect, inflation of major trading partners (INFj) has a positive effect but not significant, trade openness of Indonesia (TOPi) and trade openness of major trading partners (TOPj) has a positive and significant effect, economic distance between Indonesia and major trading partner countries (ECODISij) has a negative and significant effect, the last variable is the population of the major trading partners (POPj) has a positive and significant effect. This research is expected to help the Indonesian government, trader or policy makers to make appropriate decisions and can have a good influence on Indonesia's international trade.

**Index Terms-** Indonesian, Bilateral Trade, Gravity Model, Random Effect Model, Determinant

## 1. INTRODUCTION

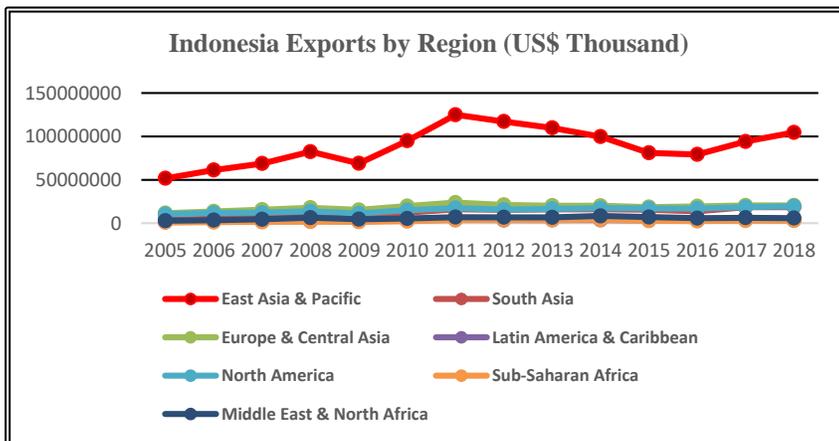
International trade is the exchange of goods and services between countries that have agreed to trade, this is done to meet the needs of countries that are not limited but have limited resources, international trade has an important role in the economic growth of a country, even trade is used as an engine for growth [1], some of the benefits derived from international trade are as follows: 1) Increasing foreign exchange for exporters and producers, 2) Opening new jobs, due to the increase in the volume of export production and the impact on reducing unemployment, 3) Opening opportunities for transfers technology from abroad into the country, 4) The occurrence of the transfer of goods and followed by the entry of foreign capital into the country [2]. In addition, international trade can expand the trade market of a country and lead to competition between these countries, this competition has an impact on improving the quality of goods but at prices that can compete in the market. Seeing the many positive impacts of international trade, every country is trying to achieve a surplus in the trade balance, thus can become a source of state treasury income which can ultimately be used to finance development and reduce poverty, coupled with the current era of economic globalization, where markets in the world is considered as a unit that is interconnected and interdependent, therefore that markets throughout the world are integrated and not limited by national territorial boundaries, and open opportunities for each country to conduct international trade.

Indonesia is one of the countries in the Southeast Asia, where international trade cannot be separated from the Indonesian economy, through export activities, Indonesia's total exports in the period 15 years 2005-2019 rose to 112 percent, in 2005 the total value of Indonesia's exports was US\$ 97 billion and in 2019 rose to US\$ 206 billion, thus the exports have an important role in the Indonesian economy, Indonesia's exports are dominated by exports of oil and gas commodities, total exports of oil and gas worth US\$ 155,839.7 million equal to 92.97% of total exports and non-oil and gas commodities worth US\$ 11,798.3 million equal to 7.03% of total exports, Exports of oil and gas commodities dominated by natural gas commodities while non-oil and gas commodity exports are dominated by processing industry commodities [3], Indonesian export strength is supported by Indonesian trading partners, Indonesia increases cooperation through free trade agreements and participates in the World Trade Organization, based on the above explanation, Indonesian has the potential to continue to collaborate and expand export markets with countries in the world. This study aims to analyze the determinants of Indonesian bilateral trade using the gravity model approach, the determinants include Gross domestic product of Indonesian and Gross domestic product of major trading partners, Inflation of Indonesian and Inflation of major trading partners, trade openness of Indonesian and trade openness of major trading partners, economic distance and population of major trading partners.

### 1.1 Overview Indonesian Exports

Indonesia is an archipelagic country located between two continents (Asia and Australia) and between two oceans (Indian Ocean and Pacific Ocean). This makes Indonesia a crossroads of world trade traffic, for example, Indonesia becomes a point of trade crossing between East Asia (Korea, Japan and China) with countries in Australia, Europe and Africa. Indonesian strategic geographical location makes Indonesia a plus in conducting international trade. Based on data from the Economic Complexity Index in 2019, Indonesia is ranked 16th in the world in terms of GDP (Current US\$), ranked 30th out of 225 countries with total exports of US\$186B and is in the same rank, Indonesian total imports are ranked 30 out of 225 countries with a total import of US\$ 165B, this result shows that Indonesian trade in 2019 was a surplus of US\$26B, and the results for Indonesian per capita product exports in 2019 were ranked 142 out of 219 countries with a total per capita product export value of US\$687, and Indonesian per capita product imports were ranked 168 out of 219 countries with a total value of US\$612, showing the same results with total exports and imports, per capita product exports and imports of Indonesia in 2019 got a surplus of US\$75. The top exports of Indonesian are Coal Briquettes (\$20.3B), Palm Oil (\$15.3B), Petroleum Gas (\$8.32B), Cars (\$4.52B), and Gold (\$4.01B). While by region in 2005-2018, the highest average Indonesian export value was in East Asia and Pacific, namely 88.5 million (US\$ Thousand), followed by Europe and Central Asia worth 18.4 million (US\$ Thousand), North America is worth 15.2 Million (US\$ Thousand), South Asia is worth 12.6 Million (US\$ Thousand), Middle East and North Africa is worth 5.8 Million (US\$ Thousand), Latin America and Caribbean is worth 2.9 Million (US\$ \$ Thousand) and the last rank of Sub-Saharan Africa worth 2.6 million (US \$ Thousand) is shown in Graph 1, while Table 1 shows Indonesian major export destination countries, where countries that join Association of Southeast Asian Nations (ASEAN) are ranked number one, followed by Japan, China, United States, Republic of Korea, Taiwan, Australia, Netherlands, Germany, Italy and other countries.

Graph 1. Indonesian Exports by region (US\$ Thousand)



Source: World Integrated Trade Solutions

Table 1. Indonesian Exports by Major Countries of Destination 2000-2019 (million US\$)

Countries	2005	2010	2015	2016	2017	2018	2019
ASEAN	15 824.9	33 347.5	33 577.0	33 778.2	39 266.4	41 913.2	41 464.5
Japan	18 049.1	25 781.8	18 020.9	16 098.6	17 798.8	19 465.6	16 003.3
China	6 662.4	15 692.6	15 046.4	16 790.8	23 083.1	27 132.2	27 961.9
United States	9 868.5	14 266.6	16 240.8	16 141.4	17 794.5	18 439.8	17 844.6
Korea, Republic of	7 085.6	12 574.6	7 664.4	7 008.9	8 200.3	9 540.1	7 234.4
Taiwan	2 475.0	4 837.6	5 043.5	3 655.8	4 229.2	4 703.1	4 034.8
Australia	2 227.6	4 244.4	3 702.3	3 208.9	2 524.4	2 819.6	2 328.6
Netherlands	2 233.5	3 722.5	3 442.2	3 254.9	4 037.8	3 896.6	3 205.0
Germany	1 781.6	2 984.7	2 664.2	2 638.7	2 668.2	2 708.2	2 405.8
Italy	1 007.2	2 370.0	1 872.9	1 572.1	1 932.6	1 920.9	1 749.3
Other	18 444.6	37 956.8	43 091.7	40 985.7	47 292.9	47 473.4	43 450.8

Total Exports	85 660.0	157 779.1	150 366.3	145 134.0	168 828.2	180 012.7	167 683.0
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Source: Statistics Indonesia

## 1.2 Gravity Model

The gravity model is used by researchers as a means to analyze and predict international trade patterns between countries. The basic assumption of the gravity model states that bilateral trade flows are influenced by economic size which can be measured through GDP or GDP Per capita and Distance between countries, where Economic size shows a positive impact on bilateral trade flows and distance shows a negative impact on bilateral trade flows. [4]. The gravity model is inspired by Newton's "Law of Universal Gravitation" theory, where the interaction of two objects is proportional to mass and inversely proportional to distance. The model gravity equation is formulated as follows [5]:

$$G_{ij} = C \frac{M_i M_j}{D_{ij}} \quad (I)$$

Where:

$T_{ij}$  = Gravitational force between two masses

$G$  = Gravitational constant

$M_i$  = Mass of object i

$M_j$  = Mass of object j

$D_{ij}$  = Distance from mass i to mass j

The gravity model was first introduced by Tinbergen in 1962 to analyze trade flows in Europe which was then followed by many researchers, and has been widely adopted in various countries by adding several variables other than economic size and distance. Here's the equation for the gravity model [5]:

$$X_{ij} = \beta_0 (Y_i)^{\beta_1} (Y_j)^{\beta_2} (D_{ij})^{\beta_3} \mu_{ij} \quad (II)$$

Where  $X_{ij}$  is the volume of exports and imports between countries i and j,  $Y_i$  is GDP in country i,  $Y_j$  is GDP in country j,  $D_{ij}$  is the distance between countries i and j,  $\mu_{ij}$  is disturbance terms,  $\beta_0$  unknown parameter of the equation. These equations are usually transformed into natural logarithmic form as follows:

$$\ln X_{ij} = \beta_0 + \beta_1 \ln (Y_i) + \beta_2 \ln (Y_j) + \beta_3 \ln (D_{ij}) + \mu_{ij} \quad (III)$$

## 2. LITERATURE REVIEW

This study aims to analyze the determinants of Indonesia's bilateral trade using the gravity model approach, many previous researchers who used the gravity model approach along with panel data, For instance. The researchers conducted empirical analysis using a gravity model on trade between the GCC and developed countries, in the period 2001-2012, this study shows that GDP per capita and population shows significant results, and for distance shows insignificant results for trade in GCC and developed countries [6], in the same context. The researcher investigates bilateral trade flows between Cameroon and the Twenty-Eight Union European countries based on a gravity model approach, Cameroon and the Twenty-Eight Union European countries have entered into a free trade agreement within the framework of the Cameroon-EU FTA, this study shows GDP per capita and economic size have positive results on the bilateral trade flows of Cameroon and 28 EU countries, and the distance shows negative results. Where every increase in GDP will affect an increase in trade volume, and every increase in distance will affect a decrease in trading volume [7]. The researcher uses a gravity model to see the potential for bilateral trade between Pakistan and China and partner countries that have signed free trade agreements, this study uses data from the period 1992-2015. The results show that Pakistan's bilateral trade with China and all FTA partner countries is positively affected by GDP, religion, WTO and trade openness, while distance and inflation have negative results [8]. The researcher uses a gravity model to analyze what factors affect the Sino-African trade, in this study using the variables of trade agreements, recession, real exchange rates, and GDP, then analyzes whether these variables affect the import-export trade of Sino and African [9]. The researcher uses a gravity model to examine the factors that affect the flow of exports and imports in South Asian countries, during the period 1985-2011, this study found that GDP and population had a positive influence on export and import flows, while geographical distance and tariffs had a positive effect negative on the flow of exports and imports of countries in South Asia [10]. Researchers using the Gravity Model is used to examine Bangladesh's imports with eight major trading partner countries, the data used consists of the years 1985-2003, in this study showed different results from several previous studies, where geographical distance had a significant impact on Bangladeshi imports, in addition to GDP partner countries and the population of partner countries have a positive impact on Bangladeshi imports [11]. This researcher uses a gravity model to analyze the factors that determine trade flows between South Africa and China using time series data for the period 1995-2014, this study shows that economic size and market size have an impact on trade flows between the two countries, while the real exchange rate has no impact no bilateral trade between the two countries

[12]. The researcher uses gravity mode to analyze the determinants of the flow of trade in services between Vietnam and the European Union using panel data covering the period 2002-2011, the results of this study are the gap in GDP per capita, population, real effective exchange rate, colonial relations, former members of the European Union and the Council of Mutual Economic Assistance has a positive influence on the flow of trade in services between Vietnam and European partner countries [13]. The researcher uses a gravity model to determine the macroeconomic behavior of the market and the export market potential of Pakistan and its trading partners for the period 1991-2011, the results show that supply capacity, price, potential demand for partner countries and market size are positive, while geographic distance, common borders, and free trade agreements show an insignificant negative impact [14].

Some of the studies above are studies from various countries that use the gravity model, because in this study the researcher analyzes Indonesian bilateral trade, here are some studies that use the gravity model and Indonesian as the research subject. This researcher analyzes the factors that affect the performance of bilateral trade between Indonesian and Yemen using the gravity model, the results of the study show that Yemen's GDP, security in Indonesian, political uncertainty and the presence of Indonesian representatives in Yemen are positive, while Indonesian GDP, Yemen security and political uncertainty have a negative effect on bilateral trade [15]. The researcher analyzes the determinants of the value of tropical wood exports using a gravity model approach with an observation period of 2003-2017 to five Indonesian export destination countries, the results of the analysis of the variable GDP Exporters, GDP Importers, exchange rates have a positive influence, while the importer population, exporter population and distance are negative [16]. The researcher uses a gravity model to determine the factors that influence the flow of Indonesian plywood trade, by examining the relationship between GDP, population, price and distance [17]. The researcher uses a gravity model to analyze the determinants of Indonesia's agricultural exports and imports, a total of 50 countries were tested with an observation period from 2007-2017 [18]. The researcher uses a gravity model to analyze the impact of tariffs and non-tariffs on Indonesia's trade performance to 18 trading partners. The results show that non-tariff policies have an effect on Indonesian exports and imports, while import tariffs do not affect imports [19]. The researcher uses a gravity model to determine the factors that influence Indonesian corn imports in the ASEAN trade, with an observation period from 1990-2016, with the results showing that GDP per capita, economic distance, exchange rates and import tariffs, the implementation of the ASEAN economic community, non-tariff barriers and lastly population growth positively affect Indonesian corn imports to ASEAN countries [20].

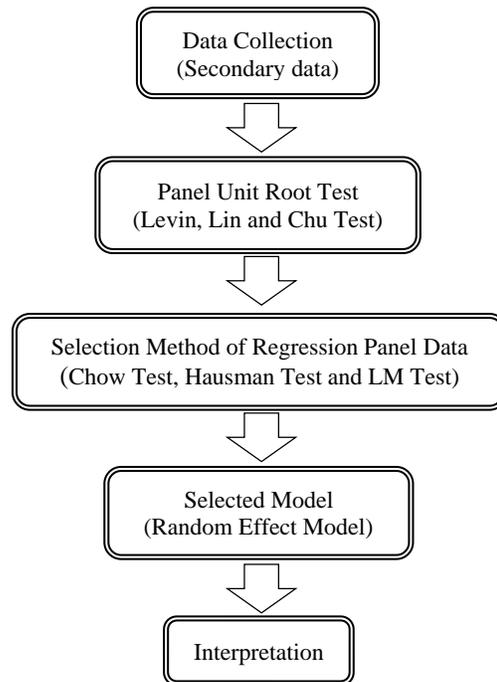
### 3. METHODOLOGY AND DATA

Several previous studies have used a gravity model with panel data types to analyze and estimate the determinants of bilateral trade between countries, Panel data is widely used by researchers because it has several advantages, 1) panel data is a combination of time series and cross section data, thus providing more varied, informative data, less collinearity between variables, more efficient and less biased, 2) panel data estimation techniques can overcome the heterogeneity problem, 3) panel data is appropriate to study the dynamics of change and can see simple impacts that cannot be seen from time series data and cross section data [21]. Before estimating the gravity model equation, the researcher conducted a panel unit root test to see the stationary data used, there are various methods for conducting a panel unit root data test, namely Levin, Lin and Chu (LLC), Im Pesaran-Swan and Fisher, after the data is stationary, it is continued to estimate the equation, there are three estimation methods used in the panel data, namely the common effect model (CEM), fixed effect model (FEM) and random effect model (REM). The common effect model (CEM) is an estimation model that combines panel data and time series data, the common effect model is the simplest estimate, this model does not pay attention to the time or individual dimensions, thus it assumes that the behavior of company data is the same in various time periods, Fixed effect model (FEM) assumes that the slope is fixed between space and time, this model is often called the Least square dummy variable, because the fixed effect uses a dummy to explain the difference in the intercept, the third model is random effect model (REM), this model is also called the Generalized Least Square technique as an estimator, this model estimates panel data where the disturbance variable may be interrelated over time and between individuals [22].

To determine which method to choose from the three estimation panel data models, a selection method of regression data panel is needed, 1) Chow test, this test is carried out to determine what model to choose between common effect model and fixed effect model, chow test hypothesis  $H_0$ : Following the common effect model while  $H_1$ : Following the Fixed effect model, the determination of this model follows the probability value, if the probability value is  $> (0.05)$ , then  $H_0$  is accepted, therefore the common effect is selected, but otherwise if the probability value is  $< (0.05)$ , then  $H_0$  rejected, therefore the fixed effect model is selected, if the fixed effect is selected then proceed to the next test, namely the hausman test, but if the common effect is selected, the model suitability test is only up to the Chow test. 2) Hausman test, statistical test to determine the fixed effect model or random effect model, the hypothesis in the hausman test is  $H_0$ : Following Random Effect model while  $H_1$ : Following Fixed effect model, the determination of this model follows the probability value, if the probability value is  $> (0.05)$ , Then  $H_0$  is accepted, therefore the random effect model is selected, but on the contrary if the probability value is  $< (0.05)$ , then  $H_0$  is rejected, so the fixed effect model is selected. 3) Lagrange Multiplier (LM) test, this test is carried out if the chow test and hausman test show that the common effect model and random effects models are selected, then this LM test is needed to determine whether the random effect model or common effect model is selected, the hypothesis of the LM test this is  $H_0$ : Following the Common effect model while  $H_1$ : Following the random effects model, the determination of this model follows the probability value, if the probability value is  $> (0.05)$ , then  $H_0$  is accepted, therefore the common effect is selected, but otherwise if the probability value is  $< (0.05)$ , then  $H_0$  is rejected, thus the random effect model is selected, a selection method of

regression data panel has been carried out, then the best estimation model to analyze the data has been selected, in this study the researcher uses panel data with a random effects model to estimate the panel data that the researcher collected previously and analyze the determinants of Indonesian bilateral trade.

### 3.1 Applying The Methodology



### 3.2 The Gravity Model Analyzing The Indonesian Bilateral Trade

The gravity model is the model most often used by researchers in analyzing international trade, because it is considered capable of explaining the flow of bilateral trade, with the major independent variables namely Gross Domestic Product (GDP) and Distance, The hypothesis for these two variables is that GDP has a positive impact and distance has a negative impact on bilateral trade flows. In this study, the researchers added several other variables such as population, inflation, trade openness, following the equation of gravity model in the determinants of Indonesian bilateral trade:

$$\ln(BT_{ijt}) = \beta_0 + \beta_1 \ln(GDP_{it}) + \beta_2 \ln(GDP_{jt}) + \beta_3 \ln(INF_{it}) + \beta_4 \ln(INF_{jt}) + \beta_5 \ln(TOP_{it}) + \beta_6 \ln(TOP_{jt}) + \beta_7 \ln(ECODIS_{ijt}) + \beta_8 \ln(POP_{jt}) + \epsilon_{ijt} \quad (IV)$$

All dependent and independent variables are written in natural logarithms,  $\ln BT_{ijt}$  is the dependent variable that describes the volume of bilateral trade (Exports + Imports) between Indonesia and its major trading partners in year t, and the independent variables are  $\ln GDP_{it}$ ,  $\ln GDP_{jt}$ ,  $\ln INF_{it}$ ,  $\ln INF_{jt}$ ,  $\ln TOP_{it}$ ,  $\ln TOP_{jt}$ ,  $\ln ECODIS_{ijt}$ ,  $\ln POP_{jt}$ , descriptions and data sources are presented in Table 2.

The independent variable in the gravity model equation (IV) has an effect on bilateral trade between Indonesia and its major trading partners. The main independent variable that becomes the standard specification for the gravity model is GDP and economic distance, the GDP of the exporting country can measure the volume of the country's production capacity and the GDP of the importing country can be used to measure the volume of absorption capacity [23], therefore the GDP of Indonesia and the GDP of the major trading partners can be used as a measure of the economy of each country, these two independent variables, the GDP of Indonesia ( $\ln GDP_{it}$ ) and the GDP of the major trading partners ( $\ln GDP_{jt}$ ) is expected to have a positive and significant impact on bilateral trade between Indonesia and its major trading partners.

Inflation is an increase in prices or changes in prices in the economy of a country, this price level is an accumulation of inflation that occurred in the past [24], inflation of Indonesia ( $\ln INF_{it}$ ) and inflation of major trading partners ( $\ln INF_{jt}$ ) are expected to have a negative and significant impact on Indonesian bilateral trade.

The more open the trade of a country, the greater its trade and involvement in international trade. Indonesia's trade openness (lnTOPit) and trade openness of our major trading partners (lnTOPjt) are expected to be positive and significant to Indonesia's bilateral trade.

Economic distance is an important factor in trade patterns, geographically the farther the distance between the source country and destination countries, the greater the transportation costs incurred. Economic distance (lnECODISijt) is expected to have a negative and significant impact on Indonesia's bilateral trade.

The last variable, population shows the size of a country, the larger the population of a country, the larger the target market, and resulting in greater trade [25], because the larger and increasing population of a country is the same as increasing domestic demand. Population of major trading partners (lnPOPjt) is expected to have a positive and significant relationship to Indonesia's bilateral trade. The summary of the expected sign is in Table 2.

### 3.3 Data and Sample Size

The dataset used is panel data, which is a combination of cross section and time series data, the time series data in this study is 2005-2019 with cross section data from 35 major trading partner countries of Indonesia from 17 countries in the Asian market (Bangladesh, Cambodia, China, Hong Kong, India, Japan, Malaysia, Myanmar, Pakistan, Philippines, Qatar, Republic of Korea, Saudi Arabia, Singapore, Thailand, UAE, Vietnam), 9 Countries in Europe market (Belgium, France, Germany, Italy, Netherlands, Russia, Spain, Switzerland, Turkey), 5 countries in the American market (Brazil, Canada, Mexico, UK, US), 2 countries in the Australian market (Australia, New Zealand) and 2 countries in the Africa market (Egypt, South Africa). This study has 1 dependent variable and 8 independent variables with a total number of observations are (35x15=525), the researcher also uses secondary data in this study from several international and national sources, a summary of the variables that the researcher has used and the data sources from which the researcher got the data will be presented in Table 2. Table 3 will show the descriptive statistical variables used in the gravity model equation (IV).

Table 2. Description of variables, expected sign, and data source

Variable	Definition	Expected Sign	Data Source
BTFijt	Total volume of bilateral trade (exports + imports) between Indonesia and major trading partners.		UN Comtrade Database, World Development Indicators (2019)
GDPit	Gross Domestic Product of Indonesia (Current US\$).	+	World Development Indicators (2019)
GDPjt	Gross Domestic Product of major trading partner (Current US\$).	+	World Development Indicators (2019)
INFit	Inflation of Indonesia (% of GDP Deflator)	-	World Development Indicators (2019)
INFjt	Inflation of major trading partner (% of GDP Deflator).	-	World Development Indicators (2019)
TOPit	Trade openness of Indonesia (Total trade/GDP).	+	World Development Indicators (2019)
TOPjt	Trade openness of major trading partner (Total trade/GDP).	+	World Development Indicators (2019)
ECODISijt	The distance between the source country (Indonesia) and its major trading partner multiplied by the total GDP, then divide by GDP in year t (Li at all, 2008). The formula is  Economic distance :  Geographic distance x $\frac{\sum GDP_j}{GDP_j}$	-	World Development Indicators (2019), Distance calculator <a href="http://www.indo.com">http://www.indo.com</a>
POPjt	Population of major trading partner.	+	World Development Indicators (2019)

Table 3. Descriptive statistics of variables used in gravity equation

Variable	Mean	Maximum	Minimum	Std. Dev.	Obs.
BTFijt	3.96E+12	7.29E+10	64971613	1.12E+10	525
GDPit	1.70E+12	1.43E+13	2.86E+11	4.48E+12	525

GDPjt	7.942113	2.14E+13	6.29E+09	3.15E+12	525
INFit	4.066308	18.14975	1.604536	5.148454	525
INFjt	0.481166	30.5427	-25.1298	5.534567	525
TOPit	0.929845	0.639879	0.373034	0.076093	525
TOPjt	115122.3	4.4262	0.001674	0.817833	525
ECODISijt	1.40E+08	551106.7	9564.209	78368.87	525
POPjt	3.96E+12	1.40E+09	865416	2.95E+08	525

Source: Authors estimation

#### 4. RESULT RESEARCH FINDING AND INTERPRETATION

##### 4.1 Panel Unit Root Test

Before estimating the equation (IV), the first step to take is panel unit root test, the panel unit root test is one of the important requirements in the econometric model which aims to see whether the data used is stationary or not, in testing the unit root for panel data, there are several methods that can be selected, namely Levin, Lin and Chu test, Im Pesaran and Shin test and Fisher [26], this study the researchers used the Levin, Lin and Chu (LLC) method. Where, the data is considered stationary if the probability value is  $< (0.05)$ , some of the data in this study are not stationary at the level, such as GDPjt (0.3803) and INFjt (1.0000), then it is necessary to continue testing these variables at the first difference level, and the results are all stationary variable in the first different stage (shown in Table.3)

Table 3. The results of Levin, Lin and Chu (LLC)

Variable	LLC Test					
	Level			First Difference		
	Statistic	Prob	Explanation	Statistic	Prob	Explanation
BTFijt	-3.52258	0.0002	Stationary	-11.6440	0.0000	Stationary
GDPit	-3.33328	0.0004	Stationary	-12.4847	0.0000	Stationary
GDPjt	-0.30470	0.3803	Not Stationary	-12.3669	0.0000	Stationary
INFjt	6.40201	1.0000	Not Stationary	-2.70115	0.0035	Stationary
INFjt	-5.68572	0.0000	Stationary	-13.0292	0.0000	Stationary
TOPit	-4.87327	0.0000	Stationary	-19.4890	0.0000	Stationary
TOPjt	-4.60433	0.0000	Stationary	-11.2132	0.0000	Stationary
ECODISijt	-10.7775	0.0000	Stationary	-13.6018	0.0000	Stationary
POPjt	-17.3943	0.0000	Stationary	-14.6982	0.0000	Stationary

Source: Authors estimation

##### 4.2 Estimation Result

At the initial estimation stage, the researcher selects the model first, to find out the best model to be used in estimating the panel data. Table 4 shows the results of the test selection method for panel data regression,

Table 4. Result of chow test, Hausman test and LM test

Effect Test	Prob.	Selected Model
Chow Test	0.0000	Fixed Effect Model
Hausman Test	1.0000	Random Effect Model
LM Test	0.0000	Random Effect Model

Source: Authors estimation

The chow test results in a prob  $< (0.05)$ , then  $H_0$  is rejected, thus the Fixed effect model is selected, then the results from the Hausman Test Prob  $> (0.05)$ , then  $H_0$  is accepted, therefore the random effect model is selected, because the chow test and the Hausman test have the results of different models, it is necessary to LM test to determine the best estimation model, the results of the LM test prob  $< (0.05)$  then the random effect model is chosen. Based on the comparison of the tests, the random effect model becomes the best model that can explain the effect of the independent variable on the dependent variable, the result panel regression results using the random effect model are presented in Table 5.

Table 5. Panel Regression result using Random effect model

Variable	Coef.	Std. Err.	t-statistic	Prob.
Constant	24.24114	1.573189	15.40892	0.0000
lnGDPit	2.78E-14	7.27E-15	3.82E+00	0.0002
lnGDPjt	1.32E-13	5.76E-14	2.30E+00	0.0218
lnINFit	-0.04458	0.023632	-1.88629	0.0598
lnINFjt	0.001296	0.004567	0.283732	0.7767
lnTOPit	0.222949	0.084808	2.628863	0.0088
lnTOPjt	0.096386	0.022372	4.308315	0.0000
lnECODISijt	-0.97031	0.046421	-20.9026	0.0000
lnPOPjt	0.51034	0.078873	6.470376	0.0000
R2	0.705626			
Adj R2	0.701062			
Prob f	0.00000			
Number of Obs.	525			

Source: Authors estimation

Based on table 5, the random effect estimation results for equation (IV), has an R2 value of 0.7056226, indicating that 70 percent of the variation in the dependent variable can be explained by the independent variable. Thus can show the overall model performance is very good. The results of the gravity model revealed that the Variable GDP of Indonesia (lnGDPit) with the GDP of the major trading partners (lnGDPjt) has a positive and significant impact on bilateral trade in Indonesia, as indicated by the probability value of GDP of Indonesia and GDP of the major trading partners, namely 0.0002 ( $< 0.05$ ) and 0.0218 ( $< \alpha 0.05$ ), the GDP of Indonesia has a coefficient value of 24,241, an increase of 1 percent in the GDP of Indonesia will cause an increase in the volume of Indonesia's bilateral trade with related trading partners by 24,241 percent, while for the GDP of the major trading partners it has a coefficient value of 2.78E- 14, where every 1 percent increase in GDP of major trading partners causes an increase in the volume of Indonesia's bilateral trade with major trading partners by 2.78 percent, therefore the result of GDP of Indonesia with GDP of major trading partners is significant in the expected sign.

Inflation of Indonesia (lnINFit), the results show a coefficient of -0.04458 and a probability of 0.0598 ( $> \alpha 0.05$ ), thus the inflation of Indonesia variable has a negative and insignificant effect, the result of inflation of Indonesia is significant with the expected sign. Inflation of major trading partners (lnINFjt) results show a coefficient of 0.001296 and a probability of 0.7767 ( $> \alpha 0.05$ ), thus the inflation of major trading partner variable has a positive but not significant effect on volume of Indonesia's bilateral trade with its major trading partners, this result is not in line with the expected sign.

Trade openness of Indonesia (lnTOPit), the results show a coefficient of 0.222949 and a probability of 0.0088 ( $< \alpha 0.05$ ), thus the variable trade openness of Indonesia has a positive and significant effect, where every one percent increase in trade openness causes an increase in the volume of Indonesia's bilateral trade with trading partners. The results of trade openness of Indonesia is significant with the expected sign. The trade openness of the major trading partners (lnTOPjt) results show a coefficient of 0.096386 and a probability of 0.0000 ( $< 0.05$ ), thus the trade openness of the major trading partners has a positive and significant effect, where every one percent increase in the trade openness of the major trading partners causes an increase in the volume of Indonesian bilateral trade amounted to 0.096386 percent, the result of trade openness of major trading partners was significant with the expected sign.

Economic Distance between Indonesia and its major trading partners (lnECODISijt), the results show the coefficient value is - 0.97031 and the probability is 0.0000 ( $< \alpha 0.05$ ), economic distance has a negative sign on the coefficient but is significant, therefore every 1 percent increase in economic distance will decrease in the volume of Indonesia's bilateral trade by 0.97031 percent, the result of economic distance between Indonesian and major trading partners is significant with the expected sign.

The major trading partner population (lnPOPjt), the results show the coefficient value is 0.51034 and the probability is 0.0000 ( $< \alpha 0.05$ ), this shows the major trading partner population has a positive and significant sign, therefore every 1 percent increase in the major trading partner of population will increase trade in the volume of Indonesia's bilateral trade by 0.51034 percent, thus the results of the population of major trading partners are significant with the expected sign. Based on the explanation, almost all independent variables are significant with an expected sign, except for the inflation variable of major trading partners, which produces a positive effect and is not significant.

## 5. CONCLUSION

International trade cannot be separated from the Indonesian economy, because international trade is used as an engine for Indonesia's economic growth, our research analyzes Indonesia's bilateral trade empirically and identifies the determinants of Indonesia's bilateral trade, we use the gravity model in this study, because the gravity model is one of the best models, which can explain bilateral trade between countries, covering the period 2005-2019 to analyze Indonesia's bilateral trade with 35 major trading partners of Indonesia, from 17 countries in the Asian market, 9 countries in the European market, 5 countries in the American market, and 2 countries in the African market. This study uses a random effect model (REM) as a tool for estimating panel data, after comparing the Chow test, Hausman test and LM test.

The results of this study increase the GDP of Indonesia and the GDP of the major trading partners have a positive and significant effect on the volume of bilateral trade in Indonesia, Inflation of Indonesia has a negative and insignificant effect on the volume of bilateral trade in Indonesia, while the inflation of the major trading partners has a positive but not significant effect on the volume of bilateral trade Indonesia, Trade openness of Indonesia and trade openness of major trading partners have a positive and significant effect on the volume of Indonesia's bilateral trade, economic distance has a negative but significant effect on the volume of Indonesia's bilateral trade volume and lastly, the population has a positive and significant effect, the results of the study, almost all independent variables were significant with the expected sign, except for the variable inflation of our major trading partners, we expected that it would be negative, but the results were positive. The results of this study are expected to help the Indonesian government to make policies or determine practical steps in increasing Indonesian bilateral trade with major trading partner countries.

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#### AUTHORS

**First Author** – Siska Setiya Dewi, School of Business, Zhengzhou University, [siskasetiyadewi@gmail.com](mailto:siskasetiyadewi@gmail.com)

**Second Author** – Liu Xia, School of Business, Zhengzhou University, [3543043@qq.com](mailto:3543043@qq.com)

**Correspondence Author** – Siska Setiya Dewi, School of Business, Zhengzhou University, +628872702060