Global Economy and Finance Journal
Vol. 4. No. 2. September 2011. Pp.13-32

The Determinant and Trade Potential of Export of the Indonesia's Textile Products: A Gravity Model

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The objective of this paper is examining the determinant factors that are influential in the export of Indonesia's textile products, especially in two aggregate products, fibre (SITC 26) and yarn and fabric (SITC 65). This paper utilizes standard and augmented gravity models, which estimate the impact of GDP, per capita income and population to export. The result concludes that the geographical distance and size of partner countries' economies significantly impact the pattern of textile product export growth. However, the size of the reporters' (Indonesia's) economy is not significant for the yarn and fabric products export. Moreover, Indonesia tends to export to partner countries with a similar level of per capita income. Finally, Indonesia needs to diversify its export destinations to countries that still experience under-traded conditions, so that Indonesia's textile industry can evade any risks concerning excessive market dependency to any country.

Field of Research: International Trade, Industrial Organization

1. Introduction

The study of international trade has increasingly become a growing concern among scholars and researchers throughout the world. Since economic globalization is now an inevitable phenomenon, more and more research has been done to study these issues. The study of international economics constitutes the flow of economic resources (such as commodity, money, human resources, etc.) between countries. Even though right now the transactions in international financial market are emerging substantially in volume, amount and complexity, yet the international trade that refers to commodity flows may be the oldest and foremost engine of the global economy. The trade flows from export and import activities reflect many things within countries/regions that engage in the global economy. It shows the need of market expansion, different taste that leads to product heterogeneity, linkages in supply chain and many other things that are essential in determining the international trade. Thus, it encourages scholars and researchers to study the factors and variables that specifically and/or generally causes trade between countries. These enduring studies from centuries ago have produced many theories in international trade.

The Ricardian theory of comparative advantage and Heckscher-Ohlin model of factor endowment marked the classical and neo-classical theories in international trade (Appleyard, Field & Cobb 2008). Subsequently, in the past few decades, many theories have derived from these papers to explain factors in international trade. Among them, there is a gravity model that studies the impact of economic size and

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geographical distance to trade flows between bilateral countries or regions. The theory pioneered by Tinbergen (1962) and Pöyhönen (1963) studies the effect of national income and geographical distance to imports of commodities[1]. Originated from Newtonian theory of universal gravity, the model postulates that the force between two objects is determined by their body mass and the distance between them. Thus, in an econophysics sense, the trade flow represents the gravitational force, the economic scale and wealth of two countries correspond to body mass of each subject, and the geographical distance is exactly the denotation of physical distance. Recently, this model is employed in social science problem solving in order to explain the flows of not only trade but also immigrants and money repatriation, foreign direct investment, etc.

This paper utilizes a gravity model to examine the bilateral export flows between Indonesia and selected trading partner countries, specifically in downstream and midstream textile industries (code 26 and 65 Standard International Trade Classification/SITC Revision 3). The objectives of this research are twofold: first, understanding the nature of Indonesian manufactured textile product exports. With regard to the gravity model, the results should show the role of independent variables (economic size/wealth, geographical distance and other control variables) that influence the export. The results also determine the significance and direction of the effect. The second objective is to reveal the trade potential between Indonesia and its selected trading partners regarding the specific commodity. The estimation results from the gravity model will be the tool to predict the export value in the same trading partner and the same period of analysis. Then, the comparison between predicted and actual export value yields the projection of trade potential, which refers to under trade or overtrade circumstances between Indonesia and its trading partner. Ultimately, the purpose of this research paper is to contribute to the study of international trade. Furthermore, it should illustrate the clear picture of the Indonesian manufactured textile industry, especially in the global market view. Therefore, the hypotheses of this research are:

- The size of economy (GDP, per capita GDP and population) and the distance between Indonesia and its selected trading partner significantly influence the export value of Indonesian textile industry;
- Under the gravity model, the Indonesian textile industry is facing under traded and over traded situations with its selected trading partners.

This paper is organized as follows. Section 2 elaborates on the importance and the background problem in the Indonesian textile industry. Section 3 reviews the existing literature which supports the theoretical implications and recent previous empirical findings of the gravity model. Section 4 presents the methodology and data of this study, followed by analysis of the empirical findings in Section 5. Finally, Section 6 provides the conclusion and limitations of the study.

2. Indonesian Textile Industry

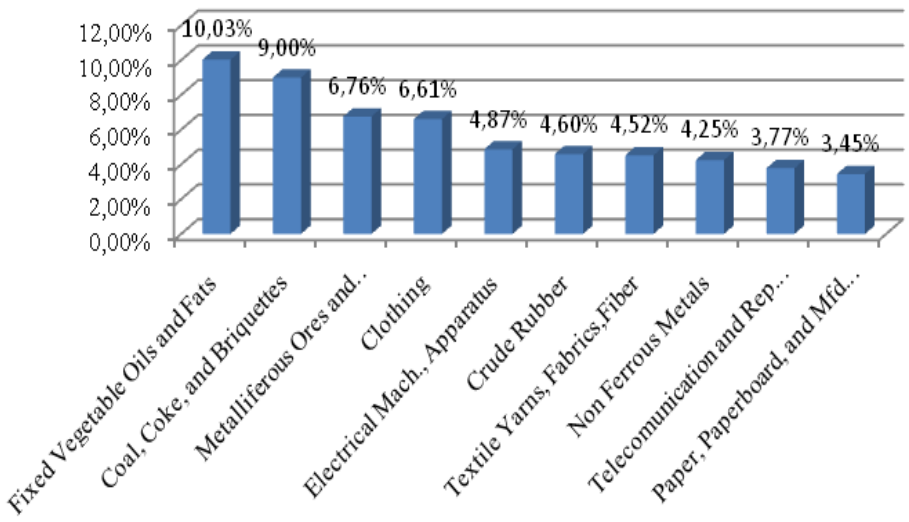
The Indonesian textile industry consists of three mainstream industries: (i) the upstream industry which produces fibre (code 26 SITC Rev.3), (ii) the midstream industry which manufactures yarn and fabrics (code 65 SITC Rev.3), and (iii) the downstream industry which is the garment industry (code 84 SITC Rev.3) (Pratiwi Anwar 2000). For a

technical reason, the term Indonesian textile industry in this paper henceforth refers to upstream and midstream industries only[2]. Prior to the 1960s, the small scale and some government owned textile companies started to contribute to Indonesian GDP along with other primary goods industries such as food and beverage. However, the introduction of textile technology happened long before Indonesian independence. Then, in the mid 1970s, the industry started to produce import substitution goods in order to fulfill domestic demands. In the 1970s, the textile industry was among the first industry to shift its paradigm to produce import substitution goods in the Indonesian manufacturing industry. Within this period, several multinational textile companies (especially from Japan) established their plants, which revived the textile industry. However, most of these multinationals were in the midstream (fabrics) industry, and the paradigm shifting began in 1975. On the other hand, the upstream (yarn and fibre) industry started to move to import substitution stage later in 1978 (Pratiwi Anwar 2000).

The next development stage, export orientation or outward looking, was reached in 1983 by the fabric industry. However, the yarn and fibre industry was lagging behind when it started to shift into the export orientation phase in 1997. Several government deregulations that coincided with the domestic global market situation have triggered the shifting in the textile industry from an inward looking to an outward looking paradigm. Since the 1970s, the government has relaxed the investment and trade regulations to induce more domestic and (especially) foreign direct investment in the textile industry. The improvements of export administration and import liberalization (that decreased the tariff on imported input materials) have substantially encouraged the firms to export their products. Furthermore, currency devaluation policy in 1978, followed in 1985, has made the global market more favorable than the domestic market. Other conditions initiating the shift in the textile industry are decreased labor costs in the 1980s (Indian Council for Research on International Economic Relations (ICRIER) 1995) combined with increase in the productivity of the textile industry. Lastly, the flourish of foreign direct investment all over the world has increased East Asian multinationals investment in the 1980s to 1990s (Osada 1994).

From the beginning of the development stage until recently, the textile industry has been contributing to Indonesia's economy particularly in total output, labor absorption, foreign direct investment and export. The decline of importance of the textile industry is mainly because of rapid growth of other manufacturing industry sectors, such as food and beverage, electronic, chemical, pharmaceutical and automotive.

Figure 1
10 Largest Indonesia Exported Products 2004-2009



Source : Computed from Central Bank of Indonesia database

In terms of its share to Indonesia's total export, the textile industry is in position number 7 among the 10 largest exported products (of 66 divisions/ two digits SITC Rev.3) in Indonesia in 2004-2009 as shown in the Figure 1. These products account for almost 60% of total export, and the textile industry share is 4.52% of total export. While the largest exported products are from the food and beverage sector (fixed vegetable oils and fats) followed by the mineral sector (coal, metalliferous ores and metal).

Furthermore, the role of the Indonesian textile industry in international trade is also very important. In 2008, the Indonesian textile industry is of the 15th rank for textile yarn and fabrics (SITC 65) exporters in the world. It contributes 1.50% of the total world exports of textiles as expressed in Table 1.

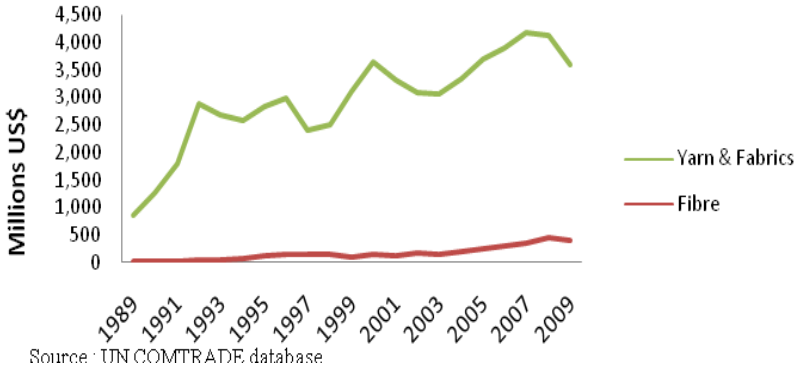
Table 1
20 Largest Textile World Exporter, 2008

Rank	Country	SITC 65		Country	SITC 26	
		Value (US$)	Share		Value (US$)	Share
1	China	65.366.583.459	26,70%	USA	6.867.422.882	23,04%
2	Italy	16.091.507.199	6,57%	Australia	2.341.243.151	7,86%
3	Germany	15.901.460.000	6,50%	Germany	2.204.633.000	7,40%
4	USA	12.470.256.158	5,09%	China	2.036.930.548	6,83%
5	Hong Kong SAR	12.256.104.656	5,01%	India	2.029.642.171	6,81%
6	India	10.372.330.047	4,24%	Rep. of Korea	1.268.691.843	4,26%
7	Turkey	9.399.326.853	3,84%	Japan	1.209.203.904	4,06%
8	Belgium	8.135.642.051	3,32%	Belgium	934.966.242	3,14%
9	France	7.367.407.581	3,01%	Brazil	870.352.859	2,92%
10	Japan	7.340.457.412	3,00%	United Kingdom	751.817.664	2,52%
11	Pakistan	7.186.246.049	2,94%	Thailand	513.495.647	1,72%
12	Netherlands	4.807.457.396	1,96%	Italy	506.450.296	1,70%
13	United Kingdom	4.445.613.921	1,82%	France	473.491.661	1,59%
14	Spain	4.355.743.982	1,78%	**Indonesia**	**454.636.464**	**1,53%**
15	**Indonesia**	**3.674.528.238**	**1,50%**	New Zealand	432.988.926	1,45%
16	Thailand	3.211.358.519	1,31%	Greece	357.864.777	1,20%
17	Czech Rep.	2.725.500.806	1,11%	Turkey	302.773.346	1,02%
18	Austria	2.248.755.576	0,92%	Netherlands	296.946.994	1,00%
19	Poland	2.173.645.375	0,89%	Czech Rep.	266.196.835	0,89%
20	Mexico	1.993.163.229	0,81%	South Africa	260.784.327	0,87%

Source : Computed from UN COMTRADE database

In addition, the industry also holds the 14th position among fibre (SITC 26) exporters in the world, with 1.53% contribution to total world exports. From the table above we know that Indonesia and Thailand are the largest textile exporters in ASEAN. Accordingly, China, India and Japan are consistently in the largest textile world exporter group with the United States and other European Union (EU) members (Germany, Belgium, United Kingdom, France, Italy and Netherlands).

Figure 2
Indonesian Textile Industry Export Trend 1989-2009



Source : UN COMTRADE database

The export trend of Indonesian textile products in the last two decades, 1989-2009, shows steady high growth for textile yarn and fabric products (figure 2). Moreover, the trend is less volatile with slightly seasonal adjustment. Even in the 1997-1998 crises the export value dropped only about 27% and recovered by 16% in the next year. However, the fibre export products growth rate told the different story. The growth trend is very flat and the export value is relatively small compared to the textile fabric product. Thus, this fact is consistent with the hypothesis that the fibre industry is lagging behind,

in terms of paradigm shifting from import substitution to export orientation as mentioned before.

Another aspect that demonstrates the real condition of the Indonesian textile industry is its export destination. The calculation of Indonesian textile export to its 40 major partner countries data in 2008 evinces that most of Indonesian textile yarn and fabric products are exported to East Asian, West European and ASEAN countries in that order. Additionally, for fibre products, over 50% of its export destination is to West European, South Asian and East Asian countries respectively (Table 2).

Table 2
Indonesian Textile Industry Export Destination, 2008
(taken from 40 major countries export partner)

Region	Yarn & Fabrics	Fibre	GDP shares	Population shares
East Asia	22,98%	13,70%	18,97%	22,92%
West Europe	19,00%	27,73%	14,17%	2,81%
ASEAN	13,69%	8,75%	2,12%	8,53%
West & Central Asia	9,14%	7,62%	3,46%	4,21%
South America	7,95%	1,83%	3,83%	5,70%
North & Central America	7,68%	12,28%	30,78%	7,33%
South Asia	5,81%	15,98%	3,07%	24,73%
Africa	3,08%	1,86%	2,32%	14,60%
Oceania	1,05%	2,97%	1,92%	0,51%
East Europe	0,80%	0,22%	3,82%	4,35%

Source : computed from UN COMTRADE database

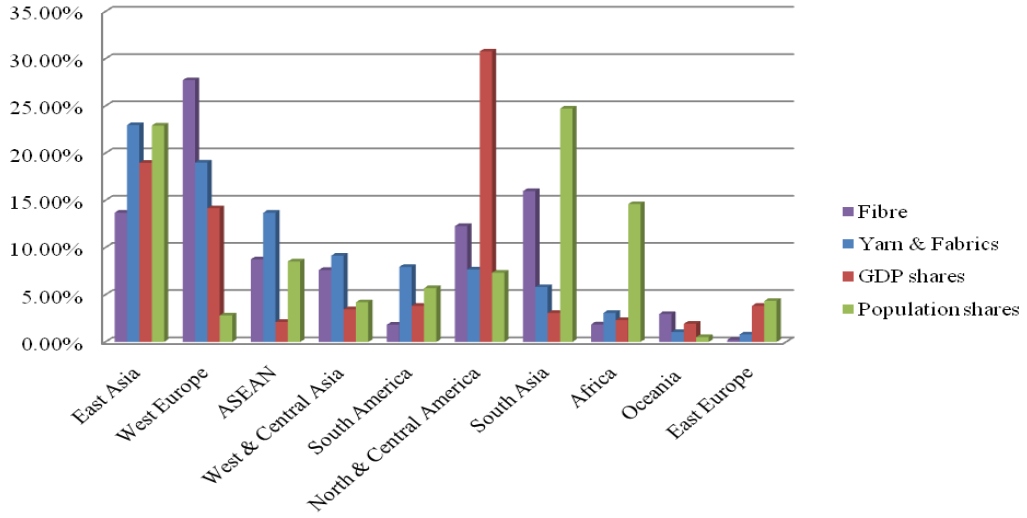
In order to correlate the fact about Indonesian textile product export destinations with the gravity model, Table 2 has included the proportion of each region GDP's and population with the world's GDP and Population, in the last two columns. Thus, we can compare the proportion of Indonesian major textile export destinations with the region's economic size and wealth, which is represented by GDP and population.

It should be noted that the proportion of the region's GDP and population shown in the table above include all country members of the region. On the other hand, the proportion of Indonesian textile product export destinations does not include all the members of the region, only the 40 major Indonesian export partners. Nevertheless, these 40 major trading partners comprise over 90% of Indonesian textile exports to the world. Thus, it is still reasonable to compare the proportion of Indonesian textile products export destination with its partner's GDP and Population share to the world.

From Figure 3, which is a graphical depiction of Table 2, we can easily visualize that there was inequality between the Indonesian textile product export destinations compared to its trading partners economic size. The export to East Asian countries represents the most balanced proportion of export destination and economic size. The gap between export proportion and economic size is relatively narrow. Conversely, West European countries absorb reasonably high Indonesian textile products, while its population is very small compared to other regions. Another example is in the North and

Central America region. The export of textile products from Indonesia to this region is relatively the same size compared to ASEAN countries, for instance. However, this region's GDP is the highest in the world.

Figure 3
Indonesian Textile Industry Export Destination, 2008
(taken from 40 major countries export partner)



Source : computed from UN COMTRADE database

Ultimately, these rough calculations above may indicate undiversified export destinations of Indonesian textile products. Therefore, it is also a sign of under trade or over trade between Indonesia and its trading partner. The case of an excessive or overtrade situation may increase the international trading risk for Indonesia. For example, if there is any economic, political or social turbulence in the country which has excessive export products from Indonesia, then Indonesia will suffer if its exports decrease abruptly. Conversely, in any country that experiences under trade with Indonesia, there are potential market expansions for Indonesia that will minimize the international trading risk.

3. The Gravity Model

The gravity model is derived from the physics law of the universal gravitational force. This concept then is utilized to explain the flow in social science issues such as trade flows, capital flows (FDI & money repatriation), and human (migration) among countries. The original specification of Newton's Law for the gravitational force of two objects *i* and *j* is expressed as:

$$GF_{ij} = \frac{M_i \, M_j}{(D_{ij})^2} \qquad (1)$$

In this equation, the gravitational force (GF) is directly proportional to the product of the masses (M) of the objects and is inversely proportional to the square of the distance (D) between them. The early application of this equation in international trade study is in a reduced form. The new form omits the square of the distance and transforms the equation into (natural) logarithms. In this form, the gravitational force is replaced by

trade flows (exports and/or imports) as the dependent variable. Furthermore, the national income (GDP) represents the body mass and the physical distance is still in its original form. Thus, the early gravity model of trade flows is as follows:

$$Ln(TF_{ij}) = LnGDP_i + LnGDP_j - LnD_{ij} \qquad \text{where } i \neq j \qquad (2)$$

The equation above simply explains that the trade flow (TF) between two countries (i & j) is the function of the GDP of i and j and the physical distance between them. Moreover, the GDP represents market size and purchasing power of trade partners while the distance is the rough measurement of physical distance between them.

Theoretical Considerations

Despite the empirical success in explaining international trade patterns (Bergstrand 1985) and regional trade blocks, the theoretical underpinnings of the gravity model have not yet been justified. Thus, some critics have attacked the gravity model for its lack of theoretical justification. Subsequently, several researchers attempted to reconcile the international trade theories with the gravity model. One of the first attempts to derive the gravity model from international trade theory is Anderson (1979). Under complete specialization, no tariff, no transportation costs and homothetic preference assumptions, he found that the gravity equation can be rearranged from a simple/pure and trade-share expenditure system. Additionally, he also justified the equation with the assumption of many goods, tariff and distance. In his conclusion, he emphasized that the gravity equity equation can be derived from the properties of an expenditure system.

Afterward, Jeffrey Bergstrand perhaps was the most praised scholar in 1980s that continuously worked in the theoretical study of the gravity model. Following Linnemann's (1966) work, Bergstrand (1985) attempted to develop a theoretical foundation for the gravity model from the partial equilibrium model. Starting with constant-elasticity of substitution (CES) function, he showed that equilibrium of export supply and import demand leads to the original gravity equation (before loglinear transformation). Of course, he conducted it under certain assumptions: small (relative) market of aggregate trade flows, identical utility and production functions, perfect goods substitutability, perfect commodity arbitrage, zero tariffs and zero transport costs. In the successive study, Bergstrand (1989) employed monopolistic competition model of Dixit and Stiglitz (1977) with the assumption of differentiated goods among firms rather than countries. In his later work, Bergstrand (1990) added Linder's hypothesis[3] in his model to capture the income differential effect. Additionally, in order to deal with the critics of his assumption, he incorporated a GDP deflator as the proxy of price and physical distance and dummy variable for tariffs.

Another well cited theoretical research on the gravity model is the study by Deardorff (1998). In his paper, Deardorff derived the gravity equation from rudimentary international trade theory of the Heckscher-Ohlin (HO) model, especially, in two extreme cases: frictionless trade and the existence of trade impediments. In the first case, he proved that the gravity equation can simply be derived from the standard HO model, either in homothetic or arbitrary preference assumption. In the latter case, impeded trade, he demonstrated that from standard HO model with transport costs, he could obtain the original gravity equation, both with Cobb-Douglas and CES preferences. In

his conclusion, Deardorff stated that even a simple gravity equation can be derived from standard theories. Furthermore, he suggests that any international trade model will be consistent with gravity equation.

Perhaps there are numerous studies that explore theoretical considerations for the gravity model. Ranging in assumptions and preferences, these studies have proven that the gravity equation can be derived from any theories of international trade. Nevertheless, the reader may wish to refer the studies of Anderson and van Wincoop (2001, 2004); Helpman and Krugman (1987); Shiro Armstrong (2007); Evenett & Keller (2002); and Harrigan (2001) for more detailed and recent contributions on theoretical findings of the gravity model.

Previous Empirical Works

Ever since the pioneer studies by Tinbergen (1962) and Pöyhönen (1963), there have been abundant studies that empirically test trade flows using the gravity model. However, these studies are too many to describe in this paper. Therefore, I only discuss some recent papers that are related to this study, in which they differ only in certain aspects.

As known by its form, the gravity model is useful in assessing bilateral trade between countries. Thus, it means that the gravity model is applicable to at least two cases. The first case is trade between multiple countries with their multiple partners. Usually, the objective of the model is to evaluate a regional trade block/area such as NAFTA, Eurozone, MERCOSUR, CAFTA, etc. For more detailed surveys of this case, the reader may refer to the following papers: Roberts (2004, 2005) tested the impact of the proposed China-ASEAN free trade area. Kharel and Belbase (2010) investigated the trade flow of the group of landlocked developing countries (LLDC) to propose the integrated trading system between them and improve their engagement in international trade. Hapsari and Mangunsong (2006) studied the determinant factors of ASEAN free trade area (AFTA) members' export and explore the impact of trade creation/diversion, factor endowment differences and export structure similarity. Salim and Kabir (2010) assessed the success of ASEAN regional integration compared to Europe Union (EU) countries trade integration. Lankhuizen, De Groot and Linders (2009) studied the tradeoff between foreign direct investment and export within OECD countries. Fratianni (2007) empirically evaluated gravity model, which covering trade in 143 countries, that separated into north (OECD) and south (non OECD) countries. Lastly, Zarsoso and Lehman (2003) examined the trade flows between 5 MERCOSUR members plus Chile and 15 EU countries.

The second case is the trade between countries with their multiple trading partners. The primary objective of this study is to characterize the determinant factors of the gravity model. However, recently many scholars have included more variables to the traditional gravity model to capture other aspects that may influence the trade flows and to assess trade potential between a country and its trading partner. Several researchers have utilized the gravity model to evaluate bilateral trade flows of aggregate or specific products in a specific country: Australia (Rahman 2009), Cambodia (Kim 2006), China (Gu 2008), wood products of South Africa (Eita & Jordaan 2007), United States (Leitão 2010), and specially frozen tart cherry product of United States (Aguilar 2006), Fiji (Ram

& Prasad 2007), Netherlands (Földvári 2006), marine products of Iceland (Kristjansdottir 2005), and India (Prabir De 2009). Please note that these aforementioned papers are perhaps only a small part of numerous studies of the gravity model using the single country reporter perspective.

Recently, the empirical research in international trade using the gravity model has become more "augmented" in terms of the number of regressors and estimation techniques. The supplementary variables vary in terms of:

- Size of economy (in addition of national income): population, per capita GDP, per capita income differentials
- Geographical distance (in addition of physical distance): nautical miles, remoteness, proximity
- Trade restrictions: tariffs, relative exchange rates
- Dummy variables to control qualitative aspects of the model: common cultures (languages, colonization), common regional trade agreements, spatial (common border, landlocked, coastal)

Furthermore, the development of econometrics has supported the improvement of regression methods from the cross section to panel data analysis which capture the dynamics of the time invariant in trade data. Nevertheless, the variation in a number of regressors and estimation methods that are utilized in the gravity model has surprisingly not reduced the power of the model to explain bilateral trade between countries.

4. Methodology and Data

This paper follows the recent empirical research in the gravity model, which augmented the traditional model into several additional models. Therefore, in examining the bilateral export of Indonesian textile products, I include additional regressors and employ panel data regression. The first model is the standard gravity model:

$$LnEXP_{it} = \beta_0 + \beta_1 LnY^{I}_{t} + \beta_2 LnY_{it} + \beta_3 LnDist_i + u_{it} \qquad (3)$$

Moreover, in order to capture the impact of other qualitative aspects, we modified the model (3) by including binary regressors (dummies):

$$LnEXP_{it} = \beta_0 + \beta_1 LnY^{I}_{t} + \beta_2 LnY_{it} + \beta_3 LnDist_i + \beta_4 DASEAN + \beta_5 DAPEC + \beta_6 DBorder + u_{it} \qquad (4)$$

Where EXP_{it} denotes export value of Indonesia to its (i) trading partners in period (t) respectively, Y^{I}_{t}, Y_{it}, D_i are the GDP of Indonesia and country i in period t respectively, and D is the geographical distance between Indonesia and country i which is time invariant. The dummy variable would take the number 1 if country i is a member of ASEAN or APEC and shared common border with Indonesia, and zero if otherwise. Finally, u_{it} is the identically and independently distributed error-terms.

As pointed out in the previous section, national income (expressed in GDP) variables are expected to have a positive impact on exports. Furthermore, Indonesian GDP and exports are likely to be in an endogenous relationship, since in the macroeconomic equation, GDP is formed partly by net foreign trade. However, in a similar case, the estimation results showed these were slightly different estimates from a standard regression and therefore, for the sake of simplicity, Y^I_t is handled as exogenous (Földvári 2006). The effect of geographical distance is negative to export, since it reflects transport costs. Lastly, the influence of dummy variables, common regional trade agreements (RTA) and shared borders, is supposed to be positive. It is natural since the purpose of RTA is to encourage trade between members. Furthermore, the same as the distance variable, neighboring countries tend to trade more rather than distant countries.

As an alternative specification, I replace national income with population, per capita income and per capita income differential in the model:

$$LnEXP_{it} = \beta_0 + \beta_1 LnP^I_t + \beta_2 LnP_{it} + \beta_3 LnYPc^I_t + \beta_4 LnYPc_{it} + \beta_5 LnDist_i + \beta_6 Ln\Delta Ypc^I_{it} + \beta_7 DASEAN + \beta_8 DAPEC + \beta_9 DBorder + u_{it} \quad (5)$$

Where YPc^I_t,YPc_{it},P^I_t, and P_{it} are GDP per capita income and population of Indonesia and country i, in time t respectively, and ΔYpc^I_{it} is per capita income difference between Indonesia and country i, in time t respectively. From mathematical perspective, this replacement does not make any difference since:

$$LnY = Ln(YPc \times P) = LnYPc + LnP \quad (6)$$

However, from an econometrics viewpoint, the results might be slightly different. The per capita income of Indonesia and its trading partner impact to export is expected to be positive, since higher income means a larger market to expand (in the view of exporting or importing country). Therefore, higher per capita countries tend to trade each other. Furthermore, as noted earlier, the addition of per capita income differential is to evaluate whether the export pattern follows Linder's hypothesis. Thus, the negative sign of the coefficient means that the model supports Linder's hypothesis and vice versa. The impact of population (both Indonesia and partner countries) cannot be indicated a priori, since the effect can flow in a different direction. Large population means a substantial domestic market and higher degree of self sufficiency. Thus, they usually tend to refrain exporting their products. However, large population also encourages higher labor division, higher economies of scale and finally, opportunity to trade in more differentiated goods.

This paper utilizes panel data regression to estimate the models above. The estimation methods in this study are estimated generalized least square (EGLS) with a weighted cross section to control contemporaneous heteroscedasticity in cross section data. Furthermore, the model estimation should run thoroughly in both fabric products (SITC 65) and yarn and fibre products (SITC 26) data. In order to assess the potential trade, I utilize the results of standard gravity model estimation. Accordingly, the trade success is the comparative measurement between actual trade and potential trade:

$$\text{Trade Success} = \frac{\text{Actual Trade}}{\text{Potential Trade}}$$

If the actual trade is smaller than potential trade, it is a sign of under trade phenomenon between Indonesia and its trading partner countries. Therefore, it means there are possibilities to export more to these countries. Conversely, if actual trade is larger than potential trade, it is a sign of over trade. In the over trade case, it does not necessarily mean that Indonesia should reduce the export level to these countries. However, it reveals a risk of possible loss if Indonesia's exports are excessively large to any country.

The data collected in this paper are time series data from 2000-2008 in a cross section of 26 countries (Indonesia, Australia, Bangladesh, Brazil, Canada, China, Hongkong SAR, Egypt, France, Germany, India, Italia, Japan, Malaysia, Mexico, Netherland, Pakistan, Philippines, South Korea, Russia, Saudi Arabia, Singapore, Spain, Thailand, United Kingdom, and United States of America) which are randomly selected from Indonesia's major trading partner countries in each continent. Furthermore, these selected countries comprise almost 70% of Indonesia total export. The following table depicts detailed data explanation of each variable.

Table 3
Variable Explanations

Variable Name	Summary	Source
Export	Total Export value. Reporter : Indonesia, Partner : 25 selected countries	United Nations Commodity Trade Statistics Database (UN COMTRADE) accessed through World Integrated Trade Solution (WITS)
GDP	GDP value at 2005 constant price	United Nations Statistics Division (UN STATS), National Account Main Aggregate Database
Population	De facto population in a country, area or region as of 1 July of the year	UN STATS, National Account Main Aggregate Database
Per capita income	GDP per head calculated as the aggregate of production (GDP) divided by the population size.	UN STATS, National Account Main Aggregate Database
∆per capita income	Absolute value of per capita income difference between Indonesia and country *i*	Computed by author from UN STATS, National Account Main Aggregate Database
Distance	Geographical distance measured in Nautical miles. Since the cargo of exported textile products travels through seas/oceans.	GeoDataSource™ Distance Calculator, http://www.geodatasource.com/distancecalculator.aspx
Dummy Variables	Membership of ASEAN and APEC, Border: shared border with Indonesia	http://www.aseansec.org/, www.apec.org

Finally, Appendix 1 presents the detailed descriptive statistics of the data used in this research paper.

5. Estimation Results

Table 4 and 5 show the GLS estimation results of the gravity model estimated with Eviews 6.0. As explained in the previous section, this paper estimates two gravity models. First, the

estimation of standard gravity model with national income, geographical distance and dummy variables. Second, the estimation of augmented gravity model with the population, per capita income and per capita income difference as an additive variable. Each table presents regression results of yarn and fabric (SITC 65) products and fibre (SITC 26) products. Therefore, in this section I discuss the results of two proposed models within two aggregated products.

Table 4
Standard Gravity Model Estimation Results

REGRESSORS	SITC 65 (Yarn & Fabrics)			SITC 26 (Fibres)		
C	**15.16702**	*3.814980*	(3.975648)***	**-45.81505**	*7.336372*	(-6.244919)***
LnY^I	**0.036355**	*0.140233*	(0.259247)	**2.554787**	*0.243715*	(10.48267)***
LnY	**0.378925**	*0.011600*	(32.66610)***	**0.422063**	*0.063701*	(6.625660)***
LnDist	**-1.002886**	*0.050322*	(-19.92931)***	**-2.184271**	*0.106890*	(-20.43473)***
DASEAN	**-0.159599**	*0.076126*	(-2.096497)**	**-1.972264**	*0.154751*	(-12.74472)***
DAPEC	**-0.247325**	*0.020729*	(-11.93144)***	**0.005506**	*0.144014*	(0.038232)
DBORDER	**-0.245762**	*0.070239*	(-3.498964)***	**-0.598574**	*0.085537*	(-6.997871)***
(Pool) Observations	250			250		
R^2	0.645373			0.589258		

- Coefficient in bold, standard error in italic, t statistics in parentheses
- * significant in 10%, ** significant in 5%, *** significant in 1%

The estimation results of the standard gravity model for yarn and fabric products in table 4 show that GDP of Indonesia is not significant in affecting the value of fabrics products export. The reason is perhaps that Indonesia is in the phase of export orientation, so the size of its national income does not impact the level of export value. As expected, the trading partners' GDP positively influences the export value, and the geographical distance has a negative impact. However significantly, all the dummy variables have negative effect on export value. The result is inconsistent with the expected effect, that neighboring countries and shared members of international organization should create more trade cooperation. This fact does not necessarily mean that becoming a member of regional/international organization would discourage trade. The possibility is the different role or policy in international trade of textile products within the country members, since they are just cooperation forums, so they do not have specific trading agreement. In addition, this may occur as the consequence of declining export trend to some ASEAN and APEC member during this period.

On the other hand, the estimation results of fibre products present slightly different facts. The GDP of Indonesia still has a positive significant impact in multiplying the export of fibre products. Furthermore, the coefficient is bigger than its trading partner countries' GDP. This means that the increase of export level will follow the rising level of Indonesia's national income. Moreover, in line with the gravity model perspective, the supply potential to export fibre products is depending on the size of Indonesia's economy.

Table 5 presents the estimation results of the augmented gravity model on fabric and yarn and fibre products. From the results, Indonesia's per capita income and population are not influential significantly to increase export value of yarn and fabric products. This

indicates the export of yarn and fabric products did not depend on the supply side of the economy or domestic demand. Thus, how large per capita income and population of Indonesia are, they do not impact the level of export value significantly. Nonetheless, the fibre products export value depends on the size of Indonesia's GDP but not its population. Therefore, it means that the level of export depends of the dimension of Indonesia's economy, as shown by positive significant of Indonesia's per capita GDP coefficient.

Table 5
Augmented Gravity Model Estimation Results

REGRESSORS	SITC 65			SITC 26		
C	**5.470505**	*53.72684*	(0.101821)	**131.6281**	*120.7119*	(1.090432)***
$LnYPc^{I}$	**-0.262074**	*0.250603*	(-1.045771)	**1.366983**	*0.655934*	(2.084026)**
LnYPc	**0.700248**	*0.028216*	(24.81712)***	**1.140321**	*0.134547*	(8.475265)***
LnP^{I}	**0.676323**	*2.894319*	(0.233673)	**-6.343299**	*6.524521*	(-0.972224)
LnP	**0.341168**	*0.016884*	(20.20597)***	**0.558350**	*0.072237*	(7.729464)***
LnΔYPc	**-0.221837**	*0.024912*	(-8.904760)***	**-0.696751**	*0.100917*	(-6.904216)***
LnDist	**-1.083439**	*0.049407*	(-21.92865)***	**-2.297343**	*0.151764*	(-15.13762)***
DASEAN	**-0.296147**	*0.075432*	(-3.926031)***	**-2.367285**	*0.333733*	(-7.093347)***
DAPEC	**-0.283229**	*0.021243*	(-13.33270)***	**-0.192828**	*0.155910*	(-1.236794)
DBORDER	**-0.362989**	*0.033008*	(-10.99713)***	**-0.316873**	*0.283917*	(-1.116077)***
(Pool) Observations	250			250		
R^2	0.607212			0.625615		

- Coefficient in bold, standard error in italic, t statistics in parentheses
- * significant in 10%, ** significant in 5%, *** significant in 1%

The positive and significant coefficients of partner countries' per capita income and population are consistent with the gravity model perspective. Therefore, they suggest that the increase in export value is larger in higher income and population partner countries, which reflects its market demand. Furthermore, the negative and significant coefficient of per capita income difference shows that the smaller gap of per capita income level of Indonesia and its trading partner encourages the export of fabric and yarn and fibre products. In other words, the pattern of export of textile products follows Linder's hypothesis, which stated that countries with similar income per capita would trade more. The negative and significant coefficient of geographical distance is also coherent with the gravity model standpoint, since it reflects transport costs. Thus, the furthest countries from Indonesia would have lower export value. Lastly, similar to estimation results of the standard gravity model, the dummy variable (shared border and membership of ASEAN and APEC) coefficient is contradictory with inherent of its purpose to enhance trade.

The summary of the predicted trade potential is shown in Appendix 2 of this paper. As mentioned in the previous section, the projected export value is generated from the results of the standard gravity model estimation. However, since the dummy variables are inconsistent and some of them are also insignificant, I use the reduced form of the

standard gravity model (without dummy variables). So, the estimation to generate the potential trade for yarn and fabrics products is:

$$LnEXP_{it} = 7.604907 + 0.255205\ LnY^{I}_{t} + 0.380035 LnY_{it} - 0.813700\ LnDist_{i}$$

While for fibre products is:

$$LnEXP_{it} = -35.950145 + 1.808263\ LnY^{I}_{t} + 0.583540\ LnY_{it} - 1.568352\ LnDist_{i}$$

The results expressed in Appendix 2 revealed that several trading partner countries are experiencing under trade with Indonesia. They are Canada, France, Mexico, Netherland, Saudi Arabia and Singapore, which are under traded in fabric, yarn and fibre products. Afterward, Malaysia, Philippines, Russian Federation, South Korea, and United Kingdom actual trades are lower than their potential trades in yarn and fabric products. Ultimately, Indonesia needs to export more fibre products to Australia, China, Germany, India, Pakistan and Thailand.

6. Concluding Remarks

In explaining the pattern of export value of Indonesia's textile products, this paper develops the standard and augmented gravity model and performs estimated generalized least squares on a data set involving 25 major trading partner countries. Furthermore, this paper calculates the potential trade value and compares it to the actual trade data within the period of analysis. The results presented in this paper not only confirm that the gravity model is applicable in this case, but also reveals some insightful phenomena.

In all models and both aggregated products (fabric, yarn and fibre products), the results exhibit positive and significant impact of the economy size of trading partner countries, which is represented by GDP, per capita income, and population. Thus, the size in the form of income or population of partner countries does matter in export growth of Indonesia's textile products. However, for the yarn and fabric products, the reporter's (Indonesia) GDP and per capita income are not significant in affecting export value. However, for fibre products, the coefficients present a contrary effect. It probably means that in the case of exported products, the yarn and fabric product is less sensitive to changes in domestic demand and supply rather than the fibre products.

From the test of Linder's hypothesis, it shows that Indonesia tends to trade more with countries that have similar preferences, which is represented by a similar income per capita. The coefficient of geographical distance that corresponds to transport costs confirms the theory of gravity. Therefore, transport costs are still the significant barrier in Indonesia's textile products export growth. Unexpectedly, the membership of ASEAN or APEC and the shared border with neighboring countries do not bring positive and significant impact in textile products export growth. Since it does not necessarily imply that joining these organizations would decrease exports, the proper policy implication is to explore more benefits of this cooperation forum, especially related to textile product trading agendas. Lastly, from the trade potential evaluation, Indonesia needs to diversify its textile products export destinations to the under traded countries.

This study is limited in its explanatory variables and models, due to simplicity issues to narrowing the discussion from the original structure of the gravity model and the least squares estimation. And it is quite common in quantitative studies which employ econometric tools. Therefore, for further development and refinement of this research, one may expect to add more explanatory variables that are proven significant from previous empirical research. Furthermore, any alternative panel estimations by modifying and enriching the data, for example cross-sectional data for fixed effect estimation, are open for further study.

Endnotes

[1] Linnemann (1966) augmented the model by including population as the proxy of economic size that reflects market and production scale of bilateral countries (Larue and Mutunga 1993, pp. 63 in Kristjansdottir 2005)

[2] Recently, the Indonesian garment industry is facing problems of overflowing new and used garment products which is smuggled from China and neighboring countries. Therefore, the number accounted in any published data of garment trade (import, market demand, consumption, etc) may not reflect the real data, since it is difficult to verify trading data from the underground/black market.

[3] Linder hypothesis (Linder 1961) is opposing traditional Heckscher-Ohlin model of factor endowments in international trade. It stated that two countries with similar level of endowments and income would share the same preferences. Therefore they would increase the trade between each other.

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Appendix 1
Descriptive Statistics

Summary	Exp 65	Exp 26	DASEAN	DAPEC	DBorder	Dist	DYPc	Y^I	Y
Mean	92321687.62	5499185.	0.160000	0.520000	0.160000	4428.680	16139.30	270032501638.2	1446274596253.
Median	73379739.50	3021188.	0.000000	1.000000	0.000000	4011.200	13864.54	263994153149.2	766711447162.3
Maximum	393064836.0	55046403	1.000000	1.000000	1.000000	9088.700	50597.39	339995203996.1	13247500000000
Minimum	1154725.000	4072.000	0.000000	0.000000	0.000000	482.1400	22.87247	216276749161.0	41752924508.13
Std. Dev.	74256785.08	7593011.	0.367341	0.500602	0.367341	2579.672	14628.76	39347609348.89	2416296038701.
Skewness	1.536108733	2.999865	1.854852	-0.080064	1.854852	0.270360	0.382145	0.353614904934	3.501569641162
Kurtosis	5.441487744	15.41022	4.440476	1.006410	4.440476	1.927746	1.748565	1.903855968067	15.73475736439
Jarque-Bera	160.4102351	1979.274	164.9675	41.66709	164.9675	15.02196	22.39821	17.72610148653	2200.187551432
Probability	0.000000000	0.000000	0.000000	0.000000	0.000000	0.000547	0.000014	0.000141522656	0.000000000000
Observations	250	250	250	250	250	250	250	250	250
Cross sections	25	25	25	25	25	25	25	25	25

Summary	YPc^I	YPc	P^I	P
Mean	1266.389	17215.01	214999244.5	169879097.0
Median	1142.730	15102.52	215049390.0	64900766.50
Maximum	2245.502	52842.89	227345082.0	1314357176.
Minimum	759.5538	317.0729	202512990.0	3932862.000
Std. Dev.	490.7592	14953.93	7962891.323	309661387.3
Skewness	0.750238	0.388051	-0.014284073	2.903560548
Kurtosis	2.279487	1.792269	1.766996140	9.999792286
Jarque-Bera	28.86010	21.46822	15.84494434	861.6640362
Probability	0.000001	0.000022	0.000362505	0.000000000
Observations	250	250	250	250
Cross sections	25	25	25	25

Appendix 2
Summary of Predicted Trade Potential

Country	Yarns and Fibres					Fabrics				
	Mean of Actual Trade	Mean of Potential Trade	Gap	Trade Success	Sign	Mean of Actual Trade	Mean of Potential Trade	Gap	Trade Success	Sign
Australia	7.904.166	3.636.909	4.267.258	2,1733		51.113.453	81.199.986	-30.086.532	0,6295	**U**
Bangladesh	3.249.357	1.381.768	1.867.589	2,3516		72.774.641	39.960.507	32.814.134	1,8212	
Brazil	1.139.645	767.474	372.171	1,4849		126.303.758	36.625.390	89.678.368	3,4485	
Canada	167.113	860.712	-693.599	0,1942	**U**	30.260.373	39.693.310	-9.432.938	0,7624	**U**
China	13.786.207	6.857.528	6.928.680	2,0104		120.111.299	120.391.783	-280.483	0,9977	**U**
Egypt	3.595.387	495.793	3.099.593	7,2518		49.058.484	24.523.410	24.535.074	5,4871	
France	842.236	2.077.760	-1.235.524	0,4054	**U**	22.559.742	66.054.161	-43.494.420	0,7427	**U**
Germany	4.245.205	2.589.023	1.656.182	1,6397		73.298.159	75.784.133	-2.485.974	0,2977	**U**
Hongkong SAR	11.169.002	3.429.184	7.739.819	3,2570		134.563.324	69.967.758	64.595.567	1,0476	
India	9.005.194	4.299.355	4.705.839	2,0945		72.445.613	88.126.855	-15.681.242	0,8221	**U**
Italy	5.760.626	2.017.274	3.743.352	2,8556		108.134.904	64.275.159	43.859.745	1,6824	
Japan	11.007.772	9.276.265	1.731.507	1,1867		321.338.565	152.249.077	169.089.488	2,1106	
Malaysia	4.959.966	14.354.090	-9.394.124	0,3455	**U**	152.877.712	144.072.969	8.804.743	1,0611	
Mexico	451.917	652.253	-200.337	0,6929	**U**	29.423.814	33.623.151	-4.199.337	0,8751	**U**
Netherland	706.328	1.033.717	-327.389	0,6833	**U**	35.781.242	41.895.730	-6.114.488	0,8541	**U**
Pakistan	18.784.661	1.075.064	17.709.596	17,4731		19.227.439	36.872.215	-17.644.776	0,5215	**U**
Philippines	2.820.598	3.097.146	-276.547	0,9107	**U**	71.696.411	63.456.669	8.239.741	1,1298	
Russian Federation	63.091	1.538.400	-1.475.309	0,0410	**U**	3.730.448	51.449.598	-47.719.150	3,8244	
Saudi Arabia	297.965	1.295.594	-997.629	0,2300	**U**	83.981.604	44.238.788	39.742.816	0,0843	**U**
Singapore	2.580.010	20.775.609	-18.195.599	0,1242	**U**	89.237.062	172.636.419	-83.399.356	0,4865	**U**
South Korea	9.023.489	3.955.228	5.068.261	2,2814	**U**	196.761.530	85.125.777	111.635.753	1,0483	
Spain	1.472.802	1.272.920	199.882	1,1570		71.825.608	48.528.816	23.296.792	1,4801	
Thailand	6.294.894	5.520.040	774.854	1,1404		84.761.989	89.476.420	-4.714.431	0,9473	**U**
United Kingdom	1.565.346	2.042.287	-476.941	0,7665	**U**	76.285.885	65.631.355	10.654.530	1,1623	
United States	16.586.644	3.288.754	13.297.890	5,0434		210.489.133	95.854.581	114.634.552	2,1959	