Master Thesis

A Panel Data Analysis of Bangladesh's Trade: The Gravity Model Approach

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The Graduate School of Hansung University

Major in International Market Analysis

Dept. of International Trade and Economics

Ahmed Ishtyak

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Advisor Professor Jaewhak Roh

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- 방글라데시 무역 패널 데이터 분석: 중력 모델 접근-

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ABSTRACT

A Panel Data Analysis of Bangladesh's Trade: The Gravity Model Approach

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The main goal of the research is to examine the variables that affect Bangladesh's trade flows' size, dispersion, and level of efficiency between 2006 and 2019. For a fourteen-year period, we concentrated our discussion on the trade flows between Bangladesh and particular nations. The main objective was to present a summary of recent trade flows in Bangladesh and to suggest some creative predictors for these flows. We want to emphasize that the conclusions drawn from our empirical study depend on the very brief time frame that we looked at, and that future research may consider extending the reference period in order to better clarify the gravity model's predictions.

Keywords: Bangladesh's Trade, Panel Data, Gravity Model.

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Section1: Introduction

Since the beginning of the field, economists have been attempting to provide an explanation for a very fundamental question: why do nations engage in trade? The nationalistic perspective of the mercantilists of the 16th and 17th centuries, Adam Smith's notion of the absolute advantage, the neoclassical model, and other theories have all been proposed to explain international commerce. Our knowledge of why countries trade increased as time went on and the field of economics developed. The Heckscher-Ohlin theory was one of the dominant ideas of the 20th century. In the Heckscher-Ohlin model, nations with a comparative advantage in labor over capital (labor abundant) will typically specialize in goods that require proportionately more labor than capital in their production (labor intensive), and nations with a comparative advantage in capital will typically specialize in goods that require significant amounts of capital in their production1. If this hypothesis is expanded, it effectively means that nations will trade with nations that are fundamentally dissimilar to their own. Labor-rich countries tend to be less developed, developing nations, while capital-rich countries tend to be more advanced industrialized nations. Oddly enough, we look to a famous physicist instead of a famous economist to gain a fuller grasp of international trade: Isaac Newton. Even though Sir Isaac Newton did not do any economic research on the subject of international trade, his law of universal gravitation turns out to be unexpectedly applicable to the subject. The direction and magnitude of international trade between two nations can be explained using an adaptation of Newton's law of universal gravitation. The Gravitational Model of International Trade is a model that incorporates this law. By using this model, we may more easily comprehend a wide range of economic variables and account for

the volume of commerce between nations. The relative size of economies, transaction costs, trade agreements, shared cultures and histories, and language obstacles are a few examples of trade variables whose effects can be explained by the gravity model. Bangladesh is one such nation with a broad and intricate range of economic factors affecting its trading status. Bangladesh is a south Asian developing country with 160 million population. Trade plays a significant role in the Economy of Bangladesh as it is a vital source of foreign exchange earnings. One of the most important topics being discussed today, not just in Bangladesh but all throughout the world, is international commerce. The rate of economic growth is constantly the main source of worry. A trade theory suggests that openness, the ratio of exports to growth domestic product (GDP), the ratio of investments to GDP, and inflation all generally have a positive correlation, as per Qaiser et al(2009). Because of less wages rather than other country like China, Korea, Us, Uk, Germany etc Bangladesh can produce product in a cheap way. A nation's overall development and economic prosperity depend heavily on trade. This is a crucial tool for industrialization, and securing foreign funding is required for long-term expansion of the gloomy economy. In terms of international trade, Bangladesh trades at far lower rates than other developing nations like India, Vietnam, and Sri Lanka, and a sizable portion of Bangladesh's overall trading potential is essentially untapped. There is controversy over the other economic factors that influence Bangladesh trade flows. Bangladesh's commerce, which consists mostly of RMG, depends on advantageous trade circumstances offered by several industrialized countries. Bangladesh's main financial, political, and cultural hub is Dhaka. The country's main seaport, which manages more than 90% of the country's international trade, is located at Chattogram (formerly known as Chittagong), the second largest economic and

financial hub. There are stock exchanges in both locations. South of Chattogram, in Matarbari, where the nation's first deep water port is being built, a future commercial powerhouse is anticipated to emerge.

This study uses the panel data estimate approach to pinpoint the major factors affecting Bangladesh's economy. In our research, we used a simplified gravity model. The gravity model has become a well-liked tool in international economics for estimating future trade between nations. It was influenced by the Newtonian concept of gravitational forces, according to which the force of attraction between two bodies is inversely equal to the square of the distance between their centers of gravity and proportionate to the product of their masses. The simplest gravity model assumes that bilateral trade flows between two nations are inversely proportional to a measure of the distance between the countries and proportionate to the product of their economic sizes (expressed by GDP) (Bergstrand, 1985). Here researcher wants to determine the key variables that influence Bangladeshi trade and to examine whether the gravity model adequately describes Bangladesh's trade patterns. In other words, the primary goal of this study is to calculate Bangladesh's potential for international trade using an augmented gravity model.

Here dependent variable is Bangladesh's Trade and independent variables are geographical distance, land endowment, carbon-di-oxide emission and the broad money of partner countries which is actually money supply of trading partners.

1.1 Overview of Bangladesh's Trade

Although a sizable amount of Bangladesh's economy is devoted to foreign trade, the nation's balance of payments is consistently negative. As Bangladesh is a underdeveloped country that's why Bangladesh does not have so many international trade partners. Only with a few country Bangladesh doing their trade such as United stated, China, India, Korea and so on.

Trading ties between Bangladesh and other countries, especially those in the SAARC region, do not bode well for the country's extension of its depressing sciences.

It should be noted right away that Bangladesh implemented trade policy reforms in the early 1990s, removing quantitative limits, significantly reducing and rationalizing tariffs, and switching from a multiple exchange rate system to a single exchange rate regime. Along with a management of trade policy that was more outwardly focused, the conversion of the current account was also permitted (World Bank, 2013). Additionally, Bangladesh's South Asian neighbors implemented similar policy changes, "albeit with non-uniform phasing and sequencing of the respective reform initiatives" (Rahman, 1997). Trade-GDP ratio increased from only 18% in 1990 to 43% in 2008 as a result of the new policies (World Bank, 2013). In the ten-year period from 1999-2000 to 2011-2012, Bangladesh's exports increased by 558.56%, from 12.2% of GDP to 20.72% of GDP.

Over the past ten years, Bangladesh's export and import patterns

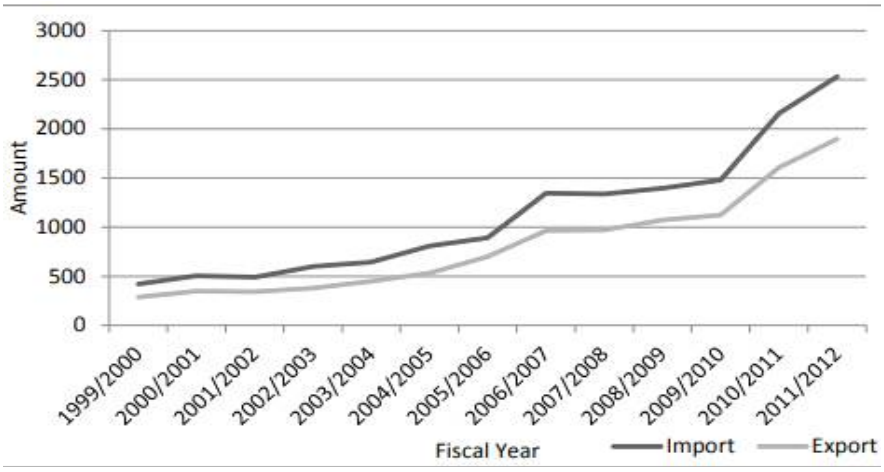

Figure 1: Bangladesh's export and import patterns

Note: Figures for import and export are presented in billions of Taka.

Source: Bangladesh's Ministry of Finance, 2013a Economic Indicators

In terms of growth, imports have not lagged behind. To meet the rising demand for foreign goods and capital equipment, Bangladesh's import growth has also been rising. Between 1999-2000 and 2011-2012, Bangladesh imports increased by 500.55 percent. Imports as a share of GDP were 17.8% in 1999-2000 before rising to 27.7% in 2011-2012. Figure also shows an increase in imports in the Bangladeshi economy.

With $9.0 billion in total (two-way) goods trade in 2019, Bangladesh is currently our 46th-largest trading partner. Exports of goods reached $2.3 billion, while imports of goods came to $6.7 billion. In 2019, Bangladesh and the United States had a $4.3 billion goods trade deficit.

Long working hours and low labor costs are the country's two major benefits. Ready-made clothing and knitwear are Bangladesh's two main exports. After China, Bangladesh is the world's second-largest exporter of clothing and textiles. Sector of ready-made clothing (RMG) generates over 80 percent of Bangladesh's total export revenue, and 10.5% of the nation's GDP.

Bangladesh earns a huge amount of money by exporting goods to its partner countries which helping to grow its economy. The United States and Europe have traditionally been Bangladesh's top export destinations, although over time, the proportion of exports to industrialized nations has decreased. Bangladesh's export share to the USA in 2004 was 27.2%, to Germany 18.5%, and to England 12.7%. However, by the end of 2008, the export proportion to the United States had decreased to 25.4%, while in other European nations like Germany and England, it had increased to 15.4% and 9.7%, respectively. Contrary to popular assumption, it exports little little to the South Asian nations that are nearby. For instance, India, Bangladesh's neighbor, receives just 1% of all exports from that country. Consequently, it is crucial to determine the key determinants of Bangladesh's trade and the potential of the nation's commerce in the future. Bangladesh is mainly an agricultural country. So in the time of export Bangladesh exports its agricultural products. Bangladesh mainly exports Knitted cloth, footwear, leather, manufacturing product, frozen food (jute products, frozen shrimp, frozen fish) etc.

Figure 2: Bangladesh major export destination

Source: United nations industrial development organization

And mainly imports Petroleum and oil(11 percent of total imports), Computers(11% of total), cotton (10.5% of total), fuels including oil (8.7% of total), electrical equipment(6.4%), iron, steel(5.8%), plastic materials(4.4%) etc. Bangladesh's main trade partners are China, India, Singapore, Hongkong(China), United States, Germany, France and so many countries. In 2017-2018, statistics shows that Bangladesh major imports from China which is almost 21.4% of total imports.

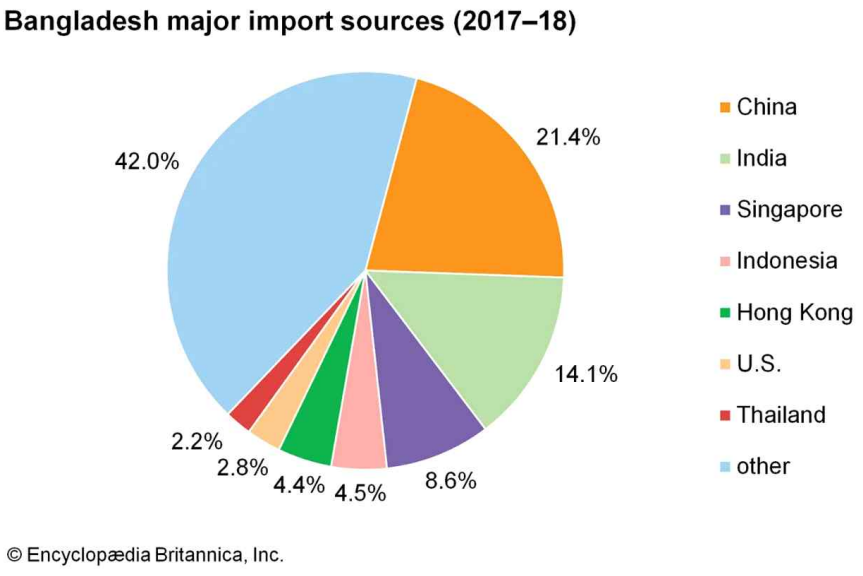

Figure 3: Bangladesh Major Import Sources

Bangladesh has a huge amount of unemployed people who are willing to work at a minimum wages but in Bangladesh job sector is not so much high. Though Bangladesh is not so developed country but still it has a huge change to help its economy by international trading with partner countries. But mainly international trade of Bangladesh is happening by water transport which is almost 85-90% of total trade by using Chittagong and Mongla seaport. Bangladesh can use road transport only with India, Myanmar, Nepal, Bhutan. To speed up its economic development, the Bangladeshi government has cut back on the imports of luxury items. By sending workers abroad, this nation receives large remittances. These increases employment abroad and money sent to Bangladesh. Saudi Arabia, the United Arab Emirates, the United States, Japan, South Korea, and other nations are currently the most popular destinations for migrant workers. In 2019-2020 exports of some product increased such a tobacco, fruit, juice, vegetables etc. Because of COVID19

Bangladesh suffers a lot.

Decreased its exporting and increased its importing product because of that pandemic situation which is a huge loss for the country.

Section 2: Literature Review

According to Awe (2013), economic growth is the process by which a nation's real per capita income rises over an extended period of time. Therefore, an economy experiences growth as its productive capacity rises, which is then employed to produce additional commodities and services. This is why foreign direct investment (FDI) has been viewed as a potential driver of growth. Export markets expand the overall market for a country's producers, which is one of the most important dynamic benefits of trade. Export expansion develops into a constant source of productivity growth if manufacturing is subject to rising returns. Along with increased returns, capital accumulation is closely related to each of these factors. There is very little room for large-scale investment in cutting-edge capital equipment in a tiny country with no trade; specialization is constrained by the size of the market. However, there is a chance for industrialization and the abolition of old production methods if a tiny, poor country can engage in commerce. It is important to keep in mind that there are at least 60 emerging nations in the world, including 31 in Africa, with populations under 15 million.

Without export markets, many products would not be produced in this continent at a profit (Thirlwa, 2000).

It is important to consider why endogenous-growth models actually give an equivocal response, despite the fact that they are frequently believed to have established the missing theoretical link between trade openness and long-run growth. The usual response to the question "Does trade stimulate innovation in a small open economy?" is "It depends," as stressed by Grossman and Helpman (1991). In particular, the outcome relies on whether the forces of comparative advantage steer resources

away from or toward economic activities that foster long-term growth (via externalities in R&D, increased product diversity, improved product quality, etc.).

Feenstra (1990), Matsuyama (1992), and others have developed cases where a nation that is lagging in technical advancement can be compelled by trade to specialize on traditional items and experience a decline in its long-run rate of growth. In actuality, such models are formalizations of some very ancient arguments regarding nascent businesses and the requirement for temporary protection in order to catch up with more developed nations (Rodrigues et al, 2001)

On the other hand, Omoju and Adesanya (2012) found a substantial correlation between the level of trade openness and per capita income. They make the argument that increased trade opportunities in an economy can boost growth by increasing the total factor productivity, the capital stock, and the stock of education. They are keen to point out that since it takes into account several aspects, they caution against making conclusions for trade policies based on their findings.

Cooper (2001), who explored the impact of foreign trade and investment on growth through income inequality and distribution in developing nations, took this topic a step further by pointing out that the analysis of theory and empirical evidence is largely inconclusive. In general, there aren't any strong theoretical arguments in favor of the idea that trade fosters growth, and empirical research supporting such a link at the

national level has come under harsh methodological criticism. Last but not least, Cooper asserts that it is hard to imagine that trade liberalization has not considerably aided in the expansion of the global economy in the latter part of the 20th century. The conclusion is that trade is a byproduct of economic growth and that trade barriers as high as they were in the 1950s would not have prevented the world economy from growing as quickly as they did, indicating that growth is influenced by other factors besides commerce.

Michaely (1977) discovers an upbeat sandwich relationship between export and economic growth. There is some evidence to indicate the good effects of trade liberalization, according to Greenway and Sapsford (1994) and Yamin et al (1995). For five ASEAN countries, Mendoza (2000) examined the relationship between openness, exports to GDP ratio, and economic expansion. He found that openness, exports to GDP ratio, and economic expansion are intertwined across all countries. Ahmad (2000) presented the findings of extensive research into computerized exports management. He spoke on the export trends and issues that Pakistan faces, as well as solutions for how to make exports easier for Pakistan and how to manage exports using computers.

Using empirical data covering the years 1870－1940, Hadass and Williamson (2003) find a correlation between economic growth, terms of trade, and exports. They discover a notable disconnect between economic growth, trade terms, and exports. Evans (2007) contends that through utilizing monetary and fiscal policies, an openness to inflation might have a favorable impact on the global market. According to Hanif and Jafri (2008), foreign debt benefits the textile and agriculture industries both in the short and long terms.

From 1980 to 2010, Kalaitzi (2013) looked at the connection between exports and economic growth in the United Arab Emirates. In order to determine whether or not there is a long-term link between the variables, the study used the two-step Engle-Granger cointegration test and the Johansen cointegration approach. Additionally, a Vector Autoregression Model was used in this work to build the Impulse Response Function and conduct the Granger causality test, which looked at the relationship between exports and economic growth. The results of this study confirmed that manufactured exports, primary exports, and economic growth had a long-term link. Additionally, the Granger causality test demonstrated a one-way causal relationship between manufactured exports and economic expansion. The UAE's economy could expand more quickly if its exports were further diversified away from oil.

When Kim and Lin (2009) explored at how export composition affected economic growth, they found that not all exports had an equal influence. Particularly, the export of primary goods, which are prone to extreme price swings, is a major source of income for many developing nations. While manufactured exports had a favorable and considerable impact on economic growth, this category of exports typically had little to no impact.According to Ahmed (2009), national and international multi-fibre agreement quotas allowed Bangladeshi garments access to a secure global market.

The amount of commerce a country engages in is significantly influenced by trade cost as well as other volume-related factors. Transportation costs (including time and freight costs), tariff and non-tariff policy barriers, information costs, contract enforcement costs, costs related to the use of other currencies, legal and regulatory costs, and local distribution costs are some examples of trade cost components.

Khan and Kalirajan (2011) divided trade costs into a variety of components, including natural costs, behind the border expenses, implicit beyond the border costs, and explicit beyond the border costs. The authors' investigation of these ideas, conducted in the absence of good information on the home and partner countries, led them to the conclusion that Pakistan's export growth between 1999 and 2004 was primarily the result of decreases in both explicit and implicit beyond-the-border costs in those nations.

Rahman (2009) suggested that tight fiscal and monetary policies be used to reduce inflation because it has a significant impact on imports. Additionally, encouraging the import of capital goods would complement the export capability. The author has also made further suggestions, including diversifying exports, raising the standard of exports, and boosting exports to nearby nations, particularly India.

Section 3: Research Design

3.1 Objectives of this study:

The trade of Bangladesh is impacted by a variety of variables. Some variables have a positive and some a negative impact. The major goal of this study is to identify the factors that influence Bangladesh's trade by estimating a gravity model with panel data and to give an overview of current trade flows in Bangladesh and to make some original predictions for these flows.

3.2 Hypothesis of The Study

The research study's hypothesis is provided below in order to satisfy the study's main goals, as is necessary in quantitative research.

- The GDP of Bangladesh has considerable impact on the trade.
- The GDP of trading partners has considerable impact on the trade.
- The geographical distance has negative significant effect on the trade.
- The land endowment has a positive significant impact on trade.
- The carbon-di-oxide has a positive significant impact on trade.
- The broad money of partner countries (money supply) has a positive significant impact on trade.

Section 4: Research Methodology:

Eight different nations are covered by the investigation. The countries were chosen based on the significance of the trade links with Bangladesh and the accessibility of the data.

The gravity model is used to determine if economic variables such as real GDP, importer-exporter distance, total land area, carbon dioxide emissions, and money supply of partner nations can adequately explain bilateral commerce between Bangladesh and other countries.

14 years of data, from 2006 to 2019, are collected.

To determine the relationship between a dependent variable and an independent variable, regression analysis is performed. Then, the usage of fixed effect and random effect models.

To choose between a fixed effect model and a random effect model, the Hausman test is used.

If there is a correlation between individual effects and the regressor, OLS estimates that ignore individual effects will be biased. So, in order to develop our empirical gravity model of trade, we used panel data techniques. According to the expanded gravity model of commerce, the amount of exports and imports between two countries depends on their incomes (GNP or GDS), populations, distance from one another (a proxy for transportation costs), and a number of other factors that either promote or deter trade between the two countries.

4.1 Research Variables:

Here, dependent variable is Total Trade (export + import) of Bangladesh. And independent variables are given in below:

- Geographical distance.
- Land Endowment.
- Broad Money (money supply) of Trading Partners.
- Carbon-di-oxide Emissions.

4.2 Correlation Test:

The correlation test determines the amount of change in one variable as a result of the other's change. We can infer that the other variable or metric is also being impacted in a similar way if there is evidence of a high connection between the two and one of them is acting in a certain way.

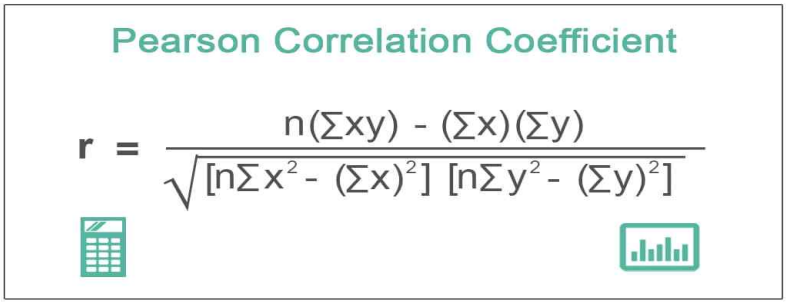

Figure 4:Pearson Correlation Coefficient

Source：Google

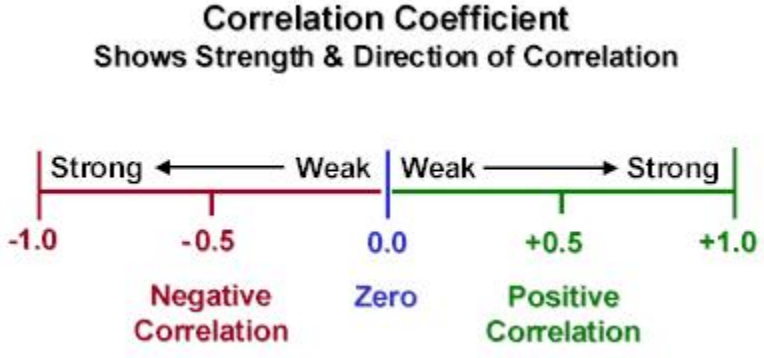

Figure 5: Direction & Strength Of correlation coefficient

Source：Google

4.3 Pooled Regression Analysis:

The pooled regression model is one kind of model with constant coefficients, pertaining to both intercepts and slopes. The entire set of data can be gathered and subjected to a least squares regression analysis using this model. The link between the dependent and independent factors, as well as the impact of the independent variables on the dependent variable, were examined in this study using pooled regression.

4.4 Fixed Effect Model:

A family of statistical models known as fixed-effects models assumes that the levels (or values) of the independent variables are fixed (or constant) and that only the dependent variable changes in response to the levels of the independent variables. Each group mean in a fixed effects model is a fixed quantity that is unique to that group.

Fixed effects are the subject-specific means in panel data with longitudinal observations for the same subject. The phrase "fixed effects estimator" in panel data analysis refers to an estimator for the regression model's coefficients that takes those fixed effects into account (one time-invariant intercept for each subject).

4.5 Random Effect Model:

In statistics, a random effects model, also known as a variance components model, is a statistical model where the model parameters are

random variables. It is a type of hierarchical linear model that assumes the data being analyzed come from a hierarchy of various populations, with the differences between those populations being related to that hierarchy.

When one thinks there are no fixed effects in econometrics, one uses random effects models in panel analysis of hierarchical or panel data (it allows for individual effects). A mixed model's special case is a random effects model. The additional premise of the random effects model is that the distribution of the individual effects is random. It is a specific instance, not just the reverse of a fixed effects model. The random effects model is more effective than the fixed effects model if the random effects assumption is true.

4.6 Hausman Test:

The Hausman test is occasionally referred to as a model misspecification test. The Hausman test can assist to decide between a fixed effects model and a random effects model in panel data analysis (the examination of data across time). An easy way to interpret the outcome of a Hausman test is to reject the null hypothesis if the p-value is low (less than 0.05). The issue arises from the fact that there are numerous test variations available, each with a unique hypothesis and set of potential outcomes. Actually, a few of the available tests point to "opposite conclusions about the null hypothesis" (Chmelarova, 2007).

Section 5: Result and Discussion

5.1 Descriptive Analysis

Variables	Description	Unit
LnTrade	Total Trade of Bangladesh (Export + Import)	Thousands in USD
LnGeo	Geographical Distance	Kilometer
Land Endowment	Land area of Bangladesh & Trading Partners	Square Kilometer
LnBroadPart	Money supply of Partner countries	
LnCO2 Emission	Carbon-di-oxide emissions	

Description of variables

Name of the partner countries are China, India, Japan, South Korea, Pakistan, Brazil, Russia, South Africa.

In this paper, dependent variable is trade of Bangladesh and independent variables are geographical distance, land endowment, money supply of partner country and carbon-di-oxide emissions.

Trade is measured on usd. Distance calculated from Dhaka (capital of Bangladesh) to capital of trading partner countries in kilometer. Land endowment is measured by square kilometer.

5.2 Correlation Test:

Correlation between dependent variable and each independent variable are as follows.

- Correlation between Trade & Geographical Distance:

```
             | lnTRADE      lnGEO
-------------+------------------
    lnTRADE  |   1.0000
             |
             |
      lnGEO  |  -0.5114     1.0000
             |   0.0000
```

Here the correlation between Trade and distance is negative and very sig nificant as when distance increases the export goes down because on that time transportation cost goes high.

- Correlation Test Between Trade and Land endowment

```
             | lnTRADE  LAND_E~T
-------------+------------------
    lnTRADE  |   1.0000
             |
             |
LAND_ENDOW~T |   0.1784     1.0000
             |   0.0611
      |
```

Here, correlation between trade and land endowment is positive and very significant.

According to the factor endowment theory, nations are likely to have an abundance of various resources. The simplest case for this distribution in economics is the notion that different countries will have different capital-to-labor ratios. To establish comparative advantage, factor endowment theory is applied.

- Correlation between trade and trading partners broad money

```
             lnTRADE lnBROA~T
-------------+------------------
     lnTRADE |    1.0000
             |
             |
lnBROADPART  |    0.5578    1.0000
             |    0.0000
      |
```

We can see that the relation between trade and broad money of partner countries is significant

and positive. In order to account for cash and other assets that can be quickly changed into

currency, broad money is the most flexible way to measure an economy's money supply.

- Correlation between trade and carbon-di-oxide emission

| lnTRADE LNCO2E~N
---+---
lnTRADE | 1.0000
|
LNCO2EMISS~N | 0.3584 1.0000
| 0.0001

Carbon-di-oxide emission is also finding in this paper. The correlati on between co2 emissions and trade is also positive and significant.

5.3 Regression Analysis:

panel variable: country (strongly balanced)
time variable: year, 2006 to 2019
delta: 1 year

Random-effects GLS regression — Number of obs = 111

Group variable: country — Number of groups = 8

R-sq:
within = 0.8197
between = 0.7202
overall = 0.7383

Obs per group:
min = 13
avg =13.9
max = 14

			Wald chi2(4)	=	473.00
corr(u_i, X) = 0 (assumed)			Prob > chi2	=	0.0000

lnTRADE	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnGEO	-.665975	.4282037	-1.56	0.120	1.505239	.1732888
LAND_ENDO	.1930857	.0948659	2.04	0.042	.007152	.3790195
lnBROADPART	.1379416	.0473759	2.91	0.004	.0450866	.2307967
LNCO2EMISS	1.29916	.177159	7.33	0.000	.9519351	1.646386
_cons	-5.569754	1.967713	-2.83	0.005	-9.426401	-1.713108

sigma_u	.35420726	
sigma_e	.09619066	
rho	.93131713	(fraction of variance due to u_i)

Table: Pooled OLS estimation

The result in the above table shows the pooled OLS estimation. The dependent variable is total Trade of Bangladesh (export + import) with other eight countries. Number of observation is 111 and number of groups is 8. Overall R-squared value is 0.7383 and probability of F test is 0.0000.

The pooled OLS result suggests that geographical distance coefficients is negative as usual because if distance is too long trade goes down because that time transportation cost goes up and if distance is low with other country trade goes up.

Next is land endowment which is total land area of Bangladesh and its trading partner countries. The coefficient is 0.19308 and p value is 0.04.

A country's factor endowment measures the amount of labor, land, capital, and entrepreneurial resources it has available for use in manufacturing. Generally speaking, nations with big or diverse factor endowments are wealthier and have greater production capacity than nations with small factor endowments. The opportunity cost of specializing in producing some items as opposed to others is also influenced by factor endowments.

After that we have lnbroadpartners which is money supply of partner countries. It says if money supply of trading partners increase 1% trade will also increase by 0.137%. and here p value is 0.004 which is very significant.

The last we have lnco2 emissions which is emission of carbon-di-oxide. Here coefficient is 1.299 and p value is 0.000 which is very significant.

The overall impact of trade on carbon emissions is difficult to evaluate since trade has many effects on greenhouse gas (GHG) emissions.

A wide range of factors, including an economy's size, the sectoral makeup of its international trade, its level of involvement in global value chains, the transportation modes it uses for imports and exports, and the energy efficiency of its production system—which is influenced in part by environmental and energy policies—determine the amount of GHG emissions hidden in international trade.

When utilizing the pooled OLS, the intercept term cannot change over time in terms of partner countries. In the panel analysis, using the random and fixed effect models is essential. Both the random effect and fixed effect theories have similar importance. The F-test is used to determine the model significance. Less than 1% of the f-test probability value meets the threshold for significance. To choose the most effective model from the random and fixed effect models, we use the Hausman specification test.

5.4 Fixed Effect Model:

note: lngeol1 dropped because of collinearity

FE (within) regression with AR(1) disturbances Number of obs = 95
Group variable: Partner1 Number of groups = 8

R-sq: Obs per group:
within = 0.5372 min = 11
between = 0.0360 avg = 11.9
overall = 0.0316 max = 12

F(3,84) = 32.51
corr(u_i, Xb) = -1.0000 Prob > F = 0.0000

```
------------------------------------------------------------------------------
   lntradel1 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lngeol1 |          0  (omitted)
    lnmentl1 |   64.67546   25.56376     2.53   0.013     13.83911    115.5118
  lnbordparl1 |  -.0511263   .1263476    -0.40   0.687    -.3023824    .2001298
      lnco2l1 |   1.899953   .4294783     4.42   0.000     1.045889    2.754018
        _cons |  -179.0932   31.31431    -5.72   0.000    -241.3651   -116.8213
-------------+----------------------------------------------------------------
       rho_ar |   .54503844
     sigma_u |   106.63035
     sigma_e |   .07542028
     rho_fov |    .9999995   (fraction of variance because of u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(7,84) = 55.79                     Prob > F = 0.0000
```

The above table is fixed effect model. The coefficient of geographical distance is omitted as distance does not change over time, distance is constant all the year that's why repeated value in the models.

Than land endowment coefficient is 64.67 which is too high and p value is 0.013 which is significant.

Next the broad money of partner countries coefficient is −0.05 and p value is 0.687 which is not significant. So here we can reject the null hypothesis.

After that carbon-di-oxide emission coefficient is positive which is 1.899953 and the p value is 0.0000 which is very significant.

5.5 Random Effect Model:

RE GLS regression with AR(1) disturbances Number of obs = 103

Group variable: Partner1 Number of groups = 8

R-sq: Obs per group:

within = 0.8231 min = 12

between = 0.7158 avg = 12.9

overall = 0.7346 max = 13

Wald chi2(5) = 261.62

corr(u_i, Xb) = 0 (assumed) Prob > chi2 = 0.0000

```
------------------- theta --------------------
   min        5%         median        95%        max
0.8355     0.8355       0.8408       0.8408     0.8408


------------------------------------------------------------------------------
   lntradel1 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lngeol1 |   -.6728629   .3213759    -2.09   0.036    -1.302748   -.0429776

  lnmentl1 |    .1933731    .0730591     2.65   0.008     .0501799    .3365664

 lnbordparl1 |  .142344     .0453258     3.14   0.002     .053507     .2311809

  lnco2l1 |     1.353634    .1908782     7.09   0.000     .9795196    1.727748
     _cons |   -5.945635    1.69493     -3.51   0.000    -9.267637   -2.623634
-------------+----------------------------------------------------------------
       rho_ar |   .54503844   (estimated autocorrelation coefficient)
      sigma_u |   .27239066
      sigma_e |   .07841698
      rho_fov |   .92346563   (fraction of variance due to u_i)

              |
```

The above we did the random effect model where R-square is 0.7346. Firstly the geographical distance has a minus sign as normal cause when distance is long cost goes up and trade becomes lower. But p value is significant here which is 0.036. next the land endowment coefficient is positive 0.1933731 and p value is also significant 0.008. After this the variable is broad money of partner countries. Which coefficients is also positive 0.142344 and P value is 0.002 that means significant value. And last the co2 which is carbon-di-oxide emissions. Its coefficients value is positive as well 1.3536 and p value is also significant.

5.6 Hausman Test:

	---- Coefficients ----			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fe	re	Difference	S.E.
lnmentl1	64.67546	.1933731	64.48209	25.56366
lnbordparl1	-.0511263	.142344	-.1934703	.1179377
lnco2l1	1.899953	1.353634	.5463195	.3847299

b = consistent under Ho and Ha; obtained from xtregar

B = inconsistent under Ha, efficient under Ho; obtained from xtregar

Test: Ho: difference in coefficients not systematic

chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)

= 9.45

Prob>chi2 = 0.0239

We did the hausman test to choose the best model between fixed effect and random effect model.

When p value is less than 0.05 we can not reject the null hypothesis and we need to choose the fixed effect model and when p value is greater

than 0,05 that time we can reject the null hypothesis and select the random effect model.

Here p value is very low (less than 0.05) so we can not reject the null hypothesis. As we can not avoid the null hypothesis so we choose the fixed effect model for this research.

Section 6: Conclusion

This paper's goals were to theoretically support the use of the gravity model in the analysis of bilateral trade and to use the gravity model to analyze Bangladesh's trade with its major trading partners using the panel data estimation technique. We have proven that there is theoretical justification for using the gravity model in applied research on bilateral trade. The gravity model is utilized in many different areas of applied research to analyze bilateral trade patterns and trade linkages.

The generalized gravity models of trade, export, and import have been estimated. The size of the economies and openness of the trading nations have a beneficial impact on Bangladesh's trade (the total of its exports and imports). The total import demand of Bangladesh's trading partners, and economic openness are the main factors affecting trade.

The negative impact of transportation costs on Bangladesh's trade is determined to be significant. This means that Bangladesh would grow more if it engaged in more trading with its neighbors. The country-specific impacts further support this. The border between India and Bangladesh is also shown to have a significant impact on Bangladesh's import. But the neighbor country of Bangladesh does not have a great trade relation with it as these country also not so developed. Also Bangladesh use mainly water transport to do export and import very rarely use road transportation. The wealth and production capability of countries with large or diverse factor endowments is greater than that of countries with limited factor endowments. Factor endowments also have an impact on the opportunity cost of concentrating in some products over others. Here in this paper we choose

land endowment which has a positive effect on Bangladesh's trade with its trading partners. Broad money of partner countries also has a positive impact on trade. As they can make more money they will import more from Bangladesh and also they can make the product more in their country and later on they can export also. Along with tangible goods like intellectual property and patents, the globe trades everything from sugar cane to high-end automobiles. Economists developed the concept of trading the right to pollute in response to the growing threat of climate change in order to provide a financial incentive to reduce emissions.

With one of the lowest labor rates in the world, Bangladesh has been able to build its industrial base, which is being led by the RMG sector. However, it is in a good position to increase its value chain position and diversify its exports. Large industries for footwear, pharmaceuticals, and agricultural processing are also present in the nation. Construction, business process outsourcing, information and communication technology (ICT), light engineering, shipbuilding, leather, jute, and ceramic products are further crucial industries.

The results have important policy effects since they show that, in order to improve Bangladesh's trade, all trade obstacles in the concerned countries—especially Bangladesh—must be liberalized to a significant level. . Given other negative repercussions of devaluation, such as internal inflation, it is necessary to devalue the currency in order to promote the nation's exports. As Bangladesh's exports are heavily dependent on foreign demand, proper quality of the goods and services must be maintained as well as an increase in the variety of goods and services. As Bangladesh's trade is not independent of country-specific effects, the propensities of all partner countries to import and export must be fully and appropriately

taken into account when trade policy is created.

Implication and Limitation of the study

The contribution of the study is that it can help researchers to get a direction of Bangladesh trade.

The information and data set in this paper are original. Researcher created a panel data set to do the OLS, Fixed effect, Random effect model. I experienced a number of obstacles when gathering the data because not all of them were accessible, therefore I had to check many wesites.

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