Master Thesis

# Determinants of Bangladesh's footwear Exports to Its Major Trade Partners: a Panel Gravity Model Approach

2023

The Graduate School of Hansung University

Major in International Market Analysis

Dept. of International Trade and Economics

Ahmed Shakil

Master Thesis
Advisor Professor Jaewhak Roh

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– 방글라데시 주요 교역국에 대한 신발수출 산업의 중력모델 –

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Submit the above thesis as a master's thesis

December 2022

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Approved Ahmed Shakil Master Thesis in International Trade and Economics

December 2022

Judge Chair 김정렬 (Sign)

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# Abstract

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The Purpose of this thesis paper is to determine the factors that influence the export of
Bangladesh's foot wear exports with 7 major trade partners. To analyze and conduct the research a panel data set has been generated to estimate the panel gravity model of Bangladesh's leather foot wears export to a total of 7 major trade partners over a period of 17 years from 2000 to 2017. There are few tests have been done including regression analysis, Fixed effect model, Random effect model and Hausman test to select between Fixed effect model and Random effect model. The dependent variable of this study is leather foot wear and the independent variables are GDP of Bangladesh, GDP of Partners country, Geographical distance, CPI( Consumer Price Index), Country tariff, country exchange, $CO^2$ emission, manufacturing of leather and Technology. The study shows that

the GDP and Co2 emissions have positive coefficient and the P value is significant. The research study is a remarkable contributor for the export of footwears industries in Bangladesh. And this research will help find more insights and pave a new way for further research in the future.

**Keywords:** *Bangladesh, Leather foot wear, GDP, Geographical Distance, CPI, Country tariff, country exchange, $CO^2$ emission, manufacturing*

# Table of Contents

## INDEX OF TABLE



## INDEX OF FIGURE

# Chapter 1. Introduction

## 1.1 Introduction

In all over the world the patterns of international trade division have altered due to advances in globalization over the past two decades, and the importance of financial development to economic growth is becoming more and more recognized (Hagemejery & Muagk, 2019). According to conventional wisdom, export growth might gradually increase foreign exchange inflows and the expansion of capital goods and service imports, two crucial components of economic growth development and productivity enhancement (Chenery, 1967, 1968; Gylfason, 1999; McKinnon, 1964). For such a emerging market in the world like Bangladesh, exporting is a crucial activity. Nearly 90% of Bangladesh's export commodities are ready made or pret garments and the country has had economic growth of over 6% over the previous ten years (Rahman et al., 2019). Thus, RMG is the only sector that the manufacturing industry as a whole depends on. In the last ten years, Bangladesh has seen a decrease in the number of RMG factories. The next stage, which can be further understood by numerous policies indicators and measure of Bangladesh's government, is to reduce RMG dependence and diversify product lines.

Bangladesh would have an advantage in the leather sector, especially given the vast number of employees employed there. There is currently a demographic population advantage in Bangladesh. The leather sector contributed 3.5% of Bangladesh's economy by US$1.2 billion in exports during the 2017 financial year, or around 0.6% of the world export sector. Export performance and trade that increases vertically is seen as a key growth factor. Exports of products and services from Bangladesh increased from US$5 billion in 1990 to US$46 billion in 2019. Bangladesh was able to profit from the tariff-free advantage and export increases after joining the “World Trade Organization (WTO)” in 1995 since it was a developing country working hard to increase its financial growth.

Since that day, especially from 2004, Bangladesh's gross domestic product (GDP) has skyrocketed. Bangladesh's exports have been growing steadily despite the devastating global financial/ economic crisis, which caused a record decline in global commerce in 2015-2017 which in turn cause a drop in worldwide export performance of almost US$3.1 trillion. Bangladesh is among the nations on pace to transition from a reduced to a middle or high income status by the year 2020. (Gimenez et al., 2020). RMG was one of the main contributors to this achievement in respect of exports to other countries. The leather and leather goods industries rank as the recognized leader among many other prospective industries that might help create a sustainable economy, including "the pharmaceutical, shrimp, jute, and vegetable sectors", among others. The seventh five-year plan of 2016-2020 places a strong emphasis on export diversification, notably in the leather sector, to solve the economic crisis and recession. Each year, the global leather market generates $150 billion USD (Kanagaraja et al.,2020). Additionally, Hayakawa and Mukunoki (2021) discover that COVID-19 has a large detrimental impact on both import and export between countries' international commerce. The COVID-19 epidemic had a negative impact on the trade in leather goods as a result. In order to identify the key variables affecting Bangladesh's leather exports and imports, and trade performance related base on the panel gravity model, this article had investigate the key drivers of Bangladesh's leather exports, imports, and trade performance in the international market. The article is organized as follows: In the second section, the current body of scholarship is examined. The backdrop for the current investigation is provided by this overview of the literature. The final section analyzes the general state and makeup of Bangladesh's leather sector. The data, sampling techniques, explanatory factors, analytical strategies, and research methodologies are all described in the fourth part. The fifth segment, which comes before, analyzes, explains, and discusses the results.

### 1.2 Problem statement

The Bangladeshi economy's overall national expansion and good attempt to develop fully include foreign commerce. This is actually a key tool for the industrialization of the nation since sustained economic development and growth requires access to precious foreign currency. However, the nation's trade balance has a persistent deficit. The commercial ties between Bangladesh and other nations, particularly 7 developed nations name as Japan  Germany, Italy, USA, UK, France and spain do not indicate any encouraging signs for the desired contribution to the nation's economic growth. The country's import expenses are far more than its export earnings. This has grown to be a major problem for lawmakers, policymakers, economics and the Bangladeshi government. There are numerous past studies on Bangladesh's trade relations with other developed countries and trade policy (e.g. Hassan 2000), but none specifically examine the factors that influence Bangladesh's leather footwear export industry in depth. Therefore, our work aims to close this knowledge gap.

We have utilized the "generalized gravity model" and panel data of seven countries estimate approach to find the key determinants of Bangladesh's exports. It employs panel data technique for the first time inside a gravity conceptual model to discover the drivers of Bangladesh's export trade of leather foot wears, reinforcing a theoretical foundation and justification for employing the gravity model in practical study of trade relations with other countries.

The remainder of the essay is structured as follows: Section III analyzes the export trade of Bangladesh using panel data of 7 countries name as Germany, UK, USA, spain, france, italy and Japan. with the gravity model; Section IV gives a risk sensitivity analysis of the model; and Section V ends the article. Section II provides a  review of literature that offers theoretical support of the gravity model. This study uses the panel data estimation approach in an effort to identify the key determinants of Bangladesh's commerce. For our investigation, we used a generalized gravity model. Since the early 1940s, a range of products and manufacturing factors traveling across local and national bounds under various conditions have been subject to the gravity model (Oguledo and Macphee 1994). This model is based on the idea of Newtonian physics mechanics. According to Newton's law of gravity, two entities are attracted to one another in a proportionate manner to their product combination of mass (measured in kilograms) divided measure by the distance in squares between their centers core of gravity (in meters). Stewart and Zipf, an astronomer, a sociologist, then extended this concept to the social sciences and human studies. They sought to use the best performance to apply that to spatial interrelations and instructions, such travel between cities.

$$I_{ij} = G\ (popipopj)/D_{ij}{}^{\alpha}$$

Where $I_{ij}$ is number of trips between city i and city j popi (j) is population in city i (j)

Dij is distance between city i and city j

G is a coefficient.

(Zhang & Kristensen (1995); Chritie 2002).

This rule has a trade−related parallel in the gravity model. The trade flow among two countries is directly proportionate to the output of each state's "economic mass," which is usually measured by GDP, each brought up to the strength of that other amount to be decided, divided by the distance measured between the 7 countries' respective mention "economic centers of gravity," which are typically their capitals. Christie(2002) states. This formula can be applied generally to

(2) $M_{ij} = KY_i^{\beta} Y_j^{\gamma} D_{ij}^{\delta}$

Where $M_{ij}$ is the flow of imports into country i from country j, $Y_i$ and $Y_j$ are country i's and country j's GDPs and $D_{ij}$ is the geographical distance between the countries' capitals. The linear form of the model is as follows:

(3) $\text{Log}(M_{ij}) = \alpha + \beta \log(Y_i) + \gamma \log(Y_j) + \delta \log(D_{ij})$

When estimated predicted, this basic model produces results that are largely satisfactory. We are aware that trade volumes are influenced by other variables, though. Most evaluation assessments of gravity models increase (3) by a predetermined amount of dummy variables of regression model to test for particular effects, such as belonging to a export trading relationship, having a land boundary, speaking same/ different languages, and so on. The model equation then becomes: assuming we want to test for p different impacts.

p

(4) $\text{Log}(M_{ij}) = \alpha + \beta \log(Yi) + \gamma \log(Yj) + \delta \log(D_{ij}) + \Sigma\, \lambda s G s$

In this essay, we'll aim to first give a theoretical rationale for applying the gravity model equation in practical research approach on trade agreements and then to use it to analyze Bangladesh's trade relations and pattern with its key trading partners. The remainder of the essay is structured as follows: In part II, the model's theoretical rationale is presented. In section III, panel data and the gravity model are used to analyze Bangladesh's trade. Ultimately, section IV summarizes and draws conclusions from the article.

# Chapter 2. Theoretical and Empirical Literatures

The gravity model of export and import has been the subject of prior theoretical and empirical research, on which this paper builds. The gravity equation was originally calculated by an economist using the “product differentiation model”, Anderson (1979). Then, using “monopolistic competition models”, Bergstrand looked at the microeconomic underpinnings of trade (Bergstrand, 1985, 1989). The notion of gravity equation was first applied by Tinbergen in the field of international commerce analysis in 1962 and originated from “Newton's gravitational theory”, which was presented in 1687 (Ismail & Gencay, 2021). The primary driving force behind this research was to add to the body of knowledge on Bangladesh's agricultural trade in general and its leather commerce (export, import) in particular. This study is important for a number of reasons. Firstly, this study would add to the body of knowledge regarding the gravity model of resource agricultural exports. For nations like Pakistan (Ghafoor, 2015; Ghafoor et al., 2012), Tanzania (Lwesya, 2018), Ethiopia (Lisanework, 2018), South Africa (Jordaan & Eita, 2012), and Bangladesh (Lisanework, 2018), there are various studies on the factors that influence leather exports, including gross domestic product (GDP), foreign direct investments, supply chain strategies, relationship between economic growth, laws and policies, economic competitiveness (Akter, 2019; Hossain et al., 2017; Paul et al., 2013;Razzaque et al., 2018).

Table 1: Review of literature

| Author(s) and Year | Topics/Issues | Findings |
| --- | --- | --- |
| Pasquali (2021) | “Global value chains and upgrading in the Kenyan leather sector” | “Based on a combination of firm-level export data and interviews across the Kenyan leather sector, this study shows that product quality and value-added tasks are higher for exports to the Global North and Global South, but that there is no systematic difference in product and functional upgrading to the two aggregate destinations.” |
| “Omoloso et al. (2021)” | “Sustainability research in leather industry” | “There is a continued increase in research that addresses the various dimensions of sustainability over the past 5 years. The impact and size of the leather industry are significant in countries such as China, India and Bangladesh; hence, the skewness of sustainability research towards these regions should not emerge as a surprise.” |
| Akter (2019) | “Factors affecting | “This study finds that the domestic marketing environment is more important |

| | | |
|---|---|---|
| | international marketing of leather goods of Bangladesh" | than the international market environment. The challenges faced by the domestic leather industry include competition at various levels, threats of new entrants, suppliers, substitute goods and customers." |
| Lisanework (2018) | "Leather export performance determinants of Ethiopia" | "This study finds that importers' GDP and FDI, and host country's domestic infrastructures, have a positive and significant impact on the export of leather and leather goods. The GDP of Ethiopia, market access preferences and exchange rate play an insignificant role." |
| Lwesya (2018) | "Determinants of leather and leather products exports in Tanzania" | "This work finds that export of raw hides, international leather price and high costs of production have deprived leather export, suggesting attracting FDI to get traction in this industry." |
| Razzaque et al. (2018) | "Leather and leather goods exports from Bangladesh" | "This research shows that despite huge export potential of leather and leather goods, it has still not gaining momentum. Suggests to re-constraints to exports and establish overall efficiency." |
| Hossain et | "Export | "This suggests that Bangladesh has a |

| | | |
|---|---|---|
| al. (2017) | diversification to China: leather and footwear industry potential” | comparative advantage score as medium and low of 6.8 and 21 products in leather and footwear industry. Also suggests diversifying four leather products.” |
| Ghafoor (2015) | “Time series analysis to find determinants of leather exports from Pakistan” | “The findings indicate that exchange rate has a negative relationship with the export of leather. Real GDP, raw material and trade openness have also a positive impact on leather export flows.” |
| Paul et al. (2013) | “Bangladeshi leather industry: An overview of recent sustainable developments” | “This study reveals that despite demand in the global leather market, the leather industry is constrained by local demand structure, sub-sector development and effluent plant system. Local sourcing of hides, low labour cost and introduction of the export processing zone seem to have given an edge.” |
| Ghafoor et al. (2012) | “Determinants of leather goods exports of Pakistan” | “A study conducted by using regression analysis found that the different prospects of export experience, raw material sourcing and shortage of energy |

| | | |
|---|---|---|
| | | are factors affecting the export performance of Pakistan. Also, to improve exports, improvement in the supply chain of raw materials and quality standards need to be undertaken.” |
| Jordaan and Eita (2012) | “Determinants of South Africa’s exports of leather products” | “This study shows that importers’ GDP, host country’s GDP, importer’s population and infrastructure for both the importer and South Africa are positive determinants of the export of leather products and exchange rate, transport costs are statistically insignificant and negative to export, respectively. Also, it suggests to diversify exports to new markets.” |

## 2.1 Leather Industry in Bangladesh

One of South Asia's classic export oriented industries is known as the leather industry employs a significant number of individuals from both regulated and unregulated sectors and works mostly with Micro to Small, and medium−sized businesses (ADB, 2016). It started in 1970 and is now a sizable industry. It is currently one of Bangladesh's key industries. Bangladesh enjoyed a comparative edge in this business over nations of a comparable size, such Vietnam, with a population size of 163 million. Rawhide wet blue, crust, or finished leather is produced by more than 200 government verified leather production plants (Ahamed, 2014). Additionally, more than 2,000 leather shoe and production facilities produce a wide range of products, including shoes, clothing, purses, luggage, wallets, and other upscale things.

The Bangladesh Commerce Department estimates that yearly, exports of leather and leather items can bring in more than $5 billion USD for Bangladesh (The Financial Express, 2021). To increase the nation's export revenue from the leather and leather-based product manufacturing, footwear, and plastics industries, the commerce department has created the “Export Competitiveness for Jobs (EC4J)” programme. Bangladeshi leather and leather goods are in high demand across the world.

A process flow diagram of the Bangladeshi leather textile industry's current obstacles is shown in Figure 1. A very distinct network of leather tanneries industry and intermediates has developed within the tanning or dying business, revealing varying capacities and robust internal hierarical structures. The non-profit “Bangladesh Tanners Association (BTA)” represents the country's leather sector. It is crucial to the growth of the leather industry in a number of ways, including the issuance of export certifications and communication with government agencies. Due to a dearth of new investments projects, poor quality product variety, the penetration insertion of artificial leather, price increases on leather goods, and a lack of monitoring on the part of the tannery residences, the leather industry has been facing difficulties for the past two years, particularly since the COVID-19 pandemic outbreak occurs. Exporters also attributed the two-year decline on the US-China trade dispute.

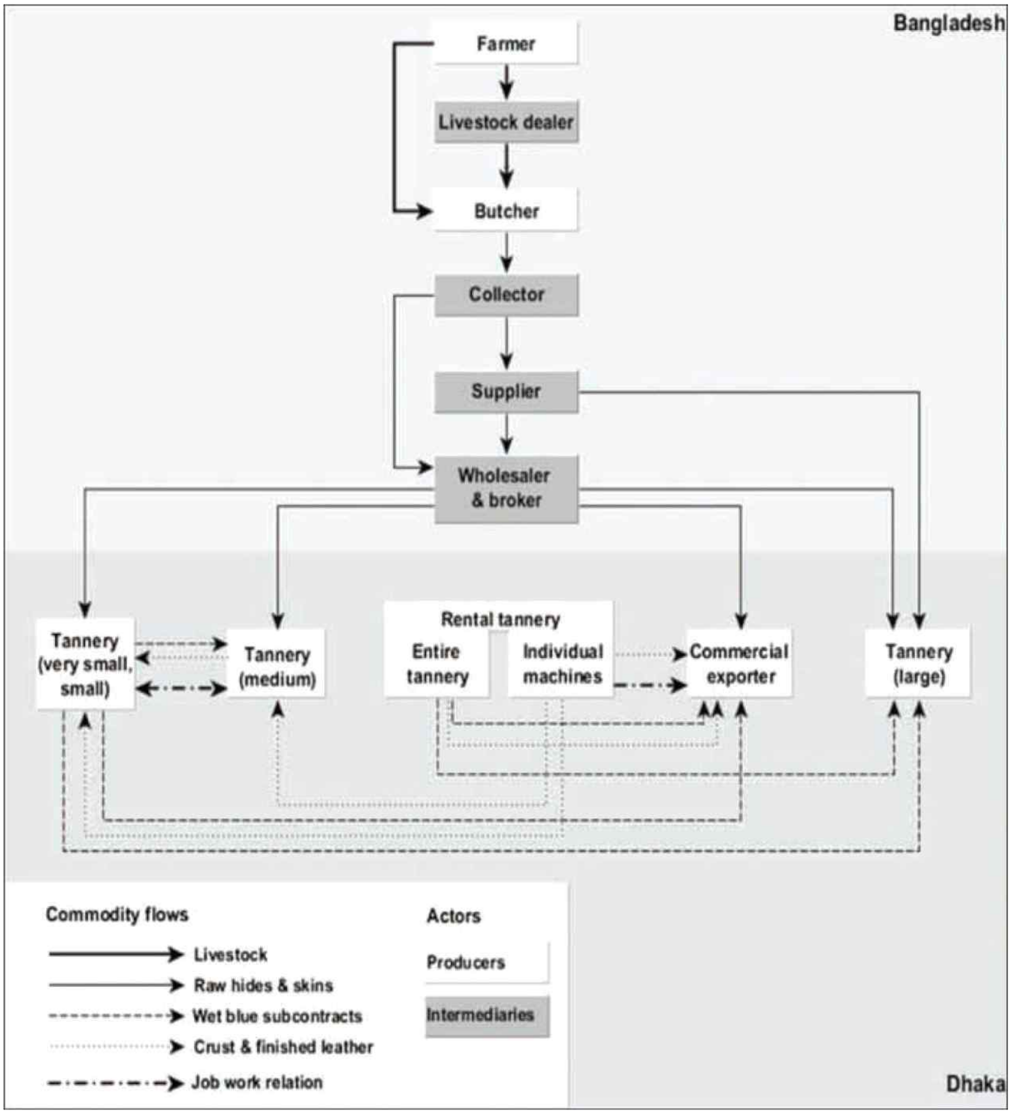


Figure1: *Flow chart of leather industry in Bangladesh*

The marketplace industry  for leather and leather products reached US$251.77 billion in 2019. Every year, Bangladesh manufactures 350 million square feet of leather, or 1% of the total worldwide leather exports (Paul et al., 2013). Nearly 2% of the worlds largest cattle and 3.7% of the goat and sheep population are found in Bangladesh.

Bangladesh may easily meet the 3% global market requirement by doubling its exports to US$2 billion (Mazhangara et al., 2019).

According to Table 2, during 2015, the countries of "USA (24.7%), Germany (8.2%), the UK (6.9%), France (6.5%), Italy (5.2%), and Hong Kong, which is a part of China (5%)," were the top importers of leather and leather items worldwide. Vietnam and India contributed in exports of 15.2% and 3.4%, of leather respectively, of the world's leather footwear in that year, while China contributed over 53% and the USA imported a significant share. The proportion of Bangladesh is only 0.8%. Bangladesh has a respectable foothold in the Japanese market despite its comparative size, holding 7.3% of the market for leather shoes.

| Country | % Share in the Global Imports | % Share of Bangladesh and Comparators in that Market | | | |
|---|---|---|---|---|---|
| | | Bangladesh | China PRC* | India | Vietnam |
| USA | 24.7 | 0.8 | 53.7 | 3.4 | 15.2 |
| Germany | 8.2 | 2.4 | 14.0 | 7.2 | 13.1 |
| UK | 6.9 | 0.5 | 16.6 | 11.7 | 10.5 |
| France | 6.5 | 0.6 | 13.0 | 6.2 | 8.9 |
| Italy | 5.2 | 0.9 | 11.6 | 4.6 | 5.9 |
| Hong Kong, China | 5.0 | 0.3 | 64.0 | 3.5 | 5.5 |

| | | | | | |
|---|---|---|---|---|---|
| Netherlands | 3.9 | 2.5 | 9.6 | 2.3 | 7.0 |
| Belgium | 3.3 | 0.2 | 21.2 | 3.5 | 19.4 |
| China PRC* | 2.7 | 0.5 | 0.0 | 2.2 | 26.4 |
| Japan | 2.4 | 7.3 | 18.0 | 2.5 | 15.1 |
| Canada | 2.2 | 1.1 | 48.8 | 2.8 | 13.0 |
| Russian Federation | 2.1 | 0.7 | 35.5 | 2.6 | 8.7 |
| Spain | 2.1 | 0.3 | 17.3 | 8.4 | 11.0 |
| Switzerland | 1.8 | 0.9 | 10.4 | 3.4 | 7.7 |
| Republic of Korea | 1.7 | 0.6 | 29.9 | 2.0 | 20.0 |

It is observed that Bangladesh's leather industry experiences several limitations that impede production and the procedure of scaling up in various ways and have negative effects that cascade. Despite the newly constructed facilities and leather primitive operations, the cost of resolving these issues is greater than in other nations. The world's largest manufacturer of leather goods, China, has also had difficulties due to rising labor prices. If leather manufacturing transfers to less expensive markets with a connected supply chain, it will sound right. Vietnam, on the other side, ranks on fourth level in the world's footwear export industry. it has over 20 years of expertise in the export of leather, with shipments to even more than 50 nations, The main importers countries are the United States, Japan, and the European Union (EU). With a high level of localisation, 90% of its leather items are exported (Phan et al., 2016).

Despite having promise, Bangladesh's leather industry has several challenges, mostly because of the sector's environmental concerns. Bangladesh has rigorous environmental regulations that need to be handled by countries who import leather. Even though different policies are EC4J have been implemented, the leather processing industry has moved from "Hazaribagh to Savar", and a committed zone has been introduced to be organized and environmentally friendly by constructing a sewage treatment plant, there hasn't been much of a distinction in the growth of exports.

However, just like the apparel industry, Bangladesh's leather sector has some advantages and disadvantages. The effective use of a large labor pool and environmental assets by manufacturers might be replicated in this situation, while at the same time duration, a high-value manufacturing supply chain could be established employing the same supply chain management expertise. Additionally, as the apparel sector enjoys a substantial market share, the leather business may emulate this to expand into a variety of markets.

Recognizing the enormous potential use of the leather industry, the Bangladeshi government has given duty-free access to heavy machinery equipment and raw resource materials as well as improved infrastructure, taxes, and customs benefits. Even though the infrastructure for producing leather has been set up through partnerships with international organizations to increase leather exports, the leather sector has not yet achieved enough traction.

## 2.2 Theoretical Justification of the Gravity Model in Analyzing Trade

The initial explanation for the gravity model is indeed the idea of Newtonian physics law. The second defense of the gravity model equation may be examined in the context of Linneman's (1966) partial balance equations of export supply and imports of goods and services (see Appendix 1 for Linneman approach). The gravity equation finds out to be a condensed version of this system based on certain simplification assumptions. Bergstrand (1985) and others pointed out that, due to the price variable's absence, this partial adjustment model was unable to explain the multiplication shape of the equation form and left a few of other its parameters undetermined. Of fact, Linneman's reasoning for excluding prices is compatible with the equation's simplest version. Anderson (1979) also constructs the gravity model from a trade share spending system (see Appendix 2), which assumes weakly differentiated transfer functions between traded and non-traded products and similarly Cobb-Douglas or consistent sensitivity of substitution (CES) preferences functions for all nations. Utility maximization in this case, taking into account the income restriction, results in traded good shares that are solely expressions of traded good prices. Since prices remain constant in cross-sections, it is possible to determine nation j's imports of country i's goods by applying the share relationships and trade (im) balance identities. The gravity equation for aggregate collective imports is then constructed by adopting log linear functions for proportions of income and population.

The author examines the endogeneity issue with income and suggests two different approaches that use instrumental variables (IV). Using alternative instruments: alternatively lagged value of income as an instrumentation or first stage OLS share estimation using revenue values derived from estimated shares as a replacement for a second phase reestimation of the gravity equation model. For a lot of items, the aggregate gravity equation can only be created by switching out the actual percentages in the second step for a weighted average.

The following strategy is based on the Walrasian general equilibrium model, where each nation has its own supply and demand functions for every good. The level of supply production in the exporting nation and the amount of demand in the importing country are determined by aggregate income. While Bergstrand (1985, 1989) establishes a micro – economic foundation basis for the gravity model, Anderson's approach examines the economy as a whole. According to him, a gravity model is a generic equilibrium equation of demand and supply systems in simplified form. The model of trade demand is created for each nation by maximizing a utility function with a "constant elasticity of substitution (CES)" while taking into account income restrictions in nations that import. The model of commerce supply, on the other hand, is developed from the exporting nation's firm's maximizing profit process, with allocation of resources controlled by the constant elasticity of transformation.

The gravity model of trade flows is then established under marketplace equilibrium conditions state, when the demand and supply for the flows are equivalent. Bergstrand contends that revenue and prices may also be utilized as independent variable of bilateral trade because the redox potential removes all endogenous factors from the explanatory portion of each equation.As a result, the author solutions the standard economic system while keeping income and certain price terms as exogenous variables rather than replacing out all endogenous variables. A "generalized gravity equation" is the phrase used to describe the resultant model. Bergstrand's research is predicated on the suppositions that monopolistic competition drives regional product diversification and that all nations have the same tastes and technological capabilities. Bergstrand's (1985) generalized equation of world commerce includes N nations, one aggregate traded good, one domestic good, and one internationally stationary sector of the economy in each country.

The output is added under monopoly rivalry among businesses that employ labor and capital as elements of production, according to Bergstrand's (1989) model, which is an extension of his earlier work. Companies manufacture specialized goods when returns to scale increase. The 'traditional' gravity model's fundamental premise of complete product substitutability, according to the micro-foundations approach, is also alleged to be unrealistic because new data has demonstrated that trade flows change depending on where they originate.

Misspecification of the gravity model results from the exclusion of pricing variables. This perspective is shared by Anderson (1979), Bergstrand (1985, 1989), Thursby and Thursby (1987), Helpman & Krugman (1985), and others. Their research demonstrates that pricing factors are statistically important in understanding trade flows across participating nations, in addition to the traditional gravity equation variables (Oguledo and Macphee 1994). Typically, a commodity goes from a nation with cheap prices to one with high ones. In light of this, it is anticipated that trade flows will be favorably correlated with changes in export prices and negatively correlated with those of import prices (Karemera et al 1999). However, only when items are ideal alternatives for one another in terms of customer preferences and when it can be transferred across markets without incurring any costs, can price and exchange rate factors be excluded. Naturally, this arrangement leads us to the typical Heckscher-Ohlin (H-O) configuration (Jakab 2001).

The gravity equation is also derived by Eaton and Kortum (1997) using a Ricardian framework, and by Deardoff (1997) using an H-O viewpoint. Deardroff demonstrates that the H-O framework model will yield the same bilateral trade relations pattern as the model with differentiated goods if trade is restricted and each good is supplied by only one nation. The gravity equation should also take distance into account if there are trade transaction expenses. Evenett and Keller (1998) demonstrate how the H-O model with both complete and imperfect system or component may provide the conventional gravity equation. Of fact, the actual success of the model depends on other assumptions other than growing returns to scale. Additionally, they contend that the growing returns to scale model is a more credible choice to understand the achievement of the gravity equation than the complete specialization version of the H-O model. Additionally, they discover that models with incomplete product specialization may explain trade volume changes more well than models with great product concentration ( Carrillo and Li 2002). Hummels and Levinsohn (1993) tested the applicability of monopolistically competitive in international commerce using intra–industry trade data. Their findings indicate that a large portion of intraindustry trade is unique to nation pairs. Their research thus supports a model of trade that involves monopolistic competition (Jakab et. al 2001).

As a result, the gravity equation may be determined using either a market structure with perfectly competitive or a monopoly. If certain presumptions about the structure of both the product and factor markets are true, then neither growing returns nor monopolistic are requirements for their usage (Jakab et. al 2001). Evenett and Keller (1998) discuss three different trade model types when analyzing the theoretical underpinnings of gravity equations. These models vary in how specialization emerges in an equilibrium state. They are:

(1) Variations in technology across nations in the Ricardian model, (2) Variability in terms of the various factor endowments between nations in the H–O model, and (3) Growing Returns to Scale (IRS) model–based higher returns at the firm level.

These concepts of perfect specialization are used as limiting examples for an imperfect specialization model. However, empirically flawed product specialization is significant. Although technology and factor endowments differ between nations in the actual world, they evolve through time and may be exported.

Trade Theoretical studies just describe why nations trade in various goods, but they do not explain why certain nations have stronger commerce ties than others or why the volume of trade between nations tends to rise or fall over time. This is how trade theories are limited in their ability to describe the magnitude of trade flows. As a result, the gravity model succeeds in this sense even if trade theories cannot account for the volume of trade. It enables additional variables to be taken into consideration in order to explain the magnitude of trade as a component of global trade flows (Paas 2000). Ricardian theory, H-O theory, disparities in resource endowments, variations in technologies, as well as the ongoing renewal of current technologies and their transmission to other nations, all contribute to trade (Posner 1961 and Vernon 1966). Mathur (1999) quotes Dreze (1961) as saying that scale economies and nation size are crucial factors in determining commerce (Paas 2000). If scale economies exist, production will be concentrated in one nation. They encourage manufacturers to distinguish their goods as well. For example, the greater the country's GDP/GNP, the greater the variety of items available. The amount of this bilateral commerce increases with the degree of GDP/GNP similarity between the two nations.

As a result of economies of magnitude and distinct products, the volume of commerce is significantly influenced by the GDP/GNP of a nation. This idea underlies contemporary theories of global commerce, and it offers a more comprehensive explanation of the pattern, direction, and pace of increase of empirical data on global trade. As a result, in recent years, new trade theories based on the assumptions of market product differentiation and efficiencies of scale have complemented, if not entirely replaced, the conventional theories. One of the authors of these novel theories Krugman (1979), Lancaster (1980), Helpman and Krugman (1985, 1989), and Deardorff (1984) merit a special remark in the framework of their theoretical and empirical trade explanations (Mathur 1999). These theories implicitly presuppose that all nations have access to comparable technology and factor endowments. The H–O and Ricardian models of trade are in opposition to how trade really operates. The HO model predicts that trade would increase as factor endowment inequalities between two nations widen. Therefore, based on this theory, we would anticipate limited commerce between west Continental countries as these nations have a lot of "North South" trade and relatively equal factor endowments. Empirical data contradict this. The international trade figures make it clear that intra–industry trade and "North–North" commerce are glaringly huge.

The trade in real life is comparable to "Linder's idea" from 1961. Depending on the existence of rising yields to production, each good is produced in one of the countries but not both, according to this him. Furthermore, it is expected that the global market will be identical given the closeness in per capita income in a country. Consequently, as even the countries' per capita economic become much more equal, so does their bilateral trade. In other words, the "absolute size of the gap" in the per capita income of any two countries will have a negative impact on their bilateral trade. The "North–North" trading trend should thus be understandable.

According to Deardorff (1997), "Heckscher–Ohlin and the gravity model" have certain parallels. According to this theory, countries with plenty of capital produce goods that demand a lot of capital. It follows that: equity rich countries keep trade more with other countries having capital–rich capacities as compared to capital–poor countries. However, capital−poor countries trade more with other countries of the same type as Markusen (1986) has already shown. This is because high−income consumers have a tendency to invest or spend a larger portion of their expenditures on capital−intensive goods. The same predictions are made by the Linder theory previously.

The rationalization we fellow are include "per capita GNP" as an unique independent variable in addition to "GNP" is that it serves as a measure of development for a country. As a country grows, consumer demand for more exotic foreign varieties of what are considered superior goods rises. Additionally, the development process may be sped up through innovation, or the production of novel commodities that are later sought afterwards as exports by nearby countries. Developed countries do indeed have better advanced transportation infrastructures that support trade. Transport costs are a key component of trade. When transportation costs are included, it is impossible for the prices of the factors to be comparable when the same object is produced in two or more nations. Additionally, it is observed when transit costs and geographical differences in demand are taken into account, different trading models may respond in different ways.

The more distance serves as a stand−in for increase transportation costs. As a result, the amount of trade between two countries is always determined by their geographic separation. According to studies using the generalized optimal approach, trading partner incomes and the distance range between them were both economically relevant and exhibited the expected positive and negative indications, respectively (Tinbergen,1962; Poyhonen 1963; Bergstrand 1980, 1990). Three separate costs come with conducting business remotely: 1 real actual shipping costs, 2) time duration related costs, and (iii) costs associated with (sociocultural) factors lack of familiarity. Among these costs, shipping costs are particularly notable (Linnemann 1966; Frankel 1997). The majority of standard economic/ general equilibrium study showed that the population densities of the trading nations had a negative and statistically significant influence on trade flows in the market, notwithstanding a few outliers in the research literature (Linnemann 1966, Sapir 1981, Bikker 1987). Tariffs and other trade restrictions have a quantitatively substantial negative effect on global trade flows. Preferential accords, on the other hand, are found to be statistically significant and trade-enhancing exchange factors.

## 2.3 Gravity Model application in Analyzing the Bangladesh Trade

### 2.3.1 A comprehensive view of the Bangladesh's Trade

The Bangladeshi economy continuesly depend heavily on the trading sector. From 0.19, 0.03, and 0.15, respectively, in 1976, country's the trade-GDP ratio and its export-GDP ratio, and also import-GDP ratio all increased to 0.32, 0.13, and 0.19 in numbers respectively, in 1999. Total trade, total exports, and total imports all increased in Bangladesh from 1988 to 1999 by 168%, 204%, and 153%, respectively. The SAARC countries had a 439% increase in trade (exports imports of goods and services) with the countries in the survey. Separately, SAARC countries experienced the biggest rise in exports (63%) followed by NAFTA countries (323%), Middle Eastern countries (85%), and SAARC countries (33%); SAARC countries saw the largest growth of imports (602%) that is followed by ASEAN (276%) and EEC (107%). America contributed for 20% of Bangladesh's total trade in 1999, being followed other countries such as by India (12%), the UK, Singapore, Japan (7%), China, and Germany (6%), and also then the rest of the world. In the same year, 39% of Bangladesh's total exports moved to the United States, 12% to Germany, 10% to the United Kingdom, 7% to France, 5% to the Netherlands, and 1% each to Italy and India. Other major export destinations for countries are Japan, Hong Kong, Spain, Canada, and the United Kingdom. The largest share of our sample's goods imported comes from Bangladeshi (18%), second by Singapore (12%), Japan (10%), China (9%) and the United States and Hong Kong (8%). Consequently, Bangladesh's total trade balance produces dismal results. When compared to 1988, Bangladesh's total trade imbalance increased by 115% in 1999. That is depicted 987% for the SAARC countries, 1098% for India, and 108% for Pakistan.

# Chapter 3. Data and Methodology

## The Generalized Gravity Model of the Bangladeshi Leather Products' Exports

The gravity model derives from the gravitational theory of Newtonian physics, which was developed in the late 1700s. In the beginnings, Tinbergen utilized this model to examine international trade. Numerous studies that are congruent with theoretical frameworks perspective like the H-O paradigm theory, the Ricardian model, monopolistic, "new trade" theory, etc. Sometimes corroborate the basic tenets of the gravity model. Since then, the economic gravity model has become the most successful empirical method for studying international commerce. What are primary variables that affect Bangladesh's export, import, and trade of leather? In order to respond to this inquiry, the panel of gravity model in Bangladesh's leather exports assumes the following form:

Information related to footwear sector exports from Bangladesh is provided inside our thesis paper. The bulk of Bangladesh's seven trade partners the US, UK, Germany, Spain, France, Italy, and Japan are among its top trading partners. The nations are selected based on the significance of their commercial relationship with Bangladesh and the accessibility of the necessary information. From 2000 -2017, a total of 16 years are covered. The investigation was conducted using the panel data.

There are few tests have been done including descriptive analysis regression analysis, fixed effect model, random effect model and Housman test. The dependent variable is export of footwear and independent variables are GDP of Bangladesh, GDP of partner country, geographical distance, exchange rate of partner country, partner country tariff, total manufacturing of Bangladesh, and total labor force of Bangladesh

This approach has two benefits: first, panels can record the important correlations between variables across time; and second, panels can track the individual impacts of un observable trading partner pairings. OLS estimates that exclude individual effects will be skewed if there is a correlation between the individual effects and the regressors. Therefore, for our experimental gravity model of trade, we employed panel data methods.

## 3.1 Methodology

According to Classical gravity models which generally assess trade effects and trade links using crossectional data for a given specific time period, say one year. The panel data technique, which collects cross−section data over a number of time periods, actually yields more high level insight information than cross−section data individually. The two advantages of this strategy are that panels may both follow the individual impacts of non − observable trading partner nations pairs and record significant cross−temporal correlations across different variables. If there is a link between the individual specific effects and the regressors, it estimates that do not account for individual specific effects will be biased. Therefore, we used panel data methodologies for our empirical gravity model of trade in Bangladesh. The “generalized gravity model” of trade states that the volume of trade, exports, and imports between countries, Xij, depends on their incomes (GNPs or GDPs), populations, proximity to one another (a proxy for transportation costs), and a number of regression equations that have random effects that either promote or impede trade between nations. Here is

$$Xij = \beta_0 \, Y_i^{\beta 1} \, Y_j^{\beta 2} \, N_i^{\beta 3} \, N_j^{\beta 4} \, D_{ij}^{\beta 5} \, A_{ij}^{\beta 6} \, U_{ij} \qquad (1)$$

In this equation, Yi (Yj) denotes the GDP of the country I (j), Ni (Nj) denotes the population of the Bangladesh I (j), Dij denotes the estimated distance between the capitals (or economic centers) of the two major countries, Aij denotes dummy variables or extraneous variables, Uij denotes the standard error, and s denotes the model's parameters specifications. Another way to write equation (1) is as follows: Using per capita income rather than just headcount.

$$X_{ij} = \beta_0 \, Y_i^{\beta 1} \, Y_j^{\beta 2} \, y_i^{\beta 3} \, y_j^{\beta 4} \, D_{ij}^{\beta 5} \, A_{ij}^{\beta 6} \, U_{ij} \qquad (2)$$

where yi (yj) represents the whole country's per-capita revenue (j). An natural logarithm of each independent and dependent variable may be used to linearize the gravity model because it was first formulated in additive form. Model (2) is thus represented as follows in year to log-linear format for estimate purposes are:

$$lX_{ijt} = \beta_0 + \beta_1 lY_{it} + \beta_2 lY_{jt} + \beta_3 ly_{it} + \beta_4 ly_{jt} + \beta_5 lD_{ijt} + \sum \delta_h P_{ijht} + U_{ijt} \qquad (3)$$

Where l stands for a variable's natural logarithm. The preferential trade tariff dummy variables make up Pijh. Dummy variables have a value of one if a condition is met and a value of zero elsewhere.

After using our data collection, we determine the gravity of three different types of transactions in Bangladesh: 1) the gravity model of trade which include exports and imports; 2) the gravity model of exports items; and (c) the gravity model of imports products. For this approach, we used refrence from Frankel (1993), Sharma and Chua (2000), and Hassan. The total industrial production and manufacturing output of Bangladesh, also the real exchange rate of the country, the national tariff, and the distance consider between the two nations are all significant dependent variables because the predictor independent variable is the foot wear leather industries between the different countries. Now that the physical border between nations, Bangladesh's Co2 emissions, Greenhouse effect, and its technological progress are all independent variables in my model. The gravity model of commerce in this research is as follows:

$$Log\ (X_{ijt}) = \alpha_0 + \alpha_1 log\ (GDP_{it} * GDP_{jt}) + \alpha_2\ log\ (REX_{it} * REX_{jt}) + \alpha_3\ log\ (Distance_{ij}) + \alpha_4\ log\ (ICT_{ijt}) + \alpha_5\ log\ (Manufacture\ i) + \alpha_6\ (Co_2\ emission_{ij}) + \alpha_7\ (\ tech_{ij})$$

Where,

$X_{ij}$ = Total trade of foot wear Bangladesh (country i) and country j,

$GDP_i$ ($GDP_j$) = Gross Domestic Product of Bangladesh i (j),

REXi ($REX_j$) = Real Exchange rate % of Country i (j),

ICT $_{ij}$= in country tariff i (j)

$Distance_{ij}$ = Distance between country i and country j,

$Manufacture_i$= total manufacturing of Bangladesh

Borderij = Land border between country i and j (dummy variable)

$Co_2$ emission = $Co_2$ emission of Bangladesh country ij

techij = Technology of country ij

Hypotheses 1

The size of such an economy is determined by adding its GDPs. Since it is bigger, there will be greater trade between the two countries; as a consequence, we expect the GDPs coefficient to increase.

2. The stronger a country's development infrastructure and per capita GDP are as indications of its overall level of development and trade, the more trading transaction there will be between its adjacent countries. Therefore, we expect that the coefficient of the PCGNP variable will be positive.

3. Trade tariffs frequently hinder commerce. Additionally, the flow of business is inversely related to transportation costs. Therefore, we expect that these variables' coefficients will be negative.

4. The dependet variables coefficient will have a positive sign, according to the H–O theory. The Linder theory, in contrast hand, predicts that the sign would be unfavorable.

5. The TR/GDP ratio reflects a country's degree of openness. A nation would experience increased trade as it became more open. Therefore, we expect this variable to have a positive sign. When examining the gravity model in case of Bangladesh's export, the following model is taken into account:

$$lX_{ijt} = \beta_0 + \beta_1 lY_{it} + \beta_2 lY_{jt} + \beta_3 ly_{it} + \beta 4 lyjt + \beta 5 lD_{ijt} + \beta 6 lyd_{ijt} + \beta 7 lER_{ijt} + \beta 8 lIn_{it} + \beta 9 lIn_{jt} +$$

$$\beta 10 lTE_{it} + \beta 11 INPI_{jt} + \beta 12 (TMB)_{jt} + \beta 13 (TR/Y)_{it} + \beta 14 (LBC/Y)_{jt} + \beta 15 ( CO^2/Y)_{jt} + \beta 16 ($$

$$TOC/Y)_{jt} \sum \delta_h P_{ijht} + U_{ijt}$$

where, X= footwear exports, Y= country GDP, y = country Teriff, D= distance, INP= in terrif part, ER = exchange rate, TMB = Total manufacturing of Bangladesh, TE = total export, LBC = Land border between countries, Co2 emission= $Co_2$ emission of Bangladesh country, TOC= t Technology of country, P =preferential dummies. Dummies are: D1= j−UK, D2=j−USA, D3= j−SPain, D4 = j−Germany, D5= j−France, D6 = j− Italy and D7= japanj, l= natural log.

Bangladesh's Gross Domestic Product, Real Exchange Rate, Country Tariffs, Country Distance, and Bangladesh's whole Manufacturing Sector. Our model now includes several other independent variables, such as the land boundary between nations, Bangladesh's CO2 emissions, and its technological development.

Hypotheses 2

1. We expect positive signs for variables of β1, β2, β7, β9 β10, β

11, β12, β13 and β14.

2. We expect negative signs for variable coefficients of β5 and β8.

3. Signs may be positive or negative for coefficients of β3, β4 and β6. The main reasons for the ambiguity are as follows: if the nation enjoys scale economies effect owing to its greater per capita income, then 3 would be positive; however, if the country exports less due to absorption effect, then β3 would be negative. Similar to the previous example, if nation j purchases more products from country I owing to increased revenue, then β4 would be positive; but, if more goods are created in country j because of advantages of economies of scale, then β4 would be negative effects. If the H– O hypothesis is correct, then 6, and if the Linder hypothesis is correct, then 6, would be positive. The following model is taken into account for the gravity model equation of Bangladesh's imports:

$$lM_{ijt} = \beta_0 + \beta_1 lY_{it} + \beta_2 lY_{jt} + \beta_3 ly_{it} + \beta_4 ly_{jt} + \beta_5 lD_{ijt} + \beta_6 lyd_{ijt} + \beta_7 lER_{ijt} + \beta_8 lIn_{it} + \beta_9 lIn_{jt} + \beta_{10}(EX/Y)_{jt} + \beta_{11}(TR/Y)_{it}$$

$$+\beta_{12}(TR/Y)_{jt} + \sum \delta_{ij} P_{ijt} + U_{ijt} \qquad \text{(c)}$$

Where, M= imports, EX/Y= export–GDP ratio, and other variables are the same as defined in the Export model.

# Chapter 4. Results

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Distance | 112 | 4766 | 13219 | 8179.57 | 2369.698 |
| LNGEO | 112 | 8.469262657658787 | 9.489410467579500 | 8.970239405479514 | .279723478744347 |
| PART_GDP_PER CAPITA | 112 | 14713.0657111519 | 56863.3714957652 | 36923.504160755720 | 8861.552807100730 |
| LN_FOOTWEAR | 112 | 566.257 | 162216.147 | 28545.42801 | 29293.623662 |
| BD_LAND | 112 | 130170.0 | 130170.0 | 130170.000 | .0000 |
| CPI_BD | 112 | 53.9091441150380 | 144.5588508880131 | 89.484598268360290 | 29.515198519250973 |
| CPI_PART | 112 | 75.9255998200054 | 110.9580173848711 | 96.325561359322250 | 8.615409545108260 |
| tarifratebd | 112 | 8.70 | 30.10 | 16.6219 | 5.98826 |
| tarifratepart | 112 | 1.23 | 3.03 | 2.0963 | .38241 |
| Exratebd | 112 | 96.3 | 153.1 | 113.663 | 14.1823 |
| technology | 112 | .1348143227139110 | .4809198941279400 | .297142396416189 | .111265217725963 |
| FOOTWEAR | 112 | 566.257 | 162216.147 | 28545.42801 | 29293.623662 |
| Valid N (listwise) | 112 | | | | |

Table 1 shows a subset of statistics known as descriptive analysis seeks to describe several characteristics of the data that are often used in a study. Descriptive statistics' primary goal is to give a quick rundown of the sampling and measurements used in a specific study. Descriptive statistics play a significant role in nearly every quantitative analysis of data when combined with a variety of visual analysis. Statistical techniques and descriptive statistics are very distinct from one another. Descriptive statistics essentially involve describing the information included in the presented data. When using inferential statistics, the goal is to draw a conclusion from the available data.

The descriptive statistics is showing that total variable was taken as 112 variables where 6 variables were taken as independent variable and one variable was taken as the dependent variable. The reason for measuring data in descriptive statistics is that it could help to identify the total observation, mean, standard deviation, minimum value and maximum value of a specific variable. After doing descriptive statistics it as found panel variable that is Countries strongly banlanced, with time duration of 2000 to 2015, N= 112 and delta 1 year. It is found that foot wear exports have (M= 28545.43, SD= 29293.62), GDP (M= 4.29e +12, SD= 4.28e +12) distance (M= 8179. 57, SD= 23.696), Country tariff (M.=724, SD= 182), country exchange (M=102.84, SD= 10.66), $CO^2$ emission 42875.63, SD= 14899.97), manufacturing of leather (M= 158e+10, SD=7.75e+09) and for Technology (M= .297, SD=1112).

## 4.1 Estimates of Gravity Equations, Model Selection and Discussion of results

### Hausman Testing

The Hausman Test is a measurement of scale to put it simply and the null hypothesis for the Hausman-Test is that there is no correlation between Independent variables and alpha. If so, FE should be avoided in the favour of Random Effect model and the study must use the Fixed Effect model if the null hypothesis is invalid.

$$\boldsymbol{H} = (\widehat{\boldsymbol{\beta}}_1 - \widehat{\boldsymbol{\beta}}_0)^T [\boldsymbol{var}(\widehat{\boldsymbol{\beta}}_0) - \boldsymbol{var}(\widehat{\boldsymbol{\beta}}_1)]^\dagger (\widehat{\boldsymbol{\beta}}_1 - \widehat{\boldsymbol{\beta}}_0)$$

$$\text{where,} \quad \dagger \text{ stands for pseudo inverse,}$$
$$\hat{\beta}_0 \text{ refers to the fixed effects estimates and}$$
$$\hat{\beta}_1 \text{ is the random effects estimates}$$

Hausman Test and experiment

```
Hausman-Taylor estimation                       Number of obs      =        112
Group variable: country1                        Number of groups   =          7

                                                Obs per group:
                                                             min =         16
                                                             avg =         16
                                                             max =         16

Random effects u_i ~ i.i.d.                     Wald chi2(5)       =       3.99
                                                Prob > chi2        =     0.5510
```

| footwear | Coef. | Std. Err. | z | P>\|z\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| TVexogenous | | | | | | |
| gdp | 4.72e-09 | 1.09e-09 | 4.32 | 0.000 | 2.58e-09 | 6.86e-09 |
| lntarifpart | 2988.941 | 11190.11 | 0.27 | 0.789 | -18943.27 | 24921.15 |
| realexchpart | -14.96263 | 182.892 | -0.08 | 0.935 | -373.4244 | 343.4992 |
| co2emission | -.6536516 | .5887615 | -1.11 | 0.267 | -1.807603 | .5002999 |
| manufactur~d | 3.29e-06 | 1.11e-06 | 2.96 | 0.003 | 1.11e-06 | 5.47e-06 |
| technology | 2634.618 | 13303.68 | 0.20 | 0.843 | -23440.12 | 28709.36 |
| TIexogenous | | | | | | |
| distance | -3.734861 | 2.16426 | -1.73 | 0.084 | -7.976732 | .5070099 |
| _cons | 13427.19 | 27841.09 | 0.48 | 0.630 | -41140.35 | 67994.72 |
| sigma_u | 9325.028 | | | | | |
| sigma_e | 14105.675 | | | | | |
| rho | .30412094 | (fraction of variance due to u_i) | | | | |

b= consistent under Ho and Ha; obtained from xtreg

B= inconsistent under Ha efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematics

Chi2(0)= (b−B'[(V_b−V_B)^(−1)](b−B)

=0.00

Prob>chi2= .

(V_b−V_B is not positive definite)

Table 5 shows the hausman test was conducted for obtaining the difference between two regression models of the fixed effect model and the random effect model. The result has showed that the difference in coefficients were not systematic. The result of random effect model was consistent under H0 and Ha but the result of fixed effect model was inconsistent under Ha but it was efficient under Ho. Therefore, a slight change could be found in each variable of the fixed effect model because the number of variable examined in the random effect model was not consistent and there was a difference while analyzing variables in the fixed effect model because some variables were omitted in the fixed effect model due to the inconsistency of results in the data.

In panel data analysis, the Hausman test's accuracy is a crucial concern, it is a method for evaluating the test's properties when working with certain data is proposed and put into practice. The breadth and strength of the Hausman test are determined using a simulation that replicates the original data. The Hausman test which is employed in dynamic panel studies to select between models, is the main emphasis of this thesis and the panel model's endogeneity is tested using the Hausman test. While using panel data has many benefits over using merely cross−sectional or time−series data, it is crucial to specify the model that will be utilized in order to get reliable findings.

After evaluating the Hausman test on the collected results of the random effect model and the fixed effect model, it could be found that both model has same results where the fixed effect model has some inconsistency and for this reason, the random effect model would be most effective to estimate the result rather than using the fixed effect model where results of some variables were omitted.

Pooled regression analysis

```
Fixed-effects (within) regression               Number of obs      =       112
Group variable: country1                        Number of groups   =         7

R-sq:                                           Obs per group:
     within  = 0.6506                                         min =         16
     between = 0.6113                                         avg =       16.0
     overall = 0.6358                                         max =         16

                                                F(6,99)            =     30.73
corr(u_i, Xb)  = 0.0275                         Prob > F           =    0.0000
```

| footwear | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| gdp | 3.31e-09 | 1.74e-09 | 1.90 | 0.060 | -1.38e-10 | 6.75e-09 |
| distance | 0 | (omitted) | | | | |
| lntarifpart | 7845.449 | 11538.24 | 0.68 | 0.498 | -15048.93 | 30739.82 |
| realexchpart | 66.0879 | 190.5226 | 0.35 | 0.729 | -311.9502 | 444.126 |
| co2emission | -.4342331 | .6124325 | -0.71 | 0.480 | -1.649432 | .7809658 |
| manufacturingbd | 3.06e-06 | 1.13e-06 | 2.71 | 0.008 | 8.18e-07 | 5.31e-06 |
| technology | 4781.289 | 13423.29 | 0.36 | 0.722 | -21853.43 | 31416.01 |
| _cons | -29372.55 | 26857.29 | -1.09 | 0.277 | -82663.24 | 23918.14 |
| sigma_u | 11995.098 | | | | | |
| sigma_e | 14526.832 | | | | | |
| rho | .40540382 | (fraction of variance due to u_i) | | | | |

PooledOLS is a straightforward OLS (Ordinary Least Squares) model applied to panel data. It skips the passage of time and individual traits in favour of a singular focus on inter−individual dependencies. Simple OLS, however, demands that there be no association between the Independent variable and any unobserved independent variables. Alpha may have an autocorrelation problem over time even if the aforementioned supposition is correct, which is the difficulty with Pooled OLS and pooled OLS is hence probably unnecessary for dynamic panel.

The equation used in Pooled regression analysis is -

$Yit = \beta Xit + \alpha it + \mu i$

Where,

Yit = Dependent Variable

Xit = Independent variable

B = Coefficients

α = Individual effects

μ = Random error

## 4.2 Experiment Results

### Estimation and Model selection

As unpredictable uncertain variables across time, the individual effects of undiscovered, individual factor variables are computed using Fixed and Random Effect models. They are able to focus on both inter- and intra-individual interdependence since they can "switch" between OLS and FE. Before including between and within estimators under, the investigation must first choose when to use which estimation. An OLS-model is often preferred if the correlation between the independent variables factors and alpha is zero (or extremely small), suggesting that there is no link between them. As was already noted, using OLS has the disadvantage of integrating alpha with time. The time series sequence of the equal constant variance is used by Random Effect modeling to select a model.

**Random effect model**

**One-way:**

$$y_{it} = \alpha + x_{it}\beta + (u_i + v_{it})$$

**Two-way:** $y_{it} = \alpha + x_{it}\beta + (u_i + \lambda_t + v_{it})$

## 4.3 Random effect result and experiment

```
F test that all u_i=0: F(6, 99) = 5.36                    Prob > F = 0.0001

. xtreg footwear gdp distance lntarifpart realexchpart co2emission manufacturingbd technology, re

Random-effects GLS regression                   Number of obs     =        112
Group variable: country1                        Number of groups  =          7

R-sq:                                           Obs per group:
     within  = 0.6380                                         min =         16
     between = 0.9176                                         avg =       16.0
     overall = 0.7406                                         max =         16

                                                Wald chi2(7)      =     242.47
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000
```

| footwear | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| gdp | 3.31e-09 | 1.74e-09 | 1.90 | 0.060 | -1.38e-10 | 6.75e-09 |
| distance | 0 | (omitted) | | | | |
| lntarifpart | 7845.449 | 11538.24 | 0.68 | 0.498 | -15048.93 | 30739.82 |
| realexchpart | 66.0879 | 190.5226 | 0.35 | 0.729 | -311.9502 | 444.126 |
| co2emission | -.4342331 | .6124325 | -0.71 | 0.480 | -1.649432 | .7809658 |
| manufacturingbd | 3.06e-06 | 1.13e-06 | 2.71 | 0.008 | 8.18e-07 | 5.31e-06 |
| technology | 4781.289 | 13423.29 | 0.36 | 0.722 | -21853.43 | 31416.01 |
| _cons | -29372.55 | 26857.29 | -1.09 | 0.277 | -82663.24 | 23918.14 |
| sigma_u | 11995.098 | | | | | |
| sigma_e | 14526.832 | | | | | |
| rho | .40540382 | (fraction of variance due to u_i) | | | | |

With the exception of distance and dummy variables, the aforementioned equation (a) is approximated for 112 observations. Exports of leather shoes have no statistically significant relationship to factors such as Bangladesh's Gross Domestic Product (p=0.06, Real Exchange Rate% p=0.729, Country Tariff p=0.498, Bangladesh's Co2 emission p=0.480, and Technology p=0.72). Only the relationship between exports of leather shoes and Bangladesh's overall manufacturing is significant (p=0.008, r=2.71), and the distance between the two nations is thus not included. With a variance of R2 = 0.=638, the overall regression equation is F(6,99)= 5.36. The total number of observations across all nations is 112. With the exception of leather manufacture, all independent factors are found to be insignificant.

Table shows in terms of predicting the significance value of all variables in the study, the random effect model of the regression analysis is showing that the gravity model equation was perfect for the study and it could increase the overall performance between exporting trade flows and valuable assets. While exploring all dependent variables and independent variables in the 1%, 5% and 10% level, all variables were statistically significant. The R square value in the random effect model is 96% which means that the overall performance of the random effect model is popularly reflected. The adjusted R square value has showed the determination coefficient of the model where the outcome could be positive by the account of 96%.

Therefore, the random effect model has showed that the gravity model equation has provided a satisfactory overall result among Bangladesh and 13 selected partner countries. However, the prediction of GDP variable was true in the random effect model where the coefficient of the variable is positive and it has the value of 3.91. In terms of the random effect model, the GDP was found as a positive sign of 3.91 where it means that the rise of export for the volume of one unit can increase the GDP of Bangladesh by 3.91%. The random effect model has also explained that there is a slight difference in the result between OLS pooled regression analysis and the random effect model.

The coefficient results of all variables in the OLS pooled regression model and random effect model are same where there is a slight change in the result of coefficient and standard deviation of all variables. The random effect model has showed that independent variables such as GDP, FDI, Distance, CPI and total reserve has positive coefficients and it means that independent variables and the dependent variable Ex are going into the right direction. But the dependent variable land has negative coefficients in the regression model and it means that the dependent variable Ex and the dependent variable land are going into the wrong direction.

$$\log (Xijt) = \alpha 0 + \alpha 1 \log (GNPit*GNPjt) + \alpha 5 \log (PCGNPDijt) + \alpha 6(TR/GDPit) + \alpha 7(TR/GDPjt) \quad (a1)$$

To evaluate the heteroscadasticity in the regression model, we performed a secondary regression that considered the heteroscadasticity for each observation of variables as well as for all data within groups. The results of the regression are pretty close in terms of significance levels and expected signals. Our FEM was also estimated using an auto associated error structure. Even if the resilience for variables is a tiny bit reduced, all coefficients are still not significant even with the correct signs. The only significant component is the production. In all variables' multicollinearity is studied. To determine if our model displays multicollinearity, we regression each independent variable on the other independent factors and calculate Ri 2's. If each of these Ri 2's is greater than the original R2, we may draw the conclusion that the model exhibits considerable multicollinearity. The results suggest that the model seems to have no multicollinearity problems. The estimation results for equation (a) above, also known as equation (d), are shown in Table 2 with the original variables. The gravity model of Bangladesh's exports is shown in equation (b) above.

# Chapter 5. Discussion of Results

As already said, our three gravity models, based on random effect model and Hausman tests, demonstrate that the optimal course of action is to use the FEM of Panel estimate. The FEM results will thus be discussed below for the three aforementioned models. The estimate makes use of White's heteroskedasticity-corrected covariance matrix estimator. In these models, the slope coefficients are taken to be constant across all nations, but the intercept terms 0i and 0i are taken to be country-specific. In REMs, the slope coefficients are assumed to be the same for all seven countries and the intercept terms are, of course, treated as random variables rather than fixed country-specific variables.

The models' descriptive statistics are shown in the table. The findings of the gravity variables solely are shown in the table along with the correlation matrices for these models. All explanatory factors have now been discovered to be significant and show the anticipated signals. Table displays the outcomes of the heteroscedasticity-corrected model. Table also mentions the structured model with autocorrelated errors.

Table 3 lists the outcomes of the multicollinearity test. We may infer from the findings that the model has no multicollinearity issues. Table lists the estimation outcomes for the variables that remained the same in equation (b) above, which is equation (d).

Equation (c), the gravity model of Bangladesh's imports, has been computed using all the factors besides distance and all other variables. In previous researches a All of the sample nations, totaling 899 observations, are covered by the model. Only GDPj, per capita GDP differential ij, inflation i, inflation j, trade/GDPi, and trade/GDPj are shown to be important in the estimating procedure. All other variables are either deemed to be unimportant or to have the wrong signals. Whereas for these variables' multicollinearity is being examined, the GDPj variable is discovered to have issues. The five explanatory variables that remain after this variable is removed from the model are all determined to be significant with the right signs. Consequently, our recommended estimated gravity import model was:

$lMijt = \beta 0 + \beta 6lydijt + \beta 8lInit + \beta 9lInjt + \beta 11(TR/Y)it + \beta 12(TR/Y)jt$ (c1)

As previously noted, based on the LM and Hausman tests, our three gravity models show that FEM of Panel estimate is the best course of action to take. Therefore, for the aforementioned three models, the FEM findings will be described below. White's gives a unique covariance matrices estimator is used in the estimate. In these models, the slope coefficients are taken to be constant across all nations, but the intercept terms 0i and 0i are taken to be country-specific. Naturally, in REMs, the gradient slope coefficients are taken to be the same for all nations, and the interception terms are taken to be random variables rather than fixed specific countries variables. The coefficient of product of GNP in our trade model is positive and quite substantial, as anticipated. This suggests that Bangladesh does more business with advanced economies.

As the product combination of Bangladesh's GNP and nation j's GNP grows by 1%, bilateral trade between Bangladesh and country j increases by 0.88% (nearly proportionally). Between Bangladesh and nation j, the coefficient of the per capita GNP difference is likewise significant at the 1% level and has a positive sign. The coefficient value is 0.23, which suggests that bilateral commerce with nation j grows, but less than proportionally, as the difference in per capita GNP between countries I and j. We may infer from the positive sign indicator of this coefficient that, in the instance of Bangladesh trade, the H − O impact (differences in factor endoments) predominates the Linder effect.

The measure of a country's openness is its trade−to−GDP ratio. This variable's coefficient for nation j is seen to be substantial, significant at the 1% level, and to have the anticipated positive sign. This suggests that with the relaxation of barriers to trade in these nations, Bangladesh's commerce with all other countries is expected to improve dramatically. According to our calculation, j nations' trade with Bangladesh might expand by up to 1.31% [exp(0.26)=1.31] for every 1% improvement in their trade openness. This variable's coefficient for nation I is likewise discovered to be highly significant at the 5% level. Trade between Bangladesh and these nations might rise by up to 2.03% with a 1% improvement in Bangladesh's trade liberalization [exp(0.71)=2.03]. We note that the country−specific impacts are significantly significant for all nations with reference to them. Mexico appears to have the lowest tendency to trade with Bangladesh of these impacts, followed by Spain, china, Italy UK, France, etc., while Nepal appears to have the highest propensity, followed by India, Pakistan, and Sri Lanka. R2 = 0.84 and F [37, 872] = 120.53 characterize the model. Additionally, there is no issue with multicollinearity among the various variables. The foregoing analysis is likewise supported by the autocorrelated error structured model (Table), even if certain variables' coefficient values are a little bit lower. The coefficients' magnitude value and sign are extremely close. The distance variable (see Table) has an expected negative sign and is significant even at the 1% level, indicating that Bangladesh prefers to trade more with its close neighbors. The coefficient value is −1.23, meaning that the bilateral commerce between Bangladesh and nation j reduces by 1.23% as the distance between the countries rises by 1%. Both the border dummy (D1) and the SAARC dummy (D2) are determined to be negligible with a positive sign. As previously noted, only the variables exchange rate, total imports of nation j, and the trade−GDP ratio of Bangladesh are shown to be highly significant for our export model.

The positive coefficient of exchange suggests that Bangladesh's exports are dependent on the depreciation of its currency. It is clear from the projected findings that 1% currency depreciation results in 0.34% more exports to j nations, all things being equal. The target country effect may be regarded as the total imports of nation j. This variable's coefficient value is discovered to be high and has the expected positive sign. According to the anticipated results, Bangladesh's exports grow somewhat faster than proportionally when nation j's overall import demand rises. The openness variable for Bangladesh, the trade−GDP ratio, exhibits the anticipated positive sign. Since this variable's coefficient is so high, Bangladesh must significantly lower its trade restrictions in order to increase exports. If all other factors remain constant, the projected coefficient of 2.27 indicates that Bangladesh's exports will rise by 9.68%

[exp (2.27) = 9.68] for every 1% increase in its trade−to−GDP ratio. All impacts are very significant in terms of country−specific effects [Table 1(A)].

According to previous findings, Mexico has the lowest tendency to buy Bangladeshi goods, followed by Sweden, Canada, New Zealand, France, the Netherlands, etc., while Nepal has the greatest propensity, followed by Pakistan, Iran, Syria, the Arab Republic of, Italy, Sri Lanka, India, etc. R2 = 0.79 and F [32, 752] = 88.78 are the model's values. Additionally, there is no issue with multicollinearity among the variables. In respect of coefficient size and sign, the auto − correlated error structured model's findings (Table 5) are quite comparable. It is interesting to see that the distance variable is negligible while having the predicted negative value. Dummy variables are often thought to be irrelevant. 23 The per capita GDP differential in the import model is positive, further supporting the H − O theory. The imports of Bangladesh rise by 0.69% for every 1% increase in this variable. The inflation in Bangladesh and the inflation rate in country j both have a positive and negative impact on imports from Bangladesh, respectively. For Bangladesh and nation j, the elasticity of import price changes is 0.09 and −0.14, respectively. Bangladesh's imports are also heavily influenced by the openness characteristics of Bangladesh and nation j. Both factors are quite important and have a favorable impact on Bangladesh's imports. According to the anticipated results, Bangladesh's imports will increase by 29.37% with a 1% increase in its trade−to−GDP ratio [exp(3.37)=25.38]. Bangladesh's imports rise by 1.79% when the trade−to−GDP ratio of nation j rises by 1% [exp (.57) = 2].76].

Therefore, it is imperative that trade barriers are lowered on both sides. Except for China, all country−specific impacts are substantial [see Table]. According to the estimated results, Bangladesh has the lowest propensity to import goods from Portugal, followed by Greece, Singapore, Belgium, Spain, etc., and the highest propensity to import goods from India, ahead of China (not significantly), Nepal, Pakistan, the United States, and Indonesia, among other countries. The model's R2 and F values for goodness of fit are 0.78 and 88.47, respectively. Additionally, there are no issues with multicollinearity among the explanatory factors. The results from the autocorrelated error structured model (Table 2) are likewise very comparable in terms of magnitudes and signs. Despite giving the anticipated negative sign, inflation in nation j is now negligible. The impacts of distance and dummy factors on Bangladesh's imports are shown in Table 2. At a 5% level, only the border simulation variable is determined to be significant. Because of their shared border, Bangladesh and India's import commerce is 1.68 times more than it is with other countries [exp(1.69) = 5]. .47].

### 5.1 Comparison among the three models

According to the actual data of the three models, increasing trade between Bangladesh and its trading partners requires that both countries' economies be more open. In all three models that are used in our study, this variable is significantly important. It is crucial to further loosen trade restrictions, particularly for Bangladesh. Both the trade model and the regression import model find the per capita GDP disparity to be a shared predictor of trade, which supports the H-O impact. For Bangladesh's exports, the currency rate is determined to be a decisive factor, but not for imports. Instead of the exchange rate, the inflation rates in the two nations are what really matter for imports. The import of the target nations has a significant impact on Bangladesh's export as well. All three models' country-specific impacts are quite comparable. The distance impact has been found to be minor for the export and import models when evaluated independently, but all models support the idea that transportation costs are inversely connected to ecommerce in Bangladesh. Even though the goodness of fit for all three models is not particularly good, distance is shown to be significantly significant when we evaluate the models using only the gravity variables (see Table). Only the import model finds pairwise fake to be important.

Multilateral Resistance Factors

The multilateral barrier factors may have an impact on bilateral trade. Recent works by Anderson and Wincoop (2003), Baier and Bergstrand (2003), and Feenstra (2003) have taken these elements into account. Anderson and Wincoop (2003) describe the multilateral trade resistance as follows, using identical, homothetic preferences of trading partner countries and a continuous elasticity of substitution utility function:

Pj = [ ∑(βipitij) 1-σ ] 1/(1- σ) i

where Pj is the j-th consumer pricing index. I is a positive distribution parameter, pi is the exporter's supply price for nation I (net of trade costs), tij is the trading cost factor between countries I and j, and is the elasticity of substitution for all items. They simplify things by supposing that trade barriers remain symmetric, or that tij=tji. Given that it depends favorably on trade barriers with all trading partners, they designate to the price index (Pi or Pj) as multilateral trade relation resistance. High multilateral resistance Pi, which is a reflection of nation i's high trade barriers, lowers demand for its products and lowers supply price pi. It is simple to understand why increased multilateral resistance of the importer j increases its trade with I supposing > 1, consistent with empirical data in the literature. Greater trade barriers between j with its other trading partners will result in lower relative prices for products coming from I and higher imports from I for a given bilateral barrier between I and j. Due to the exporter's greater multilateral opposition, trade would also expand. Trade between I and j would grow for a given bilateral barrier because more multilateral opposition results in a lower supply price pi. The authors contend that comparative trade barriers control international commerce between nations. The amount of commerce between two nations is influenced by the bilateral trade barriers between them in comparison to the overall average trade barriers that both nations experience with all of their trading partners (tij / PiPj). A decrease in relative resistance tij/PiPj is implied by an increase in multilateral trade barriers, For a big country, greater trade barriers have little impact on multilateral trade resistance since they do not effect commerce inside the nation, but for a very small poor country, increased trade barriers result in a significant rise in multilateral opposition.

The research propose that tij (unobservable) is a log linear function of the observables bilateral distance dij and whether I and j share considered as an international boundary. To calculate the trade costs, language variables can also be employed as dummy variables. The nonlinear estimating method for the multilateral resistance component in Anderson and van Wincoop (2003) is complicated, according to Baier and Bergstrand (2003). Because there is a lack of data, accounting for the functions of multilateral pricing words like pi g, pj g, pi g, and pj g has always been a challenging subject. For these multilateral words, they have utilized proxies. A substitute for the multilateral resistance term is the GDP weighted average of trade partner distance. According to Feenstra (2003), pricing must vary worldwide as soon as transportation costs or any other border obstacles are implemented. Consequently, it is necessary to consider each country's overall price indices. Three options exist for doing this. Using public data on price indexes, (2) utilizing the computational approach of Anderson and van Wincoop (2003) or using nation fixed effects to measure the price valuation indexes.

## 5.2 Application of Multilateral Resistance in the Bangladesh Trade

We have made an effort to determine how multilateral opposition has affected commerce with Bangladesh. We have used the GDP weighted mean of location from trade agreements countries and the Consumer Price Indices (CPI) of trading partners as international resistance factors, following Baier and Bergstrand (2003) and Feenstra (2003). (data on commodity prices or commodity price indexes for Bangladesh are not available). When we reestimate the gravity model for Bangladeshi trade [equation (a1)], including CPI as multilateral resistance, we see that GNPij variables and (Trade / GDP)ij are inconsequential, while CPIij is discovered to be significant.

The tiny sample in this instance [Here, the number of observations is just 112 compared to 910 in equation a1] may be the cause of the nonsignificant results for the GNPij and (Trade / GDP)j, which were significant in equation a1. There hasn't been information on Bangladesh's CPI for a very long time. The gravity model for Bangladesh export (equation b1) has also been updated, with the addition of the CPI of trade partners as a multilateral resistance variable. There are just 112 observations in all here. Although two additional factors, the total import of country j and the trade-GDP ratio of country I are determined to be unimportant, multilateral resistance variables are also shown to be significant in this instance. Because of the limited sample size, it is possible that these two factors are not significant.

However, we find the opposite (insignificant) effect of this variable un our Export Model when GDP weighted average of distance is selected as a multilateral resistance variable. Remoteness is viewed by McCallum (1995) as multilateral opposition. He gives the following definition of remoteness for nation I which we use for estimation: REMi = Dim/Ym/J The average distance between area I and all trading partners besides j seems to be reflected by this variable. As we are unable to estimate the FEM for distance and dummy variables, this result was derived using OLS. If we re-estimate the gravity equation of trade model and use GDP weighted average of distance as a multilateral resistance variable, we discover that this variable is minor in affecting the Bangladesh trade.

It has the same outcomes as those mentioned above for our export model. When we take into account multilateral resistance variable in different ways, the predicted outcomes of the trade model and export model are shown in Tables 9 and 10. We may infer from the F−value and R2 −value that the models in Table are acceptable, and as a result, CPI is the multilateral barrier variable that is appropriate for our research of Bangladesh trade. This variable has a favorable impact on Bangladesh's export and its trade. This is to be expected since bilateral trade will increase in proportion to multilateral opposition.

# Chanter 6. Summary and Conclusion

This study's goals were to offer a theoretical rationale for utilizing the gravity model to assess foot wear exports and to use the gravity model to use panel data estimates to examine Bangladesh's trade with its main trading partners. We have proven that there is theoretical justification for using the gravity model in applied research on bilateral commerce. The gravity model is utilized in many areas of applied research to analyze bilateral trade patterns and trade linkages (Koo and Karemera (1991); Zhang and Kristensen (1995), Le et. al (1996), Frankel (1997); Karemera et. al (1999); Mathur (1999); Sharma and Chua (2000); Paas (2000); Jakab et. al (2001); Kalbasi (2001); Martinez-Zarzoso & Nowak-Lehmann D (2002); Christie (2002); Carrillo and Li (2002), Egger and Pfaffermayr (2000), and Mátyás et. al (2000)). The generalized gravity models of commerce, export, and import have been calculated. Our findings indicate that the size of both the economies, differences in per capita GNP, and openness and openess of the trading nations all positively influence Bangladesh's commerce (the sum of exports and imports). Bangladesh's exports are mostly determined by the currency rate, overall import demand from partners, and Bangladesh's economy's accessible and flexible. Positive effects on Bangladesh's exports are caused by all three elements. Contrarily, the exchange rate has no impact on Bangladesh's imports, which are instead influenced by the inflation rates, disparities in per capita income, and trade openness of the participating nations. It has been shown that the cost of transportation has a significant role in adversely affecting

Bangladesh's commerce. This means that Bangladesh would prosper more if it engaged in greater commerce with its neighbors. The consequences that are unique to each nation further demonstrate this. The border between Bangladesh and India is also proven to have a significant impact on imports into Bangladesh. Although this variable was shown to be negligible in the export model, both the trade market and the import models favor the H−O hypothesis over the Linder hypothesis. The distance and country−specific impacts produced this somewhat paradoxical outcome. It's possible that the difference in per capita income may not accurately reflect the difference in factor endowment. Additionally, the H−O theory makes unreasonable assumptions like perfect competition and zero transit costs. Multilateral resistance characteristics are also favorably correlated with Bangladesh's bilateral trade and exports. The results have policy repercussions that need significant trade barrier liberalization in all concerned nations, particularly Bangladesh, in order to enhance and boost Bangladesh's commerce. Bangladesh's currency appears to be 29 overvalued. It is necessary to devalue the currency while taking other negative impacts such inflation expectations into consideration, in order to enhance the nation's exports. As Bangladesh's exports are heavily dependent on international demand, proper grade of the services and products must be preserved as well as a rise in the variety of goods and services. As Bangladesh's trade is indeed not independent of country−specific impacts, all partner nations' propensities to export and import must be brought into sufficient and suitable consideration when trade policy is set.

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```
. xtset country1 year, yearly
       panel variable:  country1 (strongly balanced)
        time variable:  year, 2000 to 2015
                delta:  1 year

. xtsum footwear gdp distance lntarifpart realexchpart co2emission manufacturingbd technology

Variable         |      Mean   Std. Dev.       Min        Max |    Observations
-----------------+--------------------------------------------+----------------
footwear overall |  28545.43   29293.62    566.257   162216.1 |     N =     112
         between |               19218   6479.287   58794.98 |     n =       7
         within  |            23209.79  -9330.803   131966.6 |     T =      16
                 |                                            |
gdp      overall |  4.29e+12   4.28e+12   5.97e+11   1.82e+13 |     N =     112
         between |            4.47e+12   1.19e+12   1.41e+13 |     n =       7
         within  |            1.03e+12   4.81e+11   8.43e+12 |     T =      16
                 |                                            |
distance overall |  8179.571   2369.698       4766      13219 |     N =     112
         between |            2548.114       4766      13219 |     n =       7
         within  |                   0   8179.571   8179.571 |     T =      16
                 |                                            |
lntari~t overall |  .7238059   .1819875   .2070142   1.108563 |     N =     112
         between |            .1245125   .5135853   .9107681 |     n =       7
         within  |            .1403964   .4172348   1.005851 |     T =      16
                 |                                            |
realex~t overall |  102.8458   10.65809   69.41596   130.4209 |     N =     112
         between |            6.948005   96.08059   116.0143 |     n =       7
         within  |            8.476064   76.18122   132.1977 |     T =      16
                 |                                            |
co2emi~n overall |  42875.63   14899.87      21650      71690 |     N =     112
         between |                   0   42875.63   42875.63 |     n =       7
         within  |            14899.87      21650      71690 |     T =      16
                 |                                            |
manufa~d overall |  1.58e+10   7.75e+09   7.49e+09   3.28e+10 |     N =     112
         between |                   0   1.58e+10   1.58e+10 |     n =       7
         within  |            7.75e+09   7.49e+09   3.28e+10 |     T =      16
                 |                                            |
techno~y overall |  .2971424   .1112652   .1348143   .4809199 |     N =     112
         between |                   0   .2971424   .2971424 |     n =       7
         within  |            .1112652   .1348143   .4809199 |     T =      16

. xtreg footwear gdp distance lntarifpart realexchpart co2emission manufacturingbd technology, fe
note: distance omitted because of collinearity

Fixed-effects (within) regression               Number of obs     =        112
Group variable: country1                        Number of groups  =          7

R-sq:                                           Obs per group:
     within  = 0.6506                                         min =         16
     between = 0.6113                                         avg =       16.0
     overall = 0.6358                                         max =         16

                                                F(6,99)           =      30.73
corr(u_i, Xb)  = 0.0275                         Prob > F          =     0.0000

---------------------------------------------------------------------------------
       footwear |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
----------------+----------------------------------------------------------------
            gdp |   3.31e-09   1.74e-09     1.90   0.060    -1.38e-10    6.75e-09
       distance |          0  (omitted)
    lntarifpart |   7845.449   11538.24     0.68   0.498    -15048.93    30739.82
   realexchpart |    66.0879   190.5226     0.35   0.729    -311.9502     444.126
    co2emission |  -.4342331   .6124325    -0.71   0.480    -1.649432    .7809658
manufacturingbd |   3.06e-06   1.13e-06     2.71   0.008     8.18e-07    5.31e-06
     technology |   4781.289   13423.29     0.36   0.722    -21853.43    31416.01
          _cons |  -29372.55   26857.29    -1.09   0.277    -82663.24    23918.14
----------------+----------------------------------------------------------------
        sigma_u |  11995.098
        sigma_e |  14526.832
            rho |  .40540382   (fraction of variance due to u_i)
---------------------------------------------------------------------------------
F test that all u_i=0: F(6, 99) = 5.36                       Prob > F = 0.0001

. xtreg footwear gdp distance lntarifpart realexchpart co2emission manufacturingbd technology, re

Random-effects GLS regression                   Number of obs     =        112
Group variable: country1                        Number of groups  =          7

R-sq:                                           Obs per group:
     within  = 0.6380                                         min =         16
     between = 0.9176                                         avg =       16.0
     overall = 0.7406                                         max =         16

                                                Wald chi2(7)      =     242.47
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000

---------------------------------------------------------------------------------
       footwear |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------+----------------------------------------------------------------
            gdp |   5.06e-09   7.29e-10     6.94   0.000     3.63e-09    6.49e-09
       distance |  -3.928714   1.285245    -3.06   0.002    -6.447748    -1.40968
    lntarifpart |  -3863.245   11082.35    -0.35   0.727    -25584.25    17857.76
   realexchpart |  -172.5104   173.5546    -0.99   0.320    -512.6711    167.6502
    co2emission |  -.8017892   .5980106    -1.34   0.180    -1.973868      .37029
manufacturingbd |   3.40e-06   1.14e-06     2.98   0.003     1.17e-06    5.64e-06
     technology |   499.6571   13682.21     0.04   0.971    -26316.99     27316.3
          _cons |   39902.13   22358.77     1.78   0.074    -3920.257    83724.52
----------------+----------------------------------------------------------------
        sigma_u |  3702.6516
        sigma_e |  14526.832
            rho |  .06100259   (fraction of variance due to u_i)
---------------------------------------------------------------------------------

. xthtaylor footwear gdp distance lntarifpart realexchpart co2emission manufacturingbd technology techn

Hausman-Taylor estimation                       Number of obs     =        112
Group variable: country1                        Number of groups  =          7

                                                Obs per group:
                                                              min =         16
                                                              avg =         16
                                                              max =         16

Random effects u_i ~ i.i.d.                     Wald chi2(5)      =       3.99
                                                Prob > chi2       =     0.5510

------------------------------------------------------------------------------
    footwear |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
TVexogenous  |
         gdp |   4.72e-09   1.09e-09     4.32   0.000     2.58e-09    6.86e-09
 lntarifpart |   2988.941   11190.11     0.27   0.789    -18943.27    24921.15
realexchpart |  -14.96263    182.892    -0.08   0.935    -373.4244    343.4992
 co2emission |  -.6536516   .5887615    -1.11   0.267    -1.807603    .5002999
manufactur~d |   3.29e-06   1.11e-06     2.96   0.003     1.11e-06    5.47e-06
  technology |   2634.618   13303.68     0.20   0.843    -23440.12    28709.36
TIexogenous  |
    distance |  -3.734861    2.16426    -1.73   0.084    -7.976732    .5070099
             |
       _cons |   13427.19   27841.09     0.48   0.630    -41140.35    67994.72
-------------+----------------------------------------------------------------
     sigma_u |  9325.028
     sigma_e |  14105.675
         rho |  .30412094   (fraction of variance due to u_i)
------------------------------------------------------------------------------
Note: TV refers to time varying; TI refers to time invariant.
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# 국 문 초 록

## 방글라데시 주요 교역국에 대한 신발수출 산업의 중력모델

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이 논문의 목적은 방글라데시의 7개의 주요 무역 상대국으로의 신발 수출에 영향을 미치는 요소들을 결정하는 것이다.

연구를 분석하고 수행하기 위해 2000년부터 2017년까지 17년간 총 7개 주요 교역국에 수출된 방글라데시 가죽 신발의 패널 중력 모델을 추정하기 위해 패널 데이터 세트를 생성했다. 회귀 분석, 고정 효과 모델, 랜덤 효과 모델 및 하우스만 검정을 포함하여 고정 효과 모형과 랜덤 효과 모형 중에서 선택하는 몇 가지 검정이 수행되었습니다. 본 연구의 종속변수는 가죽 신발이며 독립변수는 방글라데시의 GDP, 파트너 국가의 GDP, 지리적 거리, CPI(Consumer Price Index), 국가 관세, 국가 교환, CO2 배출, 가죽 제조 및 기술이다. 이 연구는 GDP와 Co2 배출량이 양의 계수를 가지며 P 값이 유의하다는 것을 보여준다. 이 연구는 방글라데시의 신발 산업 수출에 큰 기여를 했다. 그리고 이 연구는 더 많은 통찰력을 찾고 미래의 추가 연구를 위한 새로운 길을 닦는 데 도움이 될 것이다.

【주요어】 : 방글라데시, 가죽 신발, GDP, 지리적 거리, CPI, 국가 관세, 국가 교환, CO2 배출, 제조