An Empirical Test for Linder Theory and Gravity Model of Trade

Hayatu Ibrahim Abdullahi

Submitted to the
Institute of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Master of Science
in
Economics

Eastern Mediterranean University
June 2016
Gazimağusa, North Cyprus

Approval of the Institute of Graduate Studies and Research

Prof. Dr. Mustafa Tümer
Acting Director

I certify that this thesis satisfies the requirements as a thesis for the degree of Master of Science in Economics.

Prof. Dr. Mehmet Balcılar
Chair, Department of Economics

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Science in Economics.

Assoc. Prof. Dr. Çağay Coşkuner
Supervisor

Examining Committee

1. Prof. Dr. Sevin Uğural

2. Assoc. Prof. Dr. Çağay Coşkuner

3. Asst. Prof. Dr. Kemal Bağzibağli

ABSTRACT

First, I tried to see how Newton's gravitational equation, as it was transplanted into the field of International Trade by Jan Tinbergen (1962), can be time-honored by applying it to Nigerian bilateral trade pattern. For this purpose I collected the data for Nigerian bilateral trade with fifty four (54) countries, which account for more than 95% of its trade deals in the year 2013. I also adopted the OLS regression method of estimation. The result showed a strong support to the model, which says trade between is affected positively by the economic sizes and inversely by their respective distance.

Second, the Linder theory was tested using a cross-country analysis between G7 countries plus Spain, Netherlands and Austria. I adopted the Gravity equation again for this purpose where we used the 2014 trade data for those countries. The dummy for EU-membership and Language similarity were included in the model to capture the effect of the economic distance, as suggested by Johansson and Westin (1994). The result is so robust and showed support for both Linder Theory and Gravity Model.

Keywords: Gravity Model, Linder Theory, Trade, Nigeria, G7.

ÖZ

Birinci çalışmada, Newtonun yer çekim kanunun Jan Tinbergen (1962) tarafından uluslar arası ticarete uyarlanmış Gravity modelini test ettik. Bu çalışma için Nijerya'nın 54 ülke ile ikili ticaret verileri kullanılmıştır. Bu 54 ülke Nijerya ticaretinin %95'ini oluşturmaktadır. Çalışma için OLS regrasyon yöntemi kullanılmıştır. Regrasyon sonuçları teoriyi doğrular niteliktedir ve ticaret hacminin ekonomik büyüklüklerden (GSYIH) doğrusal bir şekilde etkilendiğini iki ülke arasındaki mesafeden ise negatif bir şekilde etkilendiği ortaya çıkmıştır.

İkinci çslışmada ise Linder teorisi test edilmiştir. G7 ülkeleri ile İspanya Hollanda ve Avusturya için veriler kullanılmış ve Gravity modeliye beraber Linder teorisi test edilmiştir. 2014 yılı verileriyle yapılan çalışma sonucunda Linderteorisi doğrulanmış, yani gelir düzeyleri benzer iki ülkenin daha fazla ticaret yaptığı sonuçlandırılmıştır. Bu çalışmada AB üyeliği ve benzer dil kullanımı için de dummy kullanılmıştır.

Sonuç olarak çalışmalarımız Linder teorisini ve Gravity modelini doğrulamaktadır.

Anahtar Kelimeler : Yerçekimi Modeli, Linder Teorisi, Ticaret, Nijerya, G7.

To my late father, Ibrahim T. Abdullah

And

My Late brother Nuraddeen

May their gentle souls remain in perfect peace!

Amen.

ACKNOWLEDGMENT

All praises are due to Allah, WHO made my dreams a reality, I am grateful to Him.

A profound and sincere gratitude goes to my able, resourceful, dynamic, caring, and hardworking supervisor Assoc. Prof. Dr. Çağay Coşkuner who supported and guided me toward the successful completion of this piece of work. Sir, I am sincerely grateful.

To my beloved Mum, Hajiya Saudat, my elder sister (not just by name) Jamila, my brother as well as tutor Shamsuddeen, my caring brother Zahraddeen, and my younger sisters and brother, Hafsat, Nafisat, Rahma (Simsim) and Mus'ab. I deep heartedly, would like to register my unqualified gratitude to you for the physical, emotional, moral, spiritual and financial support I received from you throughout my life, thank you for being there for me.

My special gratitude goes to the two important personalities. First, Mal. Dr. Ahmad Ridhwan, who is a father, at the same time a teacher to me, and second, my uncle Alhaji Ali Ahmad, for their support and guidance toward my success, I thank you very much.

To my friends at EMU, which include among others, Yusuf Muhd Baba Yahaya, Abdurrahman Nadani, Marwa Usman, Zainab Bello, Passant Borai, Amaka Angela Simon, I say thank you. To Razeen Kareem, her husband Bextiyar and her Cutie Varya, I will forever remember the lunch on Fridays at your home.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

INTRODUCTION

1.1 Background to the Study

International trade refers to the movement of goods and services across national borders. Import is inflow of goods and services into the home country from other countries, while export is outflow of goods and services from home country to other countries.

Trade is one of the most important human activities. It is so important that the history of nations is incomplete without touching on its trade side. Trade was known to have played a remarkable role in the pursuance of the world development. Aside from the flow of goods and services between countries, there is also movement of capital and income which if the terms are right, the countries involved will benefit from the trade (Henegedara, 2011).

For thousands of years, people were recorded to have engaged in different intra-city and inter-city trade deals though land and water routs. The south Mesopotamian city of Uruk was probably the earliest city that was recorded to have known for international trade because of its large population, fertile land and water canals for irrigation and carriage of merchandise as far back as 5,200 years ago (Ridley, 2010).

A number of theories were put forward in trying to explain the pattern of international trade. The most popular among all these theories is perhaps the Comparative Advantage or rather HO-model, which explains trade flow base upon capital and labor endowment differences.

HO-model remained the dominant theory that explains trade until 1961, when Staffen Hans Burenstam Linder introduces a theory that is challenging HO-model. Linder theory is saying that, the more similar the preferences, which is shaped by income, in any two countries the larger is the trade between them, against HO-model that says the more different are the factor endowments between countries, the larger is the trade.

For us to test the Linder theory we need to find a good proxy for preferences, where as we mentioned, income is so far the most popular and appropriate proxy we can use. Some argued that heritage will work best as a proxy of preference, but unlike income it is hard to distinguish and almost impossible to measure (Kroeber and Kluckhohn, 1952). Therefore, income similarity is by far the most essential proxy for showing similarity in preferences. To sum up, Linder discarded the idea of universal income homogeneity and preferences or independence of preferences from income levels, so he argued that the causality between trade and preferences should be studied more intensely (Ankre and Sandberg, 2010).

One other theory that is of great importance is the Gravity model. Different kinds of gravity models subsist, but one thing they have in common is they all are trying to explain the flow of trade across different locations. The frequently used explanatory

variables in this model are economic sizes, usually measured by GDPs and absolute distance between two locations. The expectation is the increased volume of trade with increase in economic sizes and decrease in trade volume with increased physical distance.

We will make use of Gravity model, first, to test its validity and then to test the Linder theory as well.

1.2 Purpose and Contribution of the Study

In this study we aimed at testing the two existing theories which are, Gravity Model and Linder Theory, and combine the two theories in the case of Nigerian bilateral trade. One important issue is that, to the best of my knowledge no single research was carried out to test the application of these theories for Nigerian trade pattern.

We will try to utilize all relevant datasets to be able to clearly identify the various explanatory variables that we are going to use, and then we will prepare a linear model for the regression and use Stata12 software package for the estimation and analyses of the models. Then finally, we will compare our result with the previous researches similar to it, in the process of explanation.

So, three aims for this research can be identified as follows;

1) To verify the popular Gravity Model by expressing the relationship between Nigerian Trade Volume as a dependent variable with other identified explanatory variables, using a linear model. In this we hope to include GDP as a proxy for economic sizes and variables that could capture the economic distance, not merely proximity between two destinations, into our explanatory variables.

2) To verify the relevance of Linder's theory of international trade through identifying the most appropriate explanatory variable that will be estimated against trade volume. In this we also hope to use per capita income differences between trading partners as a proxy for income similarity (Linder).
3) And finally, to combine the two hypotheses (Gravity model and Linder Theory), by putting the Linder variable in the Gravity model (Augmented Gravity Model) to see how well the model can explain the international trade flows between countries under study.

We will talk about the theoretical justification on how we arrived at using the above mentioned model preparation, variables used and other conceptual explanations in the subsequent chapters.

1.3 Disposition of the Paper

This research contains six chapters. Chapter one deals with the background, purpose, significance and disposition of the thesis. Chapter two will dive into the theoretical literature review for both the Gravity and Linder theories; account for the evolution of International trade theories will be dealt with in the chapter. Chapter three will provide some empirical literatures, both in support and against as well as the mixed result researches on both Gravity and Linder theories. In chapter four, the methodology used and empirical specifications for the conduct of this research will be explained. Within this chapter, we will also provide information on data. Chapter five will present the estimation results as well as the analyses of findings for this research. Finally, in chapter six I will talk about the conclusions derived from major findings and implications for policy and advance researches.

Chapter 2

THEORETICAL LITERATURE REVIEW

2.1 Evolution of International Trade Theories

Over the past few centuries, several trade theories have evolved. Some well-known ones are theory of comparative advantage, Heckser-Ohlin theory, specific factor models, Linder theory, Gravity model of trade and product cycle theory. While the basic assumptions of these models are different from each other, they all have one main focus point. That is they try to explain why international trade exist by showing that trade would be mutually beneficial for all trading partners. With this goal in mind, these trade theories try to explain the pattern of trade and the benefactor and losers of the society from such trades. Let us now look at these trade models in more detail.

Economists often divide international trade theories into 2 major points of views;

- Classical view, which mainly saw international trade as a country based.
- Modern view, which often refers to the theories that perceived international trade as a firm or industry-based.

2.2 Classical Theories of International Trade

2.2.1 Mercantilists Trade Theory

Mercantilism was one of the earliest economic theories that attempted to explain the trade patterns and growth of nations. It dated back to sixteen century. At its simplest explanation, Mercantilism opinioned that the growth of a country is determined by the amount of Gold and Silver (Money) it has. The idea of Mercantilism was based upon the promotion of Exportation and discourages Importation, so as to accumulate Gold through their trade surpluses. One way to ensure export excess is to put import restriction, which it termed as protectionism in economics.

This theory was evolved during the colonial times of European Empires, so the theory was shaped by the experiences of those days.

This protectionist's idea is still in the hearts of many nations in the world today, and almost all the countries in one time or another have adopted such idea, even though it favors only some selected industries while affect local consumers and other industries in a negative way (free trade ideology).

2.2.2 The Absolute Advantage Theory

The mercantilist's trade theory flourished until 18th century when Adam Smith published his famous book 'The Wealth of Nations' in 1776. In its simplest form, the Adam Smith's Absolute Advantage theory suggest that, countries that posses the ability to produce good more efficiently will have more advantage compare to countries with less efficiency. He further argued that, government should not restrict or intervene in the market and that goods should be allowed to flow freely and prices determined naturally by the forces of demand and supply. Smith gave hypothetical

illustration on how trade will naturally be between two countries, where if country 1 can produce a particular good at lower cost or faster than country 2, then country 1 has absolute trade advantage and should engage in producing that good, and country 2 should focus on producing good it had absolute advantage. Smith idea of Absolute Advantage was based upon efficiency.

Smith posits that, nation's wealth should not be measured by the amount of Gold it possessed, but by the level of welfare of its citizens and the best way to promote welfare is through trade by encouraging efficiency.

2.2.3 The Comparative Advantage Theory

The absolute advantage theory argued that, all nations should focus on good they produce with higher productivity. What if the country has absolute advantage, that is, higher productivity in all products compared to its trading partner?

To answer the above question, an English economist David Ricardo (1817) came up with a new theory called Comparative Advantage. He argued that, even when one country has absolute advantage on producing all the two goods, it still has to be more advantageous in producing one of those two goods. Hence it could focus on producing the one it has comparative advantage on, and leave the trade partner country to produce the other good, even though it can produce this it more efficiently than the partner country. Therefore bilateral trade could still occur between these countries.

2.2.4 Factor Proportion Theory or Heckscher-Ohlin Theory

Both absolute and comparative advantage theories do not provide any answer on how to determine what product would give such advantage to a country, or how such advantages are formed. This trade theory just attempts to do that.

In the early 1990s, the Swedish economist Eli Heckscher and his student Bertil Ohlin developed a theory which is basically suggesting that, countries will produce goods base on factor availability in their nation. If a country is capital abundant, it will gain more by producing and exporting capital intensive goods and importing labor intensive ones, the reverse is as well the case for Labor abundant nation. They argued that, going by such, country will have a competitive advantage, because naturally the more abundant is the factor, the cheaper it will be and by utilizing this abundant factor, cost of production will be low and producer will gain market advantage.

2.2.5 Leontief Paradox

The Heckscher-Ohlin theory remained popular among economists, until 1953 when American economist Wassily W. Leontief conducted a research on the United States' export goods to its trading partners. As Heckscher-Ohlin theory suggested, United States being the most capital abundant country in the world, we expect their export to be more of capital intensive goods, but surprisingly, Leontief discovered that US is actually exporting more labor intensive goods.

Some of the economists argued that, at that time the labor was more efficient and in steady supply in US, others said because that was the post-war period and many capital were destroyed, that why US produced more labor oriented products. However, what was clear is that the phenomenon is more complex than it seemed

and efforts need to be put to the understanding of forces and patterns of international trade.

2.3 Modern Theories of International Trade

2.3.1 Linder Theory (Country Similarity Theory)

This trade hypothesis was got its name from its developer, a Swedish economist and a conservative politician, Hans Martin Staffan Burenstam Linder in 1961. The basic idea of the theory was that, countries that are on the same level of, or more similar, incomes per person have more similar production and consumption choices so that they can trade more. Thus this model is also called an overlapping demand theory.

The theory was, partly, a continuation of Leontief's research in the 1950s, which discover the US, the most capital enriched country export labor intensive good, contrary to the general believe 50 years before Leontief's research. Therefore, Leontief finding and Linder theory are directly opposing Heckscher-Ohlin's theory.

As Linder suggested, producers are firstly producing for local market (internal consumption), when they decide to explore external market, they look for the one that has similar consumption preference because it has higher potential for success to them, as an external producers.

The Linder theory is useful for identifying the products quality and reputation as part of tools to understanding the level of nation's richness and their bi-lateral trade pattern. We are going to empirically verify the validity of this theory.

The main assumptions of Linder theory can be stated as:

1) Its demand oriented
2) Consumer taste is shaped by income
3) Domestic firms produce their products to for meeting the local demand

It is under these assumptions that the theory makes a conclusion that the more similar the income levels are between any 2 countries, the bigger is the trade between them.

It is important to emphasize that our intention in this paper is to verify the validity of Linder theory within the conclusion presented above.

2.3.2 Product Life-Circle Theory

This theory was developed by a Harvard professor of Business Raymond Vernon in 1960s. In its simplest form, his idea was that all products have three different development stages;

1) New product stage
2) Product maturity stage
3) Standard product stage

He further argued that, all products in their newly produced stage are being completely produced and consumed in the high income country that they were invented. The maturing stage of a product is a stage where international demand starts, so that export of that particular good starts and some industries starts moving to other high income countries. The final stage is when a product standard is established, so that production is shifted to developing countries because of cheap labor since technology is transferable at that stage. It is imperative to mention that, this theory is only valid for high-technology products.

This assumption still holds nowadays but in a faster pace, considering the high spread of Multinational companies and easy adaptation of new technologies by many developing nations.

2.3.3 Global Strategic Rivalry Theory

Paul Krugman and Kelvin Lancaster in the 1980s developed a theory called 'A Strategic Rivalry theory'. The basic idea of this theory was on the assumption that firms continuously facing with the competition challenges in their industry, and in order to prosper, they most create some measures to a gain a competitive advantage, and decisive way to do is by posing a barrier to prevent entry of new firms. This can be done through the following:

- Intellectual property right
- Scale of production
- Better experience in the industry
- More effort on Research and Development
- Exclusive process of production
- Inputs source control etc

2.3.4 National Competitive Advantage Theory

More recently, a professor of Business from Harvard, Michael Porter developed a new trade competition theory in 1990s. His idea was fundamentally trying to explicate why some countries have more competitive advantage in some specific industries. He put forward four reasons behind such incidence:

- Natural resource availability and local factors capabilities
- Demand condition in the local market
- Local supply and existence complementing industries, and
- Characteristics of the local firms

Porter also recognized that, apart from the above four diamonds, sound government policies and actions also makes country competitively advantageous in a particular industry.

Although these modern international trade theories are relatively new, but the fact is they offers undeniably interesting inclinations and till now, they are minimally been verified.

2.4 Gravity Model

Another intention of this paper, as mentioned in the previous chapter, is to verify the validity of gravity model of international trade.

The gravity model of international trade is basically saying, the bilateral trade between countries are positively affected by the economic sizes, usually measured by gross domestic product (GDP), and affected negatively by the distance between trading partners.

The model developed from Universal Gravitational theory of Sir Isaac Newton (1687), following the story of Apple tree. The theory is basically saying that; each item in this world attracts other item at a force bound by the centre line between those items, which is proportional to the product of those two items divide by their separation square (Newton, 1687).

$$Fg = G\frac{m1\ \mathrm{m2}}{r2} \qquad \textit{(equ. 1)}$$

Where,

F_g: the force of gravity

M_1 and M_2: Mass of both items

r: the distance between those two items

G: the universal gravity constant.

The first person that suggested the application of the same logic into the international trade was the Dutch economist Jan Tinbergen (1962), where he made some modification to the model as below;

$$Fij = G\frac{mi\,\mathrm{mj}}{dij}\textit{(equ. 2)}$$

Where,

F_{ij}: denotes trade flows from origin i to the destination j.

M_i and M_j: denotes the size of origin and destination countries, usually measured by their population or GDP.

Dij: the distance between the two countries usually measured by distance between the major cities of those two countries.

G: Is a constant.

The Gravity model is one of the most successfully tested models in international trade, showing remarkably well the patterns of economic interactions and movement of factors across various destinations. A popular success of this model showed that there must be theoretical backing for it, but the absence of connection to the economics left some scholars with no choice than to ignore it (Anderson, 2011).

The role played by the economic sizes is well known in the existing literature, but the point of contention was the trade connection with distance. The first time this model appeared in textbook of economic is in 2004 following the successful provision of connection between economic theory and gravity model (Feenstra, 2004). Chaney (2011) in trying to empirically provide a theoretical validity of distance effect in

trade flows explained that, for firms to export their products to other countries they need to have contact, and to have those international contacts they have to gradually meet their contacts also. His result showed the firms that go in and out more often into international markets have larger business turnover. He further showed that the large distance between firms and other international markets is the initial factor hinders the trade.

Other economists such as (Alan Deardorff, 1998 and Luca De Benedictis, 2011) have more recently contributed to the theoretical justification of Gravity equation in economics.

2.5 An Insight into Nigerian History and Trade

Geographically, Nigeria is situated in West African sub-region; it has a land area of about 356,376 square miles; it borders with Cameroon and Chad from the east, Niger from the north, Benin from the west and from the south with Atlantic Ocean. The country is one of the former British colonies, which got its independence First October 1960. With the annual population growth of 2.67 percent the population is expected to be 156,269,020 in 2015, which make it the Africa's largest population country, and despite too much reliance on oil revenues, Nigeria is positioned as the African largest economy with estimated GDP of about $502 billion USD in 2013. The country is classified as a mixed economy developing market and reached the level of middle income stage (WDI, 2006).

In 1472, the group of explorers from Portugal, which include Santarem, Escobar and others, in their search of the rout to Asia, discovered what a country Nigeria is now. It was recorded that the present Nigeria was discovered having their own existing

civilization which differs from the Europeans'. The then major empires include; Bornu and Hausa empires in the North, Benin and Oyo kingdoms from southern part of present Nigeria. These kingdoms already have their own art and cultures, industrial, agricultural and other human activities, therefore the Portuguese intruders established trade relations with those existing empire includes especially Benin, which later incorporates a Slaves trade where more than 3.5 million people were evacuated to the new world as slaves from the modern Nigeria alone (Philip, 1969 and Rodney, 1972).

Trade as one of the major economic activities of the then Nigeria, has been the course of tremendous changes in the arrangements of the then Nigerian societies, which include the consolidation of multiple societies into one organized community, formal education and religion. For instance, the emergence of Christianity in Nigeria is attributed to coming of European intruders in 16th century, those Portuguese explorers introduced a Roman Catholicism that lasted for about 200 years before it relinquished, especially in the southwestern part of the country. Thereafter these Roman Catholic missionaries returned in the early 18th century and since then the Christianity kept spreading until today (Falola and Heaton, 2008).

On the other hand, brought Trans-Sahara caravan trade was said to be the major influence of organized communities in the savanna region of the present Nigeria, and Islam got its way in the region through the Songhai Empire of western Sudan, which took over the trans-Sahara trade and made Islam the official religion in the region under Askia Muhammad regime in the late 15th century. His effort to spread the religion was recorded to include building mosques and Islamic schools, sending

Islamic clerics to various places to teach the religion, among those sent to the northern part of present Nigeria was Sheikh Al-Maghili (Lapidus, 1988).

With the abolishment of slave trade in 1865, the present Nigeria became a key provider of agricultural row materials and semi-processed natural resources to the European industrialized nations and its other trading partners. Since that time the agriculture has been the countries major source the revenue, where it led the whole world in the production of various agricultural products. For instance, between 1962 and 1968 Nigeria accounted for about 47 percent of the world's groundnut export, making the country ahead of the rest of the world in terms groundnut export. Other key products include; palm oil, cocoa, cotton among others (financial times, 2016).

In 1956, the first oil well was discovered at Oloibiri Niger-Delta area. The discovery was carried out by Shell D'Arcy, which was the only oil company that is given the concession to carry out the exploration at that time. By 1958 Nigeria started producing the oil in commercial quantity where some 5,100 barrels was coming on stream per day. Nigeria also joined the Organization of Petroleum Exporting Countries (OPEC) in 1971, and later in 1977 the Nigerian National Petroleum Company (NNPC), the first nation owned petroleum company, was established to play a key role in both down-stream and up-stream activities. Since that time, the country continued focusing its attention on petroleum sector and neglecting other sectors of the economy, including the agriculture that was the major income earner of the country prior to 1970s, which now more than 90 percent of country's gross earning is coming from the oil revenue and more than 40% of the country's GDP is

from oil revenue, making it one the mono-cultural economies of the world that solely depend on oil sector (Galadanchi, 2011).

The next chapter will present some of the empirical literatures on the Gravity model as well as the Linder theory and see how they are analyzed and what their findings are.

Chapter 3

EMPIRICAL LITERATURE REVIEW

As highlighted in the previous chapter, international trade theories evolved by through the time passage and efforts of diverse economic scholars, each according to his experience and evidence availability. We have also seen that, while each theory has its own limitation(s), it's undoubtedly they all contributed to the understanding of international trade patterns and to some extent, to the understanding and development of their pre-existed theories.

In this chapter, we are going to focus on giving account of researches that empirically verifies the validity of our two hypotheses, that is the validity Gravity Model and Linder or country similarity theory as stated in the objective part of the study in chapter one. I am going to start, first with the papers testing the applicability of Gravity Model then followed by the ones for the Linder theory. The organization of these chapter will be, first to start reviewing the papers in support of each hypothesis and then followed by those that provide counter-evidence or mixed results.

3.1 Empirical Literature on Gravity Model

As we mentioned earlier, gravity equation is one the successfully tested equations in International trade. It is basically suggest that, the trade follows between countries is positively affected by the economic sizes countries, often measured by GDPs, and affected negatively by the distance between trading partners. This equation proved to

be useful not only in terms of its validity but as a model to test various International Trade theories. For instance, Sohn (2005) attempted to explain the Korea's bilateral trade pattern by testing the plausibility of the gravity equation. In doing so, he included GDP of trade partners, distance variable, conformity index of trade and membership of APEC dummy variable in the standard gravity equation. The paper basically tried to see the pattern of trade volume between Korea and its thirty (30) trading partners, and to see the effect of those variables on its trade volume using the cross section data of 1995 by adopting OLS regression analysis. The result of this study revealed that, Korea has a remarkable gain potential if engage in trading with China and Japan, being the closer and bigger economies, which explains that the distance and the sizes of the economies has great impact in expansion Korea's trade. Hence he concluded that the Gravity model explained Korea's international trade.

Eita (2008) in his attempt to test the validity of gravity model in the case of Namibia studied the factors that influence the country's export. He used the panel data for GDP of Namibia and its thirty eight (38) trading partners, distance, GDP per capita and exchange rate of those countries between the periods of 1998 and 2006. He also added dummies for Distance, Border sharing, membership of SADC and EU member countries. he used OLS regression method and the result from the estimated equation revealed that, increase in Namibia's as well as Importer's GDPs is associated with the increase in the volume of export and increase of distance between Namibia and its importers is have negative effect on the country's export, and also the export is affected positively with border sharing, SADC members as well as EC member countries dummies because it shows a lot of untapped export potentials to various countries. Therefore, this paper supported the gravity effect for Namibia.

Yihong and Weiwei (2010) in their paper seek to analyze the potentiality of trade between china and Association of East Asian ASEAC member countries. They tested the gravity model to provide a basis for bilateral trade flows. The variables included in the model were; GDP Distance Language and other variables that may affect the trade flow between china and those countries. They also used panel data from 1993 to 2003 and adopted OLS estimation technique for this purpose. The regression result was compatible with theoretical expectation on signs of distance and size variables, and impact when they took into account the effect of size and Distance only, the outcome shows that the trade volume between China and ASEAC has a tendency to remarkably increase. Therefore, this paper supports the validity of Gravity Model.

Doumbe and Belinga (2015) also used Gravity model in trying to analyze the impact of trade agreement on international trade flow between Cameroon and European Union. They test the Cameroon's pattern of trade base on twenty eight (28) European countries whom were signatories in free trade agreement between Cameroon and Europe in January 2009. They used pooled panel data analysis from 2008 to 2012 and OLS method of regression for this purpose. Apart from GDP of those EU countries and Distance variables, they also included per capita GDP and common language and colonial relationship dummies. The result shows a highly significance and positive relationship with GDP (size proxy) and highly negative relationship with distance variable. The rest of the variables turn-out to be not significant. Therefore, their result supported the validity of Gravity Model on Cameroon bilateral trade.

Darku (2009) in trying to test the gravity model in the case of Tanzanian trade augmented the model with country specific dummies. He argued that for us to know

the regional integration effect on trade it is more appropriate to used countries' not regional specifics. He used a panel data of Tanzania trade with her twenty three (23) trading partners between the periods of 1980 to 2004 and he also adopted the OLS method of regression. He found that, where the economies' sizes have positive effect on trade, European Union countries and East African Countries have small trade potentiality effect on Tanzania. On the other hand, countries like US, Hong Kong, Japan, Singapore and India, which are more far in terms of proximity and are not among Tanzania's trading partners, are relatively more open to its exports. Therefore, the paper does not support the gravity model hypothesis.

Tri Do (2006) tried to examine the international trade flows between Vietnam and its trading partners. He used the panel data to estimate the gravity model, where he collected data for trade between twenty three European countries and Vietnam during the periods of 1993 and 2004. He runs the GDPs of those twenty three countries and Vietnam as proxy of economic size, real exchange rate, distance and history against the trade volume between Vietnam and those countries. The result showed positive impact of GDP (economic size) and real exchange rates, but distance and history variables turn out to be insignificant. Therefore, economic size affects the trade but distance does not. Hence this research is not completely in support of the Gravity model.

3.2 Empirical Literature for Linder Theory

Until 1960s, the dominant theory was a Factor Proportion theory that was originated in 1919 from the work of Heckscher and later promoted by Ohlin and Stolper Samuelson. The theory was basically suggesting that, countries produce and export goods base on factor availability in their nation. Capital abundant nations should

export capital intensive products, and the reverse is the case for labor abundant economies. However, the undisputed fact is that the majority of world trade is between developed nations. More specifically, one third of the capitally rich economies' trade occurs with their follow presumably rich nations (Leontief 1953). Other researchers such as Deardorff, (19840); Maskus (1985) and Bowen et al (1987) cast more doubt upon the Heckscher's theory. Thus, Hans Martin Staffan Burenstam Linder suggested new theory which is opposing the Heckscher's in the early 1960s.

McPherson *et al* (2000) in their attempt to verify the validity of Linder theory used a popular linear regression procedure. They verified the existence of Linder using 19 countries among the Organization for Economic Cooperation and Development (OECD) members from 1990 to 1995. They observed the trade pattern on 162 potential trading partners for each of these 19 OECDs at a particular time using a panel data. Interestingly, this paper showed a support for Linder theory in eighteen OECD countries under study and at 95% confidence level, except in one country that the Linder variable is not significant. Therefore, this study proved two contributions to the existent Linder theory literature; first, it provided support for the theory of overlapping demand in the existing literatures, second, it shows the importance of including the all the country's potential trade partner among the dependant variables even if the country has zero desire to trade. This according to the authors will provide a more accurate estimation.

Bohman and Nilsson (2006) tried to test the validity of Linder theory by verifying the existence of a common market between 17 European and Latin American states using a Cross-section analysis for 2005. They used income distribution data between

the countries rather than merely average income comparison of those countries; they also included the markets sizes and calculated common market compare with country's domestic market which effectively controls for the Linder's hypothesis. Other market variables were included to differentiate the model from conventional gravity model and OLS estimation technique was adopted. They found a positive and highly significant market variable, which support Linder effect in all estimates, except one. Therefore, their conclusion supported the Linder theory and suggested a flattering remark to the other researches with same outcome.

Faustino and Leitao (2012) in their effort to investigate the determinants of intra-industry trade IIT between Portugal and major Europe trading partners used a 2005 cross-country data of trade and adopted both dynamic and static approaches. They included variable that determine income, for testing the demand similarities and variables determine the supply of to capture the differences in the factors and resource endowments. The result of this research paper showed a negative relationship between the dependant variable Intra-Industry Trade IIT and Income per capita differences, which give a re-affirmation to the Linder's hypothesis that emphasizes the overlapping demand (countries with similar income/demand tend to trade with each other). Also, the result supported partially, the prediction of Grugman and Helpman that the factor endowment similarities have a positive relationship with volume of trade between countries. Hence this paper counts as empirical works that supports Linder theory in addition to the Grugman's assertion of factor endowment similarity effect on in international trade flows.

Bo (2013) also attempted to study the behavior of bilateral trade. He used panel data analysis considering the trade deal of China with some selected countries between the periods of 2001 to 2010. He constructed the popular gravity model to estimate the China's fourteen biggest bilateral trade partners using OLS method. The explanatory variables in this model include; gross domestic product (GDP), real GDP disparities, population of countries, proximity of each country and exchange rate per capita. As he postulated, the disparity on real GDP was used as a proxy of Linder variable. Although the findings of this paper does not all in support of the expected outcomes of these explanatory variables, for example the proximity variable was presumed to have a negative effect on international trade deal volume but it shows the positive sign, but interest is much more on the Linder variable and econometrics result showed a positive relation as expected. Therefore, the result of this research supported Linder theory.

Eppinger and Felbermayr (2013) in trying to uncover the effect of income similarity on trade flows between countries estimated, with a panel data, a successfully tested gravity equation with some augmentations using Ordinary Least Square Method between the periods of 1995 and 2009. They included all income categories of the world as a sample countries and augmented gravity equation include three variables, some social and political factor that has effect on trade, disparities in distribution of income and inequalities, as well as difference in income averages. He asserted that, these variables were included to control for the other factor that may affect trade flows between countries. The researches show a very strong positive connection between similarities in demand and inter-country trade flows. This is called the concept of overlapping demand in the trade literature which is central to Linder's

argument. Therefore, this paper counts as one of the researches in support of Linder theory.

Bernasconi (2013) empirically explore how demand pattern relations affects trade flows between Japan and its major trade partners in 2002. He used a cross sectional data of 102 different countries and distribution of income similarity was used as a proxy to demand pattern comparison, which was used to verify the proposition of Linder Hypothesis. He also constructed an augmented gravity model to capture the bilateral trade for both aggregate and disaggregate flows using OLS estimation method. The result from the estimated equation shows that, the volume of trade is higher in countries that have similar distribution of income. He then concluded that, the trade flows in both similar and differentiated consumer goods are significantly higher for countries that have more similar income distribution. Hence the demand of two identical income countries overlaps. This paper also reaffirms Linder hypothesis.

More recently, Steinbach (2015) in trying to re-examine the validity of Linder theory, studies the bilateral trade on agricultural and food items between 152 countries. He uses the Hallak's (2010) equation on sectoral gravity as it allows one to capture the important aspects in Linder theory, which are the income level and demand and supply of quality products. He collected data on 727 different agricultural products base on 6 digit code from 153 sample countries that information is available between the period of 1995 and 2012. The findings from panel data analysis suggested that, the identical demand composition explains the export trade volume between countries under study. Also, the findings showed that the resemblance effect is more on products that are processed, compare with

unprocessed ones. Therefore, he concluded that, identical aggregate demand is the major force of international trade which seconds the popular Linder hypothesis.

Kennedy and McHugh (1983) in their attempt to verify the validity of the Linder theory of Overlapping demand studied the United States trade relation with fifty seven (57) trade partners, which account for about ninety percent of their export trade deals. The researchers used US trade data between the period of 1963 and 1976, and export data for both developed and developing nation's trade partners, which make it different from previous researches. And to account for proximity and other man-influenced effects, they estimated the changes of marginal propensity of trade data against differences in income per capita. The result of this work reveals no causal relationship between differences in income and the intensity of trade for United States and its trade associates. Therefore the findings of this paper reject the Linder hypothesis. More so, the result of this research does not show any support to rival theory, the Heckscher-Ohlin because no positive relation was found between income differences and trade intensity.

Hallak (2008) explained that the past researches to him are bias because they provided support on the existence of Linder based upon the trade aggregation. He gave more appropriate measure to the assumption of Linder hypothesis by asserting that to use inter-sectoral trade is more accurate than using aggregate trade flows, where product quality plays important part in the model. Using Ordinary Least Square method, he estimated a cross-section data for sample of 64 different countries from different parts of the world in the year 1995. The findings from this paper give support to the predicted outcome. By his control for the inter-sectoral trade variable,

the result gave a strong positive support between volume of trade and income per capita match, but it did not give any systematic backing on Linder effect by using trade aggregation. This paper also gave explanation on how using trade aggregation leads to a systematic error, which makes the previous literatures unreliable for supporting the Linder theory.

Dhakal et al (2011) investigated the validity of Linder theory by using Five Eastern Asia countries. The authors used five years panel data for this purpose. This panel data contained cross country trade between those five countries as well as the bilateral trade date of those countries with their respective major trade partners. The gravity equation was developed using those mentioned variables and they run the estimation for each of these five years' trade deals. They also adopted the fixed-effect method for estimating the collected data. They asserted that their result was quite vigorous and the outcome turnout not supportive to the tested Linder theory.

Saygili (2014) empirically studied the Turkey's bilateral trade pattern. He specifically verified the existence of Linder effect in international trade flows, both import and export, between Turkey and its major thirty (30) trade partners. He estimated traditional gravity model by using a panel data to analyze the behavior of Turkish trade from 1995 to 2011, and average income difference between countries was used as Linder independent variable. More so, the researcher went ahead to estimate the gravity model of panel data using Turkey and its 16 more similar income countries to verify income similarity (Linder) effect alone, using the same time frame (by adopting the World Bank categorization of income similarity). The result from these two different models shows a remarkably significant effect of

Linder variable on volume trade flows but only on Import part, but there is no evidence of Linder effect on Turkey's Exportations. Therefore, he concluded that, Linder effect exists only on import side but not export side of Turkey's bilateral trade.

Fialova (2010) also attempted to empirically verify the validity of Linder theory in the case of Japan between the periods of 1980 to 2007. He constructed a Gravity equation using a panel data. As for the estimation, he applies GRETL software package and HAC robust variance square and covariance matrix was estimated using the fixed effect technique. The major advantage this paper has, according to the author, is Japan being an Island has exempted itself from the major weakness identified in various researches, which is inability to measure the effect of distance on bilateral trade deals between countries. Another contribution given to the existing literature was the ability of this research to capture the individual county's characteristics. However, the Linder variable is statistically not significant and therefore, the paper does not have any definite conclusion as far as Linder theory is concern, but it does provide some basis for further theoretical readings, as the author condoned.

Although there are some empirical researches that cannot find evidence in support of, or found unclear result on both Gravity and Linder effects, but the overwhelming majority of the researches supported the two hypotheses.

Critiques of those two theory argued that, most of the researches that support Gravity and Linder hypotheses are weak, because in most cases important international trade

determinants such as language similarities and international trade agreements between some countries and their potential trading partners are not taken into account, which makes the whole result questionable. Again, these hypotheses are hardly tested in underdeveloped African nations that have entirely different trade behavior, and their tradable goods are mostly row materials and traditional unsophisticated goods which are mainly needed in industrialized areas.

In this paper, I intend to test the validity of Gravity model and Linder theory, taking into consideration the above allegedly unmeasured variables, and I am going to give the account for the methodology used in the process of conducting this research in the next chapter.

Chapter 4

METHODOLOGY

The major goal in this paper is to provide an understanding on the factors affecting bilateral trade pattern through empirically investigating the feasibility of Gravity model of trade and Linder theory. For any country to implement international trade policy, it needs to have clear knowledge with regard to the factors affecting its import and export behavior. Therefore, our study seeks to answer whether these theories have adequate capability in explaining patterns of trade.

Recall that the aim of this research is to test the following two (2) hypotheses;

1) Gravity Model
2) Linder Theory

In order to test these research two (2) hypotheses, we are going to employ the Ordinary Least Square (OLS) method of estimation using the STATA 12 software package.

4.1 Empirical Specification for Gravity Model

The Gravity model is becoming popular in the field of International trade since its original construction by Jan Tinbergen in his writing 'Shaping the World's Economy' (1962). The equation as the original Newton's model is basically saying trade between countries is positively affected by the sizes of the economies usually measured with GDP, and affected negatively by the distance between respective

countries. We were able to include fifty four (54) countries that trade with Nigeria in our research, which accounted for more than 95% of the total $148.1 billion worth of the country's trade deal in the year 2013 (Observatory of Economic Complexity, 2013).

Tinbergen (1962) made some modification to the model as below;

$$Fij = G\frac{mi\,\mathrm{mj}}{dij} \qquad (equ1)$$

Where,

F_{ij}: denotes trade volume (total trade between I to j country)

M_i and M_j: denotes the size of origin and destination countries, usually measured by their GDP.

Dij: the distance between the two countries usually measured by distance between the major cities of those two countries.

G: Is the gravitational constant.

In the first model, the Gravity Equation was tested, where economic sizes (peroxide by GDP) of trading partners and Distance between those countries and Nigeria (in miles) are regressed against the volume of trade to see their effect on bilateral Trade flows.

$$\text{Tradevol}_{ij} = \beta_0 + \beta_1 \text{GDP}^F_j + \beta_2 \text{GDP}^D_i + \beta_3 \text{Distance}_{ij} + \mu \quad (equ\ 2)$$

Being the home country is always Nigeria, we simplify equation 2 by removing domestic country's GDP, as provided in equation 3 below;

$$\text{Trade vol} = \beta_0 + \beta_1 \text{GDP}^F + \beta_2 \text{Distance} + \mu \quad (equ\ 3)$$

Note that, we estimated TRADE VOLUME AND GDP[F] variables in log form to capture the effect in percentage, while DISTANCE variable is in absolute term to see the effect in per unit of miles.

Listed below are those 54 Nigeria's trade partners, which are the Nigeria's major trade partners. The trade deals between Nigeria and these countries exceeded 95% of the total Nigeria's trade in 2013.

Table 1: (Nigerian International Trade Partners)

Spain, Netherlands, France, Germany, United Kingdom, Italy, Sweden, Austria, Portugal, Denmark, Norway, Ireland, Belgium, Russia, Poland, Iceland, Lithuania, Estonia, Ukraine, Chile, India, Japan, Indonesia, South Korea, China, Thailand, Turkey, Singapore, Malaysia, Lebanon, Hong Kong, United Arab Emirate, Vietnam, Saudi Arabia, United States, Brazil, Canada, Peru, Uruguay, Mexico, Argentina, New Zealand, South Africa, Ivory Cost, Cameroon, Senegal, Ghana, Republic of Congo, Niger, Benin, Morocco, Togo, Chad, Egypt.

4.2 Empirical Specification for Linder Theory

The second model is set to verify the existence of Linder effect in bilateral trade among G7 countries, plus three other European countries and we used 2014 trade data for this purpose. The G7 is the informal name often used to describe bloc of 7 most industrialized economies of the world.

The G7 countries are United States, Canada, Germany, Italy, France, Japan and United Kingdom. The added 3 countries were Spain, Netherlands and Austria. We

formed a pair by pair between these 10 countries and the sum of which gives us 45 different pairs.

We used a GRAVITY MODEL for this purpose and the model will include GDPs of the pair countries, distance and distance square between pairs and Linder variable, which is the difference between GDP per capita of the pairs as used by (McPherson *et al* 2000, Bernasconi, 2013; Felbermayr 2013). Detailed explanation about the models and variables will follow later.

$$Tradevol_{ij} = \beta_0 + \beta_1 GDP^F_j + \beta_2 GDP^D_i + \beta_3 Distance_{ij} + \beta_3 Linder + \mu \qquad (equ\ 4)$$

Johansson and Westin (1994) suggested that, in international trade distance between countries does not necessarily mean proximity or remoteness of areas, it entails factors that provide easy access to trade between those countries. These could include; other than proximities, language similarity and various kinds of economic integrations.

Therefore, the second version of this model we add Language similarity dummy to capture its effect on trade flows between those nations and to see how it could affect the previous result as in model 5 below.

$$Tradevol_{ij} = \beta_0 + \beta_1 GDP^F_j + \beta_2 GDP^D_i + \beta_3 Distance + \beta_4 Linder + \beta_5 Language + \mu \qquad (equ\ 5)$$

We also inserted EU-Membership dummy in the same model to see how affects the trade and how robust would be our result, as depicted in equation 6 below.

$$Tradevol_{ij} = \beta_0 + \beta_1 GDP^F_j + \beta_2 GDP^D_i + \beta_3 Distance + \beta_4 Linder + \beta_5 Language + \beta_6 EU + \mu \qquad (equ\ 6)$$

Note that, all variables, both dependant and independent, are going to be estimated in their absolute terms so the interpretation will be in units.

4.3 Data

The cross-section analysis is adopted, and cross-section data is used throughout this research, where we collected 2013 data for the first hypothesis (Gravity Model test for Nigeria), while 2014 trade data for the second hypothesis (Linder theory). The data sourced mainly from World Bank database, World Development Indicator (WDI), World Income Inequality Database (WIID), the Observatory of Economic Complexity (OEC), Central Bank of Nigeria (CBN) and World Distance Calculator (WDC).

The dependent variable

Trade vol$_{ij}$: Is a trade volume between the origin country denoted as i and the trading partner j, which is calculated by the summation of Import and Export value of goods and services between the two countries (Bernasconi 2013, Felbermayr 2013, McPherson *et al* 2000).

$$\text{Trade vol} = (\text{Import}_{ij} + \text{Export}_{ij}) \quad \textit{(equ. 7)}$$

We adopted this procedure in both the two tests.

Independent variables and their expected signs

In order to be able to analyze the specific determinant of international trade we used the following independent variables;

GDP$_j$: Is the value of Gross Domestic Products (at constant 2005 price express in US dollar) of Nigeria's trading partners, which is used as a proxy to control for the effect of relative size of Nigeria and those countries. The sign of this variable is expected to

be positive as suggested by Tinbergen (1962) himself, where he argued that richer countries tend to trade more.

Distance: This variable represents the distance or proximity between Nigeria and the rest of its trading partners. According to Tinbergen (1962), the distance between two countries plays an important role in international trade flows, and that is one of the things made the application of Gravity equation into the heart of international trade possible. Although the distance between trading cities or states can be different, the distance between the capitals serves will serve as a proxy which is most frequently used. Therefore, we expressed the distance between the capital cities in miles. The distance sign is expected to be negative as it is case that the longer the distance between countries the less likely to trade with each other (Bohman and Nilsson 2006).

Language: Some researchers argued that, when we are talking of distance in international trade, it is more accurate to refer to 'economic distance' which includes difference in language, preferences, trade linkages etc (Johansson and Westin, 1994). That is why language similarity and membership of any kind of economic integration dummies where taken into consideration in both the model. Any pair of countries speaking the same language is given code (1) and code (0) given to those different languages trading partners and the sign of the language similarity is expected to be positive.

EU Membership: The European Union membership is presumed to have an effect in the trade flows between members. Therefore, the dummy was included among the

explanatory variables to capture the effect of this treaty where the trading partners that are members of EU coded (1) and non-EU members coded (0). The expected sign of coefficient of this variable is positive because of the obvious fact that those member countries will find it easier to trade with each other.

Linder: This is the concerned variable in the model, is signifies the income similarity between trading partners (Linder 1961). It is calculated using the difference between GDP per capita of home country and its trading partners (Eppinger and Felbermayr, 2013; McPherson *et al*, 2000; Jeffery, 1997***).*** Mathematically;

$$\text{Linder} = (GDPPC^{F} - GDPPC^{D}) \quad \textit{(equ. 8)}$$

For the theory to hold water we expect negative relationship between trade volume and the Linder variable. Meaning the higher the value income difference the less likely is the trade to take place.

In addition, the **GDP of home countries** and **Distance Square** variables were also included because this is what the original gravity model suggested, we deliberately exclude them from the first model because the home country is (Nigeria) the same throughout. This is only true for gravity model but not for Linder Theory test.

4.4 Estimation Technique and Specification Testing

4.4.1 Cross-section Analysis

Cross-section analysis (which otherwise called transversal or prevalence analysis) is the type of study that seeks to discover the causality between observations, usually dependant against independent variable(s) from a given sample or population and at a particular time period. For the purpose of this research we used this type analysis.

4.4.2 Heteroskedasticity

This is the econometric problem that is likely to arise when dealing with the cross-sectional data. It occurs when variance of the error term is increasing or decreasing as some of the independent variables change. So, essentially the variance of the error term isn't constant (Wooldridge, 2013).

$$var(\mu_t) \neq \sigma^2 \text{ (equ. 9)}$$

Constant variance is one of the essential assumptions of OLS. Therefore, it is important to check for heteroskedasticity because it causes the upward bias to our standard error which used to compute t-values for hypothesis testing. Therefore, essentially with the presence of heteroskedasticity our hypothesis testing is simply unreliable (Wooldridge, 2013).

The null hypothesis is Homoskedastic. That is,

$$var(\mu_t) = \sigma^2 \text{ (equ 10)}$$

and we will test to reject the null, that is the error terms are homoskedastic.

For this purpose we adopted a Breusch-Pagan test to check for the presence of Heteroskedasticity. This test procedure was developed by Trevor Breusch and Adrian Pagan in 1979 to test for Heteroskedasticity in linear regression model and the result will be duly presented.

The presentation and analysis of our findings will follow in the next chapter.

Chapter 5

EMPIRICAL RESULT

This study tries to test the validity of two hypotheses of International trade which are;

1) Gravity Model
2) Linder Theory

First, being the Newton's gravity equation which transplanted in the heart of International Trade. Is basically saying trade between countries is positively affected by the sizes of the economies usually measured with GDP, and affected inversely by the distance between respective countries.

Second, we also tried to verify the existence of Linder hypothesis which is measured by the extent to which trading partners share the same preferences. Those preferences are usually measured using Income similarity.

It is important to mention that, our initial intention was to test the Linder effect for the Nigerian bilateral trade, using those fifty four (54) trading partners. But it came into our notice that, since Nigeria will be the base country throughout and we are including the GDP of the foreign country as well as the GDP/capita differences (Linder variable) between Nigeria and the foreign countries then there is high possibility of correlation between GDP and Linder variable. In other words, the

higher the GDP of the second country the higher will be the GDP/capita difference (Linder variable) or simply Linder depends on GDP value.

So for Linder hypothesis, we used a cross-country analysis between G7 countries plus Spain, Netherlands and Austria, and we adopted the Gravity equation again for this purpose where we used the 2014 trade data for those countries as mentioned in the previous chapter.

5.1 The Estimation Results

The following table shows the regression result for Gravity Model test, using Nigeria's bilateral trade with 54 countries among its trading partners in 2013.

Table 2: **MODEL1** (The Dependant Variable: lnTradeVol)

Variables	Coefficients	Probability(Significance)
$lnGDP_j$	0.5992304* (0.0826771)	0.000
$Distance_{ij}$	-0.0001268*** (0.0000705)	0.078
Constant	5.607991* (2.047336)	0.008
R-squared	0.5234	
F-statistic	28.00	0.0000
BP-test		0.6520

Source: researcher's regression. Numbers that are in parenthesis are estimated values of standard errors, and (*), (**) and (***) are significant at 1%, 5% and 10 % levels respectively

MODEL 1 (The gravity model result)

The dependant variable Trade Volume was regressed against the independent variables;

1) GDP and
2) Distance

--GPD of the countries was found statistically significant at 99% confidence level and it is positively related to the volume of trade with coefficient (0.5992). That is, 1% increase in economic size of Nigeria's trading partners (peroxide with GDP) will course 0.6% increase in the trade volume between Nigeria and those countries.

--Distance was also found statistically significant at 90% level of confidence and it is negatively related to volume of trade with coefficient (-0.00013). That is, 1 mile increase in the distance from Nigeria to the trading partners will reduce the trade volume with 0.0013%. The result tallies with the expected outcome and it is particularly have similar findings with (Tinbergen, (1962); Sohn, (2005); Eita,(2008); Yihong and Weiwei, (2010) Doumbe and Belinga, (2015)

--R^2, that is the coefficient of determination in this regression is (0.5234), which is strong. Meaning that, 52% of the variation of the dependant variable has been captured by the model.

--F-statistic with coefficient 28.00 is also significant at 99% confidence level, which indicates that the independent variables included are jointly significant in explaining the dependant variable.

Heteroskedasticity Test Result

As we mentioned in chapter four, we are testing to reject our null hypothesis, which is the estimated variables in the model are Homoskedastic (have constant variance), for both White and Breusch-Pagan tests. Therefore, if our test is significant at least at 90% confidence level we can reject the null hypothesis.

--White-Test, with provability value of (0.2759) and

--Breusch-Pagan test, with provability value of (0.6520) were found not significant.

Graphically;

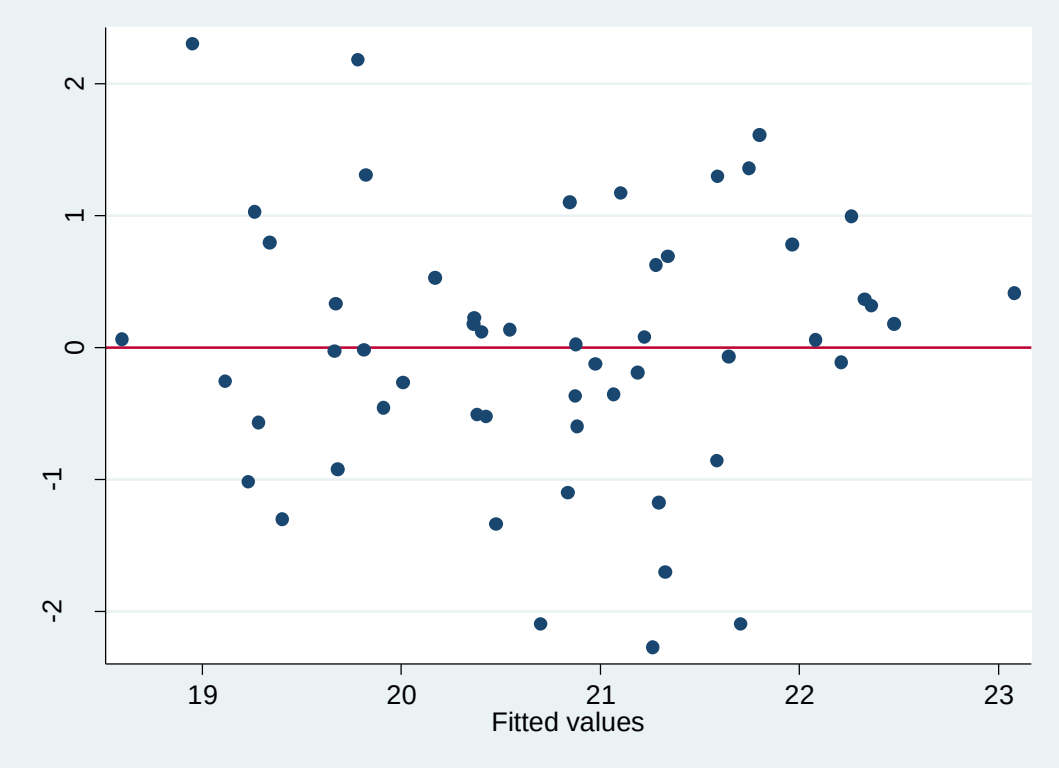

Figure 1: (Source: the heteroskedasticity test result from stata 12)

Therefore, we concluded that our error term is homoskedastic.

The table below shows the Linder hypothesis test results, using 2014 trade data for G7 countries plus Spain Netherlands and Austria, by adopting the Gravity Model.

Table 3: Linder result (The Dependant Variable: Trade Volume)

Variables	**(Model 2)** $var \neq \sigma^2$	**(Model 3)** $var=\sigma^2$	**(Model 4)** $var=\sigma^2$	**(Model 5)** $var=\sigma^2$
GDP^F	0.0143*** (0.0024)	0.0143*** (0.0053)	0. 0129*** (0. 0041)	0.0132*** (0.0039)
Distance	-2.0607*** (5114728)	-2.0607*** (6384300)	-1.9207*** (5204234)	-1.9107*** (5738325)
GDP^D	0.0043 (0 .0034)	0.0043*** (0.0016)	0.0044*** (0.0016)	0.0043** (0. 0017)
Linder	-2542142 (1588051)	-2542142* (1316113)	-1951302* (971569.5)	-1950998* (983309.6)
Language			5.6010 (7.1110)	5.5910 (7.2310)
EU				3.5409 (2.4810)
Constant	8.4310*** (2.3510)	8.4310*** (2.3010)	7.4110 *** (2.0510)	7.0410* (3.4910)
R-Squared	0.5278	0.5278	0.5501	0.5502
F-statistic	11.18	3.41	3.38	3.72
BP-test	0.0000			

Source: researcher's regression. Numbers that are in parenthesis are estimated values of standard errors, and (***), (**) and (*) are significant at 1%, 5% and 10 % levels respectively.

Model 2: Shows the regression result for Linder theory

After the conduct of Heteroskedasticity test, we found that the variance of our error term is not constant. Therefore, we need to solve the make it constant, otherwise our hypothesis is unreliable.

Graphically;

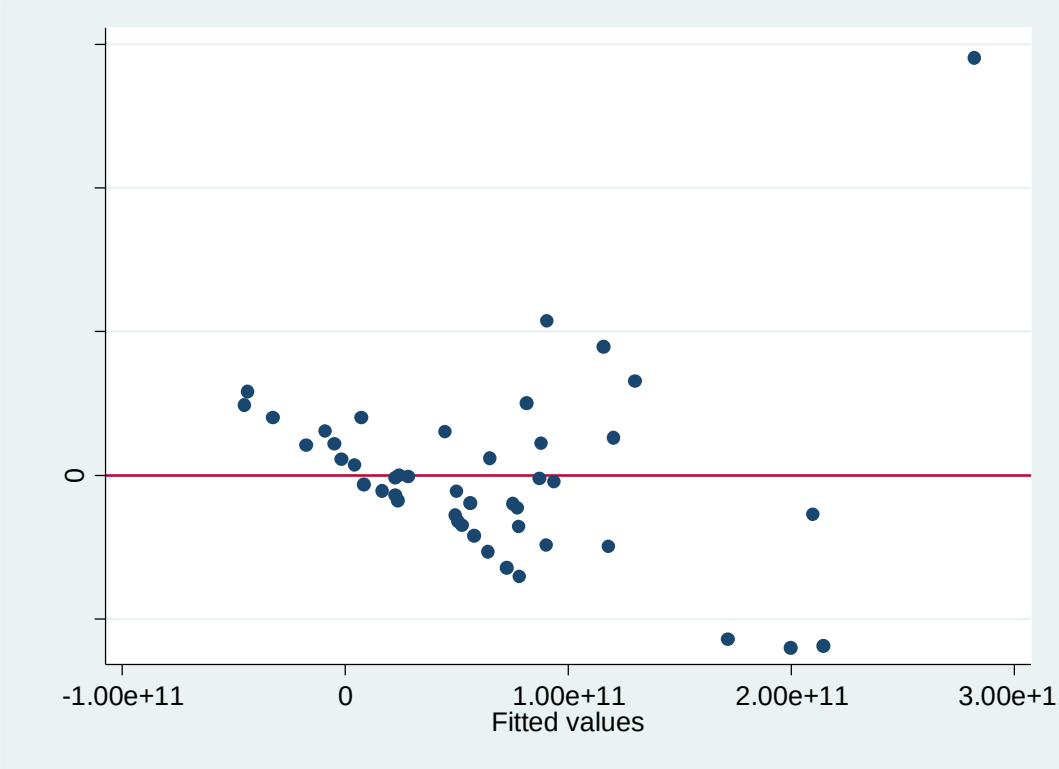

Figure 2:(Source: the heteroskedasticity test result from stata 12)

Model 3:

It shows the robust regression result for Linder as the heteroskedasticity problem is resolved.

--GPD of both foreign and domestic countries was found highly significant at 99% confidence level and they are positively related to the volume of trade with coefficient (0.0143) and (0.0043) respectively. That is, 1 million increases in the

foreign and domestic economic sizes of trading partners (GDP) will course 0.0143 million and 0.0043 million increase in the trade volume between those countries respectively.

--Distance was also found statistically significant at 99% level of confidence. As seen above, Distance has negative relation to volume of trade as expected, which has a coefficient (-2.0607). That is, 1 mile increase in the distance between trading partners will reduce the trade volume with 2.0607 million dollars. The result tallies with the expected outcome and it is particularly have similar findings with (Tinbergen, 1962; Sohn, 2005; Eita, 2008; Yihong and Weiwei, 2010; Doumbe and Belinga, 2015)

--Linder variable (Per capita GDP differences) was found marginally significant at 90% confidence level. The coefficient (-2542142) is saying that, as Linder variable increase by a dollar the trade volume will decrease by 2, 542,142 dollars. Essentially, the Linder variable has negative effect on the trade volume, as expected. This result is in line with the priori theoretical expectation and it is similar to (Linder M. B., (1961); McPherson *et al* (2000); Bohman and Nilsson, (2006); Faustino and Leitao, (2012); Bo, (2013); Eppinger and Felbermayr, (2013).

MODEL 4

--GPD of both domestic and foreign countries was found highly significant again at 99% confidence level and they are positively related to the volume of trade with coefficient (0.0044) and (0. 0129) respectively. That is, 1 million increases in the domestic and foreign economic sizes of trading partners (GDP) will course 0.0044

million and 0.0129 million increase in the trade volume between those countries respectively.

--Distance was again found statistically significant at 99% level of confidence. Distance has negative relation to volume of trade as expected, which has a coefficient (-1.9207). That is, 1 mile increase in the distance between trading partners will reduce the trade volume with 1.9207 million dollars.

--Linder variable (Per capita GDP differences) was found marginally significant at 90% confidence level. The coefficient (-1951302) is saying that, as Linder variable increase by 1 dollar the trade volume will decrease by 1, 951,302 dollars. Essentially, the Linder variable has negative effect on the trade volume, as expected.

--Language similarity variable is augmented in the model 3, as seen in model 4 to capture the effect of speaking same language on trade. The language variable as suggested by (Johansson and Westin, 1994) is one of the economic distances that affect the trade. Meaning, countries that speak the same language are expected to trade with each other more, as explained in the previous chapter.

As we include the dummy for language similarity in the model 3 the result remains the same, whereas the language similarity was found insignificant in explaining the trade volume between the countries even at 90% confidence level. This result confirms the robustness of the Gravity Model as well as the Linder theory in this study because even with the inclusion of language similarity variable the explanatory power of the Gravity model and Linder theory variables remain the same.

MODEL 5

--GPD of domestic and foreign countries was also found highly significant at 95% and 99% confidence levels and they are positively related to the volume of trade with coefficient (0.0043) and (0.0132) respectively. That is, 1 million increases in the domestic and foreign economic sizes of trading partners (GDP) will course 0.0043 million and 0.0132 million increase in the trade volume between those countries respectively.

--Distance was also found statistically significant at 99% level of confidence. As seen above, Distance has negative relation to volume of trade as expected, which has a coefficient (-1.9107). That is, 1 mile increase in the distance between trading partners will reduce the trade volume with 1.9107 million dollars.

--Linder variable (Per capita GDP differences) was found marginally significant at 90% confidence level. The coefficient (-1950998) is saying that, as Linder variable increase by 1 dollar the trade volume will decrease by 1, 950,998 dollars. Therefore, the Linder variable has negative effect on the trade volume, as expected.

--Language similarity again was found insignificant in explaining the trade volume between the countries even at 90% confidence level.

--EU-Membership dummy was added to model 4, as seen in model 5, to capture the effect of existing economic integration on trade volume between these countries. This variable is also among the economic distances that presumed to have effect on trade flows between countries as explained by Johansson and Westin (1994).

The result from model 5 above is showing that, the inclusion of the EU-Membership does not change the significance other variables, and EU-Membership is found insignificant also even at 90% confidence level. This is another confirmation about the robustness of our result as inclusion of another variable does the not made either Gravity or Linder variables lost the relevance in the model.

We will provide the conclusion and some policy implication, base on the above findings in the next chapter.

Chapter 6

CONCLUSION AND POLICY IMPLICATION

The conclusions which are drawn from the findings of this study, as well as the policy implications are hereby presented;

6.1 Conclusion

As heighted previously, our objectives in this research are to test the following two hypotheses

1) The Gravity Model
2) Linder Theory

On the basis of the empirical data collected, upon which analysis and interpretations were made, we concluded as follows:

6.1.1 Conclusion from the Gravity Model

First, for the Gravity model I tried to see how Newton's gravitational equation, as it was transplanted into the field of International Trade by Jan Tinbergen (1962), can be time-honored by applying it to Nigerian bilateral trade pattern. For this purpose I collected the data for Nigerian bilateral trade with fifty four (54) countries, which account for more than 95% of its trade deals in the year 2013, I also adopted the OLS regression method for estimating the model.

The regression result showed a strong support to the model which says trade between countries is affected positively by the economic sizes and inversely by their

respective distance, similar to (Tinbergen, 1962; Sohn, 2005; Eita, 2008; Yihong and Weiwei, 2010; Doumbe and Belinga, 2015).

6.1.2 Conclusion from the Linder Theory

Second, for the Linder theory, which sometimes called Income Similarity theory or the Theory of Overlapping Demand, was tested for the G7 countries plus Spain, Netherlands and Austria. The theory as we explain in the previous chapters, is basically saying countries with more similar income per capita are predisposed to demand more similar goods, and hence trade more with each other. For the purpose of testing this theory, OLS method of regression was estimated and we augmented the gravity equation with Linder variable, similar to (Kennedy and McHugh, 1983; Hallak's, 2010; Bernasconi, 2013; Steinbach, 2015) and the 2014 bilateral trade data for these countries was used.

The augmented gravity model estimation result showed support on both the Linder variable and the gravity theory, were as we saw. The Linder variable is significant in explaining the trade volume at 90% confidence level, and GDPs as well as Distance variables were even highly significant at 99% confidence levels. It the follows then that, these 10 countries tend to trade with country that they have more similar per capita income, *ceteris paribus*, similar to (Linder M. B., (1961); McPherson *et al* (2000); Bohman and Nilsson, (2006); Faustino and Leitao, (2012); Bo, (2013); Eppinger and Felbermayr, (2013).

Some researchers argued that, when we are talking of distance in international trade, it is more accurate to refer to 'economic distance' which includes difference in language, preferences, trade linkages etc(Johansson and Westin, 1994). That is why

language similarity and membership of any kind of economic integration dummies where augmented into the model.

First, we put language similarity variable between countries and pairs that speak the same language are given code (1) and code (0) given to those different languages trading partners and the sign of the language similarity is expected to be positive.

Although language similarity improved the fitness of the model, but does not change the explanatory power of other variables nor does it itself significant in explaining the trade flows.

Second, we also insert the EU-membership dummy into the model, and pairs who are EU members were given code 1 and those didn't share EU membership were coded 0, as explained in chapter 4.

The result in this model showed that, the inclusion of the EU-Membership does not change the significance other variables, and EU-Membership was found insignificant and negatively affects the joint specification of the model (F-statistic) as explained in the previous chapter. This may be due to the fact that, the distance between countries is correlated with EU-membership because almost all member countries are close to one another. Another issue that could be deduced from this result is the confirmation the robustness of distance variable, which overrides the EU-membership effect.

Conclusively, the result of this research supported both hypotheses, and our findings are so robust that inclusion of other variables does not made either Gravity or Linder variables lost the relevance in the model.

6.2 Policy Implication

International Trade is simply exchange of products between two or more countries. If the conditions are right, all the countries involved will get a benefit from the trade, and it could be the important driver for the economic growth and betterment of citizens' living standards through improving GDPs of the countries involved.

Generally, there is a strong connection between trade and development. By looking at the experience of most industrialized economies, especially newly developed ones, we can say that trade has played a remarkable role in pursuance of their development state (Henegedara, 2011), that is why most of developing countries are now searching for the primary products export led policies. Therefore, studies like this will provide a country with the understanding of their trade potentials, thereby taking effective measures to tap those foreseen potentials.

There is no doubt that the literatures concerning Gravity model and Income similarity theory are growing in steady pace, but still these topics are in the formative stage. This paper is based on the study of total trade. Hence the study of this nature on specific kind of product may be plausible to see their applicability on the variety of goods. Another possible extension to this research could be including more countries with different characteristics to be able to generalize our findings.

REFERENCES

Anderson, J. E. (2010). The Gravity Model. *National Bureau of Economic Research*.

Ankre, I., & Sandberg, A. (2010). Export Patterns of the Chinese Wine Industry.

Arnon, A., & J, W. (1998). Linder Hypothesis Revisited: Income Similarity Effect for Low Income Countries. *Applied Economics Letters*, 607-611.

Baldwin, R., & Taglioni, D. (2011). Gravity Chains: Estimating Bilateral Trade Flows When part and Components Trade is Important. *National Bureau of Economic Research.*

Bernasconi, C. (2013). Similarity of Income Distribution and Extensive and Intensive Margin of Bilateral Trade Flows.

Bo, P. J. (2013). Bilateral Trade of China and the Linder Hypothesis: A Gravity Model Approach.

Bohman, H., & Nilsson, D. (2007). Income Inequality as a Determinant of Trade Flows. *International Jornal of Applied Economics*, 40-59.

Bohman, H., & Nilsson, D. (2006). Introducing Income Distribution to the Linder Hypothesis. *American Economic Association*, JEL F10, D13.

Bohman, H., & Nilsson, D. (2007). Market Overlap and the Direction of Export: New Approach of Assessing the Linder Hypothesis. CESIS.

Breusch, T. S., & Pagan, A. R. (1979). A Simple Test for Heteroskedasticity and Random Coefficient Variation. Econometrica , 1287-1294.

Chete, L. N., & Adewuyi, A. O. (2010). Dynamics of Trade Between Nigeria and Other ECOWAS Countries. *Nigerian Institute of Social and Economic Research.*

Deardorff, A. (1998). Detreminant of Bilateral trade: Does Gravity Work in a Neoclassical World? *National Bureau of Economic Research,* 7-32.

Dhakal, D. P., & Upadhyaya, K. P. (2011). Another Empirical Look at the Theory of Overlapping Demands.

Do, T. T. (2006). A Gravity Model For Trade Between Vietnam and Twenty-Three European Countries.

Doumbe, E. D., & Belinga, T. (2015). A Gravity Model Analysis for Trade Between Cameroon and Twenty-Eight European Union Countries. *Open Journal of Social Science,* 3,114-122.

Eita, J. H. (2008). Determinants of Namibian Exports: A Gravity Model Approach.

Eppinger, P. S., & Felbermayt, G. J. (2014). Bilateral Trade and Similarity of Income Distributions: The Role of Second Moments. *Institute for Economic Research University of Munich.*

Eppinger, P. S., & Felbermyr, G. J. (2013). The Impact of Inequality on Trade: Empirical Analysis.

Faustino, H. C., & Leitao, N. C. (2012). Country-Specific Determinants of Intra-Industry Trade: Evidence from Portugal.

Fialova, A. (2010). Empirical of the Linder Hypothesis: The Case of Japan (1080-2007).

Gujarati, D. N. (2004). Basic Econometrics. US: McGraw Hill Companies.

Hallak, J. C. (2008). A Product-Quality View of the Linder Hypothesis.

Helena Bohman, D. N. (n.d.). Introducing income Distribution to the Linder Hypothesis.

Kellman, M., Cahn, E. S., & Glass, V. (1986). An Analysis of Pacific Basin Trade Utilizing the Test-Similarity Hypothesis. *Journal of International Economic Integration* 1(1) , 32-42.

Kennedy, T. E., & McHugh, R. (1983). Test Similarity and Trade Intensity: A Test of the Linder Hypothesis for United States Export.

McPherson, M. A., Redfearn, M. R., & Tieslau, M. A. (2000). A Re-examination of Linder Hypothesis: A Random-Effect Tobit Approach. *International Economic Journal.* vol.3, 123-136.

Saygili, R. F., & Manavgat, G. (2014). Linder Hypothesis 'An Empirical Analysis on Turkey's Foreign Trade'. *Ege Academic Review*, 261-270.

Sohn, C.-H. (2005). Does Gravity model Fit Korea's Trade Patterns? Implications for Korea's FTA Policy and North-South Korean Trade. *Centre for International Trade Studies* (CITS).

Statistics, N. B. (2015). Foreign Trade Statistics. Abuja, Nigeria: *National Bureau Of Statistics.*

Steinbach, S. (2015). Bilateral Export Trade and Income Similarity: Does Linder Hypothesis Hold for Agricultural and Food Trade? *Swiss Institute of Technology, Zurich.*

The Observatory of Economic Complexity. (2014). Bilateral Trade report. Retrieved from http://atlas.media.mit.edu/en/.

Wooldridge, J. M. (2013). Introductory Econometrics: A Modern Approach (fifth ed.). South-Western.

Arvis, J.-F. and Shepherd, B. (2013). The poisson quasi-maximum likelihood estimator: a solution to the 'adding up' problem in gravity models. *Applied Economics Letters* 20: 515-519. CEPII (2015). BACI trade database. Paris, France.

Hallak, J. C. (2010). A product-quality view of the linder hypothesis. *Review of Economics and Statistics* 92: 453--466.

Santos Silva, J. M. C. and Tenreyro, S. (2006). The log of gravity. *Review of Economics and Statistics* 88: 641--658.

Tinbergen, J. (1962). Shaping the world economy: suggestions for an international economic policy. Twentieth Century Fund.

World Bank (2015). World Development Indicator Database. The World Bank, Washington, DC.

Steinbach, S. (2015). Bilateral export trade and income similarity: Does the Linder hypothesis hold for agricultural and food trade?

APPENDIX

Appendix A: Regression Results

reg lnTRADEVOL lnGDPF DIST

```
      Source |       SS       df       MS              Number of obs =      54
-------------+------------------------------           F(  2,    51) =   28.00
       Model |  58.2292761     2   29.114638           Prob > F      =  0.0000
    Residual |  53.0297309    51  1.03979865           R-squared     =  0.5234
-------------+------------------------------           Adj R-squared =  0.5047
       Total |  111.259007    53  2.09922655           Root MSE      =  1.0197

------------------------------------------------------------------------------
 lnTradevol |  Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lnGDPF |   .5992304   .0826771     7.25   0.000     .4332491    .7652117
      DIST  |  -.0001268   .0000705    -1.80   0.078    -.0002684    .0000148
      _cons |   5.607991   2.047336     2.74   0.008     1.497793    9.718189
------------------------------------------------------------------------------
```

. reg TRADE_VOL GDPF GDPD DISTANCE LINDER

```
      Source |       SS       df       MS              Number of obs =      45
-------------+------------------------------           F(  4,    40) =   11.18
       Model |  2.1424e+23     4  5.3559e+22           Prob > F      =  0.0000
    Residual |  1.9167e+23    40  4.7917e+21           R-squared     =  0.5278
-------------+------------------------------           Adj R-squared =  0.4806
       Total |  4.0591e+23    44  9.2251e+21           Root MSE      =  6.9e+1

------------------------------------------------------------------------------
```

Tradevol	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
GDPF	.0142753	.0023639	6.04	0.000	.0094977	.0190528
GDPD	.004293	.0034101	1.26	0.215	-.002599	.011185
Distance	-2.06e+07	5114728	-4.02	0.000	-3.09e+07	-1.02e+07
Linder	-2542142	1588051	-1.60	0.117	-5751713	667428
_cons	8.43e+10	2.35e+10	3.59	0.001	3.68e+10	1.32e+11

. reg TRADE_VOL GDPF GDPD DISTANCE LINDER, robust

Linear regression Number of obs = 45

F(4, 40) = 3.41

Prob > F = 0.0171

R-squared = 0.5278

Root MSE = 6.9e+1

	Robust					
Tradevol	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
GDPF	.0142753	.0052978	2.69	0.010	.0035679	.0249826
GDPD	.004293	.0015764	2.72	0.010	.0011069	.0074791
Distance	-2.06e+07	6384300	-3.22	0.003	-3.35e+07	-7665234
Linder	-2542142	1316113	-1.93	0.061	-5202105	117820.2
_cons	8.43e+10	2.30e+10	3.67	0.001	3.78e+10	1.31e+11

```
. reg TRADE_VOL GDPF GDPD DISTANCE LINDER LANG, robust

Linear regression                               Number of obs =      45
                                                F(  5,    39) =    3.38
                                                Prob > F      =  0.0125
                                                R-squared     =  0.5501
                                                Root MSE      =  6.8e+1

------------------------------------------------------------------------------
             |               Robust
  TRADE_VOL |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        GDPF |   .0129333   .0040698     3.18   0.003     .0047015    .0211652
        GDPD |   .0043553   .0015871     2.74   0.009     .0011452    .0075655
    Distance|  -1.92e+07    5204234    -3.69   0.001    -2.97e+07    -8682823
      LINDER |   -1951302   971569.5    -2.01   0.052    -3916487    13882.91
        LANG |   5.60e+10   7.11e+10     0.79   0.436    -8.79e+10    2.00e+11
       _cons |   7.41e+10   2.05e+10     3.62   0.001     3.27e+10    1.16e+11
------------------------------------------------------------------------------

. reg TRADE_VOL GDPF GDPD DISTANCE LINDER LANG EU, robust

Linear regression                               Number of obs =      45
                                                F(  6,    38) =    3.72
                                                Prob > F      =  0.0053
                                                R-squared     =  0.5502
                                                Root MSE      =  6.9e+1
```

| Robust

Tradevol | Coef. Std. Err. t P>|t| [95% Conf. Interval]

---+---

GDPF | .0131739 .0038596 3.41 0.002 .0053606 .0209873

GDPD | .0043111 .0017348 2.49 0.017 .0007991 .0078231

Distance| -1.91e+07 5738325 -3.33 0.002 -3.07e+07 -7476076

Linder | -1950998 983309.6 -1.98 0.055 -3941604 39608.57

LANG | 5.59e+10 7.23e+10 0.77 0.444 -9.05e+10 2.02e+11

EU | 3.54e+09 2.48e+10 0.14 0.887 -4.66e+10 5.37e+10

_cons | 7.04e+10 3.49e+10 2.02 0.051 -2.00e+08 1.41e+11

. log close