ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

THE DETERMINANTS OF SUB-SAHARAN AFRICA'S (SSA) BILATERAL TRADE WITH THE NORTH: A GRAVITY MODEL APPROACH

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List of Acronyms

AFTA	ASEAN Free Trade Area
ASEAN	Association of South East Asian Nations
COMESA	Common Market for East and South Africa
DOTS	Direction of Trade Statistics
EU	European Union
FEM	Fixed Effects Model
GDP	Gross Domestic Product
GNP	Gross National Product
H-O	Heckscher-Ohlin
IMF	International Monetary Fund
LDCs	Least Developing Countries
MERCOSUR	South Cone Common Market
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Square
REM	Random Effect Model
RER	Real Exchange Rate
RTA	Regional Trade Agreement
SCO	Shanghai Cooperation Organization
SSA	Sub-Saharan Africa

UK	United Kingdom
UNCTAD	United Nations Conference on Trade and Development
USA	United States of America
USD	United States Dollar
WB	World Bank
World War II	World War Second
WDI	World Development Indicators

Abstract

This paper attempts to assess the determinants of SSA's bilateral trade with the North. In this regard, an augmented gravity model has been specified to annual imports of SSA countries from the industrial countries. The model is tested for a sample of 35 countries, 27 SSA and 8 industrial countries over the period 1995-2007. In the model, the bilateral import is a linear function of economic size, population of the country, per capita income and geographical difference and historical dummies. Specifically, SSA bilateral import is positively determined by the size of economies (GDP of the importing and exporting country), linguistic and historical ties. Infrastructure indexes which are augmented as a proxy for public infrastructures have also a positive influence. On the other hand, transportation cost proxied by geographical distance and country's access to sea are found to have a negative influence on SSA bilateral import. Likewise, the coefficient of per capita GDP differential between these countries has a negative sign indicating that the Linder effect dominates the H-O hypothesis in the case of north - SSA trade flows.

The implication of these results is that all kinds of barriers to trade must be liberalized to a greater extent to enhance SSA's bilateral trade. Since one of the main problems of Sub Saharan African trade is transport infrastructure network, improvement in infrastructure may be a pre-requisite for successful trade flows. A further study is also advised to investigate manufacturing and non-manufacturing trade flows separately since they have different trends.

I. Introduction

In this globalizing world, countries are becoming interdependent more than ever. This encourages every country of the world to have a clear understanding of globalization process since the economy of each country is closely related to the economies of other countries. Among the different kinds of linkages that could be formed among nations, international trade is the most important one.

The rapid growth of the world economy has been driven by an increasing involvement in international trade. International trade is the exchange of goods and services between nations. Since countries have different potentials in producing different products there is greater need for international trade. Hence, a country's growth is achieved if it is engaged in international trade. If a country has a comparative advantage in producing the commodity, then that advantage provides nations to specialize in those goods that it can produce most cheaply and efficiently. Hence, trade promotes competition and improved resource allocation. Competition from international trade can force domestic firms to become more efficient through modernization and innovation. Therefore, countries especially least developed countries (LDCs) should be engaged in international trade to accelerate overall economic growth which raise profits, promotes greater saving and investment. Because of this importance, international trade has received increasing attention. According to Coe and Hoffmaister (1998), a number of factors explain the renewed emphasis on trade. The most obvious is the success of many developing countries that have adopted outward-oriented development strategies. This is because strong economic performance is seen in countries that have adopted

outward-oriented development strategies as compared to earlier experiences of inward-oriented, import substitution strategies in some of the same countries. Moreover, a relatively poor economic performance is observed in other developing countries that did not embrace outward-oriented strategies.

No nation can exist in economic isolation and thus every country has to enter into trade with other countries to acquire goods and services that cannot efficiently be produced domestically but are necessary and have high demand in the country. Apart from this, trade allows countries to export items in the production of which they have advantage over other countries. This in turn enables them to acquire foreign exchange that is highly needed, among others, for industrialization and socio economic development. Marquez (2007) argued that international trade can play an important role in reducing poverty and income inequality in developing countries through its impact on economic growth. Thus, according to Falvey *et al* (2002), the impact of trade upon growth is by allowing access to the innovative products of other countries. Since developing countries do little innovation, it is primarily through trade with developed countries that they profit from higher levels of technological development.

In most of the Sub-Saharan Africa (SSA) and other developing countries, external trade can play a significant role in the performance of a country's economy. It provides employment opportunities and foreign exchange earnings used to pay imports of many products that cannot be presently produced domestically and advanced economies that are not available at home (Salvatore, 1990). Thus expanding export capacity and increasing international competitiveness are vital for rapid growth and development.

There is a generalized belief that free trade establishes the best conditions for economic development and growth. However, in the real world no country exercises free trade. Countries impose different policy measures to restrict imports and/or exports for various reasons. However, many trade barriers are recently removed by many developed countries but are still used in many developing countries.

Traditional trade theories are mainly concerned with the qualitative question of identifying the trade pattern, that is to say, what goods does a country trade? But they ignore the question of the trade volumes. These theories do not explain why some countries trade links are stronger than others and why the levels of trade tends to increase/decrease over time. In fact, understanding the factors that determine bilateral trade of a country is a practical task, as it opens up an additional horizon for trade policies. Therefore, there is a greater need of investigation in the factors that determine bilateral trade flows between countries.

Based on previous works, it is argued that developing countries will less likely benefit by trading with low-income countries than the industrial countries. The explanation is that low-income countries are not natural trading partners owing to their size and similar resources. Similarly Foroutan and Pritchett (1993) argued that trade among SSA countries is too small. They argued that the low degree of intra-SSA trade is completely explained by the low degree of trade potential amongst the countries, primarily because of their low level of gross domestic product (GDP). So if SSA countries are trading more with industrial countries and if they benefit more by trading with industrial countries than with low-income countries, what are the

major factors that determine their bilateral trade flows with the industrial countries? That is why the paper seeks to look at the determinants of North-SSA trade flows.

There have not been many attempts in the literature to quantify the major determinants of SSA's bilateral trade with industrial countries. The most recent study conducted on this issue was in 1995 by Coe and Hoffmaister. There have been so many developments since then. So, there is a gap in the existing literature between the intuitions that SSA's bilateral trade and the empirical evidence to support the intuition. The paper attempts to fill this gap.

The objective of the study is to examine empirically some of the basic determinants of Sub-Saharan Africa's (SSA's) bilateral trade with industrial countries and to look more deeply at the variables which significantly determine trade flows between these countries.

The paper is presented in five sections. The first is an introductory part, the second is concerned with the review theoretical and empirical literatures related to the topic. An overview of Sub-Saharan African (SSA) countries trade performance is reviewed in this section. The third and fourth sections are devoted to data, methodological approach and its empirical results respectively. Finally, the fifth section draws conclusion and policy suggestions based on the findings.

II. Literature Review

2.1. The Theoretical Framework

The Gravity Model

Quite often economic and social ''laws'' or relations have been borrowed from the natural sciences, physics or biology, mainly because of their hard scientific and directly intuitive

characters. The gravity model, which is the most commonly used analytical framework for studying bilateral trade belongs to this category. The model has its origins in Newton's law of gravitation in seventeenth century. Newton's law of gravity in mechanics states that two bodies are subjected to a force of attraction that depends positively on the product of their masses and negatively on their distance. Social scholars, a few centuries later, applied this law to social phenomena of quite different nature the common character of which was transfers or flows between two or more entities or sources. Thus, migration or traffic laws, not only of cars but of information too, were examined using this 'law'. Economists too applied it and Tinbergen (1962) is credited for his study of international trade flows using a gravity model. Thus, Tinbergen (1962) and Poyhonen (1963) did the first econometric studies of trade flows based on gravity equation, for which they give only intuitive justification.

As is said, the gravity model is analogous to Newton's law of gravity. The analogy is that bilateral trade is a function of attraction factors such as 'economic mass' (generally measured by GDP) and resistance factors such as distance 'economic centers of gravity' or various obstacles to trade.

$$Trade_{ij} = \alpha \frac{GDP_i GDP_j}{Distance_{ij}}$$

Where, $Trade_{ij}$ = bilateral trade between country i and j

α = constant parameter

GDP_i = gross domestic product of country i

GDP_j = gross domestic product of country j

$Distance_{ij}$ = geographic distance between country i and j

Although the base line model gives good results, a number of explanatory variables have been added to initial gravity equation to improve explanatory power of the model to analyze various bilateral trade policy issues

The second justification for the gravity equation can be analyzed in the light of a partial equilibrium model of export supply and import demand by Linneman (1966). Based on some simplifying assumptions the gravity equation turns out to be a reduced form of this model. However, Bergstrand (1985) and others point out that this partial equilibrium model could not explain the multiplicative form of the equation and also left some of its parameters unidentified mainly because of exclusion of price variable. With the simplest form of the equation, of course, Linneman's justification for exclusion of prices is consistent.

Theoretical support of the research in this field was originally very poor, but since the second half of the 1970s, several theoretical developments have appeared in support of the gravity model. Anderson (1979) made the first formal attempt to derive the gravity equation. Using a trade share expenditure system he derived the gravity model, which assumes identical Cobb-Douglas or constant elasticity of substitution (CES) preference functions for all countries and weakly separable utility functions between traded and non-traded goods. In his paper he also assumes that perfect product specialization under the Armington assumption (each country produces only one specialized good) and perfect competition; prices are the same in all countries. The gravity equation is derived from an expenditure system under constraints given by the importing countries' and the exporting ones' (via their balance of payments) incomes taking into accounts the costs related to distance. Thus, he showed that gravity model can be

derived from expenditure share equations, assuming that commodities are distinguished by place of production.

The next approach is based on the Walrasian general equilibrium model, with each country having its own supply and demand functions for all goods. Bergstrand (1985, 1989) also explored the theoretical determination of bilateral trade in a series of papers in which gravity equations were associated with simple monopolistic competition models. Like Anderson, Bergstrand assumes constant elasticity of substitution (CES) preferences and applies Armingtom assumption to derive the reduced form equation for bilateral trade involving price indices. When Bergstrand tests his assumptions for product differentiation, he concluded that price and exchange rate variables have possible and significant effects on aggregate trade flows. His estimates indicate that goods are not perfect substitutes and that imported goods are closer to being substitutes for each other than substitutes for domestic goods. According to him the gravity equation is a reduced form of a partial system of a general equilibrium model with nationally differentiated products. Helpman (1984) also demonstrated that gravity model can be derived from models of trade in differentiated products.

Later, Bergstrand (1990) distances himself from the Heckscher-Ohlin model by assuming within the framework of Dixit-Stigliz monopolistic competition, product differentiation under increasing returns to scale between firms rather than between countries. Bergstrand assumes a two-sector economy with N monopolistically competitive sectors and different factor proportions within each sector. His work therefore serves to bring together the earlier

Armington-based approaches to deriving the gravity equation with a second strand of literature in which gravity equations were derived from simple monopolistic competition models.

Eaton and Kortum (1997) also derive the gravity equation from a Ricardian framework, while Deardoff (1997) derived it from an H-O perspective. Deardoff proved that, if trade is impeded and each good is produced by only one country, the H-O framework will result in the same bilateral trade pattern as the model with differentiated products. If there are transaction costs of trade, distance should also be included in the gravity equation.

It is shown by Evenett and Keller (1998) that the standard gravity equation can be obtained from the H-O model with both perfect and imperfect product specialization. Some assumptions different from increasing returns to scale are required for the empirical success of the model. They also argue that the increasing returns to scale model rather than the perfect specialization version of the H-O model is more likely candidate to explain the success of the gravity equation. Furthermore, they found that the variations in the volume of trade can be explained better by the models with imperfect product specialization than the models with perfect product specialization.

Evenett and Keller (1998) forwarded the following three types of trade models in analyzing the theoretical foundations of gravity model. These models differ in the way specialization is obtained in equilibrium. They are:

(1) Technology differences across countries in the Ricardian model,

(2) Variations in terms of countries' different factor endowments in the H-O model,

(3) Increasing returns at the firm level in the Increasing Returns to Scale (IRS) model.

Though they belong to the perfect specialization models, they are considered as limiting cases for a model of imperfect specialization where imperfect product specialization is empirically important. In real life, though technologies and factor endowments are different in different countries, they change over time and can be transferred between countries.

According to Ricardian theory, trade occurs because of technological differences across countries. In H-O theory, trade occurs because of differences in factor endowments. According to Posner (1961) and Vernon (1966), trade takes place because of not only differences in technologies across countries but due to continuous renewal of existing technologies and their transfer to other countries. As cited by Paas (2000), Dreze (1961) and Mathur (1999) indicated that country size and scale economies are important determinants of trade.

Paas (2000) argued that as a result of economies of scale the production activities will be located in one country and this will induce the producers to differentiate their product. The larger the country is in terms of its national income, the larger the varieties of goods offered. The more similar the countries are in terms of income, the more intra-industry trade among them. Thus with economies of scale and differentiated products, the volume of trade, thus, depends in on country size in terms of its national income. This is the concept of new theories of international trade and it provides a better explanation of empirical facts of international trade in terms of their pattern, direction and rate of growth. As a result, the traditional theories are supplemented, if not replaced, by the new trade theories, in recent years, based on the assumption of product differentiation and economies of scale.

In the H-O model, the larger the differences in the factor endowments between two countries, the larger will be the trade. Therefore, based on this ground we would expect little trade between European countries since these countries have more similar factor endowments and a lot of 'North South' trade. This is contrary to empirical facts from the international trade statistics that intra-industry trade and 'North-North' trade are significantly large.

According to Deardoff (1995), the neoclassical model might be better suited in the case of trade between a developed country and a developing one where factor endowments are quite different and intra-industry trade rather limited. On the contrary, trade flows between similar countries might be better interpreted in a monopolistic competition approach.

The Linder (1961) hypothesis is related to the trade in real life. It suggests that the presence of increasing return in production of each good to be located in either of the countries but not in both of them. The demand structure will be the similar for the similarities of per capita income. So more similar the countries are in per capita income, larger is their bilateral trade. That is, "absolute value of the difference" of per capita income in any two countries will have a negative effect on their bilateral trade.

However, Deardorff (1995) shows the gravity model is consistent with H-O model expanded to include transport cost where according to the model capital intensive goods are produced by capital-rich countries. However, Markusen (1986) has already explained as a counter attack. If high- income consumers tend to consume larger budget shares of capital intensive goods, capital rich countries will trade more with other capital rich countries than with capital poor

countries, and capital poor countries will trade more with their own kind. These are the same predictions as those of the Linder hypothesis.

It can be summarized that all these authors derive a gravity model from theories based on different foundations for trade. As Helliwell (1998) notes, the gravity model has gone from being a theoretical orphan to being the favored child of all main theories of international trade.

2.2. *Empirical Literature*

Achay (2006) investigated the determinants of trade flows between various countries of the world. He applied the gravity model on a sample of 146 countries for the five-year sub-periods between 1970 and 2000. His model included such determinants of trade as GDP, distance, and regional integration agreement. His findings showed that all estimated coefficients were statistically significant and their signs were in conformity with expectations. He found that GDP, GDP per capita, common frontier, common official language, common currency or common colonial past have a positive impact on the volume of bilateral trade. On the other hand, the geographical distance factor had a negative effect on the volume of trade.

Srivastava and Green (1986) examined the bilateral trade flows between 45 exporting nations and 82 importing nations. The study considered additional variables as potential determinants of trade relations between nations. Trade flows are analyzed by the type of products being exported and imported. The findings showed that several additional variables are significant determinants of the level of bilateral trade relations between nations. Political instability is found to have a significant influence on exports but little effect on imports. Cultural similarity

appears to have a more pronounced effect on relative trade flows than does shared membership in an economic union. Further, the GDP of the exporting country is found to be a powerful explanatory variable in the relative intensity of bilateral trade relations. Distance is also found as the most important determinant of trade intensity among nations.

Kurmanalieva (2008) employed gravity model for 178 countries over the period 1996-2005. The model was augmented with variables like product of GDP, product of per capita GDP, distance, common border, trade complementarity and infrastructure. The results indicated that most variables in a world trade regression have statistically significant correlation coefficients with an expected sign. It is found that distance and international trade are correlated negatively. On the other hand, relative size variable measured by per capita GDP, affects international trade positively. Infrastructure variable showed that having good transport infrastructure in principle facilitates trade. The coefficient of complementarity index shows a positive value with high statistical significance, suggesting that world trade pattern follows a Heckscher-Ohlin trade model, which predicts that two countries in a complementary trade structure are more likely to expand their bilateral trade volume through inter-industry trade.

Batra (2004) used an augmented gravity model equation with maximum possible geographical coverage of world trade flows for 146 countries for the year 2000. Bilateral trade in his model has been explained using variables that are representative of geographical, cultural and historical proximity of bilateral trade pairs along with their economic size. The regression results indicated that almost all coefficients were highly significant, have the expected signs and were of reasonable magnitude. Both distance and income (GDP) provided most of the

explanatory power in all the regressions. The coefficients on the Gross National Product (GNP) variable, common language and dummy variable for colony in his specification were positive.

Rahman (2004) applied a generalized gravity model to analyze Bangladesh trade flows with its trading partners using the panel data estimation techniques. They estimated the gravity model of trade (sum of imports and exports). The results showed that Bangladesh's trade is positively determined by the size of the economies, per capita GNP differential of the countries involved and openness of the trading countries. The major determinants of Bangladesh's exports were found to be exchange rate, partner countries' total import demand, and openness of the Bangladesh's economy. All these factors affected the Bangladesh's exports positively. Transportation cost was found to be a significant factor in influencing Bangladesh's trade negatively.

Huot and Kakinaka (2007) attempted to access the determinants of trade flows between Cambodia and its twenty trading partners in the framework of the gravity model over the period 2000-2004. In the model, Cambodia's bilateral trade is a linear function of GDP, per capita GDPs, distance, an Association of South East Asian Nations (ASEAN) trade network variable, exchange rate volatility and a trade structure variable. The results show that a higher degree of trade complementarity is associated with a higher level of trade flows. This is consistent with a Heckscher-Ohlin model in that factor endowment difference between the countries, which is captured by the measure of trade structure, found to be a dominant driving force for trade flows.

Hapsari and Mangunsong (2006) investigated the determinants of intra and extra trade flows of AFTA members (Association of South-East Asian Nations (ASEAN) Free Trade Area, also referred to as AFTA). They developed an augmented gravity equation and included dummy variables, which represented the effects of regional trade arrangement. They found that standard gravity variables i.e. both reporting and partner country GDP, distance, common language, common border and whether the partner country is landlocked or not- have significant effects on the bilateral exports of ASEAN members. The results also showed that the reduction of tariff was also found to have a significant effect in increasing the bilateral trade flows.

Filippini and Molini (2003) used a gravity equation model to analyze trade flows between East Asian industrializing countries (including China) and some developed countries in order to show the surprising trade performance of East Asian countries in the last 30 years. He found that all signs of coefficients were consistent with model assumptions. He also found high propensity of Asian countries (including China but excluding Japan), to exchange high-tech manufactured products with Japan and USA.

Martinez and Nowak (2003) applied the gravity model to annual bilateral exports between Mercosur-European Union trades to assess trade potential following the agreements reached recently between both trade blocs. The model is tested for a sample of 20 countries, the four formal members of Mercosur plus Chile and the fifteen members of the European Union. A panel data analysis is used to disentangle the time invariant country-specific effects and to capture the relationships between the relevant variables over time. They found that the fixed

effect model is to be preferred to the random effects gravity model. Their results indicated exporter and importer incomes, as expected, had positive influence in bilateral trade flows. Exporter population had a large and positive impact on exporters, indicating that bigger countries import more than small countries. Furthermore, a number of variables, namely, infrastructure, income differences and exchange rates added to the standard gravity equation, are found to be important determinants of bilateral trade flows.

Anaman and Al-Kharusi (2003) investigated the determinants of trade flows between Brunei and the European Union (EU) using a gravity trade model. Their study analyzed merchandise trade flows between Brunei Darussalam and the fifteen members of the EU over a period from 1966 to 2000. Their analysis indicated bilateral trade flows (both imports and exports) between Brunei and EU members were driven mainly by the population and historical relationship of a few EU countries.

A study was conducted by Kalbasi (2001) to explore why some countries are over or under-traded relative to the predicted trade flows of the model. The article has considered the volume and direction of Iran and other 76 countries' trade using the gravity model. The group of countries has been divided into developing and industrial countries and trade flows have been examined to determine the impact, if any, of the stage of development on bilateral trade. The study attempted to explore bilateral trade among all the 76 countries, bilateral trade among 19 industrial countries, bilateral trade among 57 developing countries, industrial countries' exports to developing countries and finally developing countries' exports to industrial countries. This was done by analyzing the results of different equations predicting trade flows.

Regarding the results for the North-South trade flows, it was found that GDP in both importing and exporting countries affect their trade flows positively. The parameters on population variables have the expected signs and are highly significant statistically. The adjacency dummy is insignificant, not unexpected given the general absence of neighboring countries in this particular type of trade flow; most industrial and developing countries are located well away from each other. Furthermore, the coefficients of other variables like the preferential dummy variables and colonial dummies have the expected signs and are highly significant statistically.

Clark and Stanley (1999) employed variables suggested by models of North-South trade to identify country determinants of the U.S. and developing countries. Bilateral trade is found to decline with greater differences in relative factor endowments (proxied by differences in per capita GDP). Economic size and trade orientation of the trading partner influenced bilateral trade in a positive way where as distance influenced in a negative way. Their results also showed that bilateral trade between countries will be greater as countries become more similar both in relative factor endowments and economic size.

Along the same line of thought, Marquez (2007) investigated the effect of a number of factors on international trade flows in developed and developing countries. He employed the gravity model on a sample of 65 countries for the five-year sub-periods between 1980 and 2000. His augmented gravity equation included technological innovation and transport infrastructure variables. The effect of geographical (distance, adjacency, insularity and being landlocked) and social variables (regional integration agreements among countries, cultural similarities and

sharing a language) is also estimated in the model. In addition, country heterogeneity is also considered since the determinants of trade differ between developed and developing countries. His findings showed that all estimated coefficients were statistically significant and their signs were in conformity with expectations. The results indicated that distance has a considerably low explanatory power on trade compared with transport infrastructure and technological innovation. This is because the development of technology has lowered the effect of distance on trade since long distances are less important nowadays than in the past. The hypothesis that countries tend to trade more when they are closer from a technological point of view is supported by the data. His empirical analysis also proposed that trade flows were more sensitive to geographical and cultural variables for developing than for developed economies. All the estimated coefficients for technological and transport infrastructure variables were found to be major barriers to trade for developing countries.

In his paper, Ricchiuti (2007) analyzed the determinants of the trade flows between developed and developing countries using an augmented version of the gravity equation for the last two decades (from the 1980 to the 2000). He added two extra variables: the technological distance and the bilateral real exchange rate (RER). The former allows analyzing the impact of the technological gap on trade structure, the latter to study the movement in the relative prices and their impact on trade pattern. He estimated a fixed effects model (FEM) for different groups of countries. The sign and the numerical value of the coefficients of GDP and population were different when he analyzed separately countries as importers or exporters. This result supports the assumption that determinants of trade, for the two areas (developed vs. developing countries), are not the same. Moreover, as expected, the geographical and the technological

distance appear as barriers to trade, and the positive effect on export of a devaluation of the bilateral real exchange rate is confirmed by the results.

Coe and Hoffmaister (1998) estimated a gravity model of bilateral trade between developing countries in the south and industrial countries in the north. The estimates were based on bilateral trade between 84 developing countries and 22 industrial countries from 1970 to 1995. The main findings were that economic size, geographical distance and population explained the unusually low level of African trade. This results hold after controlling for a country's access to sea, composition of exports, linguistic ties with industrial countries and trade policies.

Geda and Kebret (2007) tested the determinants for trade using Common Market for East and South Africa (COMESA) as a case study. They found that almost all the standard gravity model variables had plausible (except for proximity) and statistically significant coefficients. Another important result he found was that good macroeconomic policies (such as financial deepening and infrastructure development) are important determinants of bilateral trade in Africa. The results also showed that all proxies used to measure political instability (except war) had the expected signs. However, regional integration arrangements failed to positively affect intra-regional trade. COMESA intra-trade was found not to be significantly different from its trade with nonmember countries.

A study by Kisu (2007) attempted to examine Malawi's trade with her major trading partners using an econometric gravity model. In the model, the bilateral trade is a linear function of economic size of the country, geographical distance, and exchange rate volatility, among other

factors. Preliminary results show that the fixed effects model is favorable over the random effects gravity model. Specifically, Malawi's bilateral trade is positively determined by the size of the economies (GDP of the importing country) and similar membership to regional integration agreement. On the other hand, transportation cost, proxied by distance, is found to have a negative influence on Malawi's trade.

2.3. *A Brief Picture of the SSA's Trade*

SSA as a whole trades in world markets as much as one would expect, but there is in fact a tremendous amount of variation in trade performance within the region. Rodrick (1998) showed that many SSA countries have ranked a decreasing export growth over the 1964-94 period. Those who ranked a highest export growth are oil exporters. According to him, such a variation in trade performance within SSA is due to differences in exogenous and uncontrollable factors such as geography and external terms of trade.

According to Hoekman (2005), SSA is the least diversified region in the world today. The concentration index of its exports was 0.47 in 2001, similar to that of the Middle East and North Africa, a region heavily dependent on oil exports. This is almost double the figure for Asian countries. Having the same thought, Olofin S. (2002) tried to show that the SSA countries remained the only group of countries whose exports were predominantly primary products, complemented by trade in manufactured imports.

Olofin S. (2002) found that SSA major exports fall into four broad categories, excluding oil exports. The first category comes under agricultural raw material, such as cotton, rubber, oil palm products and timber. The second major category covers export of beverages such as tea,

coffee and cocoa. The third group of major exports consists of mineral metals such as copper, diamonds and gold. Lastly, we have food products such as wheat and maize which feature more in intra-regional trade, and for which the region as a whole remains a net importer. Therefore, exports in SSA are still heavily skewed in favor of primary products, mainly mineral exports and basic raw materials. He also argued that the capacity for industrial production is still very weak and virtually nonexistent in many countries other than in a few countries such as South Africa, Zimbabwe, and more recently, Botswana.

III. Data and Methodology

3.1: The gravity model of bilateral trade

Largely inspired by the "Law of Universal Gravitation" proposed by Newton in 1687, the gravity model was exploited by Tinbergen (1962), Poyhonen (1963) and Linnemann (1966), roughly with the same function, in international trade flows between countries or regions. In its simplest form, the gravity model relates some measure of bilateral trade to economic mass of the two countries and the distance between them.

$$X_{ijt} = (Y_{it} Y_{jt})^{\beta} D_{ij} e^{\mu_{ijt}} \quad \text{.......}(1)$$

Where,

X_{ijt} indicates bilateral trade- either nominal exports, imports or the sum of the two from country i to country j.

Y_i is the nominal GDP in country i

Y_j is the nominal GDP in country j

D_{ij} is geographic distance between two countries' (i.e. country i and j) capitals (or economic centers)

t is time

Subscript i is to denote developing countries in SSA and the subscript j is to denote industrial countries in the north.

Equation (1) explains that the trade comes from the demand, but the demand is decided by the income. Therefore, the bilateral trade volume is positively related to two countries' economic mass. Since the distance increases the transport cost of commodity and prevents communication in information, the bilateral trade volume is negatively related to the distance between them.

The generalized gravity model of trade is augmented with other variables, which could describe bilateral trade. It states that the volume of trade / exports / imports between pairs of countries, X_{ijt}, is a not only a function of their incomes (GNPs or GDPs) and their distance (proxy of transportation costs) but also is a function of their populations and a set of dummy variables either facilitating or restricting trade between pairs of countries. That is,

$$X_{ijt} = \beta_0 Y_{it}^{\beta_1} Y_{jt}^{\beta_2} N_{it}^{\beta_3} N_{jt}^{\beta_4} D_{ij}^{\beta_5} A_{ij}^{\beta_6} U_{ij} \quad \ldots\ldots (2)$$

Where N_i (N_j) are populations of the country i (j), A_{ij} represents dummy variables, U_{ij} is the error term and βs are parameters of the model. Using per capita income that is a proxy for stage of development, instead of population, an alternative formulation of equation (2) can be written as

$$X_{ijt} = \beta_0 Y_{it}^{\beta_1} Y_{jt}^{\beta_2} YP_{it}^{\beta_3} YP_{jt}^{\beta_4} D_{ij}^{\beta_5} A_{ij}^{\beta_6} U_{ij} \quad \ldots\ldots (3)$$

Where YP_{it} (YP_{jt}) are per capita income of country i (j). As the gravity model is originally formulated in multiplicative form, we can linearize the model by taking the natural logarithm of all variables. So for estimation purpose, model (2) in log-linear form in year t, is expressed as,

$$\ln X_{ijt} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta 3 \ln N_{it} + \beta 4 \ln N_{jt} + \beta 5 \ln D_{ij} + \beta_6 A_{ij} + U_{ij} \ldots\ldots\ldots (4)$$

Where, ln denotes variables in natural logs. Dummy variable takes the value one when a certain condition is satisfied, zero otherwise.

3.2. Methodology

Classical gravity models generally use cross-section data to estimate trade effects and trade relationships for a particular time period, for example one year. Prior to Matyas (1997), a major drawback of all studies lies in the nature of data used and the explicit or implicit model restrictions implied by it. Inferences were drawn either up on a cross section or time series of data where heterogeneity across countries in trade flows will be extremely high. Ignoring either of these effects will result to biased, miss-specified models and miss-interpreted parameter estimates.

However, cross-section data observed over several time periods (panel data methodology) result in more useful information than cross-section data alone. According to Matyas (1997) the advantages of this method are: first, panels can capture the relevant relationships among variables over time; second, panels can monitor unobservable trading-partner-pairs' individual effects. If individual effects are correlated with the regressors', OLS estimates omitting

individual effects will be biased. Egger (2002) also pointed out that panels makes it possible to capture the relationships among the relevant variables over a longer period of time and to identify the overall role of business cycle. Therefore, the study uses a panel data methodology for our empirical gravity model of trade.

Verbeek (2000) pointed out various types of panel data analytic models. The constant coefficient model (pooled regression model) has constant coefficients of intercepts; fixed effects model has constant slopes but intercepts differ from country to the country; and the random effects model is a model with a random constant term.

3.3. The Sample Size and Data

Based on regional economic outlook reporting system and geographic location, the Sub-Saharan African countries are divided into two sub groups: Central and Western Africa, Eastern and Southern Africa. These groups are composed of 49 counties and territories. Based on their economic situation, SSA countries are further categorized into the following four groups: oil exporting, middle-income, low-income and fragile countries. A sample is taken from each of these groupings. Countries for which data was not available for all the variables in the reviewed period are excluded. Thus from 49 counties a total of 27 countries are selected. The 27[1] countries in this study constitute 55% of the Sub-Saharan African countries. Based on

[1] These countries are Benin, Central African Republic, Chad, Comoros, Congo Democratic Republic, Djibouti, Ethiopia, Gabon, Gambia, Ghana, Guinea, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Niger, Nigeria, Rwanda, Sierra Leone, Tanzania, Togo, Uganda, Zambia, Zimbabwe

their annual GDP and historical ties, the six top high income (Pilbeam, 2006) and two countries from historical ties were selected. In other words, eight countries were selected from industrial economies. Thus, from Europe six countries, namely Belgium, France, Germany, Italy, Netherlands and United Kingdom are included. From North America, the United States and from Asia Japan are considered. Thus, the study covers 35 countries. The data is obtained for the period of 1995 to 2007 (13 years). The base year was selected for the very reason that for many of the trading pairs there is limitation of available data before 1995. All observations are annual over 13 year's period running over the sample countries.

The bilateral trade data on SSA country's imports (country i's imports) from industrial countries (country j) with all other countries included in the sample is obtained from IMF's Direction of Trade Statistics (DOTS) and United Nations Conference on Trade and Development (UNCTAD) handbook of statistics for a missing observation. Whereas data on GDP, GDP per capita, population, infrastructure indicating variables (railway, roads, paved road, telecommunication, total area) are obtained from the World Development Indicators (WDI) database of the World Bank and IMF's World Economic Outlook (2008). The usual gravity model dummy variables (country's access to sea, colonial history and common language) are taken from Encarta Encyclopedia 2007 and African history book. Data on the distance between SSA country capital cities and other capital cities of country j are obtained from an Indonesian Website: www.indo.com/distance

Total SSA's imports are measured in million US dollars. GDP and GDP per capita are in constant 1995 US dollars. Population of all countries are considered in million while distance is expressed in kilometers.

3.4. Model specification and variable description

The study uses the traditional gravity model augmented by some variables and with some modifications to better analyze the determinants of North – SSA bilateral trade.

The model is estimated taking into account 27 SSA and 8 industrial countries over a period of 13 years (from 1995 to 2007). There are 216 bilateral trade flows the industrial to SSA countries for every year. This gives 2808 observations over the full 1995 – 2007 time period.

The model to be estimated is given by equation (5) below. It will have three fundamental determinants of bilateral trade volume. They are (a) import demand captured by income and income per capita of the importing country; (b) export supply capacity, captured by income and income per capita of the exporting country; and (c) resistance or attraction captured by distance and well known gravity model variables such as language, colonial history and country's access to sea. These fundamental determinants are augmented by the local (importer) country effect and the time (business cycle effect). The gravity equation is expressed in the additive form using logarithmic transformation as follows:

$$\ln(\text{imports})_{ijt} = \beta_0 + \beta_1 \ln(\text{GDP})_{it} + \beta_2 \ln(\text{GDP})_{jt} + \beta_3 \ln(\text{pop})_{it} + \beta_4 \ln(\text{pop})_{jt} + \beta_5(\text{Ydiffijt}) + \beta_6 \ln(\text{dis})_{ij} + \beta_7 \ln(\text{infra})_{it} + \beta_8 \ln(\text{infra})_{jt} + \beta_9 \text{lang}_{ij} + \beta_{10} \text{land}_{ij} + \beta_{11} \text{colony}_{ij} + \alpha_{ij} + U_{ijt} \quad (5)$$

Where,

$\ln(\text{imports})_{ijt}$ is the imports of the country *i* from the country *j* at the time *t*.

β_0 is constant

$\ln(\text{GDP})_{it}$ is the importing country i's GDP in year t

$\ln(\text{GDP})_{jt}$ is the exporting country j's GDP in year t

$\ln(\text{pop})_{it}$ is the importing country i's population in year t

$\ln(\text{pop})_{jt}$ is the exporting country j's population in year t

$\ln(\text{dis})_{ij}$ is the geographical distance between the capital cities of country *i* and country *j*

(Ydiffijt) is the absolute value difference in per capita incomes of country i and j

$\ln(\text{infra})_{it}$ is the importing country i's infrastructure index in year t

$\ln(\text{infra})_{jt}$ is the exporting country j's infrastructure index in year t

lang_{ij} is the common language between country i and j (dummy variable)

land_i is dummy variable for the importing country i access to sea

colony_{ij} is dummy for colonial history

α_{ij} fixed country-pair effects

U_{ijt} normal error terms with mean zero and variance σ_ε^2

t is time

Since individual effects are included in the regressions, decisions have to be made whether they are treated as fixed or as random. From an a priori point of view, the random effects model (REM) would be more appropriate when estimating typical trade flows between randomly drawn samples of trading partners from a larger population. On the other hand, fixed effects model (FEM) would be a better choice than REM when one is interested in estimating typical trade flows between an ex-ante predetermined selection of nations (Egger, 2000). According to Verbeek (2000) the study will use Hausman test to check whether the REM is more efficient that the FEM model.

Although the GDP per capita is mostly used as proxy for the mass of the two bodies, to stress their differences, the study prefers to analyze separately the impact of GDP and population on imports. Moreover, differently from this equation, the trade flows here analyzed are the imports of country i. Thus, $\ln(\text{imports})_{ijt}$ is the dependent variable. Since unrecorded trade is common in SSA, it is extremely difficult to incorporate informal trade in the model.

The GDP of the importing country ($\ln GDP_{it}$) controls for the demand side while GDP of the exporting country is used to control for the supply side. A higher level of income in the importing country suggests higher imports. And a higher level of income in the exporting country indicates a high level of production which increases the availability of goods for export. Therefore, both are expected to have a positive effect on trade. That is the coefficients β_1 and β_2 is expected to be positive.

The coefficient estimate exporters population ($\ln pop_{jt}$) may be negative or positive signed, depending on whether the country exports less when it is big (absorption effect) or whether the country exports more than a small country (economies of scale). The coefficient of the importers population ($\ln pop_{it}$) has an ambiguous sign too for similar reasons.

The per capita difference between two countries variable is frequently included into the gravity model to test the two hypothesis of international trade. This is associated with the effect of the difference between the two countries level of per capita. The sign of this coefficient will depend on the traditional comparative advantage effect on trade (the H-O theory) and the intra-industry theory of trade (Linder hypothesis). According to H-O model, the larger the difference in factor abundances between two countries the larger the trade will

be. Whereas Linder hypothesis suggests that the more similar the countries are in per capita income, the larger bilateral trade will be. Therefore, if the sign is positive it supports the H-O type of proportion while if it is negative it supports the Linder type proportion.

Assuming that the further a country is away from another, the more expensive bilateral trade will be. Thus, the distance coefficient is expected to be negative since it is a proxy of all possible trade cost sources.

Traditionally, the gravity model uses distance to model transport cost. However, recently Bougheas *et al* (1999) showed that transport costs are a function not only of distance but also of public infrastructure. They augmented the gravity model by introducing additional infrastructure variables (stock of public capital and length of motorway network). Their model predicts a positive relationship between the level of infrastructure and the volume of trade, which is supported using the data from European countries. Martinez and Nowak (2003) took a further step in this direction by introducing a new infrastructure index by taking information on roads, paved roads, railroads and telephones and differentiating between exporter and importer infrastructure as explanatory variables of bilateral trade flows. In this study infrastructure in each country is measured by an index constructed taking the mean over four variables: km of road, km of paved road, km of rail (each one divided per total area of the country) and telephone main lines per person. Since these measures are highly correlated among themselves, it is not possible to identify each of their influence on transport cost.

The model then includes a set of dummy variables traditionally considered to be determinants of bilateral trade flows. A dummy variable for country's access to sea ($land_{ij}$) take the value of

one if SSA country (importing country i) is landlocked and zero otherwise. For the linguistic dummy that is variable for common language ($lang_{ij}$) take the value of one if SSA and industrial countries both use common official or main commercial language.

Similarly, colony dummy ($colony_{ij}$) takes value of one if the SSA country is colonized by industrial country j. Data after the first world is used for colonial history. And out of the 27 SSA sample countries, Ethiopia and Liberia have been sovereign states for more than 50 years.

IV. Analysis of Empirical Results

4.1· Estimation of the model

The traditional gravity model augmented by some new variables used for this particular study is specified as follows:

$$\ln(imports)_{ijt} = \beta_0 + \beta_1\ln(GDP)_{it} + \beta_2\ln(GDP)_{jt} + \beta_3\ln(pop)_{it} + \beta_4\ln(pop)_{jt} + \beta_5\ln(Ydiffijt) + \beta_6\ln(dis)_{ij} + \beta_7\ln(infra)_{it} + \beta_8\ln(infra)_{jt} + \beta_9 lang_{ij} + \beta_{10} land_{ij} + \beta_{11} colony_{ij} + \alpha_{ij} + U_{ijt} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where,

$\ln(imports)_{ijt}$ is the imports of the country *i* from the country *j* at the time *t*.

β_0 is constant

$\ln(GDP)_{it}$ is the importing country i's GDP in year t

$\ln(GDP)_{jt}$ is the exporting country j's GDP in year t

$\ln(pop)_{it}$ is the importing country i's population in year t

$\ln(pop)_{jt}$ is the exporting country j's population in year t

$\ln(dis)_{ij}$ is the geographical distance between the capital cities of country *i* and country *j*

ln(Ydiffijt) is the log of absolute value difference in per capita incomes of country i and j

$\ln(infra)_{it}$ is the importing country i's infrastructure index in year t

$\ln(infra)_{jt}$ is the exporting country j's infrastructure index in year t

$lang_{ij}$ is the common language dummy between country i and j

$land_i$ is dummy variable for the importing country i access to sea

$colony_{ij}$ is dummy for colonial history

α_{ij} is fixed country-pair effects

U_{ijt} is white noise disturbance term

t is time

4.2 Hypothesis to be tested

1. The product of GDPs is considered as the size of the economy. As it is bigger, there will be more trade between the two countries. That is more imports for importing country and more production and more exports for the exporting country. So the coefficient of GDPs would be expected positive.

2. The coefficient of population for exporting and importing country may have positive or negative sign. The reasons for ambiguity are: with a higher population if the country i enjoys economies of scale effect, then $\beta 3$ would be negative; alternatively due to absorption effect if the country i imports more, then $\beta 3$ would be positive. Similarly, if country j demands more country j's goods due to higher population (absorption effect), $\beta 4$ would be negative; on the other hand, due to economies of scale effect in country j, if more goods are produced in country j, then $\beta 4$ would be positive.

3. According to the H – O theory, the sign of the coefficient of per capita difference would be positive. On the other hand, based on the Linder hypothesis, the sign would be negative.

4. Distance appears as a proxy for transportation costs implying that the coefficient of this variable is expected to have negative sign.

5. Infrastructure index is augmented as a proxy for public infrastructure. It is assumed that a well developed public infrastructure will facilitate bilateral trade between countries. So the coefficient of infrastructure indexes is expected to have positive sign.

6. Since no access to seaports determines trade negatively, the coefficient for land lockedness is expected that to be negative.

7. Both coefficients for common language and colonial history are expected to be positive.

4.3 Empirical Results

A. Ordinary least squares and cross section means

The study estimated the specified equation for aggregate trade flows using several methodologies. Firstly for a comparison purpose, the researcher used OLS ($\alpha_{ij} = \alpha$). The results are shown in table 1.

Secondly, the regression to cross-section means is applied (between estimation obtaining similar results, shown in table 2. In both cases, all the coefficients present the expected sign. In the OLS lnpopi, lnpopj and lnydiff are insignificant where as for between estimation many of the variable are significant.

The usual OLS standard errors are not reliable since α_i vary from country to country. Hence, it has different variance for different countries. This will make the composite error term

hetroskedastic and the results are biased. Therefore, we have to select a model with individual effects.

Table 1: OLS result for the specified gravity model

Variable	Coefficient	Standard Error	t-statistics	P>|t|
lngdpi	.7823381	.0270136	28.96	0.000
lngdpj	.6558949	.1250928	5.24	0.000
lnpopi	-.00826	.024478	-0.34	0.736
lnpopj	-.0301292	.1305694	-0.23	0.818
lnydiff	-.2496139	.1774758	-1.41	0.160
lndistance	1.03179	.076136	-13.55	0.000
lninfrai	.040562	.0160599	2.53	0.010
lninfraj	.6115355	.0897713	6.81	0.000
land	-.8379368	.0418751	-20.01	0.000
lang	.6150244	.0507404	12.12	0.000
colony	.9573461	.0672396	14.24	0.000
Constant	-5.935382	1.012879	-5.86	0.000

Number of observation = 2808

F(11, 2796) = 355.15

Prob > F = 0.0000

R-squared = 0.5829

Adj R-squared = 0.5812

Root MSE = .96023

Note: all variables except dummies are expressed in natural logarithms, F(n-1,nT-n-K) degrees of freedom in brackets. Where K is the number of variables in the regression, n is the number of trading pairs and T is the number of time periods.

Table 2: Between (OLS on means) result for the specified gravity model

Variable	Coefficient	Standard Error	t-statistics	P>|t|
lngdpi	.7365836	.0941106	7.83	0.000
lngdpj	4.537509	1.449893	3.13	0.002
lnpopi	.0713425	.0860769	0.83	0.408
lnpopj	-3.830563	1.417368	-2.70	0.007
lnydiff	-1.9043	.9483342	-2.01	0.046
lndistance	-1.31389	.2502356	-5.25	0.000
lninfrai	.1159289	.0628435	1.84	0.067
lninfraj	.7072257	.2843897	2.49	0.014
land	-.7716333	.130577	-5.91	0.000
lang	.5128536	.1578956	3.25	0.001
colony	1.053624	.2061425	5.11	0.000
Constant	-28.12189	7.84471	-3.58	0.000

Number of observation = 2808

F(11,204) = 38.18

Prob > F = 0.0000

R-sq: within = 0.1551 between = 0.6731 overall = 0.4740

Note: Time dummies are not reported. All variables except dummies are expressed in natural logarithms.

The between estimates exploit the between dimension of data (difference between individuals), but ignore any information within individuals. It is usually presented as an alternative to estimate long run coefficients. As can be observed from table 2, though the coefficients present the expected sign, many of the variables are insignificant in explaining bilateral trade between countries.

B. Fixed effects and random effects model

Table 3 and 4 report estimation results for fixed effect model and random effect model of the specified model respectively.

In order to discriminate between the two models the researcher test for the null hypothesis that the explanatory variables and individual effects are uncorrelated using a Hausman test. The fixed effects estimates are consistent under both the null and alternative hypothesis where as random effects estimates are only consistent and efficient under the null hypothesis. Therefore random effect model will be preferred if the null hypothesis hold, otherwise fixed effect model will be preferred.

Comparing the results of the pooled and fixed effects model (FEM), allowing for country pairs effect, as in FEM, slightly lowers the estimated SSA's income elasticities of trade, greatly rises for the industrial country income elasticities. It also greatly rises the absolute value of population coefficients and income per capita difference. For the infrastructure variable, both own and foreign infrastructure indexes have a wrong sign and become insignificant.

The variable lnydiff (difference in per capita) presents a negative signed coefficient which is also significant. This suggests that the more dissimilar the countries are in per capita income, the lower bilateral trade will be, where Linder hypothesis holds.

The Hausman test fails to reject the null hypothesis, which leads to select the random effects estimates since they are efficient. Comparing the results of fixed effect model and random effect model, random effect model slightly lowers many of the estimated coefficients that are

for GDP elasticities, absolute value of population coefficients, per capita and infrastructure variable coefficients. For the infrastructure variables, foreign infrastructure becomes significant and has a correct sign but own infrastructure though it becomes significant has the wrong sign. Other than this, the rest coefficients become significant and have the correct sign.

Table 3: Regression results for the fixed effect model

Variable	Coefficient	Standard Error	t-statistics	P>|t|
lngdpi	.4141323	.0539509	7.68	0.000
lngdpj	.8103183	.0888175	9.12	0.000
lnpopi	1.018395	.2564698	3.97	0.000
lnpopj	2.185886	1.100061	1.99	0.047
lnydiff	-2.260867	.3893223	-5.81	0.000
lndistance	--	--	--	--
lninfrai	-.0369665	.0154965	-2.39	0.017
lninfraj	-.274386	.2248728	-1.22	0.223
land	--	--	--	--
lang	--	--	--	--
colony	--	--	--	--
Constant	-46.98774	16.72532	-2.81	0.005
Number of observation = 2808			sigma_u = 3.1246772	
F(215, 2585) = 30.00			sigma_e = .53417598	
Prob > F = 0.0000			rho = .9716046	
R-sq: within = 0.1850		between = 0.1385	overall = 0.1260	

Notes: Time dummies are not reported. All variables except dummies are expressed in natural logarithms. Number of observations equals (n x T) = 2808.

Similar to that of fixed effect model, the per capita income difference presents a negative signed coefficient, which is also significant. This suggests that bilateral trade will be greater when the per capita GDPs of the trading countries are more similar.

Table 4: Regression results for the random effect model (Generalized Least squares Estimation)

Variable	Coefficient	Standard Error	t-statistics	P>|t|
lngdpi	.5573529	.0422896	13.18	0.000
lngdpj	.8187918	.0827738	9.89	0.000
lnpopi	.1556964	.0530265	2.94	0.003
lnpopj	-.3280681	.1407372	-2.33	0.010
lnydiff	-.939557	.2154867	-4.36	0.000
lndistance	-.5631738	.1849778	-3.04	0.002
lninfrai	-.0200056	.0146296	-2.81	0.005
lninfraj	.2640928	.1693996	2.53	0.010
land	-.9216809	.1216996	6.81	0.000
lang	.5689244	.1447056	3.93	0.000
colony	.9768378	.201905	4.84	0.000
Constant	-.173962	1.748305	-0.10	0.921

Number of observation = 2808

Wald chi2(11) = 941.55

Prob > chi2 = 0.0000

R-sq: within = 0.1776 between = 0.6319 overall = 0.5652

Notes: Time dummies are not reported. All variables except dummies are expressed in natural logarithms. Number of observations equals (n x T) = 2808.

4.4 Econometric Issues

A separate regression is made and panels corrected standard errors results are reported in annex 2. The results are fairly identical to the random effect estimates in terms of both in sign and significance. Hetroskedasticity and auto correlation is not a problem in the specification. With respect to diagnostics test, the Wald test reveals the overall significance in the estimates. The p-value attached to the Wald chi2 is 0.0000 indicating that the estimated regression is significant.

4.5 Interpretation of results

As indicated in the table 4 above, most of the estimated coefficients are significant in explaining SSA countries' import flows. The coefficients of GDPs are significant and positive as expected. This implies that SSA countries import more from industrial countries and these industrial countries export more to SSA. SSA's import from country j (industrial country) increases by 0.56 percent as own GDP increases by 1 percent whereas exports of country j increases by 0.82 percent as GDP increases by 1 percent. The signs of the GDPs show that wealthier countries trade more.

For the population variables, the estimation results show a negative coefficient for the industrial countries and a positive coefficient for the SSA countries. The increasing population in the importing country (SSA country) contributes to the absorption effect. The country imports more to satisfy the higher demand since the domestic market fails to meet, which is driven by an increase in population. Similarly, the increase in population in the exporting

country (industrial) results in the rise in the absorption effect. This can be noted as the demands more country j's goods increase due to higher population.

The log of absolute per capita difference variable is added to test for the existence of Linder against H-O hypothesis. This implies to address the question whether industrial countries export more to similar or dissimilar economies in terms of income. The estimated coefficient on the variable lnydiff has now the expected negative sign and it is statistically significant. Thus, the result supports the Linder hypothesis; that is bilateral trade will be greater when the per capita GDPs of the trading countries are more similar. Our result is similar to Martinez and Nowak (2003) who estimated for Mercosur-European Union trade flows.

Bilateral trade flows are also dependent on the geographic distance. Distance variable appears as a proxy for transportation costs. The coefficient of this variable shows to have negative signed as expected and is statistically significant. This implies that the more distant two countries are the lesser trade will be. This is due to an increase in transportation costs as geographical distance increases.

The estimation results for infrastructure indexes, which are augmented as a proxy for public infrastructures, on the other hand show a positive coefficient for industrial countries and a negative coefficient and a wrong sign for the SSA countries. In both countries, the coefficients are significant. The estimated coefficient on the variable $lninfra_j$ confirmed that a well-developed public infrastructure facilitates bilateral trade between trading countries. The negative result for variable $lninfra_i$ arise due to the fact that the proxy is may be inadequate in capturing public infrastructure in the SSA countries.

The interpretation of the coefficients on the dummy variables is also important for the analysis. The estimated coefficients of the three dummy variables that are included in the regression present the expected signs and are highly significant. Since the model is estimates in natural logarithms, all dummy variables are given a value of one in natural logs when the correspondent condition is satisfied and a value of zero otherwise. Thus the value of -0.9216809 (country's access to sea dummy in the column 1 of table 4) indicates that holding other things equal, countries that are landlocked trade on average about 60.3 percent {[exp (-0.923) – 1]*100} less than countries that are not landlocked.

The positive signed coefficients of common language and colonial history ties indicate that these ties boost bilateral trade between developing countries in SSA and industrial countries. Thus, the value of 0.5689244 (common language dummy in the column 1 of table 4) shows that, countries that use a common commercial language trade on average about 76.6 percent {[exp (0.569) – 1]*100} more than countries that do not use common language. Similarly, the value of 0.9768378 (the colony dummy in the column 1 of table 4) indicates that colonial ties fosters bilateral trade by 165 percent {[exp (0.977) – 1]*100}. Other things being constant, this implies that many of the bilateral trade relations between the SSA and industrial countries are a result of their colonial ties.

V. Conclusion and policy implication

5.1. Conclusion

The objective of this study was to examine empirically some of the basic determinants of Sub-Saharan Africa's (SSA's) bilateral trade with industrial countries. With this aim the study,

apply a gravity model to annual bilateral imports between 27 countries from SSA and 8 industrial countries over the period 1995 to 2007.

The results show that importer GDP (SSA countries) and exporter GDP, as expected, have a positive influence on bilateral trade flows. The estimates also suggest that, for a given level of population, trade levels tend to be lower in poorer countries than richer countries. This result is similar to the study by Coe and Hoffmaister (1998). Industrial counties population (exporters) has a large and negative effect in exports showing an absorption effect. Whereas importer population has a positive effect on imports indicating that they import more as their population increases, absorption effect.

The study investigated the role that infrastructure variables and GDP per capita differences play as explaining bilateral trade flows in a panel data analysis. The findings support the hypothesis of the importance of these variables since they all are statistically significant and present the expected sign apart from the importer (SSA) infrastructure variable that has a wrong sign. The coefficient of per capita GDP differential between these countries is also significant and has a negative sign. The negative sign of the coefficient indicated that the Linder effect (similar in per capita incomes) dominates the H-O hypothesis in the case of north - SSA trade flows.

Transportation cost and country's access to sea are found a significant factor in influencing the SSA bilateral trade flows negatively. This implies SSA countries would be better if they trade more with their neighbors. The coefficients for these variables are statistically significant and show the expected sign, which is consistent with the model assumption. On the other hand

both linguistic ties (common language) and colonial dummy variables present a positive sign and are statistically significant. This suggests that using a common commercial language and having a colonial tie foster bilateral trade between SSA and industrial countries.

5.2. Policy implication

The implications of these results are as follows. First, all kinds of barriers to trade must be liberalized to a greater extent to enhance SSA's bilateral trade. Second, one of the main problems of Sub Saharan African trade is transport infrastructure network. Therefore, improvement in infrastructure may be a pre-requisite for successful trade flows. Third, all partners propensity to export and import must be taken into account sufficiently when trade policy is set as trade is not sufficiently independent of country specific effects.

The study treats separately developed and developing countries because the impact of demographic variables might be different in the two cases. Since manufacturing and non-manufacturing trade flows have different trends, distinguishing between these two is an indication for further analysis. Because of the fact that, trade relations once established might last for a long time employing a dynamic model and examining long versus short term parameter, moreover indicates further analysis.

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Annex 1: Descriptive Statistics for the Dependent and Independent Variables

Variable		Mean	Std. Dev.	Min	Max	Observations
lnimportijt	overall	17.26109	1.483813	9.21034	21.85459	N = 2808
	between		1.373804	12.50823	20.90674	n = 216
	within		.5678315	13.9632	20.16409	T = 13
lngdpi	overall	21.79813	1.202093	18.7193	25.47115	N = 2808
	between		1.171338	19.41826	24.66874	n = 216
	within		.2808189	20.72099	22.88272	T = 13
lngdpj	overall	28.12712	1.072315	26.16854	30.20851	N = 2808
	between		1.058846	26.39465	29.93318	n = 216
	within		.1830253	27.76606	28.50456	T = 13
lnpopi	overall	15.89168	1.356956	13.09435	18.79031	N = 2808
	between		1.356075	13.21786	18.66129	n = 216
	within		.1012565	15.55799	16.07737	T = 13
lnpopj	overall	17.84342	.9939505	16.1317	19.51729	N = 2808
	between		.9959197	16.1485	19.46404	n = 216
	within		.017935	17.77943	17.89666	T = 13
lnydiff	overall	10.10572	.2340734	9.459378	10.58994	N = 2808
	between		.2262005	9.577567	10.52074	n = 216
	within		.0619872	9.906263	10.25899	T = 13
lndistance	overall	8.799598	.3739074	8.101375	9.609653	N = 2808
	between		.3747092	8.101375	9.609653	n = 216
	within		0	8.799598	8.799598	T = 13
lninfrai	overall	-3.412237	1.319384	-6.772843	-.2776196	N = 2808
	between		1.116372	-5.350185	-.3342884	n = 216
	within		.7069753	-7.54441	-.8431399	T = 13
lninfraj	overall	.1331265	.4861234	-.8420259	.8591483	N = 2808
	between		.4845633	-.8120312	.8481979	n = 216
	within		.0501811	-.1748968	.1949223	T = 13
land	overall	.3333333	.4714885	0	1	N = 2808
	between		.4724995	0	1	n = 216
	within		0	.3333333	.3333333	T = 13
lang	overall	.3101852	.4626517	0	1	N = 2808
	between		.4636438	0	1	n = 216
	within		0	.3101852	.3101852	T = 13
colony	overall	.1157407	.3199708	0	1	N = 2808
	between		.3206569	0	1	n = 216
	within		0	.1157407	.1157407	T = 13

Source: own computation

Annex 2: Panels corrected standard errors

Variable	Coefficient	Standard Error	Z-statistics	P>|Z|
lngdpi	.7823381	.0381784	20.49	0.000
lngdpj	.6558949	.201238	3.26	0.001
lnpopi	-.00826	.0268758	-0.31	0.759
lnpopj	-.0301292	.2019485	-0.15	0.881
lnydiff	-.2496139	.196454	-1.27	0.204
lndistance	-1.03179	.093887	-10.99	0.000
lninfrai	.040562	.0190126	3.13	0.011
lninfraj	.6115355	.0798171	7.66	0.000
land	-.8379368	.0471922	-17.76	0.000
lang	.6150244	.022595	27.22	0.000
colony	.9573461	.0528549	18.11	0.000
Constant	-5.935382	1.315272	-4.51	0.000
Number of obs = 2808			Estimated autocorrelations = 0	
R-squared = 0.5829				
Wald chi2(11) = 49064.61				
Prob > chi2 = 0.0000				

Declaration

I, the undersigned, declare that this project is my original work and has not been presented for degree in any other university, and that all source of materials used for the project have been duly acknowledged.

Declared by:

Name Mahlet Getachew

Signature

Date June 25, 2009

Confirmed by Advisor:

Name Girma Estifanos

Signature

Date July 1/2009

Place and Date of Submission: Addis Ababa, June, 2009