Journal of Agriculture and Sustainability
ISSN 2201-4357
Volume 3, Number 2, 2013, 144-164

Theoretical, Analytical, and Methodological Issues on Regional Integration and Bilateral Trade in the ECOWAS Sub-Region: Evidence from Literature on the Gravity Model of Trade

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Abstract

ECOWAS has been enforcing sub-regional integration through free international trade, common external tariff wall, consolidation or freezing of customs duties, non-tariff barriers to intra-trade and gradual phasing out of duties on industrial products from community projects over a period of 6-10 years at 10-16.6% annual rates of reduction depending on the classification of member states based on the level of development, location, and importance of customs revenue. However, comparatively few studies used the gravity model to explore empirically the determinants of intra-regional trade among countries in SSA, on one hand, and between the countries of regional groupings on the other hand. Some of the studies produced significant effects of the impact of regional groupings on bilateral trade in member countries, while others account for less. This paper tries to document theoretical, analytical, and methodological discuss on the topic in the context of augmented traditional gravity model of trade.

Keywords: Regional integration; Bilateral trade; ECOWAS.

1. Introduction

In West Africa, there are many regional bodies. Three of them can be identified as explicitly concerned with the promotion of intra-regional trade flows: the Economic Community of West African States (ECOWAS), Union Economique Monitaires L'Ouest Afrique (UEMOA), and Mano River Union (MARIUN).

When ECOWAS was established in 1975, it aimed, among other things, at the gradual:

- elimination of custom duties and other charges of equivalent effect in respect of the importation and exportation of goods between member states;
- abolition of quantitative and administrative restrictions on trade among the member states;
- establishment of a common customs tariff and a common commercial policy towards third countries; and
- abolition (as between the member states) of the obstacles inhibiting free movement of persons, goods, services and capital.

These are laudable objectives, but the achievements have fallen far short of expectation especially in the area of trade liberalization. The Community has been trying to provide basic infrastructure such as good roads, reliable communication network, efficient transportation system and strong financial institutions, which, hopefully, will facilitate trading among member states. There is no doubt that the Community, with 15 member states cutting across francophone and anglophone countries in the West African sub-region, has come a long way in fashioning these objectives. It has established institutions necessary not only for effective management of day-to-day activities of the Community, but also for increasing trade flows among member states. The West African Monetary Agency (WAMA), an autonomous body that grew out of the West African Clearing House (WACH), was established to facilitate multilateral payments in the sub-region and to provide means of overcoming the multiplicity of currencies in the region. The Fund for Cooperation, Compensation and Development (FCCD) was established as the financial arm of the Community. Its major functions are to mobilize financial resources for the implementation of the Community's projects and to supervise payment of compensation to member states that might have incurred losses in revenue as a result of the implementation of the trade liberalization scheme (TLS).

The Community's projects are mainly in the area of infrastructure. Two major road projects are at various stages of completion: the 4,767 km trans-coastal highway linking seven countries and the 4,633 km trans-Saharan highway. These roads are designed to open up some member states. Telecommunications is another project of the Community designed to facilitate

growth of intra-ECOWAS trade. Notwithstanding these efforts, intra-ECOWAS trade remains insignificant. It has not shown appreciable change over the years, and various reasons have been adduced for the limited response of intra-Community trade flows. Some analysts argue that these countries have limited trade potential; that is, even if trade were to be totally liberalized (i.e., all obstacles to free movement of goods and services removed) some of these countries would have little or nothing to trade with each other based on their levels of development and resource endowment. The second level of the argument centre's on why trade barriers among member states have not been removed or are difficult to remove. In this regard, past import-substitution policies, revenue constraints, and skewed distribution of benefits and compensation scheme in the Community are usually considered in the explanation of the performance of the Community (Collier, 1993). These factors tend to reinforce each other, thereby allowing for the problem to perpetuate itself. As strong as the explanations on trade potential are, we are not aware of any study that has provided any empirical analysis on ECOWAS in this respect. Although it is generally acknowledged that trade alone cannot solve all development problems, ECOWAS cannot be sure of benefiting from the current global trade dynamic without a favorable macro- and micro-economic framework.

The ECOWAS are involved in trading with countries within and outside the region. Intra-ECOWAS trade (as percent of total export and import values, 2007-2011) is represented in (figures 1). ECOWAS intra-trade, accounts for an average of 9.79 percent of the total exports, and 14.5 percent of the value of total imports (2007 to 2011). The SADC, NAFTA, EU 27, APEC and OECD account for an average 6.3, 18.1, 12.8, 21.4 and 35.8 percents within the same period, respectively of the value of total exports; while for imports the SADC, NAFTA, EU 27, APEC and OECD account for 1.7, 5.8, 22.6, 28.1 and 38.2 percent, respectively. (Figure 2)

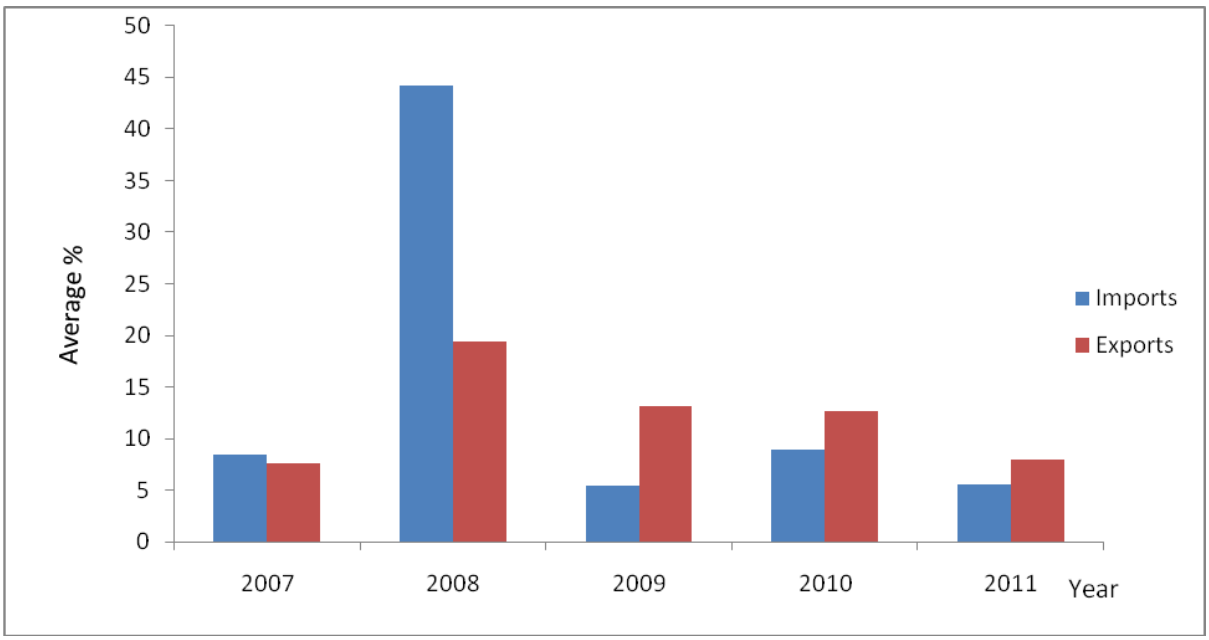

Fig. 1: Intra-ECOWAS Trade as % Total Imports and Exports for Period 2007-2011

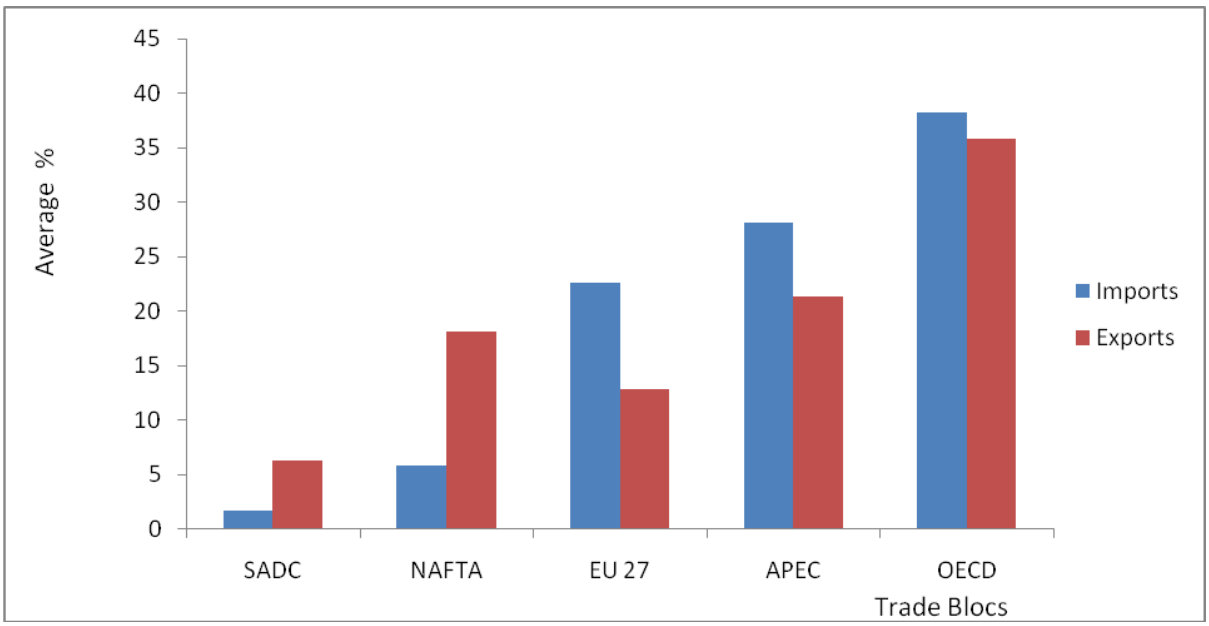

Fig. 2: ECOWAS Trade with Other Regional Trade Blocs for 2007-2011

2. Problem Statement

The low levels of regional intra trade, (exports and imports as percent of total exports and imports) values which stood at 7.6, 19.4, 13.1, 12.7 and 7.9, percents for exports and 8.4, 44.2, 5.4, 8.9, and 5.6 percents for imports in 2007,

2008, 2009, 2010, and 2011, respectively (ECOWAS Statistical Bulletin, 2012), are a major problem. During the structural adjustment programme (SAP) era (1986-1993), policies of most ECOWAS member nations were directed at altering and re-aligning aggregate domestic expenditure, specialization, and production patterns to minimize dependence on imports; enhance non-oil export base and ensure a steady and balanced economic growth.

In the light of studies carried out on sub-regional integration undertaken by developing countries, it transpires that many integration schemes have not yet achieved their objectives and that significant economic advantages have seldom been those concerned with export diversification, increase in international competitiveness, efficient resource allocation of means, or significant stimulation of production and investment in the regions (Yeast, 1999; Foroutan,1993;Nogues and Quintanilla,1993; Lyakurwa et al., 1997; Oyejide and Njinkeu, 2003). For the specific case of SSA countries, recent empirical studies suggest that the establishment of preferential trade systems between countries had no impact on the subcontinent (Ariyo and Raheem, 1991; de Melo et al., (1992). Foroutan and Pritchett (1993) show that the level of intra-SSA trade is not as low as revealed by these studies, but is higher as anticipated. What about trade arrangement between ECOWAS and other regional trade blocs? This is all the more necessary since, as has well been known since Viner's (1950) original work, trade creation brings about wellbeing while trade diversion reduces it. Besides, trade creation and trade diversion have different implications in terms of wellbeing and development depending on whether they are brought about by trade between individual countries or preferential agreements in the framework of a free trade zone. Following studies such as Krugman (1993) Krugman and Venables (1996), among others, it is accepted that more number of FTAs eliminates obstacles to trade blocs and among member countries because of the resulting low cost of transactions. Furthermore, preferential trade agreements promote trade given the reduction of tariff and non-tariff barriers. More so, diverting trade as a result of preferential trade agreements brings about welfare gains. Since Viner's (1950) work, one of the key questions about preferential trade agreements has been to know whether the benefits of creating trade exceed the cost of diverting trade. Two decades after the implementation of preferential

agreements among ECOWAS member nations, and knowing the respective impact of integration on trade between member countries, there is a good reason to question the additional impact of other trade blocs on bilateral trade within ECOWAS. In other words: Has there been a stronger trade creation between the ECOWAS member nations since the involvement of other trade blocs? : Has the diversion of trade been more viable on the import side than on the export side since the economic integration was set up?

However, the main thrust of this paper is to x-ray the theoretical, analytical, and methodological issues on trade flows among ECOWAS on the one hand and between ECOWAS and other regional trade blocs on the other hand, and provide plausible analytical framework for empirical studies.

3. Motivation for the Paper

This paper is motivated for three reasons. Firstly, the purpose of international trade policy is to help a nation's international trade run more smoothly, by setting clear standards and goals which can be understood by potential trading partners. In many regions, groups of nations work together to create mutually beneficial trade policies (for an instance, tariff elimination) and accurate estimation of the impact of trade policy on trade flows are important for evaluating economic policy, as in deciding whether to join a free trade area or not. It is evident that one of the major reasons for economic integration is to enhance welfare of the participating countries. And the major channel for achieving welfare benefits is through trade integration as in free trade areas. However, it is not clear what the eventual welfare benefits are from this type of regionalism. Trade patterns might be altered in several ways that might result in trade creation and trade diversion. The former relates to increased trade between the FTA members, while the latter concerns trade between members and non-members. Trade creation will be welfare enhancing, but trade diversion could distort total welfare benefits and even make them negative (Viner, 1950). Hence, estimates on the trade impact of free trade agreements are necessary for evaluating the merits of trade integration. Second, establishing a free trade area and analyzing its impact on trade is an interesting case study for evaluating international trade theory, which typically predicts a negative correlation

between trade and trade costs. In a recent article Anderson and Van Wincoop (2004) gave an extensive overview of trade costs, which entail transportation costs, tariff and non-tariff barriers, and information and transaction costs. Free trade areas obviously decrease tariff and non tariff barriers as well as transaction costs. Third, earlier studies on the trade impact of free trade areas have produced surprisingly wide range of estimates. Baier and Bergstrand (2007) and Glick and Rose (2002) reported large and positive trade creation effects indicating a doubling of trade or even more. However, using extreme bounds analysis, Ghosh and Yamarik (2004) conclude that the empirical evidence on the trade-creating effects of regional trade agreements is fragile. In addition, case studies on particular free trade areas show mixed results. In particular, ECOWAS estimation results are typically absent. This calls for greater understanding of theoretical, analytical, and methodological issues underpinning bilateral trade in the sub-region.

4. Theoretical Issues

Ricardo's (1817) standard trade theory hinges on batter of exports for imports; while Heckscher-Ohlin (1933) theorem conceptualized international trade as a phenomenon consisting of each country exporting goods and /or services in order to improve growth through comparative advantage, technology and competitiveness. This framework, otherwise referred to as inter-industry trade, was considered by economists as the most relevant for predicting the pattern of trade existing among nations. As well, it has been considered by many as the most logical way of embodying the links between factors of production, specialization, and patterns of trade among countries. Again, standard customs union theory as articulated by Viner (1950), predicted increased inter-industry specialization and trade, even though its wake brought serious adjustment frictions. Hence over the last two decades economists tried to examine the complexities of world trade, it was found that countries with related factor endowments engaged in more trade (intra-industry), than countries with different factor endowments, against the prediction of inter- industry trade theorists. However, in our scenario, South and North (ECOWAS and the EU) do not at all have similar factor endowments, so the most relevant trade pattern

would be in line with HO theorem which holds that the direction of international trade flows between two Countries (regions) is determined by the endowments of productive factors in the two countries (regions) and the factor content of the goods involved. Some of the economists that uphold to the inter-industry (HO framework) include; Brander (1980), Falvey (1981), and Richard, Courant, and Douglas (1994), among others. According to them, factor endowment is beneficial because it allows countries to specialize in production and exportation of commodities that are intensive in the use of factor(s) of production with which their endowments are relatively abundant.

The welfare gains from free international trade with the EU are several. First, it enjoys the static gains from trade, which increases economic well-being of a region by holding resources and technology constant. This leads to consumption and production gains. Even though production may remain fixed, the opportunity to trade at world prices leads the consumption point to a higher consumption indifference curve. These gains come about because productive resources are channeled into the region's comparative advantage industries; and because of this redistribution of resources, overall output (GDP) rises, leading to the static gains from trade.

Second, dynamic welfare gains from trade bring about increases in the economic well-being that accrue to a region because trade induces increases in the productivity of existing resources. This is because the economy of a region grows over time either due to increases in its stock of productive factors or because a technological innovation helps a region's existing stock of factors to become more efficient, culminating to a shift in a region's production possibility frontiers. The relationship between international trade and economic growth are in terms of non restrictions of trade in both raw materials, intermediate products and capital goods, such that there would be increases in stock of these categories of goods in either of the regions at any point in time. In this way, the international trade will enhance the international diffusion of all products to ensure faster economic growth through greater competition that will encourage more efficient production, as the discrepancy between price and marginal cost is closed. In addition, as competitions destroy industry rents, fewer resources are devoted to wasteful rent-seeking behaviors. Moreover, given economy of scale,

dynamic gains from free international trade accrue because trade expands the size of the market. As the market expands, industries are able to move further down their average-cost curves, bringing down prices in the process. Again, expanding the size of the market may encourage industries to step up investments in research and development, as a way of spreading the costs of these investments over larger levels of output. These investments could, in turn, raise the overall level of technology of the region. Besides dynamic gains from international trade would accrue to the region by enlarging the pool of savings that is available to fund investment purchases, through the raising of the real income of the region above the level that would exist in autarky (Husted and Melvin, 1993).

Summarily, a region that engages in free international trade enjoys welfare gains both in terms of immediate improvements in standard of living and in terms of economic growth. The standard of living that is achieved surpasses that which would be available to a competitive economy that operates in autarky. Again, political gains from free international trade increases economic well-being that accrue to a region because expanded trade and economic interdependency may increase the likelihood of reduced international hostility.

Again, possible welfare gains from trade reforms have been documented by Francois and Martin, (2007). A more opened international trading system provides greater opportunities to earn foreign exchange. Trade policy reforms impact tariff and non-tariff measures associated with cross-boarder trade, generally resulting in changes in market structure and opportunities (Achike et.al., 2011). However, economists have long recognized that trade liberalization without favourable associated conditions to trading will not always guarantee gains for all participating countries. In fact, quite a number of important determinants of trade flows need to be captured in view of the on-going agreements.

Dion (2004) gives a review of various channels through which trade can affect output (or output growth). The channels are comparative advantage (classical trade theory), increasing return to scale (new trade theory), new policies of dismantling trade barriers (public choice and trade theory), and technology (new growth theory). In recent years many of the fastest growing

developing countries in East Asia particularly have been those that have significantly over come barrier in foreign markets. China for example, has achieved economic growth of some 8% for 20 years, lifting over 200 million people out of poverty through increased foreign market penetration.

5. Empirical and Analytical Issues

Relatively small number of studies used sectoral gravity model to explore the impact of free trade areas and regional characteristics on intra-regional trade. There seems not to have been any attempt so far to quantify the likely trade expansion effects, and welfare gains especially in food and agricultural products trade that can be acquire through regional integration cum free trade areas. However, a comparatively few studies used the gravity model to explore empirically the determinants of intra-regional trade among countries in SSA, on one hand, and between the countries of regional groupings on the other hand. Summarily, some of those studies produced positive effects of the impact of regional groupings on bilateral trade in member countries, while others found non-significant effects.

The efforts of countries in Sub-Saharan Africa towards regional integration have for a long time attracted the interest of researchers. Some of the researches on bilateral trade between the countries were borne on the impact of non-registered trade between neighbouring countries on regional integration (example, Barad, 1990). Researches on the trade between neighbouring countries that have different exchange rate systems, such as (Azam, 1990) have also been carried out. Among the comparatively small number of studies that applied gravity model to identifying the major determinants of bilateral trade between SSA countries are Foroutan and Pritchett (1993), Elbadawi 1997, Ogunkola (1998), Longo and Sekkat (2004), Carrère (2006), Agbodji (2008).

Foroutan and Pritchett (1993) initiated the use of augmented version of gravity model to quantify the level of potential intra-SSA trade, comparing it with the then current level. The 19 countries studied showed an average of 3.5% for imports from African countries against an expected average of 3.6%. With respect to exports, 11 out of 19 countries observed showed an average share of 4.6% which was bigger than the envisaged 2.7%.

In West Africa, Ogunkola (1998) carried out a comparative analysis of the determinants of sub regional trade by considering pre-integration (1970-1972), and post-integration (1978-1980) regimes. It was inferred from the study's estimation results that the intra-ECOWAS trade remained very weak in spite of the integration efforts in the sub region during the periods of reference. Similar results were obtained by Longo and Sekkat (2004), who revealed that the different integration schemes produce effects of neither trade creation nor trade diversion and therefore were not able to lead to a growth in intra-African trade. In UEMOA, Agbodji (2008) carried out an empirical study on the impact of sub-regional integration on bilateral trade. The results show that membership in a common monetary zone UEMOA, and the implementation of economic reforms aimed at economic integration had significant effects on bilateral trade within the zone, mainly in terms of diversion of imports and exports.

Similarly, Batra (2004) analysed India's global trade potentials using gravity model. The augmented gravity model was first used to analyse the world trade flows and the coefficients thus obtained are then used to predict trade potential for India. The gravity model was estimated using the OLS techniques with cross-section data for the year 2000. The dependent variables in all the tests are merchandise trade (exports and imports in US dollars), in log form, between pairs of countries. The results indicated that all three of the traditional "gravity" effects (Gross Domestic Products, Population and Distance) were intuitively reasonable, with statistically significant t-statistic. It further revealed that the magnitude of India's trade potential is highest with Asia-pacific region followed by Western Europe and North America.

To assess the extensiveness of image of gravity model in specification and modeling international trade flows and free trade agreement effect, Kepaptsoglou *et al* (2010) had a 10 – year reviews of recent empirical studies from 1999-2009 with over 55 papers published within the last decade and found that gravity model has been established as a major instrument for analyzing trade flows and explaining effects of related trade agreements. Result also shown that panel data sets are preferred in recent gravity model studies with only few of it remaining on cross-sectional model.

A theoretical basis recently developed by Baier and Bergstrand (2002) underlies the gravity model. This model originates from the Newtonian Physics notion. Newton's gravity law in mechanics states that two bodies attract each other proportionately to the product of each body's mass (in kilogammes) divided by the square of the distance between their respective centres of gravity (in metres).

Latter on an astronomer, Stewart, and a sociologist Zipf transferred this law to the social sciences and attempted to apply it to spatial interactions, such as trips among cities, using the specification thus:

$$I_{ij} = G\left(pop_i pop_j\right) / D_{ij}^{\alpha} \quad (1)$$

where I_{ij} is trips between city i and city j; $pop_{i(j)}$ is population of city i(j); D_{ij} is distance between city i and city j; G is a coefficient.

The gravity for trade is analogous to this law. The analogy is as follows: "the trade flow between two countries is proportional to the product of each country's 'economic mass', generally measured by GDP, each to the power of quantities to be determined, divided by the distance between the countries' respective 'economic centres of gravity', generally their capitals, raised to the power of another quantity to be determined."(Christie, 2002). This formulation can be generalised to $M_{ij} = KY_i^{\beta} Y_j^{\gamma} D_{ij}^{\delta}$ (2)

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

$$Log\left(M_{ij}\right) = \alpha + \beta \log\left(Y_j\right) + \gamma \log\left(Y_j\right) + \delta \log\left(D_{ij}\right) \quad (3)$$

Although when estimated, this baseline model gives relatively good result, but most estimates of gravity models add a certain number of dummy variables to equation (3) to test for specific effects. The gravity model has been applied to a wide variety of goods and factors of production moving across regional and national boundaries under different circumstances since the early 1940s (Oguledo and Macphee, 1994).

The analytical framework rests on the maximization of benefits made by trade companies in monopolistic competition and of utility by the consumers in reference to the Dixit-Stiglitz preferences.

According to Carrere (2006), Baier and Bergstrand (2002) start from a model where the trade companies of country j sell their products on the market of country i at the price of P_{ij}; = p_i q_{ij}; they obtain the following balanced trade flow for every product produced by the trade company in country j selling on market i:

$$M_{ji} = \left[\frac{\gamma}{\varphi(1-\delta)}\right] \frac{Y_j}{P_j} Y_i \left[\frac{P_j \theta_{ij}}{P_j}\right]^{1-\delta} \left[s_j (1+t_i)(1+t_{ij})^{-\delta}\right] \quad (4)$$

Where:

M_{ji} is the cost-insurance-freight value of the flow of goods imported by country i from country j.

δ is the substitution elasticity between goods (Dixit-Stiglitz).

φ is the fixed cost that each firm faces.

$Y_{j(i)}$ is the GDP of country i(j).

P_j is the level of the price in country j of the representative product.

P_{ij} is the price of the product from country j in country i.

θ_{ji} is a function of the barriers at the border between i and j.

P_i is a measure of how far country i is, such that:

$$P_i = \left[\sum_{K=1}^{N} n_k \left[P_k \theta_{ik} (1+t_{ik})\right]^{1-\delta}\right]^{1/1-\delta} \quad (5)$$

Where n_j is the number of the varieties of goods manufactured in country j, t_{ij} is the ad valorem tariff rate imposed by country i on the good produced in country j, s_j is the share of goods in the national product of country j, and t_i is the share of the tariff revenue in the total revenue.

Equation 4 is accepted as the theoretical foundation of the gravity equation in relation to transport costs and tariffs. As Anderson and Van Wincoop (2003) show, the solution to

equations 4 and 5, assuming that $t_{ij} = t_{ji}$ and $\theta_{ij} = \theta_{ji}$, is:

$$p^*_j = \left(\frac{s_j Y_j}{n_j Y_w} \right)^{1/1-\delta} p_j^{-1}$$

(6)

By substituting p^*_j in Equation 4 and assuming that $t_j = 0$ (since for most countries the tariff revenue is a trivial share of the GDP), we have:

$$M_{ij} = \left[\frac{\gamma}{\varphi(1-\delta)} \right] \frac{1}{Y_w} s_j Y_i Y_j \theta_{ij}^{1-\delta} (1+t_{ij})^{-\delta} \left[P_i P_j \right]^{\delta-1}$$

(7)

Where; Y_w is the world goods product.

Equation 7 is close to the gravity model found in empirical literature. The equation suggests that the specification proper would include:

- The logarithm of the product of the GDP of countries i and j;
- The per capital GDP as a proxy for the capital endowment ratio; this determines the endogenous share of the national product (i.e.,s_j);
- A proxy for the term θ_{ij}; and
- The product of the term of multilateral resistance betweens two countries.

Following Limao and Venables (2001), θ_{ij} can be modeled as follows:

$$\Theta_{ij} = (D_{ij})^{\delta 1} (I_i)^{\delta 2} (I_j)^{\delta 3} [\, e^{\delta 4 Lij + \delta 5 Ej + \delta 6 Ei} \,]$$

(8)

Where D_{ij} is the distance between the two countries i and j; L_{ij} = 1 if countries i and j border each other and 0 if they do no; $E_{i(j)}$ = I if the country $i(j)$ is an island and 0 if not; and $I_{i(j)}$ is the state of the infrastructure of country $i(j)$. Regarding the modeling of $[P_i\ P_j]$, Rose and Van Wincoop (2001) and Feenstra (2003) suggested using terms related to the fixed effects of countries as a proxy.

The gravity model can be used for an evaluation of the actual impact of regional agreements on bilateral trade. After all, the gravity model entails a "normal" level of bilateral trade and, by introducing dummy variables related to regional agreements, captures the "atypical" levels of trade resulting from regional agreements. Therefore, to isolate the effects of trade creation and diversion of exports and imports, Soloaga and Winters (2001) introduced three dummy variables. These are: D_{TC} = 1 if both partners belong to the same integration zone and 0 if they do not (thus capturing intra-bloc trade); D_m = I if

the importer is a member of the zone and the exporter of the rest of the world and 0 if otherwise (thus capturing the bloc's imports from the rest of the world); and D_x = I if exporter j belongs to the zone and importer i to the rest of the world (thus capturing the bloc's exports to the rest of the world).

From the foregoing, then, a reduced form of the gravity equation is expressed in its logarithmic form as:

$$\ln M_{ij} = \beta_o + \beta_1 ln Y_i + \beta_2 ln N_i + \beta_4 ln N_j + \beta_5 \ln D_{ij} + \beta_6 \ln L_{ij} + \beta_7 ln E_i + \beta_8 ln E_j + \beta_9 ln I_i + \beta_{10} ln I_j + \beta_{11} D_{TC} + \beta_{12} + \beta_{13} D_X + \mu_{ij} + v_{ij}$$

(9)

Where $|\gamma|\varphi(1-\delta)|1/Y_w$ is contained in the constant term, μ_{ij} is the error term that is representative of the specific bilateral effect, and v_{ij} is the habitual symmetrical error term.

The expected signs are:

$$\beta_1 > 0, \beta_2 > 0, \beta_3 > 0, \beta_4 > 0, \beta_5 = (1-\delta)\delta_1 < 0, \beta_6 = (1-\delta)\delta_4 > 0, \beta_7 = (1-\delta)\delta_5 < 0, \beta_8 = (1-\delta)\delta_6 < 0, \beta_9 = (1-\delta)\delta_2 > 0, \beta_{10} = (1-\delta)\delta_3 > 0, \beta_{11} > 0, \beta_{12} > 0 \text{ or } < 0, \beta_{13} > 0 \text{ or } < 0$$

6. Plausible Analytical Methodologies

International trade flows will bring both trade creation and trade diversion scenarios among countries involved. The plausible modeling framework for this purpose is the Augmented Gravity Model of trade flows.

Model Specifics

With that, the expression of the gravity model to estimate is the following:

$$\ln M_{ijt} = \beta_o + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln POP_{it} + \beta_4 \ln POP_{jt} + \beta_5 \ln D_{ijt} + \beta_6 \ln L_{ijt} + \beta_7 \ln E_{it} + \beta_8 \ln E_{jt} + \beta_9 \ln I_{it} + \beta_{10} \ln I_{jt} + \beta_{11} \ln TCR_{ijt} + \beta_{12} \ln CINF_{it} + \beta_{13} \ln ECOWAS_1 + \beta_{14} \ln ECOWAS_2 + \beta_{15} \ln ECOWAS_3 + \mu_{ijt} + v_{ijt} \quad (10)$$

Where:

- M_{ijt} indicates the amount of trade of country i from country j. Although Elbadawi (1995) points out that in principle bilateral trade flows (exports or imports) would be influenced by the same factors, in this study imports will be chosen rather than exports. The choice can basically be explained by the fact that imports are better measured in the country of arrival because countries tend to monitor their imports more than their exports given that taxes are levied on the imports. Since the gravity model refers

to the trade volume, the study will deflate the value of the current imports measured in US dollars by using the US consumer price index (CPI).

- GDP_i and GDP_j represent the GDP in constant values (US dollar) of countries i and j, respectively. Given that the GDP is a variable that is indicative of the size of the economy, one expects $\beta_1 \geq 0$ and $\beta_2 \geq 0$ to confirm that the bigger the economy, the more significant trade becomes.
- POP_i and POP_j are the size of the population of countries i and j, respectively. The impact of the size of the population on bilateral trade can be positive or negative depending on whether the absorption effect is bigger than the economies of scale effect, which is equally related to the population. The assumption then is that $\beta_3 \geq 0 or \angle 0 and \beta_4 \geq 0 or \angle 0$.
- D_{ij} measures geographical distance between country i and country j. the greater the distance between the two counties, the more transport costs tend to rise, consequently reducing the volume of trade; hence, it is expected that $\beta_5 \angle 0$.
- L_{ij} is the dummy variable relating to whether the two trading countries border each other; it takes the value I if he two are neighbouring countries and 0 otherwise. For neighbouring countries, trade is expected to be intensive; this assumes that $\beta_6 \geq 0$.
- $E_{i(j)t}$ is a dummy variable equal to I if he country i(j) is an island and 0 otherwise. It is expected that $\beta_7 \geq 0 and \quad \beta_8 \geq 0$
- $I_{i(j)t}$ is a variable that indicates the infrastructure index, which is constructed form three variables: the number of kilometers of roads and of railways and the number of telephone lines per capita. Following limao and Venables (2001) and Carrere (2004), every variable, measured in density, is standardized to have the same average to be equal to 1`. The index thus corresponds to the arithmetic mean of standardized variables. Considering that more developed infrastructure is likely to foster the movement of bilateral trade, it is expected that $\beta_9 \geq 0$ and $\beta_8 \geq 0$
- TCR_{ijt} is the real bilateral exchange rate between country i and country j at time t measured by the following formula: $TCR_{ijt} = (TCN_{i/\$} TCN_{j/\$}$ x (CPI_j / COI_i), where TCN is the nominal exchange rate vis-à-vis the dollar

and CPI is the price index, notably the GDP deflator. The negative impact of the real bilateral exchange rate will be reflected in $\beta_{11} \angle 0$.

- $CINF_{i(j)t}$ is a variable introduced into the model to indicate the incentives for conducting unregistered trade. Its coefficient will thus reflect the impact of unrecorded trade on official bilateral trade. It is represented in the model by the tax pressure, measured as the ratio of the tax pressure of country i to that of country j. According to the literature, the higher the tax pressure is, the more the importers will tend to engage in unregistered trade to avoid paying taxes. This will result in the decline in official bilateral trade flows. In such a state of affairs, the coefficient $\beta_{12} \angle 0$. Is also expected to have a negative sign.
- $ECOWAS_1$ is a dummy variable indicating membership of ECOWAS; it is equal to 1 if the importing and exporting countries are members and 0 if any of them is not. Similarly, $ECOWAS_2$ takes the value 1 if the importing country is a member of ECOWAS and the exporting country is from the rest of the world; it takes the value 0 if the importing country is from the rest of the world and the exporting country is from ECOWAS. As for $ECOWAS_3$, it takes the value 1 if the exporting country is among ECOWAS and the importing country is from the rest of the world, and 0 if the exporting country is from the rest of the world and the importing country is from the ECOWAS. The signs of coefficients relating to the ECOWAS variables will be useful to verify if there is trade creation and import and export diversion within the integration region. After all, it is known that there is trade creation when intra-regional trade increases without a reduction in imports from the rest of the world, which means that $\beta_{13} \geq 0$ and $\beta_{14} \geq 0$ when the tendency to import from the rest of the world reduces while the overall tendency to trade with other members of the union increases, there is diversion of imports; in this case $\beta_{13} \geq 0$ and $\beta_{14} \angle 0$. The diversion of exports takes place when the propensity to export to the rest of the world reduces while the overall tendency to trade with other members of the Union increases; that is, $\beta_{13} \geq 0$ and $\beta_{15} \angle 0$.

Except for the dummy variable all the other variables are expressed in natural logarithm. It follows that the estimated coefficient of these variables are directly interpreted as elasticities. On the other hand the elasticities of the qualitative variables are given as the exponential of the estimated coefficients. Moreover, the estimation of equation (10) with the data about all the importing countries (all countries of ECOWAS, and other countries from the rest of the world) will enable us to obtain the coefficients estimated on the ECOWAS variable in order to appreciate whether the unilateral and preferential reforms implemented in these countries have had an impact on intra-ECOWAS trade.

7. Discussion

The gravity model relates bilateral trade flow to the gross domestic products (GDP) levels of the countries and their geographic distance. GDP reflects the market size in both countries as a measure of 'economic mass'. The market size of the importing country reflects the potential supply and diversity of goods from that country; geographic distance reflects resistance to bilateral trade. Gravity model is augmented to include variables like per capita GDP, population, infrastructures, contiguity, landlocked, language, foreign direct investment (FDI), and many others trade determinants that can be added directly or as a dummy. Trade theories were also been tested by augmented into standard gravity model. The model was used in analyzing values obtain on aggregate or disaggregate goods and of recent commonly applied in trade of agricultural products. Effects of regional trade agreements are determine by introducing the variables into gravity equation which entails whether a regional bloc is trade creating or trade diverting with another trade bloc.

8. Conclusion

This paper critically reviewed the theoretical, analytical and methodological studies exploiting the gravity model in trade flow. Based on its robust performance, the gravity model has been particularly successful and popular among researchers, despite past criticism on its theoretical background. It has been widely employed in analyzing trade in areas of all commodities and agricultural products. Therefore, researchers are urged to embark on ways of

improving trade between or among regions by determining economic, social and institutional variables that influence trade through application of gravity model.

ACKNOWLEDGEMENT:

This article is derived from the first author's ongoing Ph.D thesis writing. The other authors are the thesis supervisors. The authors acknowledge the useful comments from the departmental postgraduate committee.

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