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GUINEA-BISSAU TRADE: A PANEL DATA ANALYSIS

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ABSTRACT

Guinea-Bissau became independent in 1973 and since then governments have elaborated different development policies to promote the country's comparative advantages. In the mid-1990s, they promoted the liberalization of the economy and actually the country belongs to several regional economic blocs and it increased its insertion into new extra-continental markets. The purpose of this study is to analyze the determinants of Guinea-Bissau's exports for the 5 trading partners in the period 1990-2014, using static and panel data dynamic models based on the traditional specification and extended gravity equation of international trade. The static panel data methods suggest that exports react positively to the currency depreciation, incomes, population growth, common language, colonial heritage and geographical proximity (border effects), but decrease with the increase of trade cost, which is consistent with the conventional trade literature. The Arellano and Bond (1991) dynamic panel data model confirms this pattern, also showing a positive correlation between exports and household consumption and investment. These results are important in guiding the country's international trade policies as they suggest the importance of the variables that recur in this standard trade literature.

Contribution/ Originality: This study contributes to the existing literature by analyzing the determinants of Guinea-Bissau's exports for the 5 trading partners in the period 1990-2014, using static and panel data dynamic models based on the traditional specification and extended gravity equation of international trade.

1. INTRODUCTION

One of the most successful tools in international trade analysis is the gravity models (Eichengreen and Irwin, 1998; Wall, 1999; Polder and Meijeren, 2000; Feenstra *et al.*, 2001). A basic idea of the traditional gravitational models of international trade is analogous to Newton's law of gravity (see for example (Stewart, 1948; Coleho, 1983; Oguledo and MacPhee, 1994; Sevela, 2002)). The application of the Newtonian concept to the analysis of trade flows based on the notion that the volume of economic interactions that occur in geographic regions bears a very close relation with the specific factors of each region. These factors represent a broader set of economic activities of the countries engaged in trade, such as productivity and international transport costs, including the ratio between cif and FOB value or another more general measure of costs (Aitken, 1973; Geraci and Prewo, 1977; Bergstrand, 1985). These models based on two basic assumptions, namely supply and demand of countries determine trade flows, but both attraction factors and resistance to trade factors influenced the latter. On the one hand, the size of the markets and the productive structures represent the factors of attraction. In other words, how much a country

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can offer usually depends on the size of its market as well as its production. Small countries, which in isolation do not affect relative prices, eventually, trade little because their market sizes are comparatively smaller. On the other one, the geographical distance between two countries is a variable that represents the factors of natural resistance to trade.

Considering this idea, we applied an extended gravity model to analyze the trade of a small and poor country, but which has a significant participation both in trade and in the world production of cashew nuts. The country chosen was Guinea-Bissau, which ranked as one of the least developed countries because of the relatively very low performance of its economy, which had a per capita income of less than US $ 200 in 2016. This value, however, was not out of the reality of many African countries. For instance, in the early 1990s, countries such as Benin, former Sudan, and Uganda had per capita incomes in the same range, and far lower than those in advanced economies. Australia, Norway, United States, and Switzerland already had GDP per capita above US $ 23,954 (World Bank, 2017). The low performance of the Guinean economy greatly reflected the technical backwardness of its sectors, which did not develop almost five decades of independence. But with growing awareness country's lagging behind its largely British and French neighbors, development policies in the 1990s were directed towards introducing new products and modernization of the agricultural sector with comparative advantages, aiming to increase the participation of this sector in the composition of domestic added value and to Promote new export-oriented crops. Among the main productions were peanuts and palm oil, and domestic trade was concentrated in large cities. The characteristic of the post-independence trade network in Guinean was marked by a large coexistence of a preponderant public sector and small private traders, since the centralization of the decisions initiated soon after independence gave the nationalization of the companies that operated in the domestic market (Mendes and Jawad, 1986).

Regarding to the foreign trade, Guinea-Bissau's trading partners were extra-continental countries, of which Portugal had a larger share and exports were also predominantly agricultural products, with all manufactured products coming from abroad, explaining the country's balance of payments evolution, which had average annual deficit above of US$ 50 million since 1974 (World Bank, 2017).

The unfavorable evolution of the external accounts combined with the persistent drought that affected the entire rural area of the country, greatly affecting production, has led to the adoption of some stabilization measures in order to strengthen the modernization of the first sector and restructure trade activities. This modernization would take place through government programs to finance farmers and import machinery and equipment used in production. However, in the lack of financial institutions, both the financing of imports of machinery and equipment and associated items and that of small farmers were financed through external loans, which in turn aggravated balance of payments deficits.

In fact, the restructuring of commercial activities was motivated by the situation of the economy and its main purpose has been to give this sector an important role in the country's development process, implying a transformation of public bodies, such as public enterprises and the commerce ministry, giving greater scope to the operation of private agents (Sanha, 1988).

Nowadays, one of the most striking features of the country's economic development process since the 1990s is the growing international insertion of its economy. It started since then the country dependence on trade activities, mainly of cashew nut exports, which is now being produced and destined in large quantities not only for traditional European markets but also for new consumer markets, such as India and Singapore.

In view of this, this study seeks to address main factors that influence the exports of Guinea-Bissau. The main motivation of this research is associated with the fact that, for our knowledge, few (or no) studies have been found for purposes of empirically assessing Guinea-Bissau's trade with its trading partners. The achievement of this work can fill this empirical gap.

The purpose of this study is to analyze the export determinants of Guinea-Bissau for the five trading partners in the period 1990-2014, using static and dynamic panel data models based on the extended specification of the gravitational equation of international trade.

The econometric techniques commonly used in the estimation of static panel models refer to the pooled, Fixed Effects and Random Effects methods.

However, given the problems of time invariant variables and because there is no strong justification for the assumption that unobserved individual effects are uncorrelated with the control variables, following the convention, the first strategy was to perform the usual tests that indicate the static panel approach that best fits to the data. In addition, because the OLS parameter estimator of the log-linearized gravity models was biased under heteroscedasticity, some additional controls were introduced, and the Poisson Pseudo-Maximum Likelihood estimation technique was applied.

In the presence of endogeneity in models involving expectations, Chan *et al.* (2014) suggest the use of the Generalized Method of Moments (GMM). The second econometric strategy of the study was to adopt the dynamic panel method of Arellano and Bond (1991) characterized by the existence of lagged values in levels of the dependent variable.

The remainder of the paper is structured in four sections, in addition to that introductory section. An overview of the Guinean external sector is made in Section 2. Section 3 presents a summary of the empirical literature on gravitational models. Section 4 is intended to present gravity model of international trade and describing the extended one to be estimated. Section 4 discusses the results of the estimated model. The conclusions are presented in Section 6.

2. OVERVIEW ON EXTERNAL SECTOR IN GUINEA-BISSAU

An observable aspect from mid-1990 was the change in the behavior of the Guinea-Bissau government regarding to the practice of free trade expressed in the strategies of international insertion of the economy through the integration of regional and multilateral trade agreements. The country's entry into the Organization like World Trade Organization (WTO) in 1995 and the West African Economic and Monetary Union (WAEMU) in 1997 highlighted these strategies.

From this, according to Mendes and Jawad (1986) since the independence, the trade sector has been placed as a link of national economic integration, having received government financing for its restructuring. These funds were instrumental in opening up trade since 1984 and carried out from 1986 onwards with the structural adjustment program. The first symptom of trade liberalization was the progressive expansion of Guinean foreign trade. In fact, analyzing the flow of foreign trade in the period before and after 1990, it is possible to verify that both exports and imports grew at significantly high levels, with export growth reaching a rate of approximately 53% in 1990 in regarding to 1980 (UNCTAD, 2015).

However, the main exports of Guinea-Bissau are mostly raw materials, of which cashew nuts are the most representative. This information can best be visualized in Figure 1, showing the distribution of exports and imports by product group. It shows that low value-added raw materials represented more than 99% of Guinean exports. It is also possible to observe that the country does not export intermediate goods, consumer goods and capital goods, and the participation of this group of products in the exporting grid is very low.
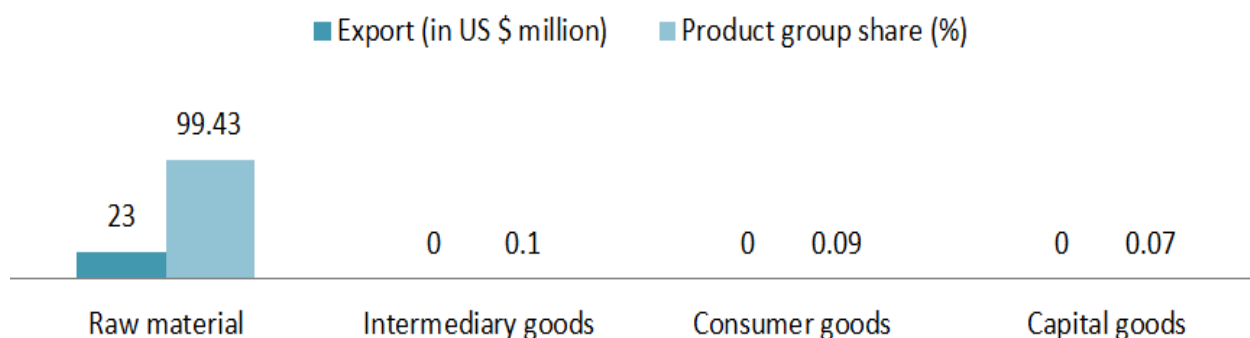
Figure –1 .Guinean exports by value added (in US $ million) and product group participation in the exporting grade (%).
Source: Prepared by authors based on World Integrated Trade Solution (WITS).

The information extracted in Guinea-Bissau's social accounting matrix of 2007 clearly shows the predominance of cashew nuts among exported agricultural products Figure 2.
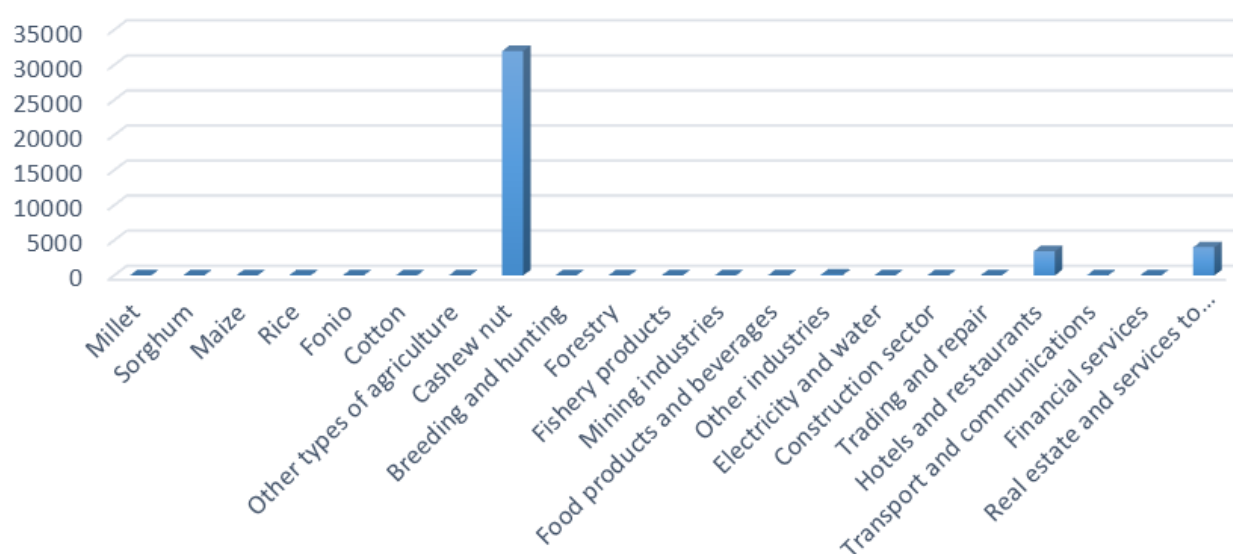

Figure-2. Export by product
Source: Prepared by authors based on Social Account Matrix of Guinea-Bissau.

The main importations are consumer goods (74.53%), intermediate goods (11.65%) and capital goods (10.21%); raw materials importations are relatively low, with an average annual value in the period 1990-2010 below US $ 3 million Figure 3.
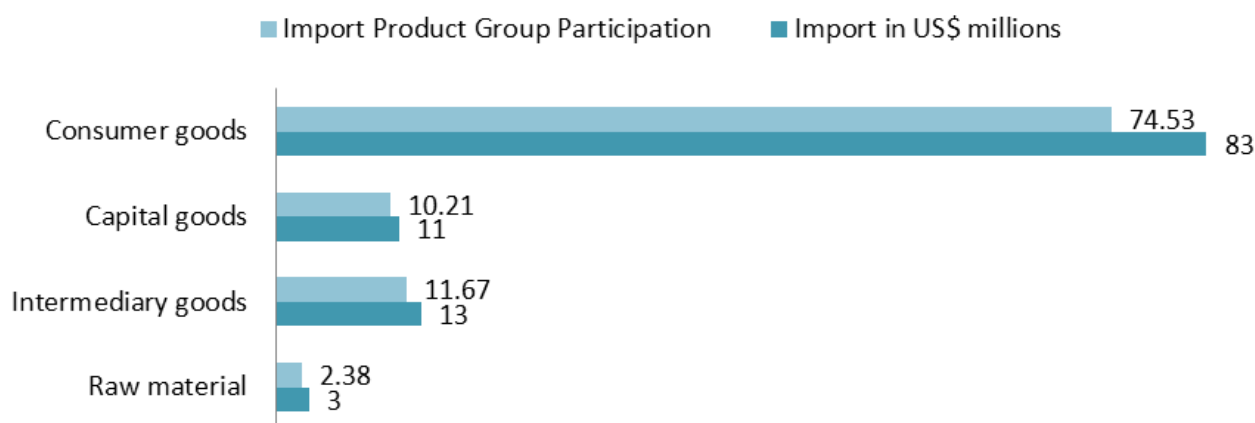

Figure-3. Import by value added (in US $ million) and share of product group in the export grid (%).
Source: Prepared by authors based on WITS.

The second trait of change after the economic opening in 1986 refers to the change in the flow of exports. Prior to the opening the exports were mostly directed to European countries particularly to Portugal. With the opening, they started to move to new markets, mainly Asian, especially to Singapore and India (see Figure 4 which shows the geographic distribution of Guinea-Bissau international trade).
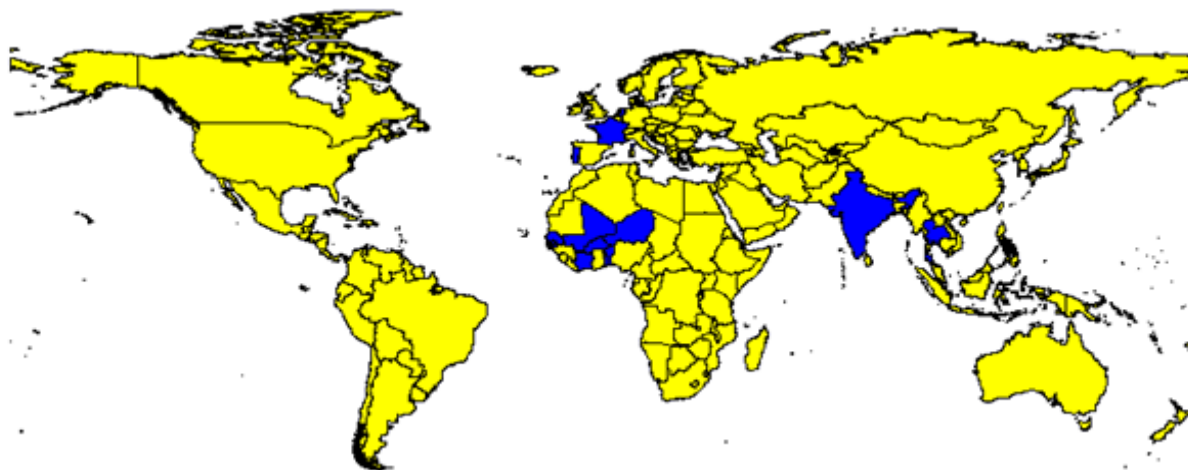

Figure-4. The distribution of Guinea-Bissau's international trade: the top partners.
Source: Prepared by author based on Correlates of War, 2008 (COW) project.

Trade between this two countries and Guinea-Bissau began in the late 1980s, when the country began to export cashew nuts to this market due to the countries' significant economic growth (an average of over 8% Since 1996) which has led to increased demand for raw materials for African countries. Because of Asian's growing demand for agricultural products, since 2007, more than 90% of the Guinean supply of fresh cashew nuts is destined for that market (Guine-Bissau, 2010). Complementary products exported to India include edible vegetables and fruits, roots and tubers, citrus peel and melons. However, the latter's share of Guinea's exports to the Indian market is relatively low, with an average annual value of no more than US $ 123,927 million (ITC, 2015). Nowadays, India is the main trade partner of Guinea, with a share of bilateral trade exceeding 86%, while Portugal is only 0.52% and Singapore 12.10% Figure 5.
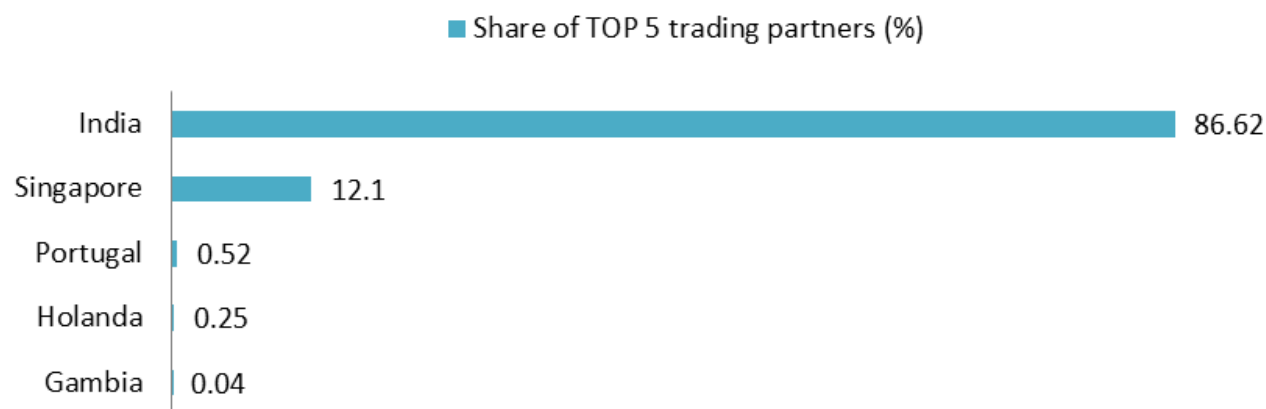
Figure-5. Guinea-Bissau's main trading partners (%).
Source: Prepared by author based on WITS.

Although India being the main recipient of the production, the share of its products in Guinean import is relatively low. For example, in 2012, Guinea's main imports from India were led by plastic products, nuclear machines and reactors, pharmaceuticals, electrical and electronic equipment, iron and steel and alcoholic beverages,

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totaling only $ 11,169 million, Which explains a trade surplus of US $ 112,758 million favorable to Guinea-Bissau (ITC, 2015).

The main exporters to Guinea-Bissau are in the majority European countries with highlight to Portugal, Holland and France. However, due to geographical proximity, the share of Senegalese products in the Guinean import grid is predominant, reaching an average annual value of US $ 46 million and an import share of over 40% Figure 6. Portugal, for its part, is the second largest exporter to Guinea-Bissau, with a share of over 37% and an annual value of US $ 42 million, while France and the Netherlands have their respective shareholdings and trade values of 3.24 % and 5.97% and US $ 4 and US $ 7 million.
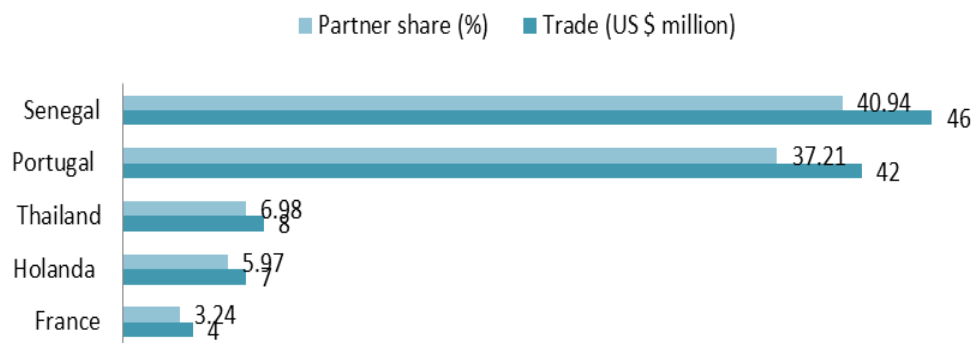

Figure-6. Import source in US $ million and partner share (%).
Source: Prepared by author based on WITS.

In general, the share of imports of goods and services in domestic GDP is higher than the exports one. In 2010, imports as a proportion of GDP was 31.90% and the following year rose to 34.66%, an increase of 2.76 points percent. In the same period, the export share was only 16.5%, which is equal to the average of the 1990s (World Bank, 2017) which has not diminished because the country has been exporting an average of more than 78,066 tons of cashew nuts each year since 1990.

In addition, it is worth noting that the potential of Guinea-Bissau's regional trade has increased with country integration into the Economic Community of West African States (ECOWAS) in the mid-1990s. The drawing for regional blocs in Africa is shown in Figure 7. Our intention is not to do a detailed analysis of these communities, but rather to provide a view of trade geography and show Guinea-Bissau's potential to take advantage of regional trade gains that ECOWAS, with a GDP of relatively USD 1,400,172, can offer.
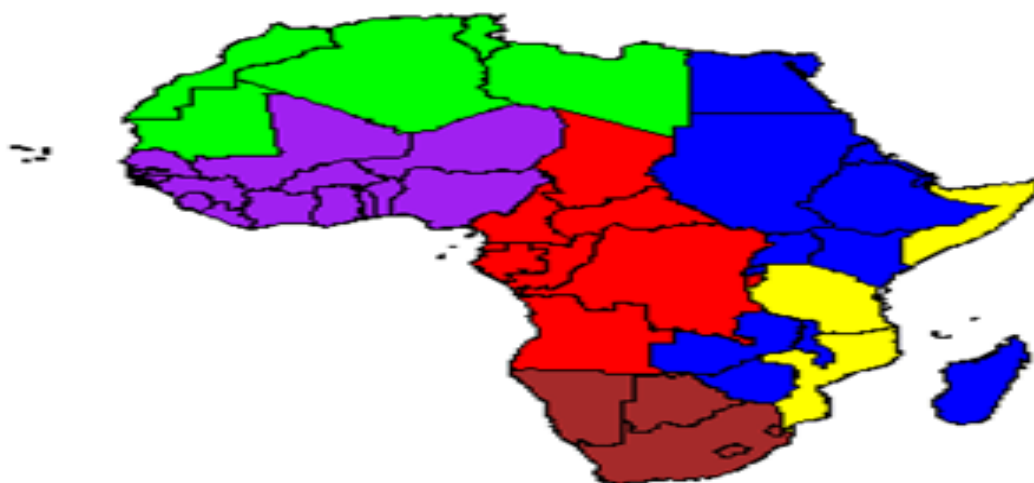

Figure-7. As cinco principais comunidades econômicas na África.
Source: Prepared by author based on Correlates of War, 2008 (COW) project.

We have selected the five most important economic communities and have each pictured a different color. Green shows the Arab Maghreb Union (AMU), which is a trade and economic policy agreement between the Arab countries of the Maghreb in North Africa, encompassing five countries, namely Algeria, Libya, Mauritania, Morocco and Tunisia together having a per capita GDP capita of USD 5,789.

The purple is ECOWAS, an economic community of 15 West African countries, such as Cape Verde, Benin, Burkina Faso, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo.

The GDP per capita of the ECOWAS Zone is USD 3,789. The part painted in blue refers to the Common Market for Eastern and Southern Africa (COMESA), which is a free trade area containing 19 countries from Libya to Swaziland and has a GDP per capita of USD 1,912. The color in red depicts the Economic Community of Central African States (ECCAS), which is an Economic Union of the African Union for the promotion of regional economic cooperation in Central Africa, comprising 10 countries with a GDP per capita of USD 1,501. Finally, the brown color refers to the Southern African Customs Union (SACU), a customs union between the five countries of Southern Africa (Botswana, Lesotho, Namibia, South Africa and Swaziland), together with a per capita GDP of USD 10,569, the highest among the communities depicted here (World Bank, 2017).

3. GRAVITY MODELS: A BRIEF LITERATURE REVIEW

The first application of Newton's gravity equation in empirical studies of international trade was made by Tinbergen (1962) which showed that the size of the markets and the productive structure of the countries are fundamental to boost the commercial transactions, which, in turn, respond negatively to transport costs.

Anderson (1979) study, which provided the first microeconomic foundations for these models, also generated a great deal of interest from economists in bilateral trade studies and their policy implications. Among the studies commonly seen, there are those applied mainly to a single country, but also to multiple countries and to economic blocks (see (Carrere, 2006; Erdem and Nazliogluy, 2008; Idsardi, 2010; Moise, 2017)).

For example, Glick and Rose (2002) show that, assuming symmetry, countries that start using a common currency experience a near doubling of bilateral trade. Sevela (2002) gravitational model estimates for bilateral trade flows in the Czech Republic (1999-2001) show that gross national income, national income per capita and geographical distance between the capitals of these economies were statistically significant at 5%.

Eichengreen and Irwin (1998) have examined the importance of regional agreements for the pattern of trade using the gravity approach to disaggregated export flows. The model was estimated through the data of commercial flows between wars (1928 and 1938) and postwar (1949, 1954 and 1964). Elasticities were estimated for each of the years, in both logarithmic and level differences; and the coefficients show some similarity and were significant for most of the years. However, in 1949 the per capita income coefficient was not significant. In the authors' view, this occurred for two following reasons: (i) intra-industry trade depressed in World War II, with the slow progress of reconstruction in Europe, which prevented the countries from exporting manufactured products at the level traditionally directed to the United States, and (ii) the dollar shortage prevented the intense flow of trade between Europe and the member States.

They show that, in the inter-war period, 90% of trade was explained by the gross incomes of the rich countries and 33% by their per capita incomes, while the distance and the border influenced respectively -78% and 79% of trade between countries that are now members of the European economic community and between European countries and the United States. As early as 1964, this flow of trade is explained by 27% of incomes, 20% of incomes per capita and -30% of distance and 1% of border.

In the context of the African countries, Longo and Sekkat (2004) estimate that in addition to traditional gravity variables, poor infrastructure, poor economic policy management and internal political tensions have a negative impact on trade between African countries. Such authors sow obstacles as specific to intra-African trade as they

have no impact on African trade with developed countries. Meanwhile, Hatab *et al.* (2010) analyze the main determinants of Egypt's agricultural exports to its main trading partners using the gravitational approach to trade, obtaining very important results for the formulation of trade policies aimed at promoting Egypt's agricultural exports to the world market.

4. EMPIRICAL METHODS

The trade gravity equation in its deterministic version specifies the export flows of k goods from country i to country j as follows:

$$X_{ijk} = A_{ij} \times Y_i . Y_j \times \frac{N_i N_j}{D_{ij}} \qquad (1)$$

where A_{ij} is a proportionality factor of any trade; Y_i is total income of country i; Y_j indicates the income of the importing country j; N_i e N_j are populations of i and j; and D_{ij}^{-1} is the inverse of the trade cost factor from country i to country j.

Definition 1: *The standard gravity model of trade*: The pattern of international trade satisfies the gravity representation if, and only if, satisfies Equation 1.

4.1. Econometric Gravity Model

The stochastic version of the gravitational model adopted in this study has the following compact structure:

$$X_{ijk} = \alpha_0 Y_{ij}^{\alpha_1} N_{ij}^{\alpha_2} C_{ijk}^{\alpha_3} Rat^{\alpha_4}{}_{ij} \varepsilon_{ijk} \qquad (2)$$

This is the equation affectionately estimated in bilateral trade analysis. Where X_{ijk} the volume of Guinea-Bissau's exports to the main trading partners (Portugal, Gambia, India, Singapore and Senegal). Y_{ii} the per capita income of Guinea-Bissau and its five partners; N_{ij} is its populations; C_{ij} is the transportation cost; Rat_{ij} is the exchange rate; α_0, α_1, α_2, α_3 e α_4 are unknown parameters to be estimated; and ε_{ijk} is a normally distributed and stochastically independent error term, that is, its first conditional moment is given by:

$$E\left[\varepsilon_{ijk} / Y_{ij}, N_{ij}, C_{ijk}, Rat_{ij}\right] = 0 \qquad (3)$$

Equation 3 implies that:

$$E\left[X_{ijk} / Y_{ij}, N_{ij}, C_{ijk}, Rat_{ij}\right] = \alpha_0 Y_{ij}^{\alpha_1} N_{ij}^{\alpha_2} C_{ijk}^{\alpha_3} Rat^{\alpha_4}{}_{ij} \qquad (4)$$

The variables per capita incomes and populations are of trade-attraction variables and theoretically must have coefficients with positive signs; while cost is a trade-resistance variable and, thus, its estimated coefficient is expected to be negative. In addition, when the exchange rate increases, it is said that there is depreciation

(appreciation) of the currency of the exporting (importer) country. On the other hand, if the exchange rate tends to zero, exports are insignificant. Therefore, α_4 depends on exchange rate is either valued or devalued.

4.1.1. Econometric Approaches

The gravity model shown previously will be estimated through panel data. According to Greene (1993); Hsiao (2003) the main advantage of panel data is that they allow the researcher great flexibility in modeling differences in behavior between individuals, providing a rich environment for the development of estimation techniques and analysis of theoretical results.

A panel model can be static or dynamic, each having the different estimation technique. The common econometric techniques most used for the analysis of static panel data refer to the approaches of Fixed Effects (FE), Random Effects (RE), and the pooled method (for more details, see (Greene, 1993; Stock and Watson, 2004; Cheng and Wall, 2005)).

However, both techniques have some basic limitations. For instance, in the context of international trade, since country preferences vary very little in time, using FE means estimating them with large standard error (Kokko and Tingvall, 2000). Cheng and Wall (2005) argued that the estimation of the trade gravity model using the pooled model can provide biased estimates because trade is influenced by many other factors not observed and associated with country characteristics and that can effectively influence the estimates (see also Harris and Matyas (1998)). Meanwhile, the assumption of the RE model that unobserved individual effects are uncorrelated with the regressors has no strong justification and if the regressors have any correlation with individual unobserved effects the treatment of RE may suffer with inconsistency (Greene, 1993).

The following panel model was postulated:

$$X_{it} = T_{it}\beta + \lambda_i + \tau_i + \varepsilon_{it} \tag{5}$$

where X_{it} is the model-dependent variable, i.e, the annual export volume; T_{it} is a vector of time-variant variables, including the log of incomes, costs, and populations, assumed to be strictly exogenous, i.e, $T_{it} = (Y_{ij}, N_{ij}, C_{ijk}, Rat_{ij})$; λ_i are the fixed effects of the country; and τ_i are the period fixed effects; and ε_{it} is defined as before.

Our first econometric strategy was to estimate Equation 5 and perform the usual tests (F / Chow, Lagrange multiplier and Hausman), which indicated the best static panel model which best fits the data (Davidson and Mackinnon, 1993; Greene, 1993;2012).

Combining Equations 4 and 5 we have the general model given by:

$$\ln X_{ijk} = \ln \alpha_0 + \alpha_1 \ln Y_{ij} + \alpha_2 \ln N_{ij} + \alpha_3 \ln C_{ij} + \alpha_4 \ln Rat_{ij} + \alpha_5 \lambda_i + \alpha_6 \tau_i + \ln \varepsilon_{ij} \tag{6}$$

It is often argued that, although acknowledging the existence of Jensen's inequality, many empirical works ignore the fact that the OLS estimator of log-linearized parameters, such as gravity models, can be biased under heteroscedasticity (Silva and Tenreyro, 2006).

To circumvent this potential problem, a series of controls were introduced in the general model, such as language, border effect and colonial heritage, and the Poisson Pseudo-Maximum Likelihood (PPML) technique was used.

The advantage of using the PPML estimator in the international trade model is not only since it allows to be taken in account existing heteroscedasticity, but also because it provides unbiased estimates even in the presence of many zeros in the dependent variable (Silva and Tenreyro, 2006).

Since the quantity exported depends not only on current income and costs, but also on a broader set of factors including the dynamics of the international market itself, the quality of exported products, the period and time in which trade takes place. etc., there are reasons to be suspicious of the existence of endogeneity which, according to Greene (2012) is common in models involving expectations (see also Florens *et al.* (2007)). For Durlauf *et al.* (2004) if the variables are endogenously determined in the economic sense, there are also chances that they are technically endogenous.

We used the Hausman (1978) test to detect endogeneity. Concern about endogeneity led many authors to propose the use of instrumental variables to estimate the coefficients of the model (Cyrus, 2002). In the context of gravitational models, Chan *et al.* (2014) suggest the use of the Generalized Moments Method (GMM) to deal with the commonly present endogeneity. Thus, the second econometric strategy was to adopt a dynamic panel data model a la (Arellano and Bond, 1991).

The dynamic model with exogenous regressors is expressed as follows:

$$y_{it} = x_{i,t}^{'}\beta + \delta y_{i,t-1} + \lambda_i + v_{it} \tag{7}$$

where y_{it} is the dependent variable of the model, which represents the volume of exports; $y_{i,t-1}$ is the same flow in the previous period. The idea of $y_{i,t-1}$ is that in the economy the achievements of a series or shocks in the economy in the past period have impacts not only in the current period, but also in the future. In other words, the observed results of the quantity exported in the present (y_{it}) are not only due to the current situation, but, above all, to past exports ($y_{i,t-1}$); $x_{it} = (\delta y_{i,t-1} x_{it}^{'})^{'}$ is a $k \times 1$ vector of explanatory variables; As before, λ_i is a set of no-observed country-specific factors.

Taking the first and fourth differences from Equation 7, we have, respectively

$$y_{i,t} - y_{i,t-1} = (x_{i,t} - x_{i,t-1})^{'}\beta + \delta(y_{i,t-1} - y_{i,t-2}) + v_{i,t} - v_{i,t-1} \tag{8}$$

$$y_{i,4} - y_{i,3} = (x_{i,4} - x_{i,3})^{'}\beta + \delta(y_{i,3} - y_{i,2}) + v_{i,4} - v_{i,3} \tag{9}$$

These latter equations provide particularly interesting information for estimation. The differentiation of the variables requires assuming a starting point in which the data generating process begins, since the valid instrument form (IV-instrumental variables) becomes entirely dependent on the condition of the moments, which allows to identify if the regressors are predetermined or if they are simply strictly exogenous.

It is possible to observed that ($y_{i,3} - y_{i,2}$) is correlated with ($v_{i,4} - v_{i,3}$), despite the hypothesis that the error term in Equation 6 in level is not correlated. However, there is no correlation between ($y_{i,1}$ and $y_{i,2}$) and ($v_{i,4} - v_{i,3}$). Therefore, we consider $y_{i,1}$ and $y_{i,2}$ as instruments for ($y_{i,3} - y_{i,2}$).

As noted, the dependent variable for the individual can be specified in terms of their values from the previous period (see Cameron and TrivediI (2009)). Our specification was based on only the first four differences, and the data generating process starting at time t = 1 and, in each differentiation, we have a missed observation. This type

of specification requires some theoretical and practical care. From the theoretical point of view, notwithstanding the lag of a policy, the more one goes back in time, the lesser justifications for economic relations between the variables of interest begin to be lost. In a structural model, a perfect causal relationship of exports from four years ago to current exports could not be established perfectly in a structural model, given the adjustment effects of other macroeconomic variables that possibly affect trade in a reasonable period. The trading partners' investment represented by gross capital formation is a good additional regressor to assess exports, as empirical studies on international trade have amply pointed out a positive correlation between increased productivity and / or economic growth and the high degree of exposure of the country to trade (Choudry and Hakura, 2000; Bernard *et al.*, 2003; Andersson *et al.*, 2007). Thus, the dynamic model was specified including two variables, such as the consumption of the families of the importing countries and the investment. The inclusion of consumer spending as an exogenous regressor is also justified because, over the life horizon, households allocate their consumption between domestic goods and imported goods, which is compatible with the assumptions of the gravitational models that admit the Armington elasticity.

Throughout this study, we have at least five estimators. In the static panel, we used the ordinary least squares estimators (OLS) derived from the pooled specification, the least squares estimator of the dummy variables (LSDV) for the fixed effects method, the generalized least squares estimator (GLS) considering the method of Random Effects and the Pseudo-Maximum Likehood (PPML) estimator. In the second strategy resulting from the use of the dynamic panel data model, an additional estimator was used, the estimator based on the generalized method of moments (GMM).

4.2. Data

The survey data were collected from two sources. The volume of exports, populations, gross capital formation, household consumption and data on per capita incomes are among the indicators of the world bank. Except for population, all model variables Table 1 were expressed in dollars. The total flow of exports is computed considering the share of each of the five Guinea-Bissau's partners in total trade.

Table-1. Variables of the Static and dynamic models.

Specification	Variables in log
Static panel Equation 6	Guinea-Bissau and partners per capita incomes (Y_{ij}); Guinea-Bissau and partners populations (N_{ij}); Transport costs (C_{ij}); Exchange rate (Rat_{ij}) and period and time fixed effects (language, border effects and colonial heritage).
Dynamic panel Equation 9	Differences in levels of the variables of Equation 6; Household consumption (CF_j) and Gross Capital Formation (FBK_{ij}). Instruments: Second difference and third difference of exports ($2d\_X_{ij}$ e $3d\_X_{ij}$) and another suggested instrument.

The exchange rate data are from the Central Bank of West African States (BCEAO) and express the US Dollar / CFA Franc (West African States Economic Community Currency).

The definition of distance, such as a proxy of transport cost, varies from study to study. In the present case, the distance in nautical miles between Guinea-Bissau and its partners was considered. All series of the model are of annual frequencies and were estimated in logarithms. For the estimation process we a licensed program, Stata 2012.

5. RESULTS AND DISCUSSIONS

In this section, we present the estimates and discuss the results of the static and dynamic models represented by Equations 6 and 9 respectively. In the first subsection, the three static panel estimation methods were compared using chow, LM and Hausman tests. The following subsection discussed the results of the estimates.

5.1. Preliminary Tests

Since the probability of the Chow test is very low, we reject the null hypothesis that the pooled method is preferable to that of fixed effects Table 2. Through the Hausman test, it is possible to reject the null hypothesis at the conventional significance levels that the OLS and GLS estimates of the β parameter are significantly different, that is, the random effects method is rejected in favor of the dummy variables one. Meanwhile, the probability of the Breusch-Pagan LM test is equal to 1, being statistically insignificant, leading to do not reject the null hypothesis, which points to the pooled rather than the random effects method.

Table-2. Preliminary tests for selection of panel data model.

Test	Model	Estimator	Prob > χ^2	Decision critera
Chow	Pooled X FE	OLS X LSDV	0.00	Rejected H_0
Hausman	RE X FE	GLS X LSDV	0.00	Rejected H_0
Breusch-Pagan	Pooled X RE	OLS X GLS	1.00	No Rejected H_0

The tests performed provided results in terms of which is the best estimator to use. The LSDV estimator is preferable to GLS and the OLS estimator, which in turn is significantly preferable to GLS. This pattern suggests that it is better to use the LSDV estimator and that the GLS is worse and therefore it is not recommended to specify the panel model assuming that the specific group effects are not correlated with the regressors. However, both estimators were considered in the estimation process, because although not all such procedures control heterogeneous characteristics, Baltagi (2013) shows that panel data alone has the benefits of controlling individual heterogeneities by suggesting that firms, states or countries are heterogeneous.

Considering the three methods of static panel models, we suppose that the hypotheses in the classic linear regression model such as that of non-perfect collinearity between the regressors, absence of residual autocorrelation and homoscedasticity are valid. Both hypotheses were evaluated or tested using traditional procedures or tests Table 3.

Table-3. Multicollinearity and autocorrelation test and heteroscedasticity of residues.

Multicollinearity		Autocorrelation	Group heteroscedasticity	Heteroscedasticity
FIV	TOL	Wooldridge	Wald	White
24,63	0,0406	Prob> χ^2 = 0.2957	Prob> χ^2 = 0.000	Prob> χ^2 = 0.000

The probability of the Wooldridge test is high, allowing no to reject the null hypothesis of the absence of first order autocorrelation in the residues. By the Wald test applied to fixed effects models and random effects it is possible to reject the null hypothesis that the variances are the same for all groups; In other words, the variances are the same for each group, since the probability of the test is very low. The White test for the pooled specification suggests rejection of the null homoscedasticity hypothesis of the panel data model. To correct this problem, we re-estimated the model using robust standard errors with White's heteroscedasticity correction, as discussed in the following subsection.

The inflation factor of the variance of 24.63 suggests that there is collinearity in the variable cost, since this value provides a tolerance factor of 0.278, far from zero.

5.2. Estimation and Interpretation of the Models

In each row or column of Table 4, the values out-of-parenthesis are the estimated coefficients, and the respective standard-errors are within the parentheses. Columns 1 to 3 report the estimates of Equation 6 through the Pooled (OLS), fixed effects (LSDV) and random effects (GLS) methods. Column 4 shows White's robust estimates, while Column 5 reports the estimates obtained using the feasible generalized least squares (FGLS) method.

All methods show a positive and statistically significant correlation between exports and income. The estimated coefficients for income, population, cost and exchange rate in Columns 1, 3 and 5 are similar and significant at the 1% level, but small. A one percent increase in income increases exports by 0.60 percent. Population growth is associated with a 0.08 points percent increase in exports, consistent with Farias and Hidalgo (2012) findings. They show that a large population of the developed exporting country has the most diversified consumption and demand for a larger fraction of goods produced abroad than the population of small island countries whose external demand is limited to basic needs. The transportation cost variation of 1 percent has an impact of -1.25 points percent on exports, while the effect of the exchange depreciation on the export flow is 1.55 points percent.

The result in Column 2 obtained through the fixed effects method implies that a 1 percent increase in income is significantly associated with an increase of 0.82 points percent in exports, consistent with the magnitudes obtained by Zhu and Gu (2009). They showed that increasing domestic and foreign incomes by 1 percent increased Chinese exports by 0.88 and 0.86 points percent, respectively. In the same column, the respective impacts of population growth and exchange rate variation are 2.93 and 0.66. Compared to White's robust OLS, GLS and standard error estimators, the income impact is greater when the least squares estimator of the dummy variables is applied, but the latter underestimates the effects of exchange rate volatility on exports by 0.90 points percent.

Table-4. Static panel model – Equation 6.

Variable\Specification	(1) OLS	(2) LSDV	(3) GLS	(4) White robust	(5) FGLS
Y_{ij}	0.59287 $(0.0785)^{***}$	0.8226 $(0.0940)^{***}$	0.5928 $(0.0785)^{***}$	0.5928 $(0.05705)^{***}$	0.8465 $(0.0920)^{***}$
N_{ij}	0.0971 $(0.0275)^{***}$	2.9308 $(0.2799)^{***}$	0.0971 $(0.0275)^{***}$	0.0971 $(0.0207)^{***}$	2.7774 $(0.2691)^{***}$
C_{ij}	-1.2481 $(0.1725)^{***}$	-	-1.2481 $(0.1725)^{***}$	-1.2481 $(0.1387)^{***}$	-1.9066 (1.6639)
Rat_{ij}	1.5535 $(0.0772)^{***}$	0.6621 (0.1204)	1.5535 $(0.0772)^{***}$	1.5535 $(0.0600)^{***}$	0.6912 $(0.1184)^{***}$
Constant α_0	13.4893 $(0.5311)^{***}$	-41.3064 $(4.0776)^{***}$	13.4893 $(0.5311)^{***}$	13.4893 $(0.5680)^{***}$	-24.6458 $(13.1260)^{**}$
R^2	0.9594				
Residual	58.400				
N	150	150	150	150	150
Number of countries	6	6	6	6	6

Note: Observations are from 1990 to 2014. The dependent variable is export volume. As the distance represents the transport costs and is fixed between countries, then by the LSDV estimator in Column 3 the cost was excluded. * $P < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

Column 5 reports the estimates when using FGLS. The estimates for income are 0.25 times greater than obtained through OLS, GLS and the White procedure and 0.024 slightly higher than the LSDV estimates. Also by FGLS, exports are positively correlated with income. A 1 percent change in income increases exports by 0.84 percent points over the period considered. Population growth and 1 percent currency depreciation lead to a

respective trade increase of 2.77 and 0.70 points percent, while the same cost variation has a negative effect of -1.90 points percent on exports.

Table 4 reports the estimates when extending the static panel model represented by Equation 6 through the inclusion of controls such as language, border effects, and colonial heritage. Language and boundaries are the model's invariant variables that affect trade. The colonial heritage captured by institutional quality or historical links between the colony and the metropolis may signal a different pattern of trade between colonized and non-colonized countries. Both methods in the columns show that the estimated coefficients of income increased or remained slightly constant. The largest gain in terms of magnitude occurred in Column 1, which now shows that by increasing income by 1 percent, exports increase by 1.15 points percent. However, the coefficients of exchange rate and the colonial heritage dummy estimated by OLS, LSDV, GLS and White's corrective procedure, although positive and greater than one unit, are statistically insignificant at conventional levels. In general, the FGLS method remains the preferred specification in this static panel approach, although with the magnitude of some of the coefficients less than the results of the Columns 1 to 4.

Concentrating on Column 5, the coefficient of the language dummy is positive and significant at 1%, suggesting that the common language is a time-invariant variable whose impact on exports is 0.30 points percent. This result corroborates the pioneering study by Geraci and Prewo (1977) which shows that the impact of the language on the exports of the countries is 0.45 points percent. In addition, the border has an important role in determining the pattern of trade between nations. Given the other factors, the result confirms this hypothesis, reporting that the border effect on exports, in addition to being statistically significant at 1%, is 3.30 points percent, consistent with the study by McCallum (1995) which had discussed the impacts of Canada-US borders on trade patterns. For the author, despite the growing formations of economic blocs and trade agreements, borders continue to play an important role in determining trade flows; These findings was also confirmed by Helliwell (1997). He shows that, due to the existence of a border effect, Canada's inter-provincial trade in the period 1988-1990 is 20 times denser than trade between Canada's provinces and US states. The colony's impact on exports is low, only 0.019 points percent, but significant at 1%.

Table-5. Static panel model extension: Equation 6.

Variable\Specification	(1) OLS	(2) LSDV	(3) GLS	(4) White robust	(5) FGLS
Y_{ij}	1.1490 (0.0831)***	0.82196 (0.0943)***	1.1490 (0.0831)***	1.1490 (0.0787)***	1.1039 (0.00733)***
N_{ij}	0.6028 (0.0555)***	2.9300 (0.2808)***	0.6028 (0.0555)***	0.6028 (0.0522)***	0.5203 (0.00246)***
C_{ij}	-0.9002 (0.1420)***	.	-0.9002 (0.1420)	-0.9002 (0.1384)***	-1.0652 (0.0150)***
Rat_{ij}	1.4423 (0.06141)	0.6618 (0.1208)***	1.4423 (0.0614)***	1.4423 (0.0561)***	1.5130 (0.0051)***
Dummy-Language	3.9519 (0.4104)***	-	0.3442 (0.1350)***	0.3442 (0.1012)***	0.2960 (0.0866)***
Dummy-Border effects	3.9519 (0.4104)**	-	3.9519 (0.4104)**	3.9519 (0.3634)***	3.3027 (0.0035)***
Dummy- Colonial heritage	0.0144 (0.0840)		0.0144 (0.0840)	0.01445 (0.00987)	0.0185 (0.0836)***
Constant α_0	-2.9977 (1.735)*	-41.2938 (4.0915)***	-2.9977 (1.7359)*	-2.9977 (1.5932)*	-
N	150	150	150	150	150
Number of countries	6	6	6	6	6

Note: * p < 0:10, ** p < 0:05, *** e p < 0:01.

To circumvent any bias that may arise from the heteroscedasticity of the linear gravitational model, the Poisson Pseudo-Maximum Likelihood estimator provides some interesting results Table 6. PPML1 reports

estimates obtained when language, border-effect and colonial heritage dummies are not included, while PPML2 shows the results when all these variables are included.

Compared to the previous estimators, the point estimates generated through the maximum likelihood estimator show a common fall for both cases of either with additional regressors or without them. The differences between the results of the FGLS and PPML are represented in Columns 3 and 4. In this Columns it is possible to observe that the coefficient associated with the income generated through the FGLS is 0.8 times greater than that resulting from the PPML estimation. In column 1, if income increases by 1 percent, exports are increased by only 0.0425 points percent. The same pattern is true for all other coefficients.

Table-6. Poisson pseudo-maximum likelihood: Equation 6.

Variable\Specification	(1) PPML1	(2) PPML2	(3) Difference (FGLS-PPML1)	(4) Difference (FGLS-PPML2)
Y_{ij}	0.0425 (0.0039)***	07420 (0.0053)***	0.804	0.3619
N_{ij}	0.0053 (0.0011)***	0.0352 (0.0034)***	2.7721	0.4671
C_{ij}	-0.0756 (0.0105)	-0.0538 (0.01143)***	-1.831	1.0114
Rat_{ij}	0.1059 (0.0042)***	0.0980 (0.0045)***	0.5853	1.415
Dummy-Langue		0.0307 (0.0078)***		0.2653
Dummy-Border		0.2224 (0.0254)***		3.0803
Dummy-Colonial heritage		0.0003 (0.0005)		0.0155
Constant α_0	2.5148 (0.0446)***	1.5444 (0.1184)***		
N	150	150		
Number of countries	6	6		

Note: *** p < 0:01.

To eliminate the specific effects of time and period of the countries considered in the sample and of the possible endogeneity commonly present in gravitational models of trade, we proceeded with the estimation adopting the specification of the panel like Arellano and Bond (1991) specification. The dynamic panel data model was estimated in two stages Table 7.

In the first stage, the transport costs represented by distance were eliminated in the differentiation process. Then we estimated the resulting model estimated through generalized method of moments (GMM1) using variables income, population, exchange rate, household consumption and investment. The results of this step are reported in Column 1, which used the Sargan test of overidentification constraint of the dynamic model, which rejected its validity. The Arellano-Bond test did not reject the hypothesis of autocorrelation of first-difference errors.

The main changes regarding to the static model occurred in the magnitude, but not in terms of the significance of the coefficients, which remained statistically significant at the 1% level. The income coefficient is now 0.88 and is relatively higher than that of Table 3 obtained by the FGLS (that is, 0.84) and the impact of exchange rate volatility on exports went from 0.70 to 0.78 points percent. Compared to the static panel, the dynamic model underestimated the effect of population on trade. That is, after eliminating the fixed effects of the country, the export demand of the Guinea-Bissau's partners becomes more sensitive to the variables measured in monetary terms than the population growth.

This may not be justified for all countries in the sample, but it is evident for most of them because the population is not a variable capable to explaining the pattern of external demand for countries with high division of labor and diversification of production and with a rate of almost zero population growth, such as Portugal and the Netherlands. In the case of India, while difficult to infer which variables have been responsible for the increase in its imports over the last two decades, a reading of population growth and income indicates clearly that the vigorous growth of its economy, averaging over 6% (World Bank, 2017) has been responsible for the demand for inputs mainly in Africa.

The investment rate is a good predictor of exports, with the coefficient estimated to be 0.69 and statistically significant at 1%. Contrary to expectations, the flow of exports responds negatively to household consumption. This result is not surprising for our specification that considers both consumption and income as exogenous regressors, because consumption itself largely dependent on disposable income.

Therefore, in the second stage, the poor explanatory population and income variable were removed in the sample to avoid the redundancy of the calculation. The interest was to verify the impacts of the consumption of the families of the 5 trading partners (which depends on the available income, savings and other forms of wealth accumulated over the life horizon) and the exchange rate volatility in exports. As in the first stage, the estimator used was also the generalized moments method (GMM2).

The new result shows that the increase in household consumption by 1 percent leads to an increase of 0.11 points percent in exports, which means that there is robustness in the estimates of the gravity model applied to assess exports from Guinea-Bissau to India, Gambia, Netherlands and Portugal.

Table-7. Dynamic panel: Equation 9.

Variable\Specification	(1) GMM 1		(2) GMM2
Y_{ij}	0.8827 (0.0835)***		
N_{ij}	0.4706 (0.1110)***		
C_{ij}			
Rat_{ij}	0.7832 (0.0178)***		0.7619 (0.4218)*
Consumption	-1.0730 (0.0894)***		0.11549 (0 .0656)***
Constant α_0		6.3248 (0.4283)***	
N		115	
Number of countries		5	5
Number of instruments		50	71
F Statistics for the first stage (K-P Wald)		24.23	24.23
Sargan test of overidentification constraints (p-value)		0.0000	1.0000
Autocorrelation Arellano-Bond Test (Prob > z)		0.9174	0.1277

Throughout this section, the results reported in the present study are robust when compared to the results found in the literature (Eichengreen and Irwin, 1998; Castilho, 2002; Zarzoso and Nowak-Lehmann, 2003; Baier and Bergstrand, 2007; Erdem and Nazliogluy, 2008; Fieler, 2011; Farias and Hidalgo, 2012; Miran *et al.*, 2013; Fally, 2015). They also satisfy the basic assumptions of the gravity model, whereby the larger the size of markets and the productive structures of the countries engaged in trade, there is the possibility for these countries to increase trade between them, and that resistance to trade increase with transport costs.

6. FINAL REMARKS

We aimed to evaluate, through the data models in static and dynamic panel, the determinants of Guinean exports to the 5 main trading partners. Besides the traditional specification, the extended gravitational model allowed to include more variables such as languages, borders and colonial heritage and household consumption.

Both estimates of the standard and extended model confirm the basic premise of the bilateral trade gravity equation that trade responds positively to population growth, income and currency depreciation, and negatively to the cost of transportation that tends to make the product more expensive abroad. The coefficients obtained by the FGLS estimator were higher in magnitude and in statistical significance than the OLS, LSDV, GLS and PPML estimators were. The dynamic model also meets the assumption of gravity models. Such a model provides interesting results as it underestimates the importance of population growth in explaining trade patterns while showing that exports respond positively to changes in household consumption and investment by recipient countries.

A comparative scenario suggests that there is robustness in the reported results, because the estimates converge in both signs and magnitude with several studies reviewed here. Of course, the results obtained may also be related to the very characteristic of the Guinean economy. Guinea-Bissau initiated development policies in the mid-1980s by focusing on the modernization of the comparative advantage of the agricultural sector. The products of this sector would be important not only to supply the domestic market with a growing population, but would be mainly processed through the new industries created and exported to the foreign markets aiming to contract the currencies very important for the public revenue and also to enable the operation Development programs.

The crisis of the 1983 drought hit the country in the midst of this set of measures and contributed greatly to making the strategies of overcoming underdevelopment unviable in the period, as it deeply affected the agricultural sector. This crisis deepened in the mid-1980s with the deterioration of the economic and financial situation because of persistent deficits in the balance of payments and external debt growth as a proportion of GDP. To get out of the crisis it was necessary to carry out reforms in several areas of the economy, which, in addition to reinforcing the potential of the first sector, also signaled the change in the behavior of the government in relation to free trade. This government action coupled with the boom in the price of agricultural commodities encouraged the international insertion of the Guinean economy in the 1990s, thus creating a dependence on export revenues comparable to the dependence of OPEC countries on oil export revenues.

Therefore, in spite of the high significance obtained by FGLS and GMM estimators, we believe that further studies will be required that take into account the characteristic of the Guinean economy, including the search for new econometric approaches that introduces in the structure of the model the institutional component and many other country characteristics that effectively influence trade. However, what we have in this present study are the excellent predictors that make it possible to understand the sensitivity of Guinean exports to a broader set of variables, including exchange rate volatility, incomes, colonial heritage.

REFERENCES

Aitken, N.D., 1973. The effect of the EEC and EFTA on European trade: A temporal cross-section analysis. The American Economic Review, 63(5): 881-892.

Anderson, J.E., 1979. A theoretical foundation for the gravity equation. The American Economic Review, 69(1): 106-116.

Andersson, M., S. Johansson and H. Lööf, 2007. Firm performance and international trade–evidence from a small open economy. CESIS: Electronic Working Paper Series, No. 99: 1-32.

Arellano, M. and S. Bond, 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. The Review of Economic Studies, 58(2): 277-297.

Baier, S.L. and J.H. Bergstrand, 2007. Do free trade agreements actually increase members' international trade? Journal of international Economics, 71(1): 72-95.Available at: https://doi.org/10.1016/j.jinteco.2006.02.005.

Baltagi, D.H., 2013. Econometric analysis of panel data. New York: Willey.

Bergstrand, J.H., 1985. The gravity equation in international trade: Some microeconomic foundations and empirical evidence. The Review of Economics and Statistics, 67(3): 474-481.Available at: https://doi.org/10.2307/1925976.

Bernard, A.B., J. Eaton, J.B. Jensen and S. Kortum, 2003. Plants and productivity in international trade. American Economic Review, 93(4): 1268-1290.

Cameron, A.C. and P.K. TrivediI, 2009. Microeconometrics using stata. Texas: Stata Press.

Carrere, C., 2006. Revisiting the effects of regional trade agreements on trade flows with proper specification of the gravity model. European Economic Review, 50(2): 223-247.Available at: https://doi.org/10.1016/j.euroecorev.2004.06.001.

Castilho, M.R.O., 2002. Mercosur exports to the European market. Economic Research and Planning, 32(1): 149-198.

Chan, F.M.N., W.H. Harris and a.L.K. Greene, 2014. Gravity models of trade: Unobserved heterogeneity and endogeneity. Workingpapers. 1-19.

Cheng, I.-H. and H.J. Wall, 2005. Controlling for heterogeneity in gravity models of trade and integration. The Federal Reserve Bank of ST. Louis, 87(1): 49-63.

Choudry, E.U. and D.S. Hakura, 2000. International trade and productivity Growth: Exploring the sectorial effects for developing countries. International Monetary Found, Working Paper: 1-24.

Coleho, D., J., 1983. Formulation in mathematical programming of the gravitational model and its economic interpretation. Nova SBEWorking Paper No. 2: 46. Available from http://libraries.fe.unl.pt/index.php/e-resources/nsbe-wp/item/formulacao.

Cyrus, T.L., 2002. Income in the gravity model of bilateral trade: Does endogeneity matter? The International Trade Journal, 16(2): 161-180.

Davidson, R. and J.G. Mackinnon, 1993. Estimation and inference in econometrics. New York: Oxford University Press.

Durlauf, S.N., P.A. Johnnson and J.R.W. Temple, 2004. Growth econometrics. University of Winsconsin, Working Paper, No. 61.

Eichengreen, B. and D.A. Irwin, 1998. The role of history in bilateral trade flows. In The regionalization of the world economy. University of Chicago Press. pp: 33-62.

Eichengreen, B. and D.A. Irwin, 1998. The role of history in bilateral trade flows. NBER Working Paper No. 5565:51: 56. Available from https://www.nber.org/papers/w5565.pdf.

Erdem, E. and S. Nazliogluy, 2008. Gravity model of Turkish agricultural exports to the European Union. International Trade and Finance Association, Paper No 21: 09.

Fally, T., 2015. Structural gravity and fixed effects. Journal of international Economics, 97(1): 76-85.

Farias, J.J. and Á.B. Hidalgo, 2012. Interstate commerce and international trade of Brazilian regions: An analysis using the gravitational model. Northeast Economic Journal, 43(2): 251-266.

Feenstra, R.C., J.R. Markusen and A.K. Rose, 2001. Using the gravity equation to differentiate among alternative theories of trade. Canadian Journal of Economics/Revue Canadienne d'Economique, 34(2): 430-447.Available at: https://doi.org/10.1111/0008-4085.00082.

Fieler, A.C., 2011. Nonhomotheticity and bilateral trade: Evidence and a quantitative explanation. Econometrica, 79(4): 1069-1101.Available at: https://doi.org/10.3982/ecta8346.

Florens, J.P., V. Marimoutou and A. Péguin-Feissolle, 2007. Econometric modelling and inference. New York: Cambridge University Press.

Geraci, V.J. and W. Prewo, 1977. Bilateral trade flows and transport costs. The Review of Economics and Statistics, 59(1): 67-74.Available at: https://doi.org/10.2307/1924905.

Glick, R. and A.K. Rose, 2002. Does a currency union affect trade? The time-series evidence. European Economic Review, 46(6): 1125-1151.Available at: https://doi.org/10.1016/s0014-2921(01)00202-1.

Greene, W.H., 1993. Econometric analysis. New Jersey: Prentice HALL.

Greene, W.H., 2012. Econometric analysis. England: Pearson.

Guine-Bissau, 2010. Beyond cashews: Diversification through trade. World Bank Document No. 59562:165. Available from http://documents.worldbank.org/curated/pt/314531468034873380/pdf/595620ESW0PORT1Main0Report01PUBLIC1.pdf.

Harris, M.N. and L. Matyas, 1998. The econometric of gravity Model. Melbourne Institute. Working Paper, No 05: 18.

Hatab, A.A., E. Romstad and X. Huo, 2010. Determinants of Egyptian agricultural exports: A gravity model approach. Modern Economy, 1(03): 134-143.Available at: https://doi.org/10.4236/me.2010.13015.

Hausman, J.A., 1978. Specification tests in econometrics. Econometrica: Journal of the Econometric Society, 46(6): 1251-1271.

Helliwell, J.F., 1997. National borders, trade and migration. Pacific Economic Review, 2(3): 165-185.

Hsiao, C., 2003. Analysis of panel data. New York: Cambridge University Press.

Idsardi, E., 2010. The determinants of agricultural export growth in South Africa. Contributed Paper Presented at the Joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa, pp: 17.

ITC, 2015. Trade statistics for international business development. Destination of Guinea-Bissau Exports. Available from http://www.trademap.org/Bilateral_TS.aspx [Accessed June 10th. 2015].

Kokko, A. and P.G. Tingvall, 2000. The eurovision song contest, preferences and european trade. Ratio institute. Sweden: Working paper, no. 183. 30.

Longo, R. and K. Sekkat, 2004. Economic obstacles to expanding intra-African trade. World Development, 32(8): 1309-1321.Available at: https://doi.org/10.1016/j.worlddev.2004.02.006.

McCallum, J., 1995. National borders matter: Canada-US regional trade patterns. The American Economic Review, 85(3): 615-623.

Mendes, R. and M. Jawad, 1986. Brief analysis of the commercial sector. Ministry of International Planning and Cooperation, Economic Studies Office, 2(2): 13-22.

Miran, B., E. Atiş, Z. Bektaş, E. Salalı and M. Cankurt, 2013. An analysis of international raisin trade: A gravity model approach. Australian Agricultural and Resource Economics Society. AARES Annual Conference No.57. pp: 17.

Moise, E., 2017. . Estimating the constraints to agricultural trade of developing countries. OECD Trade Policy Papers, no. 142: 85.

Oguledo, V. and C.R. MacPhee, 1994. Gravity models: A reformulation and an application to discriminatory trade arrangements. Applied Economics, 26(2): 107-120.

Polder, J.M. and J.V. Meijeren, 2000. Modeling and forecasting international trade flows. Rijswijk-ZH: NEA Transport Research and Training. pp: 185-198.

Sanha, I., 1988. Guinea-bissau structural adjustment program. Technical Document of Socioeconomic Information Bulletin No. 2. pp: 37-52.

Sevela, M., 2002. Gravity-type model of Czech agricultural export. Agriculture Economy, 48(10): 463-466.

Silva, J.S. and S. Tenreyro, 2006. The log of gravity. The Review of Economics and Statistics, 88(4): 641-658.Available at: https://doi.org/10.1007/s00181-008-0217-y.

Stewart, J.Q., 1948. Demographic gravitation: Evidence and applications. Sociometry, 11(1/2): 31-58.Available at: https://doi.org/10.2307/2785468.

Stock, J.H. and M. Watson, 2004. Econometrics. Sao Paulo: Pearson Education.

Tinbergen, J., 1962. Shaping the world economy; auggestions for an international economic policy. New York: Books (Jan Tinbergen), Twentieth Century Fund.

UNCTAD, 2015. United conference on trade and development. Incomes Data. Available from http://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=96 [Accessed Jan 5th 2015].

Wall, H.J., 1999. Using the gravity model to estimate the costs of protection. Review-Federal Reserve Bank of Saint Louis, 81(1): 33-40.Available at: https://doi.org/10.20955/r.81.33-40.

World Bank, W., 2017. Information on trade - imports and exports as a proportion of GDP. Available from http://data.worldbank.org/ [Accessed May 20th 2017].

Zarzoso, M.-I. and F. Nowak-Lehmann, 2003. Augmented gravity model: An empirical application to Mercosur-European Union trade flows. Journal of Applied Economics, 6(2): 291-316.Available at: https://doi.org/10.1080/15140326.2003.12040596.

Zhu, H. and H. Gu, 2009. China-US border effect of agricultural trade using gravity model. Shanghai, in IFIP International Federation for Information Processing, Volume 294, the effects of national borders on trade has adopted this model for Computer and Computing Technologies in Agriculture II, Volume 2, eds. D. Li, Z. Chunjiang. Boston: Springer. pp: 891-900. Available from https://link.springer.com/content/pdf/10.1007%2F978-1-4419-0211-5_12.pdf.