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Article

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GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

Intermediate tariffs and intraregional intermediate exports: Implications for regional value chains in ECOWAS

Barnabas Olusegun Obasaju^{1*}, Wumi Kolawole Olayiwola², Henry Okodua³, Oluwasegun Eseyin¹ and Ayodele Victor Ahmed¹

Abstract: This paper primarily aims at analysing the impact of (intermediate) tariffs on intraregional intermediate exports between 2000 and 2015 with the aim of predicting the likely implications this has for regional value chains within the Economic Community of West African States (ECOWAS). As a secondary objective, the paper investigates whether correspondingly effectively applied tariffs significantly affect other classification of exports—all products, raw products and consumer products. Paying attention to the Heckman Two-step technique, we find that tariffs on intermediate products do not significantly drive intermediate exports, *inter alia*. And as garnered from the auxiliary regression, generally, tariffs are not sufficiently low as to bolster intraregional exports in ECOWAS. The statistical insignificance of intermediate tariffs implicates that the prevailing effectively applied tariff levels is not likely to augur well for formation and strengthening of new and existing value chains in ECOWAS. The need for this regional economic community to consider reviewing tariffs downwards is exigent for both the success of value chains and regional trade integration in general.

Subjects: Regional Development; Economics and Development; Economics

ABOUT THE AUTHOR

The first author holds a Ph.D. in Economics and this current research paper is an extract from his Ph.D. The second author is a visiting lecturer in same department and the Principal Programme Officer of the Economic Policy Analysis Unit of the ECOWAS Commission, Abuja, Nigeria. The third author is a senior lecturer in Economics Department, Covenant University, Ota, Nigeria. The fourth and fifth authors are both lecturers in Economics Department, Landmark University, Omu-Aran, Nigeria.

The authors assess the impact of intermediate tariffs on intermediate exports with the aim of predicting the likely implications this has for the formation and strengthening of regional value chains within ECOWAS. The major finding is that intermediate tariff is not a significant driver of intermediate exports within ECOWAS and this revelation suggests that the current levels of intermediate tariffs is not likely to bode well for regional value chains in ECOWAS.

PUBLIC INTEREST STATEMENT

This research analyses the impact of intermediate tariffs on intra-regional intermediate exports with the aim of understanding the likely implications this has for regional value chains. This paper employs different panel data techniques to analyse the impact of intermediate tariffs on intermediate exports within the ECOWAS sub-region. Comparing various panel data techniques, the estimates from the Heckman Two-step technique are prioritised. A major finding is that although intermediate tariffs negatively affect intermediate exports within ECOWAS as expected, the former is not a significant determinant of the latter. This suggests that the current levels of intermediate tariffs are not likely to significantly support the formation of new value chains and the strengthening of existing regional value chains. This calls for downward review of intermediate tariffs charged within the ECOWAS regional economic community.

Keywords: Tariffs; intraregional exports; regional value chains; panel data techniques; ECOWAS

JEL CODES: F10; F13; F14; F15; C30; C33

1. Introduction

The role of regional economic integration (REI) in developing domestic and regional value chains through fostering intra-regional trade and trade facilitation measures has been reiterated in the Global value chain (GVC) literature such as OECD (2014), OECD & WTO (2013) and OECD, WTO and World Bank Group (2014). It is believed that REIs are able to better situate their members at vantage positions where they can maximise their gains from GVCs—gains such as income, output, productivity and employment. The Association of Southeast Asian Nations (ASEAN) is an often cited regional economic community (REC) in this respect as deepening intra-regional trade aids value addition in member countries who consequently become competitive in the global production networks. The Economic Community of West African States (ECOWAS) is expected to also help enhance the gains of her members both in integrating into regional and global value chains and in enhancing their benefits therefrom.

ECOWAS is a REC established by the treaty of Lagos on the 28th of May in 1975. As a trading union, it was set up to create a single but large trading bloc through economic cooperation (ECOWAS, 2015). Some outcomes of REI can help in optimising gains from integrating into GVCs by first developing regional capacity to aid the competitiveness of the products and services of member countries' firms be it in agriculture, industry or services. For instance, REI should aid price advantage by reducing the costs of trade via the removal of tariff and non-tariff barriers within the region. REI also creates market advantages and access as it will be easier to penetrate neighbouring countries' markets at lowered costs. Lowered or zero taxes on exports is also linked to enhanced gains of regional exporters. These and more gains from REI have the potentials of helping regional firms to tap into higher dividends from economies of scale and scope and culminate into building highly competitive regional firms when they eventually enter into global value chains.

In the GVC literature, various studies have harped on the negative consequences of high tariff charges on intermediate goods particularly owing to the fact that this set of goods lend themselves to further value addition in contrast to final goods. In this vein, the cost of intermediate tariffs are multiplied when they cross borders multiple times (Kowalski, Lopez-Gonzalez, Ragoussi, & Ugarte, 2015; Lopez-Gonzalez, 2012; Obasaju, Olayiwola, & Okodua, 2016). Allard et al. (2016) and United Nations Economic Commission for Africa (UNECA, 2015) also maintain that regional integration are pivotal to increasing Member States' gains from regional value chains and by extension GVCs.

In ECOWAS, the ECOWAS Trade Liberalisation Scheme (ETLS) is saddled, among others, with the responsibility of clearing tariff and non-tariff barriers to trade within the region. ETLS is a comprehensive trade liberalisation programme put in place early in the existence of ECOWAS. Its implementation was finally launched in 1990 and was meant to occur in different stages: (1) Immediate and full liberalisation of unprocessed goods and traditional handicrafts' trade. 2) Trade in industrial products was meant to be liberalised in phases with the phasing reflective of the developmental stage of the three groups of ECOWAS Member States. Group 1 consists of Cape Verde, Guinea Bissau, The Gambia, Burkina Faso, Mali and Niger; group 2—Benin, Guinea, Liberia, Sierra Leone and Togo; group 3—Ivory Coast, Ghana, Nigeria and Senegal. The aim of ETLS was to progressively reduce and subsequently eliminate all tariff and non-tariff barriers against intra-ECOWAS trade (ECOWAS Vanguard, 2013).

ETLS is designed to create opportunities by opening new markets for goods and services, enhancing the opportunities for investments, eliminating all custom duties thereby making trade

cheaper. Thus, it aims at facilitating the transfer of goods through customs thus making trade faster. ETLs also puts in place common rules in respect of technical and sanitary standards. The coverage of ETLs is the unprocessed goods, traditional handicraft products and industrial products (processed and semi-processed products). Since not much capital goods are produced within the region yet, the coverage of ETLs largely incorporates most of the goods produced within ECOWAS. To this end, it is expected that ETLs would be supportive of trade within ECOWAS and the formation of regional value chains through its drive towards the elimination of tariff and non-tariff barriers to trade, among others (ECOWAS Vanguard, 2013).

Going by data provided by the World Integrated Trade Solution (WITS), intermediate exports face varying tariff charges even within ECOWAS. In terms of the weighted average differences in the effectively applied (AHS) tariffs,¹ between 2000 and 2015, Guinea and Sierra Leone as reporter countries had the highest value standing, respectively, at 2.71% and 2.68% while Senegal and Cote d'Ivoire had the lowest values of -3.46% and -2.05%, respectively. This implies a weighted average difference of as high as 6.17% between the highest and the lowest charges. Considering more recent periods and the absolute rather than the difference in charges, Gambia imposed the highest charge on intermediate goods, on the average, between 2013 and 2015 while Nigeria faced the highest intermediate charges within the same period. Given the expectations from ETLs, a question that readily comes to the fore is—has the ETLs scheme been able to sufficiently clear tariff barriers to trade to the extent of significantly fostering bilateral flows of intermediate goods within the ECOWAS REC? As a secondary question, is the prevailing tariff levels in ECOWAS supportive of bilateral trade relations in other classes of products—raw materials and consumer/final products? These are the two questions this current study seeks to answer.

2. Literature review

2.1. Brief review of theories

Viewed from the perspective of GVCs, different theories have been put forward to explain the fragmentation of production processes that characterise GVCs. These theories include the strategic management theory, the international business theory, the globalisation and economic development theory, the industrial organisation theory, the international trade theory, new economic geography/location theory, and so on. Different theoretical views exist as discussed in Todeva and Rakhmatullin (2016) and Inomata (2017, Todeva and Rakhmatullin (2016) note that the new trade theory—one of the theories under the international trade theory—has become the work-horse of the GVC proponents. Inomata (2017) also posits that the new trade theory, despite some of its shortcomings, is commonly adopted in the value chain literature because it may be readily operationalised owing to the availability of data.

In the new trade theory, there is the room for increasing returns to scale (Todeva & Rakhmatullin, 2016). Here, with many goods subject to economies of scale, if a specific country produces just a few goods rather than struggle to produce all it needs, the world becomes able to produce so much of each good. International trade thus allows each country to produce limited goods within its means while also availing countries the opportunity to increase their consumption of goods (Berkum & Meijl, 2000). The role of consumers' love for varieties is particularly important as explained by the new trade theory; this love promotes the need for the differentiation of products in the presence of monopolistic competition. And just as the way consumers can maximise their utility under the "love for variety" approach, it is also possible for firms to reduce costs and produce more outputs via trade in intermediate goods (Lopez-Gonzalez, 2012).

In addition, the new trade theory stresses the benefits from competitive advantages (Asaleye, Okodua, Oloni, & Ogunjobi, 2017) and explains why and how it is possible for countries with similar levels of development (such as ECOWAS countries) to engage in trade—in the sense of "South-South trade." This is in contrast to the "South-North or North-South trade" in which case what predominates is the international exchange of goods and services between or amongst countries

significantly dissimilar in their levels of development and technology. In a nutshell, the new trade theory also describes the possibility of intra-regional trade and the formation of regional value chains. The other value chain theories are however not discounted. For example, the globalisation and economic development theory and the international business theory suggest, as important factors in international value chains, the role of FDI, the quality of institution and research and development, and this current study considers these in the empirical analyses.²

2.2. Review of empirical studies

Here, we move from general empirical review to those specific to ECOWAS. Investigating the impact of RTA on trade flows, Baier and Bergstrand (2007) endogenised the RTA variables and observed a trade-diversion effect of RTAs. Lopez-Gonzalez (2012) investigated the impact of a free trade area (FTA) on the value of intermediate imports for the Organisation for Economic Cooperation and Development (OECD). Using intermediate imports from the BEC nomenclature and input-output tables for the Trade in Value Added (TiVA) economies, and controlling for the observed endogeneity of free trade agreements using a set of country-year fixed effects, he found that an FTA increases the value of intermediate imports by 25%.

First, Lopez-Gonzalez (2012) investigated whether or not the FTA variable is endogenous following the recommendation of Baier and Bergstrand (2007) who noted that if changes in FTA are strictly exogenous to changes in trade flows, it follows that a future FTA, say an FTA+5 (i.e. 5 years future FTA), is expected to be uncorrelated with the current trade flow. After correlating the current FTA with 5 year lead of FTA, Lopez-Gonzalez (2012) observed a strong correlation between them. Providing controls by using time-varying reporter and partner fixed effects and performing a regression in the presence of the 5-year lead of FTA, the insignificant impact of the 5-year lead of FTA on current imports showed that the set of fixed effects used was appropriate in accounting for the endogeneity of FTAs.

Some empirical studies cover both developed and developing countries. One of such is Kowalski et al. (2015), which included, as one of the independent variables, tariff on intermediate goods (effectively applied tariffs) while examining the determinants of value-added trade flows using a gravity model. They controlled for the effect of RTA by using the intermediate coverage of imports (and exports) while using data from the OECD Trade-in Value Added (TiVA) database. Their sub-samples include the high-income and developing countries, but the OECD TiVA database is limited in coverage and does not include any ECOWAS country. Among other empirical findings, Kowalski et al. (2015) found that RTAs positively but insignificantly impact bilateral value-added flows in developing countries while intermediate tariffs from the origin country negatively and significantly impacts bilateral value-added flows—a finding similar to Obasaju, Olayiwola, Okodua, and Adekunle (2019) who found that intermediate tariffs negatively, albeit insignificantly, impact backward integration of ECOWAS into GVCs.

There are those studies that cover multiple countries irrespective of their region. For example, Cheong, Kwak, and Tang (2018) examined the trade effects of tariffs and non-tariff changes of preferential trade agreements. They used bilateral tariff rates for 90 importing and 149 exporting countries spanning 1996 through 2010. The study found, among others, that: (i) changes on non-tariff measures under (three) preferential trade agreements (PTAs)—customs union (CUs), free trade agreements (FTAs) and partial scope agreements (PSAs)—on the average, increase both the intensive margin (volume) trade and the extensive margin (probability) of trade; (ii) the effect of CUs stem mainly from changes in non-tariff measures while that of FTAs comes from changes in both tariff and non-tariff measures; and (iii) changes in non-tariff measures connected with CUs have a stronger trade impact on those connected with FTAs. The semblance between Cheong et al. (2018) and this current study lies in the fact that the latter also incorporates tariffs and a broader measure of cost of trade—trade cost (which in itself consists of tariff, non-tariff barriers and other barriers to trade) and their implications for intraregional trade.

In the case of Sun and Li (2018), they investigated the trade margins of the agricultural exports of China to ASEAN and their determinants from 2000 to 2015. Using an augmented gravity model of international trade, they found that the main source of growth of the agricultural exports of China to ASEAN changed from the extensive margin to the intensive margin following the formal establishment of China-ASEAN Free Trade Area (CAFTA). The pattern of the former's agricultural exports to the latter shifted from more varieties, small quantity and low price to fewer varieties, high price and large quantity. The significant determinants of the trade margins of China's agricultural exports to ASEAN were found to be relative economic scale, relative population scale, agricultural export capacity, trade integration, global financial crisis and sharing of a common border.

There are also studies with a continental outlook. In the case of Africa, Slany (2017) examined the role of trade policies in building regional value chains between 2006 and 2012. Using the UNCTAD-Eora GVC database, the author calculated the trade in value added between African countries and evaluated the position of each country in the regional value chain (RVC). A matrix of "global value-added exports" was used to derive the dependent variable- the imported foreign value added from the region embodied in the exports of a given country to that region. Using the fixed effects estimator while controlling for auto-correlation and cross-sectional correlation among standard errors, the study found that tariffs charged on capital goods are the most restrictive to imported foreign value added. Southern Africa was found to be the most integrated of the trade blocs in the African region.

There are notable differences in the focus and approach adopted by Slany (2017) and this current paper. First, the former uses foreign value-added flows as the dependent variable and uses this indicator as a measure of backward participation of a country in RVCs. This current study does not investigate the impact of intermediate tariffs on participation in RVCs but rather the impact of intermediate tariffs on intermediate exports with the aim of predicting the implications for RVCs owing to the important roles of intermediates in international value chains. Second, the former focused generally on Africa while this current study is based on ECOWAS with the merit of being able to reveal the peculiar features of ECOWAS. Third, the former is silent on the need to control for the role of RTAs as this play crucial roles on international value chains—be it regional or global.

We now report some empirical studies specific to ECOWAS. Olofin, Salisu, Ademuyiwa, and Owuru (2013) investigated the determinants of a successful regional trade agreement in West Africa between 1995 and 2010. They used the Least Square Dummy Variable (LSDV) technique to estimate a modified gravity model including but not limited to variables like income, distance, common language, political stability and infrastructure. They found that economic size, distance, landmass, common border and landlockness of countries influence intraregional exports in West Africa significantly. In addition, they found that the West African Economic and Monetary Union (WAEMU) is trade creating while the West African Monetary Zone (WAMZ) is trade diverting. This work paid much attention to the roles of WAEMU and WAMZ in intra-regional trade in West Africa. In that analysis, it would have been more insightful if they compared estimates from different techniques rather than using only LSDV. Their analysis also did not say much about how the prevalent zero trade flows was handled and not much consideration was given to the reason for using the economic integration arrangement (EIA) variables as exogenous variables. Among other differences, the focus of their study was total trade rather than trade in intermediate goods that this current study is primarily concerned with. The use of trade in intermediate goods thus gives this current study a value chain outlook. Olofin et al. (2013) did not also factor in the role of intermediate tariffs faced within the region which is the independent variable of interest of this current study.

Afolabi, Nor Aznin, and Mukhriz (2015) investigated bilateral trade flows and the level of openness in ECOWAS from 1981 to 2013 using a gravity model. They employed PPML, fully modified

ordinary least squares (FMOLS) and the canonical cointegrating regression. Adding trade and financial openness variables to the gravity variables, they found that financial openness negatively impacts intra-regional trade flows; the negativity which was significant at 10% under the fully modified OLS and the canonical-cointegrated regression techniques. The effect of trade openness varied in terms of economic and statistical significance while comparing the different techniques. This study is however silent about the possibility of selection bias and did not control for the presence of RTA. It also differs from this current study in respect of the role of intermediate tariffs faced on intra-regional intermediate exports. Other than trade integration, some scholars have also assessed stock market integration in the West African region. One of such works includes Obadiaru, Oloyede, Omankhanlen, and Asaleye (2018). Using the GARCH model, they found that significant volatility spill-overs exists between most of the market pairs in the region and beyond.

As noted by Olofin et al. (2013) and in consonance with Baier and Bergstrand (2007), whether or not to endogenise the EIA (regional trade agreement—RTA) variables has resulted into inconclusive conclusions in respect of whether they are trade creating or trade diverting. However, it is important to control for their effects when assessing the determinants of intra-regional trade flows or when examining the impact of a variable of interest on intra-regional or bilateral trade flows. From the foregoing, empirical reviews, including those based on ECOWAS point to some lacuna in the literature yet to be filled. First, and primary, is the issue of investigating the impact of tariffs charged on intermediates on intraregional exports in ECOWAS. Second, auxiliary regressions performed in this current study reveal the roles of effectively applied tariffs on corresponding classes of exports within ECOWAS. The estimation technique adopted in this current study also factors in the issue of whether or not to endogenise EIAs while not neglecting the import of employing a technique that can mitigate biases that may arise from the prevalence of zero trade flows.

3. Materials and methods

3.1. Methodology

Following the seminar paper of Anderson (1979) that gave the gravity model a sound theoretical underpinning, the gravity model has become the major workhorse of trade theorists; it is nonetheless used in other fields like migration, remittances and others. A direction-specific trade—the value of the intra-regional intermediate exports is the dependent variable here. Before specifying the base model, insights from the theory are crucial.

Proponents of the New Trade Theory (NTT) posit that this theory explains why it is possible for countries which are reasonably different, in absolute terms, in factor endowments, to engage in trade. Hence, the coefficient of this variable is expected to be negative; this follows from the reasoning that the upstream stages of the value chain (like supply of raw inputs) may be performed by countries that may be more labour intensive while the downstream stages (like branding) may be performed by more capital or technologically intensive countries. Similarly, NTT explains why countries with similar GDPs can engage in trade, hence predicts that trade flows is a positive function of similarities in GDP.

To capture the differences in factor endowments, the ratio of capital to labour force is used reflecting the distance between the exporting and importing countries in respect of relative factor endowments (Wang, Wei, & Liu, 2010). Due to the rarity of data on the actual labour employed,³ the labour force may be used as a proxy as was used by Wang et al. (2010). In similar vein, we include the relative factor endowment measured as the ratio of capital stock to labour force. With respect to the size of market, or the economic mass variable, studies such as Helpman and Krugman (1985) and Hunter and Markusen (1986) confirm the increase in international trade consequent upon the convergence in income levels and use GDP as the economic mass (or market size). Thus, a positive relationship is expected between GDP and bilateral trade flows. However, in the spirit of Baldwin and Taglioni (2011), when the role of intermediate goods is important,

emphasis shifts to gross measures rather than value-added measures like GDP. In this vein, a positive relationship is expected between gross output (proxy for economic mass variable) and intra-regional intermediate trade, but the fixed effects (time effects in this case) may be used to control for the economic mass which varies with time—this is in line with Baldwin and Taglioni (2007; 2011).

The role of foreign direct investment flows (or the inward stock of FDI as a share of GDP) has also been noted. For instance, the strategic management theory suggests that the presence of inward FDI is representative of the roles of MNEs. Thus, FDI is expected to be closely related to the export capabilities of a country. In other words, it should correlate positively with intra-regional trade. The role of intermediate tariffs, which is the variable of interest, cannot be over-emphasised when dealing with international value chains—whether regional or global. Tariffs on intermediates that cross borders multiple times incur costs that increase in the number of times such intermediates cross borders (Lopez-Gonzalez, 2012). In essence, intra-regional intermediate trade flows is expected to be decreasing in intermediate tariffs.

In the case of EIAs within a REC, which in the case of ECOWAS are WAEMU (UEMOA) and WAMZ, trade literature note the need to control for them. These arrangements may be trade creating or trade diverting. Yet it is hypothesised that a positive relationship is expected between the presence of EIAs and intra-regional trade flows. Concerning the distance between trade partners, the standard gravity model (built on the Newtonian law of gravity) in itself predicts bilateral trade flows to decrease in geographical distance between the trading partners.

To achieve the primary and secondary objectives of this research article, the model of interest is expressed in the spirit of the general framework of the Chamberlin-Heckscher-Ohlin (CHO) model. CHO as a model incorporates such variables as factor endowments and decreasing costs and generates both intra- and inter-industry trade.⁴ Furthermore, it generates different testable hypotheses in respect of the deterministic roles of country-specific factors alongside embodying implicitly, a number of testable hypotheses. These hypotheses include but not limited to testing the roles of such factors as factor endowments and similarities in GDPs in bilateral trade. Sequel to the foregoing, the preferred model of this current study is expressed as:

$$\begin{aligned} \ln(IMDEX_{ijt}) = & \varphi_0 + \varphi_1 \ln(RLF_{ijt}) + \varphi_2 \ln(GDPSIM_{ijt}) + \varphi_3 \ln(IMDTAR_{it} \cdot IMDTAR_{jt}) + \varphi_4 (INST_{it} \cdot INST_{jt}) \\ & + \varphi_5 CONTIG_{ij} + \varphi_6 COML_{ij} + \varphi_7 \ln(DIS_{ij}) + \varphi_8 \ln(TCOST_{ijt}) + \varphi_9 \ln(AtGDP_{it} \cdot AtGDP_{jt}) \\ & + \varphi_{10} WAEMU_{ijt} + \varphi_{11} WAMZ_{ijt} + \varphi_{12} \ln(INFR_{it} \cdot INFR_{jt}) + \varphi_{13} \ln(FDI_{it} \cdot FDI_{jt}) + U_{ijt} \end{aligned}$$

where *IMDEX* is export of intermediate goods; *RLF* is absolute difference in relative factor endowments; *GDPSIM* is similarity of GDP measured as $SIM_{ijt} = 1 - \frac{GDP_{it}^2}{(GDP_{it} + GDP_{jt})^2} - \frac{GDP_{jt}^2}{(GDP_{it} + GDP_{jt})^2}$. A positive coefficient on the *GDPSIM* variable would illustrate the possibility of trade between countries with similar levels of development supporting the new trade theory; *IMDTAR* is intermediate tariff (effectively applied tariffs—AHS weighted average)⁵ faced by exports. To obtain clues in respect of the weighted average differences with regard to the AHS data on tariffs, Table A in the appendix is insightful; *CONTIG* is contiguity/adjacency which is a dummy that takes the value 1 if partners share a common border and 0 otherwise; *COML* is a common language which takes the value 1 if partners have a common official language and 0; *DIS* is the distance between the two countries; *TCOST*⁶ is trade cost—an all-inclusive measure of international trade costs which covers tariffs and non-tariff measures, trade facilitation, connectivity and logistics, and geographical and cultural/historical/institutional factors.

Exports are expected to be a decreasing function of trade cost; *WAEMU* is a dummy variable which takes the value 1 if both partners belong to the West African Economic and Monetary Union, also known as UEMOA (countries here are Benin, Burkina Faso, Cote d'Ivoire, Guinea Bissau, Mali, Niger, Senegal and Togo) and 0 otherwise; *WAMZ* is a dummy variable which takes the value 1 if both partners belong to the West African Monetary Zone (these countries

are Nigeria, Gambia, Ghana, Guinea and Sierra Leone) and 0 otherwise. The sign of the coefficient on these dummies are meant to account for elements of trade creation or diversion. It is expected that other factors held constant, increased intraregional flows would increase with increased flows in these EIAs. Thus, a negative coefficient on any of these variables indicate trade diversion while a positive coefficient indicates trade creation within ECOWAS; *INST* is quality of institution⁷; *INFR* is quality of infrastructure; *FDI* is inflows of *FDI*; *U* is idiosyncratic error.

Note that in the basic gravity model, the economic mass is deflated by the ‘multilateral resistance term.’ However, here, we allow the time-varying fixed effects to capture both the economic mass (demand and supply conditions) and the multilateral resistance term, both of which vary over time.

For the quality of institution, rather than use a narrow definition of the quality of institution, a principal component analysis (PCA) is conducted to see the possibility of deriving a single/composite index. The indicators of the quality of institution which are subjected to PCA are voice and accountability, political stability, government effectiveness, regulatory quality, control of corruption and rule of law. For the quality of infrastructure, the indicators subjected to PCA are mobile cellular subscription, internet subscription, air transport, quality of port and electricity consumption. The criteria for concluding in favour of the PCA include that (1) The Eigenvalue of that component should be greater than or equal to 1. (2) The principal component must account for at least 60% of the variance in the entire series. (3) The test should pass the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, a measure which lies between 0 and 1. Specifically, the value should be greater than 0.70. Small values depict that the variables do not have much in common to warrant a principal component analysis. Kaiser (1958) gave the following labels: 0.00 to 0.49—unacceptable; 0.50-0.59—miserable; 0.60-0.69—mediocre; 0.70-0.79—middling; 0.80-0.89—meritorious, and 0.90-1.00—marvellous. Table 1 presents the summary of the results of the PCA.

As contained in Table 1, the PCA test yielded a positive result for the quality of institution but not for the quality of infrastructure as it fails the PCA test. And rather than adopt a narrow definition for the quality of infrastructure variable, it is not included in the eventual empirical estimations. Table 2 summarises the *a priori* expectations, with the negative sign indicating a negative *a priori* expectation and positive sign indicating a positive expectation.

3.2. Estimation technique

From the econometric stance, the common issues in estimating bilateral gravity models include the preponderance of zero trade flows (including zeros for some regressors), sample selection bias as noted by Heckman (1979), non-stationarity of trade flows, and endogeneity as a result of omitted variables or reverse causation such as between RTAs, among others. Several techniques have been applied using gravity models for bilateral trade flows. Linear (OLS; Least Square Dummy Variable—LSDV; truncated OLS and censoring) and non-linear techniques (Poisson Pseudo Maximum Likelihood—PPML; Heckman-Two Step; Feasible Generalized Least Squares—FGLS; Non-linear least squares) techniques and many more. Some also use techniques for dynamic models such as systems GMM and dynamic OLS.

A careful observation of various techniques and published empirical studies in this area tend to suggest that each technique has its own strengths and weaknesses. Considering the peculiar

Table 1. Summary of PCA for quality of institution and infrastructure		
	Quality of Institution	Quality of Infrastructure
KMO measure of adequacy	0.85	0.54
KMO range/label	0.80–0.89 (meritorious)	0.50–0.59 (miserable)
PCA Decision	Accept	Do not accept

Note: Authors’ design based on PCA result.

Table 2. A priori expectations

Independent Variable	Dependent Variable: Log of intermediate export $\ln(IMDEX_{ijt})$		
	Partial Derivative and <i>ceteris paribus</i>	Coefficient from Partial Derivative	A priori Expectation
Log of relative factor endowment	$\delta \ln(RLF_{ijt})$	φ_1	-
Log of GDP similarity	$\delta \ln(GDP_{SIM}_{ijt})$	φ_2	+
Log of intermediate tariff	$\delta \ln(IMDTAR_{it} \cdot IMDTAR_{jt})$	φ_3	-
Quality of institution (index)	$\delta (INST_{it} \cdot INST_{jt})$	$\varphi_4 * 100$	+
Contiguity(dummy)	$\delta CONTIG_{ij}$	$e^{\varphi_5} - 1$	+
Common Language(dummy)	$\delta COML_{ij}$	$e^{\varphi_6} - 1$	+
Log of distance	$\delta \ln(DIS_{ij})$	φ_7	-
Log of trade cost	$\delta \ln(TCOST_{ijt})$	φ_8	-
Log of agriculture contribution to GDP	$\delta \ln(AtGDP_{it} \cdot AtGDP_{jt})$	φ_9	+
Both WAEMU (dummy)	$\delta WAEMU_{ijt}$	$e^{\varphi_{10}} - 1$	+
Both WAMZ (dummy)	$\delta WAMZ_{ijt}$	$e^{\varphi_{11}} - 1$	+
Log of the quality of infrastructure	$\delta \ln(INFR_{it} \cdot INFR_{jt})$	φ_{12}	+
Log of FDI inflows	$\delta \ln(FDI_{it} \cdot FDI_{jt})$	φ_{13}	+

Note: Authors' design based on hypothesised relationships.

nature of the ECOWAS bilateral intermediate export flows, more than 40% of the total are zeros. Simply adopting a technique such as truncated OLS or censoring leads to reduction in efficiency as a result of loss of information—this may bias the estimates due to the omission of data (Estrella, 2012). Westerlund and Wilhelmsson (2009) also noted that elimination of the zero trade flows in the event that they are not distributed randomly would result in selection bias. Zero trade flows may also be as a result of the affinity (or lack of it) of some countries for the products of other countries. These suggests checking for the significance or not, of selection bias, using the Heckman Two-step technique.

In this current study, we compare the estimates of a Heckman Two-step with those of the others as a robustness check. Panel unit root tests for both first and second generations would first be carried out to circumvent the issues of non-stationarity⁸ and the estimates of Heckman Two-step, PPML, FGLS, LSDV and Pooled OLS are compared for the baseline regression. To account for the possibility of selection bias, estimates of the Heckman Two-step are prioritised. Furthermore, given the inclusion of EIAs which as noted earlier may exhibit reverse causation with the trade flows (exports of intermediates in this case), a test of exogeneity is performed in line with Baier and Bergstrand (2007) and Baier, Bergstrand, and Feng (2013). First, we correlate the current values of the RTAs within ECOWAS (WAEMU and WAMZ) with their 1 to 5-year leads and lags. Next, the export of intermediates is regressed on the 5-year lead and lags of these EIAs while using time-varying exporter and importer fixed effects to control for multilateral resistance terms and possible reverse causation. If these EIAs are exogenous, the baseline regression is run without the need to include the 5-year leads and lags of the EIAs. For all the techniques, the time-varying importer and exporter fixed effects will be added to the regression.

3.3. Sources of data

Data on Guinea Bissau especially for the variables of interest—intermediate exports and tariffs are very few; hence, this country is excluded from the analysis while the other 14 ECOWAS countries are included. The financial variables are measured in current million dollars and not deflated by US'

Table 3. Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
LRAWEX	1382	-8.821,404	3.176,919	-13.81,551	7.726,012
LIMDEX	1575	-8.816,576	3.134,887	-11.8696	6.689,053
LCONEX	1748	.0665514	3.360,297	-13.81,551	8.410,486
LALLEX	1912	9.653,036	3.390,742	-13.81,551	8.432,508
LRAWTAR	2912	5.191,202	1.425,259	0	5.993,961
LIMDTAR	2912	.949,8941	.896,535	0	6.879,187
LCONITAR	2911	1.289,009	2.16,961	0	7.517,931
LALLTAR	2912	1.234,375	2.007,694	0	7.169,353
LRLF	2521	8.807,427	7.226,629	-5.115,104	23.31,332
LGDPsim	2912	-4,720,949	1.611,785	-16.84,518	.6916,826
LTCOST	2094	5.220,028	.5.323,538	3.611,696	6.840,292
LAI GDP	2912	6.564,251	.664,1774	.615,5898	.339,304
CONTIG	2912	2.527,473	4.346,619	0	1
COML	2912	4,179,258	4,933,025	0	1
WAEMU	2912	2.304,258	4,211,777	0	1
WAMZ	2912	1.102,335	3.132,344	0	1
LDIS	2912	7.048401	.6044,909	5.238,067	8.119,218
LFDI	2912	10.16,885	2.552,782	1.907,016	17.18,281
LINFR	2912	4.198,252	3.474,976	-6.952,686	8.811,519
INST	2912	-3.133,891	4.185,296	-21.34,308	15.5987

consumer price index to avoid Baier and Bergstrand (2007)'s "bronze error." The scope of the study is 2000 to 2015; 2015 being the most recent year for which data can be obtained for most of the ECOWAS countries. Data on intermediate tariffs (effectively applied tariffs—AHS weighted average) and intermediate exports were obtained from World Integrated Trade Solutions Trains Database; GDP similarity—ECOWAS National Accounts; Quality of institution and infrastructure—Worldwide Governance Indicators; FDI and Agriculture as a share of GDP—World Development Indicators; Trade cost—obtained from United Nations' Economic and Social Commission for Asia and Pacific—UNESCAP (World bank trade cost database) and; WAEMU and WAMZ—Available in their websites.

4. Presentation and discussion of results

Table 3 presents the summary statistics. The summary statistics, among the other information it conveys, shows that the effectively applied tariffs increase with the stage of the value chain. For instance, the tariff on raw materials (RAWTAR) has the lowest mean and maximum values, followed by tariff on intermediate goods (IMDTAR) then tariff on consumer/final goods (CONTAR); this typifies the situation of tariff escalation. Tariff on all goods (ALLTAR) is a bit lower than that on consumer goods. In terms of exports, the value of all exports (ALLEX) and consumer goods exports (RAWEX) exceed those of raw materials and intermediate goods, with intermediate goods exports being the lowest.

As stated earlier, the techniques compared are Heckman Two-step, Poisson Pseudo Maximum Likelihood (PPML), Least Square Dummy Variable (LSDV), Feasible Generalized Least Square (FGLS) and Pooled OLS with Heckman being the technique of interest. But in order to avoid assuming the stationarity of trade flows and the regressors, violation of which could render the regression spurious, Table 4 first presents the panel unit root tests.

In respect of panel unit root tests, various techniques have been developed. A strata consists of those who assume that dependence amongst the entities (e.g. industries, individuals, countries, etc.) are driven by common factors (e.g. Levin, Lin and Chu and Breitung tests) while another strata believes they may be driven by individual roots or factors (e.g. The Fisher ADF and PP, and Im, Pesaran and Shin tests). All of these take the null hypothesis to be the existence of unit root test. In contrast, Hadri panel unit test takes the null to be stationarity. For the sake of comparison, different tests are used on the data to arrive at a valid conclusion in regards to the stationarity property of each series. AIC lag selection was used to determine the lag length because of its relevance to small (panel) samples.

The panel unit root tests show that all the series are stationary at least at 10% with the exception of the log of FDI (LFDI) in which most of the tests conclude that it is a non-stationary series. Sequel to this, this variable is not included in subsequent analysis. The other gravity variables—contiguity, common language and distance—are of course stationary as expected, and there is no point including them in Table 4 from this test, the fear of obtaining a spurious regression consequent upon the presence of non-stationary series is allayed.

With respect to Heckman Two-step technique, the probit (selection equation) does not include the fixed effects. In the first step, that is the probit equation, this investigates whether or not two countries trade, with 0 and 1 representing the situation of no trade and trade, respectively. In the second step, the expected values of the trade flows, based on the condition that the two countries trade, are estimated. An exclusion (or selection) variable is however needed in order to identify the parameters on both equations. The exclusion variable is selected based on the condition that it affects only the propensity or probability of trading and not the current levels of trade. Helpman, Melitz, and Rubinstein (2008), Shepotylo (2009), Bouet, Mishra, and Roy (2008) suggested, respectively, the use of common language, the governance indicators of the quality of regulation, and historical frequency of positive trade between two countries, as the selection variable.

Another alternative to the use of a given variable as an exclusion variable was proposed by Linders and de Groot (2006) and Haq, Meilke, and Cranfield (2010) who include the same set of variables in both equations while allowing the normality of the error in both equations to

Table 4. Panel unit root tests

Variable	CIPS	Fisher ADF	Fisher PP	Levin-Lin-Chu (LLC)	AIC-Selectedlag length	Hadri
LIMDEX ⁹	-1.52*(0.06)	-2.62*** (0.01)	-2.27*** (0.01)	-4.63*** (0.00)	1	7.36*** (0.00)
LRLF	-2.21*** (0.01)	-3.34** (0.00)	-4.43*** (0.00)	-6.99*** (0.00)	2	9.19*** (0.00)
LGDP5IM	-1.91** (0.02)	-1.85** (0.03)	1.40 (0.92)	-3.27** (0.00)	2	4.79*** (0.00)
LIMDTAR	-2.53** (0.04)	-6.04*** (0.00)	-5.27*** (0.00)	-8.72*** (0.00)	0	3.07*** (0.00)
LATGDP	5.54*** (0.00)	12.62*** (0.00)	9.93*** (0.00)	-9.62*** (0.00)	1	44.07*** (0.00)
LTCOST	-5.23*** (0.00)	-11.45*** (0.00)	-8.83*** (0.00)	-7.54*** (0.00)	1	39.09*** (0.00)
INST	-4.94*** (0.00)	-4.43*** (0.00)	-7.50*** (0.00)	-7.00*** (0.00)	2	11.03*** (0.00)
LFDI	-0.76(0.22)	-0.89(0.21)	-0.93(0.18)	-1.77** (0.04)	2	6.11*** (0.00)

Note: The null (H₀) for IPS is that there is unit root while for Hadri the null is stationarity.

CIPS is the cross-sectional augmented test of Im, Perasan and Shin (IPS).

***, ** and * denotes a stationary series at 1%, 5% and 10% level, respectively p values are in parentheses.

AIC and BIC used to select the lag length in case of Fisher ADF, Fisher PP, IPS and LLC. For Hadri tests, Newey-West bandwidth selecting using Bartlett kernel is employed to choose maximum lags. The results are similar when considering the intercept only and the intercept plus trend cases.

help with the identification of parameters. The work of Egger, Larch, Staub, and Winkelmann (2011) contain more information on this. In the presence of a continuous variable, precisely tariff, Cipollina and Salvatici (2013) used a common border, colonial link and tariff as exclusion variables. The alternative of including all the variables in the both equations tends to be more common in the literature and it is what is used here.

The variable of interest is intermediate tariff, but as explained earlier, there is the need to consider the role of EIAs because of the tendencies of reverse causality between EIAs and the dependent variable (intra-regional intermediate exports). To test for the exogeneity or otherwise of WAEMU and WAMZ, Tables B and C in the appendix contain the correlation statistics that shows that the past and future EIAs (up to the five-year period) have very low correlation with the current EIAs.

To verify further, the current exports (of intermediates)¹⁰ are regressed on the right hand side variables in the presence of the 5-year lag and lead of these two EIAs as presented in Table 5. Different techniques were used with the conclusion being the same. That of

Table 5. Exogeneity test for WAEMU and WAMZ

Dependent Variable: Log(IMDEX)		
Regressor	Heckman Two-step	FGLS
LRLF	-0.0839 (0.077)	-0.0639 (0.059)
LGDP SIM	0.9946*** (0.1434)	1.0423*** (0.108)
LIMDT	-0.0633 (0.078)	0.0271 (0.036)
INST	0.0876*** (0.030)	0.0875*** (0.023)
CONTIG	1.5177*** (0.289)	1.9395*** (0.219)
COML	-0.2317 (0.472)	-0.4670 (0.375)
LDIS	-0.8565*** (0.211)	-0.5674*** (0.163)
LTCOST ¹¹	-	-
LA tGDP	2.2049* (1.164)	2.2374*** (0.714)
WAEMU	0.9151 (0.578)	1.5874*** (0.409)
WAMZ	0.5955 (0.493)	1.0251*** (0.361)
WAEMU + 5	-0.1567 (0.238)	-0.0411 (0.200)
WAMZ + 5	-0.1694 (0.347)	-0.1599 (0.272)
WAEMU—5	0.1009 (0.235)	0.1234 (0.191)
WAMZ—5	-0.1708 (0.370)	0.0934 (0.293)

Note: WAEMU+5 and WAMZ+5 denote the fifth lead while WAEMU-5 and WAMZ—5 denote the fifth lag of each of WAEMU and WAMZ.

Heckman and FGLS (including the exporter-year and importer-year fixed effects) are presented here.

It is clear from Table 5 that the leads and lags of WAEMU and WAMZ do not significantly impact the current intermediate export flows. Thus, in line with the low correlation statistics as contained in Tables B and C in appendix, it may be concluded that these two integration arrangements are exogenous. Next, the baseline regression in the absence of these leads and lags is presented in Table 6 while comparing the estimates of different techniques but paying special attention to that of Heckman. All the standard errors are robust to heteroskedasticity and autocorrelation. The Inverse Mills Ratio corresponds only to Heckman Two-step estimates and indicates whether selection bias is significant. All the variables are logged apart from the quality of institution (INST) and those that are binary—the gravity variables, WAEMU and WAMZ. The dependent variable using all the techniques is the log of intermediate export (LEX) with the exception of PPML which is the level (EX) rather than the log of intermediate export.

From the lower segment of Table 6,¹² it is observed that the model is significant irrespective of the technique adopted as shown by the significant Wald chi-squared or F statistic. For the techniques that estimate the R-squared, the values show that the independent variables account for at least 73% of the variation in the dependent variable, similar though a bit higher than that obtained by a similar study on ECOWAS, specifically that of Olofin et al. (2013) who obtained R-squares averaging 0.67 (67%). Considering the two-step estimates of Heckman, the insignificance of the Inverse Mills Ratio is as a result of the use of appropriate fixed effects, particularly the time-varying importer and exporter fixed effects.¹³ The conclusion of all the techniques in respect of economic and statistical significance is very similar. However, paying attention to a continuous trade variable which is of the most interest to this current study—intermediate tariff faced by intermediate exports—it is obvious that only the two-step estimate of Heckman is economically significant. The likely reason for this is the preponderance of zeros in the intermediate tariff series.

For the sake of comparison, the auxiliary regression is presented in Table 7 to understand, more importantly, the role of the (corresponding) effectively applied tariffs on the different groups of exports.

In respect of Table 6, given the preponderance of zeros in the dependent variable, most of the figures in this series become uncensored (as revealed by the lower observations of all the families of the least square techniques which use 1124 (but 1121 in the case of FGLS) uncensored observations as compared to the censored and uncensored observations all used by the Heckman and PPML techniques¹⁵), the regression resembles a truncated regression and the Heckman technique outperforms PPML in predicting the correct sign of intermediate tariff. In a nutshell, in what follows, the estimates from Heckman are used in interpretation. The better performance of Heckman in predicting trade flows in this current study is supported by the finding of Estrella (2012) who used a dataset covering 80% of world trade and observed that Heckman sample selection model performs better, in the overall, than other techniques for the gravity equation specified by that study.

Before proceeding, all the techniques with the exception of Heckman show that only common language and intermediate tariff are not economically significant as they are incorrectly signed. In case of Heckman, only the common language is economically insignificant while all the others follow a *a priori* expectation. From the estimates, there is unison in the conclusion drawn from all the techniques about the possibility of a “South-South” trade, in this case, trade in intermediate goods amongst ECOWAS countries who have similar levels of development. This follows from the observed coefficient on the GDP similarity (LGDPsim) as it has a positive sign. In terms of GDP, apart from Nigeria whose GDP is way above others for reasons not totally unconnected to her large population, the GDPs of the rest ECOWAS countries are similar, and the positive coefficient on this

Table 6. Empirical results for intermediate tariffs-exports nexus using Heckman two-step, PPML, FGLS, LSDV and Pooled OLS

Dep. Var. LIMDEX	Heckman		FGLS PPML			LSDV	Pooled OLS
	Selection	Two-Step	(3)	(4)	(5)		
Regressors	(1)	(2)	(3)	(4)	(5)	(6)	
LRLF	0.0262*** (0.005)	-0.0535 (0.054)	-0.0024 (0.044)	-0.0107 (0.058)	-0.1819 (0.113)	-0.0517 (0.0636)	
LGDPSIM	-0.0209 (0.024)	0.74,362*** (0.070)	1.1238*** (0.072)	1.1212*** (0.090)	1.2071*** (0.115)	1.1410*** (0.106)	
LIMDT	7719.69	-0.0196 (0.053)	0.0201 (0.024)	0.0561** (0.028)	0.0602 (0.044)	0.0206 (0.036)	
INST	0.0084 (0.010)	0.0666*** (0.019)	0.0714*** (0.015)	0.0113 (0.016)	0.0621** (0.026)	0.0682*** (0.025)	
CONTIG	0.3953*** (0.121)	1.1063*** (0.189)	1.47,856*** (0.135)	0.9932*** (0.155)	1.0867*** (0.248)	1.1450*** (0.238)	
COML	-0.1237 (0.105)	-0.5174* (0.272)	-0.76,204*** (0.203)	-0.86,398*** (0.388)	-0.8826** (0.386)	-0.5423 (0.376)	
LDIS	-0.0863 (0.083)	-1.0459*** (0.138)	-0.59,607*** (0.103)	-0.47,408*** (0.122)	-1.0477*** (0.178)	-1.059*** (0.167)	
LTCOST ¹⁴							
LATGDP	-0.1451** (0.068)	1.4570* (0.868)	1.5830*** (0.562)	0.6604 (0.645)	1.4404 (1.544)	1.4720* (0.819)	
WAEMU	1.1284*** (0.140)	1.0139*** (0.338)	1.3166*** (0.253)	2.0980*** (0.473)	1.4473*** (0.396)	1.1739*** (0.400)	
WAMZ	0.5194*** (0.130)	0.7597** (0.320)	0.7029*** (0.268)	0.3864 (0.553)	0.9490** (0.392)	0.8313** (0.392)	
CONSTANT	0.9236	-3.4149	-4.5094	1.3832	0.9886	-4.9372	

(Continued)

Table 6. (Continued)

Dep. Var. LIMDEX	Heckman		FGLS PPML		LSDV	Pooled OLS
	Selection	Two-Step	(3)	(4)		
Regressors	(1)	(2)	(3)	(4)	(5)	(6)
Inverse Mills Ratio	(0.869)	(6.570)	(4.334)	(4.877)	(10.307)	(7.061)
		-0.3034 (0.336)	-			
Exporter-year FEs	No	Yes	Yes	Yes	Yes	Yes
Importer-year FEs	No	Yes	Yes	Yes	Yes	Yes
Observations	—	1841	1121	1841	1124	1124
No. of countries	14	14	14	14	14	14
Wald chi-squared(F-Stat)	—	2640.09	5787.49	45,003.77	—	—
R-squared	—	—	—	0.82	0.77	0.73
Chi-squared [p-value]	—	[0.0000]	[0.0000]	[0.0000]	—	—

Note: For PPML, the dependent variable is IMDEX and not its log.

Robust standard errors, consistent in the presence of any pattern of heteroskedasticity and autocorrelation within panels. are reported in curly brackets.

p-values are presented in square brackets.

*, **, and ***, respectively, indicate significance at 10%, 5% and 1% levels.

Table 7. Auxiliary regression

	ALL EXPORTS Dep. Variable: LALLEX				RAW EXPORTS Dep. Variable: LRAWEX				CONSUMER EXPORTS Dep. Variable: LCONEX			
	Heckman Two-step	FGLS	PPML	LSDV	Heckman	FGLS	PPML	LSDV	Heckman	FGLS	PPML	LSDV
LRLF	0.0001 (0.025)	-0.0139 (0.020)	-0.0814** (0.040)	-0.0066 (0.031)	-0.0576 (0.059)	-0.0232 (0.039)	0.0266 (0.053)	-0.0254 (0.058)	0.0565* (0.029)	0.0330 (0.024)	-0.1790** (0.050)	0.0812** (0.041)
LGDP\$IM	0.0195 (0.050)	-0.0131 (0.030)	-0.0151 (0.053)	0.0301 (0.045)	0.0704 (0.090)	0.1225** (0.059)	0.2476*** (0.083)	0.1015 (0.084)	-0.0027 (0.057)	-0.0220 (0.036)	-0.0508 (0.073)	-0.0521 (0.057)
LALLTAR/ LRAWTAR/ LCONTAR	-0.0485 (0.039)	0.0299 (0.023)	-0.3218*** (0.0369)	0.0154 (0.030)	-0.0032 (0.067)	-0.0475 (0.037)	-0.3258*** (0.059)	-0.0025 (0.054)	0.0725* (0.042)	0.0566*** (0.022)	0.0436 (0.054)	0.0195 (0.327)
INST	0.0019 (0.011)	0.0040 (0.006)	-0.0015 (0.010)	0.0107 (0.009)	0.0171 (0.021)	0.0170 (0.137)	0.0180 (0.019)	0.0251 (0.020)	0.0146 (0.124)	0.0086 (0.008)	0.0206 (0.013)	0.0116 (0.008)
CONTIG	0.0748 (0.109)	0.0047 (0.062)	0.1324 (0.108)	0.0658 (0.089)	0.0346 (0.208)	-0.0174 (0.121)	0.1341 (0.215)	-0.0355 (0.192)	0.0387 (0.123)	-0.0125 (0.075)	0.6344*** (0.126)	-0.0499 (0.112)
COML	0.2030 (0.153)	0.0497 (0.084)	0.0655 (0.180)	0.2177* (0.129)	0.3009 (0.326)	0.3179* (0.183)	0.8893*** (0.274)	0.4809* (0.281)	0.1096 (0.178)	0.2172** (0.103)	-0.0230 (0.192)	0.3127* (0.165)
LDIS	0.0425 (0.084)	-0.0086 (0.050)	-0.020 (0.086)	-0.0348 (0.070)	-0.0720 (0.166)	-0.1735* (0.097)	0.1975 (0.149)	-0.2341 (0.150)	0.1649* (0.094)	0.0131 (0.060)	0.2466** (0.105)	0.0086 (0.083)
LTCOST	-4.0199*** (0.096)	-3.5498*** (0.090)	-2.8624*** (0.128)	-2.8997*** (0.199)	-	-	-	-	-	-	-	-
LAI\$GDP	0.1164 (0.427)	-0.2270 (0.372)	0.5375 (0.548)	0.8161 (0.759)	-2.2127*** (0.848)	-1.3428 (0.930)	-4.2223*** (1.299)	2.5067 (1.747)	0.7656 (0.474)	0.3675 (0.497)	1.4508*** (0.411)	1.5551* (0.850)
WAEMU	-0.1450 (0.210)	-0.0657 (0.089)	-0.2251 (0.204)	-0.2557* (0.136)	0.0945 (0.445)	-0.3951** (0.188)	-1.2844*** (0.337)	-0.6169** (0.282)	-0.1797 (0.256)	-0.2625** (0.109)	-0.1388 (0.202)	-0.3746* (0.169)
WAMZ	-0.2443 (0.210)	-0.1777 (0.089)	0.2947 (0.204)	-0.3100* (0.136)	-0.3350 (0.445)	-0.7071** (0.188)	0.5387* (0.337)	0.3764 (0.282)	-0.1277 (0.256)	-0.2820* (0.109)	-0.1774 (0.202)	-0.1463 (0.169)

(Continued)

Table 7. (Continued)

	ALL EXPORTS Dep. Variable: LALLEX					RAW EXPORTS Dep. Variable: LRAWEX					CONSUMER EXPORTS Dep. Variable: LCONEX					
	Heckman Two-step	FGLS	PPML	LSDV	Heckman	FGLS	PPML	LSDV	Heckman	FGLS	PPML	LSDV	Heckman	FGLS	PPML	LSDV
CONSTANT	20.5469*** (0.167)	21.5089*** (0.119)	13.8339*** (0.251)	10.405** (0.162)	38.4255*** (0.367)	28.7686*** (0.300)	41.6782*** (0.325)	-4.8271 (0.428)	13.6612*** (0.192)	14.4970*** (0.144)	5.9480* (0.273)	2.1742 (0.218)				
No of obs.	1841	1457	1841	1465	1841	1147	1841	1156	1841	1381	1841	1389				
Wald chi2	7654.23	6476.28	-	-	2018.55	2190.77	-	-	5967.76	6640.69	-	-				
[p-value]	[0.0000]	[0.0000]	-	-	[0.0000]	[0.0000]	-	-	[0.0000]	[0.0000]	-	-				
R-squared	-	-	0.90	0.93	-	-	0.96	0.84	-	-	-	0.92				

variable suggests that intermediate trade is a positive function of the similarity in GDP, also in line with the Linder hypothesis.¹⁶

In the case of the relative factor endowment, the negative sign on the relative factor endowment (LRLF) suggests that the Heckscher–Ohlin model breaks down. This model posits that differences in factor endowments between two countries is a positive determinant of trade between them. Stated differently, countries similar in relative factor endowments may still engage in a two-way trade with each other, such as simultaneous trade in *intermediate goods* between cocoa beans actors in Ghana and Cote d'Ivoire; these two countries being similar in relative factor endowments. In line with the new trade theory, consumers' love for varieties may spur producers to demand or source for varying intermediate goods; this may explain the simultaneous imports and exports of intermediate goods in ECOWAS. And since the efficiency of downstream actors in a value chain is largely dependent on the efficiency of those upstream, access to quality intermediate inputs are critical to the success and benefits of and from regional value chains.

Considering the exports of *all goods* as shown in Table 7, in terms of the signs on both LRLF and LGDPSIM, there is no uniformity in the estimates. What seems to be a common point is that differences in relative factor endowments and similarities in GDP are not significant drivers of the exports of all products. As with intermediate goods, exports of *raw materials* are a positive function of similarities in GDP but a negative function of relative factor endowments. This is also an evidence in support of a South-South trade pattern within ECOWAS. Contrarily, empirical evidences here tend to support the differences in relative endowment being a positive and perhaps weakly statistically significant driver of the exports of consumer goods within the ECOWAS region, in support of the Heckscher–Ohlin model. This finding is in line with that of a similar study on ECOWAS—Afolabi et al. (2015), who used the difference in per capita income as a proxy for difference in relative factor endowments and obtained a positive and significant coefficient while assessing regionalism and ECOWAS trade performance using a gravity approach. Estimates of the similarity in GDPs rather show that the more similar countries are in GDP, the less they engage in trade in *consumer goods*. In essence, countries within this region seem to be more engaged in inter-industry trade when it comes to consumer/final goods. Contrarily, Wang et al. (2010) investigated the determinants of trade flows in OECD countries using gravity panel data models and obtained a negative and significant estimate for the relative factor endowment in support of the new trade theory.

The key variable of interest is a continuous trade policy variable—tariff on intermediates (LIMDT). This variable is correctly signed but not a significant driver of intermediate exports in ECOWAS. A 100% increase in tariff on intermediate goods results on the average to about 4.9% decline in the export of intermediate goods in the ECOWAS sub-region. The point estimate is similar to that of Kowalski et al. (2015) who used value-added trade as the dependent variable for selected developing countries for whom data were available. Their point estimate was -0.046 meaning that intermediate tariff is associated with about 4.6% decline in value-added trade, however, with a significant impact on value-added trade. But Kowalski et al. (2015) is a generalisation for developing countries and hides the specific character of ECOWAS. The estimates for this current study are however specific to ECOWAS and is quite revealing of the insignificant impact of tariffs on intermediate goods on intraregional intermediate exports within the ECOWAS sub-region.

The negative but insignificant impact of intermediate tariffs on intermediate exports within the sub-region implies that intermediate tariff is not sufficiently low as to significantly bolster intermediate exports within ECOWAS. This finding challenges the performance of The ECOWAS Trade Liberalization Scheme (ETLS) as ETLS, according to ECOWAS Vanguard (2013) was aimed at progressively reducing and later eliminating all tariff and non-tariff barriers against intra-ECOWAS trade (ECOWAS Vanguard, 2013). It is expected that since ETLS was fully implemented in 1990, its impact in this area of tariff reduction should have been significantly felt 10 years after, which means the year 2000 onwards, which is the scope of this study. Statistics from WITS reveals

the disparities in charges on intermediates within the sub-region with Gambia being the “most hostile” in terms of intermediate tariff charged and Nigeria being the country that faces the most tariff charges on intermediates, at least within the study period. Gambia charges, on the average, between 2000 and 2015 was about 14.83% as compared to the lowest charge by Senegal amounting to about 6.43%. Nigeria faced about 10.2% in 2012, 22.44% in 2014 and 25.36% in 2015 from Benin, Cote d’Ivoire and Ghana, respectively.

The finding that intermediate tariffs charged is not a significant driver of intermediate flows within the sub-region is in line with Obasaju, Olayiwola, Okodua, and Obasaju (2018) and suggests the need for the ECOWAS REC to look inwards and address the disparate and unsupportive tariff policies within the region so as to further encourage intra-regional trade flows and by extension encourage the formation and gains of and from regional value chains. Addressing trade policies at the regional level is expected to aid the formation of regional value chains which in turn is expected to enhance the gains of Member States from GVCs. The estimates for all exports and raw exports are also in sync with those of intermediate goods as effectively applied tariffs on all goods and raw materials are not statistically significant drivers of all exports and raw exports, respectively, within ECOWAS. In a nutshell, tariff levels are simply not sufficiently low as to aid trade in all products, raw materials/products and intermediate products. The coefficients on tariffs on consumer goods (LCONTAR) surprisingly fall out of a *priori* expectation as estimated by all the techniques. But there is a lack of uniformity in conclusion amongst the techniques employed, as to whether or not this variable is statistically significant.

The quality of institution within the sub-region is correctly signed and highly statistically significant in respect of the baseline regression which deals with intermediate exports but although positive, statistically insignificant for the auxiliary regression. This conclusion holds in all cases of the auxiliary regression as it is obvious that the quality of institution does not sufficiently support any of raw, consumer and all exports. While considering the entire developing nations, Kowalski et al. (2015) observed a positive and significant impact of the quality of institution on value-added trade flows. However, garnering insights from the Worldwide Governance Indicators’ (WGI) database, many values of the indicators of the quality of institution in ECOWAS fall in the negative domain (on a scale of -2.5 to 2.5) when averaged over the scope of the study, i.e. between 2000 and 2015. From WGI, only Cape Verde recorded three positive values out of the six indicators of the quality of institution subjected to the principal component analysis (voice and accountability, political stability, control of corruption, governance effectiveness, regulatory quality and rule of law). Other countries have at least two negative figures, with most recording three, four or more negatives for these indicators. Olofin et al. (2013) only used political stability which is one of the indicators of the quality of institution and observed that this variable positively and significantly impacts intra-ECOWAS exports between 1995 and 2010. But conducting a principal component analysis for the quality of institution helps this current study to avoid the narrow definition of the quality of institution.

The gravity theory of trade posits that contiguity enhances trade. From the estimates, this assertion holds true as contiguity positively and significantly impact intermediate exports within the sub-region. But contiguity does not seem to be as important when it comes to the categories of exports other than intermediates. In respect of common language, its coefficient is contrary to expectation when intermediate exports is considered. For the other categories of exports, it may be concluded that possessing a common language is a positive but not statistically significant driver of bilateral exports within the ECOWAS regional economic community but a positive and statistically significant determinant of bilateral trade flows in ECOWAS as estimated by Osabuohien, Efobi, Odebiyi, and Fayomi (2017).

The estimate of distance is both economically and statistically significant and lends credence to the fact that distance is a decreasing function of trade. Trade cost (in the case of all products’ export) is negative and highly statistically significant suggesting that the cost of trade is (sufficiently low)

supportive of bilateral trade in ECOWAS. This outcome is most likely a positive repercussion of the ongoing regional economic integration aimed at lowering the cost of trade within the REC.

The share of agriculture in GDP is weakly significant as estimated by the Heckman Two-step technique but highly significant using FGLS. The two other techniques PPML and LSDV suggest that this variable is positive but not a significant driver of intermediate trade in ECOWAS. It may be however be inferred that, being a REC reasonably dependent on agriculture, agricultural intermediate goods is playing an important role in the bilateral trade in intermediate exports within the region. For all exports and consumer exports, the share of agriculture also plays a positive role in bilateral trade within the region. Not surprisingly, the coefficient on this variable turns negative and significant when the focus shifts to raw exports. This finding seems to suggest that the higher the share of agriculture in GDP, the lower the trade in raw material exports since agriculture raw materials already accounts for a large part of the raw materials in ECOWAS.¹⁷

The roles of EIAs within ECOWAS are now examined to investigate whether integration agreements are trade creating or diverting. For the francophone-dominated agreement (WAEMU), it positively and significantly drives intermediate exports in ECOWAS even at the 1% level of significance irrespective of the technique of analysis considered. Thus, it may be concluded that WAEMU is trade creating. More explicitly, the positive coefficient on the WAEMU variable in respect of intermediate exports implies that the existence of WAEMU does not jeopardise the total intermediate export flows between the members of WAEMU and ECOWAS at large. In other words, the presence of WAEMU is associated with an increase in intermediate exports in the ECOWAS sub-region. But for other categories of exports, the empirical estimates in this current study assert that this EIA is trade diverting implying that members of this EIA tend to engage in trade amongst themselves rather than with ECOWAS at large contrary to Olofin et al. (2013) who observed that WAEMU (combining the dummy for both the partner and source country) impacts positively and significantly on intra-ECOWAS exports.

The presence of WAMZ (Anglophone dominated agreement), in respect of intermediate goods, is also trade creating, as it positively impacts intermediate exports, albeit to an insignificant degree. And as is the case with WAEMU, WAMZ is trade diverting for other categories of exports, similar to Olofin et al. (2013) who observed that the WAMZ dummy (combining the source and the partner) is negative and significant, that is, WAMZ is trade diverting.

5. Conclusion and recommendations

The new trade theory explains intermediate trade exports in ECOWAS, and the empirical estimates show that intermediate tariffs do not significantly impact intra-regional intermediate exports. The significant determinants of intra-regional intermediate exports in ECOWAS are the gravity variables, similarity in GDPs, agriculture contribution to GDP, the quality of institution and the WAEMU and WAMZ trade agreements. Contrarily, intermediate tariffs, differences in factor endowments, the WAMZ trade agreement and trade cost are not significant determinants of intra-regional intermediate exports in ECOWAS.

With the performance in value chains measured either in terms of trade in value-added or proxied by trade in intermediates—the latter being the measure adopted by this current study—the insignificance of intermediate tariffs suggests that tariffs charged on intermediates within ECOWAS do not bode well for the formation and strengthening of regional value chains. It is therefore imperative for regional efforts to synergise with national efforts to make trading within ECOWAS cheaper. National economies such as Gambia, Guinea and Sierra Leone who levy relatively high charges on intermediate goods as compared with countries like Senegal and Cote d'Ivoire should be encouraged to consider reviewing their charges on other Member States downwards in order to foster increased trade in intermediate goods within the sub-region and build resilient regional value chains.

And with the revelation provided by the auxiliary regressions, the need to review effectively applied tariffs on the different categories of exports is exigent. WAEMU and WAMZ being trade creating in terms of intermediate goods trade strongly lends credence to the possibility of forming and strengthening regional value chains when barriers to trade are significantly ameliorated.

Future studies may undertake the task of assessing the determinants of participation in regional value chains in ECOWAS using value-added measures such as the calculation of foreign and domestic value added in exports within ECOWAS. The determinants of intra-industry trade may also be investigated while paying attention to the distinction between vertical and horizontal intra-industry trade types.

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Notes

1. This means the difference between the effectively applied tariffs charged by a particular reporting country on the imported intermediate goods of its partner and the tariff charged by its partner on the imported intermediate goods of that reporting country, averaged over the study period—2000 to 2015.
2. Data on research and development is very scanty for ECOWAS, so this variable is not included in the subsequent empirical analyses.
3. Conceptually, the definition of labour force has changed from being regarded as the supply of labour to the production in the systems of national accounts (SNA) to capture those in employment to earn income and those seeking and available for this kind of work. Despite not being a measure of only the persons employed, International Labour Organisation (ILO) (2013) noted that the labour force targets more closely the population of interest for the formulation of employment, income and similar social policies and programmes.
4. Note that we do not delve into the issue of the determinants of intra-industry trade (IIT) in which case the differentiation between horizontal and vertical IIT is suggested (See a CEPII document No 1997-01, drafted by Fontagne and Freudenberg).
5. The focus of this current study is to investigate the impacts of tariffs on bilateral exports of goods being broadly grouped by the (production) stage in the value chain, within ECOWAS.
6. We use effectively applied tariffs (AHS weighted average) all through in the absence of data on bilateral effective rate (ERP) of protection for ECOWAS. See chapter two of UNCTAD's document on "quantifying trade policy" for more information about the requirements for calculating ERP.
7. Given the "all-inclusive" nature of trade cost (TCOST) as a variable, a correlation analysis was first performed to investigate whether or not it has strong correlations with individual proxy measures of trade cost incorporated in our model—tariffs, distance, common language and contiguity. The results, not reported here, show that the correlation is very weak with none exceeding 0.3. Hence, we retain each of these variable in the model to gauge their individual contribution.
8. Note: The quality of institution is not logged here because it is an index ranging between -2.5 and 2.5.
9. Many empirical studies, however, ignore stationarity tests for panels with relatively small dimension of T (i.e. few number of years).
10. The series for exports and tariffs other than those of intermediate goods are also stationary.
11. Only the results for intermediate goods are reported because of the interest of the current study.
12. The estimates for Trade Cost are intentionally unreported in all regressions involving intermediate products or raw products or consumer products' exports as the dependent variable. It is only included in the regression involving all goods as the dependent variable. This is because the trade cost data from UNESCAP is categorised based on agriculture, manufacturing and total products. We do not want to assume that trade cost for all goods (or agriculture and manufacturing) is applicable to intermediate, raw and consumer products but rather use trade cost for total products in the regression involving all products as the dependent variable.
13. Some researchers, like Allard et al. (2016), regress the dependent variable on the lags of the regressors to mitigate reverse causation. But their dependent variable was an indicator of backward integration in GVCs. Regressing the dependent variable on the lags of the regressors yielded poor fits in terms of economic and statistical significance. Hence, we rely on the fixed effects and the exogeneity tests for EIAs in this respect.
14. When the time-invariant importer and exporter fixed effects were used, in one scenario and then combining them with the time effects in the other

scenario, the Inverse Mills Ratio was significant in each case indicating significant selection bias. These estimates are available upon request.

14. Estimates of trade cost intentionally unreported. Please refer to footnote 11.
15. Experimenting with systems GMM (a dynamic model) resulted into the dropping of many zeros as is the case with other techniques apart from Heckman and PPML—this may result into selection bias. The fit was also poor.
16. This hypothesis suggests the possibility of trade between countries reasonably similar in their level of development.
17. This is supported by statistics from WITS.

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APPENDIX

Table A. Weighted average differences (AHS) of effectively applied tariffs on intermediate goods

Benin	B/Faso	Cape Verde	Cote d'Ivoire	Gambia	Ghana	Guinea	Liberia	Mali	Niger	Nigeria	Senegal	S/Leone	Togo
-0.364	-1.287	0.896	-2.049	-0.474	1.881	2.711	2.338	-1.399	-0.132	-1.586	-3.456	2.609	-0.940

Table B. Correlation statistics for WAEMU

	Waemu	Waemu_f	Waemu_f2	Waemu_f3	Waemu_f4	Waemu_f5	Waemu_1	Waemu_2	Waemu_3	Waemu_4	Waemu_5
Waemu	1.000										
Waemu_f	0.2277	1.000									
Waemu_f2	0.2800	0.2205	1.000								
Waemu_f3	0.2677	0.2790	0.2403	1.000							
Waemu_f4	0.2541	0.2500	0.2673	0.2597	1.000						
Waemu_f5	0.2252	0.2515	0.2689	0.2818	0.2525	1.000					
Waemu_1	0.2444	0.2911	0.2677	0.2602	0.2311	0.2735	1.000				
Waemu_2	0.2757	0.2460	0.2685	0.2196	0.2830	0.2639	0.2320	1.000			
Waemu_3	0.2376	0.2487	0.2457	0.2843	0.2910	0.2614	0.2501	0.1981	1.000		
Waemu_4	0.2233	0.2432	0.2546	0.2532	0.2752	0.2605	0.2231	0.1765	0.2213	1.000	
Waemu_5	0.2855	0.2347	0.2989	0.2599	0.2771	0.2630	0.2673	0.1943	0.2227	0.2211	1.000

Table C. Correlation statistics for WAMZ

	Wamz	Wamz_f	Wamz_f2	Wamz_f3	Wamz_f4	Wamz_f5	Wamz_1	Wamz_2	Wamz_3	Wamz_4	Wamz_5
Wamz	1.000										
Wamz_f	0.1818	1.000									
Wamz_f2	0.1469	0.1903	1.000								
Wamz_f3	0.2002	0.1228	0.1738	1.000							
Wamz_f4	0.2193	0.2193	0.1152	0.2124	1.000						
Wamz_f5	0.1950	0.2297	0.2211	0.1165	0.2071	1.000					
Wamz_1	0.1465	0.1658	0.1913	0.2012	0.1945	0.1781	1.000				
Wamz_2	0.1695	0.1620	0.1605	0.1697	0.1817	0.1651	0.1684	1.000			
Wamz_3	0.1473	0.1403	0.1656	0.1936	0.1871	0.2442	0.1640	0.1497	1.000		
Wamz_4	0.1543	0.1532	0.1243	0.1812	0.1754	0.1823	0.1643	0.1345	0.1532	1.000	
Wamz_5	0.1899	0.2394	0.1706	0.2091	0.2027	0.2433	0.1474	0.1316	0.1359	0.1345	1.000



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