

Ozekhome, Hassan O.; Oaikhenan, Hassan E.

## Article

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# LOGISTICS AND TRADE FLOWS: EVIDENCE FROM SELECTED ECOWAS COUNTRIES

Hassan O. Ozekehome<sup>\*1</sup> and Hassan. E. Oaikbenan<sup>1</sup>

## Abstract

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*The traditional trade literature has largely centered on the removal of artificial and non-artificial barriers to trade. The focus, has, however, in recent times, shifted to the role of logistics on trade flows, necessitating this study. Employing the Hausman-Taylor and system-GMM estimation techniques on a panel data from selected ECOWAS countries, the empirical results show that logistics has a positive but weak impact on trade in the sub-region. Foreign direct investment, world demand, exchange rate, the ease of doing business and socio-political indicator variable (which accounts for the stability of the social and political environment) are other critical variables that influence trade in the sub-region. The impact of financial development is positive but weak. We recommend amongst others, the building of sound logistics, increased investment in soft and hard infrastructure, improved ease of doing environment, and the harmonization and coordination of trade policies to enhance trade in the sub-region.*

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**Keywords:** Logistics, Trade flows, ECOWAS, Hausman –Taylor, System-GMM

**JEL Classification:** F14, F15, E61, C13

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<sup>\*1</sup>Corresponding author; Department of Economics, Glorious Vision University, Edo State, Nigeria. Email address: hassanozeke1@gmail.com.

<sup>1</sup> Department of Economics, University of Benin, Nigeria. Email address: beoaikbenan@uniben.edu

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## 1.0 INTRODUCTION

Regional integration in the ECOWAS sub-region has been a slow process, due to the low trade flows in the sub-region. The literature on trade performance has focused more on the removal of artificial and policy barriers to trade, neglecting the role of trade logistics on trade flows (see Adamu et al., 2012; Arodoye & Iyoha, 2014). According to the recent literature (see Jouanjean et al., 2015; Amoako-Tuffor et al., 2016), the removal of impediments to trade, as advanced in the traditional trade literature, may not actually translate to increased trade flows when there are considerable trade costs, arising from poor logistics that tend to diminish trade. Aside being a key determinant of trade flows and trade volumes between or among countries, logistics is a significant determinant of the dynamics of foreign direct investment, firm outsourcing and proliferation of regional trade and financial agreements (Anderson & Wincoop, 2004; Jacks, Meissner & Novy, 2008).

The bulk of the recent literature on trade performance explains comparative advantage, specialization, trade patterns and trade variation in terms of trade costs and logistics performance. These studies consistently maintained that that increased trade brought about by improved logistics, induces output directly, with the additional potential to enhance efficiency indirectly, by means of other channels, such as technology transfer, increasing scale economies, as well as the competitive influence of interaction with foreign firms in markets at home and abroad (Block & Tang, 2004). The World Bank recognizes provision of logistics as part of the broader policies of trade liberalization. According to recent studies (see, Nguyen, 2015; Jouanjean, et al., 2015), substantial variations across countries in terms of logistics capabilities and its drivers significantly correlate with country (regional) differences in trade performances. This implies that considerable trade growth could be reached by improving logistics in lagging countries and regions (Amoako-Tuffor et al., 2016). Specifically, logistics affects trade performance of a country in terms of cost, time, reliability, and predictability, which in turn affects the overall competitiveness of exports in the international market (Arvis et al., 2007). Although several factors explain trade, the focus of the World Bank has, in recent times, shifted to logistics and trade facilitation.

The general consensus is that that ports and logistics in Africa (ECOWAS inclusive), are besieged by humongous inefficiencies and infrastructural bottlenecks which combine to raise transportation and trade cost, thereby undermining the competitiveness of African economies in terms of lower trade flows (Lall et al., 2009; Lesser & Moise-Leeman, 2009). Yet, the nexus between logistics and trade flows in the ECOWAS sub-region lacks notable empirical attention in literature, especially when considered against the backdrop that, the push towards greater economic integration cannot be realized without strong trade links. The few known related studies on the logistics-trade nexus (see Clark et al., 2004, Abert, et al., 2011 and Marque-Ramos, 2011) were either country-specific or were carried out in other regions of the world. More importantly, not any of the known studies, including other pertinent studies carried out in the sub-region have investigated trade performance in the context of logistics, as opposed to the traditional focus of investigation trade in terms of artificial and non-artificial barriers. The current study, therefore, seeks to fill the aforementioned gap, by empirically examining the logistics-trade flows nexus in the ECOWAS sub-region. Accordingly, the study is relevant from the perspective of adducing empirical evidence that could inform policies that are formulated to enhance economic integration, given the current drive for greater economic integration in which strong trade performance, anchored on good logistics is critical. In this regard, the paper addresses issues of policy relevance to the sub-region, in the light of recent policy discussions to create the enabling environment that would promote trade integration in the ECOWAS sub-region.

Following this introductory section, the rest of the paper is as follows: Section 2 provides the stylized facts on logistics and trade performance in ECOWAS. Section 3 reviews the literature, which encompasses the theoretical, empirical and policy issues connected with logistics and trade flows in the

ECOWAS subregion. The methodology, model specification and data are covered in Section 4, while Section 5 consist of the empirical results and analysis. The conclusion and policy recommendations are presented in section 6.

## 2.0 STYLIZED FACTS

Available evidence shows that logistics performance in the ECOWAS sub-region has been generally poor on account of poor infrastructure, weak institutions, technological deficiency, administrative bottlenecks and corruption, all serving to engender high trade transaction costs, resulting in low competitiveness of ECOWAS goods in the international market (Jouanjean et al., 2015). The logistics performance index of some selected ECOWAS countries are reported in the Table 1.

**Table 1:** Logistics Performance Index of selected ECOWAS countries (2010-2016 (Average))

Country	Score	Custom	Infrastructure	International Shipments	Logistics Competence	Tracking and Tracing	Timeliness
Benin	2.36	2.40	2.35	2.54	2.72	2.85	2.98
B-Faso	2.63	2.70	2.38	2.50	2.60	2.45	3.05
Cabo Verde	3.28	3.15	3.40	3.19	3.10	3.62	3.55
Cote d'Ivoire	2.53	2.16	2.37	2.44	2.57	2.95	2.73
The Gambia	2.46	2.50	2.35	2.82	2.75	2.65	2.96
Ghana	2.47	2.35	2.52	2.38	2.42	2.51	2.67
Guinea	2.38	2.40	2.32	2.48	2.50	2.36	2.85
Guinea-Bissau	2.46	2.45	2.40	2.70	2.46	2.36	2.92
Nigeria	2.59	2.17	2.84	2.45	2.45	2.45	3.10
Sierra-Leone	2.25	2.20	2.44	2.50	2.36	2.40	2.78
Average	2.78	2.66	2.54	2.40	2.34	2.66	2.95

**Note:** Overall index ranges from 1=low to 5=high, with a high score representing high performance.

**Source:** Authors: Underlying data from World Bank Logistics Performance Index Database

From Table 1, we observe that the ECOWAS countries have consistently had low logistics performance indices, as the sub-region ranks low in global logistics performance index (LPI), using an overall scale (index) performance of 5 as highest, with a high score representing high performance. The economies of the sub-region have been regarded as performing rather poorly in terms of logistics, infrastructure, timeliness, tracking and tracing, among others over the last decades. It is our view that this sad state of affairs can be attributed to, amongst others, the weak infrastructure base, poor trade policy implementation, structural bottlenecks, weak institutions and inconsistent policies.

Intra-ECOWAS trade is largely constrained by weak supply response to regional market opportunities and lack of export competitiveness arising from poor logistics, infrastructure, institution and policy implementation. It is evident from Table 1, that except for Cabo-Verde (Cape Verde), most of the countries have a low logistics performance index, which largely accounts for the low volume of trade flows in the sub-region. In terms of indicators of economic integration in ECOWAS with respect to

trade<sup>2</sup> flows, available evidence reveal that between 1999 and 2009, ECOWAS share of imports ranged between 11.67 per cent and 17.04 per cent. This however reduced to a range between 10.2 percent to 16.3 percent in the period 2010 to 2016 with its exports share in the same period, ranged between 8.40 per cent to 14.18 percent and 5.1 percent to 11.4 percent; which suggests that the region is a net importer (Africa Competitive Report, 2016). Comparably, the logistics performance index (LPI) during the two periods, stood at 2.50 and 2.42, respectively. Furthermore, the region's exports USD 100 billion in 2009 from USD 20 billion in 1999, with imports rising to USD 60 billion from USD 18 billion.

The region has been characterized by deteriorating and negligible share of trade. Its share of world trade was 0.7 percent in 1980, 0.6 percent in 1990, and 0.3 percent in 2000, falling abysmally to 0.02 percent in 2015 (Africa Development Report, 2015). Intra-African and ECOWAS trade has also lagged with a value below 9 percent of total trade (Africa Development Report, 2015). The indirect trade costs, resulting from poor logistics capability, constitute 30 percent of the price consumers pay, compared to less than 10 percent in industrialized economies. Freight consists of nearly 10 percent of the imports value in developing countries, in relation to the 3 percent in developed countries, with the challenge even more daunting in the case of landlocked economies. It is worthy of note that freight cost represents over 21 percent of the value of imports in Nigeria, 24 percent in Mali, 23 percent in Niger and 22 percent in Cabo Verde. Border post delays constitute approximately 40 percent of the transport time, and suggests huge costs associated with the deterioration of product quality and staff time (Africa Development Report, 2015).

Intra-regional trade, comprising imports and exports, declined during the period. Intra-regional exports vacillated around 8.4 and 14.2 per cent during the same period, and that of imports fluctuated between 11.5 and 19.9 per cent. Deriving from these facts, both intra-regional exports and imports fell below 20 per cent, an indication that over 80 per cent of ECOWAS trade is done with other regions. Intra-ECOWAS exports was 0.1 per cent in 1999 and 0.3 per cent in 2015. Imports also accounted for a low 0.6 per cent in 2000, and 2.4 percent in 2013 (Olayiwola & Oluyomi, 2013, World Bank, 2015, a). The diminishing trend in intra-regional trade is attributed mainly to the weak logistics and poor trade facilitation (World Bank, 2015). Overall, logistics and trade performance have, on the average, remained weak in the ECOWAS sub-region all through the past decades. The low volume of trade is attributed mainly to the weak trade logistics in the sub-region which has resulted in high trade transaction costs. Other reasons for the poor trade performance are poor domestic trade policies in the context of artificial and non-artificial (natural) barriers (impediments), poor transport infrastructure and poor implementation of regional trade policies, weak institutions and technological deficiencies. The connection between poor logistics, and trade are striking. A key constraint recognized in the total trade infrastructure and transport system remains the near-absence of ports and failing infrastructure.

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<sup>2</sup>Artificial barriers are trade barriers that occur as a result of deliberate or conscious government policy. They consist of the traditional or conventional barriers to trade in the literature. They include tariff barriers, customs and behind- border related costs, legal and regulatory costs, foreign exchange costs, contract enforcement costs and communication costs. Non-artificial barriers, on the other hand, are nature-imposed barriers, on account of the geographical spread of countries.

### 3.0 LITERATURE REVIEW

LPI is a composite index that measures the ground efficiency of trade or supply chain logistics performance. It encompasses freight transportation, warehousing, port and trade infrastructure, boarder clearance, payment system and other functions outsourced by producers and merchants to dedicated service providers. The LPI is the weighted average of the country scores on the six key dimensions:

1. The efficiency of the clearance process (i.e.; speed, simplicity and predictability of formalities) by border control agencies, including customs.
2. Quality of trade and transport-related infrastructure (e.g., ports, railroads, roads, information communication technology);
3. Ease of arranging competitively priced shipments;
4. Competence and quality of logistics services (e.g., transport operators, customs brokers);
5. Ability to track and trace consignments; and
6. Timeliness of shipments in reaching the destination within the scheduled or expected delivery time.

There are many components of trade logistics which interact to impact the supply chains and ultimately influence trade flows. These include transport infrastructure, information flows, time delays and logistic service and trade facilitation. Transport infrastructure is the most critical aspect of trade logistics and adequate infrastructure is required to facilitate transportation. This includes availability of pallets, shipping containers and terminals. Corridors include roads, railway lines, sea lanes, air corridors and facilities such as signaling and traffic control. Other facilities include ports and airports. For instance, the availability of well-connected high-speed roads and efficient rail system ensures that goods are able to reach their final destination without delay once dispatched from airport or container terminals. In the same vein, well-developed information communication technology is important for trade. Telecommunication and electricity infrastructure are needed to enhance trade at the country and regional levels.

The logistics in transport- trade flows nexus has its theoretical underpinnings in the dynamic-integration theory, which holds the view that the prospects for regional trade and economic integration are likely to be stimulated through the reduction of transaction costs made possible by improved and efficient trade and transport infrastructure. Krugman (1994) and Hildegunn (2006) in advancing the theory, submit that market integration, regional trade and competitiveness can be reduced, because essential transactions and relationships are delayed and disrupted due to poor trade and transport infrastructure. Transport infrastructure, accordingly, plays a significant role in explaining the centripetal (agglomeration effects) and centrifugal (dispersion effects) forces that describe the economic organization (which in this context include trade) of territories. Limao and Venables (2001), Portugal-Perez and Wilson (2012), François and Manchin (2013) and Ramli and Ismael (2014), in giving credence to the dynamic – integration theory posit that good transport and infrastructure (which includes logistics capability), will accordingly, stimulate regional trade and integration. In line with this proposition, improved logistics and trade infrastructure will encourage external markets, improved and efficient allocation of resources, and promotion of trade flows. Recent literatures on trade (see Anderson & Wincoop, 2004; Nordas, Pinali & Grosso 2006; Shepherd & Wilson, 2007; Portugal- Perez & Wilson, 2008, a; Hoekman, & Nicita, 2011) posit that aside constituting one of the most significant factors determining trade between/among countries, logistics play a vital and substantial role in the determination of foreign direct investment, outsourcing of firms, proliferation of regional trade and financial agreements (Jacks, Meissner & Novy, 2008). The idea is that even when artificial and non-artificial barriers to trade (in terms of policy-induced distortionary forces) and other trade impediments are removed, increased trade

in the actual sense, might not be realized, particularly, when there are poor logistics and complex custom clearance procedures and other border agencies, arising from uncoordinated, unstandardized and non-transparent trade procedures (Anderson & Wincoop, 2004; Nordas et al., 2006, Portugal- Perez & Wilson, 2008, b). The World Bank (2015) has argued that improved logistics and good regional trade infrastructure have the capacity to speed up regional efficiency, encourage faster absorption of technological innovations promote trade and regional integration. Improved trade logistics and favourable trade environment supported by socio-political stability have the capacity to promote trade and regional cooperation (Lim, 2001).

On the relationship between trade flows and logistics capability, the focus of most studies have centred on the role of logistics on trade intensity and patterns. For example, studies that have focused on the link between logistics and trade include Qualey (1999); who examined the impact of different logistics indicators on trade, Kung (2001) who investigated the impact of logistics capability on regional economic integration; Devlin and Yee (2002) examine the impact of logistics on foreign trade; Limao and Venables (2001) who provide evidence that improvement in infrastructure is quantitatively significant in determining trade; Clark et al (2004) who examine the link between port efficiency, maritime transport cost and bilateral trade, and find that, an improvement in port efficiency by 50 percent would lead to a rise in bilateral trade by 25 percent. Other studies such as Wilson, et al (2004), Arvis et al (2007), Njinku, Wilson & Fasso (2008), Behars and Manners (2008), Albert and Benjamin (2011), Behar et al. (2011), Kessides (2012) assess the potential benefit of logistics and trade reforms on trade, while Wilson et al (2008) find evidence that apart from traditional determinants of bilateral trade, infrastructural services, port efficiency, institutions, and to a lesser extent, proliferation of regional agreements are significant determinants of trade. The study by Kotan and Saygili (2009) went a bit further (2009) to investigate the link between logistics, trade facilitation, macroeconomic policy (exchange and inflation rates) and trade flows. Some other studies investigate the role of logistics, infrastructure, capacity-building and legal, regulatory and institutional frameworks on trade (see for example, Portugal-Perez & Wilson, 2009; Mbekeani, 2010; Nguyen & Tongzon, 2010; Marque-Ramos, 2011; Hoekman & Nicita, 2011; Portugal-Perez and Wilson, 2012; Jouanjan, et al., 2015).

Considerable trade expansion brought about by improved logistics and trade-enhancing processes such as improved customs procedures and border clearance are believed to have contributed largely to the remarkable trade and output growth recorded in high-performing Asian economies. To this end, the the trade and growth miracle recorded by economies such as Hong Kong, Korea, Singapore and Taiwan has been supported by good logistics base and critical trade infrastructure. The trade and growth success made by these economies could largely be explained by the impressive trade reforms carried out, in the context of the provision of good logistics, stable macroeconomic and political environment, and supporting institutional framework that encourage trade (World Bank, 2015, b).

In all of these studies, there was no conscious attempt to empirically examine the effects of the depth of the financial system, the ease of doing business, foreign direct investment and world demand on trade flows, particularly for an economic bloc. These factors are crucial, especially for ECOWAS, where regional economic integration largely evolves from trade links. It is the intention of this study seeks to extend the literature in view of the foregoing gap, to adduce empirically- oriented policy perspectives for regional economic integration.

## 4.0 EMPIRICAL METHODOLOGY

### 4.1. Model Specification

In empirical specification, the systematic relationship that exists between logistics and trade flows in ECOWAS countries is captured in the stylized logistics-trade model of the form:

$$TF_{it} = f(LPI_{it}, X_{it}) \quad (1)$$

where  $TF_{it}$  is the dependent variable, here total volume of trade is used as a measure of trade performance; LPI is logistics performance index,  $t$ , is country fixed specific and time – varying effect in a particular year, and  $X$  is a vector of additional macroeconomic variables, in line with the literature, which influence trade flows (see Kotan & Saygili, 2009; Adamu et al., 2012; Ozekehome, 2016). These variables include:

FDI= Foreign direct investment inflows

WD= World/global demand

FD= Financial development

EXR = Exchange rate

EDB= World Bank Ease of Doing Business

PS- Socio-political indicator variable-measuring social and government stability

Thus, aside logistics, the key variables that have been found in the literature to be relevant in explaining trade flows include; foreign direct investment, world demand, exchange rate and financial development (an indicator of the capacity of the financial system to conduct financial intermediation and to provide finance and credit for trade) and ease of doing business. Following this, we specify the augmented version of the model to capture the determinants of trade flows in the selected ECOWAS countries as:

$$TF_{i,t} = f(LPI_{i,t}, FDI_{i,t}, WD_{i,t}, FD_{i,t}, EXR_{i,t}, EDB_{i,t}, PS_{i,t}) \quad (2)$$

where the variables are as earlier defined. We include a country political risk variable, which accounts for the impact of social and political stability on trade flows. This is hinged on the premise that countries/regions with more stable social and political environments can carry out greater degree of trade.

The empirical model specification to be estimated is thus:

$$TF_{i,t} = \alpha_0 + \alpha_1 LPI_{i,t} + \alpha_2 FDI_{i,t} + \alpha_3 WD_{i,t} + \alpha_4 FD_{i,t} + \alpha_5 EXR_{i,t} + \alpha_6 EDB_{i,t} + \alpha_7 PS_{i,t} + \varepsilon_{it} \quad (3)$$

where  $i$  represents each of the ten selected ECOWAS countries, namely, Benin, Burkina Faso, Cape Verde, Cote D'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Nigeria and Sierra-Leone, which were selected based on data availability, spanning the period 2008-2017.

The parameters to be estimated are  $\alpha_1 - \alpha_7$ , and  $\varepsilon$  represents the stochastic error term.

*A priori*, we expect:  $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7 > 0$ .

The estimation is done using the Hausman and Taylor (1981) model (HT henceforth), proposed for a model where some of the regressors could be correlated with the individual effects, and a system-GMM estimation technique, capable of addressing the threefold potential endogeneity of regressors, omitted



variables bias and measurement error problems. The HT estimator is based on an instrumental variable estimator which uses both the between and within variation of the strictly exogenous variables as instruments. This technique addresses the potential endogeneity of the regressors, and as a hybrid model, it combines the consistency of the fixed effects model with the efficiency and applicability of the random effects model. More specifically, the individual means of the strictly exogenous regressors are used as instruments for the time invariant regressors that are correlated with the individual effects (Baltagi, 2001; Baltagi, et al., 2003). The Hausman-Taylor (HT) model is written as:

$$Y_{it} = X_{it}\beta + Z_i\eta + \alpha_i + \epsilon_{it} \quad (4)$$

where  $i=1, 2, \dots, N$  and  $t=1, 2, \dots, T$ . The  $Z_i$  are individual time-invariant variables.  $\alpha_i$  is IID  $(0, \sigma_\alpha^2)$ , whereas  $\epsilon_{it}$  is IID  $(0, \sigma_\epsilon^2)$ , both independent of each other and among themselves.

Hausman and Taylor (1981) partitioned  $X$  and  $Z$  into two sets of variables  $X=[X_1, X_2]$  and  $Z=[Z_1, Z_2]$  such that  $X_1$  is  $n \times k_1$ ,  $X_2$  is  $n \times k_2$ ,  $Z_1$  is  $n \times g_1$  and  $Z_2$  is  $n \times g_2$ , and  $n=NT$ .  $X_1$  and  $Z_1$  are assumed exogenous and not correlated with  $\alpha_i$  and  $\epsilon_{it}$ , while  $X_2$  and  $Z_2$  are endogenous due to their correlation with  $\alpha_i$ , but not with  $\epsilon_{it}$ . Note also that  $X_1$  is time varying while  $Z_1$  is time invariant. Besides,  $X_2$  is time varying while  $Z_2$  is time-invariant.

It is evident from this model that OLS is biased and inconsistent, while the FE estimator that wipes out the  $\alpha_i$ , using the within-transformation, is consistent. The latter estimator also eliminates the  $Z_i$  and consequently, cannot produce estimates of  $\eta$ . The RE estimator which is GLS on (4), ignoring the endogeneity due to  $\alpha_i$ , will, also yield biased and consistent estimates of the regression coefficients. As a result, Hausman and Taylor (1981) suggest an instrumental variable estimator (i.e. Hausman-Taylor estimation technique), which yields more efficient and consistent estimates (Baltagi et al., 2003).

The dynamic system-GMM estimator on the other hand, is proved asymptotically efficient, robust to heteroskedasticity, and capable of addressing the problem of reverse causality (simultaneity). Information has shown that trade flows across countries and time (period), entails specifying a unique model to capture period and country-specific effects (economic idiosyncrasies) that are largely not observable or incomprehensible, which may likely result in potential endogeneity, making the system-GMM suitable for such analysis (Green, 2003). Against this backdrop, the system-GMM estimator provides highly precise and less biased estimates when compared to the first-differenced-GMM estimator. Added to this, it combines moment conditions for the first difference equations, using appropriately lagged variables as instruments, using additional moment conditions in the levels equations, on the condition that the first-differences are uncorrelated with the within-sample effects.

#### 4.2. Theoretical Justification for the included Explanatory variables

A number of other important variables, apart from logistics, in line with the theory, influence trade patterns, volumes and variations. Foreign direct investment is important to trade via its role in facilitating and constituting a medium advanced technology, innovative capacity, productivity growth (Lim, 2001; Balamount-Lutz, 2004, cited in Ozekhome, 2016) and thus, increase in trade. Accordingly, technological improvements, efficiency and productivity made possible by foreign direct investment, can stimulate trade. Through knowledge diffusion or contagion effects, foreign direct investment can lead to improved production and efficiency of domestic firms and thus greater trade. The inclusion of foreign direct investment, is thus, based on strong theoretical footing.

Secondly, increased world demand for goods and services brought about by an improved world economy, would imply greater exchange of goods and services. World demand is thus, an important determinant of trade (see Adamu et al., 2012).

Thirdly, financial development is an important determinant of trade through its financial intermediation role in providing trade credit and finance, and thus, encouraging trade (see Bougheas & Falvey, 2010). Thus, a well-developed financial system can finance greater level of international trade through the provision of finance and insuring of trade risks, amongst others.

Fourthly, exchange rate is an important determinant of trade since it facilitates international transactions and exchange through the conversion of currencies to a common denominator. Consequently, a change in the exchange rate directly influences international trade. The exchange rate variable is thus included in the model in accordance with the extant theory.

Fifthly, the ease of doing business is an important determinant of the international competitiveness of the business and trade. As a determinant of trade, the conduct of policy regulations in the environment and processes of trade would determine the volume and intensity of trade and business competitiveness. Hence, its inclusion in the model is justified. Finally, the level of social and political stability is an important determinant of trade.

#### 4.3. Definition of Variables and Sources of Data

The definitions of the variables in the model, unit of measurement, as well as the sources of data are provided in Table 2.

**Table 2.** *Definition of Variables and Data Sources*

Variable	Description/Measurement	Source
Trade	Total volume of recorded trade.	World Bank World Development Indicators (World Bank), World Trade Report.
Logistics Performance Index(LPI)	A weighted composite index of country's scores on proxy measures for transport and trade infrastructure, supply chain management (SCM), and trade facilitation capabilities, based on a world survey of international freight forwarders and express carriers. The LPI is based on six underlying factors, to include; efficiency of the clearance process (i.e.; speed, simplicity and predictability of formalities) by border control agencies, including customs; quality of trade and transport-related infrastructure (e.g., ports, railroads, roads, information technology); ease of arranging competitively priced shipments; competence and quality of logistics services (e.g., transport operators, customs brokers); ability to track and trace international shipments (consignments) and; timeliness of shipments in reaching the destination within the scheduled or expected delivery time.	World Bank World Development Indicators (World Bank).

Financial Development	Private credit by deposit banks as a ratio of GDP.	World Economic Outlook (IMF).
Foreign Direct investment	Foreign direct investment is total direct foreign investment inflows to GDP percent?	World Bank Development Indicators (World Bank).
Exchange Rate	Nominal exchange rate in terms of the US Dollar as a common denominator.	World Economic Outlook (IMF).
Ease of Doing Business Score (Index).	The ease of doing business measures the competitiveness of the business and trade environment indicates regulations for business in terms of regulations, and processes involved. Economies are ranked on their ease of doing business, from 1–190. A high ease of doing business ranking, which implies less business and trade inhibiting processes and documentations (in terms of regulations and institutions) means the environment is more conducive to the starting and operation of a business or trade. The rankings are determined by sorting the aggregate scores on 10 topics, each consisting of several indicators, giving equal weight to each topic.	World Bank Doing Business Report.
World Demand	World (global) demand is measured by the growth rate of the US economy (in percent i.e. real Gross Domestic product (GDP) of the United States)-being a proxy used in the literature for world economy, given that the US has the largest GDP in the world.	World Economic Outlook (IMF).
Political Stability	Annual averages of 12 weighted political risk components (variables) across countries on comparable basis- being a measure of socio and political stability. Socio-political stability captures stability in the social and political environment, absence of violence, which measures the likelihood that the government in power will be destabilized or overthrown by unconstitutional means and /or violence or threatened by the public such as terrorism, armed conflict, hostility or insurrection.	International Country Risk Guide (ICRG) Rating.

*Source: Authors*

#### 4.4. Data

We utilize panel data covering the period 2008-2017 for the ten selected ECOWAS countries based on data availability. The selected countries are Benin, Burkina Faso, Cabo Verde, Cote D'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Nigeria and Sierra-Leone, all of which are members of the Economic Community of West African States (ECOWAS), a regional economic bloc of 15 countries, with the objective of attaining economic and monetary integration of member countries.

## 5.0 EMPIRICAL RESULTS AND ANALYSIS

### 5.1 Descriptive Statistics

We present in Table 3, the basic characteristics of the data, in terms of the descriptive statistics, to provide a gloss of the variables used in the analysis. The mean trade flows in the sampled ECOWAS countries is 59.8 percent. Given a median value of 60.2 percent, there is valid statistical evidence that trade flows tend to be centered on the median value among the ECOWAS countries. The standard deviation value of 4.35 percent shows a low degree of trade dispersion in the sampled ECOWAS countries. The corresponding average values for logistics performance index, FDI, world demand, financial development, exchange rate, ease of doing business and political stability are 2.50, 11.98, 6.30, 18.75, 188.2, 87.1, and 8.45, respectively. Invariably, the ECOWAS sub- region is characterized by low logistics performance index, a factor that explains her poor trade performance.

**Table 3:** Descriptive Statistics

	Mean	Median	Max.	Min.	Std. Dev.
TRADE	59.80	60.22	73.20	38.20	4.35
LPI	2.47	2.58	4.50	1.68	2.72
FDI	11.98	12.20	22.17	1.75	5.60
WD	6.30	6.83	12.25	-1.34	4.28
FD	18.75	19.02	30.05	3.32	2.62
EXR	188.17	202.2	388.1	6.98	5.22
EDB	87.10	90.20	102.02	7.22	1.97
PS	8.45	8.64	11	5.95	1.43

*Source: Authors*

### 5.2. Correlation Analysis

The correlation among the variables is examined using the correlation matrix table, shown in table 4. A strong incidence of correlation among the independent variables could undermine the working assumptions that underlie the estimation technique and could therefore generate unrealistic estimates. The pairwise correlation matrix in the table shows a positive correlation between trade flows and the explanatory variables, including the logistics variable. An overall examination of the correlation matrix suggests that the problem of multi-collinearity in the model is not likely to be an issue, as the correlation coefficients are generally low.

**Table 4:** Correlation Matrix

	TF	LPI	FDI	WD	FD	EXR	EDB
TF	-						
LPI	0.10	-					
FDI	0.08	0.07	-				
WD	0.15	0.16	0.27	-			
FD	0.20	0.38	0.20	0.20	-		
EXR	0.12	0.19	0.16	0.23	0.14	-	
EDB	0.13	0.18	0.17	0.09	0.15	0.23	-
PS	0.25	0.09	0.18	0.05	0.20	0.19	

*Source: Authors*

### 5.3. Hausman-Taylor and System-GMM Results

The result of the Hausman-Taylor (1981) and Arellano and Bover (1995), Blundell and Bond (1998) system-GMM (dynamic panel data) estimation are reported in Table 5. The H-T results in the table shows that with the exception of the coefficient of the world trade variable, all other variables exhibited the signs that were expected *a priori*, with the coefficients of foreign direct investment, world demand, passing the significance test at the 5 percent level; that of exchange rate passing the significance test at the 10 percent level, while those of financial development and political stability achieved statistical significance at the 10 percent level. The goodness of fit indicated by the within  $R^2$  and between  $R^2$  are impressive, with 74 percent and 82 percent of the systematic variations associated with trade flows in the sub-region explained by the regressors. The regressors are therefore, relevant in explaining trade flows in the sub-region. The predictive power and capability of the model good is, accordingly, good. The F-statistic of 43.1 (with a p-value of 0.000) is highly significant, easily passing the significance test at the 1% level; an affirmation of the reliability of the explanatory power of the model, as well as validating the hypothesis of a significant linear relationship between trade flows and the regressors. Focusing on the GMM estimates, the coefficient of the lagged trade variable is positively related to current trade, but fails the significance test, implying that previous trade position positively influences current or future trade, particularly in the face of trade-enhancing policies. The impact is however not significant, due perhaps to lack of policy consistency in the sub-region. Based on the estimates, a 10 percent initial trade flows will result in a further trade by about 0.8 percent.

**Table 5:** Results of the Hausman-Taylor and GMM Estimation

Dependent Variable: Trade Flows		
Variable	H-T	System-GMM
TF(-1)	0.0872 (0.070)	0.0791 (0.063)
LPI	0.2240 (0.163)	0.2304* (0.126)
FDI	0.1560** (0.062)	0.1810** (0.083)
WD	-0.3122** (0.153)	-0.3086** (0.131)
FD	0.16081* (0.090)	0.1770* (0.093)
EXR	0.0824* (0.044)	0.0910** (0.040)
EDB	0.2257* (0.121)	0.2815* (0.153)
PS	-0.1407* (0.062)	-0.1320** (0.057)
R2 : within =0.74		
R2 : between =0.82		
F-Statistic= 43.10[0.000]		
<b>Post-Diagnostics:</b>		
Instrument Count/Rank		8
J-Stat	2.73 (0.50)	2.44 (0.47)
AR(1)	-2.886(0.004)	-2.92 (0.003)
AR(2)	-0.61 (0.54)	-0.60 (0.54)

\*\*\* Statistical significance at the 1% level; \*\* Statistical significance at the 5 % level; \* Statistical significance at the 10% level; Standard errors in Parenthesis

Source: Authors

The coefficient of the LPI variable is appropriately positively signed in line with presumptive expectation and significant at the 10 percent level, implying that logistics capability, which encompasses freight transportation, warehousing, port and trade infrastructure, boarder clearance, payment system and other processes, positively influence trade. The weak trade infrastructure, technological deficiencies, weak institutions, poor policy implementation, bureaucratic tendencies, administrative hiccups, and corruption in the sub-region could explain the not-pronounced impact of logistics on trade. This finding supports the findings of Devlin and Yee (2004), Nordas et al., (2006), and Albert, et al., (2011). The coefficient estimate, using the GMM, indicates that a 10 percent improvement in logistics will, on the average, lead to a 2.3 percent rise in the volume of ECOWAS trade.

The coefficient of the FDI variable is positively signed in line with theoretical expectation and passes the significance test at the 5 percent level. Thus, increases in FDI tend to stimulate trade, attributable mainly to innovation, advanced technology and managerial enterprise that induce trade, none of which may be accessible in the absence of FDI inflows. This finding supports the results of Lim (2001) and Balamount-Lutz, (2004). The coefficient of FDI is 0.18, showing that a 10 percent rise in FDI will trigger about 1.8 percent rise in trade flows in the sub-region.

The coefficient of the world demand variable (proxied by the real GDP of the USA) is negatively signed but statistically significant at the 5 percent conventional level. The rather unexpected negative sign may be attributable to the fact that ECOWAS countries are mainly primary products producing developing countries. The result buttresses the findings of Adamu et al., (2012). The coefficient estimate shows that a 10 percent improvement in world demand for goods and services brought about by increased world economy, will increase the level of trade in the sub-region by 3.1 percent. The coefficient of financial development (financial intermediation) is appropriately positively signed in line with *a priori* expectation. However, it failed the significance test at the 5 percent level, though significant at the 10 percent level. Thus, financial intermediation, which makes trade credit possible, tend to facilitate greater ECOWAS trade. This finding supports the findings of (Manova, 2008a, b; Bougheas & Falvey, 2010). However, the impact is weak, apparently due to the poorly developed financial system in the sub-region and the fact that financial credits by banks in the sub-region are heavily skewed to specific sectors. e.g. oil and gas, mining, quarrying, etc. The results show that improvements in the financial system by 10 percent will increase the volume of trade in the sub-region by 1.8 percent. The coefficient of the nominal exchange rate variable is positive and statistically significant at the 5 percent level, confirming the theoretical proposition that exchange rate depreciation has the potential to stimulate trade in developing countries, including the ECOWAS. This finding supports the findings of Ozekhome (2019). Unfortunately, however, many of these countries lack meaningful diversification in the composition of their output and trade. A 10 percent depreciation in nominal exchange stimulates trade in the sub-region by 0.9 percent.

The coefficient of the variable introduced to capture the ease of doing business is positively related to trade flows, implying that greater simplification, harmonization, standardization and transparency in the ease of doing business in terms of the policy regulatory environment (i.e soft regulations), paper documentation, trade and business incorporation, and other trade processes and procedures, will, enhance trade flows and, consequently, regional integration. The impact is, however, significant only at the 10 percent level; an implication that most of the ECOWAS countries are yet to carry out fundamental reforms that are capable of improving the ease of doing business environment with a view to facilitating greater volume of trade. The finding supports the position of the World Bank (2015, b). The rate of change of trade flows with respect to the ease of doing business indicates that a 10 percent improvement in the ease of doing business will stimulate trade in the sub-region by 2.8 percent. Finally, the coefficient of country socio-political stability is negatively signed and significant at the 5 percent level, indicating that political instability and poor governance that tend to diminish trade flows characterize the sub-region. Apparently, the impact of socio-political reforms on trade flows in the sub-

region has not started yielding positive effects. The finding corroborates the findings of Adamu et al., (2012).

The key diagnostics for testing the robustness and validity of results obtained, show that the Hansen-J over-identification test, which serves to verify the validity of instruments failed to reject the null hypothesis of no endogeneity problem. This implies that the over-identifying restrictions are equal to zero and valid. By implication, the specification of the model cannot be rejected, since it is appropriate and the instruments, strong and valid. The result provides the empirical evidence underscoring the choice of the exogeneity of the levels and differenced instruments, as required. The post-estimation evidence also leads to the rejection of the null hypothesis of no serial correlation at order one in the first-difference errors, but a failure to reject same at order two (with AR (1) = -2.93 (0.003)\*\*\* and AR (2) = -0.60 (0.54). There is thus, no tenable evidence to invalidate the model, considering that the estimates are robust in the presence of first-order serial correlation, but not in the second-order serial correlation in the residuals. This, therefore, implies that the model estimates are fit for structural and policy analysis.

#### 5.4 Test of Robustness

To test for the robustness of the results, which confers credibility, validity and tenability, we use the individual components of the logistic performance index in separate regression, in which trade flows is regressed on the individual logistics performance index in a disaggregated form. This implies decomposing logistics performance index into its different components and their relationship with trade analyzed. This would allow more focused policy prescriptions to facilitate trade integration in ECOWAS. The result is presented in Table 6.

**Table 6:** Trade Flows and Individual Components of the Logistic Performance index

C	CUSTOMS	INFRASTRUCTURE	INTERNATIONAL SHIPMENT	LOGISTICS COMPETENCE	TRACKING & TRACING	COST	TIMELINESS
0.051	0.1778	0.2230	0.273*	0.1115*	0.232*	-0.234**	-0.212*

Note: \*\*\*, \*\*, \* Statistical significance at the 1%, 5 %, and 10% level, respectively.

Source: Authors

From the results, the coefficient of the efficiency of the clearance process (i.e speed, formality and predictability of formalities) by border control agencies, including custom is positively related to trade flows but fails the significance test. Thus, improvements in the clearance process and other border agencies and patrol system tend to enhance greater level of trade but the impact is weak in the sub-region. This is due to the complex, uncoordinated, inconsistent, non-transparent and multiplicity of trade procedures in the sub-region in terms of customs clearances and other border agencies and documentation. This, therefore, requires the simplification, harmonization, transparency, modernization and standardization of trade procedures in terms of process documentation, customs clearance and ports.

The coefficient of the infrastructure variable is positively related to trade but fails the significance test. Thus, improvement in the quality of transport and information technology infrastructure tends to stimulate trade but the impact is weak in the ECOWAS countries, on account of the huge infrastructural

bottlenecks and technological deficiencies. The coefficient of ease and affordability of international shipments is positively related to trade flows and passes the significance test at the 10 percent level. This implies that trade expansion resulting in greater regional integration tends to result from simplicity and ability to ship consignments.

The coefficient of logistics competence is positive and significant at the 10 percent level. Thus, efficient logistics has the capacity to stimulate trade in the sub-region. The impact is, however, weak due to poor logistics capability in the sub-region. The coefficient of tracking and tracing- a measure of the ability to track and trace international shipments is positive but only significant at the 10 percent level. Thus, ability to track and trace international shipments (consignments) positively influences trade. Its impact is, however, not significant in the sub-region, an implication that, that there is need for improved tracking, tracing and effective monitoring of consignments to get to desired destination and in record time. The coefficient of domestic logistics costs is negatively related to trade and achieves statistical significance at the 5 percent level. Thus, high transaction cost of trade has an outright destabilizing effect on trade. The high cost of trade in the sub-region is due to the poor transport infrastructure (soft and hard infrastructure), such as rail, roads, ports, telecommunications (hard infrastructure) and poor regulatory and institutional environment (soft infrastructure).

Finally, the coefficient of timeliness of shipments in reaching the desired destination is negatively related to trade flows and passes the significance test at the 10 percent level. Apparently, the timeliness of consignments (shipments) to reach the desired destination in the sub-region tend to be longer than expected, as consignments tend to be delayed at borders, ports (harbours) before they are shipped due to the complex documentation requirements and procedures. Invariably, the results tend to buttress the earlier finding of the moderate impact of logistics on trade flows, arising from the weak logistics base (capability) in the sub-region.

### **5.5. Policy Implications of Findings and Recommendations**

Several important policy implications can be deduced from the empirical findings. First, sound logistics capability is critical to trade expansion in the sub-region, but the ECOWAS countries have weak logistics base, characterized mainly by weak transport and trade infrastructure, inefficient port facilities, complex customs clearance procedures and other trade distorting processes. Therefore, it is important for countries in the sub-region to articulate efficient trade-enhancing strategies through the provision of sound infrastructural base, particularly in the context of intra-regional trade infrastructure, efficient port facilities, excellent rail and good road system (i.e. hard infrastructure), harmonization of customs clearance procedures and other border agencies and trade policy reforms and processes (i.e. soft infrastructure) that will significantly reduce trade transaction costs, stimulate trade and enhance greater regional integration.

Secondly, given that the empirical evidence suggests that increased level of foreign direct investment induces greater trade flows, there is need for policies that encourage greater economic openness to investment inflows into the sub-region. This is because increased foreign direct investment, which brings in technological development and product innovation, tend to stimulate trade flows. By implication, technological improvements, greater level of efficiency, capital accumulation and productivity growth realized through greater degree of openness to trade and investment, tend to encourage higher degree of trade.

Thirdly, financial development is positively related to trade flows, as it helps to mobilize resources and provide trade credit necessary to finance and promote international trade. Therefore, policies to enhance the development of the financial sector in the sub-region are required. Specifically, continuous financial



sector reforms are essential to help the ECOWAS countries maximize the trade possibilities of sound financial system, through efficient financial intermediation.

Fourthly, the empirical results suggest that improvements in the ease of doing business tend to facilitate greater trade in the sub-region. Therefore, sustained improvements in business and trade processes in terms of simplification, harmonization and transparency of the regulatory environment are imperative to regional trade integration in the sub-region.

Fifthly, an appropriate exchange rate regime and sound policies promotes greater competitiveness in international trade.

Sixthly, increased world demand has the potential to engender increased trade in the sub-region and the wider world. The ECOWAS countries' products are, however, characterized by low price elasticity of demand. Finally, the results indicate that the sub-region is still characterized by pockets of social and political instability that have the potential of undermining trade.

## **6.0 CONCLUSION**

We have examined the nexus between logistics (with other control variables) and trade flows in the ECOWAS sub-region, using data for ten selected countries. In doing this, we employed panel data that covered the sample period 2008-2017. The estimation period was dictated by data availability. Employing the HT panel data approach and system-GMM estimation technique, which accounts for time specific and unobservable effects, e.g country specific fixed and time-varying effects (i.e. idiosyncratic economic features), in addition to joint endogeneity of explanatory variables. The evidence show that logistics has a positive but mild impact on trade flows in the sub-region. This may be attributable to the low level of trade, weak transport infrastructure, complex customs clearance procedures and a host of other trade inhibiting factors. That notwithstanding foreign direct investment, world demand, exchange rate and socio-political stability variables are other variables that influence trade in the region. The impact of financial trade is however weak.

Given the potential economic benefits realizable from improved logistics in enhancing trade, and consequently, growth in the sub-region, policy makers in the region, as matter of importance, need to articulate and implement policies, measures and strategies that are aimed at improving the quality of logistics and, hence, boosting its role in facilitating trade through increased investment in soft and hard (transport infrastructure) infrastructure. Improve ease of doing business, through amenable policy and regulatory environment, and, harmonization and coordination of trade policies are also critical. Lastly, a stable social, political and economic environment, that will enable the sub-region maximize the benefits of trade in terms of greater economic integration and growth is important.

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