

Research Article

# Impact of Ebola Virus Disease and ECOWAS Membership on Intra-Regional Trade in West Africa

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## Abstract

The West African sub-region bore the brunt of the world's largest Ebola outbreak, significantly impacting the economic activities and trade shares of the affected countries. This study seeks to examine the repercussions of the Ebola Virus Disease (EVD) on the trade shares of affected countries and to explore the potential influence of ECOWAS membership on intra-regional trade in West Africa. Using the Poison Pseudo Maximum Likelihood (PPML) estimation technique, an analysis of the augmented gravity model of international trade was conducted. The findings indicate a two-fold reduction in the trade shares of affected countries with their intra-regional partners due to the Ebola Virus Disease. Additionally, with Mauritania expressing its desire to join the ECOWAS sub-region, there is a need to explore the impact of the Regional Economic Community on intra-regional trade. Furthermore, the study reveals that ECOWAS membership has the potential to double trade levels in West Africa. The findings also suggest that Mauritania stands to gain significant benefits from becoming a member of the ECOWAS. In conclusion, this study highlights the necessity for ECOWAS to proactively respond to disease outbreaks and underscores the importance of increased research investment. Moreover, it emphasizes the need for the ECOWAS to further improve infrastructure to facilitate intra-regional trade, especially in transportation.

## Keywords

Ebola Virus Disease, ECOWAS, Gravity Model of International Trade, Poison Pseudo Maximum Likelihood (PPML), Intra-Regional Trade

## 1. Introduction

The Ebola virus disease, formerly Ebola haemorrhagic fever is a severe and fatal illness with a mortality rate of 90% [21]. According to the Center for Disease Control and Prevention report [16, 19, 20], the virus is transmitted to humans either through contact with bodily fluids of infected animals or humans. These include contact with blood, mucus, saliva, vomit, sweat, urine, breast milk, deceased body among others [27, 28, 47]. The virus invasion in humans appears to occur through mucosal surfaces, breaks, and abrasions in the skin, or

parenteral introduction [1]. The Ebola virus, which is a zoonotic pathogen virus, was reported to be harboured in bush meats notably fruit bat, with early cases of infection reported in the rural areas. The symptomatology of the disease is like many other diseases, such as malaria, intense weakness, Lassa fever, headache, diarrhoea, sore throat, impaired kidney, muscle pain, cholera, and typhoid, with an incubation period of 2-21 days [34, 41, 44].

The traditional niche of the Ebola Virus Disease on the

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African continent can be traced to Central Africa notably Yambuku in Zaire (now the Democratic Republic of Congo) and Nzara, South Sudan in 1976 [2, 10, 34, 35]. The first case was reported in a village near the Ebola River in Zaire which influenced the name of the virus. The devastating nature of the disease accounted for a mortality rate of 88% and 66% respectively during its maiden outbreak in Zaire and Nzara [3, 38]. In the year 1995, the disease resurfaced in the Democratic Republic of Congo, which claimed numerous lives including medical professionals, and exposed the vulnerability in the governance and health sector of the economy [3]. Since then, traces of the deadly disease were prevalent in the Democratic Republic of Congo, Sudan, Gabon, Congo, and Uganda, with a median of three outbreaks per year and over 30 outbreaks with a death toll close to 1600 [8].

On December 6, 2013, West Africa was hit with the index case in Guékédou, Guinea, involving the death of a 2-year-old child [33, 37]. The child came in contact with the virus while playing near an infected bat according to Robert Koch Research Institute in Berlin. Consequently, similar symptoms were experienced in his mother, sister, and grandmother which led to their demise. Then close contacts began to experience the symptoms and the outbreak began spreading its tentacles to neighbouring villages. Surprisingly, the outbreak had spread wide to neighbouring countries of Sierra Leone and Liberia. As a result, the World Health Organization (WHO) was notified on 21 March 2014 by Guinea, followed by Liberia on 30 March and Sierra Leone on 25 May and the organization confirmed the disease to be Ebola Virus Disease [14, 22, 29, 45]. The World Bank estimated that potentially catastrophic consequences may cost up to \$25 billion [77]. This was the World's largest Ebola outbreak due to its uniqueness in size, complexity, duration, morbidity, and coverage. The outbreak was officially declared as a Public Health Emergency of International Concern (PHEIC) on August 8, 2014, since the WHO estimated the true prevalence to be two to four times higher than the reported figures. In the analysis of Adam Kamradt-Scott [6], the late response of the WHO to the Ebola outbreak was an attributing factor to the spread of the disease.

On December 29, 2014, more than 20,000 infections have been reported with a death toll of 7900. Nigeria and Senegal were the frontliners to be declared Ebola-free in October 2014 by the WHO, with reported 20 cases with 8 deaths and 1 case with no death respectively [4, 12, 17, 24]. In June 2015, the WHO announced a total of 22,000 children who lost either one or both parents due to the Ebola Virus Disease. The epidemic officially ended in Sierra Leone in March 2016, then Guinea and Liberia in June 2016. According to the World Health Organization (WHO), 4,809 death was recorded in Liberia, 3,955 death was recorded in Sierra Leone, 2,536 deaths in Guinea, 8 deaths recorded in Nigeria and 6 deaths in Mali culminating in a total death counts of 11,314. The factors that led to the wide-spread was the fragility of the health sectors, home treatment of infected persons, vulnerabilities from past civil wars, damaged ecological system due to the

extractive industry, and inadequate resources deployed in the diagnosis and treatment of infected persons. Countries that recorded cases resulting from the disease were Guinea, Liberia, Sierra Leone, Nigeria, Mali, Italy, Spain, Germany, the United Kingdom, and the United States of America [13, 22, 26, 36, 39].

Undeniably, the economy of West African countries was heavily affected in trade and economic activities [18, 40, 43]. The agriculture sector was affected due to restrictions on movement influencing production volumes, relatively tighter exports, increased prices, and the loss of labour force through death. Statistically, the labour force which forms the economically active segment of the population (15-44 years) accounted for 59% of total infections by the Ebola Virus Disease in the phase of the poor health sector.

Also, the mining sector was affected due to disrupted production capacity through the shutdown of operations hitherto informal operations, and financial challenges faced by companies of the status quo notably London Mining, Arcelor Mittal SA, and Rio Tinto PLC during the epidemic. Furthermore, the transport sector was affected which resulted in high transport costs, travel bans, and border closures which harmed tourism due to stigmatization on citizens and the fear of spread [5, 6, 8, 9, 19-21, 25, 31]. Unconventionally, one major problem that emanated from the spread of the disease was the conflicts between the populace against the traditional leaders, governments, and foreign investors. In this background, the change in the ecological system due to flooding and wildlife resulting from damages caused by extractive companies coupled with relatively small gains generated from these industries to improve living standards of the populace compounded to the spread of the disease. Also, some countries with no reported cases such as Cape Verde, Ghana, Gambia, Niger, Guinea Bissau, and Togo among others, were affected economically due to fear of possible outbreak notably the tourism sector, even though stringent measures were deployed to avoid the spread of the disease across to countries of the status quo.

This has necessitated the investigation of the effect of the Ebola Virus Disease on trade in West Africa. In this background, the main objective of the study is to estimate the effect of the Ebola Virus Disease (EVD) on trade in West Africa. The specific objective is to estimate the effect of ECOWAS membership on trade in West Africa. To the best of my knowledge, there is no empirical study on the effect of the Ebola Virus Disease on trade in West Africa. The existing literature theoretically juxtaposes the effect of the disease in general, on the various variable of interests during the epidemic. This study seeks to estimate the effect of the Ebola Virus Disease on trade exports of affected nations to trading partners in the sub-region. Hypothetically, when countries are under trade treaties, there is a greater tendency of trade and movements across countries. In essence, countries are liable to spread diseases as well and necessitate the effect of ECOWAS membership on trade in West Africa since it is the

exclusive body to oversee affairs of the sub-region and in support, all affected countries are members. The study will add up to existing literature on Ebola Virus Disease on trade and the impact of the Economic Community of West African States (ECOWAS) on trade in West Africa.

The rest of the paper is organized as follows: the next section provides the theoretical framework, model, and empirical strategy. Section 3 presents the data and measurement. Section 4 presents the results and discussion. The last section concludes the paper with some policy suggestions.

## 2. Literature Review

### 2.1. The Gravity Model of International Trade

In 1962, Tinbergen propounded the gravity model of international trade, with the then of intuition, emanating from the Newton law of gravity [7, 52]. The gravity model of trade intuitively posits that trade between the two countries depends on their economic strength (GDP or GNP) and inversely related to the trade cost. It states that for two countries to trade, it depends on their level of income and the distance between them. The greater the economic mass of the countries coupled with relatively small distances, then countries will tend to trade more and vice versa. It is calculated as the log product of their economic strength divided by the log distance (log values of the trade costs). The theory

$$Y_i Y_j \text{ can be depicted as } X_{ij} = C t_{ij}$$

where  $X_{ij}$  = trade from  $i$  to  $j$ ,  $C$  is the constant,  $Y$  is the Gross Domestic Product

(GDP) and  $t$  is the distance between the countries. The model has been consistent in its prowess of using real data to determine the sensitivity of trade flows concerning a policy component. The model is used to empirically investigate the effect of trade costs on trade. It can be used to analyze the trade cost such as Tariff and non-tariff barriers, transportation cost, corruption, governance, contract enforcement, regional integration agreement, currency unions, and time delays at export/import, trade facilitation among others.

### 2.2. Empirical Literature Review

Adegun [3], theoretically investigated the effect of the Ebola Virus on the Economy of West Africa through the trade channel using data from the National Bureau of Statistics. The study used graphical representations to explain intra-regional imports and exports of affected countries. The study showed that the Ebola Virus will affect the agricultural sector, mining sector, health, transport, education, and hospitality. The study also showed that the resultant effect would have fiscal impacts due to decreased revenue hitherto increased expenditure. The study concludes that if the virus is not highly contained in the short term, its economic repercussion will be devastating to

West Africa. Etuk [21], evaluated the Ebola disease by examining the West Africa perspective with much focus on the virus, affected countries, the role of the populace, West African and Western world responses to the outbreak, and international response notably WHO during the epidemic. Additionally, the study showed that the agricultural sector, health sector, education, and tourism were heavily affected during the epidemic. The study recommended the need for emergency preparedness and public utilities during disease outbreaks. Alexander et al., [1] examined the possible factors that might have led to the emergence of Ebola in West Africa. The study evaluated the Ebola emergence in the context of why now? And why in West Africa? To expatiate its ecological, sociological, political effect due to the historical implication on the current ameliorated state, and the environmental drivers to the emergence of the virus in line with the effect on humans. Also, the study emphasized the necessary protocols to ensure attenuating the outbreak. Additionally, the study showed that there was an increase in population, poverty, social unrest among others. The study concludes the exigency for prompt disease response in countries with limited resources and recommends the significance of international organizations and Non-governmental Organizations to help curtail the adverse effect of the disease outbreak. Omoleke et al. [44], evaluated the Ebola Disease in West Africa as a threat to global health, economy, and political stability. The study deployed dataset and information from the World Health Organization (WHO) library and Information Networks for Knowledge database, PubMed, the Social Science Citation Index, WHO International Clinical Trials Registry Platform, among others. The study acknowledged the role of climate, population growth, economic activities, health, transport, trade, foreign investment among others. The study concluded that human factors notably poverty, weak health system, sanitation challenges, poor health-seeking behaviour, climatic change, a change in the ecological system, non-availability of a licensed vaccine among others, enhanced the spread of the disease. The study recommended that governments must be proactive in their commitment to providing quality healthcare facilities to curb any unforeseen health challenges in the future. Maffiola [41], studied the political economy of health epidemics with a focus on the Ebola outbreak in West Africa. The study sampled out Liberia to evaluate the government response hitherto citizens' reactions to the efforts during the 2014 Ebola outbreak. The reactions of the citizens notably through voting showed if the government was accountable to its citizens. The data used in the study were sourced from the Ministry of Health and Burial teams, ETUs, CCCs, LISGIS, and NEC. The study showed that misplacement of government relief yielded different responses during the general election. The villages that first experienced the outbreak voted against the incumbent government whereas the preceding villages voted in favour. The study concludes that there was a strategic allocation of resources by governments to stimulate the electoral motives of citizens during the health epidemic.

Piot et al. [45], examined the emergent of threats resulting from the lessons learned from Ebola. The study delineated on the political, economic, and health challenges the Ebola disease unraveled on the Economy of West Africa. The study showed that the six lessons learned were; government strengthening its capacity to respond to outbreaks and commensurate domestic and international investment geared towards health care, the need for global action across sectors due to the adverse effect of outbreaks beyond borders, implementing standardized control measures to curtail outbreaks with more vigilance and pro-active decisions, the need for

research investment into pathogens that causes outbreaks, social responsiveness as a common goal and the need to address pressing needs and indirect behaviours that affect outbreaks.

### 3. Methodology

To investigate the effect of the Ebola Virus Disease on trade, the augmented gravity model of international trade was used. The augmented model is stated as follows;

#### Model 1

*The Effect of EBOLA on trade in West Africa*

$$X_{ij} = \beta_0 \ln GDP_{ij} + \beta_1 \ln PERCAPITA_{ij} + \beta_2 \ln DISTANCE_{ij} + \gamma BORDER_{ij} + \delta LANG_{ij} + \theta COL_{ij} + \vartheta EBOLA + \beta_3 \ln GE_{ij} + \beta_4 \ln VA_{ij} + \beta_5 Vol_{ij} + \beta_6 \ln PS_{ij} \quad (1)$$

#### Model 2

*The Effect of ECOWAS membership on trade in West Africa*

$$X_{ij} = \beta_0 \ln GDP_{ijt} + \beta_1 \ln PERCAPITA_{ijt} + \beta_2 \ln DISTANCE_{ijt} + \gamma BORDER_{ijt} + \delta LANG_{ijt} + \theta COL_{ijt} + \beta_3 INFRAS_{ijt} + \beta_4 TAR_{ijt} + \beta_5 RL_{ijt} + \beta_6 GE_{ijt} + \beta_7 VA_{ijt} + \beta_8 PS_{ijt} + \beta_9 CC_{ijt} + \sigma ECOWAS_{ijt} \quad (2)$$

Where  $i$  and  $j$  denote countries,  $t$  denotes time, and the variables are defined:  $X_{ij}$  denotes the value of bilateral trade (exports) between  $i$  and  $j$ ,  $Y$  is real GDP,  $Pop$  is population,  $D_{ij}$  is the distance between  $i$  and  $j$ ,  $BORDER_{ij}$  is a binary variable which is unity if  $i$  and  $j$  share a land border,  $Lang$  is a binary variable which is unity if  $i$  and  $j$  have a common official language,  $COL_{ij}$  is a binary variable which is unity if  $i$  and  $j$  were colonized by the same colonial master,  $ECOWAS_{ij}$  is a binary variable which is unity if  $i$  and  $j$  are members of the ECOWAS and 0 otherwise,  $Vol_{ij}$  is measured as the standard deviation of the moving average of the log Real Effective Exchange Rate,  $\varepsilon_{ij}$  a vector of nuisance coefficients, and represents the myriad other influences on bilateral exports, assumed to be well behaved. Where  $I = 1, 2, N$  is the number of countries where  $N=16$ ,  $t$  is the time-series dimension of the data ( $T=18$  years), the coefficients  $\beta_1 \beta_2 \beta_3 \beta_4 \beta_5 \beta_6 \beta_7 \beta_8 \beta_9$  are parameters for their respective variables where  $\beta_0$  is the constant and  $\varepsilon$  is the error term. The coefficient of interest is  $\vartheta$  and  $\sigma$ . The coefficient of Ebola is the relevant variable in the first model because not all countries were affected.

### 3.1. Estimation Technique

Although authors recommend estimating the gravity model using a log linearized approach, it is now standard to estimate the AvW model with a fixed effect Poisson Pseudo Maximum Likelihood (PPML) since it controls for heteroscedasticity, zero trade and model misspecification [30, 48, 49]. Thus, the PPML includes observations with zero trade values of which linear estimation techniques will drop because the logarithm

of zero is undefined which leads to sampling selection bias. As a result, the omission of relevant observations poses serious problems, and information is loosed [23]. Furthermore, the robust standard errors do away with problems associated with panel data estimation. Also, PPML fits the data better by controlling for heteroscedasticity than a log-linear model since the error term has a variance occurring at a higher moment which can be influenced by one or more explanatory variables [48]. Thus, the second and highest moment conditions are absent from the estimation procedure. Therefore, the coefficients of log linearized models can be highly misleading due to the presence of heteroscedasticity. Moreover, the PPML, unlike the log-linear estimator estimates the effect of policy variables on trade whereas the log-linear estimator estimates the policy variable on the log of trade which can be misleading. Additionally, the PPML is consistent with a small sample size as well as a large sample size.

To buttress, the Monte Carlo simulation test on the best estimator for the gravity model of international trade stipulates the gravity model is best estimated as a non-linear model [48, 49]. Further studies on the best estimator for the coefficients of the gravity model is the PPML [11, 15, 42, 52]. Given this, the PPML estimation technique becomes the best option to estimate the parameters.

### 3.2. Data and Measurement

The study used a dataset with 4,320 bilateral trade observations spanning from 2000 to 2017 (some observations are missing for the dependent variable). The study used sixteen



countries in the West Africa sub-region. A summary of all of these variables, how it is defined, measurement and data sources are presented in Table 1. Table A1 in the Appendix

presents the variables in the model, description, measurement, and expected signs.

**Table 1.** Definition of variables and data source.

Variables	Measurement	Source
Bilateral trade	Export value at levels	IMF Direction Of Trade (DOTs) & UN Comtrade
GDP	log product of GDP at constant \$	World Bank's World Development Indicators
GDP per capita	log product of GDP per capita at constant \$	World Bank's World Development Indicators
Distance	log product of distance value between country-pairs	CEPII
Tariff	Log product of tariff value	World Bank's ESCAP
Government Effectiveness	Log product of values	World Bank's World Governance Indicators
Voice and Accountability	Log product of values	World Bank's World Governance Indicators
Political Stability and Absence of violence	Log product of values	World Bank's World Governance Indicators
Trade and Transport infrastructure	Log product of values	World Bank's Logistics Performance
Rule of law	Log product of values	World Bank's World Governance Indicators
Corruption Control	Log product of values	World Bank's World Governance Indicators
Volatility	The standard deviation of the moving average of log Real Effective Exchange Rate (REER)	World Bank's World development indicators and Polity V

### 3.3. Variable Definition

The export of goods was used as a proxy for bilateral trade between the reporting country and the partner in line with each country's attempts to balance its trade with the other. The data on exports were reported at the levels to suit the non-linear estimation technique procedure. The variable was adopted in the model to represent trade flows between countries since the level of imports is usually underestimated. GDP was used to proxy for the economic mass of the country in the model. The study expected GDP to have a positive relationship with trade. It was measured as the log product of the GDP of country-pairs. GDP per capita was used as a proxy for all other controls that were not specified in the model. The coefficient of GDP per capita used is expected to have a positive relationship with trade. It was measured as the log product of GDP per capita of the country-pairs in the model. Distance is the transportation cost involved in trading between the two countries. The coefficient of distance is expected to have a negative relationship with trade. The higher the transportation cost, the higher the price of the goods to be traded and vice versa. This is because, as distance increases the cost of trading among countries ostensibly increases thereby reducing the volume of trade. GDP per capita was used as a control varia-

ble for the effect of institutions on trade to represent market size based on theory. This paper employs five different key indicators of institutional quality as provided by the World Governance Indicators, the World Governance Indicators database namely; rule of law, voice and accountability, political stability and Absence of Violence, control of corruption and government effectiveness. Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.

Also, the control of corruption was captured as the perception of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as the capture of the state by elites and private interests. Furthermore, Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

Voice and Accountability as defined by WGI, Voice and Accountability captures perceptions of the extent to which a country's citizens can participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. Finally, Political Stability and Absence of Vio-

lence/Terrorism measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. The various indicators of institutions were measured as the log product of the country-pairs. Tariff is defined as the taxes charged on goods and services imported. According to the World Bank ESCAP, Tariff answers the question, 'Evaluate the effect of tariffs about agricultural goods.' The coefficient of tariff is expected to harm trade. It was measured as the log of the value for the country-pairs. According to the World Bank Logistics Performance Index, the component "Quality of trade- and transport-related infrastructure" includes results from the survey question "Evaluate the quality of trade- and transport-related infrastructure (e.g. ports, railroads, roads, information technology) in-country. The coefficient is expected to have a positive impact on trade. It was measured as the log product of the country-pairs. Real Effective Exchange Rate (REER) as computation of exchange rate volatility due to recent developments in academia [50].

Border is defined as the geographic boundaries of political entities such as countries, provinces, states amongst others. The coefficient of sharing a land border is expected to have a positive relationship with trade. Spatial theory of trade depicts those countries sharing border tends to cooperate to enhance trade. The coefficient of Language is expected to have a positive relationship with trade. Adam Smith argued in 'Wealth of Nations' that common language enhances trade and exchange through effectively communicating the task in hand to the trading partners and easily convincing parties to know it is in their best interest.

### 3.4. Modelling the Effect of Disease on Trade

The traditional determinants of trade are GDP, distance, border, common language, and common colonizer. Variables such as Government Effectiveness, Political Stability and Absence of Violence, and Voice and Accountability were introduced into the model. The rationale for these variables is as follows; Disasters are a unique test of governmental accountability [41]. Also,

governments have the opportunity to influence voters, through their responsiveness to crises on how well they can perform. Therefore, Government Effectiveness was a good proxy for the model. On the other hand, citizens have a chance to learn about the incumbent government's capacity and thus ensure electoral accountability at the time of voting [41]. Therefore, Voice and Accountability was a good proxy for the populace. Additionally, the disease outbreak aroused anger and violence of the populace against their respective governments and traditional leaders therefore Political Stability and Absence of Violence was a good proxy [46]. Trade and transport infrastructure were affected during the Ebola epidemic due to increased price hitherto limited distance coverage according to African Growth and Opportunity Act. Therefore, the quality of trade and transport infrastructure was a good proxy. Additionally, the decline in economic activities will affect currency performance which would increase the cost of international trade. In this context, exchange rate volatility was introduced in the model. Therefore, understanding the efficacy of and motives behind the response to disasters is of paramount policy relevance to provide the right incentives for governments to act appropriately in times of crisis [41].

### 3.5. Modelling the Ebola Disease in the Gravity Model of International Trade

The essential factors in the modelling of the disease are the period of occurrence, the affected countries, capturing period ex-ante and ex-post of the disease, and the intra-regional importers of the exports of the affected countries (trading partners in West Africa) since export will dwindle. Using annual data, weight is given to the number of months the disease was prevalent, and its intensity. The period (year) before and after the disease is assigned as 1. The period (year) that the disease affects trade volume of the affected country to trading partners is assigned as 0.

## 4. Empirical Results and Discussion

**Table 2.** PPML estimates for Ebola Virus Disease on Trade in West Africa.

Variables	Coefficients
GDP	2.584 ** (1.029384)
GDP per capita	2.216 (1.801548)
Distance	-.004 *** (.0007524)
Border	2.049** (.9703325)
Language	-.233 (1.55074)
Colonizer	.710 (1.772207)
Ebola	-1.705 *** (.521639)

Variables	Coefficients
infrastructure	-12.712 ** (0.011)
Government Effectiveness	-2.291 (2.543568)
Voice and Accountability	4.661 *** (1.203261)
Volatility	3.056 (3.102469)
Political Stability and Absence of Violence	3.760 (1.341768)
_cons	-35.891 ** (15.61771)

Note: \*, \*\* and \*\*\* represent rejection of null hypothesis at 10%, 5% and 1%.

Robust Standard Errors are in the parenthesis.

Author's Estimates

The coefficient of Ebola is found to be negative with an estimated coefficient of -1.705 and statistically significant at 1%. The results show that the Ebola Virus Disease reduced intra-trade exports of affected countries to its partners by two folds, all else equal. This is not startling because the three most affected countries were on the verge of collapse hitherto economic growth dwindled [3, 21].

Results for currency union effect on intra-regional trade.

**Table 3.** PPML estimates for the Effects of ECOWAS membership on trade in West Africa.

Variables	Coefficients
GDP	.849 ** (.3962187)
GDP per capita	1.630 * (.9239736)
Distance	-.001 ** (.0003867)
Border	-.0405 (.3686981)
Language	-.429 (.7932172)
Colonizer	1.157 (.7311446)
infrastructure	.578 (.9158292)
Tariff	.482 (.3561939)
RL	.655 (.563937)
GE	.182 (.8081201)
VA	-.055 (.3405651)
PS	-.019 (.2437592)
CC	-.047 (.1645486)
ECOWAS	2.004*** (.7588316)
_cons	-11.605 ** (4.859767)

Note: \*, \*\* and \*\*\* represent rejection of null hypothesis at 10%, 5% and 1%.

Robust Standard Errors are in the parenthesis.

Author's Estimates

The coefficient of ECOWAS was positive with a coefficient of 2 and significant at 1%. The result shows that ECOWAS membership doubles the level of trade of members in West Africa. This is not startling because regional trade agreement stimulates trade flows of member-states by eliminating some barriers to trade. Additionally, the ECOWAS had been a voice in ensuring political and economic sustainability, to ensure growth in the sub-region.

## 5. Discussion

The theory asserts that disease outbreaks adversely affect trade [40]. The study's results not only confirmed the theory but also underscored the significant impact on trade flows. Additionally, the theory underscores the influence of membership in Regional Economic Communities on trade [51]. Empirically, the study validated the established theory and shed light on the potential impact on Mauritania should the country choose to join ECOWAS.

## 6. Conclusion

The analysis reveals that the Ebola Virus Disease led to a two-fold reduction in trade export shares of affected countries with their regional partners, while ECOWAS membership doubled the level of trade. This indicates a significant negative effect of Ebola on trade in West Africa. The study recommends proactive measures to address potential disease outbreaks and emphasizes the need for increased investment in medical research. Additionally, the study urges improvements in trade and transport infrastructure, along with the implementation of mandatory medical tests before traveling within the sub-region. Finally, the study suggests reevaluating Mauritania's membership in favour of rejoining the ECOWAS over its current membership in the Arab Maghreb Union (AMU).

## Author Contributions

Stanley Abban is the sole author. The author read and approved the final manuscript.

## Conflicts of Interest

The authors declare no conflicts of interest.

## Appendix

**Table A1.** *The Effect of Ebola on trade.*

Number of parameters: 13

Number of observations: 123

Number of observations dropped: 0

Pseudo log-likelihood: -1.677e+09

R-squared: .96067316

(Std. Err. adjusted for 32 clusters in pairings)

trade	Robust						
	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]		
lnGDP	2.583855	1.029384	2.51	0.012	.5662989	4.601412	
lnpercapita	2.216443	1.801548	1.23	0.219	-1.314526	5.747413	
Indistance	-.003814	.0007524	-5.07	0.000	-.0052888	-.0023393	
border	2.049413	.9703325	2.11	0.035	.147596	3.95123	
lang	-.2334202	1.55074	-0.15	0.880	-3.272814	2.805974	
colonizer	.7095882	1.772207	0.40	0.689	-2.763874	4.18305	
Ebola	-1.704759	.521639	-3.27	0.001	-2.727152	-.6823652	
infrastructure	-12.71167	5.017295	-2.53	0.011	-22.54539	-2.877952	
GE	-2.291091	2.543568	-0.90	0.368	-7.276393	2.694212	
VA	4.660808	1.203261	3.87	0.000	2.30246	7.019156	
volatlity	3.055929	3.102469	0.98	0.325	-3.024799	9.136657	
PS	3.760022	1.341768	2.80	0.005	1.130205	6.38984	
_cons	-35.89109	15.61771	-2.30	0.022	-66.50123	-5.280954	

**Table A2.** *The Effect of ECOWAS membership on trade in West Africa.*

Number of parameters: 15

Number of observations: 363

Number of observations dropped: 0

Pseudo log-likelihood: -1.902e+10

R-squared: .53173236

(Std. Err. adjusted for 78 clusters in pairings)

trade	Robust						
	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]		
lnGDP	.8491892	.3962187	2.14	0.032	.0726148	1.625764	



trade	Robust				
	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
lnpercapita	1.629767	.9239736	1.76	0.078	-.1811875 3.440722
lndistance	-.0008047	.0003867	-2.08	0.037	-.0015626 -.0000468
border	-.0404739	.3686981	-0.11	0.913	-.7631089 .6821611
lang	-.4294525	.7932172	-0.54	0.588	-1.98413 1.125225
colonizer	1.156959	.7311446	1.58	0.114	-.2760577 2.589977
infrastructure	.5782084	.9158292	0.63	0.528	-1.216784 2.373201
Tariff	.4815705	.3561939	1.35	0.176	-.2165567 1.179698
RL	.6551379	.563937	1.16	0.245	-.4501584 1.760434
GE	.1817317	.8081201	0.22	0.822	-1.402155 1.765618
VA	-.0554966	.3405651	-0.16	0.871	-.722992 .6119987
PS	-.0189212	.2437592	-0.08	0.938	-.4966805 .458838
CC	-.0471887	.1645486	-0.29	0.774	-.369698 .2753206
ECOWAS	2.004066	.7588316	2.64	0.008	.5167831 3.491348
_cons	-11.60545	4.859767	-2.39	0.017	-21.13042 -2.080483

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## Biography



**Stanley Abban** obtained a Master of Philosophy in Economics from Kwame Nkrumah University of Science and Technology in Kumasi, Ghana. He has been actively involved in various international research collaboration projects, leading to the publication of six research articles and a co-authored book chapter. His work has also been featured in the African media and he has contributed to an annual report for Africa. Additionally, he has served as a peer reviewer for esteemed journals and received invitations to participate in several conferences. Currently, he is dedicated to teaching economics at a secondary school in Ghana.

## Research Field

**Stanley Abban:** Currency or Monetary Union, International trade, Disease outbreak on trade, Trade and non-trade barriers, Money, Capital and Foreign Exchange Market