

Determinants of cocoa export trade in Nigeria (2014-2022): A gravity model approach

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Abstract: Nigeria has embraced trade openness, especially in cocoa product, as an essential strategy for sustained economic growth. However, challenges affecting cocoa exports persist with recent declines in production. This study investigates the trends in Nigeria's cocoa export and analysed the determinants factor of cocoa exports trade in Nigeria using Panel data spanning the period of 2014 to 2022. Relevant data for Nigeria and 17 partner countries were sourced from the World Development Indicators (WDI) of the World Bank, Food and Agricultural organization database (FAOSTAT), Centre d'Etudes prospective et d'Informations Internationales (CEPII), While trend analysis was used to examine movement of Nigeria cocoa production and export, the determinants of cocoa export trade in Nigeria was analysed using Panel Corrected Standard Errors Model (PCSE) within Gravity Model framework. The findings revealed that graphical movement of Nigeria cocoa export witnessed gradual decline in export trade volume till around 2017, before it began to improve afterwards, while; an average growth rate of 0.4% was also recorded in cocoa exports trade volume in Nigeria. Results of gravity model analysed using PCSE technique showed that cocoa export trade in Nigeria was positively ($p=0.001$) influenced by Nigeria Gross Domestic Product 0.468, and that of the trading partner countries 0.231, local cocoa production (0.733) and common language 0.663, However, Nigeria cocoa export trade was negatively impacted by distance to export partner countries -107.8($p=0.001$), and common colonial heritage -2.154($p=0.001$). The study concluded that the determinants that affect growth of cocoa exports trade are gross domestic products, population of the country, production of cocoa and common language were found to have a positive significant impact on the volume of cocoa exports trade. To boost cocoa export, this study recommends increased investment in cocoa production by private investors and the government to drive economic growth. Additionally, this study encourages the government to reinforce bilateral ties with cocoa trading partners through trade promotion measures, such as bilateral agreements, particularly with countries sharing common language to expand market access and maximize financial gains from cocoa exports.

Keyword: Cocoa, determinants, export trade, trend, gravity model, Nigeria

INTRODUCTION

In the 1970s, Nigeria's export economy heavily relied on agricultural commodities, with crops like cocoa, palm oil, groundnuts, ginger, sesame, and cashew playing a central role in earning foreign exchange and supporting local consumption. Cocoa exports have historically provided Nigeria with stable foreign exchange, contributing around 37.9% of Nigeria's agricultural export volume, underscoring its significance for economic diversification beyond oil (Ndubuaku and Asogwa, 2021). The cocoa industry is particularly crucial for southwestern Nigeria, where suitable climatic conditions allow for over 70% of the country's cocoa production. This sector supports thousands of smallholder farmers, providing employment and income for millions, especially in rural areas, and helping reduce poverty (Adebayo and Alheety, 2019; National Bureau of Statistics, 2023). However, Nigeria's cocoa industry faces challenges like aging farms, low yields, and volatile global prices. In response, the government has launched initiatives such as the Cocoa Development Programme in 2005 and the Agricultural Transformation Agenda (ATA) in the 2010s to revitalize the sector, improve production, and increase Nigeria's standing in the global cocoa market (Felix *et al.*, 2020).

Nigeria is focusing on diversifying its economy, especially in the cocoa sector, to boost foreign exchange earnings and reduce economic

vulnerability. Cocoa, the most profitable agricultural export, generates significant employment and revenue for cocoa-producing states (Idowu *et al.*, 2007; Bello and Mitchell, 2018). Policymakers view agricultural exports as essential for generating foreign earnings, creating job opportunities, and enhancing economic productivity. Understanding export dynamics is crucial as exports drive employment and contribute to Nigeria's economic growth. This paper seeks to examine the trends and growth rate of Nigeria cocoa export and to also analyse the determinants of cocoa export trade in Nigeria. This study aims to assist policymakers in promoting the agricultural sector by analysing factors affecting export trade and the role of diversification in reducing export volatility. The research also aims to guide potential investors by providing insights into promising agricultural commodities and to fill a gap in academic literature on Nigeria's rural commodity export trade.

According to Eita (2008) used a gravity model with panel data to examine Namibian exports, finding that increases in both importer GDP and Namibia's GDP boosted exports, while higher importer GDP per capita and greater distance reduced exports. Notably, Namibia's GDP per capita had minimal impact on export levels. Allaro (2010) investigated the export performance of oilseeds in Ethiopia using an Error Corrected Model (ECM). The study showed that real output and nominal exchange rate had significant positive effects on

oilseed exports, suggesting that increased production and favourable exchange rates bolster export performance.

Mohamed *et al.* (2014) analysed factors influencing Egypt's bilateral exports via gravity model analysis, identifying Egypt's GDP, the importer's GDP, importer population, regional trade agreements (RTAs), and shared borders as key influences on Egypt's exports to its primary trading partners. Martinez-Zarzoso *et al.* (2003) explored trade determinants between Mercosur and EU countries using an Augmented Gravity Model. They found that additional variables such as infrastructure, income disparities, and exchange rates significantly impacted bilateral trade flows beyond the standard gravity model factors.

Abolagba *et al.* (2010) focused on factors influencing Nigeria's agricultural exports of cocoa and rubber through Ordinary Least Squares (OLS) regression. Findings indicated that output, domestic consumption, interest rate, producer prices, and exchange rate were critical to the export performance of these commodities. Dominic M. U. (2017) analysed the impact of exchange rate on Nigeria's cocoa exports using Augmented Dickey-Fuller (ADF) unit root tests, Johansen co-integration, and OLS regression. The study concluded that factors such as agricultural export volumes, exchange rate, trade openness, and world cocoa prices collectively influence Nigeria's cocoa export performance.

Conclusively, all these studies highlight the role of GDP, exchange rates, infrastructure, and trade agreements in shaping export outcomes, emphasizing the complex interplay of economic factors across countries and commodities.

METHODOLOGY

The study was conducted in Nigeria, a West African country situated on the Gulf of Guinea. Nigeria spans between latitudes 4°N and 14°N and longitudes 2°E and 14°30'E, covering a land area of 923,770 km. Nigeria is bordered by Benin to the west, Niger to the north, Chad to the northeast, and Cameroon to the east, with the Atlantic Ocean to the south. The country's terrain transitions from dense mangrove and rainforests in the south to near-desert conditions in the northeast, providing a range of ecosystems suited for diverse agricultural production. An estimated 61 million hectares, or 66% of Nigeria's land area, is cultivable, supporting both cash and food crop farming across six geopolitical and agro-ecological zones (Adebayo and Alheety, 2019).

The varied climate supports major cash crops, such as cocoa, cashew, oil palm, rubber, kola nuts, coffee, and cotton, alongside food crops like cassava, groundnuts, soybeans, beans, millet, plantain, maize, yam, and rice. This climatic and ecological diversity is essential for Nigeria's

agricultural productivity and positions the country as a significant producer of both export and food crops (Iyoha and Okin, 2017; Nora and Arti, 2016).

This study utilized a panel data covering the period of 2014 and 2022 to examine factors influencing Nigeria's cocoa exports. The dataset including key economic variables like, Gross Domestic Product (GDP), exchange rates, distance between Nigeria and its trade partners, population, production levels, export value, official languages, colonial history, and existing free trade agreements for Nigeria and 17 trading partner countries were sourced from the World Bank's World Development Indicators (WDI), CEPII, FAOSTAT, ensuring a reliable and extensive dataset.

The analysis focused on Nigeria's trade relationships with countries such as Belarus, Bulgaria, Canada, India, China, Estonia, France, Germany, Indonesia, Italy, Malaysia, the Netherlands, Russia, Singapore, Spain, Turkey, the United Kingdom, and the United States.

Analytical techniques

The trend analysis for Nigeria's cocoa export crop was examined using graphical representations, while the growth rate model was adopted from Gujarati and Porter (2009) and previously used by Khalid and Burhan (2006) and Oyinbo and Emmanuel (2012), was applied to estimate the growth trend of Nigeria's cocoa export trade from 1961 to 2022. This model is based on the compound interest formula, which calculates growth over time and is expressed as:

$$Y_t = Y_0(1 + r)^t \dots \dots \dots 1)$$

Where:

Y = traded crop measures using (GDP);

Y_0 = Initial value of cocoa export crop (metric tonnes);

r = Compound rate of growth of cocoa export trade demand and output over time.

Taking the natural logarithm of Equation (1), Equation (2) was derived as:

$$\ln Y_t = \ln Y_0 + t \ln(1 + r) \dots \dots \dots 2)$$

If, $a_0 = \ln Y_0$ and $a_1 = \ln(1 + r)$, Equation (2) above is re-written as:

$$\ln Y_t = a_0 + b_1 t \dots \dots \dots 3)$$

Adding disturbance term to equation (3), the explicit form of the model employed was derived as:

$$\ln Y_t = a_0 + a_1 t + u_t \dots \dots \dots 4)$$

Where;

a = constant term;

a_0 = Coefficient of time variable;

u_t = Random term.

After the estimation of Equation (1), the compound rate of growth was computed as follows:

$$r = (e^{a_1} - 1) \dots \dots \dots 5)$$

where;

r = compound rate of growth;

a_1 = estimated coefficient from Equation (1).

Model specification

To achieve a robust result and get beyond evident statistical obstacles, the gravity model was estimated using the panel corrected standard error model (PCSE). The baseline gravity model, as employed by Bonuedi (2013) is the basis for the regression analysis equation utilized in this study, which has the following form: $TT_{ijt} = \alpha$

$$\left(\frac{GDP_{it}^{\beta_1} \times GDP_{jt}^{\beta_2}}{D_{ij}^{\beta_3}} \right) \dots \dots \dots 3.10)$$

This study used the augmented gravity model estimation methods from Bonuedi (2013), Panda and Sethi (2015), Sharma (2001), and Batra (2006). GDP per capita GDP and distance have been employed as independent variables in the gravity model since the dependent variable is the cocoa export from Nigeria. In our model, this study also included a few more independent factors. As a result, the model has been "augmented" by adding additional control and dummy variables that could impact Trade. Thus, the augmented gravity model:

$$jt = \alpha + \beta_1 GDP_{it} + \beta_2 GDP_{jt} + \beta_3 Dij + \beta_4 POP_{it} + \beta_5 POP_{jt} + \beta_6 REER_{jt} + \beta_7 produc_{jt} + \beta_8 LANG_{ij} + \beta_9 FTA_{ij} + \beta_{10} Col_{ij} + \mu_{ij} \dots \dots \dots 3.11)$$

Where;

- α is the general intercept,
- $\beta_1, \dots \dots \beta_{10}$ are all elasticity coefficients,
- i and j represent Nigeria and its trading partner, respectively,
- t represents time or the year,
- jt = Bilateral total Trade between Nigeria and the trading partner at time t ,
- GDP_{it} = GDP of country i at time t ,
- GDP_{jt} = GDP of country j at time t ,
- Dij = Distance between country i and j ,
- POP_{it} = Population of country i at time t ,
- POP_{jt} = Population of country j at time t ,
- $produc_{jt}$ = productivity in tonnes of country j at time t ,
- $LANG_{ij}$ = Common official language (dummy variable),
- FTA_{ij} = free trade agreement (dummy variable),
- Col_{ij} = Common colonial past (dummy variable),
- μ is the error term.

Preliminary assessment approach

In econometric analysis, especially in a panel dataset, diagnostic tests are very important, and it is a condition that must be undergone in ensuring the genuineness and reliability of the model estimates diagnostic tests are essential for addressing econometric issues such as multicollinearity, cross sectional dependence,

heteroscedasticity and autocorrelation, etc. These tests help to enhance the credibility of the findings and ensure that the estimated results reflect the true relationships between the variables.

Prior to conducting panel corrected standard error estimates, this study conducted assessments for multicollinearity using matrix of correlation and variance inflation factor (VIFs). The overall analysis shows low multicollinearity among the variables, but it suggests that multicollinearity may still exist. Cross-sectional Dependency test that was carried out using Breusch-Pagan LM Test, Pesaran Scaled LM Test, Pesaran CD Test, assesses whether there is interdependence between the cross-sections (countries) in the panel dataset, the statistical results and corresponding p-values from all three tests indicate cross-sectional dependence among the panel data variables.

The Unit Root Test carried out using the Cross-sectionally Augmented IPS (CIPS), a second-generation unit root test, to examine the Stationarity and order of integration of the variables, given the presence of cross-sectional dependency in the dataset, The CIPS test results for the variables revealed that some variables were stationary at levels while Others required first differencing to achieve Stationarity. In other words, they are integrated at orders 0 and 1, respectively, commonly denoted as $I(0)$ and $I(1)$. The successful confirms that the dataset is suitable for further panel data analysis after addressing unit root issues.

To find out the cointegration relationship, Kao, Pedroni, and Westerlund cointegration tests were conducted to assess the presence of long-term cointegration among the variables in a panel dataset. These tests are designed to confirm whether the variables exhibit a long-term equilibrium relationship, which is essential for panel data econometric modelling. These results collectively confirm the presence of long-term equilibrium relationships among the variables across the panels.

Slope heterogeneity test was conducted to examine whether the slope coefficients across the panel data are homogeneous or heterogeneous, the result showed that the p-value is less than the standard significance level of 0.05, the null hypothesis of slope homogeneity is rejected. This implies that the slope coefficients are heterogeneous, meaning that the relationship between the variables varies across different cross-sectional units (countries).

RESULTS AND DISCUSSION

Trend analysis of cocoa export trade (1961-2022)

Over the past 61 years, Nigeria's cocoa export trend has shown periods of growth and decline due to various factors, analysed using trend analysis with graphical and regression methods. Initially, cocoa was a major export product, with export volumes rising from 200,000 tonnes in 1961

to 350,000 tonnes by 2020. The 1960s saw high cocoa export volumes due to post-independence agricultural focus. However, the discovery of oil in the 1970s led to a shift away from agriculture, causing a significant decline in cocoa exports as government attention and investment moved to oil. Structural Adjustment Programs (SAPs) in the 1980s, driven by IMF and World Bank recommendations, further cut agricultural investment, contributing to ongoing low cocoa export volumes during that decade. Efforts to revive cocoa exports began in 2005 under President Olusegun Obasanjo, who launched the Cocoa

Development Programme to support cocoa production and diversify the economy.

This program saw gradual results, with modest increases in cocoa exports. In the 2010s, President Goodluck Jonathan's Agricultural Transformation Agenda (ATA) aimed to modernize agriculture, increase private investment, and expand market access. Falling oil prices and rising global cocoa demand, particularly from China, further shifted Nigeria's focus back toward agriculture, contributing to higher cocoa export volumes by 2020.

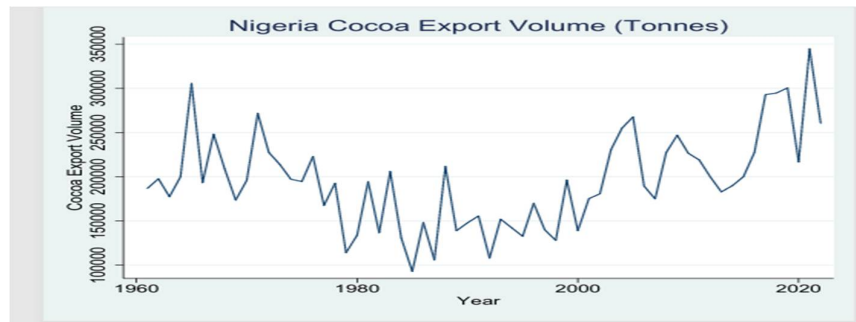


Figure 1: Trend Analysis for Cocoa Export Value in Nigeria

Source: Author's computation, 2024

The Growth Rate Equation for cocoa export in Nigeria

The growth analysis of Nigeria's cocoa exports from 1961 to 2022 revealed a modest annual increase of 0.4%. The positive time coefficient suggests an upward trend in cocoa exports, which is statistically significant at 10% levels. However, this growth rate is positive but quite low, the R-squared

explained about 4.1% of the variation in cocoa export by the time trend, T. This positive trend is likely driven by favorable export policies, including improved incentives and the removal of commodity boards, which increased farmers' profit margins. These findings align with Ojiako *et al.* (2007), who found stronger growth rates in crop exports during Nigeria's post-SAP period.

Table 1: Export Growth Rate of Cocoa (1961-2022)

Variable	Coefficient	Std Error	t-Statistic	Probability
T	0.003686	0.001939	1.900926	0.0621
C	12.02855	0.070257	171.2078	0.0000
Dependent Variable: LNCEV				
Method: Least Squares				
Date: 08/18/24, Time: 22:13				
Sample: 1961-2022				
Included observations: 62				
R-squared	0.056804	Mean dependent var	12.14467	
Adjusted R-squared	0.041084	S.D. dependent var	0.279055	
S.E. of regression	0.273263	Akaike info criterion	0.274960	
Sum squared resid	4.480351	Schwarz criterion	0.343577	
Log likelihood	-6.523766	Hannan-Quinn criter.	0.301901	
F-statistic	3.613519	Durbin-Watson stat	0.979375	
Prob (F-statistic)	0.062118			

Source: Author's computation, 2024

Result on determinant factor affecting Cocoa export in Nigeria and its major Trading Partners

The study utilizes a Panel Corrected Standard Error (PCSE) model to identify key

determinants affecting cocoa exports in Nigeria and its trading partners. This model is beneficial as it corrects heteroscedasticity, autocorrelation, and cross-sectional dependence noted in previous related

works, thereby, providing reliable estimates where traditional OLS models may falter (Beck and Katz, 1995; Cameron and Douglas, 2015). The analysis focuses on factors such as the GDP of both Nigeria and its trading partners, population, production levels, geographical distance, common language, and free trade agreements (FTA). The findings highlighted several significant drivers of cocoa export value. Nigeria's GDP and the GDP of trade partners were positively associated with cocoa exports, with a \$1 million increase in partner GDP boosting Nigerian cocoa exports by \$0.231 million, while a similar increase in Nigeria's GDP led to a \$0.468 million rise, both Nigeria's and its partners' economic growth significantly boost export performance. This result is also in agreement with Korhan *et al.* (2015) and Tambi (2001) who found a positive relationship between GDP and export, and also the study conducted by Majeed and Ahmad (2006), Majeed *et al.* (2013), Teweldemedhin (2013), and Suresh and Neeraj (2014) have concurred that indeed GDP is an important determinant of export performance.

The results also demonstrated mixed impacts of population on cocoa exports. While

Nigeria's population positively influenced exports due to an expanded domestic market, the population size of partner countries had a negative impact. This suggests that as a partner's population grows, income per capita may decrease, reducing overall trade demand. This finding concord with the study of Bonuedi (2013) that population have negative effect on trade flows. It also points out that the Nigerian cocoa export patterns follow a crop distribution, focusing on the production and export of quantity-based products and reliant on total market size.

Increased cocoa production also positively affected export values, this reflects the positive relationship between higher production and increased competitiveness in the global market which also supporting Adam Smith's theory of absolute advantage, where a country exports commodities, it produces efficiently. Results of Rocdiani and Wulandari, (2022), stated that the amount of production on competitiveness, positively influence the amount of production and export competitiveness. If there is an increase in production, that will increase export competitiveness (Sa'diyah and Dwidjono, 2020).

Table 2: Basic Estimation Results for the PCSE

VARIABLES	(Model 1) EXV	(Model 2) EXV	(Model 3) EXV	(model 4) EXV
<i>GDPd</i>	0.116*** (0.0197)	0.266*** (0.0217)	0.269*** (0.0205)	0.231*** (0.0199)
<i>GDPn</i>	0.533*** (0.0621)	0.536*** (0.0620)	0.533*** (0.0625)	0.468*** (0.0643)
<i>POPd</i>	-0.253*** (0.0534)	-0.374*** (0.0531)	-0.381*** (0.0490)	-0.359*** (0.0490)
<i>POPn</i>	2.385*** (0.289)	2.075*** (0.289)	2.086*** (0.291)	2.451*** (0.298)
<i>D.PROD</i>	0.721*** (0.0756)	0.739*** (0.0756)	0.739*** (0.0756)	0.733*** (0.0752)
<i>D.DIST</i>	-601.2*** (176.6)	-174.9 (229.7)	-186.7 (226.9)	-107.8 (236.7)
<i>COCL</i>		-1.602*** (0.0853)	-1.688*** (0.128)	-2.154*** (0.141)
<i>COLG</i>			0.105 (0.0920)	0.663*** (0.0965)
<i>FTA</i>				-2.039*** (0.0763)
Constant	-45.46*** (4.928)	-41.77*** (4.918)	-41.84*** (4.931)	-45.85*** (4.982)
Observations	2,627	2,627	2,627	2,627
R-squared	0.024	0.036	0.037	0.108
Number of crossid	17	17	17	17

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Source: Author's computation, 2024

Interestingly, geographical distance negatively impacted trade, as expected, but was insignificant, implying Nigeria's cocoa trade is not restricted to neighbouring countries. This result is in

line with the finding of Khan *et al.*, (2013) and Mohamed *et al.*, (2014). This variable gave the expected negative sign because the longer the distance, the less trade with partners. Common

colonial ties were negatively significant, justifiably due to restrictive trade dynamics with former colonies, while common language became positively significant in model 4, suggesting language commonality with great understanding facilitates trade. FTAs had a negative impact on export values, potentially due to regulatory complexities like export duties. Importantly, the R-squared improved from 0.024 to 0.108 across models, suggesting a 10.8% increase in the explained variance for cocoa export values.

CONCLUSION AND RECOMMENDATIONS

A trend analysis found out that cocoa exports have grown during the period under consideration. There has been an upward and positive trend in the growth of the cocoa exports trade. Cocoa exports have grown by 0.4 percent for the period under review. The study found that the determinants that affect growth of cocoa exports trade are gross domestic products, population of the country, production of cocoa and common language. The coefficients of the key variables (*GDPs* and distance) gave an expected sign that is consistent with the predictions of the PCSE model. Specifically, Nigeria's export trade flows were found to increase with economic size as measured by *GDP* significantly. However, distance was not a significant factor that determines trade flows as Nigeria trade more with farther countries. Nigeria's partnering countries was found to significantly decrease cocoa export values which indicating that larger populations in partner countries may decrease export demand. Contrarily, the population of Nigeria was found to increase Nigeria export value of cocoa significantly, highlighting the expanding domestic market and export potential.

Common colony with trading partners was found to reduce trade flows of Nigeria significantly. Common language was found to be significant in determining Nigeria's cocoa trade flows. While free trade agreement was also found to decrease trade flows significantly.

Based on the findings, the following recommendations are geared towards the expansion of Nigeria's trade flows with the rest of the world to maximize economic gains from international trade:

1. This study encourages the government to reinforce bilateral ties with cocoa trading partners through trade promotion measures, such as bilateral agreements, particularly with countries sharing common language to expand market access and maximize financial gains from cocoa exports.
2. Government and private investors should set up, formulate and implement Policy actions to further improve the prices of cocoa, while cocoa farmers should be encouraged with provision of cocoa

production incentives such as high yielding varieties and other inputs, and should be educated on appropriate cocoa preservation techniques otherwise Nigeria's cocoa prices will continue to fall due to poor quality.

3. Private investors, and government should invest more in cocoa production in Nigeria to take advantage of the increased growth rate and drive economic growth.

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