Macroeconomic Variables as Determinants of Agricultural Exports in Nigeria

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ABSTRACT

Agricultural exports in Nigeria have been adversely affected by fluctuations in macroeconomic indicators. Insufficient private agricultural investment and limited public expenditure directed toward the sector have resulted in inadequate productivity and suboptimal export performance. This study investigates the macroeconomic determinants of agricultural exports in Nigeria. A multiple regression model is specified, with agricultural exports (as a percentage of total merchandise exports) as the dependent variable. The independent variables are national output (economic growth rate), inflation rate, interest rate, exchange rate, and tariff rate. The analysis employs descriptive statistics, correlation, stationarity, and cointegration tests. After confirming the absence of multicollinearity, heterogeneity, autocorrelation, and nonstationarity in the time series data, the variables are deemed suitable for regression analysis. The model is estimated using ordinary least squares, and the results are interpreted at the 5% significance level. The findings indicate that all macroeconomic indicators, except the tariff rate, significantly influence agricultural exports. It is recommended that Nigerian policymakers reassess the effects of macroeconomic policies on the country's external balance, with particular attention to agricultural exports.

Keywords: agricultural exports, macroeconomic variables, multiple regression, Nigeria

INTRODUCTION

Over the past three decades, the proportion of Nigeria's agricultural exports within total merchandise exports has declined from 1.45% to 0.43% (National Bureau of Statistics, 2023). This decline underscores the need for effective strategies to revitalize Nigeria's agricultural output to satisfy foreign demand (Voice of Nigeria, 2023). Such strategies require a robust empirical understanding of the determinants of agricultural exports (Abdullahi et al., 2021; Oyetade et al., 2020). Accordingly, this paper analyzes the factors influencing the volume and direction of agricultural exports in Nigeria. Although this objective has been addressed in previous literature, limited attention has been given to the impact of macroeconomic variables on the supply of agricultural exports from Nigeria. This study, therefore, examines five macroeconomic variables; national output, inflation rate, interest rate, exchange rate, and tariff rate that are primarily shaped by national policies and events, as determinants of agricultural export volume.

The rationale for including these macro variables is hinged on the premise that there is mixed evidence of their influence on agricultural exports. For example, while the national output positively influences the agricultural exports (Osabohien et al., 2019), there is a crowding-out phenomenon such that the elevated interest rates result in lower investment in goods and services, including the tradables, causing exports to fall (Nwosa, 2021). In clear perspectives, monetary tightening (whereby the benchmark interest rates are increased) has been persistently pursued by the Central Bank of Nigeria (CBN). Consequently, most farmers lament little access to loanable funds (Osabohien et al., 2019). Where such loans are available, the huge borrowing costs have eroded the intended gains from them (Nwosa, 2021). Moreover, where the interest rates are low, the political economy is arranged to dissuade farmers from long-term focus on boosting their productivity (Akinbile et al., 2023). The unfolding events around the CBN's Anchor Borrowers Programme offer an instance of the stifled terrain of agricultural exports, with the CBN's policy playing a huge drag role (Akinbile et al., 2023). Furthermore, exchange rate depreciations are generally expansionary in output and exports (Abolagba et al., 2017). This is

because, as the domestic currency loses value against the foreign currency, it becomes cheaper for foreigners to demand domestically produced goods, leading to a rise in exports. The effect of rising exports is rising national output (Akinbode & Ojo, 2018). In this context, one would expect the persistent fall in the value of the naira against the dollar to bolster Nigeria's agricultural exports. Nevertheless, available evidence does not suggest this (Awolaja & Okedina, 2020). Falling agricultural exports have instead been associated with naira depreciations. Also, rising inflation in Nigeria could incentivize the country's agricultural exports to increase. Again, this remains to be validated empirically. Finally, the Nigerian government is known to practice a protective trade policy for its agricultural industries, implying that the movements of tariff rates might shed light on the movement of agricultural exports. Taking these factors together, this study analyses the macroeconomic determinants of agricultural exports in Nigeria.

LITERATURE REVIEW

Extensive evidence in the literature identifies agricultural exports as a key determinant of economic growth. However, this study examines the reverse relationship. Akinkunmi (2017), in an analysis of Nigeria's economic growth and its determinants, identified output growth as a benchmark variable intersecting with other macroeconomic indicators. The study linked developments in Nigeria's agricultural sector to the sector's significant contribution to GDP, suggesting that economic growth tends to benefit its primary drivers. Consequently, since agricultural exports do not lead Nigeria's economic growth, the agricultural sector derives limited benefits from overall economic expansion (Akinkunmi, 2017). During the 2016 recession, which disrupted many economic activities, agriculture was identified as the most resilient sector. Although agriculture contributes approximately a quarter to Nigeria's GDP, economic growth does not significantly enhance agricultural exports (Akinkunmi, 2017). This observation was later supported by Osabohien et al. (2019) and Abdullahi et al. (2021). Okafor and Isibor (2021) further examined the effects of exchange rate, inflation rate, and interest rate on the development of Nigeria's agricultural sector, with a focus on exports. Using annual time series secondary data and ordinary least squares (OLS) analysis, they found that the exchange rate had a positive effect on agricultural exports, while inflation had a significant negative impact. Interest rates were found to be insignificant. Based on these results, Okafor and Isibor (2021) recommended that monetary authorities implement policies to reduce inflationary pressures. These findings align with those of Udah et al. (2015), who investigated the role of monetary instruments and infrastructure in agricultural development. However, Udah et al. (2015) emphasized the importance of agricultural credit and monetary expansion to boost productivity and exports, contrasting with Okafor and Isibor's (2021) recommendations. Oriavwote and Eshenake (2017) employed error correction modelling (ECM) and Granger-causality techniques to assess the impact of agricultural productivity and the exchange rate on exports. Their results indicated that agricultural output is the primary driver of agricultural exports, suggesting that policies aimed at enhancing exports should focus on increasing output. Furthermore, agricultural output can serve as a significant source of economic growth, as it constitutes a component of national output. Additionally, Oriavwote and Eshenake (2017) found that exchange rate depreciation can stimulate agricultural exports.

According to the authors, exchange rate depreciations (or devaluations) expand the exporting country's trade openness and encourage foreign importers of the locally made goods. This argument is supported by the extant theoretical propositions of the J-curve hypothesis (Trofimov, 2020). Similar results have been reported by David et al. (2014) using the time series data that were sourced from the Ghanaian economy. The effect of trade openness and tariff rate on agricultural exports was brought into the limelight by Tsaurai (2022) in their analysis of the growth of the agricultural sector in the middle-income countries in Africa (inclusive of Nigeria), with financial development included as the intervening variable. The analysis was carried out under the dynamic generalized methods of moments (GMM) approach. According to Tsaurai (2022), the dynamic GMM and the pooled OLS results indicated that the influence of economic growth on agricultural sector growth was significantly negative. Also, fixed, random, and pooled effects showed that trade openness and tariffs on the growth of the agriculture sector were significantly positive. This was facilitated by the growing financial development in the sampled African countries (Tsaurai, 2022). More recently, Okuduwor et al. (2023) assessed the significance of tariffs and trade openness as the factors linking agricultural exports to economic growth. Their results were similar to those of Tsaurai (2022). However, while the former employed GMM techniques on the panel time series data, the latter performed the ARDL analysis on the single-country time series data. Aside

from this, the two studies were the same regarding the objectives, variables, and conclusions. Previously, Ebi and Ape (2014) evaluated the supply response of seven agricultural export commodities from Nigeria between 1970 and 2010. An econometric analysis, which the ECM anchored, was employed to estimate export supply behaviors of the seven commodities, including cocoa, benniseed, rubber, palm oil, groundnut, cottonseed, and soybeans. The authors found that the response of export supply to changes in relative price was positive and significant for five commodities, except cocoa and soybeans. Also, output growth and more investment credit to the agricultural sector positively and significantly influence the export supply of the commodities. Other identified supply factors were the road network transporting agricultural produce and communication, facilitating trade. Mesike et al. (2010) had earlier made similar conclusions.

MATERIALS AND METHODS

This research is designed with an ex-post facto approach so that the determinants of Nigeria's agricultural exports are analysed and discussed. These determinants are specifically related to the macro and trade variables such as the national output, inflation rate, interest rate, exchange rate, and tariff rate. A multiple regression model was adopted to guide the analytical framework in capturing these variables' individual and joint impact. The baseline model is specified as: Where AGREXP is agricultural exports, NATOUT is national output (which is proxied by the gross domestic product), INFRATE is inflation rate, INTRATE is interest rate, EXCRATE is exchange rate, and TARRAT is tariff rate. In econometric terms, the model is specified as: Where the AGREXP is the dependent variable and other variables are independent variables. The variables retain their earlier definitions. The parameters – measure the changes in the dependent variable when the independent variables change by one unit. The parameter is the constant of the model. is the error term which is normally distributed with zero mean (its value converges to zero) and constant variance – this is important to produce unbiased, efficient estimates. The analytical technique began with cleaning the data in a spreadsheet. After this, the descriptive statistics of the variables were discussed. This was followed by a correlational analysis to explore the inter-relationships among the variables. Then the regression model was analysed using the ordinary least squares (OLS) technique. The annual time series data on these variables were sourced from the World Development Indicators of the World Bank. The data covered the 30 years 1992-2022. The unit of measurement of all the variables is percentage, except the national output in billions of dollars.

RESULTS AND DISCUSSION

Descriptive Analysis

The descriptive statistics of the variables are presented in Table 1. The average value of agricultural exports (as a fraction of total export of goods and services) over the sample period is 0.96% ± 1.68%. Only about 1% of total merchandise exports are traceable to the agricultural sector. This development is partly blamed on the Nigerian government's switch from agricultural to oil exports in the 1970s. The standard deviation is noteworthy as it indicates a wide spread in the sample distribution. This is further supported by the wide gap between the minimum value (0.01%) and the maximum value (7.27%) of agricultural exports. These statistics suggest that the supply of agricultural exports from Nigeria is prone to high volatility. The mean national output of the Nigerian economy is $326billion. A perspective is generated on this value if it is noted that Nigeria is the largest economy in Africa. While the standard deviation ($ 141billion) is considerably low, the maximum value of $535 billion relates that the recent performance of the Nigerian economy is rather unimpressive – the economy recently witnessed periods of recessions and slow growth.

Table 1: Descriptive statistics of the variables

	AGREXP	NATOUT	INFRAT	INTRAT	EXCRAT	TARRAT
Mean	0.96	3.26E+11	18.59	18.49	155.43	22.72
Maximum	7.27	5.35E+11	72.84	31.65	425.98	92.88
Minimum	0.01	1.55E+11	5.39	11.48	17.30	11.95

Standard Deviation	1.68	1.41E+11	16.49	3.94	114.75	15.56
Skewness	2.81	0.11	2.11	1.19	0.82	3.07

Source: Author's Data Analysis (2025)

The inflation rate is currently averaged at 18.59% ± 16.49%. This describes Nigeria as having inflationary pressures. Unlike many advanced economies where inflation is targeted at 2%, the Nigerian policymakers have not particularly considered high prices of consumer goods and services as an important macroeconomic problem – this assertion is linked with the deviation of the CBN from its hitherto target of a single-digit inflation. Yet, the standard deviation of 16.49% points to inflation being characterized by large fluctuations in Nigeria. The interest rate shares the same mean value as the inflation rate, but with a lower standard deviation (3.94%). The average exchange rate is N155/$1. For anyone conversant with macroeconomic events in Nigeria, the exchange rate currently tilts around N1000/$1 in the unofficial parallel markets. However, this current event is not captured in this study for two reasons. First, the end-year of the time series used for the empirical analysis is 2022, when the exchange rate was at its maximum (N425/$1). Second, no official source has reported the aggregated exchange rates in the country until this paper was sent for publication. Nigeria also pursues an unstable trade policy. This is reflected by the standard deviation of the tariff rate (15.56%) being close to its mean value (22.72%). The tariff rate on the import of raw materials and primary inputs is included in this study because the literature has established that the tariff regime is a driver of the importing country's exports. In practice, countries institutionalize the tariff regime in response to the trade policy mechanisms that other countries have pursued (Okuduwor et al., 2023). All the variables are skewed to the right, meaning they have positive trends. As they have been growing over time, this result has disparate interpretations. While the growth of agricultural exports and national output is desirable because it indicates impressive performance of the economy, the growth of the inflation rate, interest rate, exchange rate, and tariff rate is unwelcome due to their contractionary impact on economic activity. For example, higher inflation or interest rates diverts resources from productive purposes. Similarly, a higher tariff rate may result in a counterreaction leading to lower foreign demand for domestic goods.

Correlation Analysis

As reported in Table 2, the correlation coefficients among the variables are pro-intuitive. Agricultural exports and national output are positively correlated at 0.17. This follows the theoretical argument that exported output is first produced at home and counted as part of the domestic GDP. Also, domestic inflation and agricultural exports are negatively associated at -0.06. When the consumer price index of a country is elevated, demand for the country's exports is depressed. This agrees with the extant submission in the literature (for example, Udah et al., 2015; Ebi & Ape, 2014; Mesike et al., 2010). The negative link between tariff rate and agricultural exports (-0.18) is similarly explained by the fact that tariffs make domestic goods more expensive, resulting in lower exports. Nevertheless, the negative relationship between the exchange rate and agricultural exports is counterintuitive. Given that exchange rate is quoted as naira (N) per dollar ($) in this paper, one would interpret an increase as naira depreciation and a decrease as naira appreciation against the dollar. In the standard economic analysis, an exchange rate depreciation makes exports cheaper, leading to higher demand for exports. Thus, the persistent fall in the value of the naira against the dollar is expected to be positively correlated with the agricultural exports (Bawa et al., 2018), but this was not the case, as given in Table 2. The subsequent section will generate More informed empirical arguments on this relationship. The coefficients among the other variables satisfy the theoretical links and intuitive arguments.

Table 2: Correlation coefficients among the variables

	AGREXP	NATOUT	INFRAT	INTRAT	EXCRAT	TARRAT
AGREXP	1.00					
NATOUT	0.17	1.00				
INFRAT	-0.06	-0.44	1.00			
INTRAT	-0.11	-0.72	0.51	1.00		

EXCRAT	-0.08	0.88	-0.38	-0.68	1.00	
TARRAT	-0.19	-0.61	0.75	0.49	-0.48	1.00

Source: Author's Data Analysis (2025)

Stationarity Analysis

A stationarity analysis was conducted to determine the likelihood of mean reversion in the variables included in the present study. This analysis was hinged on Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The use of dual tests was focused on ascertaining consistency in the stationarity properties of the variables. In the context of this study, a series is said to be stationary if it has constant mean, constant variance, and constant covariance (Traore & Diop, 2022). Nevertheless, following Traore and Diop (2022), constancy in mean is enough to indicate constancy in variance and covariance. Furthermore, the PP test captures both constancy in mean and variance, providing toolbox for verifying the ADF stationarity report mainly identifies constancy in mean (Fowler et al., 2024). The statistical ADF and PP values were obtained at constant and linear trend specifications. These are contained in Table 3. The corresponding critical values are presented in Table 4.

Comparing statistical and critical values shows that all variables are stationary at levels. That is, they are all I (0). This stationarity provides credence to use OLS as an appropriate estimation technique in the present study. According to Fowler et al. (2024), time-series variables integrated of order 0 tend to exhibit the same characteristics in the short and long run. By implication, the short-run properties of variables discussed in this study are extended over the long run. In other words, there is no deviation of behaviour between the short run and the long run, suggesting that using short-run models such as the autoregressive distributed lag (ARDL) model or error correction model (ECM) in this study is superfluous.

Table 3: ADF and PP Statistics

	ADF statistic	PP statistic	Order of integration
AGREXP	-4.2345	-4.4592	I(0)
AGREXP (-1)	-8.5433	-8.6592	
NATOUT	-4.4590	-4.4409	I(0)
NATOUT (-1)	-9.4562	-9.4021	
INFRAT	-4.7458	-4.6672	I(0)
INFRAT (-1)	-8.6439	-8.4722	
INTRAT	-4.1295	-4.0098	I(0)
INTRAT (-1)	-9.4981	-9.4881	
EXCRAT	-5.7632	-5.0879	I(0)
EXCRAT (-1)	-10.3208	-10.1125	
TARRAT	-4.7766	-5.5587	I(0)
TARRAT (-1)	-9.5883	-10.4344	

Source: Author's Data Analysis (2025)

Cointegration Test

The Johansen cointegration test further strengthened the description of the variable's stability properties. As Yussuf (2022) discussed, cointegration is invoked to establish a long-run relationship among all variables in the model. In this study, while the zero-order integration reported in the preceding section is an indicator of strong long-run convergence among the variables, the computed cointegration test strengthens this indication. This

result is presented in Table 5. With the Johansen (statistical) values being greater than critical values only at none and at most one specification, it was obtained that there are two cointegration equations. This is consistent between the eigenvalue and trace statistical values. Thus, reliable long-run relationships exist in the time series estimated in this study.

Table 4: Asymptotic Critical Values of ADF and PP

Level of significance	Form of test	Levels	First differences
1%	ADF	-4.2528	-4.2627
	PP	-4.2529	-4.2627
5%	ADF	-3.5485	-3.5530
	PP	-3.5485	-3.5530
10%	ADF	-3.2071	-3.2096
	PP	-3.2071	-3.2096

Source: Author's Data Analysis (2025)

Table 5: The Johansen cointegration test

Hypothesized number of cointegrating equations	Eigenvalue	Trace statistic	Critical value	p-value
None	0.85	115.56	40.17	0.00
At most 1	0.82	52.88	24.28	0.00
At most 2	0.24	8.34	12.32	0.33
At most 3	-0.12	0.66	4.13	0.61

Source: Author's Data Analysis (2025)

Regression Analysis

The regression coefficients are telling. As summarized in Table 6, an increase in the national output by $1 billion leads to an increase in agricultural exports by about 0.017%. This result echoes the assertion that a pathway to bolster the export of agricultural output in Nigeria is through growth trajectories of the national economy. After all, the agricultural sector is one of the most significant components of Nigeria's GDP, currently sharing around 25% of the overall economic activity. Since agricultural raw materials exported are locally produced, the logic is that an expansion of the national output will necessarily improve agricultural exports. This submission supports the earlier findings in the literature (such as Abdullahi et al., 2021; Osabohien et al., 2019; Akinkunmi, 2017). However, it was found that a rise in inflation by 1% would lead to an increase in agricultural exports by 0.012%. Like the behavior of the national output, the inflation rate has an expansionary effect on the volume of exported agricultural goods. This result can be justified by the reasoning that prices of 10 agricultural raw materials are relatively low on the world market, implying that foreign importers might shrug off the news that Nigeria's inflation rate has increased. It is the case that, no matter the rise in agricultural exports, their prices are still low on the world markets. In addition, Nigeria is not an example of hyperinflation, so foreign importers might be less worried about buying Nigeria-made agricultural goods and services.

Table 6: Regression estimates

Dependent variable: AGREXP			
Independent variable	Coefficient estimate	Standard error	t-statistic
NATOUT	1.17E-11	3.87E-12	3.026*

INFRAT	0.012	0.026	0.468*
INTRAT	-0.03	0.051	2.534*
EXCRAT	-0.02	0.005	2.767*
TARRAT	-0.01	0.029	1.463**
R-squared = 0.668; Adjusted R-squared = 0.489; F-stat =37.18; Log-likelihood = 54.78			

* Implies the coefficient estimate is significant at 5%

** implies the coefficient estimate is not significant at 5%

Source: Author's Data Analysis (2025)

In contrast, increases in other independent variables (interest rate, exchange rate, and tariff rate) hurt agricultural exports. Particularly, when the interest rate increases by 1%, agricultural exports are down by about 0.03%. This result re-establishes the theoretical impact of changes in the interest rate on the real sector. When the central bank increases the benchmark interest rate (or the federal funds rate), domestic investment crowds out because the borrowing costs for investment purposes would inadvertently increase. Moreover, a similar increase in the exchange rate reduces the agricultural exports by 0.02%. When the increase is in the tariff rate, the exports are down by 0.01%. It follows that changes in macroeconomic variables determine the volume of agricultural exports in Nigeria. While national output and inflation rate have expansionary effects, interest, exchange, and tariff rates have contractionary effects on agricultural exports. As suggested by the t-statistics, the independent variables are statistically significant at 5% except for the tariff rate. The R-squared shows that all the variables jointly account for about 66.8% of the variation in the agricultural exports. While this is noteworthy, it demonstrates that other determinants of agricultural exports differ from those included in this study. The F-stat (37.18) indicates that the independent variables are jointly significant in having an exact impact on agricultural exports. Finally, the log likelihood (54.78) shows that the coefficient estimates are typically distributed, such that the mean values are valid for most of the series in the population sample. This confirms that the estimated model represents a good fit of the population sample.

CONCLUSION AND RECOMMENDATION

This Study Revalidates the Macroeconomic Determinants of Agricultural Exports in Nigeria by Specifying and Estimating a Multiple Regression Model That Includes five Macroeconomic Aggregates: National Output, Inflation Rate, Interest Rate, Exchange Rate, and Tariff Rate. The Findings Indicate that these Macroeconomic Indicators Have Not Been Effectively Leveraged by Nigerian Policymakers to Enhance Agricultural Exports. Although GDP Demonstrates Expansionary Effects on Agricultural Exports, The Current Structure of The Nigerian Economy Prioritizes the oil and Service Sectors Over Agriculture. The Oil Sector Contributes Approximately 10% To Nigeria's GDP But Accounts for Nearly 90% of Total Exports, While the Service Sector Represents Up To 55% Of Overall Economic Output. Without A Strategic Shift in Government Focus Toward the Agricultural Sector, Significant Improvement in Agricultural Exports is Unlikely. Therefore, It Is Recommended That the Nigerian Government Diversify Its Revenue Sources to Include Agricultural Export Gains. Historical Evidence Shows That Agriculture Was the Foundation of The Nigerian Economy During the First Decade of Independence (1960-1970). Rather Than Maintaining a Mono-Cultural Focus on The Oil Sector, Policymakers Should Encourage Both Domestic and Foreign Investment in Agriculture. This Approach Offers the Most Effective Means of Strengthening the Country's External Balance and Increasing Agricultural Exports.

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