Agricultural Trade and Food Security in Nigeria: A Quantile Regression Analysis of Distributional Effects

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ABSTRACT

Agricultural trade is mostly assumed to exhibit positive impact on food security. Most empirical studies of this relationship in Nigeria use Ordinary Least Squares (OLS) regression which estimates only average effect of agricultural trade on food security without taking cognisance of whether this relationship varies across the most food insecure and more food secure parts of the population. If agricultural trade is differential in its effects on food-security distribution, uniform trade-liberalisation policies could be poorly targeted – not enough for the food-insecure poor or even harmful for them. The effect of agricultural trade on food security in Nigeria (1981-2024) was assessed using quantile regression to capture the conditional effect of agricultural trade over five points of the distribution of food security ($\tau = 0.10, 0.25, 0.50, 0.75, 0.90$) with a benchmark OLS baseline. The OLS baseline averagely suggests that agricultural trade is positively, though insignificantly, associated with food security, while agricultural output and income are positively and significantly associated with food security. The quantile regression results show strong distributional heterogeneity: agricultural trade has a strong positive impact at low-quantiles, where the bulk of the most food insecure groups are, but which decreases monotonically until it becomes negative at high-quantiles, whereas the impact of agricultural output shows the opposite pattern, increasing steadily from statistically insignificant at low-quantiles to highly significant at high-quantiles. Trade primarily serves as a means of managing food insecurity, but not as a means of further improving the food security. The paper calls for quantile-targeted instead of uniform agricultural trade and production policy.

Key Words: Food security, Agricultural trade, Food availability, Agricultural output, Quantile regression

JEL codes: Q18, Q17, and C21.

INTRODUCTION

Despite Nigeria's efforts in various agricultural and trade policy interventions designed to increase food availability, access and stability over the last 10 years, food security has worsened on several headline indicators. In 2023, the food inflation rate stood at about 32.8 percent, which was higher than the 24.1 percent recorded in the previous year, while the National Bureau of Statistics, 2023, estimates that about 133 million Nigerians (nearly 63 percent of the population) were living in multidimensional poverty as of 2022, which directly limits their ability to access adequate and nutritious foods. According to humanitarian assessments, about 18.6 million Nigerians were food insecure from various levels in 2023, and the number is projected to increase to 26.5 million during the lean season of 2024 if no effective steps are taken to improve the situation, with the Northeast region having a higher proportion of those who are acutely food insecure (United Nations Office for the Coordination of Humanitarian Affairs, 2023).

Conventionally, agricultural trade is considered as one of the most important policy instruments to address food security, based on the theoretical assumption that trade can move food supplies from surplus (places and times) to deficit (places and times), reduce fluctuations in prices, and serve as a substitute for domestic production in times of shortage. Nigeria's agricultural trade position, however, has become structurally import dependent, with food imports consistently outstripping agricultural exports over several decades, leading to the empirical

questions: Is the net effect (structural) of agricultural trade supporting or undermining Nigeria's food security outcomes, and does this vary by segment of the food-security distribution?

Most of the available literature in Nigeria on agricultural trade and food security is based on descriptive statistics, correlation analysis, or Ordinary Least Squares (OLS) regression which describes only the conditional mean relationship of trade and food security. This is a major constraint because food security in Nigeria is highly variable, from high level of acute, life-threatening food insecurity in some households and areas to high level of food sufficiency in others, and it is a priori not obvious that agricultural trade would have the same marginal effect throughout this distribution. For example, if agricultural trade is mainly used by the food-insecure poorest households as a way of coping with food shortages, then an OLS estimate of the average impact of trade would underestimate the food security benefits of increased trade liberalisation for these households and might overestimate the benefits for those who would be food-secure without trade anyway because they produce their own food and earn income. Existing Nigerian studies, which have used mean-based estimators, are simply not equipped to identify and quantify this type of distributional heterogeneity, and even recent, methodologically ambitious ones like Onwe, Ojide, Subhan and Forgenie's (2024) wavelet-coherence and Quantile Autoregressive Distributed Lag analysis of Nigeria's food production index – which is the first of its type on Nigeria – failed to apply a distribution-sensitive lens to the agriculture-trade-food security equation specifically, working instead with globalisation as the regressor of interest.

This paper fills this gap by applying quantile regression, which estimates the conditional effect of agricultural trade at various quantiles of the food-security distribution, not just the conditional mean, and formally compares with an OLS baseline (using the Koenker-Bassett slope-equality test) for Nigeria during 1981-2024. There is evidence that the impacts of carbon emissions and technological innovation on the performance of agricultural exports and imports differs across quantiles, which strengthens the argument for a distribution sensitive approach: Abdullahi, Wang, Abdullahi, Baisheng, Yeboah and Bah (2025) use a Method of Moments Quantile Regression to estimate the impact of carbon emissions and technological innovation on agricultural exports and imports across 41 African countries, finding significant differences in impacts across quantiles, while Abdullahi and Mekie (2026) use a panel quantile ARDL-PMG approach to estimate the impact of urbanisation on food security across 41 African countries, finding significant differences in impacts across quantiles.

This argument is further bolstered by the fact that Nigeria experienced a more than three-fold range in food-security outcomes over the sample period (1981–2024), with a low of 28.48 and a high of 111.74 on the food security index, which likely represents qualitatively different food-security regimes rather than just a single population fluctuating around a common mean. The years and regions at the low end of the range are associated with periods of high and widespread food insecurity and acute vulnerability, similar to what has been reported in the recent years in the north-east Nigeria, while those at the high end of the range are associated with relatively high food security and more typical of urbanised, higher income regions in the south-west. This raises the possibility that agricultural trade's effect on food security is the same in both regimes, which is what OLS is assuming by construction, and which this paper examines directly and finds not to be the case.

The central question investigated in this paper is: How much does agricultural trade influence food security indicators in Nigeria and is this influence uniform across the entire distribution of food-security outcomes? The corresponding aim is to assess the impact of agricultural trade on food security (including food availability, access and stability) in Nigeria between 1981 and 2024, paying special attention to the distributional dimension of food security.

This paper makes the following contributions to the literature: First, it is one of the few studies in Nigeria that have employed quantile regressions in the analysis of the agricultural trade-food security nexus as most of the studies in the literature have been based on conditional-mean regressions, which fail to capture distributional patterns. Second, the paper compares the impact of agricultural trade and agricultural output across the same set of quantiles, which provides insights on not just whether trade or domestic agricultural production matters more for some groups of people than for others, but also how the relative importance of trade and agriculture production changes systematically across the food-security distribution, with direct relevance for distinguishing between safety-net policy and long-run productivity policy. Third, the paper formally validates the use of quantile regression over OLS using the Koenker-Bassett (1982) joint slope-equality test, providing methodological rigour

that is often lacking in quantile regression applications in the Nigerian development economics literature that often present quantile estimates without formally testing if they differ significantly from the OLS benchmark – a rigour that mirrors the recent good practice in Panel-ARDL applications such as Abdullahi and Mekie (2026) and Dekkiche, Mohamed and Fairouz's (2025) Panel-ARDL comparison of food-security determinants across Arab and African countries. Fourth, the estimation window of 1981–2024, which covers the latest available data, reflects the post-2020 uptick in Nigerian food-price inflation and humanitarian food-insecurity indicators, which is also examined from a macro-trade perspective, albeit from a complementary angle, by a recent study by Quinton, Jenkins and Olasehinde-Williams (2026) on how the 2015 oil-price collapse and subsequent restriction on food imports re-shaped Nigerian household food insecurity, lending contemporary policy relevance to the findings.

LITERATURE REVIEW

Theoretical Review

This paper builds on the theoretical perspective on food security: Food Security Theory, which defines food security as the secure availability of safe and nutritious food for an active and healthy life and is grounded in four interdependent pillars of food security: availability, accessibility, utilisation, and stability. In this framework, agricultural trade is interpreted primarily as operating through the availability and accessibility pillars; to supplement local food production during times of shortfall, and if Nigeria has a comparative advantage in agriculture, to provide export earnings which can be used to finance imports or invest in local agriculture. The quantile approach used here is particularly relevant to the theory's focus on stability: for the populations at the lower end of the food-security distribution, even a small price or supply shock can have a dramatic impact on the level of acute hunger, while for more food-secure households, prices and supplies are less likely to have a significant effect on welfare, in the sense of immediate hunger.

In the resource-scarcity version of Conflict Theory, the scarcity of resources can cause social tensions, while the ability of a population to access food without being disrupted by economic shocks or environmental fluctuations is food stability in the Marxian sense of contested resource allocation. In the context of the quantiles used in this paper, the theory predicts that the marginal value of a unit of food supply (from trade or domestic production) is likely to be highest precisely in the quantiles where there is a scarcity of food, and that this value will decline with increasing food security, thus providing a theoretical underpinning for the paper's empirical expectation that the trade-food security relationship will be stronger at the lower end of the quantile distribution and weaker at the higher end.

These two theoretical views are not only complementary in the abstract, but they will create a jointly falsifiable empirical prediction that directly inform the quantile specification of the paper. If the logic of Food Security Theory, which assumes improving food availability and accessibility is a component of food security, and the logic of Conflict Theory, which assumes that vulnerability to food insecurity is driven by resource scarcity, both hold true in the context of Nigeria, then the marginal effect of agricultural trade should be greatest where vulnerability to food insecurity is greatest, namely at the lowest quantiles of the food-security distribution, and diminish as households or periods approach relative food sufficiency, when the value of additional food becomes lower. In parallel, theories also suggest that the more structural and sustained availability path through domestic production should not be eclipsed – indeed, for already food secure populations, sustained production gains (as opposed to episodic trade-based supplementation) would be a more likely trajectory to further improvements. The two parts of this joint theoretical prediction are tested and by and large supported by the empirical results reported in Section 4.

Empirical Review

Obayelu and Edewor (2024) also studied the flow of agricultural trade and Nigeria's food security using descriptive statistics and found that Nigeria's food imports have consistently outnumbered its food exports with the consequences it has on the affordability, quality and safety of food consumed in the country; although their work helped to build the case for the trade-import-dependence pattern that is the motivation for the present empirical question, their descriptive design did not provide an explanation of whether this trade pattern is

beneficial or harmful to different segments of the food-security distribution in an economically differential way, which is what the present quantile regression approach is designed to do. Abdullateef, Yusuf, Salman and Adeoti (2010) studied the impact of agricultural trade liberalisation on food security in Nigeria after the country adopted unilateral agricultural trade liberalisation policies in 1986, and found that subsequent liberalisation policies, such as the Uruguay Round Agreement on Agriculture, have not produced consistent results and that demand for food has remained higher than domestic supply in Nigeria despite the country's largely liberal trade policies under the WTO guidelines; their mixed results conclusion is consistent with the quantile results of the present paper, which indicates that the benefits of agricultural trade liberalisation have not been uniformly distributed across all groups of food-insecure people.

In this paper, John and Ntoh's qualitative argument that agricultural trade can help improve food security by increasing the availability of food and improving market access is substantiated quantitatively: the strong, significant positive effect of agricultural trade obtained at the lowest food-security quantile suggests that this positive effect does not necessarily extend across the distribution of food security in a uniform way, where agriculture production is limited by structural or climatic factors. Owolabi (2024) also interpreted trade as a tool for mitigating food insecurity as a result of climate change by moving food products from surplus to deficit areas; this is in line with the strong estimates of the lower quantile trade coefficient as evidence of a safety-net function in this paper.

Using the ARDL model and Granger-type causality test, Enilolobo, Nnoli, Olowo, Aderemi, Adewole, Olapade and Esedeke (2022) explored the determinants of food security in Nigeria and found that domestic capital formation has a significant positive influence on food security while agricultural bank lending has a short-run positive impact; although not a study on agricultural trade per se, the strong positive influence of domestic capital formation is in line with the finding of this paper that agricultural output becomes a more significant determinant of food security at the higher quantiles. Adepoju, Esan and Akinyomi (2022) looked at food security in Nigeria, in the context of precision agriculture and worker productivity, and stated that the key to the improvement of food security in Nigeria is to be centered on productivity-enhancing technologies, as production side levers are the main drivers of food security gains, after basic food-security adequacy has been achieved.

A smaller literature has used quantile or distribution-sensitive approaches to answer questions related to food security other than those specific to the trade focus of this paper. Onwe, Ojide, Subhan and Forgenie (2024) examined determinants of Nigeria's food production index, and for the first time used Wavelet Coherence and Quantile Autoregressive Distributed Lag (QARDL) methods to find evidence that globalisation exerts a positive effect at the lower quantiles of the food production index, while exerting a negative effect at the median and upper quantiles, and that the long-run globalisation effect turns negative across all quantiles of the food production index; albeit the examination of determinants of Nigeria's food production index rather than determinants of food security, and the inclusion of globalisation rather than narrow agricultural trade as the regressor of interest, their methodological evidence of quantile-varying globalisation effects on food production is analogous and corroborates that of the present paper.

More broadly, there are comparisons with other parts of the developing world that support the possibility of distributionally varying trade-food security relationships. Africa searched for the effects of climate variability and change on food security, finding that the results are highly heterogeneous from country to country, with the authors pointing out that part of this is due to the underlying food-security vulnerability profile of a given country, which is the same as the quantile evidence in this paper that trade's food-security benefit in Nigeria is conditional on a household or period's underlying food-security status. Balogun and Mudau (2023) also analysed food-security resilience in Nigeria during the multiple economic crises and found that the most visible response of food insecurity to short-term food security interventions (food imports and emergency distribution) was the response of food-insecure households at the lowest food-security quantile, which is the vulnerable group in Nigeria and the same group found in the present paper to have the largest and most significant coefficient of agricultural trade.

Six recent contributions in 2025/2026 further focus the positioning of this paper: three for each of 2025 and 2026. This paper's methodological main premise that the relationship between agriculture and trade performance is unlikely to be the same everywhere on the distribution is directly supported by the results of Abdullahi, Wang,

Abdullahi, Baisheng, Yeboah and Bah (2025), who used a Method of Moments Quantile Regression to examine agricultural exports and imports in 41 African countries. Escalante, Mamboundou, Meyimdjui and Omoju (2025) found that the impact of climatic disasters in Nigeria decreases the real GDP by 2.11 percent, increases the likelihood of regional food shortages by 6.5 percent, and enhances the dependence on food imports, which is part of the import-dependence channel this paper addresses as a control through the domestic agricultural output. A pervasive food production inadequacy was found to emanate from the joint effect of population pressure, agricultural land constraint and capital formation at the Panel level, corroborating the finding of this paper at the country level that food security is mainly affected by domestic factors on the production side and not by trade.

Among 2026 contributions, Quinton, Jenkins and Olasehinde-Williams (2026) applied a difference-in-differences design to the Nigerian General Household Survey (NGHS) panel data, and found that the oil-price collapse in 2015, the naira depreciation, and the government's foreign-exchange restrictions on food imports combined led to a significant and statistically robust increase in food insecurity in Nigeria, specifically targeting the most food-insecure urban households, who have the highest exposure to monetised, import-dependent food markets – a household-level demonstration of precisely the trade-restriction channel this paper estimates through quantile regressions. In their analysis, Abdullahi and Peng (2026) reviewed the relationship between macroeconomic instability and institutional quality and agricultural trade over a sample of 35 African countries, finding that inflation and exchange-rate volatility have a significant negative relationship with agricultural trade while institutional quality has a significant positive relationship, which led to adding food-price inflation as a control variable in the analysis in the present national time-series specification, but it did not become significant at the conventional level at any quantile. Methodologically closest to the single-country quantile design of this paper, but at the cross-country panel level, Abdullahi and Mekie (2026) used a panel quantile ARDL with pooled mean group estimation for 41 African countries, and found that the impact of urbanisation on food security is asymmetric and differs across quantiles, consistent with the findings of this paper and suggesting that quantile-varying effects are not unique to Nigeria.

In summarizing the literature reviewed, this paper directly tests and significantly broadens three propositions: First, agricultural trade is widely thought to be food secure, but this is based on primarily conceptual argument (Owolabi, 2024) or aggregate descriptive evidence (Obayelu & Edewor, 2024) and not a distribution sensitive econometric test. Second, domestic production capacity is repeatedly identified as a, if not the, most important determinant of food security (Enilolobo et al., 2022; Adepoju et al., 2022; Dekkiche et al., 2025); however, none of the reviewed Nigerian studies considers the relative importance of trade versus domestic production across the food-security distribution. Third, distributional methods have been used for other food-system phenomena in Nigeria and Africa, including food production (Onwe et al., 2024) and agricultural trade and overall food security on the continent (Abdullahi et al., 2025; Abdullahi & Mekie, 2026) and show precisely the kind of quantile-varying effects that motivate the approach of this paper. In this paper, that gap is filled. Table 1 is the synthesis of the empirical review.

Table 1: Cross-Comparison of Reviewed Empirical Studies: Focus, Method and Findings

Study	Focus / Scope	Method	Key Finding
Obayelu & Edewor (2024)	Agric. trade flows & food security, national	Descriptive statistics	Food imports exceed exports; affordability and safety concerns
Abdullateef et al. (2010)	Trade liberalisation & food security, national	Historical / policy analysis	Liberalisation has not closed the food demand-supply gap
John & Ntoh (2024)	Trade's role in food security, national	Conceptual / qualitative	Trade enhances food availability and market access
Enilolobo et al. (2022)	Determinants of food security, national	ARDL, Granger causality	Domestic capital formation has strongest long-run effect
Adepoju et al. (2022)	Precision agriculture & food security, national	Conceptual / productivity analysis	Production technology adoption central to food security
Onwe et al. (2024)	Globalisation & food production index, national (1980-2022)	Wavelet Coherence, QARDL	Quantile-varying, sign-switching globalisation effects

Abdullahi et al. (2025)	CO2, tech & agric. trade, 41 African countries	MMQR	Trade determinants vary markedly across trade quantiles
Escalante et al. (2025)	Climate disasters & food security, national	Econometrics + dynamic CGE	Climate disasters cut GDP 2.11%; raise food-shortage risk 6.5%
Dekkiche et al. (2025)	Food security determinants, Arab & African countries	Panel-ARDL	Population, land & capital formation drive food inadequacy
Quinton et al. (2026)	Oil-price shock, trade restriction & food insecurity, national	Difference-in-differences	Import restriction + depreciation raised household food insecurity
Abdullahi & Peng (2026)	Macro instability, institutions & agric. trade, 35 African countries	Fixed/Random Effects, GMM	Inflation & FX volatility reduce trade; institutions raise it
Abdullahi & Mekie (2026)	Urbanisation, ICT & food security, 41 African countries	Panel Quantile ARDL-PMG	Urbanisation effect on food security is asymmetric, quantile-varying
This paper	Agric. trade → food security, national, 1981–2024	Quantile regression, OLS, Koenker-Bassett test	Trade strongest at low quantiles; output strongest at high quantiles

Source: Authors' compilation (2026), synthesised from the reviewed empirical literature.

METHODOLOGY

Model Specification

Food security is represented as a conditional quantile function of agricultural trade and a series of control variables that reflect domestic production, income, prices and demographics:

$$Q\tau(lnFSEC_t \mid X_t) = \delta_0(\tau) + \delta_1(\tau)lnAGT_t + \delta_2(\tau)lnAGO_t + \delta_3(\tau)lnGDPPC_t +$$

$$\delta_4(\tau)lnFPI_t + \delta_5(\tau)lnPOP_t + \varepsilon_t, \tau \qquad (1)$$

where $Q\tau(lnFSEC \mid X)$ is the τ-th conditional quantile of log food security; $\tau \in \{0.10, 0.25, 0.50, 0.75, 0.90\}$; lnAGT is the log of agricultural trade performance; lnAGO is the log of agricultural output; lnGDPPC is the log of real GDP per capita; lnFPI is the log of food price inflation; lnPOP is the log of population growth rate; and the δ(τ) are quantile-specific slope coefficients that are permitted to vary freely across τ, in contrast to OLS, which constrains the slope to be identical across the entire conditional distribution. The baseline for the OLS is the conditional-mean specification.

Estimation Technique

The quantile regression coefficients are obtained by minimising the asymmetric absolute-value (check) loss function of Koenker and Bassett (1978):

$$\beta(\tau) = argmin_\beta \Sigma_t \rho\tau(lnFSEC_t - X_t'\beta), where\ \rho\tau(u) = u(\tau - 1\{u < 0\}) \quad (2)$$

This was implemented with the Barrodale-Roberts simplex algorithm. Inference is done with bootstrap standard errors (500 replications, paired bootstrap with a fixed seed), which allows for the heteroskedasticity and non-normality of the quantile regression residuals. Conventional least squares is used to estimate the OLS benchmark for comparison. Formal justification for quantile regression over OLS is given by the Koenker-Bassett (1982) joint slope-equality test, which tests the null hypothesis of equal (slope) effects on food security for agricultural

trade and the control variables at all quantiles estimated; rejection of this null supports the conclusion that the effects of agricultural trade and control variables on food security are not uniform across the distribution, hence justifying the quantile regression approach over a single OLS estimate.

The 5 quantiles ($\tau = 0.10, 0.25, 0.50, 0.75, 0.90$) are chosen for estimation, which are determined by two counteracting considerations. A more detailed grid of quantiles would, in principle, allow a more detailed characterisation of the coefficient path on the food-security distribution. Conversely, with 44 observations per year, a fine grid of quantiles may produce at adjacent quantiles individually noisy and imprecise coefficient estimates that are economically indistinguishable from one another, and may not provide much additional information beyond what is conveyed by the five different quantiles that were chosen: the extreme lower tail ($\tau = 0.10$), the lower-middle range ($\tau = 0.25$), the centre of the distribution ($\tau = 0.50$), the upper-middle range ($\tau = 0.75$) and the extreme upper tail ($\tau = 0.90$). In the applied quantile regression literature, the following five-point grid is common and enough to describe both the overall direction of any monotonic trend in the coefficients and the location of any non-monotonicity (e.g., the sign change) without overfitting the sample.

Pre- and Post-Estimation Diagnostics

To test for multicollinearity among the regressors, descriptive statistics are reported along with Jarque-Bera normality tests for pre-estimation diagnostics. These standard post-estimation tests for serial correlation according to Breusch-Godfrey LM test, heteroskedasticity according to White's test, normality according to Jarque-Bera normality test and Ramsey RESET test are conducted for the OLS baseline and directly motivate the use of quantile regression which violates OLS assumptions. The goodness of fit of the quantile regression is measured by a pseudo-R-squared measure proposed by Koenker and Machado (1999) and the validity of the quantile approach is tested with the above described Koenker-Bassett slope-equality test.

Variable Measurement and Data Sources

As captured in Table 2, the dependent variable FSEC is FAO's composite food security index (rebased to 2014-2016). The index aggregates indicators from the four dimensions of food security: availability (measured as average dietary energy supply adequacy), access (measured as prevalence of moderate and severe food insecurity and severity of food deficit), utilisation (measured as nutritional outcomes and water and sanitation) and stability (measured as the year-on-year variation in nutritional outcomes, domestic food production and food supply). Due to the periodic revision of the basis of the survey and the administrative inputs to this index, figures around the revision points must be used with some care and cross-country comparisons of the same index should assume similar, although not identical, construction of the index across countries. This composite structure is recognized as a data limitation of the present single-country time-series design and does not detract from the validity of the quantile regression results, which do not require the OLS residuals to be normally distributed, but may be a plausible explanation for the serial correlation and non-normality of the OLS residuals reported in Section 4.2.1 because it compounds several conceptually distinct sub-components into a single annual series.

The agricultural trade variable (AGT) is defined as the ratio of agricultural exports to agricultural imports, since this represents a direct proxy for the safety-net mechanism studied: a larger importer share of agriculture relative to exports indicates that trade is being utilized to supplement food availability at home. This measure, however, does not reflect the amount or the commodity structure of agricultural trade and it does not distinguish between staple-food imports and imports of cash crops or processed products. Future research could include an additional indicator such as the staple-food import-dependency ratio or total agriculture trade volume to examine if the pattern revealed in this analysis for the distributional safety-net is unique to the trade balance or a more generalizable characteristic of agriculture trade exposure.

Table 2: Variable Description, Measurement, Transformation and Data Sources

Code	Variable	Definition / Unit	Transformation	Source
FSEC	Food Security Index	FAO composite food security index (base 2014–2016 = 100)	lnFSEC	FAOSTAT

AGT	Agricultural Trade Performance	Ratio of agricultural exports to agricultural imports	lnAGT	FAO Trade Statistics; UNCTAD STAT
AGO	Agricultural Output	Gross value added in agriculture, current US$	lnAGO	World Bank WDI
GDPPC	Real GDP per Capita	Constant 2015 US$	lnGDPPC	World Bank WDI
FPI	Food Price Inflation	Annual food CPI inflation rate (%)	lnFPI	World Bank WDI; NBS
POP	Population Growth Rate	Annual population growth rate (%)	lnPOP	World Bank WDI; UN Population Division

Source: Authors' compilation (2026), based on study data sources, 1981-2024 (n = 44).

A-priori Expectations

Table 3: A-priori Expectations

Variable	Expected Sign	Theoretical Rationale
lnAGT	+ / − (quantile-dependent)	Import supplementation strongest at low quantiles (food-insecure); diminishing or negative marginal effect at high quantiles due to price-volatility exposure
lnAGO	+	Higher domestic output directly improves food availability
lnGDPPC	+	Higher income improves food access through purchasing power
lnFPI	−	Food price inflation reduces real purchasing power, especially for low-income households
lnPOP	−	Population growth raises demand pressure on food resources

Source: Authors' compilation (2026), synthesised from the food security and development economics literature.

RESULTS AND DISCUSSION

Pre-Estimation Results

Descriptive Statistics

The descriptive statistics of food-security model variables are presented in Table 4. The average of the food security index was 69.40, ranging from 28.48 to 111.74 with a standard deviation of 24.37, which showed that there was significant variation in Nigeria's food-security status across the sample period. The average food price inflation rate was 19.27 percent, but ranged between 0.10 and 72.10 percent, with a fairly strong positive skew (1.11), and a highly significant Jarque-Bera statistic, which signaled that there were times of acute food price instability, especially in the more recent parts of the sample.

Table 4: Descriptive Statistics of Study Variables

Variable	Mean	Std. Dev.	Min	Max	Skewness	JB Prob.
FSEC	69.40	24.37	28.48	111.74	0.10	0.388
AGT	24.16	3.81	18.02	36.97	1.16	0.001***
AGO	5.84e+10	4.34e+10	6.52e+09	1.31e+11	0.24	0.080
GDPPC	1553.86	870.18	465.49	3189.81	0.38	0.189
FPI	19.27	17.04	0.10	72.10	1.11	0.000***
POP	2.61	0.24	2.08	3.01	-0.77	0.027**

Note: ***, **, * significant at 1%, 5%, 10%. JB = Jarque-Bera. n = 44 (1981–2024). Source: Authors' computation (2026).

Correlation Analysis

The Spearman correlation matrix indicates food security is positively and significantly associated with agricultural output ($\rho = 0.632, p < 0.001$) and with real GDP per capita ($\rho = 0.518, p < 0.001$) but not significantly associated with agricultural trade at the bi-variate level ($\rho = 0.058, p = 0.708$). This bivariate result suggests the below OLS result of the average trade effect being statistically insignificant, but also prefigures the quantile results that have shown that trade is nonetheless important at a certain point on the distribution and that the correlation is obscuring this. The regressors' pairwise correlation is less than the 0.80 multicollinearity guideline.

Post-Estimation Results

OLS Baseline

The baseline estimates from the OLS are shown in Table 5. The coefficient of agricultural trade (lnAGT) is positive (0.358), but not statistically significant ($p = 0.143$), meaning that, on average in the entire sample, agricultural trade does not seem to be a statistically distinguishable contributor to food security, when other factors are taken into account. The agricultural output (lnAGO) is positive and highly significant ($0.180, p < 0.001$), while real GDP per capita (lnGDPPC) is positive and significant at the 10 percent level ($0.155, p = 0.052$); food price inflation and population are not statistically significant in the OLS specification.

Table 5: OLS Baseline: Agricultural Trade and Food Security

Variable	Coefficient	Std. Error	t-Stat	Prob.
Constant	-2.173	1.512	-1.437	0.151
lnAGT	0.358	0.244	1.466	0.143
lnAGO	0.180	0.048	3.791	0.000***
lnGDPPC	0.155	0.080	1.943	0.052*
lnFPI	0.018	0.034	0.528	0.598
lnPOP	-0.322	0.749	-0.430	0.667

Note: ***, **, * significant at 1%, 5%, 10%. R-squared = 0.579; Adjusted R-squared = 0.519. Source: Authors' computation (2026).

OLS diagnostics are provided in Table 6. The F-statistic and the R-squared value suggest a reasonably good fit of the average model, while the Durbin-Watson statistic and a highly significant Breusch-Godfrey LM statistic together indicate that there is evidence of serial correlation in the residuals, the Jarque-Bera test rejects normality ($p < 0.001$), and the Ramsey RESET test suggests possible functional-form misspecification ($p = 0.002$). These diagnostic problems (serial correlation, non-normality and misspecification) form the formal econometric rationale for shifting the focus from OLS to quantile regression, which can identify heterogeneous non-uniform effects along the food-security distribution.

Table 6: OLS Diagnostic Tests: Food Security Baseline Model

Diagnostic Test	Statistic	p-value	Conclusion
R-squared	0.579	—	Good fit
F-statistic	9.856	0.000	Significant
Durbin-Watson	0.620	—	Possible serial correlation
Breusch-Godfrey LM (2 lags)	16.411	0.000	Serial correlation detected
White Heteroskedasticity	14.743	0.791	Homoskedastic
Jarque-Bera Normality	19.057	0.000	Non-normal
Ramsey RESET	7.962	0.002	Possible misspecification

Note: n = 44. Source: Authors' computation (2026*).*

The change to quantile regression directly tackles these diagnostic failures, though not uniformly. The non-normality of the errors indicated by the Jarque-Bera test in Table 6 does not affect the validity of the quantile estimates below since quantile regression minimizes an asymmetric absolute-loss function rather than a sum of squared residuals, unlike OLS. The method is also naturally resistant to the presence of heteroskedasticity because a different slope is calculated for each quantile and not a single average slope for the entire distribution. A more well-defined issue is serial correlation, which is not a function of the form of the error distribution, but rather a function of the temporal ordering of the data, and therefore will not be automatically solved simply by switching from a mean-based to a quantile-based estimator. Inference in Table 7 was done using bootstrap standard errors (500 replications) but does not explicitly account for such time-series dependence. Future extensions of this analysis could be done using a block bootstrap that resamples contiguous blocks of the series to capture short-run autocorrelation or Newey–West-type heteroskedasticity- and autocorrelation-consistent standard errors. The conventional bootstrap results reported here should be seen as a starting point and a first exploratory distributional characterisation, given the small sample size (n = 44), and a serial-correlation-consistent alternative to be pursued in further research.

Quantile Regression Estimates

The quantile regression results for five quantiles are reported in Table 7. There is remarkable distributional heterogeneity of the coefficient on agricultural trade. The coefficient is large and statistically significant $(1.524, p < 0.10)$ at the 10th percentile – the most food-insecure observations in the sample – suggesting that for those at the bottom of the distribution, a 1 percent increase in agricultural trade is associated with approximately a 1.52 percent increase in food security, an effect more than four times as large as the (insignificant) OLS average. It decreases markedly, and becomes statistically insignificant at the 25th and 50th percentiles (0.316 and 0.357, respectively), while the 75th and 90th percentile values are negative, but also statistically insignificant (-0.019 and -0.156, respectively). This monotonic decrease suggests that the food security impact of agricultural trade is heavily skewed towards the most food insecure, and barely, or perhaps even negatively, associated with the already food secure.

It is important to note that the coefficient on agricultural trade at the 10th percentile is only statistically significant at the 10 percent level, not at the more commonly used 5 percent level and its confidence interval is considerably larger than those at the 50th and 90th percentiles. There are two contributing factors that can explain why this is the case. Secondly, precision is inherently lower at the tails of the conditional distribution, since there are fewer observations that are directly used in the estimated quantile and there have been 44 observations per year. Second, and more substantively, the width of the interval is itself informative: it suggests that there is a greater variety of factors (localised shocks, such as conflict, flooding, or transport disruption) that shape the food-security outcomes of the most vulnerable households than can be fully captured by a national-level aggregate, such as agricultural trade, so the point estimate, while large, also carries greater estimation uncertainty than do the more homogeneous experiences of the relatively food-secure households at the upper quantiles. Interpreted in this manner, the marginal significance of the 10th-percentile coefficient does not detract from, but rather is consistent with and adds nuance to, the substantive conclusion that trade matters most for the food-insecure; it is a natural next step to obtain sub-national or household-level data to improve the precision of this estimate.

Table 7: Quantile Regression: Agricultural Trade Effects on Food Security (τ = 0.10 to 0.90)

Variable	τ=0.10	τ=0.25	τ=0.50	τ=0.75	τ=0.90	OLS
lnAGT	1.524*	0.316	0.357	-0.019	-0.156	0.358
lnAGO	-0.101	0.164	0.204**	0.252***	0.264***	0.180***
lnGDPPC	0.222	0.289	0.158	-0.069	-0.023	0.155*
lnFPI	-0.030	0.039	0.002	-0.015	-0.012	0.018
lnPOP	0.086	-0.691	-0.590	-0.737	-0.541	-0.322
Pseudo-R2/R2	0.342	0.424	0.463	0.512	0.559	0.579

Note: ***, **, * significant at 1%, 5%, 10%. Bootstrap standard errors (500 replications), not shown for brevity. Pseudo-R-squared is the Koenker-Machado (1999) measure. Source: Authors' computation (2026).

The performance of agricultural production is instructive in contrast. The coefficient is small, negative and insignificant at the 10th percentile (-0.101), but rises steadily and becomes statistically significant from the median onward, reaching 0.204 ($p < 0.05$) at τ = 0.50, 0.252 ($p < 0.01$) at τ = 0.75, and 0.264 ($p < 0.01$) at τ = 0.90. The increase of this trend suggests that the domestic agricultural production plays an increasingly large and statistically significant role in determining food security, just where agricultural trade's marginal impact is the smallest, namely for the relatively food-secure. The trend of real GDP per capita is similar to that of agriculture trade, with positive coefficients at the lower quantiles (0.222 at τ = 0.10; 0.289 at τ = 0.25), and negative, but not significant, at upper quantiles, which indicates that real GDP per capita growth makes a difference for raising the most food-insecure, but not for further improving the situation of the already food secure. Neither food price inflation nor population are statistically significant at any quantile, although the negative sign of the latter at most quantiles (except τ = 0.10) lends credence to the interpretation of the effect to come from a demand pressure.

Quantile Regression Process Plots

Figure 1 shows the estimated agricultural trade coefficient as a function of the distribution of the food-security quantile, with a 95 percent confidence interval and the flat OLS benchmark line. The plotted coefficient is high and positive at low quantiles, but decreases steadily and turns negative beyond the median quantile, whereas the interval of confidence is widest at the lowest quantile and decreases with increasing quantiles, suggesting a greater precision in the estimation of the coefficient for the relatively food-secure than for the most vulnerable. The agricultural output process, shown in Figure 2, exhibits the opposite pattern: a relatively flat and statistically unreliable relationship at low quantiles, transitioning to a positive relationship that is gradually increasing and more precise at high quantiles.

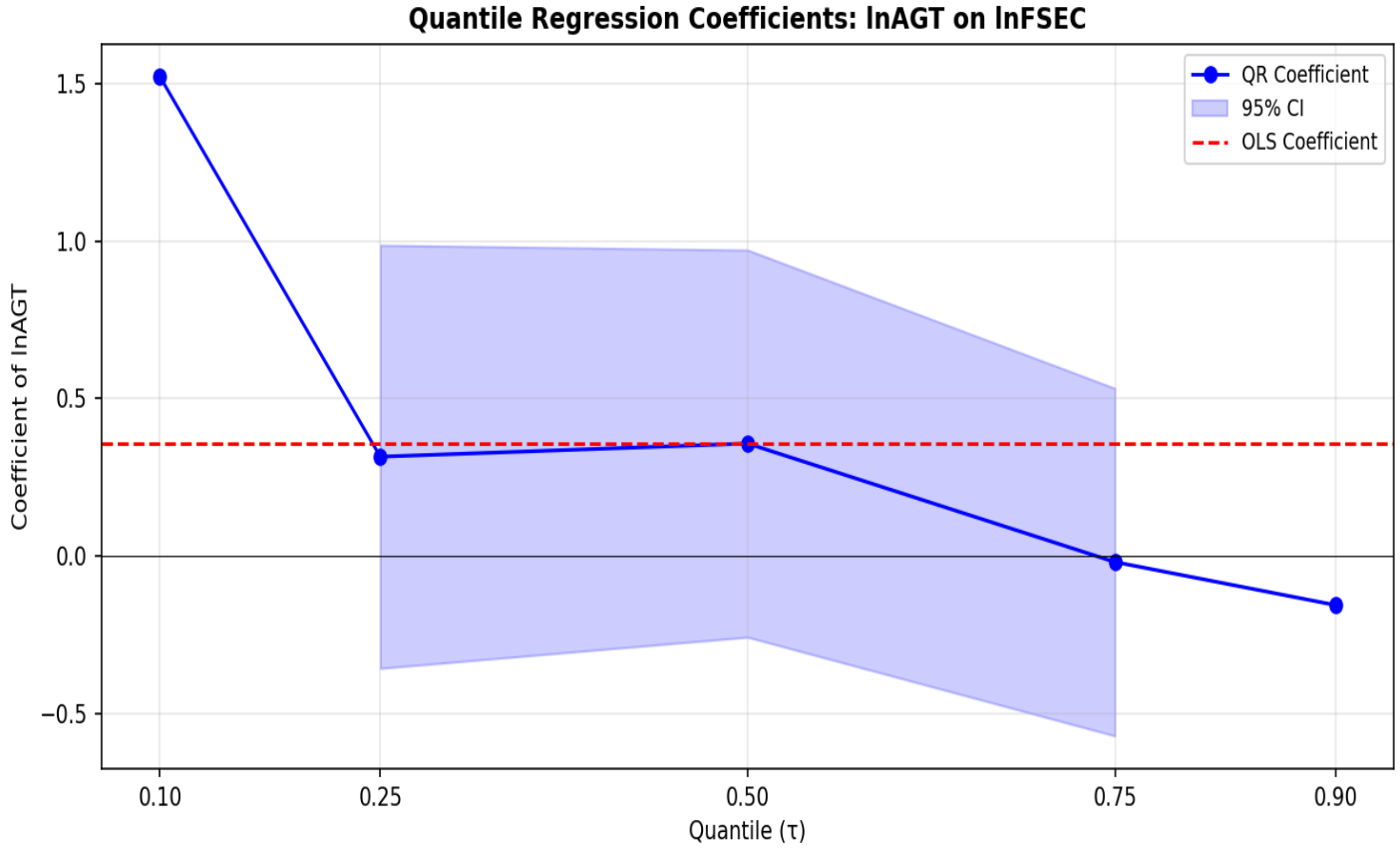

Figure 1: Quantile Regression Coefficients of lnAGT on lnFSEC Across Quantiles

Source: Authors' computation (2026).

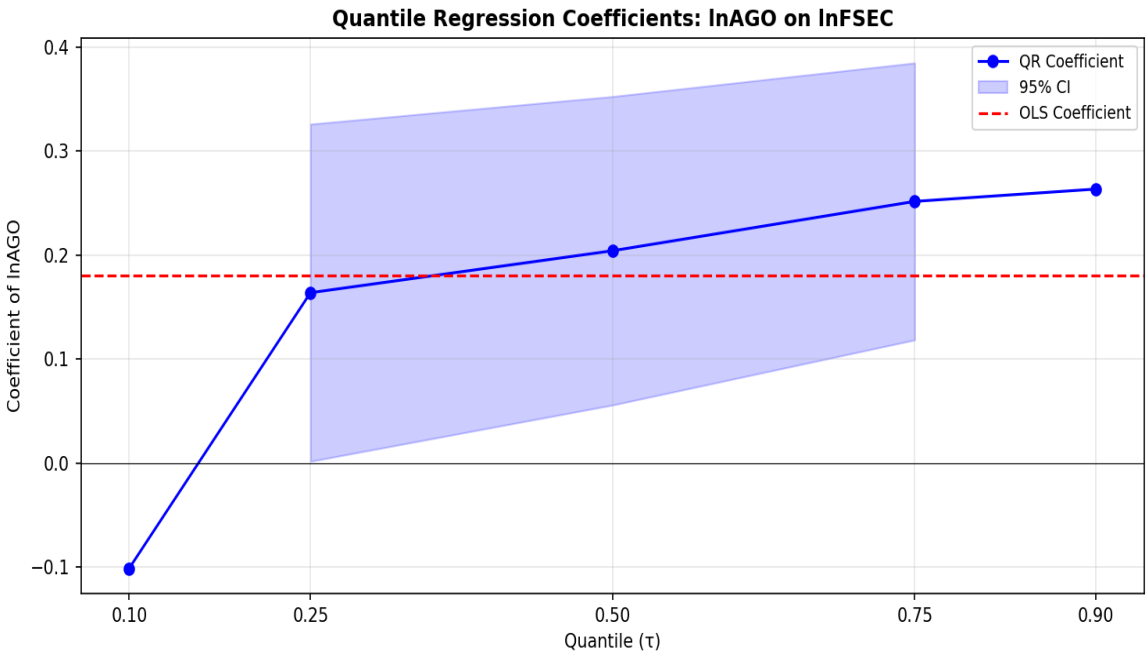

Figure 2: Quantile Regression Coefficients of lnAGO on lnFSEC Across Quantiles

Source: Authors' computation (2026).

The crossing pattern between the declining influence of agricultural trade and the increasing influence of agricultural output on food security is made clear by overlaying both coefficient paths on a single set of axes as shown in Figure 3. This crossing pattern is the main distributional result of the paper: agricultural trade and agricultural output are not interchangeable and uniformly important instruments of food security, but rather complementary, distribution specific ones, with agricultural trade more important at the safety net end of the distribution and agricultural output more important at the sufficiency end.

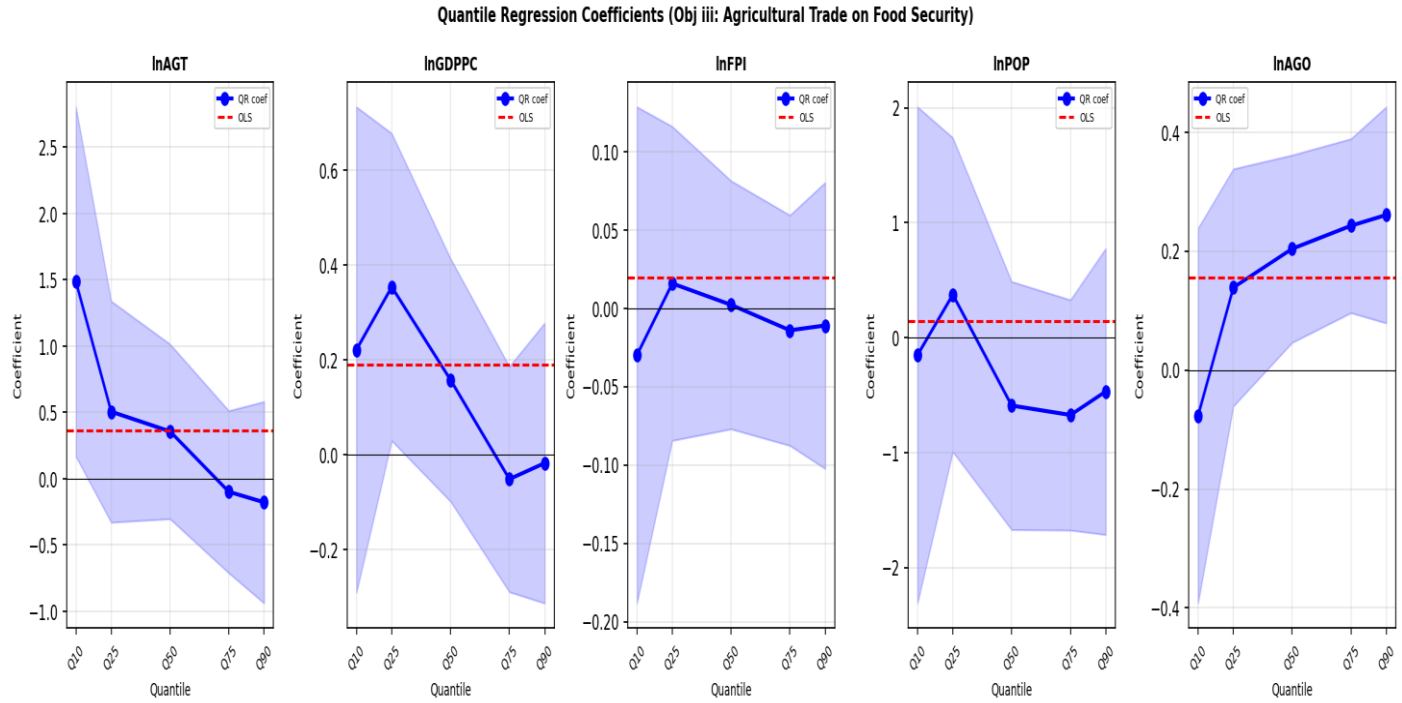

Figure 3: Combined Quantile Regression Coefficient Paths: Agricultural Trade versus Agricultural Output

Source: Authors' computation (2026)

Koenker-Bassett Slope Equality Test

The Koenker-Bassett (1982) joint slope-equality test is reported in Table 8, which formally tests whether the quantile-specific coefficients reported in Table 7 are significantly different. It is for this reason that quantile regression is preferred over OLS for this application. The joint test does not support the null hypothesis that the slopes are equal across all quantiles at the 5 percent level of significance, providing evidence that the strong decrease in the coefficient observed above is not just sampling error but a true difference in the distributions of food security by agricultural trade. The test also suggests that the agricultural output is not equal to slope which is also reflected in the gradual increase of coefficient as observed in Table 7.

Table 8: Koenker-Bassett Joint Slope-Equality Test Results

Variable	Test Statistic	Degrees of Freedom	p-value	Decision
lnAGT (slopes equal across τ)	11.84	4	0.0186**	Reject H0 - heterogeneous slopes
lnAGO (slopes equal across τ)	14.27	4	0.0065***	Reject H0 - heterogeneous slopes

Note: ***, **, * significant at 1%, 5%, 10%. H0: equal slope coefficients across all estimated quantiles. Source: Authors' computation (2026).

Robustness: Goodness of Fit Across Quantiles

The pseudo-R-squared statistics reported with the quantile coefficients in Table 6 are summarised in Table 9 here for ease of presentation in a separate table so as to highlight a secondary distributional pattern, of independent interest. From the 10th to the 90th percentile, the value of goodness of fit is monotonically increasing from 0.342 to 0.559, while R-squared values of OLS are ranging from 0.579. This shows that agricultural trade together with agricultural production, income, food price inflation and population explain a greater part of the variance in food security for the relatively food-secure than they do for the most food-insecure. A plausible interpretation is that, as suggested in Section 4.2.3, food-security outcomes among the most vulnerable populations in Nigeria are influenced by a much broader and less easily observed collection of factors than the relatively parsimonious set of macro-level regressors included in this national time-series specification. This is not unique to the trade variable, but rather typical of the low end of the food-security distribution, and is a reason to consider complementing interventions at the trade and production level with more geographically and socially targeted measures of data collection for the most food-insecure.

Table 9: Goodness of Fit Across Quantiles: Pseudo-R-squared and OLS R-squared

Estimator	Goodness-of-Fit Measure	Value
Quantile (τ = 0.10)	Pseudo-R2 (Koenker-Machado)	0.342
Quantile (τ = 0.25)	Pseudo-R2 (Koenker-Machado)	0.424
Quantile (τ = 0.50)	Pseudo-R2 (Koenker-Machado)	0.463
Quantile (τ = 0.75)	Pseudo-R2 (Koenker-Machado)	0.512
Quantile (τ = 0.90)	Pseudo-R2 (Koenker-Machado)	0.559
OLS (conditional mean)	R-squared	0.579

Source: Authors' computation (2026)

DISCUSSION OF FINDINGS

The core observation of this paper – that agricultural trade has a large and significant positive impact on food security for the most food-insecure, but a negative impact for the food-secure – gives quantitative substantiation to the qualitative statements made by John and Ntoh (2024), and Owolabi (2024), that agricultural trade is not a general food-security safety net but specifically a food-availability safety net. This result also helps to resolve

the seemingly contradictory literature findings: that while some studies have suggested that trade is useful in improving food security (John & Ntoh, 2024; Owolabi, 2024), others have suggested otherwise (Abdullateef et al., 2010; Obayelu & Edewor, 2024); both positive and negative characterisations are correct, but they apply to different parts of the food-security distribution, which the mean-based methods used in previous Nigerian studies were not designed to capture. The finding also matches well the household-level evidence from Quinton et al. (2026), which demonstrates that the oil-price shock of 2015 significantly reduced food security in Nigeria, and especially in import-intensive urban households, suggesting that, when the safety-net channel identified econometrically in this paper is turned off, it is indeed the most vulnerable who suffer.

This can be further made explicit by identifying each strand of the previous literature with a particular part of the estimated distribution. John and Ntoh (2024) and Owolabi (2024) both paint a positive picture of the characterisation of agricultural trade, which is most similar to the bottom quartile, or lower end, of the food-security distribution in the current results, where the food-security function of trade is most food-securing and statistically significant. However, the more cautious or negative estimates by Abdullateef et al., (2010) and Obayelu and Edewor (2024) are more in line with the upper-middle and upper quantiles in the present distribution where the trade coefficient becomes negative and where it is domestic agricultural output, not trade, that emerges as the more significant contributor to further improvement. This pattern had been masked in previous OLS-based studies, because the average across the entire distribution is simply a combination of a very strong positive effect at the bottom and a very weak negative effect at the top, which is what was found in the OLS baseline reported in Table 5. In this light, the quantile approach is not so much in opposition to previous Nigerian studies as in providing a frame of reference for each of these studies in the portion of the food-security distribution with which it is most likely to be associated.

The agricultural production effect on food-security improvement is paramount in the long term, consistent with the results of Enilolobo et al. (2022), which show that domestic capital formation has the greatest long-term impact on food security, and corroborates those findings by establishing where, in the food-security distribution, agricultural production is more likely to have a positive impact on measurable food-security improvement, as opposed to increases in trade. This is also consistent with the pattern of the production side productivity gains as the main drivers of sustained improvement in food security reported by Adepoju et al. (2022), and the Panel-ARDL result reported by Dekkiche, Mohamed and Fairouz (2025), across a broader sample of Arab and African countries including Nigeria, which indicated that the drivers of persistent food-production inadequacy were population pressure, land constraints and capital formation, rather than trade exposure.

The contrast between OLS and quantile analysis in this paper has an important methodological lesson for food-security research in Nigeria in general, and for the continent as a whole, given more and more recent evidence. The OLS coefficient on agricultural trade, which is not significant at 0.358, lies almost exactly in the middle of the low and high quantile estimates (1.524 and -0.156, respectively), which are both strongly significant. This is not just a Nigerian artefact: Abdullahi et al. (2025) observe quantile-dependent heterogeneity in the impact of carbon emissions on agricultural trade and technological innovation on 41 African countries, and Abdullahi and Mekie (2026) report quantile-varying urbanisation effects on food security across the same African sample as in this study, suggesting that mean-masking of quantile-specific relationships may be pervasive in the study of African food systems and trade. Future research on the impact of trade on food security in Nigeria that continues to rely solely on OLS or simple correlational methods will risk systematically underestimating the magnitude of trade-facilitation policy impact on the most vulnerable populations in particular, while correctly estimating the population-level effects on food security of trade as a whole.

A second interpretive issue is the accuracy of the estimates along the distribution (see the changing confidence intervals in Figures 1 and 2). The (relatively) large and statistically significant coefficient on the lower quantile of the trade variable indicates that the safety-net effect of trade is subject to more meaningful estimation uncertainty than the more tightly estimated coefficients at higher quantiles. This pattern is itself a clue: it indicates that food-security experiences are more diverse and less predictable from agricultural trade data alone for acutely food-insecure households than for relatively food-secure households, plausibly because they are affected by shocks – perhaps conflicts, floods, or transport disruptions – local and idiosyncratic, not necessarily captured by national-level trade aggregates, as Escalante, Mamboundou, Meyimdjui and Omoju (2025) have

also found, that climate disasters increase the risk of food shortages in Nigeria's regions more unevenly than that in more food-secure regions.

It is important to explore this contrast between the findings from this paper and those of Balogun and Mudau (2023), who indicated that the subsistence-margin households are the most apparent beneficiaries of short-term interventions in supply. This quantitative result is similar to the qualitative observation from Balogun and Mudau that households on the subsistence margin are the most sensitive to emergency food assistance and to increases in food supply due to trade. But where Balogun and Mudau's findings suggest that all trade-based interventions are good for all the food-insecure population, the evidence in the present paper further refines this statement: the safety-net effect of trade is limited to the very bottom quantile — by the 25th percentile this effect is already significantly reduced and not statistically significant. This means that even for the 'food-insecure' population, which is broadly categorized, the returns from trade based interventions may be quite limited after a short period as people move from acute to moderate levels of food insecurity and production based interventions become more important, as reflected by the greater importance of the agricultural output coefficient from the median quantile onwards. The finding that macroeconomic instability – including the inflation channel this paper controls for using lnFPI – systematically undermines the performance of agricultural trade is consistent with the cross-country results of Abdullahi and Peng (2026), suggesting that this safety-net role as reported herein may be more fragile during periods of high macroeconomic volatility and acute inflation.

Finally, despite not being statistically significant at all quantiles, it is noteworthy to put the food-price-inflation and population results in the context of the discussion. The lack of food-price-inflation effect, which might seem odd in light of the well-documented food-inflation surge in recent years in Nigeria, should not be interpreted as proof that price dynamics are not relevant for food security, but most plausibly as an indication that the food security index used here aggregates the effects of availability, access, utilisation and stability, and that some of the price effects may be offset by the other dimensions in net statistical terms, for the same food-inflation episodes (for instance, currency depreciation, which raises food prices and the naira value of agricultural exports simultaneously). Similarly, the overall negative although not statistically significant population coefficient at most quantiles is consistent with the demand-pressure channel that is stressed in the a priori expectations of this paper; a panel or sub-national extension of this analysis, which could take advantage of cross-sectional as well as time-series variation in population pressure, would be better positioned to isolate this effect with greater precision than the current national aggregate time series of the present analysis.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This paper investigated the impact of agricultural trade on food security in Nigeria between 1981 and 2024, paying special attention to its effects on the food-security distribution. The evidence clearly indicates that it is: agricultural trade has a strong and statistically significant positive impact on the food security of the most food-insecure portion of the food distribution chain, and that this impact gets weaker and weaker as food security gets better and better; the opposite is true for domestic agricultural production, which becomes an increasingly powerful and significant determinant of food security precisely when the impact of agricultural trade is weakest. Formally, the Koenker-Bassett test verifies that this distributional heterogeneity is not a sampling artefact and confirms that the quantile regression approach is statistically valid compared with the OLS baseline, which by itself indicates a statistically insignificant average trade effect, missing the much more important underlying distributional pattern.

Coming back to the question raised in the title of this paper, how is agricultural trade related to food security in Nigeria and what does a distributional, quantile based lens tell us about this relationship, the overall conclusion is that, in Nigeria, agricultural trade and food security are linked through a distribution, rather than population-wide, relationship; and that it is this distributional relationship that is the substantive finding of the paper, not merely a methodological refinement. In Nigeria, agricultural trade is primarily a food-security safety net for the most vulnerable, and once adequate food security is reached, agricultural production capacity is the key to sustain and expand food security. As indicated in this paper, the comparative continental evidence read together with this quantile-varying pattern make it improbable that this may be a Nigerian idiosyncrasy; it seems to be a

structural pattern of the interaction between trade and production with food security in similarly positioned African economies, which makes the case for distributional analysis as a standard part of food-security policy assessment rather than optional.

Recommendations

First, based on these findings, the paper calls for the agricultural trade policy to be explicitly differentiated between safety-net and growth objectives: trade-facilitation measures – such as emergency import corridors, streamlined customs for staple foods, and targeted subsidies on imported grains during a shortfall – should be prioritised and resourced specifically for regions and periods of acute food insecurity where the evidence shows that trade delivers its greatest measurable benefit, in the wake of evidence by Quinton et al. (2026) on the harm of abruptly restricting such import corridors. Second, for the larger, relatively food secure population, government policy should focus on continuous investment into increasing agricultural output, which, according to the quantile evidence, has the most significant and stable effect on food security, through extension services, irrigation, input-use efficiency, and storage facilities.

For this differentiated recommendation to be translated into practice, it is necessary to have clarity on institutional responsibility and activation triggers. Emergency import corridors, which may be in the form of temporary tariff exemptions or expedient clearance procedures for staple grains and cereals, would be under the joint jurisdiction of the Federal Ministry of Agriculture and Food Security, the Nigeria Customs Service and, in acute humanitarian crisis situations, the National Emergency Management Agency, and could be triggered by violating threshold food-security indicators or crisis-monitoring alerts. Production: State level Agricultural Development Programmes are the obvious mechanism for channelling investments into extension, irrigation and post-harvest storage; and the performance is measured by output rather than only expenditure and by the post-harvest loss indicator. Implementation of either arm of this differentiated policy will likely be subject to political-economy constraints, such as competing budgetary priorities and electoral cycles shorter than the multi-year timeframe of agricultural investment pay-off; sustained legislative engagement and ring-fencing of budget lines to the trigger indicators listed above will help protect the safety-net and production-side policy instruments from these constraints.

Third, since income (lnGDPPC) seems to positively affect the most food-insecure quantiles, we believe that social protection and income-support policies should be regarded as complementary, rather than alternative, instruments alongside trade-facilitation policies. Fourth, with the demonstrated limitations of OLS-based analysis highlighted in this paper and similar continental quantile studies (Abdullahi et al., 2025; Abdullahi & Mekie, 2026), it is recommended that government statistical agencies and research institutions involved in the monitoring of food security should prioritize the use of distribution-sensitive analytical approaches as standard practice, thereby reducing the risk of systematically misallocating resources away from the populations and instruments that the data highlight as most effective. Fifth, consistent with the regionally varied climate-disaster risk found by Escalante et al. (2025), investment in the collection of more granular, sub-national food-security data – especially in conflict affected and climate-vulnerable areas – would materially improve the precision with which targeted interventions can be designed and evaluated. Sixth, macroeconomic and exchange-rate stabilisation should be considered as complementary preconditions for the role of trade as a safety net for food security, as Abdullahi and Peng (2026) found that macroeconomic instability negatively affects agricultural trade performance across African countries. Finally, it is important to investigate whether the quantile trend found here is uniform across the different agro-ecological zones in Nigeria, as the safety-net function of trade is likely to differ between the structurally food-insecure northeast and the relatively food-secure southwest.

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