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MACRO-ECONOMIC VARIABLES AND FOOD SECURITY IN WEST AFRICA: AN INVESTIGATION OF SELECTED ECONOMIES

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Abstract

This study examined the nexus between key macroeconomic determinants, specifically lending interest rate, inflation, exchange rate, agricultural employment, and public agricultural expenditure, and food security in six West African economies (Benin, Burkina Faso, Cabo Verde, Gambia, Ghana, and Nigeria) from 2004 to 2023. Employing an ex-post facto research design, the study utilised panel data from FAOSTAT, the World Development Indicators, and the Bank of Ghana, with gross agricultural production proxying food security. A Panel Autoregressive Distributed Lag model, estimated using the Pooled Mean Group estimator, was applied. Results indicate that inflation significantly impedes food security in the long run, while public agricultural expenditure and agricultural employment significantly improve it. The study advocates for inflation control, targeted agricultural spending, and enhanced credit accessibility.

Keywords*:* Food Security, Inflation, Agricultural Employment, Gross Agricultural Output, West Africa.

JEL Code: Q18

1. Introduction

Agriculture is the backbone of livelihoods across Africa, yet untapped agricultural potential has sustained poverty and deepened food insecurity. The African Development Bank (AfDB, 2023) reports that more than 200 million Africans were undernourished in 2015 and projects that this figure could reach 320 million by 2025. The Food and Agriculture Organization view food security as more than the availability of food, since it also covers accessibility, affordability, and nutritional adequacy (FAO, 2015, as cited in Kalkuhl et al., 2016). Food security is therefore a problem of economic access as much as of production.

This is especially evident in West Africa, where agriculture is a major employer and a pillar of economic stability (Osabohien et al., 2021; Sesay et al., 2021; Wudil et al., 2022), contributing over 35% of Gross Domestic Product in many countries (Obiora et al., 2023). Despite this importance, food insecurity persists, aggravated by unstable markets, volatile inflation, agricultural unemployment, and insufficient investment (Obiora et al., 2023). Chronic hunger and malnutrition weaken public health and long-term economic prospects, and the World Food Programme (WFP, 2024) reports that about 16.7 million children across the continent suffer acute hunger and malnutrition. The burden is also uneven. Among Benin, Burkina Faso, Cabo Verde, Gambia, Ghana, and Nigeria, Nigeria records by far the largest number of severely food-insecure people over the past decade, followed by Ghana and Benin. This disparity

suggests that national macroeconomic conditions, rather than agricultural endowment alone, shape food security outcomes.

Several macroeconomic channels are plausible. Inflation erodes household purchasing power and raises the cost of inputs such as seeds and fertilizer, depressing productivity and investment, with the heaviest effects on low-income rural households that depend on volatile farm output (Obiora et al., 2023; Osabohien et al., 2021). Exchange rate dynamics operate similarly: because production relies on imported inputs, depreciation raises production costs and output prices, whereas a stable rate encourages production (Liefert & Persaud, 2009). The 2022 Russia–Ukraine conflict illustrates the external dimension, as disrupted wheat supplies raised prices in import-dependent economies such as Ghana and Nigeria, reducing both food accessibility and dietary quality. Financial and labor conditions matter as well. Agricultural lending can ease the financial strain of production, processing, and marketing (Ogechi et al., 2016), but high lending rates place credit beyond the reach of the average farmer. Agricultural employment, particularly among young people, has declined because of low profitability and weak support infrastructure, shrinking the region's capacity to produce food (Obiora et al., 2023). Government expenditure on subsidies, price support, and rural infrastructure can offset market failures in the sector, although its scale depends on national fiscal capacity (Newttie Jambo, 2017).

Despite the importance of these variables, existing studies have largely examined lending interest rates, inflation, exchange rates, agricultural employment, and government expenditure in isolation. Little attention has been paid to how they jointly shape food security, which limits the policy value of existing findings. Because these factors operate simultaneously and reinforce one another, analyzing them separately risks overstating or understating their individual effects and obscuring the most effective levers for reform. This study addresses the gaps by examining the combined influence of lending interest rate, inflation, exchange rate, agricultural employment, and government expenditure on food security in six West African economies (Benin, Burkina Faso, Cabo Verde, Gambia, Ghana, and Nigeria) over the period 2004–2023, using gross agricultural production as a proxy for food security. This study provides an integrated empirical assessment of the macroeconomic determinants of food security in West Africa, in contrast to the single-variable approach that dominates the literature. It identifies the variables with the greatest influence, thereby indicating where policymakers should concentrate their efforts. It also supports United Nations Sustainable Development Goals 2 (Zero Hunger) and 8 (Decent Work and Economic Growth) by clarifying how stable macroeconomic conditions can sustain food access and economic growth.

2. Literature Review

2.1 Concepts

The lending interest rate is the cost of borrowing from financial institutions, and high rates push smallholders toward costlier informal credit and Inflation is a sustained rise in the general price level, erodes purchasing power and raises input costs, weakening food affordability and farm reinvestment (Rahman et al., 2014; Aye & Odhiambo, 2021; Obiora & George, 2023). Agricultural employment is the share of the workforce engaged in farming-related activity and responds to profitability and food price inflation (Li & Hualou, 2019; Habanabakize & Zerihun, 2024). Food security involves access to sufficient, safe, and nutritious food (Kamiljon, 2011).

2.2 Theory

Two theories anchor this study. Cobweb Theory, associated with Goodwin and Hotelling, explains how production lags and expectations based on past prices generate cyclical output and price fluctuations, which in West Africa are amplified by seasonal cycles, poor market information, and external shocks; it informs the treatment of inflation and exchange rate volatility. The Lewis Dual-Sector Model (Lewis, 1954) describes the transfer of surplus labour from traditional agriculture to modern industry, and its West African adaptation stresses retaining labour and raising farm productivity, linking agricultural employment and government expenditure to food security.

2.3 **Empirical Review**

Recent evidence on the macroeconomic drivers of food security in Africa shows that effects differ by variable and by dimension of food security. Using panel data for 28 sub-Saharan African countries over 2012–2022, Noah et al. (2024) estimated panel-corrected standard error and system GMM models separately for the demand and supply sides of food security. Food price inflation was negatively related to every dimension but significantly so only for demand and affordability, while agricultural employment improved demand-side outcomes but had no significant effect on food supply and availability. Trade openness raised affordability yet weakened the supply side. These results suggest that a single aggregate proxy can mask how macroeconomic variables actually operate.

West African evidence on public spending is consistent with this nuance. Kamenya (2023) applied a fixed effects generalized least squares model to panel data for nine ECOWAS countries, including Benin, Burkina Faso, Gambia, Ghana, and Nigeria, and found that public agricultural expenditure improves food security, although the impact lags depending on the type of expenditure, which led the author to recommend disaggregated expenditure data. In Nigeria, Raifu and Oladejo (2024) used an autoregressive distributed lag framework over 1984–2018 and reported that agricultural expenditure raises agricultural output in the long run, whereas institutional quality helps only in the short run and does not moderate the expenditure–output relationship. Together, the two studies indicate that spending matters, but its benefits depend on composition and timing.

Price and labor channels have also received attention. Akosile (2023) modeled food inflation in Nigeria with an ARDL approach and found that interest rates exert a significant negative effect, that a weaker naira raises food prices initially while the long-run effect is a significant reduction, and that crude oil prices raise food inflation. For South Africa, Habanabakize and Zerihun (2024) applied bounds testing and an error-correction framework to quarterly data for 2010–2021 and showed that food imports, inflation, and real wages disrupt agricultural employment in the long run, recommending that inflation and wage policies be combined with easier imports of foods that complement domestic production.

These studies confirm that inflation, exchange rates, employment, and public spending each shape food-related outcomes, but they typically examine one or two variables, a single country, or a continent-wide panel, and none jointly models lending interest rate, inflation, exchange rate, agricultural employment, and government expenditure for West African economies.

3. Methodology

3.1 Data Type and Sources

The study adopts a quantitative, ex-post facto research design based on secondary data. The data form a balanced panel of six West African economies (Benin, Burkina Faso, Cabo Verde, the Gambia, Ghana, and Nigeria) observed annually from 2004 to 2023, which yields 20 time periods and 120 country-year observations. The panel structure capture cross-country heterogeneity that a single-country time series would miss, and it increases the degrees of freedom available when the number of annual observations per country is small. Because the time dimension is comparable to or larger than the cross-sectional dimension, the data are better suited to dynamic heterogeneous panel techniques than to the short-panel estimators.

The variables were drawn from three established databases. Gross agricultural production, agricultural employment, and government expenditure on agriculture were obtained from the Food and Agriculture Organization Corporate Statistical Database (FAOSTAT). Lending interest rate, inflation, and the exchange rate were obtained from the World Bank's World Development Indicators (WDI). Where WDI coverage of the lending rate was incomplete, the series for Ghana was supplemented with data from the Bank of Ghana. All series are official statistics compiled by international and national institutions, which supports their comparability across countries

3.2 Method of Analysis

The analysis proceeds with estimation and post-estimation tests. The pre-estimation stage begins with descriptive statistics, which summarize the central tendency, dispersion, skewness, and kurtosis of each variable and help to identify outliers. Pairwise correlations and variance inflation factors (VIF) are then used to assess multicollinearity among the regressors, with a mean VIF above 10 taken as evidence of a severe problem.

Because macroeconomic shocks in one West African economy can spill over to its neighbors through trade, shared monetary arrangements, and regional food markets, the Pesaran cross-sectional dependence (CD) test is applied before any stationarity testing. Stationarity is then examined using the Levin–Lin–Chu (LLC) test, which assumes a common unit root process across countries, the Im–Pesaran–Shin (IPS) test, which allows the unit root process to differ across countries, and the cross-sectionally augmented IPS (CIPS) test, which remains valid under cross-sectional dependence. Using all three provides a check on whether the order of integration is sensitive to the assumptions imposed. Pedroni's residual-based test is then used to determine whether the variables are cointegrated, that is, whether they share a long-run equilibrium relationship.

The main estimator is the Pooled Mean Group (PMG) estimator for the panel autoregressive distributed lag (ARDL) model proposed by Pesaran, Shin, and Smith (1999). The PMG estimator constrains the long-run coefficients to be identical across countries while leaving the intercepts, short-run coefficients, error-correction speeds, and error variances free to differ. This is a reasonable compromise for the present sample. The six economies face broadly similar structural constraints in agriculture and share long-run technological and market relationships, but they differ in monetary regime, since Benin and Burkina Faso belong to the West African Economic and Monetary Union while the Gambia, Ghana, and Nigeria operate independent currencies, and they therefore adjust to shocks at different speeds. The suitability of the PMG estimator is verified by comparing it with the Mean Group (MG) and Dynamic Fixed Effects (DFE) estimators through Hausman tests. A failure to reject the null hypothesis

that the difference in coefficients is not systematic favors PMG, which is then more efficient than the alternatives. The speed of adjustment is read from the error correction term, which should be negative and statistically significant if the variables return to their long-run equilibrium after a shock.

The Dumitrescu–Hurlin panel Granger causality test is applied to determine the direction of causality between agricultural production and each macroeconomic variable. This test allows the causal relationships to differ across countries and is therefore consistent with the heterogeneity assumed in the PMG framework.

3.3 Model Specification

The model is adapted from Aye and Odhiambo (2021), who examined the threshold effect of inflation on agricultural growth in developing countries. Gross agricultural production is used as the proxy for food security and is expressed as a function of five macroeconomic variables:

$$GPRO_{it} = f(INTR_{it}, INFL_{it}, EXR_{it}, AGREM_{it}, GOVEXP_{it}) \quad (3.1)$$

where GPRO is gross agricultural production, INTR is the lending interest rate, INFL is inflation, EXR is the exchange rate, AGREM is agricultural employment, and GOVEXP is government expenditure on agriculture. The subscripts *i* and *t* denote country and year, respectively. The static econometric form of the model is:

$$GPRO_{it} = \beta_0 + \beta_1 INTR_{it} + \beta_2 INFL_{it} + \beta_3 EXR_{it} + \beta_4 AGREM_{it} + \beta_5 GOVEXP_{it} + \mu_{it} \quad (3.2)$$

where β_0 is the intercept, β_1 to β_5 are the slope coefficients, and μ_{it} is the stochastic error term. To separate short-run dynamics from the long-run relationship, Equation 3.2 is re-expressed as a panel ARDL(p, q, q, q, q, q) model in error correction form, estimated by PMG:

$$\Delta GPRO_{it} = \varphi_i(GPRO_{i,t-1} - \theta_1 INTR_{i,t-1} - \theta_2 INFL_{i,t-1} - \theta_3 EXR_{i,t-1} - \theta_4 AGREM_{i,t-1} - \theta_5 GOVEXP_{i,t-1}) + \Sigma_{j=1}^{p-1} \lambda_{ij} \Delta GPRO_{i,t-j} + \Sigma_{k=1}^{5} \Sigma_{j=0}^{q-1} \delta_{kij} \Delta X_{k,i,t-j} + \alpha_i + \varepsilon_{it} \quad (3.3)$$

where Δ is the first-difference operator, X_k represents the k-th regressor, θ_1 to θ_5 are the long-run coefficients, which are restricted to be equal across countries, φ_i is the country-specific error correction coefficient, λ_{ij} and δ_{kij} are the country-specific short-run coefficients, α_i is the country-specific intercept, and ε_{it} is the white-noise error term. For the long-run relationship to be valid, φ_i must be negative and significant. The three null hypotheses of the study are tested using the significance of the long-run coefficients and of the error correction term, the correlation and multicollinearity diagnostics, and the cointegration and causality tests, respectively.

3.4 A Priori Expectations

The expected signs follow from economic theory and existing literature. A higher lending interest rate raises the cost of financing seeds, fertilizer, equipment, and storage, and discourages smallholders from borrowing formally, so a negative relationship with agricultural production is expected ($\beta_1 < 0$). Inflation raises input costs, erodes farm profitability, and reduces the real purchasing power of rural households, which depresses investment and output, so a negative sign is expected ($\beta_2 < 0$). Because agriculture in these economies depends on imported fertilizers, machinery, and chemicals, a rise in the exchange rate, defined as more units of local currency per U.S. dollar, signifies depreciation and higher input costs, and a negative sign is therefore expected ($\beta_3 < 0$). A larger agricultural workforce increases the labor available for cultivation, processing, and marketing, so a positive sign is expected ($\beta_4 > 0$). Public spending on subsidies, extension services, irrigation, and rural infrastructure raises productivity and corrects market failures, so a positive sign is also expected ($\beta_5 > 0$). Finally,

the error correction term is expected to lie between −1 and 0, which indicates convergence to long-run equilibrium.

3.5 Justification and Measurement of Variables

Gross agricultural production (GPRO) is the dependent variable and is measured as the FAOSTAT gross production index. It is used as a proxy for food security because it captures the aggregate output of the crop and livestock sectors and therefore reflects the availability dimension of food security on which the other dimensions, namely access, affordability, and utilization, ultimately depend. Direct indicators such as the prevalence of undernourishment are available only as short, smoothed three-year averages and would leave too few observations for dynamic panel estimation. Lending interest rate (INTR) is the interest rate charged by banks on loans to the private sector, measured in percentage per annum. It is included because credit is the principal means by which farmers finance inputs and bridge the gap between planting and harvest, and because the cost of borrowing is a primary channel through which monetary policy reaches the agricultural sector. Inflation (INFL) is the annual percentage change in consumer prices and is included because price instability affects both the cost of production and the affordability of food. Exchange rate (EXR) is the official rate expressed in local currency units per U.S. dollar, so that an increase indicates depreciation. Agricultural employment (AGREM) is the number of people employed in agriculture, measured in thousands. It is included to represent the labor input in the production function and the structural transition from agriculture described in the Lewis dual-sector model, which is a concern in a region where youth participation in farming is declining. Government expenditure (GOVEXP) is public spending on agriculture measured as a percentage of total government expenditure, which makes it comparable across countries of very different fiscal size. It is included to capture the extent to which the state supports the sector through subsidies, infrastructure, and research. The five regressors operationalize the cost of finance, the cost of living and production, the external price of inputs, the labor force, and the fiscal commitment, which correspond to the supply-side and structural mechanisms emphasized by the cobweb and Lewis's dual-sector that underpin the study.

4. Results and Discussion

This section reports the relationship between gross agricultural output within selected West African economies and its determinants, given that, the methodology of the study was collected on this basis and will be presented, analyzed and summarized. A descriptive statistics table is presented to explain and summarize the nature of the data in operation. This aided in accessing data variability, model selection and a quick multicollinearity check. Subsequently, a test for stationarity was conducted. This study uses the Levin-Lin-Chu (LLC), Im-Pesaran-Shin (IPS) and Cross-sectionally Augmented IPS (CIPS) tests to determine unit root among the data, with a conclusion of mixed order of integration. Cross Sectional Dependence and Co-integration Tests were carried out to obtain the characteristics of each model in the study. The PMG, MG, and DFE estimators were used to determine the relationships between the variables. And a causality test was carried out on the variables as a post-estimation analysis.

Table 1: Descriptive statistics

Statistic	GPRO	INTR	INFL	EXR	AGREMP	GOVEXP
Mean	93.74	15.14	6.96	238.00	5752.63	2.85
Median	93.55	11.26	5.37	111.71	2857.95	2.77
Maximum	143.61	36.50	38.11	623.76	26809.34	6.15
Minimum	57.58	4.74	-3.23	0.90	21.35	0.44
Std. Dev.	20.03	9.26	6.92	228.07	7924.72	1.35
Skewness	0.18	0.48	1.41	0.47	1.58	0.07
Kurtosis	2.25	1.78	6.07	1.48	3.96	2.17
Jarque-Bera	3.48	12.10	86.94	15.99	54.65	3.56
Probability	0.176	0.002	0.000	0.000	0.000	0.169
Observations	120	120	120	120	120	120

Source: Author's computation (2025) Using Eviews and Stata

Gross agricultural production (mean 93.74; SD 20.03) and government expenditure are approximately normally distributed (Jarque-Bera $p > 0.10$), whereas lending interest rate, inflation, exchange rate and agricultural employment reject normality at the 1% level. Inflation is markedly right skewed (1.41) and leptokurtic (6.07), reflecting occasional price spikes, while the wide ranges of exchange rates and agricultural employment point to strong cross-country heterogeneity.

Table 2: Pairwise Correlation Matrix and Variance Inflation Factors (VIF)

Variable	GPRO	INTR	INFL	EXR	AGREMP	GOVEXP	VIF
GPRO	1.0000						N/A
INTR	0.0513	1.0000					3.81
INFL	0.1184	0.4670	1.0000				2.79
EXR	0.1154	-0.7868	-0.3830	1.0000			2.33
AGREMP	0.1212	0.0404	0.4832	0.0625	1.0000		2.17
GOVEXP	-0.0281	-0.6892	-0.5173	0.5109	0.0192	1.0000	1.58

Source: Author's computation (2025) Using Eviews and Stata

Correlations between gross agricultural production and each regressor are weak ($|r| \leq 0.12$). The strongest associations among regressors are the negative links of lending interest rate with exchange rate (-0.79) and with government expenditure (-0.69). All VIF values (1.58–3.81) lie far below the threshold of 10, so multicollinearity is not a concern for the estimated model.

Table 3: Pesaran Cross-Sectional Dependence (CD) Test

Variable	CD statistic	Probability
GPRO	1.13	0.260
INTR	3.88	0.000*
INFL	5.53	0.000*
EXR	14.92	0.000*
AGREMP	-1.36	0.174
GOVEXP	0.75	0.454

Source: Author's computation (2025) Using Eviews and Stata

The null hypothesis of cross-sectional independence is rejected at the 1% level for lending interest rate, inflation and exchange rate, indicating that common shocks are transmitted across the sampled economies. It is not rejected for gross agricultural production, agricultural employment and government expenditure. Because dependence is present, a second-generation unit root test is required alongside first-generation tests.

Table 4: Levin-Lin-Chu (Llc) Panel Unit Root Test

Variable	Level statistic	P-value	First-difference statistic	P-value	Order
GPRO	0.7701	0.7794	-4.6864*	0.0000	I(1)
INTR	-1.2395	0.1076	-6.6155*	0.0000	I(1)
INFL	2.2294	0.9871	-3.9977*	0.0000	I(1)
EXR	2.5902	0.9952	-3.9473*	0.0000	I(1)
AGREMP	-0.3141	0.3767	-1.7610**	0.0391	I(1)
GOVEXP	-3.2017*	0.0007	-11.9896*	0.0000	I(0)

Source: Author's computation (2025) Using Eviews and Stata

The LLC test, which assumes a common unit root process, fails to reject non-stationarity in levels for gross agricultural production, interest rate, inflation, exchange rate and agricultural employment, all of which become stationary after first differencing. Government expenditure is stationary in levels. The variables are therefore integrated of mixed orders.

Table 5: Im-Pesaran-Shin (IPS) Panel Unit Root Test

Variable	Level statistic	P-value	First-difference statistic	P-value	Order
GPRO	2.8103	0.9975	-5.7944*	0.0000	I(1)
INTR	-0.8228	0.2053	-5.7915*	0.0000	I(1)
INFL	-1.8756**	0.0304	-5.5024*	0.0000	I(0)
EXR	5.0075	1.0000	-3.0716*	0.0011	I(1)
AGREMP	3.7731	0.9999	-2.2272**	0.0130	I(1)
GOVEXP	-3.9750*	0.0000	-6.5295*	0.0000	I(0)

Source: Author's computation (2025) Using Eviews and Stata

Allowing for heterogeneous autoregressive roots, the IPS test classifies inflation and government expenditure as stationary in levels, while gross agricultural production, interest rate, exchange rate and agricultural employment are integrated of order one. The mixed order of integration again supports a panel ARDL framework rather than conventional cointegration methods that require uniform integration orders.

Table 6: Cross-sectionally augmented IPS (CIPS) panel unit root test

Variable	Level statistic	First-difference statistic	Order
GPRO	-1.382	-2.340**	I(1)
INTR	-2.483**	-4.697*	I(0)
INFL	-2.988*	-4.258*	I(0)
EXR	-1.065	-2.242***	I(1)
AGREMP	-0.749	-2.756*	I(1)
GOVEXP	-3.712*	-5.323*	I(0)

Source: Author's computation (2025) Using Eviews and Stata

After accounting for cross-sectional dependence, lending interest rate, inflation and government expenditure are stationary in levels, whereas gross agricultural production, exchange rate and agricultural employment become stationary only after first differencing (critical values: -2.21, -2.34 and -2.60 at 10%, 5% and 1%). No variable is integrated beyond order one, which justifies the PMG estimator.

Table 7: Pedroni residual-based panel cointegration test

Statistic	Value	Probability
Panel v-statistic	-1.552	0.9397
Panel rho-statistic	1.931	0.9732
Panel PP-statistic	-1.623	0.0523***
Panel ADF-statistic	-0.068	0.4728
Group rho-statistic	2.428	0.9924
Group PP-statistic	-1.585	0.0565***
Group ADF-statistic	1.677	0.9533

Source: Author's computation (2025) Using Eviews and Stata

Here, only the panel and group PP statistics reject the null of no cointegration, and only at the 10% level; the remaining five statistics do not. Evidence of a long-run equilibrium among the variables is therefore present but weak, and it is complemented by the error correction term in the PMG model.

Table 9: Pooled Mean Group (PMG), Mean Group (MG) and Dynamic Fixed Effects (DFE) estimates

	PMG			MG			DFE		
Variable	**Coef.**	**S.E.**	**Prob.**	**Coef.**	**S.E.**	**Prob.**	**Coef.**	**S.E.**	**Prob.**
Long-run coefficients									
INTR	0.284	1.129	0.802	11.838	7.910	0.135	-3.996	5.003	0.424
INFL	-1.407	0.375	0.000*	-2.203	1.305	0.091***	-0.949	2.509	0.705
EXR	-0.026	0.033	0.446	1.872	1.947	0.336	0.239	0.277	0.389
AGREMP	0.372	0.003	0.000*	-0.933	0.872	0.284	-0.005	0.019	0.767
GOVEXP	11.004	1.642	0.000*	35.816	23.828	0.133	10.043	12.242	0.412
Short-run coefficients									
ECT	-0.232	0.142	0.102	-0.441	0.096	0.000*	-0.112	0.053	0.035**
D.INTR	-0.701	0.399	0.078***	-0.303	0.069	0.314	-0.423	0.478	0.376
D.INFL	-0.222	0.399	0.078***	-0.492	0.308	0.039**	0.027	0.241	0.909
D.EXR	0.099	0.110	0.371	0.133	0.024	0.146	0.001	0.043	0.974
D.AGREMP	0.234	0.422	0.572	0.387	0.446	0.386	0.001	0.004	0.822
D.GOVEXP	1.802	1.272	0.156	0.336	2.281	0.883	0.460	1.357	0.735
Constant	-6.177	17.246	0.720	80.283	57.280	0.161	13.295	12.877	0.302

Source: Author's computation (2025) Using Eviews and Stata

In the PMG long-run equation, inflation exerts a negative effect (-1.407), while agricultural employment (0.372) and government expenditure (11.004) are positive, all significant at the 1% level; interest rate and exchange rate are insignificant. The error correction term (-0.232) has the expected sign and implies that about 23% of disequilibrium is corrected each period, although it is significant only at roughly the 10% level (p = 0.102).

Table 10: Hausman specification tests

Null: difference in coefficients not systematic	MG vs PMG	DFE vs PMG	DFE vs MG
Chi-square (3)	0.88	0.81	-5.96 (invalid)
Prob. > chi-square	0.9716	0.9766	Asymptotic assumption not met
Decision	Fail to reject H0	Fail to reject H0	Inconclusive
Preferred estimator	PMG	PMG	Inconclusive

Source: Author's computation (2025) Using Eviews and Stata

Neither the MG-PMG nor the DFE-PMG contrast is significant (p = 0.972 and 0.977), so the long-run homogeneity restriction imposed by PMG is not rejected and PMG is both consistent and more efficient. The DFE-MG test returns a negative chi-square statistic that violates the asymptotic assumption and is therefore inconclusive. PMG is retained as the preferred estimator.

Table 11: Dumitrescu-Hurlin panel Granger causality test

H0: A does not cause B	Z-bar tilde	P-value	Reject H0?	H0: A does not cause B	Z-bar tilde	P-value	Reject H0?
GPRO → INTR	-0.1678	0.8668	No	EXR → GPRO	4.2742*	0.0000	Yes
GPRO → INFL	-0.9316	0.3515	No	EXR → INTR	0.6376	0.5231	No
GPRO → EXR	2.9444*	0.0032	Yes	EXR → INFL	-0.2249	0.8220	No
GPRO → AGREMP	1.1800	0.2380	No	EXR → AGREMP	4.4580*	0.0000	Yes
GPRO → GOVEXP	1.0393	0.2987	No	EXR → GOVEXP	0.1420	0.8871	No
INTR → GPRO	2.0266	0.2427	No	AGREMP → GPRO	2.4803**	0.0131	Yes
INTR → INFL	1.1129	0.2658	No	AGREMP → INTR	-0.1004	0.9200	No
INTR → EXR	6.6622*	0.0000	Yes	AGREMP → INFL	2.0858**	0.0370	Yes
INTR → AGREMP	6.1460*	0.0000	Yes	AGREMP → EXR	1.3272	0.1844	No
INTR → GOVEXP	2.1230**	0.0338	Yes	AGREMP → GOVEXP	0.9677	0.3332	No
INFL → GPRO	2.1230**	0.0338	Yes	GOVEXP → GPRO	-0.5831	0.5598	No
INFL → INTR	19.7247*	0.0000	Yes	GOVEXP → INTR	0.3141	0.7535	No
INFL → EXR	4.1936*	0.0000	Yes	GOVEXP → INFL	1.0241	0.3058	No
INFL → AGREMP	5.8445*	0.0000	Yes	GOVEXP → EXR	0.4883	0.6254	No
INFL → GOVEXP	-0.9577	0.3882	No	GOVEXP → AGREMP	2.9912*	0.0028	Yes

Source: Author's computation (2025) Using Eviews and Stata

Exchange rate (p < 0.01), inflation (p = 0.034) and agricultural employment (p = 0.013) Granger-cause gross agricultural production, whereas interest rate and government expenditure do not. Feedback exists between production and exchange rate, and between inflation and agricultural employment. Interest rate and inflation lead several other variables, indicating that monetary conditions transmit to agricultural output mainly through exchange rate, prices and labor.

5. Conclusion and Recommendations

5.1 Conclusion

This study examined how lending interest rate, inflation, exchange rate, agricultural employment and government expenditure affect food security, proxied by gross agricultural output, in Benin, Burkina Faso, Cabo Verde, the Gambia, Ghana and Nigeria from 2004 to 2023. The PMG estimates show that in the long run, government expenditure on agriculture and agricultural employment raise output significantly, while inflation lowers it significantly. Interest rate and exchange rate effects were not statistically significant in the long run. The causality tests further show that inflation drives agricultural output, and that output and the exchange rate influence each other. Food security in West Africa therefore depends on stable prices, an engaged agricultural workforce and well-directed public investment.

5.2 Recommendations

Policymakers should make price stability a priority through credible inflation-targeting, since inflation is the clearest macroeconomic threat to agricultural output. Governments should raise agricultural spending and direct it to irrigation, rural infrastructure, mechanization and research, where it has the strongest long-run payoff. Training, grants and subsidies should be used to attract young people to farming and retain them. Financial institutions should develop affordable, agriculture-specific credit products, supported by exchange rate stability to contain the cost of imported inputs. Regional trade agreements should also be strengthened so that farm producers move freely across borders.

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