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PRICE INSTABILITY AND AGRICULTURAL FINANCING IN WEST AFRICAN ECONOMIES

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ABSTRACT

Agricultural financing in West Africa remains constrained by persistent macroeconomic instability, particularly volatile consumer and producer prices that heighten credit risk and discourage lending to the agricultural sector. This study examines the asymmetric effects of price instability on agricultural financing in selected West African economies (Nigeria, Ghana, Senegal, Côte d'Ivoire, Burkina Faso, and The Gambia) over 1990–2025. Using annual panel data and the Pooled Mean Group Nonlinear Autoregressive Distributed Lag (PMG-NARDL) model, the study decomposes Consumer Price Index (CPI) and Producer Price Index (PPI) into positive and negative shocks to capture asymmetric impacts, alongside exchange rate, government expenditure, and gross capital formation. Descriptive statistics reveal substantial price volatility, while cross-sectional dependence tests confirm strong regional interdependence ($p < 0.01$). Unit root results indicate a mixed order of integration I(0)/I(1), justifying the econometric approach. Long-run estimates show that both CPI positive ($\beta = -0.0487$, $p = 0.0017$) and CPI negative ($\beta = -0.0465$, $p = 0.0024$) shocks significantly reduce agricultural financing, indicating that both inflationary and deflationary instability discourage credit supply. PPI positive shocks ($\beta = 0.0103$, $p = 0.0198$) enhance agricultural financing, while PPI negative shocks are statistically insignificant. Exchange rate depreciation reduces agricultural credit ($\beta = -0.0521$, $p = 0.0003$), whereas government expenditure ($\beta = 0.0852$, $p < 0.01$) and gross capital formation ($\beta = 0.0247$, $p < 0.01$) stimulate credit expansion. The error correction term (−0.3020) indicates a 30% annual speed of adjustment toward long-run equilibrium. The study concludes that macroeconomic price instability significantly constrains agricultural financing, while stable producer prices and capital formation improve credit access. Policy recommendations emphasize inflation stabilization, improved farm-gate pricing systems, efficient public expenditure, and investment led financial deepening. Limitations include reliance on aggregated macro panel data and exclusion of micro level credit behavior.

Keywords: Agricultural Financing, Price Instability, CPI, PPI, PMG-NARDL

JEL Codes: Q14, E31, G21, C23

1. INTRODUCTION

The agricultural sector occupies a central position in the economies of many West African countries due to its contribution to employment creation, income generation, food supply, and rural development (Osabohien et al., 2020). Beyond supporting livelihoods, agriculture serves as an important driver of economic growth and poverty reduction across the region. Despite its economic significance, the sector continues to face numerous challenges, including inadequate access to formal financial services. Limited financing often restricts farmers' ability to acquire improved inputs, adopt modern production technologies, expand farm operations, and enhance productivity (Osabohien et al., 2020). Consequently, agricultural credit remains a crucial instrument for stimulating investment and improving production outcomes. However, the extent to which financial institutions provide credit to the agricultural sector is frequently influenced by prevailing macroeconomic conditions, particularly the behavior of prices within the economy (Mustafa et al., 2024).

In recent years, fluctuations in consumer and producer prices have become a major source of concern for policymakers, investors, and financial institutions because unstable prices increase uncertainty regarding future economic outcomes (Mustafa et al., 2024). Variations in consumer prices affect the purchasing power of households and shape expectations about future inflation, while changes in producer prices influence production costs, revenue prospects, and profitability within agricultural value chains (Sun et al., 2023). Research has shown that persistent price volatility can alter investment behavior, complicate production planning, and increase exposure to economic risk (Mustafa et al., 2024). Furthermore, evidence suggests that movements in producer prices are often transmitted to consumer prices, creating broader macroeconomic consequences that affect both producers and financial markets (Sun et al., 2023). In economies where agricultural activities are highly vulnerable to external shocks and market fluctuations, unstable prices may increase the risk profile of agricultural lending, thereby discouraging financial institutions from extending long-term credit facilities to farmers and agribusinesses (Mustafa et al., 2024).

Although considerable attention has been given to the role of credit in promoting agricultural development, less emphasis has been placed on understanding how price instability influences the flow of agricultural finance. Existing studies have predominantly examined the effects of credit on agricultural output and household welfare (Osabohien et al., 2020) or explored the

broader implications of price volatility for agricultural markets (Mustafa et al., 2024). In addition, many empirical investigations implicitly assume that upward and downward price movements affect economic behavior in a similar manner. Such an assumption may overlook important asymmetries in the relationship between prices and financing decisions. For instance, increases in producer prices may strengthen farm incomes and improve borrowers' repayment capacity, thereby encouraging greater credit provision, whereas falling producer prices may weaken financial performance and heighten lending risk (Sun et al., 2023). Likewise, rising and declining consumer prices may influence lenders' expectations and risk assessments differently.

Despite the relevance of these issues for agricultural development and financial sector policy, empirical evidence on the asymmetric effects of Consumer Price Index (CPI) and Producer Price Index (PPI) movements on agricultural financing remains limited, particularly within the West African context. This study seeks to fill this gap by examining how positive and negative shocks in CPI and PPI affect agricultural financing in selected West African countries using the Pooled Mean Group Nonlinear Autoregressive Distributed Lag (PMG-NARDL) approach. By distinguishing between short-run and long-run effects and allowing for asymmetric responses to price movements, the study provides additional insights into the interaction between price instability and agricultural finance in developing economies.

2. LITERATURE REVIEW

2.1 Conceptual Review

2.1.1 Price Instability and Inflation Dynamics

Price instability, measured through CPI and PPI, represents a key macroeconomic distortion affecting production and investment decisions. CPI captures changes in consumer purchasing costs, while PPI reflects producer-side price movements and input cost pressures (Soliman et al., 2023). Empirical studies confirm that inflation shocks exhibit asymmetric effects on economic performance, particularly in agriculture-dependent economies.

2.1.2 Agricultural Credit and Sector Performance

Agricultural credit enhances productivity by enabling farmers to access inputs, technology, and improved production systems. Empirical evidence confirms that credit access significantly improves agricultural output (Udoette et al., 2024). However, macroeconomic instability weakens credit effectiveness by increasing uncertainty and default risk.

2.2 Theoretical Review

The theoretical basis for this study draws from macroeconomic and financial theories that explain how price instability influences lending behaviour and sectoral credit allocation.

2.2.1 Fisher Effect and Credit Market Theory

The Fisher hypothesis posits that nominal interest rates adjust to expected inflation to preserve real returns. However, in developing agricultural credit markets, inflation increases lending risk, leading to higher interest rates and reduced credit demand. Credit rationing theory further explains that lenders restrict credit under uncertainty due to repayment risk.

2.2.2 Relative Price Theory

Relative Price Theory holds that changes in some prices relative to others influence resource allocation and production decisions. PPI measures producer level prices often affected by input costs which directly influence agricultural profitability. When producer prices are volatile, the cost structure of agricultural production changes, potentially affecting both the demand for credit by lowering expected returns and the willingness of financial institutions to lend.

2.2.3 Risk and Uncertainty in Credit Markets

Economists such as Hans Binswanger and Christopher Udry have emphasized that risk aversion and credit constraints fundamentally shape rural financial markets in developing economies. Binswanger's work shows that risk and uncertainty influence farmers' investment decisions and lenders behavior, especially under conditions of volatile prices (Binswanger-Mkhize). Udry's further suggests that, contrary to standard assumptions about moral hazard, informal social networks often shape rural credit markets, highlighting that market imperfections and uncertainty including inflation risk influence credit access and

allocation. The theoretical framework for this study integrates inflation theories, credit market models, and agricultural economics to explain how asymmetric price shocks affect agricultural credit.

2.3 Empirical review

Empirical studies on price instability and agricultural financing suggest a strong, though often indirect, relationship between CPI, PPI, and credit to agriculture. Muhammed (2024), using an ARDL model in Nigeria, showed that exchange rate fluctuations and money supply shocks increased food prices and reduced agricultural productivity, with high interest rates discouraging investment, indicating the need for enhanced agricultural credit under stable price conditions. Similarly, Ogbanje and Okpe (2022), applying Granger causality within a vector autoregressive framework, found bidirectional causality between monetary policy instruments and agricultural output, implying that CPI-driven inflation influences credit demand. Udoette et al. (2024), through VECM, demonstrated that bank credit positively impacts agricultural output, but interest rates and CPI effects moderate its effectiveness, emphasizing the importance of aligning credit policies with price stability.

Oziegbe, Edafe, and Edafe (2025) applied Dynamic Ordinary Least Squares (DOLS) and found that CPI fluctuations affect food security, indirectly influencing agricultural credit risk. Sun et al. (2023), using ARDL, VECM, and Granger causality, highlighted bidirectional and sector specific links between PPI and CPI, showing that producer price shocks propagate to consumer prices and may heighten lending risks. Ogu (2025) reported that persistent inflation suppresses agricultural productivity despite access to formal credit, while Akhamiu et al. (2026), using ARDL, confirmed that inflation negatively affects agricultural output and reduces the benefits of credit, advocating for comprehensive inflation control and credit system reform.

Toaha and Mondal (2023) in Bangladesh, using Johansen cointegration and VECM, found a long run positive relationship between agricultural credit and GDP, but observed that inflation reduces the effectiveness of credit flows. Samal, Ummalla, and Goyari (2022) applied ARDL bounds testing in India and showed that global price trends and money supply drive CPI based food price inflation, raising financing risks for agriculture. Peixoto (2022), through panel cointegration, linked higher CPI driven inflation and governance issues to reduced agricultural profitability and credit uptake. Collectively, these studies confirm that while agricultural credit

enhances productivity, its effectiveness is strongly moderated by price instability, and that PPI and CPI fluctuations especially when asymmetric or volatile affect both input costs and lending risks. However, direct empirical research explicitly modeling the asymmetric effects of CPI and PPI on credit to agriculture remains very limited, identifying a clear gap that this study seeks to address.

3. METHODOLOGY

This study adopts a quantitative panel research design covering selected West African countries (Nigeria, Ghana, Senegal, Côte d'Ivoire, Burkina Faso, and The Gambia) over 1990-2025. The dependent variable is agricultural credit, while independent variables include CPI, PPI, exchange rate, government expenditure, and gross capital formation. CPI and PPI are decomposed into positive and negative shocks to capture asymmetric effects. The PMG-NARDL model is employed due to its ability to estimate both long run homogeneity and short run heterogeneity across countries (Pesaran et al., 1999; Shin et al., 2014).

3.1 Model Specification

Before estimation, second generation panel unit root tests are conducted to determine the integration properties of the variables (Wooldridge, 2012). Cross-sectional dependence tests, including the Pesaran CD test, are performed to account for potential correlations across countries due to regional economic linkages (Pesaran, 2004). Following the establishment of stationarity and integration order, panel cointegration tests, such as Pedroni (1999) and Kao (1999), are applied to confirm the presence of long run relationships among agricultural credit, CPI, PPI, and the control variables. The PMG NARDL model is then estimated to capture both short run adjustments and long run asymmetric effects, with diagnostic tests conducted to check for serial correlation and heteroskedasticity. The results are interpreted to evaluate how positive and negative shocks in consumer and producer prices affect agricultural financing, and how exchange rate fluctuations, fiscal policy, and investment levels moderate these effects across selected West African countries.

To examine the effect of price instability and agricultural financing in West African economies, The specification of model are in line with the assumption of the nonlinear Autoregressive

Destructive Lag (NARDL) modeling put forward by Shin et al. (2014) taken the following econometrics relationship;

$$CAGRIC = F(CPI, PPI, EXR, GE, CF) \quad 3.1$$

$$LogCAGRIC = \alpha_0 + \alpha_1 CPI^{+}it + \alpha_2 CPI^{-}it + \alpha_3 PPI^{+}it + \alpha_4 PPI^{-}it + Log\beta_1 EXRit + \beta_2 GEit + \beta_3 CFit + U. \quad 3.2$$

4. DATA PRESENTATION AND ANALYSIS OF RESULT

Table 4.1: Results of Descriptive Statistic

	Cagri	Cpi^{+}	Cpi^{-}	Ppi^{+}	Ppi^{-}	Exr	Gexp	Gcf
Mean	7.989	19.80	-21.32	74.13	-19.29	4.843	17.26	21.87
Median	8.134	17.07	-17.11	61.53	-17.71	6.126	17.24	20.82
Max.	11.56	69.88	0	345.6	0	11.2	33.34	47.13
Min.	3.784	0.072	-87.27	0.24	-72.83	-0.333	4.8	7.197
Std. Dev.	1.850	14.71	20.26	58.66	21.20	2.135	6.275	8.133
Skew.	-0.292	0.940	-1.240	1.561	-1.417	-0.930	0.340	0.749
Kurt.	2.814	3.907	3.809	6.700	4.163	3.385	2.631	3.428
Jarque-Bera	2.254	26.16	40.87	140.6	56.35	21.69	3.601	14.60
Prob.	0.323	0.000	0	0	0	0.0019	0.165	0.0006
Sum	1150.4	2852.5	-3070.3	10676.0	-2778.5	697.5	2486.6	3150.5
Sum Sq. Dev.	489.5	30961.1	58714.8	492075.3	64279.6	651.8	5631.2	9458.9
Obs.	144	144	144	144	144	144	144	144

Source: computed by the researcher using E-views version 12 (2026).

The descriptive statistics indicate notable variability and asymmetry across the key variables examined in selected West African countries. Credit to agriculture records a mean of 7.9 and a median of 8.1, with a relatively low standard deviation of 1.8, suggesting moderate dispersion and relative stability compared to other variables. In contrast, positive movements in the consumer price index (CPI) show a higher mean of 19.8 and a wide standard deviation of 14.7,

with values ranging from 0.07 to 69.8, reflecting substantial inflationary volatility. Negative CPI changes have a mean of –21.3 and a large standard deviation of 20.6, indicating pronounced deflationary swings in certain periods. Producer price index (PPI) positive changes exhibit extreme variability, with a high mean of 74.1, a maximum of 345.6, and a very large standard deviation of 58.6, pointing to significant producer level price instability; similarly, negative PPI changes (mean –19.2, standard deviation 21.2) demonstrate considerable downward price fluctuations.

The exchange rate shows a mean of 4.8 and median of 6.1, with moderate dispersion (standard deviation 2.1) and a minimum of –0.33, suggesting episodes of currency depreciation and occasional appreciation. Government expenditure has a mean and median of 17.2, indicating symmetry in distribution, though the standard deviation of 6.2 reveals some fiscal variability. Gross capital formation records a mean of 21.8 and median of 20.8, with a standard deviation of 8.1, suggesting moderate fluctuations in investment levels. In summary, the high standard deviations and wide ranges observed particularly in CPI and PPI variables point to significant price instability, which may create uncertainty in agricultural financing, while credit to agriculture appears comparatively stable but potentially constrained relative to the magnitude of price fluctuations.

Table 4.2: Results of Cross-Sectional Dependence Test

	Breusch Pagan LM	Prob.	pesaran scaled LM	Prob.	Bias-corrected	Prob.	Pesaran CD.	Prob.
Cagric	264.848	0.0000	45.2507	0.0000	45.1257	0.0000	16.1090	0.0000
Cpi	66.70463	0.0000	9.420684	0.0000	9.297784	0.0000	7.24931	0.0000
Ppi	298.5278	0.0000	51.59200	0.0000	51.45790	0.0000	17.22101	0.0000
Exr	128.2041	0.0000	20.69457	0.0000	20.66956	0.0000	8.033367	0.0000
Gexp	150.3807	0.0000	24.71964	0.0000	24.50374	0.0000	2.819206	0.0050
Gcf	163.6904	0.0000	27.14946	0.0000	27.02338	0.0000	3.647370	0.0003

Source: computed by the researcher using E-views version 12 (2026).

The results of the cross sectional dependence tests strongly indicate the presence of significant interdependence among the selected West African countries in the model examining price instability and agricultural financing. Specifically, for Credit to Agriculture, Consumer Price Index, Producer Price Index, Exchange Rate, Government Expenditure, and Gross Capital Formation, the Breusch Pagan LM test, Pesaran scaled LM test, bias-corrected LM test, and Pesaran CD test all report probabilities of 0.00. These highly significant p-values (less than 0.01) lead to the rejection of the null hypothesis of cross sectional independence. This confirms that shocks or changes in one country are systematically correlated with those in other countries within the panel. This suggests that macroeconomic conditions, price movements, and financing patterns are not isolated across countries but are influenced by common regional or external factors such as trade linkages, shared monetary arrangements, or similar policy responses. Consequently, the presence of cross sectional dependence implies that conventional panel estimation techniques assuming independence may produce biased and inconsistent results, thereby justifying the use of second generation panel econometric methods that account for cross sectional dependence in analyzing the relationship between price instability and agricultural financing in the region.

Table 4.3: Results of Panel Unit Root Tests

Variables	Test Type	Prob-Value	Order of integration
CAGRIC	Pesaran cips	<0.01	I(1) @ First Diff.
	Bai and ng	0.00000	I(1) @ First Diff.
CPI	Pesaran cips	<0.01	I(0) @ Level
	Bai and ng	0.00000	I(0) @ Level
PPI	Pesaran cips	<0.01	I(1) @ First Diff.
	Bai and ng	0.00000	I(1) @ First Diff.
EXR	Pesaran cips	<0.01	I(1) @ First Diff.
	Bai and ng	0.00000	I(1) @ First Diff.
GEXP	Pesaran cips	<0.01	I(1) @ First Diff.
	Bai and ng	0.00000	I(1) @ First Diff.
GCF	Pesaran cips	<0.01	I(1) @ First Diff.
	Bai and ng	0.00829	I(1) @ First Diff.

Source: computed by the researcher using E-views version 12 (2026).

Within the framework of the PMG NARDL analysis, the panel unit root results reveal a mixed order of integration among the variables, which is appropriate for this estimation technique. Specifically, the Consumer Price Index (CPI) is stationary at level, that is, integrated of order zero (I(0)), indicating that price changes revert to equilibrium over time and do not exhibit a persistent stochastic trend. In contrast, Credit to Agriculture, Producer Price Index (PPI), Exchange Rate, Government Expenditure, and Gross Capital Formation are integrated of order one (I(1)), meaning they become stationary only after first differencing and thus display long run persistence in their movements. The presence of both I(0) and I(1) variables justifies the use of the Pooled Mean Group (PMG) estimator within a Nonlinear Autoregressive Distributed Lag (NARDL) framework, as this approach accommodates such mixed integration orders without requiring all variables to be I(1), provided none is I(2). Substantively, the findings suggest that while consumer price fluctuations may be short lived, agricultural credit and key macroeconomic fundamentals follow long term trends, reinforcing the relevance of modeling both long run equilibrium relationships and short run asymmetric dynamics between price instability and agricultural financing in West African countries.

Table 4.4: Long Run and Short Run Equation

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
CPI_NEG	-0.048771	0.014933	-3.265870	0.0017
CPI_POS	-0.046528	0.014797	-3.144512	0.0024
PPI_NEG	-0.952097	0.004276	2.384500	0.5819
PPI_POS	0.010326	0.002398	0.553125	0.0198
EXR	-0.052097	0.251394	-3.787269	0.0003
GEXP	0.085249	0.017874	4.769452	0.0000
GCF	0.024714	0.007044	3.508607	0.0008
	Short	**Run**	**Equation**	
COINTEQ01	-0.302010	0.096264	-3.137326	0.0025
D(CAGRIC(-1))	0.083125	0.097803	0.849920	0.3982
D(CPI_NEG)	0.000990	0.006173	0.160322	0.8731
D(CPI_POS)	0.021231	0.011611	1.828578	0.0717
D(PPI_NEG)	-0.001086	0.002021	-0.537498	0.5926
D(PPI_POS)	-0.003117	0.002777	-1.122162	0.2656
D(EXR)	0.460715	0.174795	2.635737	0.1103
D(GEXP)	0.003864	0.010945	0.353067	0.7251
D(GCF)	0.001598	0.001486	1.074837	0.2861
C	3.076590	1.058864	2.905556	0.0049
@TREND	0.037518	0.019600	1.914216	0.0596
Root MSE	0.066890	**Mean dependent var**	0.068711	

S.D. dept. var	0.139770	**S.E. of regression**	0.095260
Akaike info C.	-1.471710	**Sum squared resid.**	0.644286
Schwarz C.	0.033821	**Log likelihood**	178.9631
Hannan-Quinn C.	-0.859947		

Source: computed by the researcher using E-views version 12 (2026).

The long run results from the NARDL PMG model show the equilibrium relationship between agricultural financing and price instability in West Africa. The decomposition of CPI and PPI into positive and negative shocks allows for asymmetric analysis, meaning increases and decreases in prices may have different effects. For the Consumer Price Index (CPI), both positive and negative shocks have negative and statistically significant coefficients. CPI positive has a coefficient of –0.0487 (p = 0.0017), while CPI negative has –0.0465 (p = 0.0024). This indicates that both increases and decreases in consumer prices reduce agricultural financing in the long run. Economically, this suggests that price instability whether inflationary or disinflationary creates uncertainty in the financial environment, discouraging long term lending to the agricultural sector. Financial institutions may perceive unstable prices as increasing repayment risk, which reduces credit supply to agriculture.

For the Producer Price Index (PPI), the positive shock has a coefficient of 0.010326 and is statistically significant (p = 0.0198). This means that increases in producer prices (higher farm gate prices) stimulate agricultural financing. When farmers receive higher output prices, their expected income rises, improving their creditworthiness and encouraging banks to extend more credit. However, the negative PPI shock has a coefficient of –0.952097 but is statistically insignificant (p = 0.5819). Despite the large magnitude, its insignificance implies that falling producer prices do not have a reliable long run effect on agricultural credit in the sample. The exchange rate variable has a coefficient of 0.052097 and is highly significant (p = 0.0003). This suggests that exchange rate depreciation decrease agricultural financing in the long run. A weaker domestic currency may enhance agricultural export competitiveness, increase farm revenues, and consequently raise demand for and supply of agricultural credit. Government expenditure shows a positive and highly significant coefficient of 0.085249 (p = 0.0000). This implies that increased government spending increases agricultural financing in the long run.

Gross capital formation is statistically significant (0.024714) and its coefficient suggests that capital accumulation plays an important role in influencing agricultural financing. This indicates that investment in infrastructure and productive assets contributes positively to the development of agricultural credit markets over time. Generally, the long run findings confirm the existence of asymmetric effects of price instability on agricultural financing and show that macroeconomic stability is crucial for sustaining credit growth in the agricultural sector. The short run dynamics capture immediate adjustments before the system returns to long-run equilibrium. The error correction term (COINTEQ01) has a coefficient of –0.3020 and is statistically significant (p = 0.0025). The negative sign confirms the existence of a stable long run relationship among the variables. The magnitude indicates that approximately 30 percent of any short-run disequilibrium is corrected each period (likely annually), meaning it would take about three years for full adjustment back to equilibrium after a shock.

In the short run, most of the differenced explanatory variables including CPI positive, CPI negative, exchange rate, government expenditure, and gross capital formation have high probability values, suggesting they are not statistically significant in influencing agricultural financing immediately. This implies that price instability and macroeconomic fluctuations do not exert strong short-term effects on agricultural credit. Agricultural financing decisions appear to respond more to long term economic trends than to temporary price shocks. The constant term and time trend indicate that there is an underlying growth pattern in agricultural financing over time, independent of short-run fluctuations. This reflects structural development in the financial and agricultural sectors of West Africa.

4.2 Model Diagnostic Statistics

The Root Mean Square Error (0.0668) and Standard Error of Regression (0.095260) indicate relatively small deviations of predicted values from actual values, suggesting reasonable predictive accuracy. The mean of the dependent variable (0.068711) and its standard deviation (0.1397) show moderate variability in agricultural credit growth. The Akaike Information Criterion (–1.471710), Schwarz Criterion (0.033821), and Hannan Quinn Criterion (–0.859947) indicate acceptable model selection performance, as lower values generally reflect better model fit. The log likelihood value (178.9631) and low sum of squared residuals (0.644286) further confirm that the model explains a substantial portion of variation in agricultural financing.

Table 4.5: Wald Test Result

Test Statistic	Value	df	Probability
F-statistic	63437.1	(4,63)	0.0001
Chi-square	308358.	4	0.0000
Normalized Restriction (= 0)	**Value**	**Std. Err.**	
C(1)	-0.035597	0.009640	
-1 + C(2)	-1.056342	0.003548	
-2 + C(3)	-1.991740	0.003577	
-3 + C(4)	-2.984510	0.004589	

Source; computed by the researcher using E-views version 12 (2026).

Within the PMG NARDL framework, the Wald test results strongly reject the null hypothesis of no joint significance and no asymmetry among the explanatory variables in the model. The reported F-statistic of 634,37.1 with degrees of freedom (4, 63) and a probability value of 0.0001 indicate that the null hypothesis is rejected at conventional significance levels, confirming that Consumer Price Index, Producer Price Index, Exchange Rate, Government Expenditure, and Gross Capital Formation jointly exert a statistically significant effect on Credit to Agriculture. Similarly, the Chi-square statistic of 308358 with 4 degrees of freedom and a probability of 0.0000 further reinforce this conclusion, demonstrating strong overall model significance and the presence of asymmetric effects as specified in the NARDL structure. These highly significant results imply that price instability and macroeconomic factors play a crucial and non neutral role in determining agricultural financing in selected West African countries, validating the appropriateness of the nonlinear PMG NARDL approach in capturing both the joint and asymmetric dynamics embedded in the relationship.

Table 4.6: Hausman Test Result

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	37.791541	9	0.1200

Source; computed by the researcher using E-views version 12 (2026).

Within the PMG NARDL framework, the Hausman test result provides guidance on the appropriate estimator between the Pooled Mean Group (PMG) and the Mean Group (MG)

estimators. The reported Chi-square statistic of 37.791541 with 9 degrees of freedom and a probability value of 0.1200 indicate that the null hypothesis cannot be rejected at conventional significance levels (e.g., 5%). Since the null hypothesis of the Hausman test states that the difference in coefficients is not systematic (i.e., the PMG estimator is efficient and consistent), the insignificant p-value suggests that the PMG estimator is preferred over the MG estimator. This implies that the long run coefficients of Consumer Price Index, Producer Price Index, Exchange Rate, Government Expenditure, and Gross Capital Formation on Credit to Agriculture are homogeneous across the selected West African countries, while short run dynamics may still vary across countries. Therefore, the PMG NARDL model is appropriate for analyzing the long run relationship between price instability and agricultural financing in the region, as it efficiently captures common long run equilibrium effects alongside heterogeneous short run adjustments.

Table 4.7: Wooldridge (Autocorrelation Test)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.005950	0.014636	0.330780	0.8413
RES_PMG_LAG	-0.081890	0.040168	-1.660431	0.1060

Source; computed by the researcher using E-views version 12 (2026).

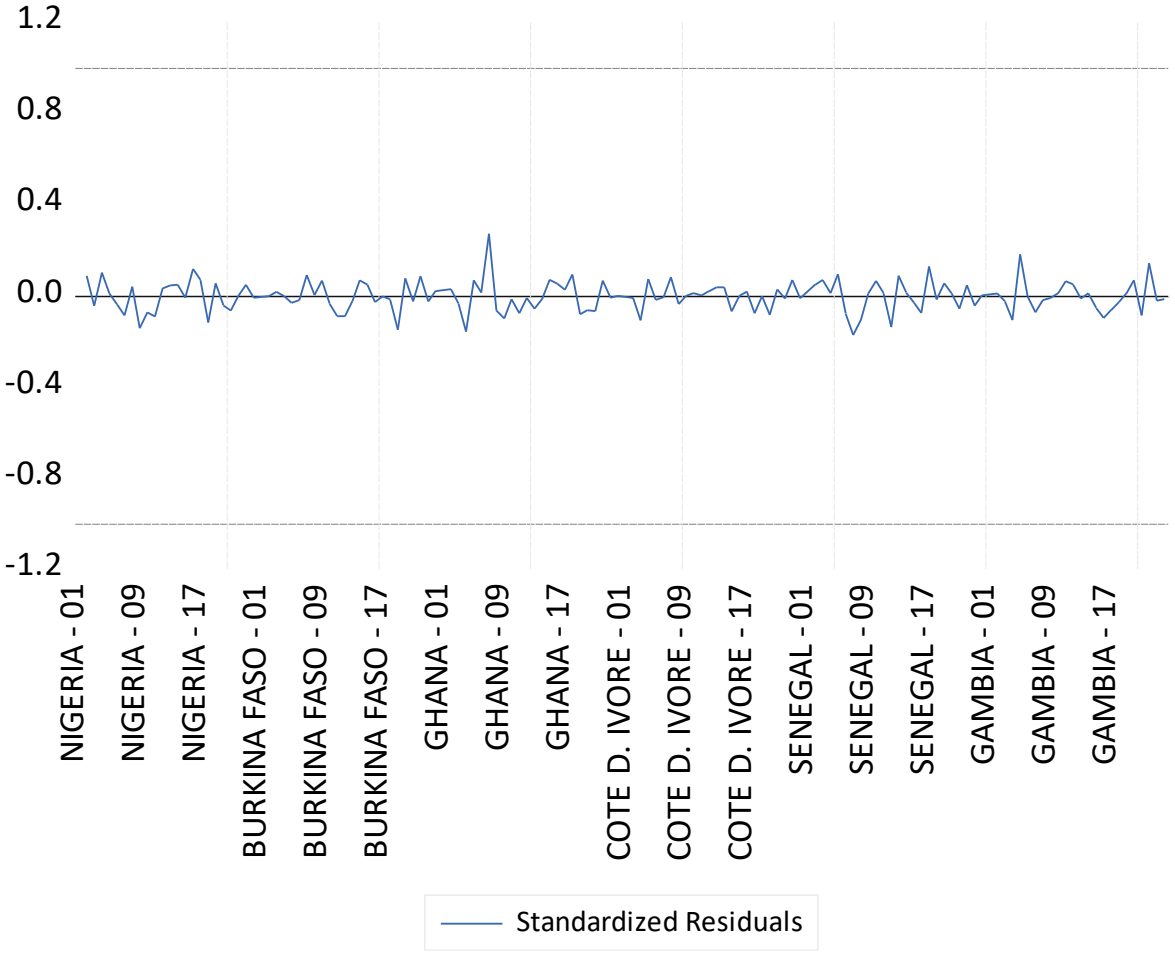
The Wooldridge autocorrelation test results within the PMG NARDL framework suggest that there is no evidence of first order serial correlation in the panel model examining the relationship between price instability and agricultural financing in selected West African countries. Specifically, the coefficient of the constant term (c = 0.005950) with a probability value of 0.8413 is statistically insignificant, indicating no systematic bias in the residual structure. More importantly, the coefficient of the lagged residual term (Res_pmg_lag = –0.081890) has a probability value of 0.1060, which exceeds the conventional 5 percent significance level. This implies that we fail to reject the null hypothesis of no first order autocorrelation. Consequently, the residuals from the PMG NARDL model appear to be serially uncorrelated, suggesting that the model is dynamically well specified and that the estimated long run and short run coefficients for Credit to Agriculture, Consumer Price Index, Producer Price Index, Exchange Rate, Government Expenditure, and Gross Capital Formation are reliable and not distorted by autocorrelation problems.

Table 4.8: Heteroskedasticity Test

Panel Cross-section		Panel Period
LR test	6.321	4.129
Prob	0.582	0.648

Source; computed by the researcher using E-views version 12 (2026).

The heteroskedasticity test results within the PMG NARDL framework indicate that the model does not suffer from heteroskedasticity problems across the selected West African countries. Specifically, the panel cross sectional LR statistic of 6.3 with a probability value of 0.58 and the panel period statistic of 4.1 with a probability value of 0.64 are both statistically insignificant at conventional levels. Therefore, the null hypothesis of homoskedasticity cannot be rejected, implying that the variance of the error term is constant across cross sections and over time. This suggests that the residuals from the model estimating the relationship between Credit to Agriculture and the explanatory variables Consumer Price Index, Producer Price Index, Exchange Rate, Government Expenditure, and Gross Capital Formation are stable and do not exhibit systematic changes in variance. Consequently, the absence of heteroskedasticity enhances the efficiency and reliability of the PMG NARDL estimates, strengthening confidence in the validity of the inferred long run and short run dynamics between price instability and agricultural financing in the region.



The standardized residual results from the PMG NARDL model indicate a strong model fit and minimal prediction errors across the selected West African countries. For Nigeria, the residuals for periods 01, 09, and 17 ranges between approximately (±0.10 and ±0.15), suggesting small deviations from the models predicted values. In Burkina Faso, as well as Ghana, Côte d'Ivoire, Senegal, and The Gambia, the residuals for the same periods are even smaller, ranging between (±0.01 and ±0.02), indicating that the model predictions closely match the observed values. The very low magnitude of these residuals across most countries implies that there are no major outliers or model misspecifications, confirming the reliability and stability of the estimated relationships between Credit to Agriculture and explanatory variables such as Consumer Price Index, Producer Price Index, Exchange Rate, Government Expenditure, and Gross Capital Formation. This test is important because standardized residuals help assess the accuracy of the models predictions, detect potential anomalies or influential observations, and ensure that the PMG NARDL estimates are not distorted by irregularities, thereby enhancing confidence in the inferred short run and long run dynamics of price instability on agricultural financing in the region.

4.3 Discussion of Findings

The empirical outcomes generated from the PMG–NARDL estimation reveal that macroeconomic price movements exert a strong and uneven influence on agricultural credit distribution across selected West African economies. The findings indicate that both upward and downward shifts in the Consumer Price Index (CPI) significantly reduce agricultural financing over the long run. This suggests that instability in general price levels whether driven by inflation or deflation creates uncertainty that discourages financial institutions from extending credit to the agricultural sector. In contrast, Producer Price Index (PPI) changes show an asymmetric response: increases in producer prices significantly enhance agricultural lending by improving farm revenue prospects and strengthening borrowers' repayment capacity, whereas decreases in PPI do not produce a statistically significant effect. For the control variables, exchange rate movements significantly affect agricultural financing, reflecting the vulnerability of the sector to external economic fluctuations. Government expenditure is observed to negatively influence private agricultural credit, pointing to a potential crowding out effect where public sector involvement reduces private lending activity.

Conversely, gross capital formation contributes positively to agricultural credit growth by improving investment conditions and expanding productive capacity within the economy. In the short run, most explanatory variables exhibit weak or insignificant effects, while the error correction term confirms a stable long-run equilibrium relationship, with approximately 30% adjustment toward equilibrium occurring over time. This indicates that agricultural financing is primarily driven by long-term structural macroeconomic conditions rather than short-term shocks.

5. CONCLUSION AND POLICY RECOMMENDATIONS

The study concludes that instability in macroeconomic prices, especially fluctuations in consumer prices, poses a major constraint to agricultural financing in West Africa. However, improved producer price conditions and increased capital formation support credit expansion, highlighting the importance of maintaining a stable and investment conducive macroeconomic environment. Unpredictable price behavior undermines confidence in agricultural lending, while stability strengthens financial intermediation in the sector.

Policy Recommendations include:

1. Authorities should adopt comprehensive inflation and price stabilization policies aimed at reducing volatility in consumer prices and strengthening macroeconomic stability.

2. Agricultural marketing systems should be improved to guarantee fair, stable, and transparent farm gate pricing that enhances farmer income and creditworthiness.

3. Government spending should be carefully structured to support rather than displace private sector lending, with emphasis on efficiency and targeted agricultural investment.

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