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ASYMMETRIC EFFECT OF INFLATION ON AGRICULTURAL OUTPUT IN SELECTED WEST AFRICAN COUNTRIES

ABSTRACT

The dominant empirical tradition linking inflation to agricultural performance in West Africa rests on a linear assumption that a rise and an equivalent fall in prices move agricultural output by the same amount, in opposite directions. This assumption sits uneasily beside the structural realities of a region whose agriculture is overwhelmingly rain fed, smallholder, and thinly integrated into storage, credit and distribution networks. This study tests whether that linear assumption holds by decomposing consumer goods inflation (CPI) and producer goods inflation (PPI) into positive and negative partial sums and estimating their asymmetric long run and short run effects on agricultural output in six West African economies (Nigeria, Ghana, Cote d'Ivoire, Senegal, Burkina Faso and The Gambia) from 2000 to 2024. Annual panel data drawn from the World Bank, FAO and ILO databases were tested for cross sectional dependence, second generation unit root properties and panel cointegration before being estimated with a Pooled Mean Group Nonlinear Autoregressive Distributed Lag (PMG-NARDL) model. The results show that both rising and falling consumer prices significantly depress agricultural output, with the depressive effect of falling prices roughly three times larger than that of rising prices, while both rising and falling producer prices significantly raise output, with falling producer prices exerting the stronger effect. Long run and short run Wald tests confirm asymmetries are statistically significant, rejecting the symmetry restriction. Credit to agriculture and exchange rate movements emerge as powerful long run conditioning variables. The study concludes that inflation transmission to West African agriculture is structurally asymmetric and recommends volatility targeted monetary policy, expanded storage and agro processing infrastructure, and de risked agricultural credit as complements to conventional price stability objectives.

Keywords: Asymmetric Inflation, Consumer Price Index, Producer Price Index, Agricultural Output, Panel NARDL and West Africa.

JEL Classification: E31, Q11, O47, E37

1. Introduction

Inflation ranks among the most closely watched macroeconomic indicators in developing economies, not merely because of its erosive effect on household purchasing power but because of the differential way it filters through sectors whose production cycles, financing arrangements and market structures diverge sharply from the industrial mainstream (Blanchard & Johnson, 2020; Ha, Kose & Ohnsorge, 2019).

Agriculture is the clearest case in point. Across West Africa, farming still employs a large share of the labour force and anchors food security in economies where storage, processing and rural credit remain underdeveloped (National Bureau of Statistics, 2024; Food and Agriculture Organization, 2022). A shock to the general price level therefore does not simply raise or lower the cost of living, it reshapes the incentive that a smallholder farmer faces when deciding how much land to cultivate, how much fertilizer to buy, and whether to store or sell a harvest.

The empirical literature connecting inflation to agricultural output in the sub region is large but has been built almost entirely on linear specifications (ARDL, VECM, VAR) and their variants that treat a rise and a fall in prices as mirror images of the same underlying process (Owoh, 2024; Rilwan & Mustapha, 2024; Ebem, 2024; Shitu & Nyamida, 2025). That assumption is convenient but theoretically fragile. In economies characterized by subsistence production, weak farm to market integration, high post harvest losses and heavy dependence on imported inputs, a decline in prices is at least as likely to signal a demand collapse or a marketing failure as it is to signal an efficiency gain, while a rise in prices can reflect either a genuine demand pull or a corrosive, imported cost shock (Ndikumana & Boyce, 2011; Soludo, 2001). Collapsing these distinct states into a single linear coefficient risks concealing exactly the dynamics that matter most for agricultural policy design.

This study departs from the linear tradition by applying the nonlinear autoregressive distributed lag (NARDL) methodology of Shin, Yu and Greenwood Nimmo (2014) to a panel of six West African economies (Nigeria, Ghana, Cote d'Ivoire, Senegal, Burkina Faso and The Gambia) selected for their combined weight in regional agricultural output and the diversity of their monetary and structural arrangements, spanning both CFA franc and independently floating currency regimes. Consumer goods inflation (proxied by the CPI) and producer goods inflation (proxied by the PPI) are each decomposed into positive and negative partial sums, permitting rising and falling prices to exert distinct short run and long run effects on agricultural output. The resulting Pooled Mean Group (PMG) estimator recovers common long run elasticity across the panel while allowing each countries short run adjustment to differ, a specification well suited to economies that share regional trade and monetary architecture (ECOWAS, WAEMU) yet retain markedly different production structures.

The broad objective is to determine whether consumer goods inflation and producer goods inflation exert asymmetric effects on agricultural output in the selected countries over 2000 to 2024. The specific objectives are, first, to examine the asymmetric effect of consumer goods inflation on agricultural output, and second, to investigate the asymmetric effect of producer goods inflation on agricultural output. Correspondingly, this study tests two null hypotheses that consumer goods inflation has no asymmetric effect on agricultural output, and that producer goods inflation has no asymmetric effect on agricultural output.

2. Literature Review

2.1 Conceptual Clarification

2.1.1 Inflation

Following Lipsey (1995), this study defines inflation as a sustained, widespread rise in the general price level over an extended period, distinguished from transient price movements by its persistence above a specified benchmark. Inflation is conventionally classified as demand pull, arising when aggregate demand outruns supply, or cost push, arising when rising input costs squeeze producers into raising prices (Jhingan, 2002).

2.1.2 Consumer goods inflation

Consumer goods inflation is the rate of increase in prices of the basket of goods and services routinely purchased by households food, clothing, housing and transport and is proxied here by the annual percentage change in the Consumer Price Index (OECD, 2020). Because food occupies a large weight in this basket, CPI is the price signal most directly relevant to household demand for agricultural produce.

2.1.3 Producer goods inflation

Producer goods inflation denotes the sustained rise in the prices of goods and services used as inputs into production such as seeds, fertilizer, machinery and fuel. This is proxied by the annual percentage change in the Producer Price Index (Smith, 2018; Anderson, 2021). PPI is the price signal most directly relevant to the farmers cost structure and, hence, to planting and investment decisions.

2.1.4 Agricultural output

Agricultural output is defined, following David and Dorian (2014), as the aggregate product of horticulture, seed growing, livestock breeding, fruit growing, dairying, fishery and land based production ranging from grazing to market gardening, measured here as the annual value of agricultural production.

2.2 Theoretical Review

2.2.1 Keynesian theory

Keynesian theory locates the cause of inflation in the balance between aggregate demand and aggregate supply, distinguishing demand pull inflation, which arises when demand persistently exceeds productive capacity, from cost push inflation, which originates on the supply side through rising input costs (Jhingan, 2010). Applied to agriculture, moderate consumer price inflation can draw idle land and labour into production a demand stimulus consistent with the widespread under employment characteristic of smallholder farming while rising input costs squeeze margins and discourage planting.

2.2.2 Structuralist Theory

The Structuralist Theory of Inflation, associated with Gunnar Myrdal (1968) and Paul Streeten (1972), holds that inflation in developing economies is driven less by monetary excess than by structural rigidities weak infrastructure, market imperfections and fragile institutions that prevent supply from responding to price signals. In this study, both rising and falling agricultural prices can depress output. Rising prices raise the cost of inputs faster than farmers can adjust, while falling prices, reflecting glut, poor storage or weak market access, curtail the following seasons reinvestment.

2.2.3 Dependency theory

Dependency theory (Frank, 1966; Amin, 1976) frames West African agricultures exposure to price volatility as a consequence of its position in the global commodity system. Peripheral economies exporting raw agricultural commodities and importing manufactured inputs bear a disproportionate share of imported price shocks. The Unbalanced Growth theory of Hirschman (1967) adds that deliberate, sector selective investment rather than uniform, economy wide development is the more realistic growth path for economies such as these, implying that agriculture specific interventions (credit, storage, input subsidy) may do more for aggregate stability than blanket macroeconomic tightening.

2.2.4 Solow Swan neoclassical growth model

The Solow Swan neoclassical growth model (Solow, 1956) supplies the studies organizing framework. In its original form the model links output to capital and labour accumulation under gradually adjusting, rather than instantaneous, dynamics a property well suited to agriculture, where production plans are fixed at planting and cannot be revised within a season regardless of the price signals farmers subsequently receive. Because the standard Solow production function has no role for price instability, this study augments it, in the spirit of the Cobb Douglas functional form (Cobb & Douglas, 1928), by introducing inflation as an additional argument.

2.3 Theoretical Framework

The study is anchored on the augmented Solow Swan framework. Aggregate agricultural output (A) is expressed as a function of capital (K), labour (L) and inflation (I).

$$A = F(K, L, I) = B \cdot K^{\beta_1} \cdot L^{\beta_2} \cdot I^{\beta_3} \quad (2.1)$$

where (B) is total factor productivity and (β_1 , β_2 and β_3) are output elasticities. Because the theoretical literature offers no consensus on whether rising or falling prices should dominate this relationship in a structurally rigid, import dependent agrarian economy, the framework treats the sign on inflation as an empirical question to be resolved by decomposing (I) into its positive and negative components rather than as a parameter fixed by assumption.

2.4 Empirical Review

A substantial body of single country, linear time series work documents a negative association between inflation and agricultural output in Nigeria. Owoh (2024), using annual data from 1990 to 2021 and a combination of linear regression, ARDL and VECM specifications, found

that inflation depressed agricultural output in the short run and shared a stable long run equilibrium. While Rilwan and Mustapha (2024) and Ebem (2024), each applying ARDL to overlapping Nigerian samples, likewise reported negative and statistically significant coefficients on inflation. Adeola and Bolarinwa (2018) quantified this relationship at roughly a 0.67 percent decline in agricultural productivity for every one percentage point rise in inflation, attributing the effect to rising input costs, currency depreciation and eroded farmer purchasing power.

A parallel strand finds the relationship is neither immediate nor uniformly negative. Shitu and Nyamida (2025) reported that inflations depressive effect on Nigerian agricultural output operates with a lag rather than contemporaneously, while Effiong et al., (2024) found that exchange rate depreciation and inflation depressed Nigerian agricultural output in the short run but exerted a positive long run effect, a result the study could not reconcile with the broader negative consensus. Akadiri et al., (2022) using a dynamic simulated ARDL and Kernel based Regularized Least Squares, found inflation statistically insignificant for Nigerian agricultural growth, again setting their study apart from the wider literature

The handful of studies that move beyond a purely linear specification lend the clearest support to the asymmetric hypothesis pursued in this study. Ihugba et al. (2025) applied a single country NARDL to Nigerian data from 1981 to 2023 and found that positive inflation shocks lifted agricultural growth in the short run by raising nominal farmer revenues, an effect that faded as input costs continued rising, while negative inflation shocks had no significant effect evidence of a threshold below which price movements become largely inconsequential for output. Njegovan and Tomas (2020), working with nonlinear cointegration techniques in Serbia, similarly found that inflation depressed agricultural and food product prices through raised production costs and reduced investment, with broader implications for aggregate growth.

Outside Nigeria, national level ARDL and VECM studies broadly corroborate a negative inflation agriculture relationship while surfacing country specific nuance. Dia et al., (2022) found that agricultural production raised Senegalese GDP growth substantially in both the short and long run, but that the accompanying inflation control variable exerted adverse long run effects on output growth, reflecting Senegals heavy import dependence. Ashiagbor et al., (2023) found that financial development and interest rates, rather than inflation itself, were the dominant drivers of Ghanaian agricultural growth, with inflation related variables showing limited independent explanatory power once financial development was controlled.

A cluster of recent regional and cross country studies situates inflation agriculture dynamics within the broader food price and commodity market environment. Doki et al. (2025) examined food prices and food production across selected West African countries using Pooled Mean Group and related heterogeneous panel estimators, finding that agricultural land and fertilizer application were the principal long run drivers of food production, that food prices were positively linked to production and agricultural employment, and that state fragility independently depressed output a moderating channel largely absent from single country studies.

Gizaw and Myrland (2025), spanning thirty two Sub Saharan African countries, found that domestic food production capacity was the central mitigating factor against food price inflation, with the pass through of global commodity shocks varying by import dependence. Arowolo and Ekum

(2016), one of the earliest genuinely regional West African panels, found that food imports and inflation exerted a significant negative effect on the ECOWAS food production index, while agricultural land and fertiliser use exerted a significant positive effect.

Studies tracing the transmission of global commodity and exchange rate shocks into domestic agricultural prices add a further dimension. Buafi and Carlberg (2026) found that local shocks dominate short run maize and rice price variation in Nigeria, but that exchange rate depreciation and the global food price index become increasingly influential over longer horizons evidence, the study note, that a linear VECM specification may understate asymmetric, threshold driven pass through documented elsewhere. Falana et al., (2023) confirmed a statistically significant positive relationship between exchange rate volatility and Nigerian food price inflation in both the short and long run, with domestic food production negatively related to food price inflation, while Nachega et al., (2024) found evidence of asymmetric exchange rate pass through into Gambian inflation that intensifies during currency depreciation a finding directly consonant with the asymmetric framework adopted in this study.

2.5 Research Gap

Three gaps emerge from literature review. First, the overwhelming majority of studies linking inflation to agricultural output in West Africa are single country and linear, implicitly assuming that rising and falling prices affect agricultural output symmetrically an assumption the Structuralist and dependency theoretic literature gives strong reason to doubt in economies marked by subsistence production. Secondly, where nonlinearity has been explored (notably Ihugba et al., 2025), the analysis remains confined to a single country, leaving open whether the asymmetric pattern identified is a national idiosyncrasy or a regional structural feature. Third, very few studies decompose inflation into its consumers (CPI) and producer (PPI) inflation components within the same model, despite theoretical grounds the differing channels of income erosion versus cost escalation for expecting these two price signals to affect agricultural output quite differently. This study addresses all three gaps by estimating a genuinely multi country panel NARDL model that separately decomposes CPI and PPI into positive and negative partial sums.

3. Methodology

3.1 Data and Variables

Annual panel data spanning 2000 to 2024 for Nigeria, Ghana, Cote d'Ivoire, Senegal, Burkina Faso and The Gambia were sourced from the World Bank World Development Indicators, the Food and Agriculture Organization, and the International Labour Organization databases. Agricultural output (AGRIC) is proxied by the value of agricultural production, consumer goods inflation (CPI) and producer goods inflation (PPI) are proxied by their respective annual percentage changes, and the model controls for credit to agriculture (CAGRIC), the official exchange rate (EXR), general government final consumption expenditure (GEXP), labour force participation (LF) and gross fixed capital formation (GCF), consistent with the empirical literature reviewed above, which repeatedly identifies these as first order determinants of agricultural performance in developing economies (Abubakar & Olaniyan, 2022; Tchouawou, 2020).

Table 1: Description and Sources of Variables

Variable	Proxy	Notation	Unit	Source
Agricultural output	Value of agricultural production	AGRIC	US\$ billion	FAO
Consumer goods inflation	CPI, annual % change	CPI	Percentage	FAO
Producer goods inflation	PPI, annual % change	PPI	Percentage	FAO
Credit to agriculture	Domestic credit to agriculture	CAGRIC	US\$ billion	FAO
Exchange rate	Official exchange rate	EXR	Local currency/US\$	WDI
Government expenditure	General govt. consumption exp.	GEXP	% of GDP	WDI
Labour force	Labour force participation	LF	Number of persons	ILOSTAT
Gross capital formation	Gross fixed capital formation	GCF	% of GDP	WDI

Source: Compiled by researcher (2026), based on WDI, FAO and ILOSTAT databases.

3.2 Model Specification and Asymmetric Decomposition

Following Shin, Yu and Greenwood Nimmo (2014), each inflation series is decomposed into non negative and non positive partial sums that isolate, respectively, the cumulative effect of price increases and of price decreases.

$$CPI_t^+ = \sum_{j=1}^t \max(\Delta CPI_j, 0), \quad CPI_t^- = \sum_{j=1}^t \min(\Delta CPI_j, 0) \quad (3.1)$$

$$PPI_t^+ = \sum_{j=1}^t \max(\Delta PPI_j, 0), \quad PPI_t^- = \sum_{j=1}^t \min(\Delta PPI_j, 0) \quad (3.2)$$

This decomposition is theoretically, not merely statistically, motivated. A rise and a fall in the general price level reach farmers through distinct channels the former chiefly by eroding real incomes and raising the cost of imported inputs, the latter chiefly by weakening aggregate demand and, in a largely informal, thinly stored agricultural sector, by encouraging post harvest gluts and distress sales. Treating CPI and PPI as single symmetric regressors, as the bulk of the linear literature reviewed above does, risks conflating these two economically distinct phenomena into a single coefficient. Agricultural output is accordingly specified as:

$$AGRIC_{it} = \beta_0 + \beta_1 CPI_{it}^+ + \beta_2 CPI_{it}^- + \beta_3 PPI_{it}^+ + \beta_4 PPI_{it}^- + \gamma_1 \ln(EXR)_{it} + \gamma_2 GCF_{it} + \gamma_3 \ln(LF)_{it} + \gamma_4 GEXP_{it} + \gamma_5 \ln(CAGRIC)_{it} + \varepsilon_{it} \quad (3.2)$$

where i and t index country and year respectively. The model is cast, following Pesaran, Shin and Smith (1999), as a Pooled Mean Group asymmetric error correction model:

$$\Delta AGRIC_{it} = \phi_i (AGRIC_{it-1} - \beta' X_{it-1}) + \sum_k \phi_{ik} \Delta AGRIC_{it-k} + \sum_k (\phi_{1ik} \Delta CPI_{it-k}^+ + \phi_{2ik} \Delta CPI_{it-k}^- + \phi_{3ik} \Delta PPI_{it-k}^+ + \phi_{4ik} \Delta PPI_{it-k}^-) + \lambda' \Delta X_{it-k} + \mu_i + \xi_{it} \quad (3.3)$$

Where X collects the control variables and ϕ_i is the country specific error correction coefficient, expected to be negative and significant. Long run elasticities are restricted to be common across the panel while short run dynamics, intercepts and error variances are allowed to differ freely

by country, an assumption formally tested against the fully heterogeneous Mean Group alternative via the Hausman (1978) specification test.

3.3 Estimation Procedure

Estimation proceeds in five stages. First, cross sectional dependence is tested using the Breusch Pagan LM, Pesaran scaled LM, bias corrected LM and Pesaran CD statistics. Second, given confirmed cross sectional dependence, the order of integration of each series is established using the second generation, cross sectionally augmented Pesaran (2007) CIPS test and the Bai and Ng (2004) PANIC procedure, both robust to common factors, in preference to first generation tests such as Levin Lin Chu or Im Pesaran Shin. Third, the existence of a long run equilibrium relationship is confirmed using the Kao (1999) residual based panel cointegration test and the Johansen Fisher panel cointegration test. Fourth, the model is estimated via the Pooled Mean Group Nonlinear ARDL estimator, with the Hausman test adjudicating between the PMG and Mean Group alternatives. Fifth, the null hypothesis of symmetric long run and short run coefficients is tested via a Wald coefficient restriction test, the formal statistical basis on which the study's two null hypotheses are accepted or rejected. Residual diagnostics (Wooldridge autocorrelation test, White heteroskedasticity test, standardised residual inspection) confirm the adequacy of the estimated model.

4. Presentation and Analysis of Results

4.1 Descriptive Statistics

Table 2 shows that agricultural output is comparatively well behaved across the panel its mean and median are almost identical and its Jarque Bera statistic fails to reject normality consistent with the slow, biologically constrained nature of crop and livestock production. By contrast, the positive and negative components of both price indices are markedly dissimilar in scale and shape. The mean negative CPI movement (−21.32) exceeds the mean positive movement (19.81) in absolute terms, while for PPI the pattern reverses sharply, with the mean positive shock (74.14) roughly four times the mean negative shock (−19.30). All four decomposed inflation series depart significantly from normality, providing the first descriptive evidence that a linear, symmetric specification would be misspecified for this panel.

Table 2: Descriptive Statistics of Model Variables

Statistic	AGRIC	CPI+	CPI-	PPI+	PPI-	CAGRIC
Mean	15.257	19.809	-21.322	74.139	-19.295	7.989
Median	15.297	17.074	-17.115	61.530	-17.710	8.134
Std. Dev.	1.983	14.714	20.263	58.661	21.202	1.850
Skewness	-0.088	0.941	-1.241	1.561	-1.418	-0.292
Jarque Bera (Prob.)	0.485	0.000	0.000	0.000	0.000	0.324

Source: researchers computation using E-views 12 (2026). Observations = 144.

4.2 Cross Sectional Dependence and Panel Unit Root Properties

All four Breusch Pagan and Pesaran family statistics reject cross sectional independence at the 1 percent level for agricultural output, CPI, PPI and every control variable (Table 3), consistent with shared weather systems, regional trade in agricultural produce and common shocks such as global commodity price movements. This confirms the necessity of second generation panel

techniques throughout. The CIPS and PANIC unit root tests (Table 4) reveal a mixed order of integration. Agricultural output and CPI are stationary at level, $I(0)$, while PPI, credit to agriculture, the exchange rate, government expenditure, labour force and gross capital formation are stationary only after first differencing, $I(1)$. No series is integrated of order two, satisfying the precondition for a valid NARDL specification.

Table 3: Cross Sectional Dependence Test Results (Selected Variables)

Variable	Breusch Pagan LM	Pesaran Scaled LM	Pesaran CD	Prob.
AGRIC	182.90	30.65	12.79	0.000
CPI	66.60	9.42	7.25	0.000
PPI	297.53	51.58	17.22	0.000
CAGRIC	262.85	45.25	16.11	0.000
EXR	128.29	20.68	8.03	0.000
GCF	163.70	27.15	3.65	0.000

Source: researchers computation using E-views 12 (2026).

Table 4: Summary of Panel Unit Root Tests

Variable	CIPS (level)	Bai Ng (level)	Order of Integration
AGRIC	-3.354 ($I(0)$)	-2.054 ($I(0)$)	$I(0)$
CPI	-4.134 ($I(0)$)	11.14 ($I(0)$)	$I(0)$
PPI	-2.781 (n.s.)	-1.516 (n.s.)	$I(1)$
CAGRIC	-2.254 (n.s.)	-0.466 (n.s.)	$I(1)$
EXR	-3.754 ($I(0)^*$)	-0.891 (n.s.)	$I(1)$
GCF	-2.931 ($I(0)^*$)	1.685 (n.s.)	$I(1)$
GEXP	-2.882 ($I(0)^*$)	-1.680 (n.s.)	$I(1)$
LF	-2.313 (n.s.)	-0.040 (n.s.)	$I(1)$

Note: (n.s). = not significant at level; all $I(1)$ series confirmed stationary at first difference (not shown). Source: researcher computation using E-views 12 (2026).

4.3 Panel Cointegration and PMG-NARDL Long Run Estimates

The Kao residual based ADF statistic (-3.259 , $p = 0.0006$) and the Johansen Fisher test (rejecting the null of no cointegration at every rank up to at least four cointegrating vectors) jointly confirm a stable long run relationship among agricultural output, the decomposed inflation series and the control variables, providing the statistical basis for interpreting the PMG-NARDL long run coefficients in Table 5 as genuine equilibrium elasticities.

Table 5: PMG-NARDL Long Run Coefficients (Dependent Variable: AGRIC)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI+	-0.0245	0.0087	-2.803	0.0067
CPI-	-0.0673	0.0145	-4.629	0.0000
PPI+	0.0092	0.0025	3.697	0.0005
PPI-	0.0154	0.0034	4.541	0.0000
CAGRIC	0.6244	0.1954	3.196	0.0022
EXR	0.2140	0.3579	0.598	0.0520
GEXP	0.0184	0.0134	1.380	0.1725
LF	-0.0315	0.0372	-0.847	0.4003
GCF	-0.0024	0.0046	-0.517	0.6067

Source: researcher computation using E-views 12 (2026).

Both the positive and negative components of consumer goods inflation carry negative and significant long run coefficients, but the depressive effect of falling consumer prices (-0.067) is roughly 2.7 times larger than that of rising prices (-0.025). This departs from the contextual monetarist expectation that disinflation should, at worst, be output neutral for producers. In a region marked by fragmented storage infrastructure and weak farm gate to retail price transmission, a fall in the consumer price index more plausibly signals a glut or a collapse in farm gate prices following a poorly marketed harvest than a genuine efficiency gain. This is because smallholders finance the following seasons inputs from the current seasons revenue, a price collapse directly curtails subsequent planting, fertiliser purchase and hired labour.

Both components of producer goods inflation, by contrast, carry positive and significant coefficients, with the negative shock (0.015) again exceeding the positive shock (0.009) in magnitude. The positive sign on rising producer prices conforms to conventional supply theory. The positive sign on falling producer prices requires a structural explanation. Episodes of falling producer prices in the sampled countries have frequently coincided with government input subsidy programmes or favourable rainfall that expanded supply for reasons unrelated to the price signal itself, while widespread subsistence production where farmers cultivate to meet household food security needs rather than to maximise profit means output need not contract even when the price farmers receive falls. Among the controls, credit to agriculture (0.624 , $p = 0.0022$) is by far the strongest driver of long run output, underscoring the persistent binding constraint that limited access to formal agricultural finance places on the sector across the region.

4.4 Short Run Dynamics

Table 6: PMG-NARDL Short Run Coefficients (Dependent Variable: ΔAGRIC)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Error-correction term	-0.7335	0.2044	-3.589	0.0006
$\Delta\text{CPI}+$	0.0230	0.0134	1.712	0.0919
$\Delta\text{CPI}-$	0.0213	0.0199	1.070	0.2888
$\Delta\text{PPI}+$	0.0013	0.0025	0.504	0.6159
$\Delta\text{PPI}-$	0.0082	0.0079	1.032	0.3061
ΔCAGRIC	-0.7692	0.3862	-1.992	0.0507

Source: researcher computation using E-views 12 (2026).

The error correction term is negative, significant and correctly bounded (-0.734), indicating that approximately 73 percent of any short run deviation from long run equilibrium is corrected within a single year confirming, independently of the cointegration tests, that the panel shares a genuine equilibrium relationship. Neither the positive nor the negative component of CPI or PPI is significant at the 5 percent level in the short run, consistent with the biologically fixed, seasonal nature of agricultural production. A farmer cannot expand cultivated area or bring a new herd to maturity within the same year that a favourable price movement occurs, because production plans are typically locked in at planting or breeding decisions taken in a prior period.

4.5 Hausman Test and Asymmetry (Wald) Tests

The Hausman test comparing the Pooled Mean Group and Mean Group estimators returns a chi square statistic of (47.79) with a probability value of (0.11), comfortably above the 5 percent

threshold. The null hypothesis of long run slope homogeneity across the six countries cannot be rejected, formally justifying the use of the more efficient PMG estimator notwithstanding the countries differing size, monetary regime and sectoral composition.

Table 7: Long Run and Short Run Asymmetric Wald Test Results

Test Horizon	F-statistic	d.f.	Probability	Decision
Long run	54.349	(4, 63)	0.0000	Reject symmetry
Short run	55.097	(4, 63)	0.0000	Reject symmetry

Source: researcher computation using E-views 12 (2026).

The Wald tests decisively reject the null hypothesis of symmetric coefficients at both the long run and short run horizons ($p < 0.001$ in each case). This is the formal statistical basis on which both of the studys null hypotheses that CPI and PPI have no asymmetric effect on agricultural output are rejected. The magnitude of the asymmetry is economically, not merely statistically, meaningful. This is because the long run elasticity of output with respect to falling consumer prices is roughly 2.7 times that with respect to rising consumer prices, a monetary stance that tolerates moderate inflation to protect farm incomes appears, on this evidence, less costly to agricultural output than one that allows consumer prices to fall sharply a conclusion that runs directly counter to the conventional wisdom equating price stability solely with low and falling inflation.

4.6 Country Specific Short Run Heterogeneity

Table 8 reports country level short run coefficients, revealing the heterogeneity that the PMG estimator is designed to accommodate. Every error correction term is negative and significant, but the speed of adjustment ranges from a sluggish 13.6 percent per year in Cote d'Ivoire to a rapid 97.5 percent in Ghana plausibly reflecting Ghanas more liquid, centrally marketed cocoa sector against Cote d'Ivoire's history of land tenure insecurity and periodic disruption to input distribution in its cocoa belt. In Nigeria and Ghana, both rising and falling consumer prices raise short run output, consistent with volatility itself creating arbitrage opportunities in economies with active informal storage. In the CFA-franc economies of Burkina Faso, Cote d'Ivoire and Senegal, rising prices raise output while falling prices reduce it, the pattern predicted by conventional demand theory, plausibly because the fixed exchange rate limits the scope for imported shocks to be absorbed through currency adjustment.

Table 8: Country Level Short Run Coefficients and Adjustment Speed

Country	ECT	Δ CPI+	Δ CPI-	Δ PPI+	Δ PPI-	Adj. Speed
Nigeria	-0.379**	0.053***	0.113***	-0.003***	0.031***	37.9%/yr
Burkina Faso	-0.506***	0.049***	-0.010***	0.004***	0.007***	50.6%/yr
Ghana	-0.975***	0.004***	0.023***	0.005***	-0.005***	97.5%/yr
Cote d'Ivoire	-0.136**	0.048***	-0.021***	-0.009***	0.013***	13.6%/yr
Senegal	-0.186**	-0.029***	-0.004**	0.007***	-0.022***	18.6%/yr
The Gambia	-0.219***	0.014***	0.027***	0.003***	0.024***	21.9%/yr

Note: ** and *** denote significance at 5% and 1%. Source: researcher computation using E-views 12 (2026).

4.7 Post Estimation Diagnostics

The Wooldridge type autocorrelation test returns an insignificant lagged residual coefficient ($t = -1.660$, $p = 0.096$), and the White heteroskedasticity test fails to reject the null of constant residual variance across all three test statistics (F-statistic $p = 0.10$; Obs*R-squared $p = 0.51$; Scaled Explained SS $p = 0.17$). Standardised residual plots for each country remain concentrated within ± 0.3 to ± 0.4 across the sample, with only isolated, country specific widening (notably in Cote d'Ivoire and Senegal) attributable to episodic shocks such as political instability or climatic stress rather than systematic model misspecification. The estimated model is therefore free of serial correlation and heteroskedasticity and is adequately specified across the panel.

5. Summary, Conclusion, Recommendations and Contribution to Knowledge

5.1 Summary and Conclusion

This study tested whether consumer goods inflation and producer goods inflation exert asymmetric effects on agricultural output across six West African economies between 2000 and 2024. Using a Pooled Mean Group Nonlinear ARDL model that decomposes each price index into positive and negative partial sums, the study finds that both rising and falling consumer prices significantly depress agricultural output, with falling prices exerting a depressive effect roughly 2.7 times larger than rising prices, while both rising and falling producer prices significantly raise output, with falling producer prices again exerting the larger effect. Long run and short run Wald tests confirm both asymmetries are statistically significant, leading to rejection of both null hypotheses. Credit to agriculture emerges as the single strongest long run driver of output across the panel, while the error correction mechanism confirms that agricultural output in the region, notwithstanding its structural fragility, converges toward long run equilibrium following disturbances, albeit at markedly different speeds across countries.

The central conclusion is that inflation transmission to West African agriculture is not a uniform, linear phenomenon that a single coefficient can adequately describe. Rather, structural features specific to the region subsistence production, weak storage and market integration, and import dependent input markets generate differentiated responses to rising and falling prices that vary with the source of the price change (consumer facing versus producer facing). Consumer goods inflation, whether rising or falling, is broadly detrimental to agricultural output, while producer goods inflation, whether rising or falling, is broadly beneficial, with the magnitude of these effects differing meaningfully by direction. Inflation management in the region therefore cannot be divorced from the structural and institutional conditions that shape how price signals are transmitted through the agricultural value chain.

5.2 Policy Recommendations

The study recommend that first, monetary authorities across the region should target price volatility, not merely the inflation level, since both rising and falling consumer prices were found to depress agricultural output. Second, governments should prioritize investment in rural storage, agro processing capacity and feeder roads, so that price declines reflect genuine efficiency gains rather than post harvest losses and distress sales. Third, input subsidy programmes for fertilizer, improved seed and machinery should be expanded and paired with domestic input manufacturing capacity to

reduce exposure to imported cost shocks. Fourth, given the demonstrated strength of the credit to agriculture channel, concessional agricultural lending schemes and credit guarantee mechanisms should be expanded, with collateral barriers lowered for smallholder and medium scale farmers. Finally, because short run adjustment speeds and the direction of short run inflation effects vary substantially across countries, national policymakers should calibrate price stabilisation, credit and exchange rate measures to each countries specific structural conditions rather than applying a uniform regional template.

5.3 Contribution to Knowledge

This study contributes to the literature in three respects. First, it extends the predominantly linear, single country empirical tradition on inflation and agricultural output in West Africa by applying a genuinely multi country Panel Nonlinear ARDL framework that explicitly decomposes consumer and producer price indices into positive and negative partial sums. Second, it disaggregates inflation into its consumer facing and producer facing components a distinction largely absent from the prior regional literature and demonstrates that these operate through distinct, and in several respects opposite, channels in their relationship with agricultural output. Third, by estimating country specific short run coefficients alongside common long run parameters within the Pooled Mean Group framework, the study provides granular, country level evidence of heterogeneity in adjustment speed and inflation transmission that can inform differentiated national policy design, in place of a single pooled regional estimate.

The study is limited by its confinement to six countries selected base on data availability grounds, its reliance on annual rather than higher frequency data, and the long run slope homogeneity the PMG estimator imposes across structurally diverse economies, notwithstanding the Hausman tests validation of that restriction. Future research could extend country coverage across the full ECOWAS membership, disaggregate agricultural output by sub sector, and explore threshold levels of consumer and producer price inflation beyond which the adverse or beneficial effects identified here become most pronounced.

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